Sustainable Insights in Public Real Estate Performance:

ESG Scores and Effects in REIT Markets

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Abstract

In this paper, we examine and discuss the interaction between transparent Environmental, Social and Corporate Governance (ESG) ratings and public real estate performance in the US REIT market, by analyzing the adoption, scores and effects of the available ESG ratings. In an era of financial crises and increasing concerns about sustainable development goals, the public fund market has made significant progress on improving transparency and enhancing the protection of investor value through best practices. In all matters, transparency is key. Our analysis of REIT returns yields various new insights. First, we document a strong difference in the loading of the ESG factor across the three different metrics. For GRESB, we typically report negative coefficients, indicating that high GRESB scores are associated with weaker REIT returns, while higher ESG-score of Reuters and KLD are accompanied by a performance premium. Second, when zooming in on each of these metrics, we discover that the ESG-effect on REIT returns changes over time. For all three measures, we find negative ESG-loading in the early years, and positive coefficients during the most recent years. Thirdly, we find an important difference in return effects across the three ESG components. Using the history of KLD subs cores, we find a positive return effect for both S and G, while E ended up with a return discount. This could be due the difference in efforts needed to realize E, S and G ambitions, especially for real estate investment companies.

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1. Introduction

In 2015, the United Nations COP21 Paris conference led to 174 nations signing a climate treaty with the objective of limiting global warming to 2 degrees versus pre-industrial levels. Institutional investors are under increasing pressure from governments, regulators and other stakeholders to contribute to this climate goal. The real estate market can play a pivotal role in contending with the harming effects of climate change, as real estate markets around the world account for around 30 percent of total $CO2$ emissions. Large institutional investors have invested over 8% of their assets in real estate and are expected to increase their allocation in the coming years[1]. With these allocations they can make a change for the better, by selecting into real estate investments that align with their broader environmental social and governance (ESG) charters.

Publicly listed real estate investment firms are often used as a convenient and liquid means to build up real estate exposure, as their stock market listing offers investors clear advantages when it comes to trading and portfolio management. At the start of 2018, investors could choose between no less than 800 publicly listed real estate investment firms, varying widely in portfolio size, focus and strategies. Their market values, represent a firm fraction of the underlying real estate markets, and therefore their ESG decisions will have an impact on how real estate markets can contribute to achieving UN and climate goals. During their firm selection process, investors can consider new and specific features of ESG aspects, which have increasingly become a more significant aspect of the investment selection and evaluation process. Asset managers and other financial institutions increasingly rely on ESG ratings agencies to assess, measure and compare companies' ESG performance, and can choose between different ESG rating providers.

Thus far, however, very little is known and analyzed regarding the effects of these ESG scores on public real estate stock performance. This lack of knowledge and evidence may well hamper the swift adoption of ESG evaluations that is needed to mobilize investors for the underlying social causes.

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[1] See Andonov et al. (2013) for a full review of pension fund investments in real estate.

Today, investor opinion on socially responsible investment differ widely. While, some investors mostly fear the initial marginal costs of sustainability investments, others are more concerned about the implicit long-term risks of unsustainable stranded real estate assets within their portfolio. These differing views are also reported by the Wall Street Journal, issuing headline articles ranging from *"If you want to do good, expect to do badly"* (WSJ, June 28 2018) to *"Companies find value in combining compliance"* (WSJ, May 15 2018). In other words, the jury is still out.

In this paper, we examine and discuss the interaction between transparent ESG and sustainability ratings with public real estate performance, by analyzing the adoption and effects of GRESB (Global Real Estate Sustainability Benchmark), Reuters and KLD. In an era of financial crises and increasing concerns about ESG, the public fund market has made significant progress on improving transparency and enhancing the protection of investor value through best practices. In all matters, transparency is key. ESG ratings are as public as the listing of REITs, yet a critical evaluation of the effects of ESG scores is still absent in the literature. Hence, in this project, we carefully study the diffusion and coverage process of ESG rating as a new means of enhancing informational transparency regarding public real estate fund management. We will compare the different ESG ratings for individual US REITs and assess their consistency. Importantly and following anecdotal evidence as reported in the news (e.g. "Is Tesla or Exxon More Sustainable? It Depends Whom You Ask" – WSJ, May 17 2018), we give an insight on the reasons why different ratings seem to portray a different story (and ranking among companies). We profile the high and low scores by analyzing the property type specializations, regional focus, and the investor base of these REITs. This way, we are able to assess the driving forces for high ESG scores, and verify whether the different raters offer consistent results.

Unfortunately, the finance literature regarding ESG and sustainability on a real estate portfolio level is very limited. Most of the available studies focus mostly on energy efficiency as part of sustainability, using energy certification as a metric, and have reported contradicting results. By combining the US REIT data with a broader overview of ESG metrics, our work contributes to previous studies in several ways. Firstly, we provide an objective discussion of the literature on UN's goal and the fit with available ESG metrics. This project will also contain an in-depth (both theoretical and numerical) presentation of the ESG scores and their potential impact on public real estate performance. Thirdly, we apply multivariate regressions to identify the impact that ESG scores have had on public real estate return time series.

Our results show a compelling size difference between high- and low ESG-scoring REITs. For each ESG-metric, we find that the top quartile ESG scoring REITs managed more than twice as many assets as the lower quartile. This can be due to a size effect that helps larger REITs to enhance to realize their

environmental ambitions. Our analysis of REIT returns yields various new insights. First, we document a strong difference in the loading of the ESG factor across the three different metrics. For GRESB, we typically report negative coefficients, indicating that high GRESB scores are associated with weaker REIT returns, while higher ESG-score of Reuters and KLD are accompanied by a performance premium. Second, when zooming in on each of these metrics, we discover that the ESG-effect on REIT returns changes over time. For all three measures, we find negative ESG-loading in the early years, and positive coefficients during the most recent years. This could indicate that investors needed time to warm up to the new information that was conveyed by these ESG-measures. Perhaps, they have been more concerned with the costs of ESG compliance during these starting years, while the virtues of ESG became recognized only after a while. Thirdly, we find an important difference in return effects across the three ESG components. Using the history of KLD subs cores, we find a positive return effect for both S and G, while E ended up with a return discount. This could be due the difference in efforts needed to realize E, S and G ambitions, especially for real estate investment companies. Organizing good governance and ensuring social responsibility tends to induce less costs as reducing the carbon footprint of an entire real estate portfolio. This third insight can also help us to explain the first. Given that high E-scores are associated with negative return effects, we can reason why the GRESB score was accompanied by negative coefficients. GRESB overweighs E within their ESG metric. This is also the most important implication of our results for our readers. It is important to first define your own ESG priorities before selecting the ESG metric with which you would like to include ESG into your selection process. Our results show that differences exist, and that these differences matter.

Our paper continues with a brief discussion of the most relevant literature on ESG and REIT stock performance. After discussion on methodological framework, we introduce and present our data and discuss the different ESG metrics used in the subsequent empirical analysis. The results of our REIT return analysis are discussed step by step, starting with a standard baseline asset pricing model and finalizing with a careful analysis of the E, S and G impact on REIT returns. We finish our paper with a short summary of our most important results and their implications.

2. Literature Review on ESG and REIT Performance

Environmental, social and governance (ESG) refer to the three central factors in measuring the sustainability and ethical impact in a company. Including these non-financial considerations into financial asset decision dates back to the 1950s and 1960s when US pension funds managed by Trades Unions recognized this opportunity to affect a wider social environment using their capital assets (Roberts, 1958). This started with small initiatives focused on specific social needs, like affordable

housing, but soon extended to broader ethical issues like the repugnance of apartheid in South-Africa. Today, a wide range of ESG aims and goals has been identified, and various means and manners have emerged to incorporate these issues into the investment process.

In the finance literature, these ESG metrics have been put to the test, to assess the interlink between ESG ratings and corporate financial performance. This interlink is complex, as ESG criteria can reduce the investment universe and thereby reduce the available diversification benefits, and enhance the risk of ESG frontrunners. Moreover, ESG screening also introduces additional costs into the investment selection process. These information and screening costs are easy observable in the short-term, while the benefits of ESG practices are often intangible, difficult to quantify, and materialize in the long term similarly to R&D investments (Lev et al. 2005). Derwall et al. (2011) evaluated the stock performance of US firms for the period 1992-2008, using KLD as ESG metric to distinguish leaders and laggards. Their results show that low-scoring ESG firms (sin stocks) outperform in the short run, these profit-generating opportunities do not persist in the longer run. Enforcing high ESG standards may weaken returns initially, in the long run this return difference vanished, as high ranking ESG firms catch up.

Overall the empirical evidence on integral ESG scores is very limited within the real estate literature. Instead, E, S and G have been mostly analyzed separately using different metrics and markets. Especially sustainability has been studied, internationally. Eichholtz, Kok and Yonder (2012) studied the U.S. Real Estate Investment Trust (REIT) market and documented an empirical link between energy efficiency and sustainability of properties and the operating and stock performance of a sample of publicly listed REITs. Their evidence suggests a positive relation between the greenness of the portfolio – measured as the percentage of LEED and Energy Star certifications - and three measures of operating performance; return on assets, returns on equity, the ratio of funds from operations to total revenues. Green REITs performed better, both operationally and in their stock performance. Fuerst (2015) studied the performance effects that coincided with the GRESB ratings for REIT in North America, Asia and Europe for the period 2011-2014. Although data coverage was still very weak during this early period, Fuerst (2015) reported that high sustainability scores resulted in enhanced operational performance and lower stock market risks. Mariani et al. (2018) focused on the European listed real estate markets, using LEED and BREEAM certifications as metrics for REIT sustainability. Contrary to the earlier work, Mariani et al (2018) document that the percentage of certified building in the European REITs portfolios has a negative impact on ROA, ROE and stocks' alphas while also improving the stocks' beta. According to the authors, this is mainly due to the incremented costs related to the refurbishments and adjustments processes needed to obtain the BREEAM and LEED certification.

Regarding the social aspects of ESG, the literature is thin. Ferrell et al. (2016) applied MSCI's Intangible Value Assessment (IVA) database to identify the voluntarily initiated aspects of corporate social responsibility (CSR) for a sample 1,500 companies worldwide during the period 1999 – 2011. Using an instrumental variable approach, they document that CSR ratings are higher for companies with fewer agency problems and that certain aspects of CSR (e.g., labor and social protection) are associated with increased executive pay-for-performance sensitivity and the maximization of shareholder value. For real estate investment, and US REITs specifically, Fuerst et al (2011) offer evidence for a positive relationship between CSR ratings and Tobin's Q. Using the KLD data during a 2003-2010 sample of US REITs they document that this spread in firm valuation is mainly due to a negative effect for low scoring CSR REITs, positive scores had no compelling effects on REIT returns.

Regarding the governance aspects of REITs, Cannon and Vogt (1995) were among the firsts to empirically analyze the performance effects of two competing governance structures in the market – the "self-administered" versus the "advisor" REITs. The first outperformed, also after correcting for their greater market risk. The authors also found traces of ownership structure within the return variations, indicating that shareholder structure and involvement can have materials effects in this market. Bauer et al (2010) have built on this work and have used the Corporate Governance Quotient Index (CGQ) - a metric developed by Institutional Shareholder Services (ISS) that rates publicly traded companies in terms of the quality of their corporate governance - and firm performance. They uncover a significant and positive relationship but only for US REITs with low dividend payout ratios. Anglin et al (2013) studied the relationship between corporate governance and REITs' earnings management. Their findings indicate that, despite the unique legal and reporting structure, REITs engage in certain forms of earnings management, and that the ability for REITs to manipulate earnings is reduced when corporate governance is more effective. In other words, also within the strongly regulated REIT regime, setting high corporate governance standards can create value for investors.

In all cases, studies have been focused on aspects of ESG, and have been limited by their choice of metrics. In this study, we hope to profit from the emergence of broader ESG metrics that have become available in recent years. We take the perspective of US REIT investors, and compare different metrics to assess whether the subsequent selection process is influenced by ESG scope and measurement.

3. Research Methodology

Our analysis starts with a thorough and detailed discussion of available data. After presenting the overall performance and characteristics of our REITs sample and differences between more or less ESG

compliant companies, we discuss both the ESG scores and sub-scores to highlight the different components of each measure.

Subsequently, we examine firm specific returns in an asset pricing framework using a five-factor model as our benchmark. These regressions are run on both total and partial returns for firm *i* (*return$_i$*) over the 2011-2018 period, during which ESG score are available. We explain the cross-sectional and time variations in returns using different combinations of factors as follows. Initially, we model the companies' excess return (*exc.return$_{it}$*) using the five factors without considering ESG metrics:

$$exc.return_{it} = \alpha + \beta_1^{MKT} MKT_{it} + \beta_2^{HML} HML_t + \beta_3^{SMB} SMB_t + \beta_3^{RMW} RMW_t + \beta_3^{CMA} CMA_t + \varepsilon_{it}$$

(1)

where *MKT$_t$, HML$_t$, SMB$_t$, RMW$_t$,* and *CMA$_t$,* respectively refer to the monthly return of the stock market index less the risk free rate and the monthly premia of book-to-market, size, operating profitability and conservative investment factors[2]. Other factor models – e.g. Fama and French (1993) using the first three factors only – have also been estimated and results do not significantly change, therefore they are not reported.

In model (2) we add the ESG scores (*ESG$_{it}$*) to the previous model specifications as follows:

$$exc.return_{it} = \alpha + \sum_{j=MKT,HML,SMB,RMW,CMA} \beta_j * X_{jt} + \lambda * ESG_{it} + + \varepsilon_{it}$$

(2)

Besides simply adding ESG scores of individual companies to the five-factor model, we also create a further sixth factor following the methodology proposed by Fama and French (1993) with some adjustments. Quartiles[3] of REIT portfolios by ESG scores are created with monthly data and annual rebalancing. The return of the bottom quartile portfolio is subtracted from the return of top quartile portfolio to create our high-minus-low ESG factor (HESGL$_t$). We then extend model (6) with our sixth factor and obtain the following estimation model:

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[2] Please visit Kenneth French's website for further explanation:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_5_factors_2x3.html.
[3] Quartiles rather than deciles are used because of data constraints (i.e. the minimum number of REITs existing at any point in time is not enough to have a statistically meaning portfolio return measure)

$$exc.return_{it} = \alpha + \sum_{j=MKT,HML,SMB,RMW,CMA} \beta_j * X_{jt} + \lambda * HESGL_t + +\varepsilon_{it} \qquad (3)$$

As using different providers is likely to cause different outcomes (as anecdotally signaled by investors and other market participants), we investigate the impact environmental (E), social (S) and governance (G) factors separately because their weight in the computation of the overall score changes by provider. Therefore we construct three risk factors accordingly, and estimate three separate six factor model as follows:

$$exc.return_{it} = \alpha + \sum_{j=MKT,HML,SMB,RMW,CMA} \beta_j * X_{jt} + \lambda * HEL_t + +\varepsilon_{it} \qquad (4a)$$

$$exc.return_{it} = \alpha + \sum_{j=MKT,HML,SMB,RMW,CMA} \beta_j * X_{jt} + \lambda * HSL_t + +\varepsilon_{it} \qquad (4b)$$

$$exc.return_{it} = \alpha + \sum_{j=MKT,HML,SMB,RMW,CMA} \beta_j * X_{jt} + \lambda * HGL_t + +\varepsilon_{it} \qquad (4c)$$

4. Data and ESG Metrics

The ecosystem of organizations that provide ESG data is vast and products offered range from a wide variety of overall rating scores (sometimes including sub-dimensions), ratings on specific issue areas, overall rankings of companies based on specific scores, as well as tools providing evaluation of companies' ESG performances. According to the Global Initiative for Sustainability Ratings, over 100 organizations are collecting data, analyzing, and rating or ranking company ESG performance today (GISR, 2018).

Even though there has been substantial consolidation of rating agencies over the course of the last 30 years, the diversity of these data vendors remains impressive. Some of these organizations are for profit, others are non-profit, and some have a subject matter focus, such as climate (e.g., the former Carbon Disclosure Project, CDP) or human rights (e.g., Corporate Human Rights Benchmark), while others focus on the entire range of issues covered under ESG. Increasingly, data vendors also diversify their service offering, moving away from only selling data and research to investors, to offering consulting services and including multiple technology and management solutions in their portfolio, such as application programming interfaces (APIs) that feed ESG data directly onto corporate servers or advise on ESG integration into wider investment strategies and engagement. Additionally, data vendors increasingly face pressures to grow and internationalize the universe of companies they cover,

as data users seek ever larger quantities of data to benchmark their analyses. A trend which supports consolidation and benefits larger data vendors.

Depending on the topic and geographical focus, data vendors collect the ESG information needed for rating periodically (usually annually) and in a variety of ways. They use surveys to companies, analyses of company documents (e.g., sustainability reports), interviews with company personnel and other stakeholders (such as trade unions, NGOs, etc.), and, increasingly, natural language processing and artificial intelligence technologies to scrape the web of unstructured data (e.g., TruValue Labs). Some also collect surveys to individuals to capture perceptions of companies along various dimensions (e.g., Corporate Human Rights Benchmark, Ethisphere, JUST Capital, and Reputation Institute). Data will be used in different ways to create a specific range of indicators, representing qualitative and quantitative data dimensions, frameworks, and conventions which data vendors design. Each vendor has their own trade-marked methodology to sell data with a specific value proposition. However, since transparency about indicators and methodologies used is low, the distinct contribution of diverse methodologies is not always obvious.

In this study, we examine the most popular ESG metrics for US REITs, provided by GRESB (the Global Real Estate Sustainability Benchmark), Thomson Reuters, and KLD. Below, we briefly discuss each metric and offer a first insight in our data coverage and summary statistics.

GRESB

From 2009 onwards, GRESB, an investor-driven organization, started to transform the way investors assess the environmental, social and governance (ESG) performance of real assets globally. More than 250 members, of which about 60 are pension funds and their fiduciaries, use the GRESB data in their investment management and engagement process, with a clear goal to optimize the risk/return profile of their investments. Since 2009, GRESB has assessed nearly 1,000 property companies and funds, jointly representing more than USD 2.8 trillion in property under management, as well as almost 200 infrastructure assets and funds, on behalf of close to 60 institutional investors.

Over the past eight years, real estate investors have come to see GRESB participation as a sign of a fundamental commitment to ESG performance. They know that they can access information about GRESB participants and recognize that participants have taken a significant step toward leadership on ESG issues. GRESB results help investors understand the sustainability related strengths and weaknesses of their investments. Similarly, participating companies and funds can use the information to identify specific opportunities for improvement. In both cases, GRESB's information provides both absolute and relative measures of performance, including key performance metrics such as

greenhouse gas emissions and rankings within peer groups. This information supports engagement with critical stakeholders, communicating strengths to external audiences and highlighting relative weaknesses to operational teams.

GRESB conducts annual assessments of real estate portfolios, capturing critical information regarding ESG performance and sustainability best practices. The assessments are guided by what investors consider to be key issues in ESG integration in real asset investments. They are aligned with international reporting frameworks, such as GRI and PRI. After a data quality control process, the data is scored with each company, fund and asset receiving a GRESB Score, which is compared against peers in the region and same property type for real estate, and the same region and sector for infrastructure. In addition, the GRESB Rating provides an overall, high-level metric for investors to evaluate the ESG performance of real asset investments. These are aggregated in two sub-scores; (1) management & policy, which is focused on the measurement of corporate intend and ambitions, (2) implementation & measurement, which quantifies the realization of sustainability at corporate level. Both aspects are also blended in the total GRESB score.

Thomson Reuters

Thomson Reuters provides ESG data on over 5,000 listed companies including many of the primary, global and some regional indices like MSCI World, MSCI Europe, STOXX 600, NASDAQ 100, Russell 1000, S&P 500, FTSE 100, ASX 300 and MSCI Emerging Market. Thomson Reuters has in-depth coverage across 400+ ESG data points and 100+ ESG analytics back to 2002. Their processes are designed to ensure the highest data quality levels with stringent quality control and methodology. Every company update goes through different levels of manual validations. In parallel, all data goes through automatic checks – looking for logical relationships between the data points, consistency across years and expected ranges of the quantitative data. Thomson Reuters offers standardized and comparable ESG data thus solving one of the greatest challenges in using this information. The data analysts capture the data as reported by the companies together with the link back to source and then standardize the values in common units across all companies. Full detailed transparency is provided by detailed information links to each data point.

Professional investors use ESG data to define a wide range of responsible investment strategies and integrate it into their traditional investment analysis. Corporate executives (e.g. CSR and IR managers) use the content to benchmark their own performance against peers and track relevant news. Quantitative analysts use the ESG data within the Quantitative Analytics solution to identify a new range of signals. Issues such as climate change, executive remuneration and employee rights are

becoming as important as traditional metrics for companies and investors, that is why having access to an objective and comparable database and analysis tools is so important.

KLD (MSCI)

KLD Research & Analytics, Inc. (KLD) was the leading authority on social research for institutional investors. To meet the needs of social investors, KLD provided research, benchmarks, compliance, and consulting services analogous to those provided by financial research service firms. After acquisitions by Riskmetrics, KLD was integrated by MSCI ESG Ratings in 2010. MSCI ESG Ratings are designed to help institutional investors understand ESG-driven risk and opportunities and integrate these factors into their portfolio construction and management process. Their global team of over 170 research analysts rates over 6,400 companies (11,800 total issuers including subsidiaries) and more than 400,000 fixed income securities globally. The team assesses thousands of data points across 37 ESG issues, focusing on the intersection between a company's core business and the industry issues that can create significant financial risks and opportunities for the company. Companies are rated on a AAA-CCC scale relative to the standards and performance of their industry peers.

Environmental, social, and governance risks and opportunities are posed by large scale trends (e.g. climate change, resource scarcity, demographic shifts) as well as by the nature of the company's operations. Companies in the same industry generally face the same major risks and opportunities, though individual exposure can vary. A risk is material to an industry when it is likely that companies in a given industry will incur substantial costs in connection with it (for example: regulatory ban on a key chemical input requiring reformulation). An opportunity is material to an industry when it is likely that companies in a given industry could capitalize on it for profit (for example: opportunities in clean technology for the LED lighting industry). The MSCI ESG Ratings model focuses only on issues that are determined as material for each industry. MSCI identifies material risks and opportunities for each industry through a quantitative model that looks at ranges and average values for each industry for externalized impacts such as carbon intensity, water intensity, and injury rates. Companies with unusual business models for their industry may face fewer or additional key risks and opportunities. Company-specific exceptions are allowed for companies with diversified business models, facing controversies, or based on industry rules. Once identified, these Key Issues are assigned to each industry and company.

To arrive at a final letter rating, the weighted averages of the Key Issue Scores (binary: 0 or 1) are aggregated and companies' scores are normalized by their industries. After any overrides are factored in, each company's Final Industry-Adjusted Score corresponds to a rating between best (AAA) and worst (CCC). These assessments of company performance are not absolute but are explicitly intended

to be relative to the standards and performance of a company's industry peers. Once the Key Issues have been selected for a GICS Sub-Industry, we set the weights that determine each Key Issue's contribution to the overall rating. Each Key Issue typically comprises 5-30% of the total ESG Rating. The weightings take into account both the contribution of the industry, relative to all other industries, to the negative or positive impact on the environment or society; and the timeline within which we expect that risk or opportunity for companies in the industry to materialize.

In our empirical analysis, we link the different ESG scores of multiple years to a dataset of US REIT performance and key firm characteristics obtained from *Thomson Reuters* and *WRDS*.

Table 1 | summary statistics

Acronym	Variable	Mean	S.D.	Min.	Max.	Skewness	Kurtosis
$AT_{i,t}$	REIT Assets ('000)	4326266	5478074	401	3.44×10^7	2.51	10.071
$DC_{i,t}$	Debt/Capitalization(%)	38.398	16.338	0	112.67	0.343	4.014
$GRE_{i,t}$	Gross Real Estate Investments/Assets(%)	96.152	22.791	0	231.71	-1.174	7.895
$TR_{i,t}$	Total Return(%)	1.116	4.386	-20.123	144.322	15.052	474.545
MRP_t	Market Risk Premium	0.437	1.53	-3.683	2.572	-0.98	3.697
SMB_t	Small Minus Big Return	0.41	0.718	-0.648	2.063	0.389	2.606
HML_t	High Minus Low Return	0.243	1.04	-1.288	2.973	0.672	3.401
RMW_t	Momentum Factor	0.407	0.856	-1.327	1.948	0.392	2.645
CMA_t	Liquidity Factor	0.295	0.91	-0.815	2.968	1.181	4.506
$ESG - A_{i,t}$	ESG-GRESB	55.503	20.339	6.14	93.978	-0.273	2.227
$ESG - B_{i,t}$	ESG-Reuters	47.226	13.677	18.53	88.26	0.591	3.051
$ESG - C_{i,t}$	$ESG - KLD^a$	0.909	0.205	0.36	1.51	-0.261	3.366

Notes: All statistics are based on a sample of 3686 unbalanced panel observations (2000-2018 by 194 REITs). (a) This weighted score is based at 1. A score of 1 illustrates a neutral position while an outcome above 1 shows more strengths than concerns and vice versa for a score below 1.

In table 1, we offer an overview of key statistics for our US REIT sample. This sample includes 194 different equity REITs, and covers the period 2000 to 2017. During this period, the average REIT in our sample, managed €4.3bln using a debt ratio of 38 percent, yielding an average monthly total stock return of almost 1.12 percent. In our analysis, we will explore the cross-sectional variation in these total stock returns across the individual REITs. This we do first using standard asset pricing models that correct the time variation in REIT total returns for their loadings on the validated risk factors; market risk, firm size, firm value, return momentum, and stock liquidity. Table 1 also present the summary statistics for these five return factors. As a next step, we then include the different ESG measures available. At the bottom of table 1, we present the summary statistics for the GRESB, Reuters, and KLD metrics. Perhaps, more interesting than these averages and distribution statistics, are the correlations between the variables. These are stated in the correlation matrix in table 2. Especially, the correlation between the different ESG metrics are of interest here, as one would expect high scores that reflect consistency. But, when reviewing the right bottom corner of table 2, we find paired correlations that never exceed 0.4. For instance, the paired correlation between KLD and GRESB, measuring ESG for the same REITs equals 0.226. Although this correlation is positive and statistically significantly different from zero, the coherence appears to be low at best.

Table 2| correlation matrix

	AT	DC	GRE	TR	MRP	SMB	HML	RMW	CMA	GRESB	Reuters	KLD
AT	1											
DC	-0.265***	1										
GRE	-0.239***	-0.368***	1									
TR	0.009	-0.102	0.112	1								
MRP	0.108***	0.054	-0.05	0.216**	1							
SMB	-0.094	0.031	0.016	-0.104	0.628***	1						
HML	-0.008	-0.028	0.014	0.297***	0.749***	0.821***	1					
RMW	-0.095	-0.064	0.069	0.065	-0.295***	0.22**	0.256***	1				
CMA	-0.019	0.005	-0.003	0.235**	0.736***	0.864***	0.988***	0.298***	1			
GRESB	0.208**	-0.084	-0.145	-0.071	-0.193**	0.104	0.112	0.309***	0.068	1		
Reuters	0.403***	-0.202**	-0.217**	-0.055	-0.004	0.052	0.053	0.082	0.045	0.4***	1	
KLD	0.4325***	-0.206**	-0.177*	0.187**	-0.104	-0.228**	0.032	-0.063	-0.047	0.348***	0.37***	1

Note: Signs ***, ** and * represent significant results at 1%, 5%, and 10% level respectively.

An explanation for this surprising result may be found in table 3. There, we list the weighting schemes of the three ESG metrics. We specify both the measurement items that are included in scoring E, S, and G for each metric, and state the weights that each metric uses for mixing these E, S, and G-scores into their integral ESG measure. Table 3 shows remarkable differences on both accounts. We find that each metric provide uses a different set of items to build up their sub scores and we find that the put different emphasis on the sub score when combining them into their ESG-score. For instance, regarding the E-score, GRESB and KLD have only 5 items in common, and differ on 4. But perhaps more striking is the fact that GRESB weighs this E-score for 57% in their total ESG score, while KLD applies a much smaller E-weight of only 17 percent. Obviously, this will have a vast effect on how their ESG score align. An important difference, that ought to be considered by investors that chose one above the other. Over- or underweighting E within the ESG score is decision that needs to be made explicitly.

Table 3| ESG metric weighting schemes

	GRESB	Thomson Reuters	KLD (MSCI)
E	57%	34%	17%
Energy score	15%	✓	✓
GHG score / Climate change	3.60%	✓	✓
Water score	4.70%	✓	✓
Waste score	5.10%	✓	✓
Technical building assessment	3.30%		✓
Monitoring & environmental management system	14%	✓	
Building certifications	10.90%		
Raw material sourcing		✓	✓
Biodiversity and land use		✓	✓
Environmental policy			
Environmental supply chain incidents			
S	18%	35.5%	25%
Sustainability focused community engagement process	2.20%		
Community engagement impact monitoring	1.10%	✓	
Tenant engagement and satisfaction	8%		
Employees' training and satisfaction / Human capital	5.80%	✓	✓
Product liability (safety)		✓	✓
Controversial sourcing			✓
Social opportunities			✓
Policy on freedom of association		✓	
Policy on elimination of discrimination		✓	
Customer responsibility		✓	
G	25%	30.5%	58%
Management / Corporate governance	8.80%	✓	✓
Policy & Disclosure	9.50%	✓	✓
Sustainability risk assessments	5.10%		
Tax transparency			✓
Anti-competitive practice			✓
Signatory to UN global compact			

5. Empirical Results

Before, we start our empirical analysis with the estimation of our asset pricing models for the REITs in our sample, we compare their summary statistics after ranking them based in their ESG scores. This will help us to identify whether differences in REIT returns related to the observed variations in ESG-score are also signaling some other stylized facts linked to other return-relevant firm characteristics. Therefore, Table 4 reports the summary statistics for quartiles that contain the top versus bottom 25% of REITs ranked by their individual ESG scores.

Table 4| Firm characteristics across ESG rankings

Panel A: Top 25% ESG scores

Acronym	Variable	GRESB		Reuters		KLD	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
$AT_{i,t}$	REIT Assets ('000)	1.33×10^7	8753152	1.11×10^7	7158563	7660285	7464677
$DC_{i,t}$	Debt/Capitalization(%)	32.796	8.348	35.184	11.804	35.8	14.106
$GRE_{i,t}$	Gross Real Estate Investments/Assets(%)	97.505	21.673	97.251	17.645	97.94	17.094
$TR_{i,t}$	Total Return(%)	0.898	4.754	0.808	6.975	1.087	7.5
MRP_t	Market Risk Premium	1.134	3.022	0.857	3.673	0.654	4.13
SMB_t	Small Minus Big Return	-0.063	2.324	0.101	2.454	0.202	2.469
HML_t	High Minus Low Return	0.002	2.237	0.046	2.575	0.132	2.616
RMW_t	Momentum Factor	0.127	1.547	0.258	1.671	0.26	1.848
CMA_t	Liquidity Factor	-0.094	1.423	-0.043	1.522	0.108	1.456
$HESGL_t$	Estimated ESG Factor	-0.078	1.684	-0.305	2.461	-0.166	1.543

Panel B: Bottom 25% ESG scores

Acronym	Variable	GRESB		Reuters		KLD	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
$AT_{i,t}$	REIT Assets ('000)	6118619	3736962	4617337	4458066	3320398	3278619
$DC_{i,t}$	Debt/Capitalization(%)	30.388	9.822	38.387	15.224	35.991	13.018
$GRE_{i,t}$	Gross Real Estate Investments/Assets(%)	107.652	15.074	99.704	19.43	98.902	17.752
$TR_{i,t}$	Total Return(%)	0.961	4.881	1.175	7.109	1.411	6.898
MRP_t	Market Risk Premium	1.104	2.993	0.898	3.605	0.762	3.846
SMB_t	Small Minus Big Return	-0.095	2.34	0.087	2.457	0.109	2.426
HML_t	High Minus Low Return	-0.036	2.243	0.044	2.592	0.119	2.333
RMW_t	Momentum Factor	0.124	1.541	0.244	1.633	0.195	1.867
CMA_t	Liquidity Factor	-0.126	1.424	-0.062	1.521	0.14	1.411
$HESGL_t$	Estimated ESG Factor	-0.102	1.679	-0.316	2.373	-0.23	1.481

The most striking difference across these two sub-groups is the average size, measured by REIT assets. For all three ESG rankings, we find that the high scoring REITs have almost twice the asset size of their low scoring peers. This could be the result of economies of scale that help larger REITs to enhance their ESG efforts. Therefore, we incorporate the exposure of each REIT to a size factor in our models, following the use of small-minus-big size factor identified being relevant in the finance literature.

When considering the rest of table 4, we find a lot of consistency. First across the three different ESG sample rankings, which have been found different in their measurement and weightings schemes but when ranked yield similar REIT profiles within the top versus bottom ranks. For GRESB, Reuters and KLD, we find that the largest REITs have the higher scores, while the debt ratios tend to be slightly lower within these top quartile firms. But we also find consistency regarding some of the risk factor loadings across these ranked buckets. Although, we find that the total return of the high scoring REITs is 7 percent lower, on average, we also find premia regarding the 5 return factors that are similar.

Baseline model estimations

The original five factor model has been adopted to estimate the first baseline results assessing individual REIT returns. In this section of the analysis we use annual data, which is the update frequency of ESG scores given by different providers. Clearly the use a monthly frequency will be used in the main part of our analysis because it allows more variation.

Table 5| Five factor model for REIT excess returns

Independent Variable	M1a	M2a	M3a
MRP_t	0.933***	0.934***	1.238***
	(0.095)	(0.096)	(0.153)
SMB_t	0.47***	0.467***	1.238***
	(0.135)	(0.138)	(0.242)
HML_t	0.671***	0.67***	1.141***
	(0.141)	(0.143)	(0.305)
RMW_t	-0.024	-0.024	0.191
	(0.185)	(0.187)	(0.298)
CMA_t	-0.128	-0.122	-0.695**
	(0.179)	(0.182)	(0.305)
Alpha	0.265	0.262*	-0.583*
	(0.177)	(0.149)	(0.3)
Fixed REIT Effect	N	Y	Y
Fixed Time Effect	N	N	Y
R-sq	0.11	0.11	0.15
Observation	2455	2455	2455

Notes: The dependent variable is total excess return. Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.

Table 5 reports the aggregate results of the baseline model estimations, with a market risk beta's of around 1.0 and significant loadings for the size and value factors, which are in line with literature and which strengthen once we include firm and time fixed effects. The original robust-minus-weak profitability factor (RMW) appears to be less relevant for REITs and this may be explained by the industry adopting and preferring a cash-flow based measure of income. Regarding a conservative vs aggressive investment (CMA), we find a negative loading but only when we use firm and time fixed effects.

After validating the standard asset pricing model specification as a suitable baseline model for our REIT sample, we turn to focus on the effects of ESG ratings. First, we simply add the annual ESG scores of each REIT to the five-factor model. We thereby estimate model (2) to test whether the ESG score level covaries with the corresponding REIT returns, controlling for the standard five factors. Table 6 shows the results for each ESG measure and with different fixed effect settings.

Table 6| Five factor model for REIT excess returns, including ESG scores (annual data)

Independent Variable	A1a	A2a	A3a	B1a	B2a	B3a	C1a	C2a	C3a
MRP_t	0.191	0.136	-0.173	0.913***	0.987***	2.518***	1.077***	1.101***	2.817***
	(0.403)	(0.419)	(0.616)	(0.074)	(0.08)	(0.339)	(0.068)	(0.07)	(0.253)
SMB_t	-2.223**	-1.824		-0.128	-0.269	0.55	0.196*	0.171	3.339***
	(1.135)	(1.183)		(0.213)	(0.219)	(0.539)	(0.119)	(0.125)	(0.613)
HML_t	1.2	1.004	0.176	0.257**	0.479***	-1.39***	0.316***	0.318***	-1.792***
	(1.15)	(1.683)	(0.535)	(0.127)	(0.143)	(0.514)	(0.096)	(0.102)	(0.58)
RMW_t	-0.458	-0.717	-0.59	-0.391**	-0.325*	2.655***	0.061	0.105	3.844***
	(0.66)	(0.692)	(1.355)	(0.172)	(0.181)	(0.67)	(0.143)	(0.151)	(0.608)
CMA_t	-0.047	-0.037		0.306	-0.02	0.315	0.084	0.114	0.328*
	(1.482)	(2.344)		(0.224)	(0.246)	(0.425)	(0.14)	(0.14)	(0.195)
$ESG - GRESB_{i,t}$	-0.002	-0.012	-0.009						
	(0.015)	(0.029)	(0.03)						
$ESG - Reuters_{i,t}$				-0.007	-0.031***	-0.01			
				(0.005)	(0.009)	(0.01)			
$ESG - KLD_{i,t}$							0.05	0.351	-0.343
							(0.29)	(0.345)	(0.426)
Alpha	0.825	1.515	1.515	0.555**	1.577***	-0.057	0.188	-0.111	-2.291***
	(0.879)	(1.406)	(2.179)	(0.254)	(0.424)	(0.579)	(0.301)	(0.355)	(0.643)
Fixed REIT Effect	N	Y	Y	N	Y	Y	N	Y	Y
Fixed Time Effect	N	N	Y	N	N	Y	N	N	Y
R-sq	0.04	0.03	0.04	0.32	0.3	0.49	0.39	0.39	0.53
Observation	177	177	177	793	793	793	1423	1423	1423
REIT	41	41	41	163	163	163	146	146	146

Notes: The dependent variable is total excess return. Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively. ESG measures have annual frequency so this is estimated with annual data.

The results for these ESG scores are weak. The only specification that yields significant coefficients is the REIT fixed effects estimation for the Reuters ESG score, were we document a negative coefficient, indicating that high ESG-scores coincide with lower than average REIT returns. At the same time, we should be careful with the interpretation of these ESG coefficients, since we already noticed that the ESG score covary with other firm characteristics.

ESG as the sixth factor

To better assess the effects of ESG, we ought to re-specify our asset pricing model by including ESG return sensitivity as the sixth factor. As for the other five factors, we construct a time series for the return spread of high-minus-low ESG REIT portfolios and include these spreads as factor six. After this model conversion, we are now able to estimate and report six factors that allow a straightforward interpretation.

Table 7| Six factor model for REIT excess returns, with ESG return spreads as the sixth factor (annual data)

Independent Variable	A7a	B7a	C7a	A8a	B8a	C8a	A9a	B9a	C9a
MRP_t	0.361	0.939***	1.056***	0.376	0.934***	1.055***	0.122	1.904***	1.896***
	(0.301)	(0.108)	(0.124)	(0.309)	(0.109)	(0.126)	(0.241)	(0.22)	(0.218)
SMB_t	-1.376*	0.584***	0.461*	-1.41*	0.605**	0.483*		0.48	0.939**
	(0.751)	(0.25)	(0.255)	(0.766)	(0.255)	(0.26)		(0.315)	(0.46)
HML_t	0.818	0.855***	0.457***	0.614	0.85***	0.453***	0.606***	1.145***	0.608
	(1.145)	(0.174)	(0.171)	(1.177)	(0.176)	(0.175)	(0.21)	(0.343)	(0.44)
RMW_t	0.032	0.138	-0.316	0.105	0.141	-0.316	0.363	1.559***	1.147***
	(0.51)	(0.221)	(0.28)	(0.527)	(0.223)	(0.284)	(0.564)	(0.42)	(0.404)
CMA_t	0.684	-0.147	0.132	1.034	-0.142	0.14		0.146	0.337
	(1.587)	(0.249)	(0.243)	(1.635)	(0.251)	(0.246)		(0.326)	(0.301)
$HESGL - GRESB_t$	-0.656			-0.795			-0.592		
	(0.808)			(0.83)			(0.427)		
$HESGL - Reuters_t$		0.683***			0.688***			0.309	
		(0.164)			(0.167)			(0.291)	
$HESGL - KLD_t$			0.865***			0.876***			0.515
			(0.298)			(0.302)			(0.429)
Alpha	0.687	0.358*	0.467**	0.679	0.343**	0.434**	0.695	-0.315	-0.392
	(0.421)	(0.188)	(0.233)	(0.433)	(0.162)	(0.177)	(0.426)	(0.296)	(0.301)
Fixed REIT Effect	N	N	N	Y	Y	Y	Y	Y	Y
Fixed Time Effect	N	N	N	N	N	N	Y	Y	Y
R-sq	0.02	0.12	0.12	0.02	0.12	0.12	0.02	0.15	0.15
Observation	1114	2076	1889	1114	2076	1889	1114	2076	1889
REIT	187	187	178	187	187	178	187	187	178

Notes: The dependent variable is total excess return. Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.
But after creating HESGL with different samples for the three measures, the model is estimated on the full REIT sample for both no. of REITs (e.g. 187 for GRESB as well) and time period (shorter for GRESB)

Table 7 reports estimation results for each ESG measure still using an annual dataset, again using annual data and with and without REIT fixed effects. Particularly, we construct the *HESGL* factor with the sample available for each of the three measures, but we then price this market-level factor to the whole REIT sample[4]. Without time fixed effects, our results show positive and significant results for both the Reuters and KLD measures and non-significant negative for GRESB. When we introduce time fixed effects, the HESGL factor does not seem to explain REIT pricing. However, the need for variation in this factor suggests the use of a monthly frequency where the pricing will be tested from this point onwards.

To allow for a better comparison, Table 8 provides the same six factor model estimation with a monthly frequency for both a common sample period that starts in 2011 (Panel A) and the full sample of each ESG measure (Panel B). Results that are still similar for the common sample with negative (this time significant) factor loading for GRESB and positive for Reuters and KLD, also when using REIT and time fixed effects. When considering the full time series for each measure, as reported in Panel B, we find that the factor loading for KLD changes to negative. Using the longer time series causes this change, indicating time variation in the data. It appears that ESG compliance reduced return in the early years.

In order to properly assess this time variance in ESG loadings, we stratify our estimation across sub periods since the inception of each ESG measure. We estimate results for the full and sub sample periods for each ESG metric separately, and present our main findings in Table 9A-C.

Focusing on the ESG results, we find similar patterns across all three metrics. For all three, we find consistent results to the whole sample period. For all three measures we find that factor loadings turn from negative in the first period (11-13 for GRESB and earlier for Reuters and KLD) to positive in the latter years. These negative factor loadings could be the result of the initial investment costs that are associated with ESG compliance (screening costs, membership fees, internal management needed for ESG policy) and a learning curve to turn ESG compliance in favor of shareholders' performance (i.e. REITs had to learn their trade to benefit from investments made to improve ESG compliance). In case of Reuters, factor loadings have been positive since 2007 leading to a positive coefficient for the overall period as well. However, factor loadings for the KLD measure are positive only starting from 2011 and they are negative (and significant) if we consider the overall sample period, with the initial 2002-10 period dominating over the most recent one.

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[4] In other words, GRESB, Reuters and KLD refer to the construction of the three different HESGL measures, but the REIT sample used to estimate the factor loadings is the same for all measures (observations differ because of the different sample period, which is shortest for GRESB and longest for Reuters).

Table 8| Six factor model for REIT excess returns, for common sample period (monthly data from 2011 onwards)

Panel A: Common sample (from 2001 onwards)

Independent Variable	GRESB			Reuters			KLD		
Period	2011-17			2011-17			2011-16		
MRP_t	0.558***	0.558***	-0.191	0.567***	0.567***	-0.164	0.612***	0.613***	-0.105
	(0.045)	(0.045)	(0.128)	(0.045)	(0.045)	(0.133)	(0.051)	(0.051)	(0.137)
SMB_t	-0.079	-0.079	-1.608***	-0.053	-0.053	-0.380	-0.118***	-0.119	0.509**
	(0.068)	(0.067)	(0.319)	(0.068)	(0.068)	(0.309)	(0.080)	(0.080)	(0.242)
HML_t	-0.035	-0.038	1.562***	0.050	0.044	1.960***	-0.090***	-0.096	-0.515**
	(0.079)	(0.079)	(0.301)	(0.086)	(0.086)	(0.328)	(0.092)	(0.092)	(0.214)
RMW_t	0.049	0.049	-2.117***	0.083	0.082	-0.795***	0.16	0.155	0.5996*
	(0.097)	(0.097)	(0.279)	(0.097)	(0.097)	(0.299)	(0.122)	(0.122)	(0.318)
CMA_t	0.19	0.196	-1.709***	0.072***	0.083	-1.743***	0.136***	0.150	-0.005
	(0.121)	(0.122)	(0.383)	(0.128)	(0.128)	(0.434)	(0.151)	(0.151)	(0.504)
$HESGL_t$	-0.301***	-0.296***	-1.537***	0.262***	0.256***	1.985***	0.02	0.011	1.694***
	(0.073)	(0.073)	(0.197)	(0.088)	(0.088)	(0.280)	(0.131)	(0.131)	(0.428)
Alpha	0.526***	0.521***	-0.241	0.553***	0.546***	-0.901*	0.657***	0.624***	1.564***
	(0.016)	(0.140)	(0.590)	(0.157)	(0.141)	(0.472)	(0.207)	(0.163)	(0.575)
Fixed REIT Effect	N	Y	Y	N	Y	Y	N	Y	Y
Fixed Time Effect	N	N	Y	N	N	Y	N	N	Y
R-sq	0.01	0.01	0.06	0.01	0.01	0.06	0.01	0.01	0.05
Observation	13008	13008	13008	13008	13008	13008	10797	10797	10797

Panel B: Full sample for each measure

Independent Variable	GRESB			Reuters			KLD		
Period	2011-17			2002-17			2002-16		
MRP_t	0.558***	0.558***	-0.191	0.634***	0.633***	0.1097	0.632***	0.631***	1.523***
	(0.045)	(0.045)	(0.128)	(0.024)	(0.024)	(0.122)	(0.025)	(0.025)	(0.112)
SMB_t	-0.079	-0.079	-1.608***	0.308***	0.3095***	2.196***	0.279***	0.281***	1.439***
	(0.068)	(0.067)	(0.319)	(0.036)	(0.036)	(0.164)	(0.039)	(0.039)	(0.285)
HML_t	-0.035	-0.038	1.562***	0.263***	0.262***	-0.023	0.278***	0.278***	-0.39**
	(0.079)	(0.079)	(0.301)	(0.038)	(0.038)	(0.157)	(0.0402)	(0.0403)	(0.153)
RMW_t	0.049	0.049	-2.117***	0.302***	0.302***	0.606***	0.203***	0.204***	-0.006
	(0.097)	(0.097)	(0.279)	(0.048)	(0.048)	(0.227)	(0.051)	(0.051)	(0.169)
CMA_t	0.19	0.196	-1.709***	-0.169***	-0.168***	-0.915***	-0.215***	-0.213***	-1.906***
	(0.121)	(0.122)	(0.383)	(0.059)	(0.059)	(0.296)	(0.064)	(0.064)	(0.209)
$HESGL_t$	-0.301***	-0.296***	-1.537***	0.5497***	0.549***	0.686***	-0.284***	-0.284***	-1.949***
	(0.073)	(0.073)	(0.197)	(0.028)	(0.028)	(0.054)	(0.055)	(0.055)	(0.238)
Alpha	0.526***	0.521***	-0.241	0.624***	0.591***	5.422***	0.655***	0.577***	9.685***
	(0.156)	(0.140)	(0.590)	(0.152)	(0.083)	(0.609)	(0.207)	(0.0902)	(0.778)
Fixed REIT Effect	N	Y	Y	N	Y	Y	N	Y	Y
Fixed Time Effect	N	N	Y	N	N	Y	N	N	Y
R-sq	0.01	0.01	0.06	0.07	0.07	0.16	0.05	0.05	0.16
Observation	13008	13008	13008	24392	24392	24392	22181	22181	22181

Notes: The dependent variable is excess return of REITs. HESGL is the difference in excess return between top 25% ESG rated portfolio and bottom 25% ESG rated portfolio (top minus bottom). Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.

In order to properly assess this time variance in ESG loadings, we stratify our estimation across sub periods since the inception of each ESG measure. We estimate results for the full and sub sample periods for each ESG metric separately, and present our main findings in Table 9A-C.

Focusing on the ESG results, we find similar patterns across all three metrics. For all three, we find consistent results to the whole sample period. For all three measures we find that factor loadings turn from negative in the first period (11-13 for GRESB and earlier for Reuters and KLD) to positive in the latter years. These negative factor loadings could be the result of the initial investment costs that are associated with ESG compliance (screening costs, membership fees, internal management needed for ESG policy) and a learning curve to turn ESG compliance in favor of shareholders' performance (i.e. REITs had to learn their trade to benefit from investments made to improve ESG compliance). In case of Reuters, factor loadings have been positive since 2007 leading to a positive coefficient for the overall period as well. However, factor loadings for the KLD measure are positive only starting from 2011 and they are negative (and significant) if we consider the overall sample period, with the initial 2002-10 period dominating over the most recent one.

As results are clearly different for different measures, even if somewhat consistent over time, we turn to the composition of E, S and G factor of each measure recalling Table 3, which showed an overweight in E for GRESB and G for KLD, while Reuters showed a more balanced weighting among the three components. In fact, we believe that differences in factor loadings may be due to differences in the weighting reported for the three measures.

E, S, and G analysis

Besides the three aggregate ESG scores, we also have data on E, S and G sub scores for the KLD measure for each individual REIT for the period 2002-2016. This allows us to analyze the performance effect of each element, separately. Given, that we already identified a relevant time variance in our results, we perform this sub score analysis for both varying time spans. In tables 10A-C, we state the results for E, S, and G.

In table 10A, we show that a high E-score is associated with a significant negative return for the initial years as well as the overall sample period (whose data availability restricts it to 2002-13). This result is consistent and can also help to explain why our findings for the GRESB overall ESG measure have been negative, as 57 percent of GRESB ESG score relates to E component.

Table 9| Six factor model for sub periods

A: GRESB

Period	2011-13	2014-16	2011-16
MRP_t	-0.273***	0.245	-0.276**
	(0.070)	(0.192)	(0.137)
SMB_t	-0.766***	0.969***	-1.365***
	(0.179)	(0.237)	(0.340)
HML_t	2.343***	-1.4504***	0.168
	(0.203)	(0.232)	(0.372)
RMW_t	-1.018***	2.010***	-2.260***
	(0.240)	(0.450)	(0.315)
CMA_t	-0.152	-0.018	0.648
	(0.126)	(0.255)	(0.150)
$HESGL_t$	-1.625***	0.968**	-2.099***
	(0.113)	(0.431)	(0.245)
Alpha	1.141***	4.288***	0.577
	(0.343)	(0.695)	(0.548)
Fixed REIT Effect	Y	Y	Y
Fixed Time Effect	Y	Y	Y
R-sq	0.22	0.03	0.05
Observation	4762	6035	10797

B: Reuters

Period	2002-06	2007-10	2011-13	2014-16	2011-16	2002-16
MRP_t	-0.299***	0.323***	0.260***	0.343**	-0.213	0.110
	(0.075)	(0.086)	(0.065)	(0.138)	(0.135)	(0.126)
SMB_t	-0.186	2.807***	-0.293*	0.772***	-0.346	2.196***
	(0.144)	(0.267)	(0.167)	(0.247)	(0.3199)	(0.169)
HML_t	1.330***	-0.405***	4.204***	-1.322***	2.285***	-0.023
	(0.175)	(0.111)	(0.233)	(0.261)	(0.412)	(0.162)
RMW_t	-0.940***	1.654***	1.573***	1.358***	-0.573**	0.606***
	(0.141)	(0.356)	(0.199)	(0.403)	(0.273)	(0.235)
CMA_t	0.306**	-3.402***	-1.891***	-0.784	-2.356***	-0.916***
	(0.155)	(0.289)	(0.232)	(0.528)	(0.548)	(0.306)
$HESGL_t$	-0.193**	0.759***	1.7003***	-0.228	2.144***	0.686***
	(0.086)	(0.039)	(0.116)	(0.387)	(0.2504)	(0.056)
Alpha	-0.687*	0.615	-1.070***	4.336***	-0.557	5.426***
	(0.364)	(0.830)	(0.313)	(0.655)	(0.536)	(0.629)
Fixed REIT Effect	Y	Y	Y	Y	Y	Y
Fixed Time Effect	Y	Y	Y	Y	Y	Y
R-sq	0.20	0.48	0.22	0.03	0.05	0.16
Observation	5985	5399	4762	6035	10797	22181

Notes: The dependent variable is excess return of REITs. HESGL is the difference in excess return between top 25% ESG rated portfolio and bottom 25% ESG rated portfolio (top minus bottom). Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.

C: MSCI (KLD)

Period	2002-06	2007-10	2011-13	2014-16	2011-16	2002-16
MRP_t	-0.216***	-0.564***	0.322***	0.380**	-0.105	1.523***
	(0.079)	(0.119)	(0.065)	(0.157)	(0.137)	(0.112)
SMB_t	-0.199	-1.447***	1.440***	1.117***	0.509**	1.439***
	(0.128)	(0.234)	(0.185)	(0.274)	(0.242)	(0.285)
HML_t	1.429***	1.271***	3.789***	-0.308	-0.515**	-0.390**
	(0.144)	(0.097)	(0.211)	(0.256)	(0.214)	(0.153)
RMW_t	-0.859***	-2.885***	3.065***	1.578***	0.5996*	-0.006
	(0.135)	(0.223)	(0.242)	(0.442)	(0.318)	(0.169)
CMA_t	0.373**	-3.586***	-1.664***	-2.614***	-0.005	-1.906***
	(0.180)	(0.255)	(0.246)	(0.553)	(0.504)	(0.209)
$HESGL_t$	-0.380***	-1.297***	3.242***	1.655***	1.694***	-1.949***
	(0.081)	(0.1705)	(0.225)	(0.430)	(0.428)	(0.238)
Alpha	0.123	4.419***	-1.258***	3.452***	1.564***	9.685***
	(0.338)	(0.719)	(0.322)	(0.689)	(0.575)	(0.778)
Fixed REIT Effect	Y	Y	Y	Y	Y	Y
Fixed Time Effect	Y	Y	Y	Y	Y	Y
R-sq	0.20	0.48	0.22	0.03	0.05	0.16
Observation	5985	5399	4762	6035	10797	22181

Notes: The dependent variable is excess return of REITs. HESGL is the difference in excess return between top 25% ESG rated portfolio and bottom 25% ESG rated portfolio (top minus bottom). Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.

Table 10B reports the estimations for S-score, which has most consistent weights in the construction of the three ESG measures (18%, 35.5% and 25% for respectively GRESB, Reuters and KLD). We find a positive premium for socially responsible companies, which is consistent over time. Results show positive and significant factor loadings for each sub period and the overall sample. It seems that investors have bought into the merits of social screening right from the start, while environmental virtues have been deemed as costlier.

Finally, as far as corporate governance is concerned, we report a negative and significant full sample factor loading, which is mainly driven by earlier years. The latter period, in fact, reports positive factor loadings, suggesting that shareholders benefit from good corporate governance. This positive G-result also attributes to the positive overall ESG score that we documented for KLD. Given that KLD weights the G-component with 58 percent in the total ESG-score.

All in all, these separate E, S, and G results show that investor appreciation has not only varied over time, but also differed across ESG elements. While social responsibility and good governance have been favored almost from the start, environmental awareness has needed longer to gain any positive performance impact. This may well be the result of the tangibility of environmental measures within the real estate industry. While social responsibility and governance are more policy related issues, that

Table 10| Six factor model for sub periods

A: E, Environmental weighted subscore

Period	2002-06	2007-10	2011-13	2002-13
MRP_t	1.685***	1.380***	0.833***	0.784***
	(0.134)	(0.075)	(0.119)	(0.077)
SMB_t	-0.120	0.265	-0.760***	1.597***
	(0.089)	(0.221)	(0.155)	(0.170)
HML_t	0.858***	2.121***	-0.082	1.2997***
	(0.153)	(0.110)	(0.237)	(0.075)
RMW_t	0.503***	2.039***	-0.170	-1.512***
	(0.129)	(0.364)	(0.243)	(0.163)
CMA_t	1.365***	-3.880***	0.794***	0.246
	(0.158)	(0.282)	(0.247)	(0.1997)
HEL_t	-0.075	-0.377***	0.243	-0.340***
	(0.061)	(0.041)	(0.149)	(0.033)
Alpha	-0.721**	-0.479	0.390	1.365***
	(0.297)	(0.845)	(0.322)	(0.432)
Fixed REIT Effect	Y	Y	Y	Y
Fixed Time Effect	Y	Y	Y	Y
R-sq	0.27	0.48	0.35	0.46
Observation	2551	5399	1501	9451

B: S, Social weighted subscore

Period	2007-10	2011-13	2014-16	2011-16	2007-16
MRP_t	1.417***	0.108	0.616***	0.1303	1.417***
	(0.136)	(0.078)	(0.138)	(0.117)	(0.194)
SMB_t	-1.840***	-0.165	1.052***	-0.956***	-1.839***
	(0.214)	(0.166)	(0.252)	(0.356)	(0.304)
HML_t	-0.322**	2.687***	-0.039	0.021	-0.322*
	(0.129)	(0.221)	(0.266)	(0.330)	(0.183)
RMW_t	1.912***	1.215***	0.779**	-0.038	1.912***
	(0.191)	(0.2001)	(0.358)	(0.289)	(0.271)
CMA_t	3.314***	-0.126	-2.955***	-0.536	3.313***
	(0.298)	(0.315)	(0.624)	(0.504)	(0.423)
HSL_t	1.957***	0.851***	0.288**	-0.250**	1.957***
	(0.061)	(0.073)	(0.129)	(0.106)	(0.086)
Alpha	2.461***	-2.555***	2.610***	2.254***	2.639***
	(0.406)	(0.329)	(0.665)	(0.650)	(0.578)
Fixed REIT Effect	Y	Y	Y	Y	Y
Fixed Time Effect	Y	Y	Y	Y	Y
R-sq	0.48	0.22	0.03	0.05	0.15
Observation	4079	4762	6035	10797	14876

C: G, Governance weighted subscore

Period	2002-06	2007-10	2011-13	2014-16	2011-16	2002-16
MRP_t	-0.254***	-0.564***	0.331***	0.384**	0.610***	1.861***
	(0.084)	(0.119)	(0.073)	(0.187)	(0.215)	(0.127)
SMB_t	0.167	-1.447***	1.331***	-0.249	0.215	1.056***
	(0.109)	(0.234)	(0.191)	(0.253)	(0.224)	(0.252)
HML_t	1.267***	1.271***	3.517***	-0.488	-0.801***	-0.592***
	(0.141)	(0.097)	(0.246)	(0.340)	(0.240)	(0.171)
RMW_t	-0.808***	-2.885***	2.883**	-0.873*	0.508	0.188
	(0.126)	(0.223)	(0.208)	(0.479)	(0.316)	(0.165)
CMA_t	-0.009	-3.586***	-1.663***	0.365	-0.488	-1.569***
	(0.168)	(0.255)	(0.274)	(0.591)	(0.485)	(0.2001)
HGL_t	-0.231***	-1.297***	3.401***	0.044	0.732***	-1.929***
	(0.077)	(0.170)	(0.216)	(0.200)	(0.274)	(0.236)
Alpha	1.056***	4.419***	-1.581***	-0.162	2.303***	9.757***
	(0.308)	(0.719)	(0.345)	(0.696)	(0.600)	(0.774)
Fixed REIT Effect	Y	Y	Y	Y	Y	Y
Fixed Time Effect	Y	Y	Y	Y	Y	Y
R-sq	0.20	0.48	0.22	0.03	0.05	0.16
Observation	5985	5399	4762	6035	10797	22181

Notes: The dependent variable is excess return of REITs. HGL is the difference in excess return between top 25% governance issue rated portfolio and bottom 25% governance issue rated portfolio (top minus bottom). Figures in parentheses show standard error. Signs ***, **, * represent significant level at 1%, 5%, 10% respectively.

can be adopted and implemented swiftly, environmental footprints take more and longer to reduce. Obtaining strong E-scores require material efforts, which are recognizes by investors.

6. Conclusions and Implications

In this paper, we generate new insights into ESG within the REIT market. From 2002 onwards, investors were granted the opportunity to involve ESG-scores in their REIT selection process. While REIT coverage was limited in the early years, we find that more measures became available as time progressed. More investors became interested in contributing to the UN sustainable development goals and searched for means to quantify the relevant firm aspects to adjust their due diligence accordingly. This increased investor demand was propelled by the surge of the environmental footprint ambitions with which the real estate market has been targeted by policymakers. Besides social responsibility and good governance, investors also got challenged to contribute to contending with the effects of climate change by reducing the environmental impact of their real estate portfolio. Nowadays, a plethora of metrics has become available to measure and monitor these ambitions.

In our analysis, we focus on the three most popular ESG-measures; GRESB, Reuters and KLD (MSCI). We studied the composition of these measures, and performed time series analyses to assess the effects that these ESG scores have had on REIT stock performance. Our results are important and novel. First, we observe pervasive differences in the ESG measurement across the available metrics. For instance, in the case of GRESB the Environmental aspects make up 57 percent of their total ESG score. For KLD, this is only 17 percent. A remarkable difference, which will lead to differences in ESG scores, without necessarily indicating any variations in E, S, or G-efforts on REIT levels. Differences that need to be accounted for when considering the interlink with corresponding REIT returns.

When considering the adoption and ESG-score of individual REITs, we identified a compelling size difference between high- and low scoring REITs. For each ESG-metric, we find that the top quartile ESG scoring REITs managed more than twice as many assets as the lower quartile. This can be due to a size effect that helps larger REITs to enhance to realize their environmental ambitions. This size difference therefore needs to be accounted for, once we start analyzing the interaction between ESG scores and REIT performance, as size is a recognized performance driver on its own.

In our analysis of REIT returns, we apply the standard five factor asset pricing model to control for market risk, size, value, momentum and stock liquidity, before we focus on the effects that individual ESG scores. This return analysis yields various new insights. First, we document a strong difference in the loading of the ESG factor across the three different metrics. For GRESB, we typically report negative coefficients, indicating that high GRESB scores are associated with weaker REIT returns, while higher ESG-score of Reuters and KLD are accompanied by a performance premium. Second, when zooming in on each of these metrics, we discover that the ESG-effect on REIT returns changes over time. For all three measures, we find negative ESG-loading in the early years, and positive coefficients during the most recent years. This could indicate that investors needed time to warm up to the new information that was conveyed by these ESG-measures. Perhaps, they have been more concerned with the costs of ESG compliance during these starting years, while the virtues of ESG became recognized only after a while. Thirdly, we find an important difference in return effects across the three ESG components. Using the history of KLD subs cores, we find a positive return effect for both S and G, while E ended up with a return discount. This could be due the difference in efforts needed to realize E, S and G ambitions, especially for real estate investment companies. Organizing good governance and ensuring social responsibility tends to induce less costs as reducing the carbon footprint of an entire real estate portfolio. This third insight can also help us to explain the first. Given that high E-scores are associated with negative return effects, we can reason why the GRESB score was accompanied by negative coefficients. GRESB overweighs E within their ESG metric. This is also the most important implication of our results for our readers. It is important to first define your own ESG priorities before selecting

the ESG metric with which you would like to include ESG into your selection process. Our results show that differences exist, and that these difference matter.

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