

A Work Project, presented as part of the requirements for the Award of a Master's degree in  
International Finance from the Nova School of Business and Economics.

EXAMINING NORTH AMERICAN REITS IN A VOLATILE INTEREST RATE  
ENVIRONMENT WITH ESG CHARACTERISTICS

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## **Abstract**

This paper examines the empirical link between the Environmental, Social and Governance (ESG) performance and Long-Term Interest Rates with the financial performance of Real Estate Investment Trusts (REITs) for a consecutive 6-year period, 2017 to 2023. The dataset is comprised of 24 of the largest North American equity REITs by asset size, and the dynamic relationships are tested through a Panel VAR and Granger Causality model. The results support previous literature on the sensitivity of REIT returns to interest rate changes but find no evidence to support ESG performance as a positive driver of financial performance.

**Keywords:** REITs, Interest Rates, ESG, Volatility and Financial Performance.

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# **1 Introduction**

Real estate investing has long been a key pillar of the global economy, with the total value of the world's property standing at \$379.7 trillion, four times global GDP (Tostevin and Rushton 2023).

The high capital requirements of real estate investing however, have historically meant these lucrative long-term investments were out of reach for the 'everyday' citizens. The creation of Real Estate Investment Trusts (REITs), defined by the National Association of Real Estate Investment Trusts (NAREIT) as a company that holds or finances income-producing real estate across different property sectors, provides the opportunity for all investor profiles to tap into profits from valuable real estate, and get access to dividend-based income ("What's a REIT?" 2023).

Since the inception of REITs in 1960 by the United States Congress, the principal requirements to legally qualify as a REIT have not changed. The key founding principles are: at least 75% of assets invested in real estate, with at least 100 shareholders and, very importantly, with at least 90% of its taxable income returned to shareholders as dividends ("Investor Bulletin: Publicly traded REITs" 2016). Investors are able to invest in publicly traded REITs in three ways: buying company stock, through a mutual fund or through an Exchange Traded Fund (ETF). This paper will focus on investments and returns generated from owning a percentage of a REIT, stock ownership.

The current global listed REIT market was estimated, by NAREIT, in December 2022, to have reached \$1.9 trillion ("Global Real Estate Investment" 2023). The global demand for REITs has surged over the last 30 years, climbing from 120 to the current 893 existing listed REITs in over 40 countries ("Global Real Estate Investment" 2023). Despite Asia showing significant growth over the last 10 years, North America remains the largest, driven by the

strong and mature US market, as represented by its significantly heavier index weight within renowned global indexes (eg. North America is 71.9% of the S&P Global Equity REITs index) (“S&P Global REIT” 2023).

Publicly traded REITs are hybrid investment products between the underlying real estate and the equity markets where they operate (Corgel, McIntosh and Ott 1995). Considering the previous literature exploring influencing factors on REIT financial performance has compellingly and consistently concluded interest rate sensitivity of REIT returns to long-term interest rates (Allen, Madura, and Springer 2000), and found REIT returns to be influenced by monetary regime changes on separate significant occasions, namely in 1979 and 2008 (Liang, McIntosh and Webb 1995; Morri and Liu 2017). In this paper, we will further study this effect for a consecutive recent period which includes two significant monetary regime changes. Namely rate cuts between 2018 and early 2020 and aggressive hikes from mid 2020 until mid 2023.

Considering how REITs might behave in volatile economic periods, previous literature has explored ESG as both having resilience benefits in tough economic conditions (Liu, Nemoto and Lu 2023 and Doré 2021) and stimulating company returns in both downturns and upturns of the economy (Yin, Li, and Su 2023 and Feng and Wu 2021). However, specific studies on REIT financial performance and ESG variables are more limited and less conclusive. Evidence of increased financial efficiency and performance exists (Eichholtz, Kok, and Yönder 2012) but not for all samples (Coën, Lecomte and Abdelmoula 2018). Interestingly, differences in how each ESG component is priced by investors also exists (Erol, Ünal, and Coşkun 2023).

Accordingly, this paper aims to contribute to the understanding of the dynamic relationship between ESG features and a period of high economic volatility, on REIT performance. Only Equity REITs are considered over the same time horizon, with a focus on

the most mature and uniform REIT market: North America, to minimize discrepancies between country specific factors. Moreover, by using a Total Return measure of REIT performance this paper avoids the common theme in previous literature of ignoring additional return aspects, including the capital appreciation of the underlying assets.

The following research question is proposed: **Does the ESG performance and a volatile Interest Rate period significantly impact the financial performance of North American REITs?**

The main estimation technique used to measure the relationship between the various time-series variables proposed is a Panel Vector Autoregressive (PVAR) estimation model. To increase the validity of the study a cointegration test and a granger causality test are also applied. The sample consists of 24 North American Equity REITs, analyzed over 74 observation months (May 2017 to June 2023).

The results indicate a clear negative correlation between LTIRs and Total Returns, further supported by the PVAR model showing significant results for the 1- and 2-month lag of LTIRs against Total Returns, and the Granger Causality test showing one-way directional causality from LTIRs to Total Returns. On the other hand, despite finding a positive correlation between all ESG measures and absolute Total Returns, no significant dynamic relationship is found between any of the proposed lagged ESG variables to the tested standardized Total Returns. However, the results of the Pairwise Granger test showed a REIT's financial performance may be useful in forecasting its Social and Governance performance.

## **2 Literature Review**

The first section of this literature review will discuss the contribution of the ESG factor to performance. The second section deep dives into the growing role of ESG within the REITs investment universe. The final section examines prior empirical research on REIT

performance under hawkish and dovish economic scenarios. Overall, the findings highlight: ESG as increasing resilience and stimulating performance for publicly traded companies; some level of significant positive relationship exists between ESG and REITs; and conclusive previous research on a causal relationship between interest rates and REIT performance.

## **2.1 Contribution of the ESG factor**

The resilience of stock prices tends to be talked about, especially, in economic downturns or major events which impact financial markets. Proactive ESG practices, as encouraging sustainable and responsible economic growth can be highly important in promoting the green recovery (Liu, Nemoto and Lu 2023). Studying publicly listed companies in 2016-2021, Lui, Nemoto and Lu (2023) show stock returns during the COVID-19 period to be positively correlated with ESG performance, concluding the benefits as: enhanced stock market stability and increased market liquidity. A potential reason for an outperformance from strong ESG companies, are stronger social practices which allowed them to better manage reputational and social risks during uncertain times (Doré 2021). Overall, ESG focused companies or funds, have additional layers of risk management which can provide a competitive edge during very unpredictable times.

Moreover, ESG has also been found to enhance financial performance in changing macroeconomic environments. In Yin, Li, and Su (2023), ESG performance positively impacted the stock returns of respective companies between 2011-2020. The study analysed Chinese companies, highlighting an interest rate period marked by high volatility in China. ESG can also stimulate performance due to better company positioning to seize growth opportunities or projects, often by benefiting from a competitive edge, such as lower costs of capital. Feng and Wu (2021) found REITs with stronger ESG disclosure, demonstrate lower costs of debt, higher credit ratings and higher unsecured debt to total debt ratio, all key financing metrics for the real estate industry. Accordingly concluding investors favor active

ESG disclosure. Overall, Yin, Li, and Su (2023) and Feng and Wu (2021) show ESG as a stimulator of financial performance over both loose and tight monetary policy periods.

## **2.2 ESG Principles and REIT Performance**

This second section aims to provide an overview of the recent, and to some level inconsistent and limited, results of previous research regarding ESG performance in REITs.

Starting on a negative note, from 2010-2016, Coën, Lecomte and Abdelmoula (2018), showed that using risk-adjusted performance measures, based on multi-factor models, non-green US REITs tended to perform better than green REITs. The sampled period was of medium-low interest rate volatility, as it was not marked by any major FED monetary action, and rates averaged around the 2% target.

Amongst the first researchers on the topic were Eichholtz, Kok, and Yönder (2012), who examined the connection between the financial success of commercial property owners, such as REITs, and the sustainability of commercial buildings. Their conclusion was a positive correlation between the greenness of the portfolio and its operating success. The determinants of success for their sample of US REITs from 2000-2011, a highly volatile interest rate period, were ROE, a performance measure, and ROA, an efficiency measure.

The contrast between Coën, Lecomte and Abdelmoula (2018) and Eichholtz, Kok, and Yönder (2012) findings, indicates two major trends; first, ESG as it is defined today, and sustainability metrics used in the 2000's are significantly different. Secondly, it is important to consider that sustainability metrics had little to no regulation at the time, opening the door for inflated scores to 'match' strong financial performance, or in modern terms 'greenwashing'.

Measuring the performance of REITs with a strong ESG foundation is increasingly important, and here regulation has been playing a massive role. The recent launch of global frameworks for ESG reporting by the European Commission (ESRS) and the IFRS (ISSB),

both in 2023, demonstrate the growing importance and scrutiny relating to ESG reporting standards for all companies. Therefore, a breakdown of ESG into its three categories: Environmental, Social and Governance, is becoming a prerequisite for a detailed analysis of financial performance of any fund. Indeed, investors also price each ESG component differently. As found by Erol, Ünal, and Coşkun (2023) through a PVAR-Granger causality model and a fixed-effects panel data model based on 234 ESG-rated REITs between 2003-2019, Environmental and Social investing practices were more significant drivers of financial performance for REITs, over their sample period of high economic volatility (includes pre-2008 crisis and then zero interest-rate policy).

Overall, the fast-growing number of papers considering ESG factors on REIT performance, is mostly limited to datasets between the global financial crisis of 2008 until the Covid-19 Pandemic, or 2020. This paper will attempt to explore how ESG factors can affect REITs over the most recent window of a volatile economic period.

## **2.3 Interest Rate Sensitivity of REIT Performance**

In accordance with financial markets theory, stock markets almost immediately react to interest rates movements. As a macro-economic indicator, interest rates are a proxy for economic volatility (Seabury 2023).

Over the years, there has been a lot of research on the connections between interest rates and REIT returns. Starting with Liang, McIntosh and Webb (1995) who concluded that between 1973 and 1989 both long and short-term interest rates influenced REIT returns. Furthermore, the authors note that significant tax reforms (such as 1986) and monetary regime changes (such as 1979) occur, respectively, around the changeover points of the return-generating periods. Indicating Fed and government action as impactful in REIT returns.

Additionally, according to Allen, Madura, and Springer (2000), REITs might not be able to separate their performance from external market and economic forces. In their study

of 46 US publicly traded REITs, they discovered compelling evidence that both short and long term fluctuations in interest rates had an impact on REIT returns, over the whole sample period (1993-1997).

More recent studies exploring the influence of Fed action on REIT returns have shown similar conclusions to Liang, McIntosh and Webb (1995). After the 2008 financial crisis, (Morri and Liu 2017) concentrated on understanding how sensitive the profits of US REITs were to shifts in interest rates brought about by monetary policy. The study's findings, based on a multifactor model, highlighted how the performance of REITs is sensitive to interest rates over time. Specifically, the performance changes under the FED's Quantitative Easing (QE) measures between 2009 and 2015 were relevant, while the 1995–2008 period showed little significance. In practical terms, the QE sensitized the real estate market through lower interest rates, which led to improved performance.

Overall, the previous literature consistently shows some level of sensitivity of REIT returns, as measured by share price appreciation, to interest rate movements. This study will test this relationship through a total return measure, also considering dividends.

## **2.4 Hypothesis Development**

The objective of this paper is to study the financial behavior of REITs, considering how they are impacted by their ESG performance and by the interest rate environment in which they are studied. Considering how the two predictive variables; ESG and a volatile interest rate period, interact with a metric of REIT Total Returns. Accordingly, and considering the discussion of the literature review, two hypotheses are proposed.

First, examining the data which indicates a noteworthy sensitivity of US REIT returns to US interest rate movements in various interest rate periods: 1973-1989 (high volatility- steep rate cuts and hikes), 1993-1997 (medium to high volatility- steep rate hikes) and 2009-2015 (high volatility- trendline of rate cuts) (Liang, McIntosh and Webb 1995; Allen, Madura,

and Springer 2000; and Morri and Liu 2017). Based on this indication that in various interest rate periods, a relationship has been found between REIT returns and long-term interest rates, it is proposed for our sample period:

**Hypothesis 1:** “North American REIT financial performance is significantly associated with long term interest rate movements over the last 6 years of economic volatility.”

Second, it is considered there are positive findings of ESG influence on REIT performance from Eichholtz, Kok, and Yönder (2012) over a period of high interest rate volatility (2000-2011), and of Erol, Ünal, and Coşkun (2023) of specific ESG variables as more significant impactors of performance over a prolonged period of volatility (2003-2019). Given that a relationship has been observed between REIT returns and ESG throughout a range of volatile interest rate periods, it is proposed for our sample:

**Hypothesis 2:** “The ESG performance of a North American REIT is positively associated with its financial performance over a volatile interest rate period.”

Performance is measured for both hypotheses using the coefficients on the PVAR Models 1 and 2, as well as the Pairwise Granger Causality Tests' F-statistic, which is discussed in greater detail in the Methodology section.

## **3 Data**

### **3.1 Sample**

For this study, the 50 largest publicly traded equity REITs, by asset size, were sampled, isolating North America as the biggest contributor with 42 REITs, a 39/3 split between US and Canada, respectively. As an economic region, North America exhibits the least variation in regulations and economic performance between contributing countries, increasing the

validity of our study. Given >92% of the sample are US based REITs, US macro-indicators will serve as a proxy for North American macro performance.

Additionally, as previously mentioned, the US REIT market is undoubtedly the most mature, which increases the likelihood of finding relevant ESG performance data due to improved environmental regulations, stronger corporate governance, and more developed social infrastructure found in maturer industries (Daugaard and Ding 2022).

### **3.1.1 Data Extraction**

In order to test this paper's hypothesis, Bloomberg was used to extract; monthly financial data: Total Returns, and monthly S&P ESG data: Overall ESG score and Environmental, Social, and Governance & Economic dimensions scores. Macroeconomic data was extracted partially from the OECD, namely the monthly US Long term Interest Rates (LTIRs). The macro control variables are reported monthly from Refinitiv workspace: Consumer Price Index, Producer Price Index, Unemployment Rate and Housing Starts, and FRED: two money supply measures; M1 and M2, and monthly GDP data.

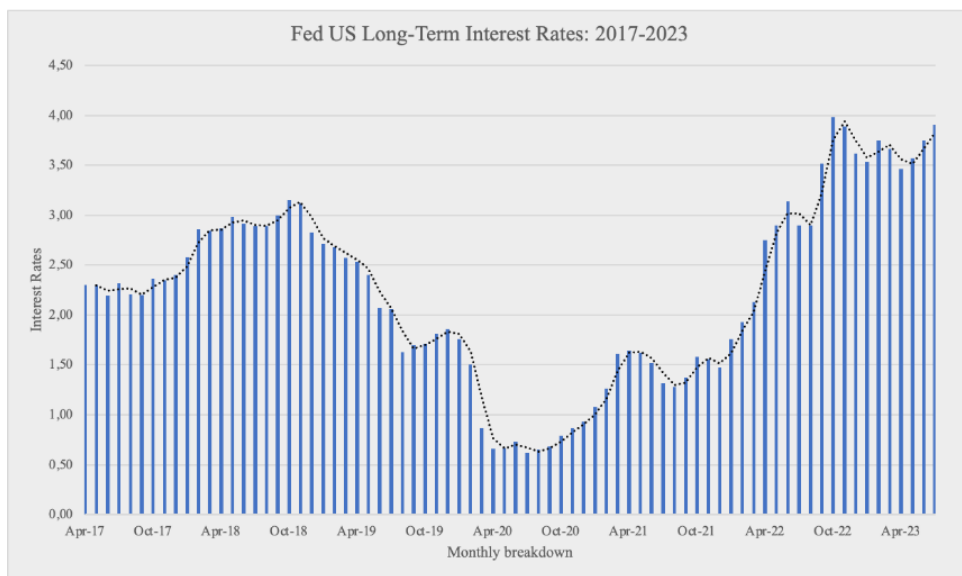
An overview of all variables chosen for this study, split by dependent, independent and control variables is found in Appendix: Table 1.

## **3.2 Macro-economic Variables Selection**

### **3.2.1 Long Term Interest Rates**

The average holding period for REITs is nearly 7 years, or 79 months, according to NAREIT findings. This is due to REITs typically being invested in long-term assets, which can take years to develop and lease up, and sometimes be difficult to sell. REITs are often seen as core investments to an investor's long-term portfolio, providing income, diversification benefits and inflation protection. Therefore, the investment horizon for shareholders of REITs tends to be around 5-10 years or longer, as to reap the full benefits (Arnold 2023).

A common measure of the long-term economic outlook by governments are LTIRs, and consistent with macroeconomic theory tend to have a strong inverse relationship with equity market returns (Alam and Uddin 2009). The long-term investment horizon of REITs is best paired with LTIRs, which are implied by the trading price on US 10-year bonds and consider: price charged by lender, risk from borrower and change in capital value (OECD 2023). Accordingly, US LTIRs are deemed an appropriate proxy of the economic environment over the 6-year sample period.



*Graph 1: Trendline of the evolution of US LTIRs between 2017-2023.*

LTIR data extracted for the final sample (May 2017- June 2023) shows significant volatility. A slow increase in rates can be seen until 2018, followed by a sharp cut from 3.15% in Oct. 2018 to 0.66% in Apr. 2020. A low interest rate environment can be seen in 2020/2021, with rates remaining around or below 1.5%. For a large part of 2020, LTIRs were set below 1% as a government response to stimulate liquidity in the economy, after the economic shock caused by COVID-19. On the other hand, over the last 15 months, LTIRs hiked quickly above 2.75%, and show an average rate of 3.67% over the last 10 months. Overall, the sample shows strong hawkish and dovish economic action in effect in a 6-year period.

### **3.2.2 Control Variables**

The study of a macro level variable on its own as a measure of correlation against REIT returns limits its predictive ability. Due to LTIRs being a macroeconomic indicator of the health and future expectations of an economy, they are grouped with various other popular economic variables, often displaying high levels of correlation (Adrian 2017). To isolate the relationship between LTIRs, ESG and REIT returns, one must create a controlled testing environment. As a result, seven control variables were chosen, detailed in Appendix: Table 2.

## **3.3 REIT Specific Variables**

### **3.3.1 Financial Performance**

Considering the nature of the legal structure of a REIT, namely the >90% dividend distribution clause, adequate importance should be placed on dividend returns as a measure of performance for shareholders (Chen 2023). Nonetheless, the appreciation of the underlying assets in which REITs invest remains a key factor in attracting investors towards this investment vehicle. Indeed, the total value of a REIT's assets rises in tandem with the value of its properties, often driven by macroeconomic factors such as market demand and favorable economic conditions, while also impacted on a smaller scale by micro factors such as improving the properties (“Capital appreciation in REITs” 2023).

Moreover, a study discussed in Corgel, McIntosh and Ott (1995) in their review paper, concluded through a cointegration analysis that long-term equilibrium exists between REIT returns and a REITs underlying accounting fundamentals. There is a specific mention of; earnings, dividends, book value and cash flows. Accordingly, and in line with some level of previous literature, the most encompassing metric of REIT performance was deemed to be a measure of total returns. The Total Return Index (Gross Dividends), defined by bloomberg as the “one day total return index as of today” is used as a proxy for total REIT performance.

### **3.3.2 Sustainability: ESG performance**

NAREIT defines ESG as “...the environmental stewardship, social responsibility, and good governance practices that, when actively and holistically measured, managed, and disclosed, ensure sustainable business performance and accountability to the industry’s investors, tenants, workforce, and communities (“Sustainability Resources and research” 2023).

A holistic measure of ESG is increasingly important for both internal fund performance analysis and external analysis taken by stakeholders, ranging from investor sentiment to the type of media coverage received. The S&P Global ESG scores attempt to provide a unique ecosystem that gradually raises the bar for sustainability requirements and promotes business disclosures. Indeed, through a proprietary tool, labeled the Corporate Sustainability Assessment (CSA) by the S&P, an in-depth company engagement is considered in addition to the standard publicly available disclosures (“Sustainable1 Solutions: ESG Scores” 2023).

Consequently, the S&P Global ESG Rank, a percentile rank of the S&P ESG score, was chosen as the primary variable of ESG performance. Moreover, to allow for further understanding of the relevance of each ESG pillar in impacting REIT performance, the specific ranks were included: S&P Global Environmental Dimension Rank, S&P Global Governance & Economic Dimension Rank, and S&P Global Social Dimension Rank. Appendix: Table 3 shows a detailed description of how each rank is constructed.

## **3.4 Data Overview**

### **3.4.1 Data Cutdown**

The extracted data period is from May 2017 to June 2023, for a total of 74 observation months of all variables. Excluding all REITs with no S&P ESG data over this period (15) and the mortgage REITs (2), the sample is cut down from 42 to 25 REITs. Furthermore, a

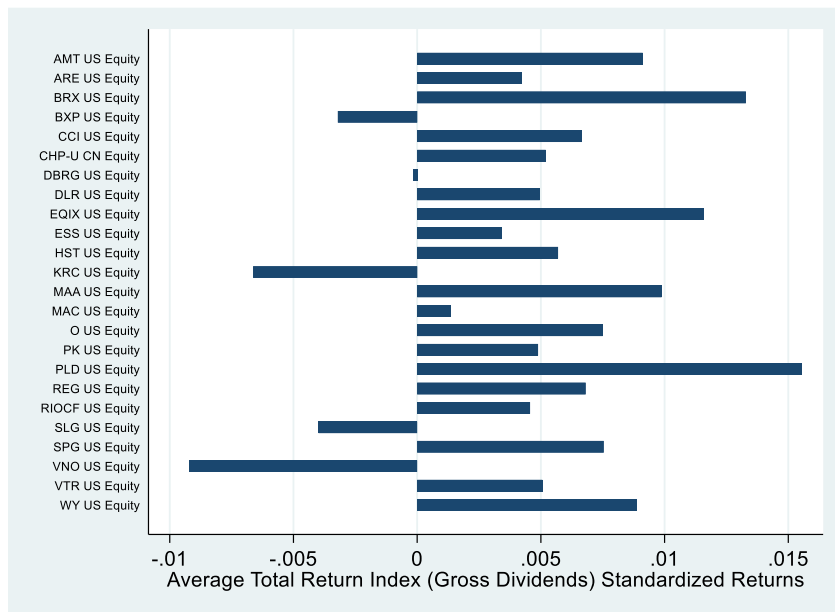
graphical representation of the evolution of the overall S&P ESG rank performance per REIT, over the sample period, concluded VEREIT, Inc. as a clear outlier in the data, as shown in Appendix: Graph 1. As a result, an additional REIT was excluded from the final sample.

### 3.4.2 Final Sample

The final sample consists of 24 North American REITs, with total asset size ranging from 6.87B to 91.94B, and a median of 15.77B (Appendix: Table 4). Sorting by primary industry of investments, Retail is the most prominent, with Specialty and Office focused REITs closely in second, as shown in Appendix: Graph 2. An individual overview of each REIT, as per Bloomberg, is provided in Appendix: Table 5.

### 3.4.3 Descriptive Statistics and Correlation

The individual average REIT performance was calculated for Absolute Total Returns (Appendix: Graph 3) and Standardized Returns. Over the sample period, standardized returns show average positive returns for 19 out of the 24 total REITs analyzed (Graph 2).



Graph 2: Overview, per REIT, of the average monthly Standardized Total Returns.

Additionally, a breakdown of the average score per REIT on the S&P Global ESG Rank, Environmental, Social and Governance ranks can be found in Appendix: Graphs 4 to

7. Overall, the Environmental pillar showed the greatest disparity within scores, while Social the least. In Governance, two REITs stand out as low performers, namely CHP and DBRG.

Moreover, table 1 below shows the descriptive statistics of all variables used in this study. Standardized returns increased by an average of 0.5% per month but showed a high standard deviation of 9.5%, indicating the data allows for negative values, as discussed above.

The overall ESG Rank shows a difference of 96 points between the highest and lowest scoring month for any REIT, and a mean of 53.60. As expected, this indicates there were significant increases in the ESG score throughout the sample period. The individual metrics displayed similar ranges to the overall ESG score, with Governance (57.23) and Environmental (55.48) scoring above ESG average, while Social scored below (48.16).

**Descriptive statistics**

| Variable | Obs.  | Mean    | Std. Dev. | Min     | Max      |
|----------|-------|---------|-----------|---------|----------|
| TR1      | 1,776 | 125.690 | 150.154   | 7.874   | 1010.640 |
| TR       | 1,752 | 0.005   | 0.095     | -0.724  | 0.644    |
| LIR      | 1,776 | 2.218   | 0.918     | 0.620   | 3.980    |
| ESG      | 1,776 | 53.596  | 28.881    | 2.000   | 98.000   |
| ENV      | 1,776 | 55.476  | 28.817    | 1.000   | 99.000   |
| SOC      | 1,776 | 48.160  | 28.224    | 3.000   | 97.000   |
| GOV      | 1,776 | 57.226  | 27.851    | 5.000   | 100.000  |
| CPI      | 1,776 | 0.295   | 0.334     | -0.800  | 1.300    |
| PPI      | 1,776 | 0.274   | 0.455     | -1.300  | 1.400    |
| UMP      | 1,776 | 4.750   | 2.150     | 3.400   | 14.700   |
| HSG      | 1,776 | 0.423   | 9.358     | -30.200 | 22.600   |
| M1       | 1,776 | 3.868   | 27.565    | -1.900  | 238.800  |
| M2       | 1,776 | 0.603   | 1.064     | -1.100  | 6.400    |
| GDP      | 1,776 | 0.179   | 0.014     | 0.165   | 0.205    |

*Table 1:* Descriptive Statistics of dependent, independent and control variables of the study.

Table 2 presents the correlation matrix. In line with Liang, McIntosh and Webb (1995) and Allen, Madura, and Springer (2000), this paper finds a clear negative correlation between LTIRs and Total Returns. On the other hand, ESG and Total Returns show less conclusive results. The absolute returns show positive while standardized returns show negative correlation. In line with expectations, correlation between overall ESG score and its three

components is extremely high, with the Environmental pillar first, closely followed by Social and Governance.

### Correlation matrix

|      | TR1    | TR     | LIR    | LESG   | LENV   | LSOC   | LGOV   | CPI    | PPI    | UMP    | HSG    | M1     | M2     | GDP   |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| TR1  | 1.000  |        |        |        |        |        |        |        |        |        |        |        |        |       |
| TR   | 0.036  | 1.000  |        |        |        |        |        |        |        |        |        |        |        |       |
| LIR  | -0.032 | -0.080 | 1.000  |        |        |        |        |        |        |        |        |        |        |       |
| LESG | 0.054  | -0.019 | 0.122  | 1.000  |        |        |        |        |        |        |        |        |        |       |
| LENV | 0.048  | -0.025 | 0.090  | 0.957  | 1.000  |        |        |        |        |        |        |        |        |       |
| LSOC | 0.038  | -0.015 | 0.132  | 0.932  | 0.839  | 1.000  |        |        |        |        |        |        |        |       |
| LGOV | 0.094  | -0.007 | 0.095  | 0.895  | 0.780  | 0.890  | 1.000  |        |        |        |        |        |        |       |
| CPI  | 0.069  | 0.011  | -0.029 | 0.199  | 0.170  | 0.205  | 0.188  | 1.000  |        |        |        |        |        |       |
| PPI  | 0.055  | -0.007 | -0.153 | 0.109  | 0.091  | 0.110  | 0.099  | 0.753  | 1.000  |        |        |        |        |       |
| UMP  | -0.001 | 0.170  | -0.662 | -0.056 | -0.029 | -0.061 | -0.035 | -0.160 | -0.093 | 1.000  |        |        |        |       |
| HSG  | 0.007  | 0.040  | -0.022 | 0.000  | 0.000  | 0.003  | 0.001  | 0.236  | 0.169  | -0.028 | 1.000  |        |        |       |
| M1   | -0.007 | -0.042 | -0.234 | -0.032 | -0.018 | -0.032 | -0.022 | -0.165 | 0.014  | 0.504  | 0.025  | 1.000  |        |       |
| M2   | -0.002 | 0.081  | -0.642 | -0.103 | -0.074 | -0.107 | -0.082 | -0.359 | -0.190 | 0.778  | -0.256 | 0.538  | 1.000  |       |
| GDP  | -0.094 | -0.004 | 0.164  | -0.460 | -0.428 | -0.486 | -0.469 | -0.342 | -0.222 | -0.188 | 0.001  | -0.044 | -0.065 | 1.000 |

Table 2: Correlation Matrix of dependent, independent and control variables of the study.

## 4 Empirical

### 4.1 Methodology

The purpose of this model is to investigate how a company specific factor, ESG, and a macroeconomic measure of volatility, LTIRs, potentially impact the total returns of a sample of chosen REITs. A PVAR model is chosen and represented as such:

$$TR_{it} = \alpha + \beta'X_{it} + \varepsilon_{it}$$

Where,  $TR_{it}$  is the Standardized Total Return of REIT  $i$  at month  $t$ . Indeed,  $t$  represents the time period and  $i$  the cross-section. The  $\alpha$  is the intercept, and the error term is represented by  $\varepsilon$ . The coefficient of its respective  $x$  variable is  $\beta$ , also analyzed as a function of  $i$  and  $t$ .

A PVAR is a statistical model used to examine the dynamic relationships between several time series variables from numerous units or entities (Wooldridge 2009). The nature of this study calls for exactly this type of econometric analysis. Alternative methods include a Pooled ordinary least squares (POLS) model or a Fixed Effects (FE) model. Both statistical models are considered simpler to implement, compared to a PVAR. Indeed, a POLS does not account for cross-sectional heterogeneity, while a FE model only accounts for cross-sectional heterogeneity, and is not able to capture dynamic relationships (Wooldridge 2009).

PVAR models use historical data for the variables to represent dynamic relationships, taking into consideration the reality that the variables past values frequently affect their current values. This is called the lag. Considering these feedback effects, generally helps to smooth out noise in the dataset and reduce risk of error from spurious correlation between independent variables, therefore enhancing its predictive density (Corradi and Swanson 2006). This model considers a 1- and 2-month lag length.

The 1-lag model is described in further detail in the following equation, which includes the overall ESG element and the key macroeconomic factors influencing REIT total returns:

$$TR_{it} = \alpha + \beta_1 LESG_{i,t-1} + \beta_2 LIR_{i,t-1} + \beta_3 CPI_{i,t-1} + \beta_4 PPI_{i,t-1} + \beta_5 UMP_{i,t-1} + \beta_6 HSG_{i,t-1} + \beta_7 M1_{i,t-1} + \beta_8 M2_{i,t-1} + \beta_9 GDP_{i,t-1} + \varepsilon_{it} \quad (i)$$

An alternative estimation model is proposed, changed only by breaking down the ESG foundation into its three pillars:

$$TR_{it} = \alpha + \beta_1 LENV_{i,t-1} + \beta_2 LSOC_{i,t-1} + \beta_3 LGOV_{i,t-1} + \beta_4 LIR_{i,t-1} + \dots + \varepsilon_{it} \quad (ii)$$

The validity of the PVAR model is enhanced by specifically testing for the relationship amongst variables. The robust and non-parametric Kao Residual cointegration test was performed to determine if a long-run equilibrium relationship exists. It is highly important to assess whether the assumption of a PVAR, of cointegration between variables, is valid or not. This allows us to understand if the model is correctly specified and if so we can interpret the model coefficients meaningfully (Breitung and Pesaran 2008).

Moreover, upon retrieving coefficient results for both models, a Granger Causality test is used to assess the usefulness of a variable in anticipating another variable. Testing the level of long-term predictive ability of the independent variables on the dependent variable, Total Returns, is highly important. This allows for an understanding of the underlying mechanisms that drive the PVAR model findings (Granger 1969).

## 4.2 Results

The Kao Residual cointegration test results are presented below. As shown in Table 3, the cointegration tests for both models are significant at the 1% level. This indicates an extremely low probability that the observed data could have occurred by chance (Kwak 2023). As the p-value is less than the 1% significance level, the null hypothesis, of this test, of no cointegration is therefore rejected. This shows the presence of cointegration in the models, indicating that the PVAR models are correctly specified, and the coefficient results may be interpreted as meaningful.

### Kao Residual Cointegration Test

|               | t-Statistic | Prob. |
|---------------|-------------|-------|
| ADF – Model 1 | -3.448*     | 0.000 |
| ADF – Model 2 | -3.452*     | 0.000 |

Note: \*, \*\* & \*\*\* indicate level of significance at 1%, 5% & 10% respectively.

Table 3: Summary of results of the Kao Residual Cointegration test for Model 1 and 2.

The overall econometric model results are presented below in Tables 4 and 5. The coefficients of the independent variables will be analyzed considering the different lag periods. The coefficient value indicates the impact of that variable on the dependent variable and is significant if its p-value is less than significance level at 1%, 5% or 10% (Kwak 2023).

### Panel Vector Autoregressive Estimation: Model 1

| TR                  | Coefficient | t-Statistic | Std. Error |
|---------------------|-------------|-------------|------------|
| TR <sub>t-1</sub>   | -0.188*     | -7.675      | 0.025      |
| TR <sub>t-2</sub>   | 0.004       | 0.149       | 0.026      |
| LIR <sub>t-1</sub>  | 0.084*      | 6.032       | 0.014      |
| LIR <sub>t-2</sub>  | -0.03**     | -2.263      | 0.013      |
| LESG <sub>t-1</sub> | 0.016       | 0.918       | 0.017      |
| LESG <sub>t-2</sub> | -0.018      | -1.083      | 0.017      |
| CPI <sub>t-1</sub>  | -0.039*     | -3.153      | 0.012      |
| CPI <sub>t-2</sub>  | -0.047*     | -3.797      | 0.012      |
| PPI <sub>t-1</sub>  | 0.033*      | 3.833       | 0.009      |
| PPI <sub>t-2</sub>  | 0.007       | 0.830       | 0.009      |
| UMP <sub>t-1</sub>  | -0.041*     | -9.094      | 0.004      |
| UMP <sub>t-2</sub>  | 0.048*      | 10.904      | 0.004      |
| HSG <sub>t-1</sub>  | 0.001*      | 3.199       | 0.000      |
| HSG <sub>t-2</sub>  | 0.000       | 1.469       | 0.000      |
| M1 <sub>t-1</sub>   | -0.002*     | -9.134      | 0.000      |

|                    |          |        |       |
|--------------------|----------|--------|-------|
| M1 <sub>t-2</sub>  | -0.001*  | -5.898 | 0.000 |
| M2 <sub>t-1</sub>  | 0.088*   | 13.065 | 0.007 |
| M2 <sub>t-2</sub>  | 0.017**  | 2.152  | 0.008 |
| GDP <sub>t-1</sub> | 27.687*  | 2.964  | 9.342 |
| GDP <sub>t-2</sub> | -27.802* | -3.017 | 9.215 |
| C                  | -0.143*  | -2.925 | 0.049 |

Note: \*, \*\* & \*\*\* indicate level of significance at 1%, 5% & 10% respectively.

Table 4: Results of Panel VAR regression on Total Returns, Overall ESG score, LT interest rates and seven macro-economic control variables.

**Panel Vector Autoregressive Estimation: Model 2**

| TR                  | Coefficient | Std. Error | t-Statistic |
|---------------------|-------------|------------|-------------|
| TR <sub>t-1</sub>   | -0.192*     | 0.025      | -7.805      |
| TR <sub>t-2</sub>   | 0.001       | 0.026      | 0.057       |
| LIR <sub>t-1</sub>  | 0.083*      | 0.014      | 5.958       |
| LIR <sub>t-2</sub>  | -0.029**    | 0.013      | -2.138      |
| LENV <sub>t-1</sub> | -0.011      | 0.022      | -0.513      |
| LENV <sub>t-2</sub> | 0.004       | 0.021      | 0.206       |
| LSOC <sub>t-1</sub> | 0.003       | 0.024      | 0.110       |
| LSOC <sub>t-2</sub> | -0.002      | 0.023      | -0.070      |
| LGOV <sub>t-1</sub> | 0.045       | 0.032      | 1.393       |
| LGOV <sub>t-2</sub> | -0.04       | 0.032      | -1.284      |
| CPI <sub>t-1</sub>  | -0.039*     | 0.012      | -3.153      |
| CPI <sub>t-2</sub>  | -0.047*     | 0.012      | -3.814      |
| PPI <sub>t-1</sub>  | 0.034*      | 0.009      | 3.898       |
| PPI <sub>t-2</sub>  | 0.007       | 0.009      | 0.848       |
| UMP <sub>t-1</sub>  | -0.041*     | 0.004      | -9.093      |
| UMP <sub>t-2</sub>  | 0.049*      | 0.004      | 10.940      |
| HSG <sub>t-1</sub>  | 0.001*      | 0.000      | 3.180       |
| HSG <sub>t-2</sub>  | 0.000       | 0.000      | 1.444       |
| M1 <sub>t-1</sub>   | -0.002*     | 0.000      | -9.209      |
| M1 <sub>t-2</sub>   | -0.001*     | 0.000      | -5.975      |
| M2 <sub>t-1</sub>   | 0.088*      | 0.007      | 13.048      |
| M2 <sub>t-2</sub>   | 0.018**     | 0.008      | 2.261       |
| GDP <sub>t-1</sub>  | 27.119*     | 9.343      | 2.903       |
| GDP <sub>t-2</sub>  | -27.229*    | 9.215      | -2.955      |
| C                   | -0.151*     | 0.051      | -2.954      |

Note: \*, \*\* & \*\*\* indicate level of significance at 1%, 5% & 10% respectively.

Table 5: Results of Panel VAR regression on Total Returns, Environmental score, Social score, Governance score, LT interest rates and seven macro-economic control variables.

Model 1 shows significant results for the first lag of Total Returns and the first and second lag of LTIRs. The LTIRs interestingly show opposite directions in their relationship with Total Returns for a one and two period lag. The 1-month lag on LTIRs shows a significantly stronger positive relationship with Total Returns, where a 1% increase in rates leads to a 0.084% increase in Total Returns. However, with a 2-month lag, the relationship is

inverted, and a 1% increase in rates leads to a 0.03% decrease in REIT Total Returns. Model 2 showed almost identical conclusions on both the 1- and 2-month lagged LTIRs.

The overall results of Model 1 and 2 on the relationship between LTIRs and Total Returns indicate that at least a 2-month lag exists between monetary action and a real impact on Total Returns is felt. In economic terms, a 1% increase in LTIRs is already a very impactful action for many businesses. However, a 2 % increase is undoubtedly going to influence, on various scales, the vast majority of companies. Therefore, this highlights the apparent short-term resilience of REIT financial performance as it maintains positive returns, even in a hawkish environment.

According to the results of the PVAR estimation model 1 and 2, no significant relationship, positive or negative, is found between any of the proposed ESG variables to REIT Total Returns. This means that ESG has no apparent significant influence on Total Returns, under either of the lag periods. Furthermore, these conclusions are in line with the findings of the pairwise granger causality test, presented in Table 6. Despite two ESG related unidirectional causal relationships being found to be significant at the 10% level, the direction of these relationships does not provide support for an influence on Total Returns. Instead, it indicates the opposite, that movements in the financial performance of REITs can influence their ESG performance, namely the Social and Governance scores. Overall, this means that a REIT's financial performance may be useful in forecasting its Social and Governance performance, and not the other way around.

Moreover, a significant p-value on the LTIRs and Total Returns relationship indicates one-way directional causality between the two variables with 99% confidence. This indicates that even after adjusting for the impact of other factors in the model, the US LTIRs can still help to predict Total Returns of a given REIT sample (Granger 1969).

### Pairwise Granger Causality Tests

| <i>Causality</i> | <i>Obs.</i> | <i>F-Statistic</i> | <i>Prob.</i> |
|------------------|-------------|--------------------|--------------|
| LIR → TR         | 1704        | 10.4368*           | 0.000        |
| TR → LIR         |             | 2.248              | 0.106        |
| LESG → TR        | 1704        | 1.674              | 0.188        |
| TR → LESG        |             | 1.715              | 0.180        |
| LENV → TR        | 1704        | 1.348              | 0.260        |
| TR → LENV        |             | 1.335              | 0.264        |
| LSOC → TR        | 1704        | 1.837              | 0.160        |
| TR → LSOC        |             | 2.693***           | 0.068        |
| LGOV → TR        | 1704        | 1.860              | 0.156        |
| TR → LGOV        |             | 2.707***           | 0.067        |

Note: \*, \*\* & \*\*\* indicate level of significance at 1%, 5% & 10% respectively.

Table 6: Results of Pairwise Granger Causality Test between dependent variable and each of the independent variables.

### 4.3 Further Discussion

The results of the statistical model presented in the previous section indicate that Hypothesis 1 should be accepted, with significant results found for North American REIT financial performance to be associated with LTIRs, over the studied high economic volatility period. As discussed in the correlation matrix (section 3.4.3): US LTIRs have a negative correlation with REIT total returns (Table 2). The extent to which causality can be inferred is confirmed by the significant coefficients on LTIRs, with 99% confidence for a 1-month lag and 95% confidence for a 2-month lag (Table 4 and 5). Additionally, some level of influence is further confirmed by the one-way causality between LT interest rate and Total Returns (Table 6). The findings are therefore in line with previous literature that similarly concluded REIT returns sensitivity to LTIRs, over a period of high interest rate volatility (Liang, McIntosh and Webb 1995; Allen, Madura, and Springer 2000; and Morri and Liu 2017).

On the other hand, Hypothesis 2 of this study should be rejected. Indeed, no significant evidence is found to infer that the ESG score of a North American REIT is positively associated with its financial performance over a volatile interest rate period. However, despite no conclusion on the direction and magnitude of the relationship, the one way causality between Total Returns and the Social and Governance pillars, does indicate Total Returns

may be useful in forecasting specific ESG metrics. These findings are partially in line with Erol, Ünal, and Coşkun 2023, but in different causal directions, as they found social and environmental investing policies were more important predictors of financial performance for REITs over a similarly volatile economic period (2003-2019).

The differences in findings of this paper and the seemingly similar study of Erol, Ünal, and Coşkun (2023), indicates inconclusiveness still exists in mapping ESG's influence on REIT returns. The source of differences is hard to pinpoint as it may be a mixture of various sample consideration: they considered all REIT types over 5 countries while this study only considered Equity North American REITs. Furthermore, the earlier period they considered (since 2003) arguably provides less reliable ESG data, since a few environmental policies at the time already created the idea of being ESG active and lead to high scores. The growing importance of ESG policy and stricter regulations, as discussed in the literature review, leads to increased difficulty in achieving high ESG scores across all pillars, and often lagging the level of financial performance.

Overall, in line with the findings of Coën, Lecomte and Abdelmoula (2018), but opposed to the findings of Eichholtz, Kok, and Yönder (2012), this study does not find any real evidence of ESG leading to financial over performance of REITs. These findings, to an extent, oppose the theory of Doré (2021) that better managed reputational and social risks, so higher ESG scores, can lead to an overperformance during uncertain times.

#### **4.3.1 Limitations to Findings and Potential Improvements**

Limitations exist on the extent to which results can be concluded with 100% certainty and/or generalized. Firstly, the predictive capability of the PVAR model can be questioned due to its complexity of working with various time-series dynamic relationships. This model was fine tuned to the best possible ability, given time and budget constraints for this paper. Secondly, given the contradicting direction of results on the LTIRs coefficient of the PVAR

model between the 1- and 2-month lag, it would be interesting to test a longer lagged period to see if and how the direction and magnitude of the relationship between interest rates and total returns would change. Moreover, the inconclusive findings on ESG prompt a recommendation for further studies to consider testing multiple separated sample periods of specific LTIR volatility, to check for differences of ESG impact on REIT performance. Lastly, the sample of this study is limited to North American REITs, with a heavy focus on the US, limiting its ability to infer relationships for other economic regions or continents.

## 5 Conclusions

The goal of this paper was to examine the financial behavior of REITs, considering the effects of both the interest rate environment they operate in and their ESG performance. It explored the potential for dynamic relationships between the company specific; financial and ESG performance, and macro-economic indicator; LTIRs. This study considered overall ESG scores and individual ESG dimensions for just over a 6-year period (2017-2023), monthly, for 24 North American publicly traded equity REITs. Aiming to answer the proposed research question: **Does the ESG performance and a volatile Interest Rate period significantly impact the financial performance of North American REITs?**

In line with previous literature, this study finds conclusive results on the interest rates and financial returns dynamic. Indeed, all statistical tests found significant results that LTIR's impact the Total Returns of a REIT. Indicating REIT financial performance sensitivity to changes in its economic environment.

On the other hand, the results show no significant causal relationship between a REIT's ESG scores and their financial performance. The PVAR model concluded insignificant coefficients, for what would have detailed the impact a 1% increase in ESG scores would have had on Total Returns. Only the absolute Total Returns measure showed a

positive correlation with all ESG scores over the sample period. The one-way causal relationships found through the Pairwise Granger Causality Test, indicate Total Returns as useful in forecasting a REITs performance on the 'Social' and 'Governance & Economic' ESG dimensions.

This highlights an interesting phenomenon: over the last 6 years, REITs with a strong financial performance were more likely to have successfully implement ESG policies. These REITs were seemingly more willing to invest in responsible social and governmental practices, such as engaging with the community, more diverse leadership, inclusive hiring policies, etc. Surprisingly, this same relationship is not observed for the Environmental pillar. Environmental action tends to be associated with tougher decisions and, at first, greater costs, possibly reasoning for no significant relationship being found there. Moreover, based on the lack of significant findings of a positive ESG impact on REIT returns, this paper questions if the contributing ESG factors to performance (discussed in section 2.1), namely increasing resilience and stimulating performance in volatile economic environments, can be applied to the hybrid investment universe of REITs.

Overall, the approach to ESG management within the investment universe, including REITs, has massively evolved over the last 6 years. Driven by ramped up regulation, increased shareholder pressure and increased profitable ESG driven investment opportunities. The future trend is a global adoption of proactive ESG management. Nonetheless, the results of this study still indicate that for the limited portion of the North American REIT industry sampled, ESG driven decision making has not existed over the last 6 years, indicating a predominantly reactive, rather than proactive approach.

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## 7 Appendix

### Tables

#### Detail of variables

| Identifier                   | Variable                                                  |
|------------------------------|-----------------------------------------------------------|
| <b>Dependent Variable</b>    |                                                           |
| TR1                          | Total Return Index (Gross Dividends) Absolute Returns     |
| TR                           | Total Return Index (Gross Dividends) Standardized Returns |
| <b>Independent Variables</b> |                                                           |
| ESG                          | S&P Global ESG Rank                                       |
| LIR                          | Monthly Long Term Interest Rates                          |
| GOV                          | S&P Global Governance & Economic Dimension Rank           |
| ENV                          | S&P Global Environmental Dimension Rank                   |
| SOC                          | S&P Global Social Dimension Rank                          |
| <b>Control Variables</b>     |                                                           |
| CPI                          | CPI MoM %Change                                           |
| PPI                          | PPI MoM & %change                                         |
| UMP                          | Unemployment Rate                                         |
| HSG                          | Housing Starts % change                                   |
| M1                           | Money Supply M1 MoM change                                |
| M2                           | Money Supply M2 MoM change                                |
| GDP                          | USA GDP_Monthly MoM % Change SA                           |

Table 1: Overview of final variable selection to be used in this paper's panel study.

| Macro-economic Indicator                            | Index description                                                                                                                                                                                                                                                                           | Notes                                                               |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Inflation growth: Consumer Price Index (CPI) MoM SA | Measures the monthly change in prices paid by consumers for goods and services (Medical care, Food and Beverages, Housing, Transportation, Education and Communication, Recreation, Apparel and Other goods and services) ("U.S. Bureau of Labor Statistics: Producer Price Indexes" 2023). | Extracted from Refinitiv. Labeled as High Relevance on Refinitiv.   |
| Producer Price Index (PPI) Final Demand MoM         | The PPI measures the average change in selling prices that domestic producers receive for their output over time ("U.S. Bureau of Labor Statistics: Producer Price Indexes" 2023).                                                                                                          | Extracted from Refinitiv. Labeled as Medium Relevance on Refinitiv. |
| Unemployment Rate                                   | The unemployment rate measures the percentage of the total labor force (sum of employed and unemployed) which is jobless ("U.S. Bureau of Labor Statistics: Producer Price Indexes" 2023).                                                                                                  | Extracted from Refinitiv. Labeled as High Relevance on Refinitiv.   |
| Housing Starts MoM Change                           | Measures the monthly change in the total number of new residential housing units covered by authorized building permits (US Census Bureau 2019).                                                                                                                                            | Extracted from Refinitiv. Labeled as High Relevance on Refinitiv.   |
| Money Supply:                                       | M1 consists of currency outside the US Treasury and federal reserve, demand deposits at                                                                                                                                                                                                     | Extracted from Federal Reserve                                      |

|                                                                                |                                                                                                                                                                                                                                                                   |                                                      |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| M1, Percent Change, Monthly, Seasonally Adjusted                               | commercial banks, and other checkable deposits - OCDs (before May 2020) or other liquid deposits (beginning May 2020) (“FRED   St. Louis Fed” 2023).<br>M1 is more liquid than M2. Closely monitored as an indicator of inflation.                                | Economic Data (FRED).                                |
| M2, Percent Change, Monthly, Seasonally Adjusted                               | M2 consists of M1 plus savings deposits (before May 2020), small-denomination time deposits (<\$100k), and balances in retail money market funds (MMFs). (“FRED   St. Louis Fed” 2023).<br>M2 is a broader indicator of overall liquidity of the economy than M1. | Extracted from Federal Reserve Economic Data (FRED). |
| GDP: Real Gross Domestic Product, Percent Change, Monthly, Seasonally Adjusted | The monthly change in the value of goods and services produced by labor and property located in the United States, adjusted for inflation. (“FRED   St. Louis Fed” 2023).                                                                                         | Extracted from Federal Reserve Economic Data (FRED). |

Table 2: Overview of the Control Variables

| ESG Variable                                    | Variable Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S&P Global ESG Rank                             | Total sustainability percentile rank, converted from the total sustainability score, based on the S&P Global ESG Rank (formerly RobecoSAM Corporate Sustainability Assessment).<br>A company's Total Sustainability Score is the sum of all question scores and ranges from 0-100. The Total Sustainability Score is based on individual questions that roll up into criteria, which in turn roll up into three dimensions - Economic, Environmental and Social. The types and weights of individual questions and criteria are adjusted for each industry-specific questionnaire to reflect the materiality of specific sustainability themes within each industry. The Total Sustainability Score can be defined as follows: Total Sustainability Score = (Number of Question points received x Question Weight x Criterion Weight)."                                                                                       |
| S&P Global Governance & Economic Dimension Rank | Economic dimension percentile rank, converted from the economic dimension score, based on the S&P Global Governance & Economic Dimension Rank (formerly RobecoSAM Corporate Sustainability Assessment).<br>The Economic Dimension comprises on average 6-10 criteria covering material, non-financial themes. These themes include general themes like Corporate Governance, Codes of Business Ethics, Risk & Crisis Management as well as cross-industry themes such as Brand Management, Customer Relationship Management, Innovation Management and Tax Strategy. Individual industries also have industry-specific themes that address specific sustainability risks and opportunities. Each criterion can contain between 2-10 questions. Each criterion is worth up to 100 points, and is assigned a weight (percentage) of the total questionnaire. The criteria within the dimension roll up to the dimension weight. |
|                                                 | Environmental dimension percentile rank, converted from the environmental dimension score, based on the S&P Global Environmental Dimension Rank (RobecoSAM Corporate Sustainability Assessment).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S&P Global Environmental Dimension Rank | The Environmental Dimension comprises on average 4-10 criteria covering material, non-financial themes. These themes include general themes like Environmental Reporting, Environmental Policy & Management and Operational Eco-Efficiency as well as cross-industry themes such as Biodiversity, Product Stewardship and Climate Strategy. Individual industries also have industry-specific themes that address specific sustainability risks and opportunities. Each criterion can contain between 2-10 questions. Each criterion is worth up to 100 points, and is assigned a weight (percentage) of the total questionnaire. The criteria within the dimension roll up to the dimension weight.                                                                                                                                                                                                                                         |
| S&P Global Social Dimension Rank        | Social dimension percentile rank, converted from the social dimension score, based on the S&P Global Social Dimension Rank (formerly RobecoSAM Corporate Sustainability Assessment).<br>The Social Dimension comprises on average 5-10 criteria covering material, non-financial themes. These themes include general themes like Social Reporting, Corporate Citizenship & Philanthropy, Human Capital Development, Talent Attraction & Retention and Business & Human Rights as well as cross-industry themes such as Stakeholder Engagement and Occupational Health & Safety.<br>Individual industries also have industry-specific themes that address specific sustainability risks and opportunities. Each criterion can contain between 2-10 questions. Each criterion is worth up to 100 points, and is assigned a weight (percentage) of the total questionnaire. The criteria within the dimension roll up to the dimension weight. |

Table 3: Detailed description of how overall ESG score, and the ESG score for each of the 3 pillars is constructed. The description was extracted from Bloomberg as is.

| Ticker         | REIT name                             | Country | Industry              | # of employees | Market Cap<br>(as of 30/11/2023) | Asset Size<br>(as of Q3 2023) |
|----------------|---------------------------------------|---------|-----------------------|----------------|----------------------------------|-------------------------------|
| PLD US Equity  | Prologis Inc                          | US      | Industrial            | 2 466          | 104.446                          | 91.94                         |
| AMT US Equity  | American Tower Corporation            | US      | Specialty             | 6 391          | 96.114                           | 65.653                        |
| CCI US Equity  | Crown Castle Inc.                     | US      | Specialty             | 5 000          | 50.299                           | 38.699                        |
| DLR US Equity  | Digital Realty Trust Inc              | US      | Specialty             | 3 412          | 42.75                            | 41.933                        |
| SPG US Equity  | Simon Property Group, Inc.            | US      | Retail                | 2 500          | 46.057                           | 32.965                        |
| ARE US Equity  | Alexandria Real Estate Equities, Inc. | US      | Office                | 593            | 18.943                           | 36.783                        |
| VTR US Equity  | Ventas Inc                            | US      | Healthcare Facilities | 451            | 18.272                           | 24.967                        |
| EQIX US Equity | Equinix Inc                           | US      | Specialty             | 13 046         | 75.887                           | 31.685                        |
| BXP US Equity  | Boston Properties, Inc.               | US      | Office                | 780            | 8.946                            | 24.739                        |
| WY US Equity   | Weyerhaeuser Co.                      | US      | Specialty             | 9 200          | 23.141                           | 17.550                        |
| VNO US Equity  | Vornado Realty Trust                  | US      | Office                | 3 146          | 4.924                            | 16.453                        |

|                 |                                                |        |                      |       |        |        |
|-----------------|------------------------------------------------|--------|----------------------|-------|--------|--------|
| O US Equity     | Realty Income Corp                             | US     | Retail               | 391   | 38.853 | 55.337 |
| DBRG US Equity  | DigitalBridge Group, Inc                       | US     | Real Estate Services | 300   | 2.856  | 6.87   |
| ESS US Equity   | Essex Property Trust, Inc.                     | US     | Residential          | 1 770 | 14.101 | 12.498 |
| HST US Equity   | Host Hotels & Resorts                          | US     | Hotel & Motel        | 165   | 12.477 | 12.292 |
| SLG US Equity   | SL Green Realty Corp.                          | US     | Office               | 1 137 | 2.405  | 9.61   |
| CHP-U CN Equity | Choice Properties Real Estate Investment Trust | Canada | Retail               | 285   | 9.321  | 12.91  |
| RIOCF US Equity | RioCan Real Estate Investment Trust            | US     | Retail               | 565   | 5.236  | 15.09  |
| REG US Equity   | Regency Centers Corporation                    | US     | Retail               | 440   | 11.413 | 12.381 |
| MAA US Equity   | Mid-America Apartment Communities Inc          | US     | Residential          | 2 387 | 14.843 | 11.382 |
| KRC US Equity   | Kilroy Realty Corporation                      | US     | Office               | 259   | 3.944  | 11.47  |
| PK US Equity    | Park Hotels & Resorts Inc                      | US     | Hotel & Motel        | 91    | 3.076  | 9.305  |
| MAC US Equity   | The Macerich Company                           | US     | Retail               | 650   | 2.55   | 7.588  |
| BRX US Equity   | Brixmor Property Group Inc.                    | US     | Retail               | 500   | 6.409  | 8.336  |

Sources of data: Yahoo finance, Macrotrends.net, and Companiesmarketcap.com

Table 4: Overview of the 24 REITs chosen in final sample.

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prologis Inc               | Founded in 1983, Prologis, Inc., is the global leader in logistics real estate with a focus on high-barrier, high-growth markets. Prologis owns, manages and develops well-located, high-quality logistics facilities in about 20 countries across four continents. Prologis acquires and develops facilities for more than 6,600 clients including Amazon, FedEx, Home Depot, Wal-Mart, Geodis, and Kuehne + Nagel. The US accounts for about 85% of total revenue. Prologis is organized as an industrial real estate investment trust (REIT). In 2022, Prologis acquired Duke Realty Corporation, for approximately \$23 billion.                                                                                                                                                                           |
| American Tower Corporation | American Tower is one of the largest global real estate investment trust and a leading owner, operator and developer of multitenant communications real estate. The company rents space on towers and rooftop antenna systems to wireless carriers and radio and TV broadcasters who use the infrastructure to enable its services. It owns and operates more than a portfolio of more than 224,770 communications sites, including some 1,715 distributed antenna system (DAS) networks. American Tower also offers tower-related services such as site application, structural analysis to determine support for additional equipment, and zoning and permitting management services. Its customers include its tenants, licensees and other payers. American Tower generates most of its revenue in the US. |
| Crown Castle Inc.          | Crown Castle International Corp is a real estate investment trust (REIT). The company owns, operates, and leases towers and other infrastructure for wireless communications. Crown Castle manages and leases wireless communication coverage and infrastructure sites in the United States and Australia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Digital Realty Trust Inc   | Digital Realty Trust, Inc. owns, acquires, repositions, and manages technology-related real estate. The company's properties contain applications and operations critical to the day-to-day operations of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       | technology industry tenants and corporate enterprise data center tenants. Digital property portfolio is located throughout the United States and in England.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Simon Property Group, Inc.            | Simon Property Group is the largest shopping mall and retail center owner in the US. The self-managed, self-administered real estate investment trust (REIT) owns, develops, and manages regional shopping malls, outlet malls (under the Premium Outlet and The Mills brands), boutique malls, and shopping centers. Its real estate portfolio is composed of some 195 retail properties totaling approximately 172.6 million sq. ft. of leasable space. Its portfolio covers more than 35 states and Puerto Rico, about 35 Premium Outlets and Designer Outlet properties primarily located in Asia, Europe, and Canada.                                                                                                                                                                                            |
| Alexandria Real Estate Equities, Inc. | Alexandria Real Estate Equities owns, develops, and operates offices and labs to life science tenants, including biotech and pharmaceutical companies, universities, research institutions, medical office developers, and government agencies. A real estate investment trust (REIT), Alexandria owns over 430 specialized properties with approximately 47.4 million sq. ft. of rentable space in the US and Canada. Its portfolio is largely located in high-tech hotbeds such as Greater Boston, New York City, the San Francisco Bay area, San Diego, Seattle, Maryland, and Research Triangle. The company was founded in 1994.                                                                                                                                                                                 |
| Ventas Inc                            | Ventas is a real estate investment trust (REIT) that holds a highly diversified portfolio of senior housing communities, medical office buildings (MOBs), life science, research and innovation centers, hospitals and other healthcare facilities located throughout the US, Canada, and the UK. Ventas's portfolio of more than 1,300 properties is buoyed by the demographic tailwind of a large and growing aging population. The company has a third-party institutional capital management business, Ventas Investment Management (VIM), which includes its open-ended investment vehicle, the Ventas Life Science & Healthcare Real Estate Fund (the Ventas Fund). The US generates the most revenue with nearly 90% of the company's total revenue.                                                           |
| Equinix Inc                           | Equinix is a global digital infrastructure company. Platform Equinix combines a global footprint of International Business Exchange (IBX) data centers in the Americas, Asia-Pacific, and Europe, the Middle East and Africa regions, interconnection solutions, edge services, unique business and digital ecosystems and expert consulting and support. Its customers include telecommunications carriers, mobile and other network services providers, cloud and IT services providers, digital media and content providers, financial services companies, and global enterprise ecosystems in various industries. Altogether, Equinix operates more than 220 data centers around the world and gets some 55% of revenue outside the Americas region.                                                              |
| Boston Properties, Inc.               | Boston Properties is a fully integrated, self-administered and self-managed real estate investment trust (REIT) and is one of the largest publicly traded office REITs that owns, develops, and manages mostly Class A office buildings in large US cities. Its core markets are Boston, Los Angeles, New York, San Francisco, and Washington, DC. As one of the nation's largest office owners and developers, Boston Properties owns about 175 office properties with some 54.1 million rentable square feet. Its largest tenants include the US government, Salesforce.com, Arnold & Porter Kaye Scholer, and Biogen. The REIT also owns a handful of retail, hotel, and residential properties. The company's chairman Mort Zuckerman was the co-founder of Boston Properties in 1970.                            |
| Weyerhaeuser Co.                      | Weyerhaeuser Company is one of the largest manufacturers of wood products in North America. The company makes and distributes high-quality wood products, including structural lumber, oriented strand board, engineered wood products and other specialty products to residential, multi-family, industrial, light commercial as well as repair and remodel markets. It is also one of the world's largest private owners of timberland. The company harvests trees for its products from 10.6 million acres of forest that it owns in the US and 14.1 million acres that it manages in Canada. The US generates about 85% of the company's revenue. Incorporated in 1900 as Weyerhaeuser Timber Company in the state of Washington, when Frederick Weyerhaeuser and 15 partners bought 900,000 acres of timberland. |
| Vornado Realty Trust                  | Vornado Realty Trust is a real estate investment trust (REIT) with holdings in office, retail, hospitality, and residential space. The company's commercial property holdings total approximately 19.9 million sq. ft. of space, primarily in New York City. It also owns the 3.7 million sq. ft. theMART office building in Chicago, and a controlling stake in San Francisco's 1.8 million sq. ft. office complex 555 California Street. In addition, Vornado owns about a third of New York retail property owner Alexander's. Building Maintenance Services LLC (BMS), a wholly owned subsidiary, which provides cleaning and security services for its buildings and third parties.                                                                                                                              |
| Realty Income Corp                    | Realty Income Corporation is an S&P 500 company and member of the S&P 500 Dividend Aristocrats index. The self-administered real estate investment trust (REIT) acquires and manages primarily freestanding commercial properties that generate rental revenue under long-term net lease agreements with its commercial clients. Realty Income owns around 12,235 (mostly retail) properties spanning approximately 236.8 million sq. ft. of leasable space across every US state, though about 30% of the REIT's rental revenue comes from its properties in Texas, Florida, Ohio, Georgia, Illinois, and                                                                                                                                                                                                            |

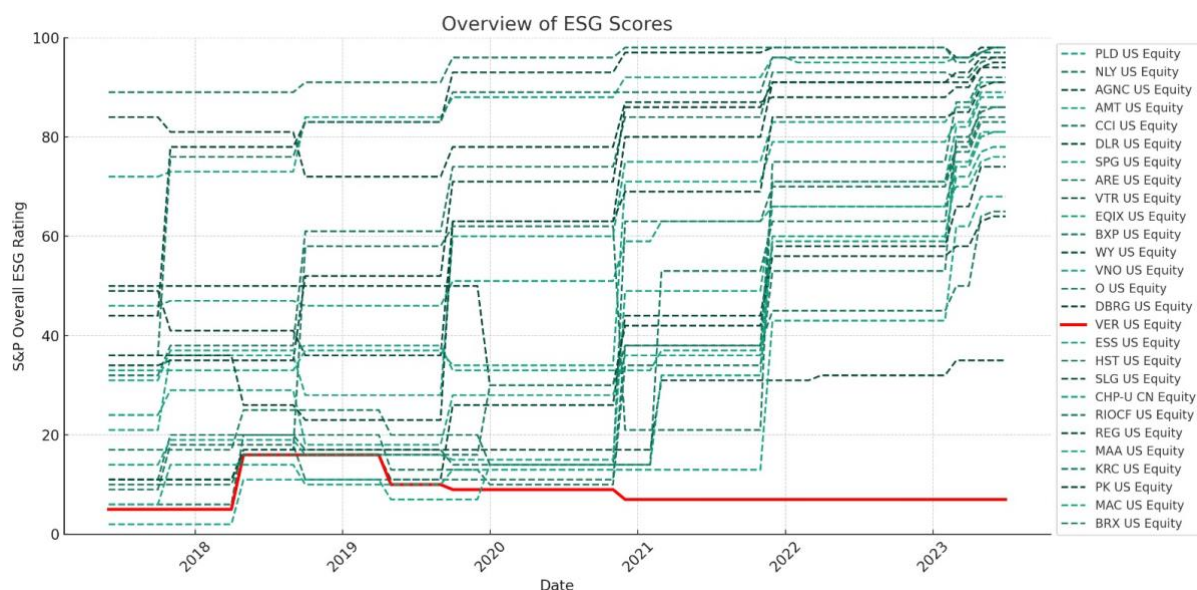
|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                | Tennessee. Realty Income's top five tenants include Walgreens, 7 Eleven, Dollar General, Wynn Resorts, and Dollar Tree/Family Dollar. The US generates about 90% of the company's total revenue.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DigitalBridge Group, Inc                       | DigitalBridge Group, Inc. operates as a digital infrastructure firm. The company invests in data centers, cell towers, fiber networks, small cells, and edge infrastructure. DigitalBridge Group serves customers in the United States.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Essex Property Trust, Inc.                     | Essex Property Trust acquires, develops, redevelops, and manages apartment communities, located along the West Coast of the US. The self-managed and self-administered real estate investment trust (REIT) owns more than 250 operating apartment communities aggregating some 62,145 apartment homes, excluding the company's ownership in preferred equity co-investments, loan investments, three operating commercial buildings, and a development pipeline comprised of one consolidated project and one unconsolidated joint venture project aggregating some 265 apartment homes.                                                                                                                                                                        |
| Host Hotels & Resorts                          | Host Hotels & Resorts is the largest hospitality real estate investment trust (REIT) in the US and one of the top owners of luxury and upscale hotels. It owns around 80 luxury and upper upscale hotels mostly in the US (but also in Canada and Brazil) totaling some 42,200 rooms. Properties are managed by third parties; most operate under the Marriott brand and are managed by sister firm Marriott International. Other brands include Hyatt, Ritz-Carlton, Westin, and Hilton. In addition, Host owns non-controlling interests in seven domestic and one international joint venture that primarily own hotels. Host generates most of its revenue in the US.                                                                                       |
| SL Green Realty Corp.                          | SL Green Realty is a self-managed real estate investment trust (REIT), engaged in the acquisition, development, repositioning, ownership, management and operation of commercial and residential real estate properties, principally office properties, located in the New York metropolitan area, principally in Manhattan, a borough of New York City. The firm has interests in about 50 consolidated and unconsolidated properties in Manhattan buildings totaling more than 29.7 million square feet. SL Green's largest tenants by rentable square feet are Paramount Global, Credit Suisse Securities (USA), Inc., and Sony Corporation. The REIT also provides well-collateralized debt and preferred equity investments.                               |
| Choice Properties Real Estate Investment Trust | Choice Properties Real Estate Investment Trust invests in commercial properties. The company focuses on commercial real estate holdings located in Canada with the intent of developing the property and increasing productivity of operations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| RioCan Real Estate Investment Trust            | RioCan has a can-do attitude about property investment. Canada's largest real estate investment trust (REIT), RioCan owns and manages Canada's largest portfolio of shopping centers, with ownership interests in about 220 retail properties, totaling more than 38 million sq. ft. of leasable space, including about 15 development properties. Most of RioCan's shopping centers are anchored by a supermarket or big-box store; major tenants include Metro and Loblaw supermarkets, and TJX and Wal-Mart Stores. The majority of the company's holdings are located in Canada's six largest metropolitan areas: Toronto (largest market), Vancouver, Montreal, Ottawa, Calgary, and Edmonton. RioCan has about 15 properties under development in Canada. |
| Regency Centers Corporation                    | Regency Centers is a fully integrated real estate company and self-administered and self-managed real estate investment trust (REIT) that owns, operates, and develops shopping centers located in suburban trade areas with compelling demographics. Some of its tenants include Publix, Kroger, Albertsons Companies, Amazon, Whole Foods, and TJX. The REIT wholly owns or has interests in about 405 properties measuring over 50 million sq. ft. of leasable space. The REIT focuses on high-growth areas in states including California, Florida, Texas, New York and Georgia, home to the majority of its wholly-owned holdings.                                                                                                                         |
| Mid-America Apartment Communities Inc          | Mid-America Apartment Communities (MAA) is a self-administered, self-managed real estate investment trust (REIT) that focuses solely on buying multifamily residences. MAA owns or has interests in more than 100,000 apartment units in more than 15 states, primarily located in the South West, Southeast and Mid-Atlantic regions of the US. Its largest markets, wherein about 70% of the company's apartment units are offered are located in Georgia, Texas, North Carolina, and Florida. MAA, which has an average property occupancy rate of about 95%, targets large and midsized markets.                                                                                                                                                            |
| Kilroy Realty Corporation                      | Kilroy is a self-administered real estate investment trust (REIT), which operates in premier office and mixed-use submarkets in the US. Kilroy Realty owns, manages, and develops Class A office space, mostly in Greater Los Angeles, San Diego County, the San Francisco Bay Area, Greater Seattle and Austin, Texas. Its portfolio includes about 120 office properties encompassing about 15 million square feet of leasable space. In addition, the company also boasts six future development sites, which accounts for about 60 gross acres of undeveloped land. A majority of Kilroy Realty's more than 420 tenants are involved in technology, media, healthcare, and entertainment.                                                                   |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Park Hotels & Resorts Inc   | Park Hotels & Resorts is the second largest publicly-traded lodging real estate investment trust (REIT) with a diverse portfolio of iconic and market-leading hotels and resorts with significant underlying real estate value. The company's portfolio consists of some 45 premium-branded hotels and resorts with approximately 29,000 rooms, of which some 90% of its rooms are luxury and upper upscale and all of its rooms are located in the US and its territories. The company operates its high-quality hotels in major urban and convention areas including the New York City, Washington, DC, Chicago, San Francisco, Chicago, and others. It operates resorts in leisure areas such as Hawaii, Orlando, Miami Beach and Key West, and operates various hotels and resorts at gateway airports. |
| The Macerich Company        | Macerich provides the infrastructure that houses top retail shops throughout the US. The self-administered real estate investment trust (REIT) acquires, develops, leases, and manages shopping and strip malls. Its portfolio consists of about 45 regional shopping centers and some five community shopping centers totaling approximately 47 million sq. ft. of gross leasable space. The properties are located in the US, with top markets in Arizona, California, and the New York metropolitan area. Macerich's tenants include some of the country's leading retailers, including Victoria's Secret, Gap, Dick's Sporting Goods, American Eagle Outfitters, and Foot Locker.                                                                                                                       |
| Brixmor Property Group Inc. | Brixmor Property Group hopes you swing by the grocery store more than once a week. The internally-managed real estate investment trust (REIT) owns a portfolio of about 520 strip mall-style shopping centers across 38 states. Its properties are situated in high-traffic commercial areas anchored by grocery store chains such as Ahold, Kroger, Publix, Safeway, and Wal-Mart. Besides the main grocery store tenant, its shopping centers offer a mix of smaller retailers such as Dollar Tree or other big box stores such as Best Buy, Kmart, and TJX Cos. Altogether Brixmor Property Group owns some 87 million sq. ft. of leasable space; each shopping center averages about 166,100 sq. ft. The trust went public in 2013.                                                                     |

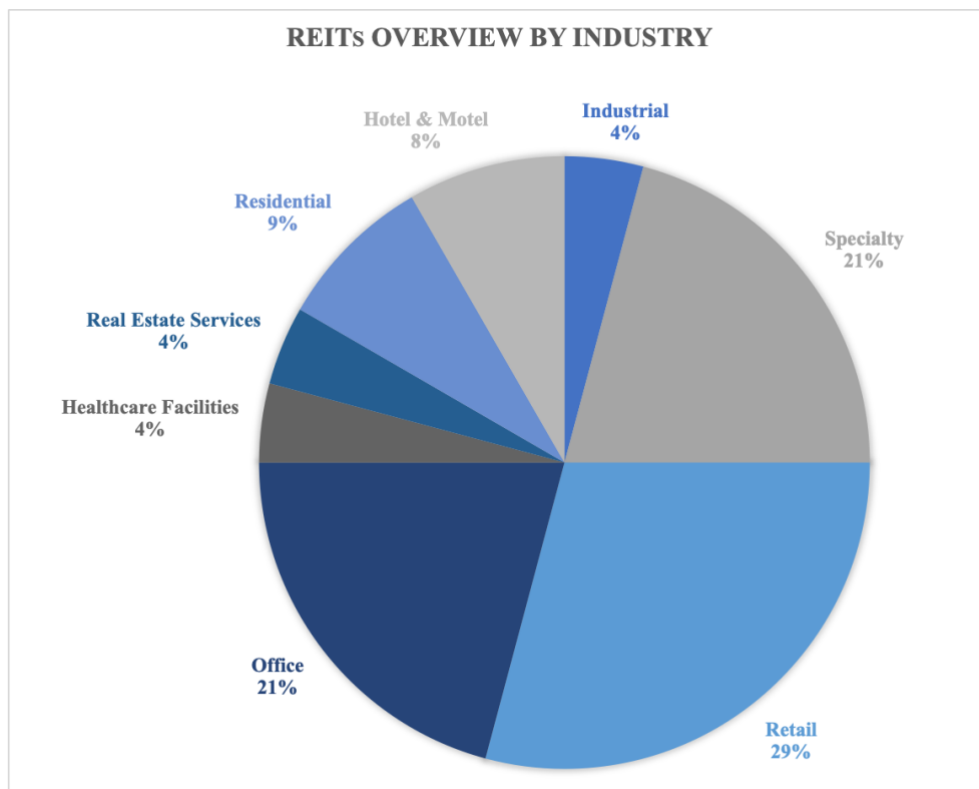
Source of data: Bloomberg

Table 5: Bloomberg's company description of each REIT chosen in final sample

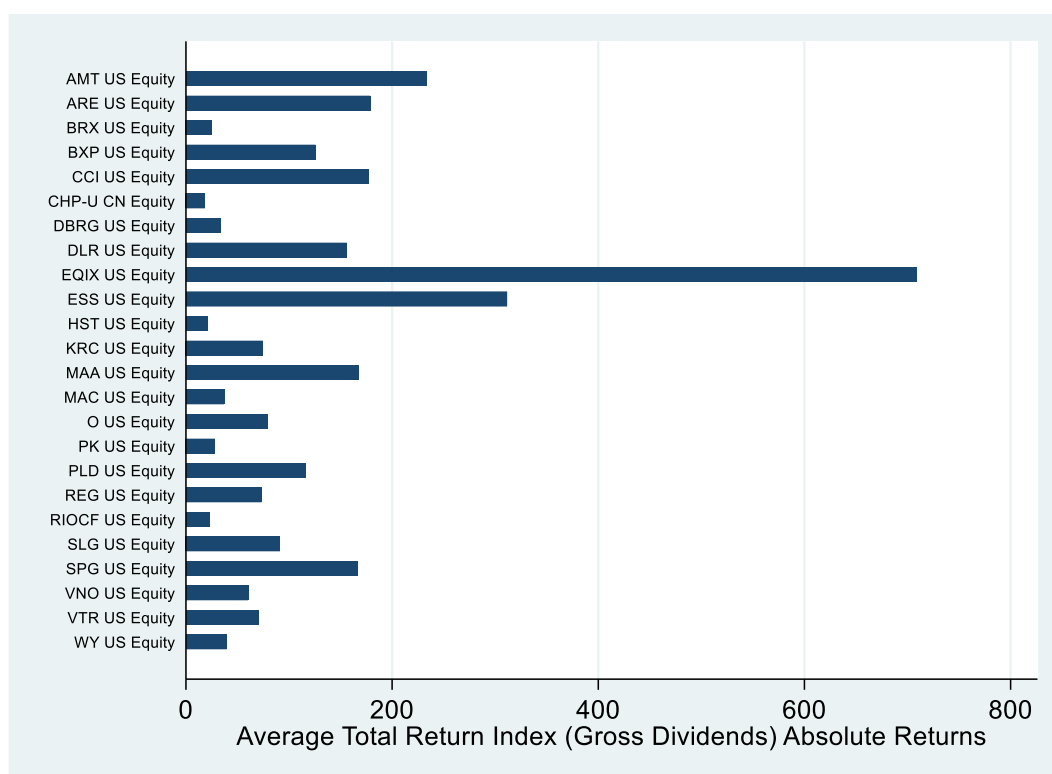
## Graphs



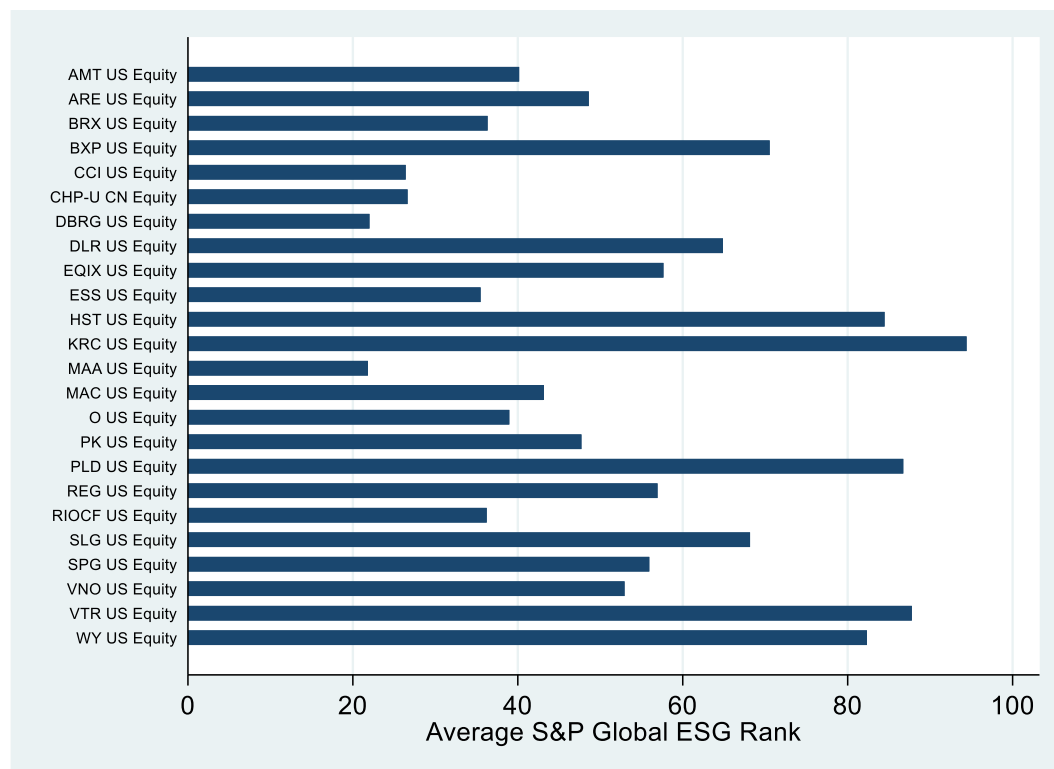
Graph 1: Plot of the evolution of the S&P ESG rank per REIT between May 2017 and June 2023, highlighting graphically 'VER US Equity' as a sample outlier.



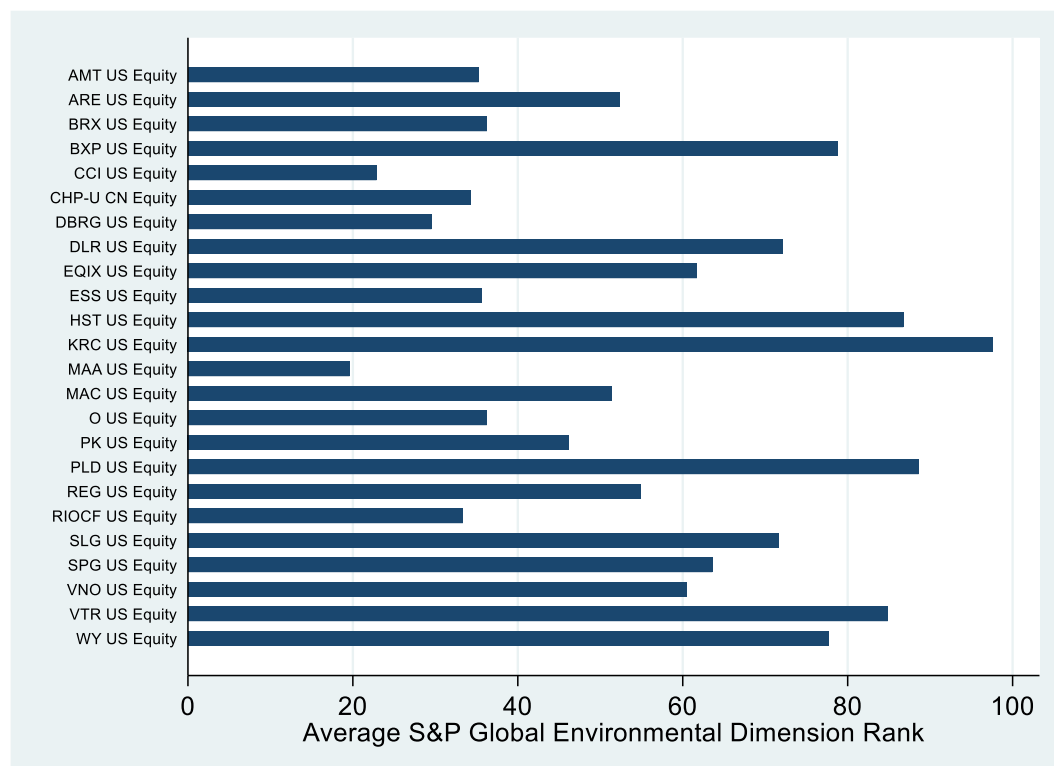
Graph 2: Pie chart with overview of sample distribution by Industry of each REIT.



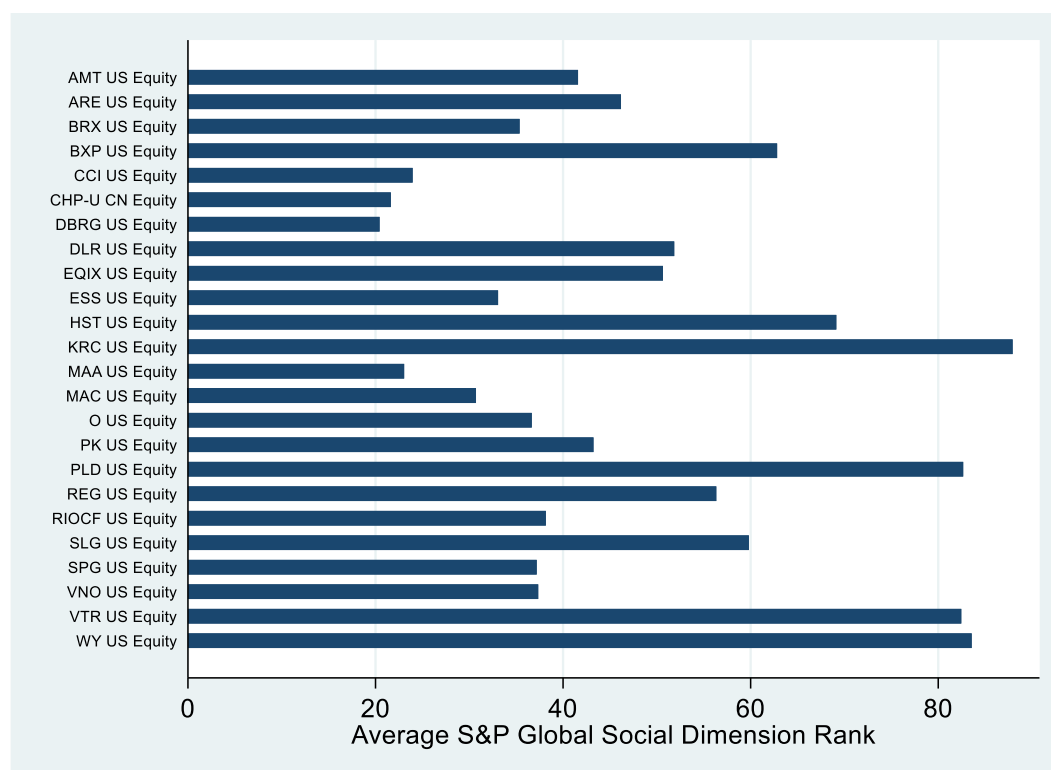
Graph 3: Overview, per REIT, of the average monthly Total Returns – Absolute over the total sample period.



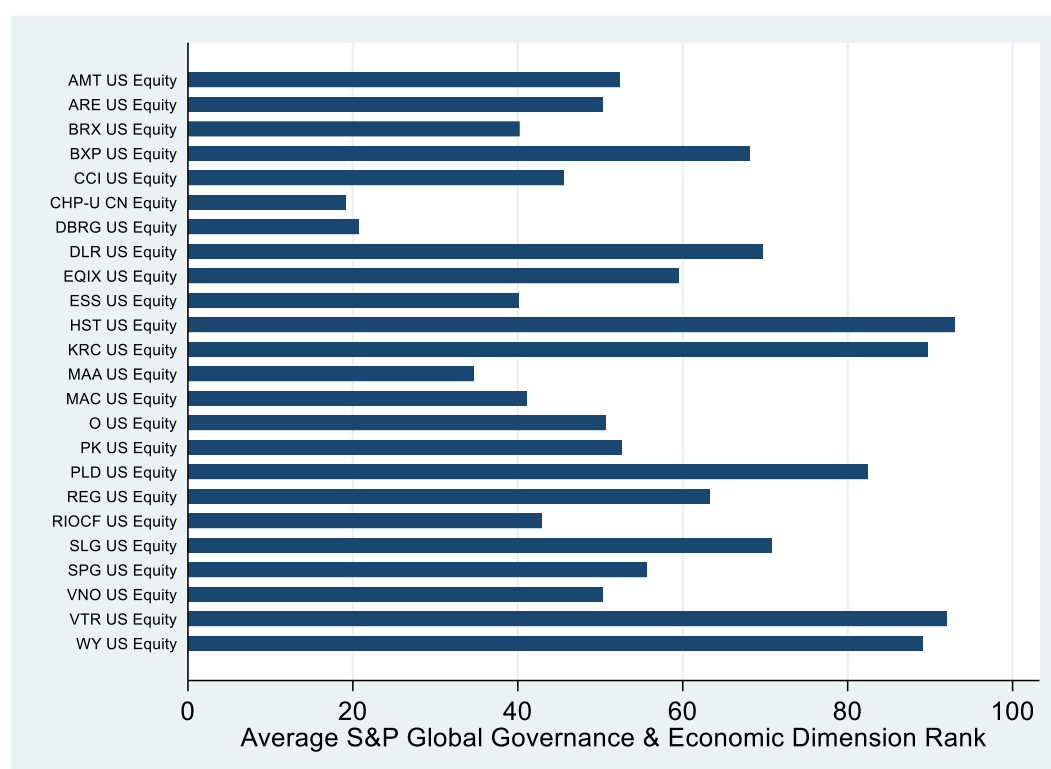
Graph 4: Overview, per REIT, of the average monthly S&P Global ESG Rank over the total sample period.



Graph 5: Overview, per REIT, of the average monthly S&P Environmental Dimension Rank over the total sample period.



Graph 6: Overview, per REIT, of the average monthly S&P Social Dimension Rank over the total sample period.



Graph 7: Overview, per REIT, of the average monthly S&P Governance Dimension Rank over the total sample period.