



**REAL ESTATE INVESTMENT TRUSTS AND SUSTAINABLE INVESTING
STRATEGIES**

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ABSTRACT

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This thesis studies the relationship between environmental, social and governance scores and real estate investment trusts in the United States for a 9-year period from January of 2014 until January 2023. The period is also studied in sub-periods from 2014 until 2018 and from 2019 until 2023. The study is conducted via portfolio analysis, where portfolios are formed based on four different strategies, best-in-class, worst-in-class, momentum, and negative momentum. The thesis focuses on equity REITs, but mortgage REITs are also studied. These sustainable strategies have been previously studied in the context of stocks, with mixed findings. This thesis adds to the previous research by adding new insight to their application for REIT investing.

The performance of portfolios was compared to a REIT benchmark index via absolute returns, and performance measures, the Sharpe ratio and information ratio. The excess returns of portfolios were also studied with Fama and French 3 and 5-factor and Carhart 4-factor regression models, to assess whether these factors can explain excess returns of real estate investment trust portfolios.

Real estate investment trusts with low ratings were found to outperform the benchmark index, as well as other studied portfolios. Portfolios with increasing ESG scores attained a similar performance to the benchmark index, with slightly less risk. The Fama and French 3-factor model factors can explain most of the excess returns, with statistically significant factor loadings in all periods. No significant abnormal returns were found, except for the negative momentum portfolio for mortgage REITs. Carhart 4-factor model, nor the Fama and French 5-factor model added explanatory power compared to the 3-factor model. This study concludes that sustainable investing is not beneficial when investing in real estate investment trusts, as it led to returns lower than the overall REIT market and REITs with a low level of ESG performance.

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Tässä pro-gradu tutkielmassa tutkitaan ympäristön, yhteiskuntavastuun ja hallintotavan (ESG) pisteytyksiä sekä näiden yhteyttä yhdysvaltalaisen kiinteistösijoitusrahastojen (REIT) tuottoihin 9-vuoden ajanjaksolla vuoden 2014 tammikuusta, vuoden 2023 tammikuuhun. Myös kahta osakautta, vuodesta 2014 vuoteen 2018, sekä vuodesta 2019 vuoteen 2023 tutkitaan erikseen. Tutkimus on tehty portfolio analyysin avulla, jossa portfoliot rakennetaan neljän eri strategian perusteella. Nämä strategiat ovat luokan parhaat, luokan huonoimmat, positiivinen momentum, sekä negatiivinen momentum. Tutkimuksessa keskitytään osakepohjaisiin kiinteistösijoitusrahastoihin, mutta asuntolainoihin sijoittavat kiinteistörahastot otetaan myös huomioon. Aikaisempi vastuullisen sijoittamisstrategioiden tutkimus on keskittynyt pääosin osakemarkkinoihin, ja tulokset ovat vaihtelevia. Tämä työ lisää tietoutta näiden strategioiden käytöstä kiinteistösijoitusrahastoihin.

Portfolioiden suorituskykyä mitattiin vertaamalla näiden tuottoja kiinteistösijoitusrahasto-indeksiin absoluuttisin tuottojen, Sharpen mittarin, sekä informaatio luvun avulla. Tuottoja tutkittiin myös Fama-French 3 ja 5 faktorin, sekä Carhartin 4-faktorin regressiomalleilla.

Matalan ESG-tason kiinteistösijoitusrahastot ylisuorittivat verrattuna kiinteistösijoitusrahasto-indeksiin, sekä muihin testattuihin portfolioihin. Kasvavan ESG tason portfoliot tuottivat samankaltaisesti kuin indeksi, hieman matalammalla riskillä. Fama-French 3-faktori malli selittää suurimman osan ylituotoista, korkealla merkitsevyydellä kaikilla periodeilla. Epänormaaleja tuottoja ei löytynyt, lukuun ottamatta negatiivisen momentumin asuntolaina-kiinteistösijoitusrahastoyhtiö portfolioita. Carhartin neljän faktorin malli eikä Faman ja Frenchin viiden faktorin malli lisännyt kokonaisuuskykyä kolmen faktorin malliin verrattuna. Tämän tutkimuksen perusteella vastuullinen sijoittaminen ei ole kannattavaa yhdysvaltalaisiin kiinteistösijoitusrahastoihin sijoitettaessa, sillä se johtaa matalampiin tuottoihin kuin kiinteistösijoitusrahasto-indeksiin tai matalan ESG-tason kiinteistösijoitusrahastoihin sijoitettaessa.

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1. Introduction

Sustainable investing and environmental, governance and social (ESG) related issues have captured the interest of investors during the past two decades and has become mainstream. As organizations and stakeholders' interest in companies' sustainability have grown, studying ESG related correlation with stock prices seems interesting. These environmental, social and governance factors are relevant for most companies and thus investors must also take these into consideration when making investment decisions. Sustainable investing, also called CSR investing, that comes from the term corporate social responsibility can be explained by taking environmental, social and governance aspects and risks and opportunities associated with these factors into consideration. Normally when pricing securities we examine the present value of cash flows, risks and required rate of return. However, based on research done on the subject, the environmental social and governance aspects are not always properly included in the valuations of companies (Silvola & Landau 2021, 6, 16) and that companies with high level of ESG incorporation outperforms companies with low level of incorporation. The demand for sustainable investments makes it important to study this phenomenon in more depth. While the impact of different ESG factors on regular stocks and bonds have been increasingly researched, their correlation with Real Estate Investment Trusts (REITs) returns specifically have not received much attention, even though real estate is one of the most pollutive industries, and thus should benefit from integrating ESG policies.

1.1. Objectives of the research and data

The objective of this research is to test performance of REIT portfolios with four different strategies. Two of the strategies are built to mimic the performance of REITs with high or improving environmental, social and governance ratings, and the other two mimics the opposite, low or decreasingly rated REITs. The purpose is finding whether implementing sustainability related strategies can improve the performance of REIT portfolios. This thesis improves upon the current ESG studies by showing new insights for the relevance of ESG factors and implementing sustainable strategies in REIT investing, and in addition to often

studied equity REITs; mortgage REITs are also tested. Also, to my knowledge is the first study to implement an ESG momentum strategy in portfolio construction in the REIT universe. This research is based on the years 2014-2023, but also the sub-periods from 2014-2018 and 2019-2023 are studied separately to see if performance is comparable between different time periods.

The ESG score data for the study is based on ESG scores acquired from Refinitiv, where the company ESG scores are measured by Refinitiv's framework based on 10 main themes, such as emissions, human rights, environmental product innovation, stakeholders, which forms a base for each environmental, social and governance components of the ESG. (Refinitiv 2022).

1.2. Limitations

This study uses Refinitiv environmental social and governance scores for creating real estate investment trust portfolios. However, as there are multiple companies and organizations offering sustainability ratings for companies, which have been shown to have differences in previous studies, using different ESG data provide could lead to differing results. As the investment universe is only real estate investment trusts based on the United States, the universe is somewhat limited. Also, the number of REITs with available ESG scores in the first half of the study period 2014-2022 is quite a lot lower than those towards the latter half of the study. Thus, the amount of diversification increases only in the latter periods. Also, the cut-off point used for best-in-class and worst-in-class portfolios could affect the performance of portfolios.

1.3. Research questions

Research questions that this thesis intends to answer are:

1. Does best-in-class inclusion improve performance of REIT portfolios and outperform the benchmark?
2. Does inclusion of ESG momentum improve performance of REIT portfolios and outperform the benchmark?
3. Do multi-factor models have explanatory power for excess returns of REIT portfolios?

The portfolio performance is studied with absolute returns and performance metrics, sharpe ratio and information ratio and regression models, CAPM, Fama-French 3-factor and 5-factor models and Carhart 4-factor model which are applied to all the REIT portfolios.

2. Theoretical background

In this chapter, we go through the basic information about real estate investment trusts, environmental, social and governance scores and most common sustainable investing strategies. Also, we review the theory of the regression models and performance measures used in this thesis. At the end of this chapter, some of the prominent studies regarding sustainable strategies and studies about sustainability in the context of real estate investment trusts are reviewed.

2.1. Real estate investment trusts

Real Estate Investment Trusts, e.g., REITs are companies that own and manages or operates income producing real estate assets for their shareholders, often referred as equity REITs, or by providing lending and buying mortgages, which are called mortgage REITs. The beginning of REITs came in the year 1960 from President Dwight D. Eisenhower, who signed the REIT Act of 1960 to the law, with the intention to increase smaller investors, such as retail investors to get better access to real estate, through managed portfolios. Nowadays publicly traded REITs are a significant asset class, that own or operate around \$2.5 trillion of real estate assets, and they are available through majority of brokerages and are as easy to acquire as any other public equities. (Baker et al. 2019; Aroul et al. 2022)

Public REITs can be purchased as individual stocks, or part of larger mutual funds or ETFs. This gives investors opportunities to focus on specific types of real estate or include them in diversified portfolios, depending on their risk appetite and needs. There are several different types of REITs. The most common ones are equity REITs and mortgage REITs but there are also so-called hybrid REITs, which are REITs that hold both properties and mortgages. These can be further divided into publicly traded REITs, public non-traded REITs, and private REITs (Baker et al. 2019). Real Estate Investment Trusts operate and own assets in many important sectors of society and economy overall. These include retail, infrastructure,

healthcare, residential, hotels and resorts, storage as well as many others. Individual REITs often focus on one or few of the sectors, depending on their size and expertise.

The difference between equity real estate investment trusts with other real estate companies is that REITs never develop properties with the intention to resell them, but rather are the operators of these properties. Equity real estate investment trusts gain most of their revenue through rents, where the REIT is the landlord, and tenants are the lessees. This means in effect that investors can have exposure to real estate investments without directly acquiring actual real estate for themselves, and thus even with small amount of investment can have access to real estate. Thus, REIT investing can be considered as an indirect investment in real estate assets. As real estate investments are often made with significant leverage through lending, REIT investing can also offer access with less risk and smaller investment compared to directly owning individual real estate assets. Similarly, if an investor wants to invest to the other side, the investor can invest in mortgage REITs, where the investor invests in REITs that provides lending to the real estate market, such as for other real estate companies through originating and purchasing mortgages and mortgage-backed securities. Thus, mortgage REITs are in a way like banks, in the sense that they provide lending services, but as they don't have access to customer deposits, they raise funds through issuing debt or equity through capital markets (Krewson-Kelly & Thomas 2016).

Even though real estate investment trusts are like any other companies in many ways and are listed to exchanges similarly to stocks, they have a few distinct differences with most of them. For a company to be registered as a REIT, it must follow certain requirements of the Internal Revenue Code, most importantly according to Baker et al. (2019):

- Organized as an entity that is a corporation, trust or similar.
- Management is done by a board comprised of trustees or directors.
- Minimum of 100 shareholders.
- Five or less people can have a maximum of 50% ownership.
- Real estate assets must be a minimum of 75% of total assets.
- Gross income must include a minimum of 75% from rents, mortgages, or real estate sales.
- Distribute 90% or more of taxable profits to shareholders via dividends. (Baker et al. 2019, 152-153)

In addition, companies registered as REITs are exempt from paying corporate taxes if the company pays at least 90% of its taxable income to its shareholders, thus avoiding double taxation of profits (Baker et al. 2019). Real estate investment trusts also use a high amount of debt in their operations compared to many other industries, which is necessary because of the dividend policy associated with them, which limits their ability to invest in growth through profits.

For this research Refinitiv (2020) Business Classification is used for classification of REITs. The classification divides REITs to four categories. These are Diversified REITs, Residential REITs, Specialized REITs, and Commercial REITs.

- Diversified Reits: include all REITs that own diversified type of real estate assets.
- Specialized REITs: include Specialized, healthcare, hospitality, self-storage, timber, mortgage, and Islamic REITs.
- Commercial REITs: include commercial, office, retail, and industrial REITs.

- Residential REITs: include residential REITs that focuses in apartment (buildings), student housing, manufactured and single-family homes.

2.2. ESG and sustainable investing strategies

Sustainable investing (or socially responsible investing) is a way of investing that has gained increasing attention in the 21st century (Dorfleitner et al. 2015). According to Silvola and Landau (2021) sustainable investing takes environmental, social and governance factors into consideration in investing strategies. Typical environmental, social and governance factors considered are emissions, energy efficiency, waste management, human rights, labor rights, anti-corruption and bribery actions, taxes, and actions of management, among others. Sustainable investment strategies have gained lately more attention from investors and scholars alike. Sustainable investments globally have increased 55% during the 2016 to 2020 period to a total of \$35.3 trillion which represents 35.9% of all assets under management (GSI 2020). As the understanding of ESG related issues grew importance in the investing scene, in 2005 the Principles for Responsible Investment (PRI) was created by a group of institutional investors across the world, brought together by the United Nations. There was a total of 6 principles that were created, in order to increase the adoption and understanding of ESG issues, and today over 4000 signatories across the world with in excess of \$120 trillion of assets have committed to follow these principles in their investing. (PRI, 2021)

As previous studies have shown that traditional financial models such as the CAPM have been unable to explain all the expected return of stocks, and the fact that ESG factors and financial performance have been shown to have correlation in studies (Friede et al. 2015). Adding ESG related factors can yield new insights and makes studying their relevance in asset pricing interesting.

There are multiple popularized strategies that can be used in sustainable investments screening. According to Gutterman (2021) at least the following strategies are popular among the sustainable investing space:

- Exclusionary/negative screening

Largest category of sustainable investment categories. Avoiding assets because of moral values, standards or norms, ethical convictions, or legal requirements.

- Best-in-class/positive screening

Investing in assets with demonstrated high ESG performance. This method has been used to improve risk-reward composition of a portfolio, in addition to supporting sustainable companies.

- Norm-Based screening

Making investment decisions by the screening of “potential investments against minimum standards of business practice based on international norms relating to climate protection, human rights, working conditions, and action plans against corruption” (Gutterman, 2021, 12)

- ESG integration

Including ESG risks and opportunities to financial analysis, to increase the accuracy of risk and reward evaluation.

- Impact investing

Investing in companies, organizations, or funds to create positive social and/or environmental impact.

- Thematic investing

Investing focusing on themes of sustainability like “cleantech, infrastructure, energy efficient real-estate, or sustainable forestry.” (Gutterman, 2021, 13).

- Active ownership

Focusing on engagement with portfolio companies with the purpose of influencing the company to make change and to draw attention to environmental and social issues. (Gutterman, 2021, 11-13)

In the following sub-chapters, we will go through some of the more prominent sustainable investing strategies.

2.3. Exclusionary/negative screening

Exclusionary screening can be considered the oldest form of sustainable investing strategy. Ethical investors have for a long time for example excluded so called sin stocks from their investment universe. These are for example tobacco, weapons and military equipment, and more recently high pollution industries such as coal mining (Silvola and Landau, 2021; Boffo and Patalano, 2020). In a sustainable investing strategies, this screening can be used for example by excluding companies from portfolios, which the investor seem unethical. As the interest for environmental, social and governance factors have increased, and more data is available people can make better investment decisions based on their own preferences. ESG data providers and the availability of sustainability related data have changed the game for investors and birthed multiple new strategies than can be implemented in investing. In investing strategies, negative screening is often implemented by removing companies according to their overall ESG or similar ratings or with a thematic or material exclusion of companies based for example on an individual constituent of an ESG rating. This kind of approach was studied for example in Nagy et al. (2016) and Verheyden (2016) studies. Including only negative screening or worst-in-class exclusion have not shown to be enough to gain excess return, but have shown to reduce tail-risk, and are often it is used in combination with other strategies.

2.4. Best-in-class/positive screening

Best-in-class screening refers to a strategy where investors seek to gain outperformance by investing only in companies with high level of ESG related implementation. As ESG information has become more available this kind of strategy has gained prominence over strategies of negative screening. Similarly, to negative screening, in best-in-class investing companies are chosen if they are within a top percentage of the investable universe. This can mean that for example only 10%-30% of companies are included. Other prominent strategy

is what Nagy et al. (2013) suggested, called the tilt-strategy, where companies with higher ESG scores are overweighted.

2.5. ESG Momentum

ESG momentum strategies are somewhat new in CSR studies. They invest in companies that has shown improvement in their ESG score (Boffo and Patalano, 2020). They are constructed similarly to regular stock return-based momentum strategy portfolios, but rather than constructing portfolios based on the change of portfolio returns, ESG momentum portfolios are constructed based on the change of a sustainability metric such as an ESG score, provided by an analytics company. The idea is to choose stocks based on their respective change in previous year's score compared to the next and rebalance accordingly to assess their predictive ability.

Some ESG momentum strategies incorporate the ESG ratings to traditional investment strategies such as the momentum strategies firstly proposed by Jegadeesh and Titman (1993). This ESG momentum strategy can be implemented in a way where investor longs companies with positive change in their ESG score over a period and short companies with negative change. One example of this type of combination strategy is the study by Kaiser (2020), where ESG ratings were combined with a momentum, value, and growth strategies in U.S and European markets. The findings were that inclusion of ESG ratings increased the overall ESG scores and lowered portfolio risk, without negatively affecting portfolio returns. They also argue that the ESG information is relatively more adopted in the European markets compared to the U.S markets and thus investors in the U.S market can potentially benefit more from ESG information. As the ESG momentum strategy have not been used in that many studies there are differences in the implementation of this strategy. The performance of these ESG strategies is often studied with different kind of factor models.

2.5.1. ESG Scores

Nowadays the amount of ESG data is vast and there are multiple providers for this data. Some of the largest providers include, MSCI, Refinitiv, Sustainalytics, and Robeco SAM

(Boffo and Patalano, 2020). This is great for investors, as they can easily access ESG related information. However, as ESG scores are partially based on information companies publish themselves, therefore the information is not always trustworthy. Companies could use their reporting for “greenwashing” or ESG washing to look more responsible and sustainable than they are. Also, the ESG related information is yet to be standardized and is rather scattered across different providers of data. The ESG ratings from different agencies offering ESG ratings are also shown to not to have great correlation even though the scoring methodology is somewhat similar. This is due to the different weights and in the composition of the final combined scores. (Gutterman, 2021; Dorfleitner et al. 2015)

2.5.2. Refinitiv ESG Scores

Refinitiv (2022) has one of the largest ESG information databases in the industry, that covers as much as 85% of the world’s market cap, including over 12 000 individual public and private companies. The ESG Scores provided by Refinitiv are based on over 600 metrics in the company-level of which 186 measures are used for evaluating individual companies’ ratings based on the most important metrics of its industry. These measures are divided into 10 categories, in the three parts that ESG Score consists of which are environmental, social and governance pillars. These scores are recalculated and updated on a weekly basis based on new information available and based on updates in the data or news. The scores are divided into 4 quartiles from 0-100, and to grades from A± to D±.

A score of 0-25 or a grade of D- to D+ represents companies with poor ESG performance and inadequate level of transparency in their reporting.

A score of 25-50 or a grade of C- to C+ represents an adequate level of ESG performance and transparency in reporting.

A score of 50-75 or a grade of B- to B+ represents a good level of ESG performance and transparency in reporting.

A score of 75-100 or a grade of A- to A+ represents outstanding level of ESG performance and reporting.

Figure 1. ESG Score (Refinitiv, 2022)



Environmental pillar score consists of three categories. Resource use is based on themes such as water usage, energy efficiency, sustainability of packaging and the sustainability of supply chains. Themes such as emissions emitted, waste management, level of biodiversity and usage of environmental management systems are associated with emission part of environmental score and lastly product innovation, and revenues, research and development and capital expenditures benefiting the environment are the themes associated with innovation category.

Social pillar score consists of community, human rights, product responsibility, such as responsible marketing, product quality and data privacy. And most importantly workforce and taking into consideration things associated with it such as diversity, career development and training, safety, health and working conditions.

Governance Pillar score consists of CSR strategy, ESG and CSR reporting and transparency, Management, which consists of structure and for example compensation. And of course, shareholders, and their rights and ability of takeover defenses.

2.6. Capital asset pricing model

CAPM model is one of the most known asset pricing models, which is still widely used for a base in asset pricing and measuring performance of mutual funds and managed portfolios. It is based on Harry Markowitz (1952), mean-variance portfolio theory also commonly known as modern portfolio theory. It assumes risk-averse investors and that for given the expected return, investors try to minimize variance and maximize returns for the level of variance. (Fama and French, 2004). In other words, investors base their investment decision on the risk and reward of the investment and with a given expected return will always prefer the option with less risk.

The Capital asset pricing model was created in the 1960s by Sharpe (1964), Lintner (1965), Treynor (1961) and Mossin (1966). It is interpreted based on the concept in finance, that correlation between an asset's risk and asset's return compared to the market return, which can also be shown in graphical form with the security market line (SML). The Capital Asset Pricing Model assumes that the market portfolio of all investable securities in the market is mean variance-efficient, thus having only systematic risk and a beta of 1. Meaning that all the market risk can be avoided by high enough diversification. The equation for the standard CAPM model can be seen in equation (1), where β_i is the assets volatility compared to the market, $E(R_i)$ is the expected return of asset or portfolio, R_f is the risk-free rate of return and $E(R_m - R_f)$ is the expected excess return of market over the risk-free rate. (Fama and French, 2004; Francis and Kim, 2013)

(1)

$$E [R_i] = R_f + \beta_i [E(R_m) - R_f]$$

Where:

$R_i = \text{asset return}$

$\beta_i = \text{asset beta}$

$R_f = \text{risk free return}$

$R_m = \text{market return}$

The model has also been criticized for its unrealistic assumptions, according to (Francis and Kim, 2013) the CAPM assumes

- 1) No taxes or transaction costs, fractions of shares can be purchased.
- 2) Unlimited borrowing, no margin requirements
- 3) Investors make decisions only based on mean and standard deviation of returns of their portfolios.
- 4) All information is the same and available for everyone.
- 5) Risk-free rate is the same for everyone.
- 6) Investors have the same expectations for expected return, variance, and covariance for any security.

Jensen (1968) was the first to show that the CAPM can be used as a univariate time-series regression model, illustrating that the intercept of this regression also known as “Jensen’s alpha” measures whether the investor has over or underperformed compared to the market according to CAPM. If the CAPM assumptions hold true, then the intercept term α should always be zero. The equation for the regression model can be found in equation (2).

(2)

$$R_{it} - R_{ft} = \alpha_i + \beta_{im} (R_m - R_{ft}) + \varepsilon_{it}$$

where:

$R_{it} = \text{asset return}$

$R_{ft} = \text{risk free return}$

$R_{mt} = \text{market return}$

$\alpha_i = \text{asset alpha}$

β_{im} = asset beta

ε_{it} = error term

Even though the capital asset pricing model has its limitations, the model has been the foundation for many asset pricing models that are extensions to it with additional factors explaining excess returns.

2.7. Multi-factor models

As Fama & French and others have argued, CAPM is often unable to explain the expected returns of assets correctly. Continuing the studies in the 1970s and later, many researchers found that other explanatory variables such as size, momentum, and different price ratios increased the added explanatory power for asset returns compared to the CAPM (Fama & French 2004). One of the more commonly used models is the Fama-French 3-factor model by Fama and French (1993), where they added two factors according to the small firm and value anomalies, in where small cap companies tend to outperform large caps and high book-to-market value companies outperform low book-to-market value companies. These factors were created to capture the change in stock returns according to their size and book to market ratio. These two factors in Fama-French 3-factor model are the small-minus-big factor SMB (size) and HML, which is the high minus low (value) factor. The regression model can be seen in equation (3).

(3)

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \varepsilon_{it}$$

where:

R_i = asset return

R_f = risk free return

R_m = market return

α_i = asset alpha

β_i = asset beta

SMB_t = return of small minus big

HML_t = return of value minus growth

ε_{it} = error term

Later Carhart (1997) added a new factor to the Fama-French 3-factor model, following the findings of Jegadeesh and Titman (1993) and others, that buying previous winners and selling previous losers can earn positive abnormal returns. The added factor is MOM (momentum). The regression model can be seen in equation (4).

(4)

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{im}MOM_t + \varepsilon_{it}$$

where:

R_i = asset return

R_f = risk free return

R_m = market return

α_i = asset alpha

β_i = asset beta

SMB_t = return of small minus big

HML_t = return of value minus growth

MOM_t = return of past winners minus past losers

ε_{it} = error term

In later studies such as see. Novy-Marx (2013) and Titman et al. (2004) many other anomalies such as the profitability anomaly, where companies with high profitability outperforms companies with low profitability and investment anomaly, where companies with little investments outperforms companies that invests aggressively could not be explained by the original Fama-French 3-factor model, thus Fama and French (2015) included two new explanatory variables to their original model. These were called RMW, representing the returns of high profitability companies – low profitability companies, and CMA, representing the returns of little investing firms – aggressively investing firms. The regression model can be seen in equation (5).

(5)

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{ir}RMW_t + \beta_{ic}CMA_t + \varepsilon_{it}$$

where:

R_i = asset return

R_f = risk free return

R_m = market return

α_i = asset alpha

β_i = asset beta

SMB_t = return of small minus big

HML_t = return of value minus growth

RMW_t = return of robust profitability minus weak profitability

CMA_t = return of conservative minus aggressive

ε_{it} = error term

2.8. ESG Momentum and screening studies

On the early study regarding ESG momentum, Nagy et al. (2013), studied a ESG momentum strategy, that select stocks to a portfolio based on a positive change of their respective year over year ESG rating. Within the study a worst-in-class exclusion and a tilt strategy was also implemented, with an overweight on stocks with high ESG ratings and underweighting stocks with low ratings. The tilt strategy is a more long-term strategy, as firms with high ESG ratings can avoid future costs such as fines or labor issues and benefit from ESG related opportunities. The ESG momentum strategy is a more short-term strategy and doesn't have the purpose of increasing the ESG profile of a portfolio, as the companies improving their score can have any level of ESG score and are not necessarily have high score. The study was based on MSCI ESG research ratings. The research covered a global investment universe, with MSCI World Index as the benchmark and the period of February 2007 to

December 2012. Portfolios were rebalanced every three months. They used a multi-factor risk model called the BARRA global equity model (GEM3). The findings were that higher ESG rated companies outperformed statistically significantly, and that the ESG momentum strategy provided even better risk-adjusted returns. In a later study by Nagy et al. (2016) the same phenomenon was studied with two added years but with removing the worst-in-class exclusion. The results were like the first study, which confirmed their earlier finding that inclusion of highly or improving ESG rated companies can be done without sacrificing performance and can even increase performance.

Verhaegen et al. (2016) studied the performance of large and mid-cap stocks in the global universe, including stocks from 23 developed countries and 23 developing countries, in the period 2010–2015 using the best-in-class methodology and ESG momentum. They created 6 portfolios with two types of thresholds, 10% and 25%, thus only including stocks within the top 90% of ratings and top 75% of ratings in the portfolios respectively, with biannual rebalancing. An ESG momentum strategy was also implemented, therefore also including companies with improvement in ESG scores in the last 3 and 6 months, from the bottom 10% and 25% scoring companies. An extended Fama-French 3-factor model was used, with an added momentum factor. They found that inclusion of ESG screening decreased tail-risk and that three out of four ESG portfolios provided positive unadjusted and adjusted returns.

In a study by Bansal et al. (2022) studied the performance of companies from three different sources, MSCI-ESGSTATS, RepRisk and CSRWire. They compared CSR scores, which are like ESG scores and created portfolios for the returns of top decile and bottom decile from 1991 to 2013. The findings were that high scoring stocks outperformed low scoring stocks during good financial times but underperformed during recessions. That is in line with the fact that demand for SRI strategies is higher during better financial times and lower in recessions.

Kempf & Osthoff (2007) in an early ESG study found that simple strategy, where going long on companies with high ESG ratings and short in companies with low ESG ratings

outperformed the benchmark index with a significant model alpha. In the study they created portfolios for high scoring ESG companies, low scoring companies and a combination portfolio where they went long on high scoring companies and short on low scoring companies. The study period was years from 1992-2004. The performance was studied with Carhart 4-factor model. The findings were that both high ratings and long-short strategy had significant model alphas, even with considerable transaction costs included. Cut-off point was also found to have impact on the alpha.

In a more recent study, Halbritter & Dorfleitner (2015) studied whether the outperformance indicated in previous studies holds true, when comparing ESG ratings between different rating providers. These were Bloomberg, Asset4 and KLD. They used a similar approach to Kempf & Osthoff (2007) but didn't find meaningful differences in returns between low and high scoring portfolios. The period used also was found to be meaningful, as most of the studies showing high rated ESG portfolios outperforming their low rated counterparts, was based on periods earlier than 2007.

Heijningen (2019) studied the performance of global equity portfolios by two different methods; firstly, by creating portfolios based on ESG score levels and the change in ESG scores. In addition to these separate materiality and immateriality portfolios were formed similarly to the ESG score portfolios. The materiality and immateriality adjusted scores were done from an industry level and adjusted for each individual ESG score from a separate database. Both best-in-class and worst-in-class portfolios were created, and a best-worst portfolio based on scores. The performance was tested with an extended version of the Fama and French 3-factor model (1993), including Carhart's momentum factor (1997), quality and liquidity factors. The findings were that score levels are more important than changes and lead to more consistent results.

Bergskaug (2019) studied the ESG momentum strategy, comparing the performance of the momentum strategy in both developed and developing market universes. The portfolios were created by limiting the changes of ESG scores to bottom and top decile, and within these

positive and negative changes were studied in addition to positive-negative momentum. The study concludes no significant abnormal returns in either of the investment universes.

ESG Best-in-class and ESG momentum was also researched in related report published by Société Générale (Societe Generale, 2019) which compared the performance of a top 10% and top 30% ESG-rated and a ESG Momentum portfolio, within the top 30% rated ESG stocks, with a positive, neutral, and negative momentum. They chose the stocks based on a 10% increase in ESG ratings from the previous year for the positive momentum and -10% increase in ratings for negative momentum. They found that both top rated ESG portfolios and momentum portfolios outperformed compared to a European benchmark of Stoxx 600, with an increase in performance when including the momentum methodology.

A recent study by Bruno et al. (2022) studied the U.S mid and large cap stock universe and similar stocks in other developed areas excluding the U.S. by with 3 ESG based strategies, the combined ESG score and each of the constituents individually, by ESG momentum based on the change of ESG scores and a combination strategy. The performance was tested on the CAPM and an extended Fama-French 3-factor model with additional 4 factors, that were momentum, low volatility, high profitability, and low investment and by adjusting for downside risk. ESG data was based on MSCI ESG data. They concluded that ESG-strategies does not provide risk-adjusted alpha, nor downside risk protection.

2.9. Real estate investment trusts related ESG studies

There have been some studies regarding the relationship between real estate or real estate investment trusts and their sustainability within the scope of ESG, but the amount of studies is somewhat limited. In this sub-chapter we will go through some of them.

Cajias et al. (2014) studied the linkage between social and environmental responsibility and financial performance based on a sample of publicly traded US real estate companies that

included four subsectors that were home construction, hotels and others, REITs, and financial services. Models based on Tobin's Q ratio and annual total return were used and the data used was from the period of 2003-2010. The study found that overall high ESG scores affected company values positively, however when ESG strengths and concerns were compared as separate variables the study found that high ESG concerns affected the total returns positively while strengths affected total returns negatively.

Siew (2015) Studied 15 Australian REITs with high level of ESG implementation by Markov chain analysis to predict their behavior. Their study concluded that the price movement of Australian ESG REITs cannot be generalized, thus not having evidence for outperformance in the Australian market and must be independently analyzed for further evidence.

Morri et al. (2021), researched a sample of 50 listed European REITs and the connection between greenness indicators and companies operating performance indicators. The data was acquired from the time-period of 2012-2016. Multiple linear regression-based model was used for the study. Seven indicators were chosen based on the Green Real Estate Sustainability benchmark (GRESB) rating, and they were compared to two operating performance indicators, that were return on equity (ROE), and return on assets (ROA). The study found that the GRESB rating have positive impact on REITs return on equity and return on assets. However, the GRESB rating constituents separately doesn't have same impact on them.

Aroul et al. (2022) Studied all publicly traded REITs in the U.S. They compared ESG Scores based on the S&P Global database to their operational performance. OLS was used for the study. The result of the study shows a positive relationship between ESG scores and REIT operational efficiency, and that higher operational efficiency seems to lead to higher operational performance. Also, higher adoption of ESG initiatives increases the Funds from operations.

Coën et al. (2018), studied the performance of green and non-green REITs. To assess whether green reits perform better than non-green REITs. The research included 226 REITs,

of which 108 were classified as green and 118 non-green, in the period from January 2010 to February 2016. Fama-French 3-factor model was used for the calculation of excess returns and used performance measures such as Sharpe ratio and information ratio was used. They found that non-green REITs performance measures often exceed the ones of green REITs, however the financial performance difference between green REITs compared to non-green REITs is not statistically significant.

Coën and Desfleuers (2022) studied the relative performance of green U.S. REITs, in 2010-2018 period. Comparing analysts estimates to actual EPS and FFO results. They defined the “greenness” of companies from Compustat database. They found that analysts have higher expectations for green REITs, which leads to overreactions for negative and non-surprises.

3. Methodology and data

The purpose of the research is to study how ESG scores are related to the financial performance of U.S. REITs, focusing on equity REITs but the performance for mortgage REITs is studied in a more limited matter. Usage of European REITs was considered for this research, but the use of U.S based REITs was decided, because the U.S. has the largest number of REITs listed in their exchanges, and other markets such as Europe does not necessarily have comparable REIT legislation between different countries, although mostly similar. For instance, there are differences in the profit distribution requirements and in the way the corporate entities must be formed. Also, as Kaiser (2020) suggested there might be more value for ESG investing in the U.S. markets, while in Europe ESG is more included in asset prices.

As individual REITs often only specializes on specific type of properties (Baker, et al., 2019), it was decided to include all different equity REIT types, such as diversified REITs, specialized REITs, commercial REITs, and Residential REITs to capture the highest amount of diversification possible for each of the portfolios. Both REIT types are also studied separately. The period of interest for this study is from 2014 until 2023.

The study focuses on getting information about ESG ratings effect on REIT expected returns on two ways: Firstly, similarly than done in many sustainable investing studies, we use a screening strategy to form portfolios according to the best-in-class and worst-in-class methodology similarly to Kempf and Osthoff (2007); Heijningen (2019); Halbritter and Dorfleitner (2015). In these studies, the cut-off point was mostly the top and bottom decile, but in this study, we use a cut-off point of 30%, which seems reasonable to gauge the difference in financial performance between top and bottom rated portfolios on ESG score, similarly to the approach done in Societe Generale (2019). This is done so that 1) the performance of both equity and mortgage REIT portfolios are comparable. 2) limited data in the early periods 3) and the low level of REITs available in the in the overall REIT universe.

The second way of gauging the effect of ESG ratings is to form REIT portfolios according to change in their previous change in ESG scores. This is also often called the ESG momentum strategy Nagy et al. (2013); Bergskaug (2019); Boffo and Patalano, (2020). With this strategy we try to get information about the short-time effect of ESG ratings on REIT expected returns. This strategy is implemented to gauge the difference in financial performance between REIT portfolios with improving ratings and decreasing ratings and compared to the overall REIT universe. This study uses somewhat similar methodology for ESG momentum portfolios as Nagy et al. (2013), and Heijningen (2020) used, without a cut-off point. The momentum is measured similarly as Societe Generale (2019), with a 10% threshold for change in ESG scores, but the ESG momentum difference is calculated from the whole sample rather than within the top 30% and bottom 30% of ESG scores. This is done to not limit the diversification potential as Verhaegen et al. (2016) suggested, but to also keep the approach economically significant.

Performance is tested for the whole period from 2014 to 2022, but also separately for the sub-periods of 2014-2018 and 2019-2022. This is done to compare if there is any difference in results during these different types of periods of financial performance in the broader stock market and economy. In total 4 categories of portfolios are built for both equity and mortgage REITs for the three sub-periods. The ESG score for each year represents the ESG performance of that year.

ESG score at the end of a year t , represents the environmental, governance and social performance of the company for that fiscal year. For example, ESG score for a REIT for year 2014 is the ESG performance of that fiscal year. Thus, the selection of a stock to the portfolio in the year t for the “momentum” based portfolio is chosen based on the change of the ESG score from year $t-2$ to $t-1$. For example, if the change of REITs ESG score over fiscal year 2012 to fiscal year 2013 is positive it will be included in the portfolio for year 2014.

The best and worst-in-class portfolios the portfolios are created such that 30% highest (lowest) scoring REITs for the year t-1 is added for the year t. meaning that if a REITs ESG score based on for example the fiscal year of 2013 is in the top 30% it will be included to the portfolio for the fiscal year 2014. The portfolios are rebalanced every year with equal weighting.

In total there are 4 portfolios for both equity and mortgage REITs, for each period.

- 1) The Top portfolio is a portfolio where if REITs for the previous year had an ESG score within the top 30% of the sample, it will be included in the portfolio for the following year. These are called the Equity Top and Mortgage Top portfolios.
- 2) The Bottom portfolio is a portfolio where if REITs for the previous year had an ESG score within the bottom 30% of the sample, it will be included in the portfolio for the following year. In the results section these are called the Equity Bottom and Mortgage Bottom portfolios.
- 3) The momentum portfolio is a portfolio where if REITs year-over-year increase in ESG score is over 10% it will be included in the portfolio for the following year. These are called the Equity Momentum and Mortgage Momentum portfolios.
- 4) The negative momentum is a portfolio where if REITs year-over-year decrease in ESG score is over 10% it will be included in the portfolio for the following year. These are called the Equity Negative momentum and Mortgage Negative momentum portfolios.

3.1. Data

The monthly stock price data is taken from Yahoo Finance for the period January 2013 to January 2023. Yahoo Finance data was used because Refinitiv price data doesn't include

dividends and Yahoo Finance have data that adjusts prices according to dividends and splits. This is important to gauge the total return of the REITs as they pay out most of their profits to their shareholders as dividends. We study the whole period and two sub-periods separately from January 2014 until December 2018, and From January 2019 until January 2023. The REIT benchmark index, which the ESG portfolios are compared to is the S&P United States All-REIT index, adjusted to dividends and splits. This represents a portfolio that mimics the overall REIT universe. This was also acquired from Yahoo Finance.

The dataset includes all REIT types available in Refinitiv database. It includes all types of REITs according to Refinitiv business classification, including diversified REITs, commercial, such as offices, retail and industrial REITs, residential REITs and specialized, such as healthcare, hospitality, and mortgage REITs. If any REIT didn't have an ESG score available for any year within the study period, it was excluded. In total 186 real estate investment trusts matched this criterion and were included in the dataset. The distribution of REITs within different areas can be seen in Table 1.

Table 1. REIT classification

Classification by Activity	Number of REITs
Diversified	6
Commercial	26
Office	16
Retail	26
Industrial	10
Residential	19
Specialized	9
Healthcare	15
Hospitality	17
Self-Storage	5
Timber	3
Mortgage	34
Equity REITs	152
Mortgage REITs	34
Total	186

3.2. Data analysis

ESG Data used for this study was acquired from Refinitiv Eikon. The dataset included all publicly traded companies that is registered in the U.S. as real estate investment trusts and that have ESG scores available. As momentum portfolios need 2 years' worth of data to be included in the portfolio, the period for momentum portfolios would have been one year shorter compared to the best-in-class / worst-in-class portfolios. Because of this only a 9-year period is used, to keep both strategies comparable. The number of REITs, as well as the mean, minimum and maximum of ESG scores in each year for equity and mortgage REITs can be seen in Tables 2 and 3.

Table 2. Descriptive stats ESG Scores for Equity REITs

Year	Mean	Median	Minimum	Maximum	Count
2012	38,19	36,46	1,81	80,48	44
2013	39,98	37,65	2,03	87,81	44
2014	41,44	42,17	1,60	82,14	45
2015	36,70	31,91	5,81	87,39	98
2016	37,95	32,97	9,46	81,24	126
2017	40,14	34,68	8,10	83,40	138
2018	42,78	40,59	6,24	86,32	145
2019	47,00	46,09	9,07	89,74	148
2020	49,39	50,19	9,66	89,73	151
2021	52,31	54,58	11,87	88,69	152

According to the mean scores in Table 2, there seems to be a clear positive trend in mean ESG scores for all REITs and in the number of REITs with available ESG data as they increase significantly from 44 for the year 2012 to 152 for the year 2021. Also, the mean scores for equity REITs increase from 38,19 in 2012 to 52,31 in 2021. Similarly, according to Table 3, the early period for Mortgage REITs only has 4 REITs with ESG scores, thus studying those periods is not optimal and only scores for the years 2017-2021 are used. In this time the mean scores increase from 25,27 to 31,49, while the maximum scores increased from 40,40 to 63,18. The scores on average are significantly higher overall in equity REITs compared to mortgage REITs.

Table 3. Descriptive stats for ESG scores of mortgage REITs

Year	Mean	Median	Minimum	Maximum	Count
2012	18,71	19,18	10,74	25,75	4
2013	22,20	22,01	11,60	33,19	4
2014	24,19	23,50	12,99	36,77	4
2015	22,81	21,73	12,60	36,69	9
2016	23,37	21,52	9,85	40,24	19
2017	25,27	26,14	9,39	40,40	28
2018	24,79	23,15	9,66	39,45	30
2019	27,00	25,81	8,87	52,64	32
2020	29,45	28,42	10,96	60,00	33
2021	31,49	31,19	11,26	63,18	34

The regression models used in this study are the Fama-French 3 and 5-factor models and Carhart 4-factor model. The monthly data for these factors are acquired from Kenneth-French database. The description of the data can be found in Table 4.

Table 4. Fama-French factors

	<i>Mkt-RF</i>	<i>SMB</i>	<i>HML</i>	<i>MOM</i>	<i>RMW</i>	<i>CMA</i>
Mean	0,008	-0,001	-0,001	0,003	0,004	0,001
Standard Error	0,004	0,003	0,004	0,004	0,002	0,002
Median	0,011	0,000	-0,005	0,006	0,004	-0,002
Standard Deviation	0,046	0,028	0,037	0,037	0,021	0,023
Minimum	-0,134	-0,083	-0,140	-0,124	-0,048	-0,069
Maximum	0,137	0,071	0,128	0,100	0,072	0,077
Count	108	108	108	108	108	108

Both best-in-class and worst-in-class portfolios have the same number of REITs, as they are created by including only the top 30% REITs and bottom 30% based on their ESG scores. However, as momentum portfolios are not restricted, positive momentum and negative momentum have different numbers of REITs, as they are chosen only if they match

the momentum criteria that was explained earlier in the chapter. The portfolio summaries can be seen in Table 5.

The average Equity Top Portfolio ESG rating is above 60 in the beginning and increases to close to 75 at the end of the period. Thus, according to Refinitiv (2022) they have a good level of ESG performance and transparency in reporting. The Equity Bottom portfolio ESG rating is between 20 and 30 for the period, thus representing a poor to adequate level of ESG performance and reporting. The Equity Momentum portfolio falls approximately in between the Equity Top and Bottom portfolios, which means that the portfolio includes REITs from between the top and bottom range of the ESG levels of real estate investment trusts. The Equity Negative Momentum portfolio ESG scores are in similar range but slightly better compared to the Bottom portfolio, therefore it seems that REITs with decreasing momentum in scores are mostly REITs with low ESG scores. The number of REITs in the Equity Top and Bottom portfolios increases almost 4-fold from 12 in 2014 to 44 in 2022. The Equity Momentum portfolio also has a 4-fold increase from 14 in 2014 to 56 in 2022, while the Equity Negative Momentum portfolio has large discrepancy in the number of REITs between different years. This happens since the average ESG Scores overall are increasing in the 2014-2022 period, and thus there are less REITs with decreasing ESG ratings.

The Mortgage REIT portfolios seem to have on average smaller ESG scores compared to the equity REIT portfolios, with the Mortgage Top portfolio having scores between 34 and 47, Mortgage Bottom portfolio having scores between 16 and 18, Mortgage momentum having scores between 29 and 33, and Mortgage Negative Momentum having scores between 22 and 27. The same phenomenon where the amount of mortgage REITs with ESG scores with decreasing ratings is lower holds true, for the same reasons as in with the equity REITs.

Table 5. Average ESG scores and number of REITs in portfolios

Equity Top			Equity Bottom		
Year	ESG Score	REITs	Year	ESG Score	REITs
2014	62,93	12	2014	19,46	12
2015	64,38	13	2015	20,34	13
2016	60,23	29	2016	18,74	29
2017	61,79	37	2017	20,22	37
2018	65,39	40	2018	20,33	40
2019	68,56	42	2019	19,88	42
2020	70,82	42	2020	23,37	42
2021	72,84	44	2021	25,37	44
2022	74,86	44	2022	27,82	44

Equity Momentum			Equity Negative Momentum		
Year	ESG score	REITs	Year	Average	REITs
2014	36,97	14	2014	26,65	8
2015	43,45	12	2015	25,69	6
2016	44,19	26	2016	34,00	3
2017	42,20	46	2017	28,90	7
2018	41,84	54	2018	27,81	11
2019	47,26	44	2019	27,29	17
2020	45,61	65	2020	31,64	16
2021	49,52	50	2021	32,97	21
2022	48,25	56	2022	31,82	11

Mortgage Top			Mortgage Bottom		
Year	ESG Score	REITs	Year	ESG Score	REITs
2019	34,15	9	2019	16,06	9
2020	39,82	9	2020	16,12	9
2021	44,88	9	2021	17,79	9
2022	47,12	10	2022	17,90	10

Mortgage Momentum			Mortgage Negative Momentum		
Year	ESG Score	REITs	Year	ESG Score	REITs
2019	29,57	5	2019	22,33	8
2020	34,88	12	2020	25,01	5
2021	32,85	16	2021	26,99	9
2022	33,24	12	2022	23,35	4

3.3. Performance measures

The performance of the strategies compared to the REIT benchmark portfolio is studied with annualized returns, the Sharpe ratio and information ratio. For the Sharpe ratio calculation, the average yield of 10 year-government bond within the period is used. The Sharpe ratio is a measure to calculate the risk-adjusted overperformance of a portfolio compared to its benchmark.

It can be written as:

$$\text{Sharpe ratio} = \frac{R_p - R_f}{\sigma_p}$$

where:

R_p = Portfolio returns

R_f = Risk-free rate

σ_p = Standard deviation of portfolio excess return

The information ratio is like the Sharpe ratio, but rather comparing the performance against a risk-free rate, the information ratio compares it to a benchmark.

It can be written as:

$$\text{Information ratio} = \frac{R_p - R_b}{\sigma_{R_p - R_b}}$$

Where:

R_p = Portfolio returns

R_b = Benchmark returns

$\sigma_{R_p - R_b}$ = Standard deviation of excess return (tracking error)

3.4. Research questions

H_0 = Best-in-class inclusion improves performance of portfolios and outperforms the benchmark.

Removing companies with low ESG integration or including only companies with high ESG integration has shown to have significant abnormal returns and lower volatility. Also, high ESG integration has shown to correlate with higher operational efficiency and for return on equity and return on assets for REITs.

H_1 = Positive momentum strategy improves performance of portfolios and outperforms the benchmark.

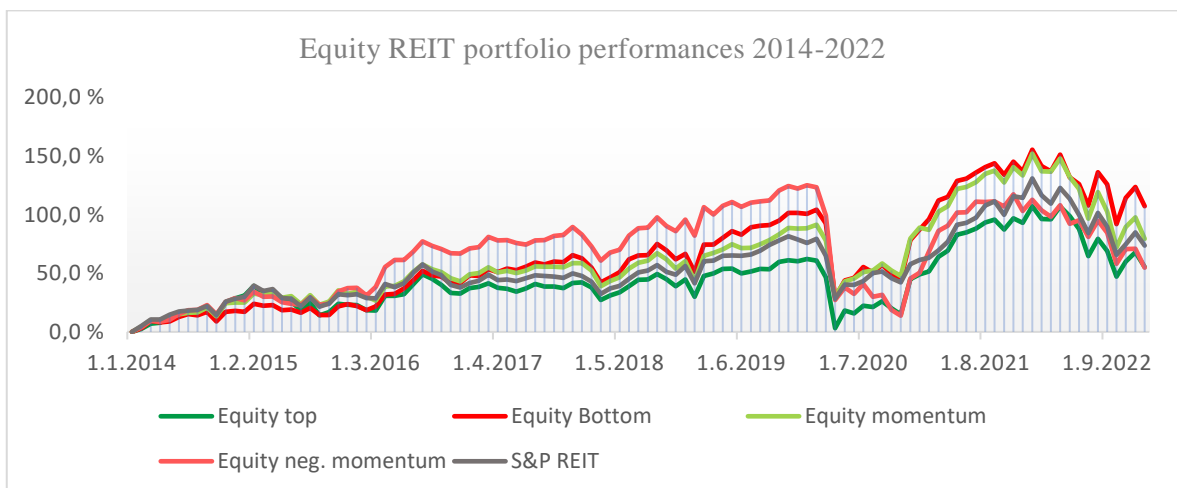
Even though this is not conclusive evidence, some of the previous studies such as Verhaegen et al. (2016), Nagy et al. (2013) have found that inclusion of ESG momentum criteria in portfolio selection could decrease volatility and could also have improvement in portfolio performance.

H_2 = Best-in-class and positive momentum strategy lead to significant abnormal returns for REITs over the market

4. Results

The following graph (Figure 2.), shows the cumulative returns of equity REIT portfolios. The top portfolio seems to underperform for the whole period, while the bottom portfolio outperforms the benchmark for the whole period consistently. The positive momentum strategy also seems to outperform the benchmark slightly for the early period and for most of the late period from 2019-2022. The negative momentum strategy shows overperformance for the early period from 2014 to 2018, but all the gains are lost by the end of the whole period.

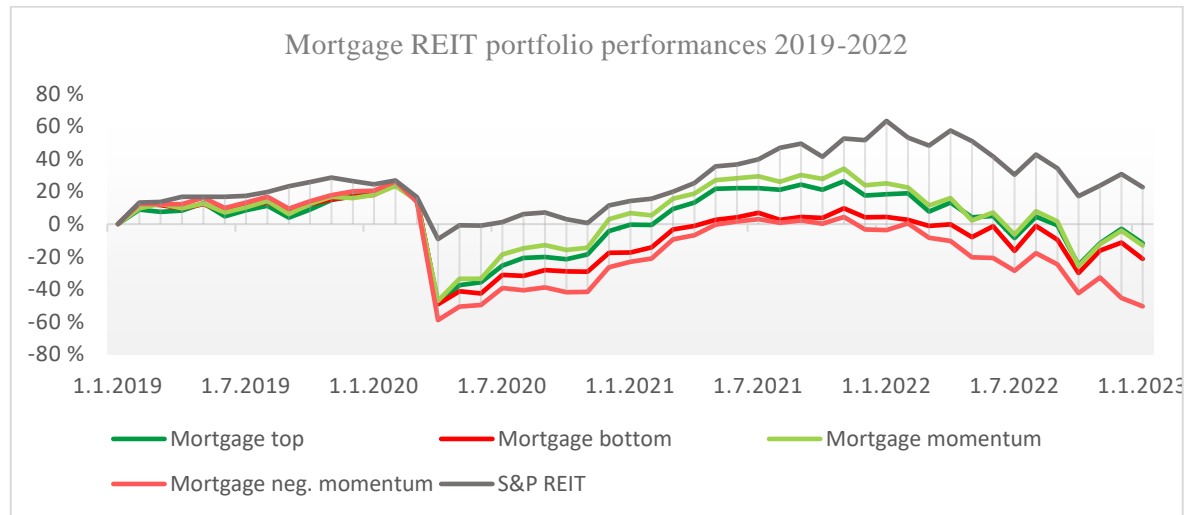
Figure 2. Equity REIT cumulative returns



All the mortgage REIT portfolios (Figure 3.) underperformed for the whole period from 2019-2022, with the negative momentum strategy having the lowest cumulative returns followed by the bottom portfolio. The momentum and top portfolios seem to have slightly better performance compared to the two other strategies tested and have similar performance with each other. The mortgage REITs had a huge drop during the early covid-19 market shock, with above 60% decrease in returns. They, however, had a strong recovery to almost same levels as pre-covid, but all ended with negative cumulative returns as the interest rates started to increase sharply in 2022. Based on the absolute returns, higher ESG

scoring mortgage REITs and positive momentum mortgage REITs seems to outperform compared to low and negative momentum.

Figure 3. Mortgage REIT cumulative returns



The performance metrics show interesting insights (Table 6). The top equity portfolio underperforms the benchmark by 1.3% in annualized returns and bottom portfolio outperforms the benchmark by over 2%, however the momentum portfolios shows that positive momentum outperforms slightly, while negative momentum underperforms.

The Equity Top portfolio underperforms compared to the benchmark within all periods. This can be seen from both the annualized returns and information ratio. The Equity Bottom overperformed the index, as well as the top portfolio, by a significant margin in all periods. Thus, it seems like preferring the best rated REITs doesn't seem to improve performance over the benchmark and, low rated REITs are preferred over them. However, the Sharpe ratio in all periods is low in all periods indicating that compared to the portfolio risk, the performance has not been very good. This holds true for all portfolios.

The positive momentum portfolio outperforms the benchmark slightly in all periods except the 2019-2022, with similar Sharpe ratios and positive information ratios. The negative

momentum portfolio underperformed for the overall period, but overperformed during the 2014-2018 period, while underperforming with negative returns in 2019-2022 period. Thus, there seems to be differences in how this strategy performs in different environments. When the overall economic environment is good for REITs, the strategy seems to outperform, but in bad environments it underperforms. Also, implementing positive momentum strategy seems to increase the risk-adjusted performance compared to the benchmark.

For the mortgage REITs both the top-rated portfolio and momentum portfolio performed better than low rated and negative momentum portfolios. All the portfolios had a negative annualized return and negative Sharpe and information ratios, indicating that selling these portfolios short would have been profitable. However, only having the 2019-2022 period decreases the reliability of this finding. As they are operating as lenders, there have been two shocks affecting them during this period, firstly the covid-19 related market turbulence and the increased interest rates, which decreases their assets value, and increases their risk more heavily than equity REITs.

Overall, it seems like including ESG for REIT portfolio creation doesn't improve performance. The positive momentum strategy seems to slightly improve the risk-adjusted performance compared to the benchmark, with an increase of 0.4% in annualized returns over the 9-year period. However, unlike expected, the best rated equity REIT portfolio underperforms. Also, the REIT bottom portfolio is the best performing portfolio overall, and consistently beats all other portfolios, in different periods. Thus, overweighting REITs with low ratings would offer above benchmark returns. The negative momentum also has outperformance in the 2014-2018 period but underperforms for the whole period and for the 2019-2022 period.

Table 6. Performance measures for portfolios.

2014-2018	Annualized return	Sharpe ratio	Information ratio
Equity Top	0,054	0,206	-0,518
Equity Bottom	0,086	0,478	0,254
Equity momentum	0,075	0,371	0,095
Equity negative momentum	0,127	0,740	0,840
S&P REIT Benchmark	0,072	0,341	0,000
2019-2022	Annualized return	Sharpe ratio	Information ratio
Equity Top	0,045	0,096	-0,062
Equity Bottom	0,082	0,221	0,240
Equity momentum	0,057	0,145	0,047
Equity negative momentum	-0,040	-0,188	-0,536
Mortgage Top	-0,030	-0,121	-0,330
Mortgage Bottom	-0,058	-0,187	-0,415
Mortgage Momentum	-0,034	-0,124	-0,318
Mortgage negative momentum	-0,161	-0,390	-0,658
S&P REIT Benchmark	0,053	0,156	0,000
2014-2022	Annualized return	Sharpe ratio	Information ratio
Equity Top	0,050	0,134	-0,163
Equity Bottom	0,084	0,295	0,230
Equity momentum	0,067	0,225	0,058
Equity negative momentum	0,050	0,124	-0,108
S&P REIT Benchmark	0,063	0,234	0,000

4.1. Regression models

The performance of these strategies is also studied regarding the broader market, with regression models. These are the regression models introduced earlier, which are CAPM, Fama-French 3 and 5 models and Carhart's 4 factor model. The factors for these models is acquired from the Kenneth French database.

$$(1) \quad R_{it} - R_{ft} = \alpha_i + \beta_{im} (R_m - R_{ft}) + \varepsilon_{it}$$

$$(2) \quad R_{it} - R_{ft} = \alpha_i + \beta_{im} (R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \varepsilon_{it}$$

$$(3) \quad R_{it} - R_{ft} = \alpha_i + \beta_{im} (R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{im}MOM_t + \varepsilon_{it}$$

$$(4) \quad R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_m - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{ir}RMW_t + \beta_{ic}CMA_t + \varepsilon_{it}$$

The CAPM results (Table 7), show that there are no significant alphas, and the market factor can explain the results in all periods for all portfolios.

Table 7. CAPM regression results

CAPM results				
2014-2022	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>
<i>Alpha</i>	-0,003	-0,001	-0,002	-0,003
	(0,004)	(0,004)	(0,004)	(0,005)
<i>MKT-RF</i>	1,056***	1,070***	1,017***	1,010***
	(0,086)	(0,081)	(0,078)	(0,103)
<i>R-Squared</i>	0,590	0,619	0,618	0,477
<i>Observations</i>	108	108	108	108
2014-2018	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>
<i>Alpha</i>	0,001	0,003	0,002	0,006
	(0,005)	(0,004)	(0,005)	(0,005)
<i>MKT-RF</i>	0,696***	0,680***	0,675***	0,628***
	(0,145)	(0,124)	(0,136)	(0,141)
<i>R-Squared</i>	0,284	0,341	0,349	0,256
<i>Observations</i>	60	60	60	60
2019-2022	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>
<i>Alpha</i>	-0,006	-0,004	-0,006	-0,012
	(0,006)	(0,006)	(0,005)	(0,009)
<i>MKT-RF</i>	1,200***	1,226***	1,155***	1,171***
	(0,107)	(0,109)	(0,093)	(0,147)
<i>R-Squared</i>	0,732	0,734	0,770	0,581
<i>Observations</i>	48	48	48	48
2019-2022	<i>Mortgage Top</i>	<i>Mortgage Bottom</i>	<i>Mortgage Momentum</i>	<i>Mortgage neg. Momentum</i>
<i>Alpha</i>	-0,012	-0,014	-0,013	-0,021
	(0,010)	(0,011)	(0,011)	(0,013)
<i>MKT-RF</i>	1,621***	1,566***	1,711***	1,677***
	(0,174)	(0,191)	(0,179)	(0,228)
<i>R-Squared</i>	0,653	0,594	0,665	0,541
<i>Observations</i>	48	48	48	48

Results tested with monthly data. Alpha is the intercept, MKT-RF is the beta. R-squared is the model performance measure and observations are the number of months in the period. Factor significances tested with student t-test, where ***, **, * are significance levels 1%, 5%, 10% respectively. Standard errors are in parentheses. ESG Top, ESG Bottom, ESG Momentum, ESG neg. momentum are the equity REIT portfolios, Mortgage top, Mortgage Bottom, Mortgage Momentum and Mortgage neg. Momentum are the mortgage REIT portfolios. The results at the top represent the results for the overall period from 2014 to 2022, 2014 to 2018 is in the middle and 2019 to 2022 in the bottom of the table.

The Fama-French 3-factor model (Table 8.) shows that most of the time the market factor, SMB and HML factors can explain most of the excess returns for all portfolios. The alphas, which represents the abnormal return, are positive during the early period from 2014 to 2018, and for the overall period. However, none of the alphas for any of the portfolios are statistically significant portfolios, except the negative momentum portfolio for the 2019-2022 period.

The market factor shows that even though the overall beta is close to 1 for the whole period, the betas are much lower in the 2014-2018 period, around 0.5-0.6. This means that during this period the portfolios showed low market exposure. For this period the alphas were also positive, thus outperforming the market. However, for the 2019-2022 market betas were on average above 1.1, thus having been aggressive compared to the market. Therefore, it seems like the REITs overall seem to perform with lower risk than the market in stable periods, and with more risk during more volatile periods.

The Equity Bottom portfolio, which outperformed other portfolios, shows significant betas with high confidence level for the SMB factor, thus the portfolio performs similarly to small cap companies and thus captures small cap premia. The HML factor is significant for all periods within 1-10% confidence levels, but there is difference between periods. For the overall period and 2019-2022 period it performs similarly to value stocks with positive loadings but for 2014-2018 like growth stocks, with negative loadings.

Both the Equity Bottom portfolio and Equity Negative Momentum portfolios seem to have similar explanatory factors, as both the SMB and HML factors have significant loadings for all the periods.

The R-squared values represent the goodness of fit of the model. For the 3-factor model they range from 0,551 to 0,661 for the whole period and from 0,315 to 0,441 and 0,718 to 0,796 in the 2014-2018 and 2019-2022 periods respectively. As the portfolios hold only REITs, the explanatory power of the model is adequate.

The added momentum factor doesn't seem to improve the model performance at all, with no significant loadings for the momentum factor (Appendix 1). Also, the Fama-French 5-factor model (Appendix 2) doesn't seem to improve the overall model performance much, with often under 2% increase in R-squared. Also, none of the additional factors are statistically significant except the CMA factor for the Equity Top portfolio in the 2014-2018 period. Also, the HML factor is not significant anymore for any of the portfolios for the overall period.

All mortgage REIT portfolios have much larger MKT-RF factor betas compared to the equity REIT portfolios, with the values being in the 1,4-1,6 range, compared to the Equity REIT portfolios which had MKT-RF betas withing 1,0-1,15 range. Thus, these portfolios were more volatile compared to the market and to the equity REIT portfolios. Also, in addition to the market factor, HML value factor loadings are all significant with 1% significance level. The abnormal returns are all negative for the portfolios, although not statistically significant, except the Mortgage negative momentum portfolio with a statistically significant alpha of -0,020 with a 10% significance level.

Table 8. Fama-French 3-factor regression results.

2014-2022	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>	<i>Mortgage Top</i>	<i>Mortgage Bottom</i>	<i>Mortgage Momentum</i>	<i>Mortgage neg. Momentum</i>
Alpha	-0,003	0,000	-0,002	-0,001				
	(0,004)	(0,004)	(0,004)	(0,004)				
MKT-RF	1,017***	1,000***	0,995***	0,923***				
	(0,087)	(0,081)	(0,081)	(0,100)				
SMB	0,209	0,413***	0,121	0,489***				
	(0,150)	(0,140)	(0,139)	(0,173)				
HML	0,238**	0,187*	0,118	0,354***				
	(0,104)	(0,096)	(0,096)	(0,119)				
R-Squared	0,616	0,661	0,626	0,551				
Observations	108	108	108	108				
2014-2018	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>	<i>Mortgage Top</i>	<i>Mortgage Bottom</i>	<i>Mortgage Momentum</i>	<i>Mortgage neg. Momentum</i>
Alpha	0,001	0,003	0,002	0,007				
	(0,005)	(0,004)	(0,005)	(0,005)				
MKT-RF	0,640***	0,580***	0,627***	0,545***				
	(0,150)	(0,121)	(0,140)	(0,142)				
SMB	0,218	0,422***	0,158	0,339*				
	(0,190)	(0,153)	(0,177)	(0,180)				
HML	-0,240	-0,289*	-0,327*	-0,267				
	(0,198)	(0,159)	(0,184)	(0,188)				
R-Squared	0,315	0,441	0,341	0,318				
Observations	60	60	60	60				
2019-2022	<i>Equity Top</i>	<i>Equity Bottom</i>	<i>Equity Momentum</i>	<i>Equity neg. Momentum</i>	<i>Mortgage Top</i>	<i>Mortgage Bottom</i>	<i>Mortgage Momentum</i>	<i>Mortgage neg. Momentum</i>
Alpha	-0,006	-0,003	-0,005	-0,012	-0,012	-0,013	-0,013	-0,020*
	(0,006)	(0,006)	(0,005)	(0,007)	(0,009)	(0,009)	(0,009)	(0,011)
MKT-RF	1,138***	1,138***	1,118***	1,031***	1,529***	1,428***	1,601***	1,469***
	(0,102)	(0,104)	(0,094)	(0,129)	(0,157)	(0,165)	(0,164)	(0,200)
SMB	0,300	0,511**	0,178	0,795***	0,366	0,654*	0,512	1,140**
	(0,218)	(0,220)	(0,200)	(0,275)	(0,333)	(0,352)	(0,348)	(0,424)
HML	0,369***	0,315**	0,239**	0,549***	0,758***	0,862***	0,725***	0,901***
	(0,118)	(0,119)	(0,108)	(0,148)	(0,180)	(0,190)	(0,188)	(0,229)
R-Squared	0,787	0,791	0,796	0,718	0,757	0,736	0,757	0,757
Observations	48	48	48	48	48	48	48	48

Results tested with monthly data. Alpha is the intercept, MKT-RF, SMB and HML are the betas. R-squared is the model performance measure and observations are the number of months in the period. Factor significances tested with student t-test, where ***, **, * are significance levels 1%, 5%, 10% respectively. Standard errors are in parentheses. ESG Top, ESG Bottom, ESG Momentum, ESG neg. momentum are the equity REIT portfolios, Mortgage top, Mortgage Bottom, Mortgage Momentum and Mortgage neg. Momentum are the mortgage REIT portfolios. The results at the top represent the results for the overall period from 2014 to 2022, 2014 to 2018 is in the middle and 2019 to 2022 in the bottom of the table.

5. Conclusions

The top ESG rated equity REIT portfolio seems to underperform regardless of the period, while the bottom rated equity REIT portfolio outperforms the benchmark as well as other strategies in both the overall period and both separate periods. Thus, it seems like investing in REITs with low ratings would be profitable and perform better than the average real estate investment trust and high rated REITs, this is in line with Coën et al. (2018). Also, no statistically significant outperformance during good or bad financial times was found. Even though these portfolios show positive abnormal returns in the 2014-2018 period, and negative abnormal returns for the overall period compared to the market, none of the alphas are significant even with 10% significance level. And they can be explained mostly by the Fama-French 3-factor model market, value, and size factors with statistically significant loadings in different periods. This answers to the first research question:

1. Does best-in-class inclusion improve performance of REIT portfolios and outperform the benchmark?

Hence, the first null hypotheses H_0 : Best-in-class inclusion improves performance of portfolios and outperform the benchmark is **rejected** as equity REIT portfolio with the lowest ratings (Equity Bottom) outperformed the portfolio with the highest ratings (Equity Top) with over 3% for the overall period and the all-REIT benchmark portfolio with over 2% annually. The performance measures also support this finding.

The positive momentum strategy outperforms the negative momentum strategy for the overall period for equity REITs. It also slightly outperforms the benchmark, but adjusted to risk the performance is very similar to the all-REIT benchmark. Similarly, to the top and bottom strategies, this strategy doesn't offer statistically alpha compared to the market. The multi-factor model factors don't have much explanatory power for the positive momentum strategy for the overall period. This answers the second research question:

2. Does inclusion of ESG momentum improve performance of REIT portfolios and outperform the benchmark?

Hence, the second null hypotheses: H_1 : Positive momentum strategy improves performance of portfolios and outperform the benchmark is **accepted**, as this strategy slightly outperforms the benchmark for the overall period and the sub-periods, in both absolute performance and based on the performance measures.

None of the portfolios except the negative mortgage momentum portfolio for the 2019 to 2022 period have statistically significant alphas. Also, the market factor MKT-RF and SMB factor have statistically significant loadings for most of the portfolios, while the HML factor also has statistically significant loadings for some of the portfolios. Thus, the Fama-French 3-factor model factors can explain most of the excess returns. The performance was also tested with the Carhart 4-factor and Fama-French 5-Factor models, but these models didn't have increased explanatory power compared to the 3-factor model. This answers to the third research question:

3. Do multi-factor models have explanatory power for excess returns of REIT portfolios?

Hence, the third null hypothesis: H_2 = Best-in-class and positive momentum strategy lead to significant abnormal returns for REITs over the market is **rejected**. As the Fama-French 3-factor model variables can explain most of the excess returns of REITs, and no significant alphas are found, except one mortgage REIT portfolio.

All the mortgage REITs underperform the benchmark. They also underperform compared to the market. The negative momentum strategy has significant negative alpha, with the Fama-French 3-factor and Carhart 4-factor models, being the only strategy with statistically significant abnormal return over the market. The overall mortgage REIT results can probably

be explained by the fact that in previous studies mortgage REITs have been seen to have more correlation with the bond market than the stock market. Also, the period from 2019 to 2022 has significantly higher interest rates compared to the period before that. As real estate investment trusts have high debt levels, and as mortgage REITs provide lending, the mortgage assets values deplete especially with fixed interest rates.

Based on these results, incorporating ESG to REIT investing might be profitable if equity REITs with low level of ESG integration are included. This finding is not in line with previous studies for the broader stock universe, such as Kempf & Osthoff (2007), where even the simple strategy of buying companies with high ratings and selling low rated companies were profitable. In fact, the opposite seems to be true for real estate investment trusts. The positive momentum strategy seems to have some improvement in performance compared to the REIT benchmark portfolio, as similar returns can be achieved with slightly less risk. Therefore, investing in REITs by improving ESG integration can be done without sacrificing returns.

The overall results suggest that sustainable investing is not beneficial when investing in real estate investment trusts. If investors seek for investments in the real estate investment trust sector and want to include the REITs with highest responsibility according to their ESG performance, they will not have similar returns than the broader REIT market or the REITs with low level of ESG performance. The reason for this could be that high ESG rated REITs are already included in investors' portfolios that want to invest in REITs with a higher level of sustainability and thus the premia is already included in prices. On the flipside, real estate investment trusts with low ratings are most likely not included in such portfolios nor in larger mutual funds, institutional investors portfolios or ETFs, that often have certain sustainability criteria or excludes low ESG rated companies and sin stocks. Thus, there seems to be more value in equity REITs with low ESG integration.

Because of this, shareholders, and other stakeholders of real estate investment trusts with low level of sustainability in terms of ESG should advocate for increasing the sustainability

in all fronts, the environmental factors, social factors, governance factors. This is especially true since real estate is one of the most polluting industries when considering the whole value chain from construction to operations. Inclusion of sustainability is not only beneficial for the environment, social factors, and governance but to the stakeholders and could also increase the shareholder value as the stock prices could come closer to the real estate investment trusts with high sustainability as more sustainable investors would be interested in investing in them and thus close the underpricing associated with them.

This study used Refinitiv ESG scores to measure the level of environmental, social and governance of real estate investment trusts. As multiple data providers have this type of data available, doing this research with different data providers ESG data might come to different conclusions. Therefore, comparing results with other providers' data would be interesting. For future research studying of individual constituents of ESG ratings would also be interesting. For example, how environmental scores, social scores, or governance scores individually would affect portfolio performance. Also, studying different REIT markets such as the U.K or Europe in general could provide interesting insights. Inclusion of other companies in the real estate sector in addition to real estate investment trusts could also offer new perspectives.

References

- Aroul, R. R., Sabherwal, S. & Villupuram, S. 2022. ESG, operational efficiency and operational performance: evidence from Real Estate Investment Trusts. *Managerial finance*. [Online] 48 (8), 1206–1220.
- Baker, H. K., Filbeck, G. & Kiyamaz, H. 2019 *The Savvy Investor's Guide to Pooled Investments: Mutual Funds, ETFs, and More*. Bingley: Emerald Publishing Limited.
- Bergskaug, E. 2019 *Performance of the ESG Strategy*. <https://urn.fi/URN:NBN:fi-fe2019121748628>
- Boffo, R. & Patalano, R. 2020. *ESG Investing: Practices, Progress and Challenges*, OECD Paris, Available: <https://www.oecd.org/finance/ESG-Investing-Practices-Progress-Challenges.pdf>
- Bruno, G., Esakia, M. & Goltz, F. 2021. 'Honey, I Shrunk the ESG Alpha': Risk-Adjusting ESG Portfolio Returns. *Scientific Beta*. <https://cdn.ihsmarket.com/www/pdf/0521/Honey-I-Shrunk-the-ESG-Alpha.pdf>
- Cajias, M., Fuerst, F., McAllister, P. & Nanda, A. 2014. Do responsible real estate companies outperform their peers? *International journal of strategic property management*. [Online] 18 (1), 11–27.
- Carhart, M. M. 1997. On Persistence in Mutual Fund Performance. *The Journal of finance* (New York). [Online] 52 (1), 57–82.
- Coën, A. & Desfleurs, A. 2022. The relative performance of green REITs: Evidence from financial analysts' forecasts and abnormal returns. *Finance research letters*. [Online] 45102163–.
- Coën, A., Lecomte, P. & Abdelmoula, D. 2018. The Financial Performance of Green Reits Revisited. *The journal of real estate portfolio management*. [Online] 24 (1), 95–105.
- Dorfleitner, G., Halbritter, G. & Nguyen, M. 2015. Measuring the level and risk of corporate responsibility – An empirical comparison of different ESG rating approaches. *Journal of asset management*. [Online] 16 (7), 450–466.
- Fama, E. F. & French, K. R. 1993. Common risk factors in the returns on stocks and bonds*

- Fama, E. F. & French, K. R. 2004. The Capital Asset Pricing Model: Theory and Evidence. *The Journal of economic perspectives*. [Online] 18 (3), 25–46.
- Fama, E. F. & French, K. R. 2015. A five-factor asset pricing model. *Journal of financial economics*. [Online] 116 (1), 1–22.
- Francis, J. C. & Kim, D. 2013. *Modern portfolio theory foundations, analysis, and new developments + website*. 1st edition. Hoboken, N.J: Wiley.
- French, K. 2022 Description of Fama/French Factors. Available:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html
- Friede, G., Busch, T. & Bassen, A. 2015. ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of sustainable finance & investment*. [Online] 5 (4), 210–233.
- Gutterman, A. S. 2021. *Sustainable finance and impact investing*. New York: Business Expert Press.
- Halbritter, G. & Dorfleitner, G. 2015. The wages of social responsibility — where are they? A critical review of ESG investing. *Review of financial economics*. [Online] 26 (1), 25–35.
- Heijningen, K. V. 2019. The impact of ESG factor materiality on stock performance of firms. Working Paper. Erasmus Platform for Sustainable Value Creation
- Jegadeesh, N. & Titman, S. 1993. Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *The Journal of finance (New York)*. [Online] 48 (1), 65–91.
- Jensen, M. C. (1968) The Performance Of Mutual Funds In The Period 1945-1964. *The Journal of finance (New York)*. [Online] 23 (2), 389–416.
- Kaiser, L. 2020. ESG integration: value, growth and momentum. *Journal of asset management*. [Online] 21 (1), 32–51.
- Kempf, A. & Osthoff, P. 2007. The Effect of Socially Responsible Investing on Portfolio Performance. *European financial management: the journal of the European Financial Management Association*. [Online] 13 (5), 908–922.

Krewson-Kelly, S. & Thomas, R. B. 2016. *The Intelligent REIT Investor: How to Build Wealth with Real Estate Investment Trusts*. 1st edition. Newark: John Wiley & Sons, Incorporated.

Lintner, J. 1965. The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The review of economics and statistics*. [Online] 47 (1), 13–37.

Markowitz, H. 1952. Portfolio Selection. *The Journal of finance* (New York). [Online] 7 (1), 77–91.

Morri, G., Anconetani, R. & Benfari, L. 2021. Greenness and financial performance of European REITs. *Journal of European real estate research*. [Online] 14 (1), 40–61.

Mossin, J. 1966. Equilibrium in a Capital Asset Market. *Econometrica*. [Online] 34 (4), 768–783.

Nagy, Z., Kassam, A. & Lee, L.-E. 2016. Can ESG Add Alpha? An Analysis of ESG Tilt and Momentum Strategies. *The Journal of investing*. [Online] 25 (2), 113–124.

Nagy, Z., Cogan, D. & Sinnreich, D. 2013. Optimizing Environmental, Social and Governance Factors in Portfolio Construction: Analysis of Three ESG-Tilted Strategies (February 20, 2013). Available: SSRN: <https://ssrn.com/abstract=2221524>

Novy-Marx, R. 2013. The other side of value: The gross profitability premium. *Journal of financial economics*. [Online] 108 (1), 1–28.

PRI brochure. 2021. Principles For Responsible Investment An Investor Initiative In Partnership With Unep Finance Initiative And The Un Global Compact [Web document] <https://www.unpri.org/download?ac=10948>

Refinitiv. 2022. Environmental, Social and Governance (ESG) Scores from Refinitiv, [Web document] accessed 21.10.2022. Available: https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

Refinitiv. 2020. The Refinitiv Business Classification Methodology [Web document] Available:

https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/trbc-business-classification-methodology.pdf

Sharpe, W. F. 1964. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of finance* (New York). [Online] 19 (3), 425–.

Siew, R. Y. J. 2015. Predicting the behaviour of Australian ESG REITs using Markov chain analysis. *Journal of financial management of property and construction*. [Online] 20 (3), 252–267.

Silvola, H. & Landau, T. 2021. *Sustainable Investing: Beating the Market with ESG*. Cham: Springer International Publishing AG

Societe Generale S.A. 2019. ESG rating and momentum. Available: https://corpgov.law.harvard.edu/wp-content/uploads/2019/03/esg-momentum_SGCIB.pdf

Titman, S., Wei, K. C. J., & Xie, F. 2004. Capital Investments and Stock Returns. *Journal of financial and quantitative analysis*. [Online] 39 (4), 677–700.

Treynor, J.L. 1961. Market Value, Time, and Risk. Available: SSRN: <https://ssrn.com/abstract=2600356>

Verheyden, T., Eccles, R. G., & Feiner, A. 2016. ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification. *Journal of Applied Corporate Finance*. [Online] 28 (2), 47–55.

Appendix 1. Carhart 4-factor regression results

2014-2022	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	-0,002 (0,004)	0,001 (0,004)	-0,001 (0,004)	-0,001 (0,005)				
MKT-RF	1,001*** (0,095)	0,987*** (0,088)	0,991*** (0,088)	0,890*** (0,109)				
SMB	0,199 (0,153)	0,405*** (0,142)	0,119 (0,142)	0,469*** (0,175)				
HML	0,217* (0,114)	0,171 (0,106)	0,113 (0,106)	0,310** (0,131)				
MOM	-0,055 (0,124)	-0,042 (0,116)	-0,013 (0,115)	-0,113 (0,143)				
R-Squared	0,617	0,661	0,626	0,553				
Observations	108	108	108	108				
2014-2018	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	0,001 (0,005)	0,003 (0,004)	0,001 (0,005)	0,007 (0,005)				
MKT-RF	0,663*** (0,156)	0,593*** (0,126)	0,656*** (0,145)	0,527*** (0,148)				
SMB	0,217 (0,192)	0,421 (0,154)	0,156 (0,178)	0,340 (0,182)				
HML	-0,161 (0,237)	-0,244 (0,191)	-0,229 (0,220)	-0,327 (0,225)				
MOM	0,111 (0,181)	0,063 (0,146)	0,139 (0,168)	-0,085 (0,172)				
R-Squared	0,320	0,443	0,349	0,318				
Observations	60	60	60	60				
2019-2022	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	-0,005 (0,006)	-0,002 (0,006)	-0,004 (0,005)	-0,011 (0,007)	-0,013 (0,009)	-0,015 (0,009)	-0,014 (0,009)	-0,020* (0,012)
MKT-RF	1,066*** (0,116)	1,090*** (0,119)	1,065*** (0,107)	0,982*** (0,148)	1,574*** (0,180)	1,510*** (0,189)	1,646*** (0,189)	1,465*** (0,230)
SMB	0,216 (0,226)	0,456** (0,231)	0,116 (0,209)	0,738** (0,289)	0,418 (0,351)	0,749** (0,368)	0,564 (0,367)	1,135** (0,448)
HML	0,307** (0,126)	0,274** (0,129)	0,194 (0,117)	0,507*** (0,161)	0,797*** (0,196)	0,933*** (0,206)	0,763*** (0,205)	0,898*** (0,251)
MOM	-0,220 (0,170)	-0,144 (0,174)	-0,160 (0,157)	-0,148 (0,217)	0,137 (0,264)	0,249 (0,277)	0,137 (0,276)	-0,013 (0,337)
R-Squared	0,795	0,794	0,801	0,721	0,758	0,740	0,758	0,695
Observations	48	48	48	48	48	48	48	48

Results tested with monthly data. Alpha is the intercept, MKT-RF, SMB, HML and MOM are the betas. R-squared is the model performance measure and observations are the number of months in the period. Factor significances tested with student t-test, where ***, **, * are significance levels 1%, 5%, 10% respectively. Standard errors are in parentheses. ESG Top, ESG Bottom, ESG Momentum, ESG neg. momentum are the equity REIT portfolios, Mortgage top, Mortgage Bottom, Mortgage Momentum and Mortgage neg. Momentum are the mortgage REIT portfolios. The results at the top represent the results for the overall period from 2014 to 2022, 2014 to 2018 is in the middle and 2019 to 2022 in the bottom of the table.

Appendix 2. Fama-French 5-factor regression results

2014-2022	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	-0,003 (0,004)	0,000 (0,004)	-0,002 (0,004)	-0,001 (0,005)				
MKT-RF	0,991*** (0,094)	0,949*** (0,088)	0,960*** (0,088)	0,905*** (0,110)				
SMB	0,387** (0,172)	0,540*** (0,161)	0,224 (0,162)	0,521** (0,201)				
HML	0,039 (0,148)	0,083 (0,138)	0,072 (0,139)	0,261 (0,172)				
RMW	0,303 (0,213)	0,247 (0,199)	0,188 (0,200)	-0,002 (0,249)				
CMA	0,231 (0,229)	-0,052 (0,214)	-0,036 (0,216)	-0,006 (0,268)				
R-Squared	0,630	0,670	0,631	0,556				
Observations	108	108	108	108				
2014-2018	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	0,001 (0,005)	0,003 (0,004)	0,002 (0,005)	0,007 (0,005)				
MKT-RF	0,698*** (0,152)	0,603*** (0,126)	0,662*** (0,146)	0,577*** (0,147)				
SMB	0,329 (0,212)	0,494*** (0,176)	0,171 (0,204)	0,433** (0,206)				
HML	-0,583** (0,258)	-0,484** (0,214)	-0,509** (0,248)	-0,499* (0,250)				
RMW	0,368 (0,347)	0,294 (0,287)	0,095 (0,334)	0,348 (0,336)				
CMA	0,716* (0,421)	0,310 (0,348)	0,393 (0,405)	0,412 (0,408)				
R-Squared	0,373	0,458	0,353	0,347				
Observations	60	60	60	60				
2019-2022	Equity Top	Equity Bottom	Equity Momentum	Equity neg. Momentum	Mortgage Top	Mortgage Bottom	Mortgage Momentum	Mortgage neg. Momentum
Alpha	-0,008 (0,006)	-0,003 (0,006)	-0,004 (0,006)	-0,010 (0,008)	-0,008 (0,009)	-0,009 (0,010)	-0,010 (0,010)	-0,011 (0,011)
MKT-RF	1,123*** (0,117)	1,103*** (0,119)	1,086*** (0,109)	1,059*** (0,148)	1,472*** (0,177)	1,364*** (0,187)	1,549*** (0,188)	1,390*** (0,217)
SMB	0,436 (0,265)	0,564** (0,268)	0,237 (0,245)	0,690** (0,333)	0,212 (0,399)	0,472 (0,422)	0,406 (0,423)	0,713 (0,489)
HML	0,202 (0,187)	0,230 (0,189)	0,215 (0,173)	0,421* (0,235)	0,979*** (0,281)	1,042*** (0,298)	0,839*** (0,298)	1,275*** (0,345)
RMW	0,111 (0,276)	0,040 (0,279)	0,056 (0,255)	-0,273 (0,347)	-0,123 (0,416)	-0,125 (0,440)	-0,076 (0,441)	-0,436 (0,510)
CMA	0,172 (0,278)	-0,079 (0,281)	-0,077 (0,257)	0,053 (0,350)	-0,623 (0,420)	-0,651 (0,444)	-0,467 (0,445)	-1,168 (0,514)
R-Squared	0,793	0,797	0,799	0,727	0,770	0,749	0,764	0,733
Observations	48	48	48	48	48	48	48	48

Results tested with monthly data. Alpha is the intercept, MKT-RF, SMB and HML, RMW, and CMA are the betas. R-squared is the model performance measure and observations are the number of months in the period. Factor significances tested with student t-test, where ***, **, * are significance levels 1%, 5%, 10% respectively. Standard errors are in parentheses. ESG Top, ESG Bottom, ESG Momentum, ESG neg. momentum are the equity REIT portfolios, Mortgage top, Mortgage Bottom, Mortgage Momentum and Mortgage neg. Momentum are the mortgage REIT portfolios. The results at the top represent the results for the overall period from 2014 to 2022, 2014 to 2018 is in the middle and 2019 to 2022 in the bottom of the table.

Appendix 3. Data source

Adjusted closing price	Yahoo Finance
REIT benchmark index	Yahoo Finance
ESG Scores	Refinitiv Eikon Database
Market returns & risk-free rate	Kenneth R. French Database
SMB	Kenneth R. French Database
HML	Kenneth R. French Database
MOM	Kenneth R. French Database
RMW	Kenneth R. French Database
CMA	Kenneth R. French Database