Lisbon School of Economics & Management
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MASTER

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MASTER´S FINAL WORK

DISSERTATION

APPLICABILITY OF U.S. REIT PRICING FACTORS TO THE WESTERN EUROPEAN REIT MARKET: DESCRIPTIVE PORTFOLIO EVIDENCE

LEONIK WADEHN

JUNE - 2025

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GLOSSARY

CAPM – Capital Asset Pricing Model

CMA – Conservative Minus Aggressive Investment

EPRA – European Public Real Estate Association

EW – Equally Weighted

FMP – Factor Mimicking Portfolio

GFC – Global Financial Crisis

HML – High Minus Low

IFRS – International Financial Reporting Standards

MD – Maximum Diversification

MVP – Minimum Variance Portfolio

REIT – Real Estate Investment Trust

RMW – Robust Minus Weak Profitability

RP – Risk Parity

SMB – Small Minus Big

TA – Tangency Allocation

WML – Winners Minus Losers

ABSTRACT, KEYWORDS AND JEL CODES

This thesis investigates whether U.S. REIT pricing factors, specifically size, value, momentum, profitability, and investment, exhibit explanatory power in the Western European Real Estate Investment Trust (REIT) market. Using a descriptive, return-based portfolio-sorting methodology across 218 REITs from seven Western European countries over the 2006–2024 period, the study constructs long-short factor mimicking portfolios without relying on regression-based models. The findings reveal that size and profitability factors deliver robust, statistically significant return premia, consistent with evidence from U.S. markets. In contrast, value and momentum show weak or no significance, while the investment factor exhibits a counterintuitive negative premium, with aggressively investing REITs outperforming conservative ones. The findings highlight that some factor effects generalise across markets, while others depend heavily on institutional and regional contexts.

KEYWORDS: Factor investing; REITs; Western Europe

JEL CODES: G11; G12; G15

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TABLE OF CONTENTS

Lisbon School of Economics & Management
Universidade de Lisboa

FIGURES AND TABLES

Lisbon School of Economics & Management
Universidade de Lisboa

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AI DISCLAIMER

This dissertation was developed with strict adherence to the academic integrity policies and guidelines set forth by ISEG, Universidade de Lisboa. The work presented herein is the result of my own research, analysis, and writing, unless otherwise cited. In the interest of transparency, I provide the following disclosure regarding the use of artificial intelligence (AI) tools in the creation of this thesis/internship report/project:

I disclose that AI tools were employed during the development of this thesis as follows:

- AI-based research tools were used to assist in the literature review and data analysis.
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Leonik Wadehn, 30.06.2025

MASTER'S IN FINANCE – DISSERTATION

By Leonik Wadehn

Using monthly data for 218 REITs in seven Western-European countries (2006-2024), this study tests whether the five U.S. REIT pricing factors size, value, momentum, profitability and investment, explain REIT returns. Descriptive long-short portfolio sorts show that size and profitability generate robust premia, mirroring U.S. evidence. Value and momentum are weak or non-existent and investment is reversed, with aggressive REITs outperforming conservative peers. The results suggest that some factor effects generalise across regions, while others depend on Europe's distinctive institutional and market structure.

1. INTRODUCTION

In recent years, investor interest in European Real Estate Investment Trusts (REITs) has increased. REITs, which are companies that own or finance real estate and trade on public exchanges, give investors a stock-like way to tap into property markets. By law, they pay out most of their earnings as dividends, turning physical real estate into liquid, dividend-generating investment vehicles. According to CBRE's 2025 Investor Intentions Survey, 92% of market participants plan to maintain or increase their buying activity for European properties in 2025 and nearly three-quarters expect investment activity to rebound by the end of the year (Vezyridis et al., 2025). At the same time financing conditions have continued to improve, as the European Central Bank cut its main deposit rate to 2.00%. This marks its eighth reduction since mid-2024, bringing borrowing costs to their lowest level in over two years (Koranyi & Canepa, 2025). This combination of rising demand and easier financing has translated into strong performance, market liquidity and investor confidence. In the last 360 days alone, the FTSE EPRA Nareit Developed Europe Index, a key benchmark for the sector, has climbed over 20%, while capital raising activity for European property companies exceeded €8.7 billion, underscoring the sector's rising importance (Mattson-Teig, 2025).

However, these dynamics raise the question of which factors truly drive European REIT returns. While factor-based models have become fundamental for understanding asset returns in general equity markets, their development and validation have been mostly concentrated in the United States. The applicability of these established U.S. pricing factors to the Western European REIT market remains largely unanswered. This leads to

the core research question of this thesis: Do the same pricing factors that explain U.S. REIT returns hold economic and statistical significance in the Western European REIT sector? A dedicated analysis of European REITs is important because the market differs fundamentally from its U.S. counterpart. It is fragmented, with significant variations in size, maturity, and regulation. This structural fragmentation creates distinct market dynamics and potential inefficiencies, suggesting U.S. pricing models require validation before being applied in Europe.

The literature on asset pricing has evolved significantly since the introduction of the Capital Asset Pricing Model (CAPM) by Sharpe (1964). Empirical studies quickly challenged it, leading to the development of multi-factor models that incorporate additional variables. Notably, Fama & French (1993) introduced size and value factors, Carhart (1997) added momentum and Fama & French (2015) again further expanded the framework to include profitability and investment. These models, though initially conceived for broad equities, have increasingly been applied to REITs in the U.S. Studies such as Chui et al. (2003b), Ooi et al. (2007) and Bond & Xue (2017) have confirmed the presence of factor premia in REIT returns. These findings suggest that REITs, despite their sector-specific nature and real asset backing, are subject to some of the same pricing anomalies observed in general equities. Accordingly, this study tests the applicability of those five key U.S. REIT pricing factors to the Western European REIT market.

The research question is addressed by constructing factor mimicking portfolios (FMPs) based on REIT data from seven Western European countries, namely Belgium, France, Germany, Italy, the Netherlands, Spain, and the United Kingdom. These countries were selected based on the maturity of their REIT regimes and the availability of market data. In contrast to studies using regression-based models, this work uses a portfolio-sorting methodology to derive factor premia directly from the data as done by Chan et al. (1998) and Andronoudis et al. (2024). In this approach, REITs are sorted into groups according to each factor's characteristic and a value-weighted long-short portfolio is formed to observe the return spread for each factor. This non-parametric design provides a straightforward indication of each factor's effect on returns. It avoids imposing strict model assumptions and is particularly well-suited to the limited sample size, as it can reduce estimation noise and enhances the interpretability of the results. The robustness is

then assessed through various alternative specifications and a Fama-MacBeth regression, which tests the factors' simultaneous pricing power.

While prior research on European factor performance is scarce and has focused either on single countries like Spain or on broad pan-European equities, this analysis contributes to the existing literature by being the first to test those five U.S. REIT pricing factors across multiple Western European countries. It uncovers unique factor patterns that challenge the universal applicability of U.S. models. Notably, it documents a reversed premium for the investment factor and a complete absence of the momentum premium, two findings that stand in contrast to established U.S. evidence and advance our understanding of regional market differences. Specifically, this research contributes to several groups: For academics, it provides an out-of-sample test on factor performance, questioning their international generalizability. The python codes are another contribution as they can be used for future research. For investors and portfolio managers, the findings offer actionable guidance for enhancing European real estate strategies, identifying which factors generate reliable premia and which do not. The analysis further demonstrates that combining these factors can create diversified portfolios capable of delivering superior risk-adjusted returns in a challenging market. For policymakers, the results show how national and regional regulations can influence market dynamics and investment returns, providing insight for evaluating the impact of such frameworks.

This thesis is structured as follows. Chapter 2 reviews the relevant literature on asset pricing factors in both general equity markets and REIT specific contexts, covering U.S. and European findings. It also compares the European REIT regimes to the one from the U.S. Chapter 3 outlines the data collection process, including the selection criteria for REITs, data sources, and processing methodology. It also describes how the FMPs are constructed and presents the exact sorting metrics used for each factor. Chapter 4 presents the empirical results, including statistical properties of each FMP. Chapter 5 offers a detailed discussion of these initial findings, interpreting them in the light of existing theory and the structural differences between U.S. and European REIT markets. Chapter 6 then conducts robustness checks to confirm the stability of the findings and Chapter 7 explores the practical implications by constructing and evaluating multi-factor portfolios. Finally, Chapter 8 concludes by summarizing the key results and proposing directions for future research.

2. LITERATURE REVIEW

2.1 Overview of Asset Pricing Models

Asset-pricing theory provides a framework for understanding which risks or characteristics are rewarded with higher returns. CAPM was the beginning and argued that the market portfolio's excess return explains expected returns. However, empirical tests soon revealed that a one-factor model could not fully capture the cross-section of stock returns. This limitation inspired further research into other potential explanatory variables such as the so-called "small-firm effect" found by Banz (1980) and the value premium discovered by Basu (1977). Notably, Fama & French (1993) combined those findings and showed that firm size and value characteristics have additional explanatory power beyond the market beta. They introduced the Fama & French three-factor model, which supported the market factor with SMB (Small Minus Big, representing size risk) and HML (High Minus Low, representing value, or more specifically book-to-market risk). In this model too, small-cap stocks and high book-to-market (value) stocks historically have earned higher average returns than large-cap and growth stocks, respectively.

Subsequent research identified other possible return predictors. One of the most prominent is momentum, the tendency for assets that have performed well in the recent past (winners) to continue outperforming in the future and vice versa (first documented by Jegadeesh & Titman (1993)). Carhart (1997) added a momentum factor (often denoted WML, Winners Minus Losers) to create a four-factor model, finding that momentum captures significant variation in returns unexplained by the Fama & French three-factor model. The momentum effect is often attributed to behavioural biases (investor under-reaction/over-reaction) rather than traditional risk, as for example shown by Hong & Stein (1999). This distinction is crucial, as it raises questions about whether momentum represents a compensable risk factor or an anomaly that could be arbitraged away, potentially varying in strength across different market structures or asset classes like REITs.

More recently, Fama & French (2015) extended their framework by proposing two additional factors related to a firm's profitability and investment behaviour. Their five-factor model adds RMW (Robust Minus Weak Profitability) and CMA (Conservative

Minus Aggressive Investment) factors to the existing market, SMB, and HML factors. The idea is that profitable firms and those that undertake less-aggressive investment tend to earn higher returns than unprofitable or heavy-investment firms, patterns that had already been documented in broad equity markets before (e.g. the profitability premium of Novy-Marx (2013) and the investment factor of Titman et al. (2004)). The rationale originates from valuation theory, more precisely from the dividend-discount model, as shown by Fama & French (2015). They show that by manipulating an equation from Miller & Modigliani (1961) it is possible to arrive at the following equation:

$$\frac{M_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}}}{B_t} \quad (1)$$

This equation can then be used to explain why the value, profitability and investment factors yield higher returns. First, if everything is fixed except the current value of the stock (M_t) and the expected stock return (r), then a lower value of M_t or equivalently a higher book-to-market ratio implies a higher expected return (value factor). Second, fixing everything except the expected future earnings ($Y_{t+\tau}$) and the expected stock return (r), the only way to maintain equality when expected future earnings increase is for the expected return to increase as well in order to discount those earnings more (profitability factor). Lastly, fixing the values of book equity (B_t), M_t and expected earnings, higher expected growth in book equity ($dB_{t+\tau}$) must lead to a lower expected return in order to keep the equation equal (investment factor). However, a potential limitation of directly applying this valuation theory to European REITs is the nature of their book value. Unlike REITs in the U.S., many European REITs use fair value accounting for their properties under IFRS. This practice could mean that the book value of equity already incorporates much of the information about future earnings and growth prospects, potentially weakening the strength of the value, profitability and investment factors.

While Fama & French (2015) found that this five-factor model provides improved explanatory power for U.S. stock returns relative to the old three-factor model, the underlying reason why those factors work is still debated. Some scholars suggest these premiums may reflect mispricing or behavioural effects instead of a reward for additional risk. For example, Ali & Ülkü (2019) argue that the profitability factor in effect combines elements of value and earnings momentum, capturing a neglected or delayed reaction to

good earnings news. Consistent with a mispricing view, they document a pronounced "Monday effect" in RMW factor returns (returns jump following weekends), implying that investors under-react during the week and then correct their mispricing after a pause. Such patterns are hard to reconcile with a pure risk story and instead point to investor behaviour influencing returns. Lakonishok et al. (1994) likewise provides evidence that the value factor is due to systematic mispricing caused by sub-optimal behaviour of the typical investor and not because these strategies are fundamentally riskier.

2.2 Factor Evidence in U.S. REITs

The U.S. has the longest history of listed REITs (dating back to 1960) and a large, liquid REIT market. Not surprisingly, most empirical research on REIT pricing factors is focused around the U.S. While initially many asset-pricing studies excluded REITs, treating them as a separate asset class due to their hybrid nature (stock-like liquidity but real estate-based income), this has changed in recent years. Overall, the literature finds that U.S. REIT returns indeed exhibit many of the same factor premiums observed in the broader stock market, though with some nuances.

Mcintosh et al. (1991) were the first to show evidence of the "small-firm effect" in U.S. REITs and Chui et al. (2003b) followed by examining the cross-section of expected REIT returns. They found a significant size effect in the earlier part of their sample, where from 1977 to 1990 smaller REITs earned higher returns than larger REITs. Post-1990, their results suggested that the size premium became less pronounced for REITs. This change in later years might reflect the maturation and institutionalization of the REIT market in the 1990s, which increased large-cap REIT participation. As this is a process European markets are currently undergoing at different speeds, the relative importance of factors may shift. Therefore, one cannot assume that the size factor identified in the 1990s U.S. market will be perfectly mirrored, as the European market could be in a different stage. However, other research covering different sample periods often find that size remains an important factor for U.S. REITs even today (e.g. Andronoudis et al. (2024) and Essa & Giouvris (2023)).

A value premium has also been documented in U.S. REITs, where value REITs have yielded higher average returns than growth REITs. Ooi et al. (2007) provide direct

evidence of this, being consistent with the broader equity value premium. Notably, they did not find evidence that REIT value outperformance was due to higher fundamental risk. Instead, they pointed to behavioural explanations (investors tendency to extrapolate past growth too far) as a driver. This aligns with extrapolation theory, wherein investors overly discount distressed, asset-rich firms (value REITs) and overpay for glamorous growth REITs, leading to subsequent return reversals in favour of the former. However, as with size, there have been different periods. Chui et al. (2003b) noted a significant value premium pre-1990 in REITs, but mixed evidence thereafter. The mixed evidence post-1990 for value REITs raises questions about the stability of this factor and whether the traditional book-to-market metric adequately captures the value premium for REITs, especially considering that property valuations (a key component of book value for REITs) can be subject to different accounting treatments (e.g. fair value vs. historical cost) which might affect the factors construction. Moreover, if behavioural biases are indeed the primary driver, the factor could change with market and investor differences, leading to a time- and region-varying premia.

Momentum is found to be quite strong in U.S. REITs. While momentum as an anomaly was first established in general equities, several studies confirm its presence in REITs. Chui et al. (2003b) reported that momentum (based on 12-month previous returns) significantly explained REIT returns, especially in the post-1990 period when it became the dominant factor in their regression. Later studies, including Hung & Glascock (2008) and Goebel et al. (2012), reinforced that a momentum strategy yielded abnormal returns in REITs that could not be explained by the standard three-factor model. The pronounced strength of momentum in U.S. REITs is particularly interesting given their real asset backing, which could lead to the expectation of smoother price trends. This finding could imply that REIT-specific information flows, investor or even the trading characteristics of REIT shares contribute significantly to these continuation patterns. However, one might question whether such momentum is purely behavioural, or if it instead reflects slow reactions to fundamental changes in property sub-markets or leasing environments that other factors do not immediately capture.

Because the Fama & French five-factor model is relatively recent (Fama & French, 2015), empirical evidence on the two factors profitability and investment in REITs is still growing. Initial studies adapting these two to REITs indicate that they are indeed relevant.

For example, Glascock & Lu-Andrews (2014) constructed a profitability factor for REITs (using metrics like gross profit or net operating income as a proxy for profitability) and found it had significant predictive power for REIT returns. Similarly, Bond & Xue (2017) applied an investment-based asset pricing perspective to REITs, creating REIT-specific versions of the CMA and RMW factors and showing that both were significant in explaining the cross-section of REIT returns. These findings mirror the original results by Fama & French (2015): more profitable REITs tend to outperform weaker ones, and REITs with conservative investment profiles (low asset growth, perhaps reflecting disciplined capital expenditure or lower acquisition rates) outperform aggressive expanders.

Andronoudis et al. (2024) also investigated the existence of a premium for all five factors over a long post-1993 sample for U.S REITs using FMPs. They found that all factors except for profitability are significant drivers. This result contrasts with Glascock & Lu-Andrews (2014) and Bond & Xue (2017), highlighting that the definition of profitability (for example gross profit vs. operating income) and the specific sample period or methodology can lead to different conclusions. For the investment factor, while the theory suggests conservative investment is rewarded, the nature of REIT business models which often involves active capital deployment and development raises the question of whether a simple "low asset growth" metric universally identifies outperforming REITs without considering the strategic rationale and quality of the investments.

2.3 Structural Differences in European REITs

While the U.S. REIT market is by far the largest and most mature, most European REIT regimes are relatively younger and have only been established in the last two decades (EPRA, 2024a). As of the end of 2024, the U.S. had 170 stock exchange-listed REITs with a combined equity market capitalization of about €1,206 billion, whereas for example Germany had only six listed REITs worth around €1.4 billion (EPRA, 2024b). Other European markets fall in between: Belgium, France, Spain and the UK each have a dozen or more REITs, while Italy and the Netherlands have even fewer REITs compared to Germany. This disparity in market size and maturity could have significant

implications for factor investing. Smaller, less liquid markets might exhibit stronger anomalies due to lower arbitrage activity but could also suffer from higher transaction costs that eliminate factor premia. Their relatively recent establishment also means shorter historical data series, making robust factor identification more challenging.

While all REIT regimes share common elements (notably tax-transparency in exchange for high dividend payouts), there are small differences across countries. As seen in "The Global REIT Survey" by the European Public Real Estate Association (EPRA, 2024b), the U.S. REIT rules require at least 90% of taxable income to be distributed as dividends and impose asset and income tests (primarily real estate related), but they do not impose a leverage limit or mandatory listing. In contrast, many European REIT regimes have subtle variations. For example, Germany's G-REIT law (introduced 2007) mandates 90% payout of annual net income but crucially forbids investment in residential property built before 2007 and requires REITs to be publicly listed. Germany also caps leverage as G-REITs may not exceed 66.25% debt-to-assets. These restrictions partly explain why Germany's REIT market remains small (Kowalke & Funk (2022)). On the other hand, France's REITs (SIICs, launched 2003) and the UK's REITs (launched 2007), require 75%–80% of assets in rental real estate and 90%–95% income payout, with no formal leverage cap (only Interest expense for UK REITs is limited by the Financing Cost Ratio). That makes them broadly similar to the U.S. and both countries saw rapid growth in their REIT sectors. Interestingly, Belgium's regime (initially Sicafi in 1995, reformed to BE-REIT in 2014) mandates high payout while imposing leverage restrictions and has been successful as well. Their REITs often trade at a premium to net asset value, indicating strong investor demand in a favourable tax environment (Mattson-Teig (2022)). Spain introduced its REIT framework (SOCIMI) in 2009 (reformed 2012) with a 0% corporate tax conditional on 80% rental income payout and stock exchange listing. While also having no restrictions on leverage, Spain's REIT sector has flourished too. Italy's SIIQ regime (2007) similarly offers tax exemption on rental income if 70% of earnings are distributed, though only a couple of companies (e.g. IGD) took up this structure. The Netherlands have one of the oldest regimes (Fiscale Beleggingsinstelling, 1969) and impose 0% corporate tax for 100% payout of net income. Historically, this created a stable but small group of listed property funds, making the Netherlands an important part of any Western European REIT study.

In summary, the selected countries have comparable tax-transparency REIT models, which justifies grouping them. All offer corporate tax exemption for distributed real estate income, aligning them with the U.S. model. However, these subtle variations in leverage limits, property type specializations and the specifics of payout requirements could interact with the formation and performance of factor portfolios. For instance, leverage constraints might dampen the risk and return profiles of REITs in certain countries, potentially affecting the size or value premia. Similarly, restrictions on asset types could limit diversification and influence profitability. A further critical difference is the use of the International Financial Reporting Standards (IFRS) in Europe, which, unlike U.S. GAAP, allows for the fair value accounting of investment properties. While this most directly impacts the construction of the value factor, it could also alter the metrics used for profitability (through fair value adjustments in the income statement) and investment (affecting total asset growth figures), raising questions about the direct comparability of these factors across regions.

Western European REIT markets also differ from the U.S. in investor culture and market penetration. U.S. investors, including large institutions, widely accept REITs. U.S. pension plans allocate significant portions to general equities and REITs, which has helped the REIT sector integrate with mainstream capital markets (Kowalke & Funk (2022)). In parts of Europe, there has been a preference for direct property funds or private real estate vehicles over exchange-traded REITs. For example, open-ended non-listed real estate funds have been popular in Germany, possibly slowing the adoption of REITs (Mattson-Teig (2022)). Nonetheless, this is gradually changing as investors recognize the benefits of the REIT model (liquidity, diversification and yield). In countries like the UK and Belgium, REITs have been embraced and often trade at healthy valuations, suggesting strong investor support. This matters for factor analysis: a broad, liquid investor base may arbitrage away some anomalies. If European REIT markets are less efficient or have lower analyst coverage than the U.S., investors might find even larger mispricing-based premiums (e.g. momentum or value). Conversely, if markets are dominated by a few institutional players, factor returns could be different.

Compared to the U.S., empirical research specifically on European REIT factor performance is relatively scarce. Some country-specific work has been done, for instance, Su & Taltavull (2021) examined Spanish REITs (SOCIMIs) from 2007–2017 using

CAPM, Fama & French, and Carhart models. They found that the Fama & French three-factor model explained Spanish REIT returns better than CAPM or even a four-factor model, with size and value factors significantly influencing returns. Interestingly, their results indicated a positive size premium but a negative value coefficient, suggesting that in Spain, growth-oriented REITs outperformed value REITs in that period. That highlights that U.S. factor patterns may not fully translate without context. On the other hand, the Pan-European analyses done by Schmidt et al. (2011) constructed size, value, and momentum factors and reported them as highly correlated with their U.S. factor counterparts. While that study was for broad European equities, it suggests that at least for traditional factors Europe exhibits the same anomalies.

2.4 Research Gap and Motivation

The literature review highlights that while factors like size, value, and momentum are well-studied in U.S. markets, their applicability to the Western European REIT sector is underdeveloped. The existing literature on European REITs tends to be either country-specific or focuses on broader European equity markets rather than the unique characteristics of REITs. This leaves a significant gap concerning the collective behaviour of these factors across a portfolio of Western European REITs.

Furthermore, the structural and regulatory landscape of Western Europe presents distinct features that could influence factor premia. Differences in market maturity, investor culture, accounting standards and specific REIT regulations concerning leverage or property types all suggest that a direct extrapolation of U.S. findings is inappropriate. For instance, the mixed evidence for the value and size factor in later U.S. REIT studies and the divergent finding of a negative size premium in Spain underscores the need for region-specific research. Similarly, while momentum is strong in U.S. REITs, its existence in potentially less liquid or differently structured European REIT markets requires testing. For the newer factors profitability and investment, the U.S. REIT literature itself is still developing and shows some mixed results (e.g. for profitability) and their behaviour in the European REIT context is largely uncharted territory.

This study is therefore motivated by the need to bridge these identified gaps. The primary purpose is to investigate the existence and characteristics of the five U.S. REIT

pricing factors in the Western European REIT market. The growing scale and regulatory convergence of European REIT markets further enhance the timeliness and relevance of this investigation. Building on this, the core research questions (RQs) for this thesis are:

RQ1: Do U.S. REIT pricing factors, namely size, value, momentum, profitability and investment, generate economically and statistically significant return premia in the Western European REIT market when constructing factor mimicking portfolios?

RQ2: How do the characteristics of any identified factor premia in Western European REITs compare with established findings from the U.S. REIT market literature?

RQ3: Are the observed factor premia in the Western European REIT market robust to variations in portfolio construction parameters and different sample periods?

Drawing upon the literature reviewed, which points to both the potential for factor persistence and the likelihood of regional variations, the following hypotheses are formulated:

H1 (Size): The size factor will generate a statistically significant positive return premium in the Western European REIT market.

H2 (Value): The value factor premium will not be statistically distinguishable from zero in the Western European REIT market.

H3 (Momentum): The momentum factor will generate a statistically significant positive return premium in the Western European REIT market.

H4 (Profitability): The profitability factor will generate a statistically significant positive return premium in the Western European REIT market.

H5 (Investment): The investment factor will generate a statistically significant premium in the Western European REIT market, but its direction is uncertain

3. DATA AND METHODOLOGY

3.1 Data

This analysis is based on a dataset of REITs collected from Bloomberg. The sample selection follows the approach of Bond & Xue (2017) and Chiang et al. (2006), who focused exclusively on equity REITs. Accordingly, the dataset is filtered to include only

entities categorized under the Global Industry Classification Standard (GICS) sector "Equity Real Estate Investment Trusts." This ensures that the study captures only REITs whose primary source of income is derived from real estate ownership and operation, excluding mortgage REITs and other non-equity entities.

The geographical scope of the analysis is limited to Western European countries that had an established REIT regime prior to 2010. For that purpose, REITs from Belgium, France, Germany, Italy, the Netherlands, Spain and the United Kingdom are included. These seven countries collectively represent the core of Western Europe's REIT universe in terms of market size and maturity, making them suitable for investigating the applicability of U.S. pricing factors. While the size of the U.S. REIT market allows for deep, single-country analysis, the smaller and more fragmented nature of individual European REIT markets favours a multi-country approach. By selecting multiple countries, the sample for a more robust factor analysis is increased, ensuring the availability of a sufficiently long historical record of financial data for empirical testing. To address survivorship bias, both currently active and inactive REITs were included in the sample.

For each REIT, the data fields as seen in Appendix A were collected. Where applicable, the data was converted to Euro using Bloomberg's built-in currency-conversion tool. The data was drawn as reported, without any forward-filling by Bloomberg. While other data vendors such as LSEG (formerly Refinitiv), CapitalIQ, and FactSet were considered as well, Bloomberg was selected due to its superior data completeness and efficient bulk downloading capabilities, making it the most suitable for this study.

The final dataset then contained monthly data for a total of 218 REITs over a 25-year period from December 31, 1999 to December 31, 2024, as only from 1999 onward more than ten REITs had a value for the field *Last Price* and *Historical Market Cap,* both necessary for the construction of the FMPs. However, while the results for the full sample will be presented as well, the primary analysis focuses on the period from December 31, 2006 to December 31, 2024. This specific timeframe is chosen not only because it aligns with the availability of benchmark data from the FTSE EPRA Nareit Developed Europe Index on Bloomberg, but because it marks a period of greater market maturity and

regulatory harmonisation. This period ensures accounting comparability as starting in 2005 all listed companies in the European Union had to prepare their consolidated financial statements in accordance with IFRS (IAS Regulation (EC 1606/2002)). The benchmark index is chosen as it is designed to track the performance of listed real estate companies and REITs in developed Europe.

Data processing is conducted using Python (see Appendix B). Financial data, excluding last price and dividends, is forward filled to populate missing monthly values. This method is chosen to preserve the actual reporting frequency of financial data and create a consistent dataset for portfolio formation without artificially creating values through interpolation or back-filling, which would introduce look-ahead bias. A restriction with a maximum forward-fill window of up to one year is implemented under the assumption that financial data older than one year may no longer be deemed reliable by market participants. Additionally, forward-filling is constrained from extending beyond the last available valid price to avoid creating values in periods where the security may no longer have been trading. Then, following Andronoudis et al. (2024), Total Return is computed for each REIT as:

$$Total\ Return_t = \frac{Last\ Price_t - Last\ Price_{t-1} + Dividends_t}{Last\ Price_{t-1}} \quad (2)$$

Using Total Return as the return metric in this study is particularly appropriate due to the REITs typical high dividend payout ratios. This measure therefore more accurately reflects the returns accruing to investors, capturing both capital gains and income components.

3.2 Construction of the Factor Mimicking Portfolios

To determine the economic and statistical relevance of each factor, this study employs a portfolio-sorting methodology to create FMPs utilizing the data collected above and Python. It was chosen over regression-based analyses for its robustness and lower estimation noise, which is especially relevant given the small and fragmented Western European REIT market. This non-parametric and descriptive method provides clear, interpretable evidence on factor premia without relying on the strong assumptions of a specific asset pricing model. The resulting long-short portfolio returns represent a direct

measure of the factor premium, a valuable output for both testing the international generalizability of asset pricing theories and offering practical insights to investors considering factor-based strategies in European real estate securities.

Similar to Andronoudis et al. (2024) and Essa & Giouvris (2023), the focus of this study lies on the factors size, value, profitability, investment and momentum as they have been found significant in previous literature. The methodology of the construction generally follows Chan et al. (1998) and Andronoudis et al. (2024), whose works were inspired by the standard methodology introduced by Fama & French (1993). First, each factor's sorting metric is winsorized at the 0.25th and the 99.75th percentiles to limit the influence of extreme observations by capping values at the specified percentile thresholds (as done by Andronoudis et al. (2024) and Chui et al. (2003b)). All eligible REITs are then ranked based on each factor's sorting metric at each portfolio formation date and are assigned to a long or short portfolio according to that rank.

A critical decision in this study is the frequency of portfolio rebalancing. While options range from monthly as in Bond & Xue (2017) over quarterly as in Andronoudis et al. (2024) to annually dated to the end of June as in Essa & Giouvris (2023) and Fama & French (1993), this analysis adopts a quarterly rebalancing frequency for all factors based on accounting data (size, value, profitability, investment) and monthly for the price-based momentum factor. This choice represents a deliberate trade-off tailored to the data. A monthly rebalance for accounting-based factors would rely heavily on forward-filled data, potentially introducing noise, whereas an annual rebalance, would be too slow to capture the dynamic nature of European property markets and corporate actions. Quarterly rebalancing therefore provides the optimal balance, aligning with the natural frequency of most corporate financial reporting while remaining timely enough to capture meaningful economic signals. The other options are used for robustness checks.

Equally important is the choice of breakpoints for sorting REITs into portfolios. Literature presents various options, including quintiles (like Essa & Giouvris (2023) and Andronoudis et al. (2024)), three groups with 0.3 and 0.7 as breakpoints (like Chui et al. (2003a)) and to split the REITs at the median into two groups (as done by Bond & Xue (2017) and by Goebel et al. (2012) in the robustness section). For the main analysis, this study utilizes the median split due to the small sample. Using finer partitions like quintiles

would result in portfolios containing very few stocks. Such small portfolios would then be highly sensitive to idiosyncratic risk from single firms, making their returns poor proxies for the underlying factor. The other options are again used for robustness checks.

Once the REITs are sorted and split, a long-short portfolio is created to capture the factor premium. The long and short position hereby depend on the factor that is being analysed and will be explained together with the sorting variable for each factor in the next section. While the long-short portfolio is formed in month t, the returns are calculated monthly from month t+1 onward until the next formation date, therefore following an out-of-sample methodology (as done by Jegadeesh & Titman (1993) and Andronoudis et al. (2024)). The out-of-sample methodology is used to replicate a real-world scenario where an investor bases decisions only on data available through t and then holds the portfolio from point t+1 onward until the next portfolio formation date. For the computation of the returns of the long and short portfolio, a value-weighted approach is selected as that appears to be the academic standard (Fama & French (1993), Chui et al. (2003b), Bond & Xue (2017) and Andronoudis et al. (2024)). However, to check the robustness of the results and to verify that the findings are not disproportionately driven by a few large-cap REITs, equal weighting will be applied as well (as in Chan et al. (1998) and Andronoudis et al. (2024)).

3.3 Factor Sorting Variables and Long-Short Rationale

For this section, this study closely follows the methodology of Andronoudis et al. (2024). The FMPs are constructed as zero-investment portfolios (taking offsetting long and short positions of equal value), therefore isolating the return attributable to specific factors without requiring net capital investment. Transaction costs are excluded.

For the construction of the size FMP, REITs are sorted according to their current month's market capitalization. The long position is then taken in the bottom group (small firms) while the short position is in the top group (big firms), forming the spread that isolates the return attributable to the "small-firm effect".

For the value FMP, this study slightly simplifies the calculation in comparison to the standard US focused literature. The sorting variable is always the book-to-market ratio, which here will be calculated as:

$$BM_t = \frac{Total\ Equity_t - Preferred\ Equity\ and\ Hybrid\ Capital_t}{Market\ Capitalization_t} \quad (3)$$

The difference is that the part "plus balance sheet deferred taxes, and Investment tax credit (if available)" (as seen in Fama & French (1993)) is left out from the calculation of the book value of equity (the numerator). This adjustment is made to allow for a more equal comparison across countries as tax regulations can vary substantially. After sorting the REITs according to this metric and splitting them into groups, the long position is taken in the top group (high BM ratios, value firms) while the short position is taken in the bottom group (lower BM ratios, growth firms). This spread captures the value premium that the dividend-discount model associates with a higher book-to-market ratio as seen in the literature review.

Regarding the momentum FMP, momentum is being measured by computing the cumulative Total Return in the previous six months of each REIT and sorting is done accordingly (as in Chui et al. (2003b)). The long-short portfolio will then be constructed by going long into the top group (winners) and by shorting the bottom group (losers). This spread is designed to harvest the momentum premium linked to investor under- and over-reaction.

In the construction of the profitability FMP, the same book value calculation from the value sorting variable is used to compute the return on equity (ROE). The ROE is computed as:

$$ROE_t = \frac{\text{Income before extraordinary Items}_{\ t}}{Book\ Value\ of\ Equity_{t-3}} \quad (4)$$

Income before extraordinary items is divided by the one-quarter-lagged book value of equity (as in Bond & Xue (2017) and Andronoudis et al. (2024)). The profitability premium is then computed by going long into the firms in the top group (high ROE, robust firms) and short into the ones in the bottom group (low ROE, weak firms). The spread reflects the profitability premium implied by the dividend-discount model as shown before.

Finally, the sorting variable of the investment FMP is the growth rate in total non-cash assets but instead of the annual growth rate (as used by Bond & Xue (2017) the quarterly growth rate is taken. Andronoudis et al. (2024) argued that using a quarterly

growth rate is more consistent with the quarterly rebalancing frequency and makes the factor more responsive to changes in corporate investment policy. The approach to match the growth rate to the sorting frequency will be mimicked in this study, which is relevant for the robustness checks later. The quarterly growth rate of total non-cash assets is then formed as:

$$Growth\ Rate_t = \frac{Total\ Assets_t - Cash\ and\ Cash\ Equivalents_t}{Total\ Assets_{t-3} - Cash\ and\ Cash\ Equivalents_{t-3}} - 1 \qquad (5)$$

As with the size factor, all REITs in the bottom group are being bought (low growth, "conservative") and all REITs in the top group are being sold (high growth, "aggressive"). This spread captures the investment premium predicted by the dividend-discount model as previously seen.

Table 1 summarises the methodology of the construction of the factor mimicking portfolios to provide an overview.

Table 1: Summary of Factor Portfolio Construction

Factor	Sorting Variable	Breakpoint	Long / Short Position	Weighting	Rebalancing
Size	Market Capitalization	Median	Long Small-Cap REITs / Short Big-Cap REITs	Value-Weighted	Quarterly
Value	Book-to-Market (BM) Ratio	Median	Long High BM REITs / Short Low BM REITs	Value-Weighted	Quarterly
Momentum	Cumulative 6-Month Total Return	Median	Long Past Winners / Short Past Losers	Value-Weighted	Monthly
Profitability	Return on Equity (ROE)	Median	Long High ROE REITs / Short Low ROE REITs	Value-Weighted	Quarterly
Investment	Quarterly Growth in Non-Cash Assets	Median	Long Low-Growth REITs / Short High-Growth REITs	Value-Weighted	Quarterly

4. EMPIRICAL RESULTS

This chapter presents the empirical findings (Table 2), where the statistical significance of the monthly total returns is assessed via Newey-West adjusted p-values (Newey & West, 1987). This is done to address potential autocorrelation and heteroskedasticity in the time series data, as done by Chui et al. (2003b) and Novy-Marx (2013). Inspired by Glascock & Lu-Andrews (2014), the maximum lag length for the test is set to three. The one-month EURIBOR rate, as sourced from Bloomberg, serves as the risk-free rate for calculating excess returns used in the Sharpe ratios.

The results show that only the size and profitability factors generated statistically significant positive premiums at the conventional 5% level. The investment factor produced a negative mean return, being marginally significant at the 10% threshold. By contrast, the value portfolio earns an economically modest return and momentum is virtually zero, both failing to reject the null hypothesis of no average premium. Over the same window, the benchmark delivers a negative average monthly return.

Table 2: Descriptive Statistics of Monthly Factor Portfolio Returns

2006 - 2024	**Size**	**Value**	**Momentum**	**Profitability**	**Investment**	**Benchmark**
Mean Return (%)	0.53**	0.33	0.03	0.71**	-0.60*	-0.24
Newey-West p-value	0.02	0.29	0.90	0.04	0.09	N/A
Std. Dev. (%)	3.57	4.45	3.79	4.4	5.16	5.85
Sharpe Ratio	0.13	0.06	-0.01	0.15	-0.13	-0.05
Skewness	0.09	0.38	-0.57	1.44	-1.60	-0.42
Kurtosis	1.25	11.55	7.71	10.69	8.06	2.59
Jarque-Bera Stat.	13.19	1146.47	502.51	1035.94	635.92	62.57

Notes: Significance levels for Mean Monthly Return based on Newey-West p-values: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The benchmark index is the FTSE EPRA Nareit Developed Europe Index. Sharpe Ratios are monthly and calculated using the average one-month EURIBOR as the risk-free rate.

Risk, as measured by the standard deviation of monthly returns, ranges from 3.57% for size to 5.16% for investment, while the benchmark is the most volatile at 5.85%. When the one-month EURIBOR (0.07% on average per month) is taken into considerations via Sharpe ratios, size and profitability lead with 0.13 and 0.15 as seen in Figure 1, value is

modestly positive at 0.06, and momentum (-0.01), investment (-0.13) and the benchmark (-0.05) all exhibit negative risk-adjusted performance.

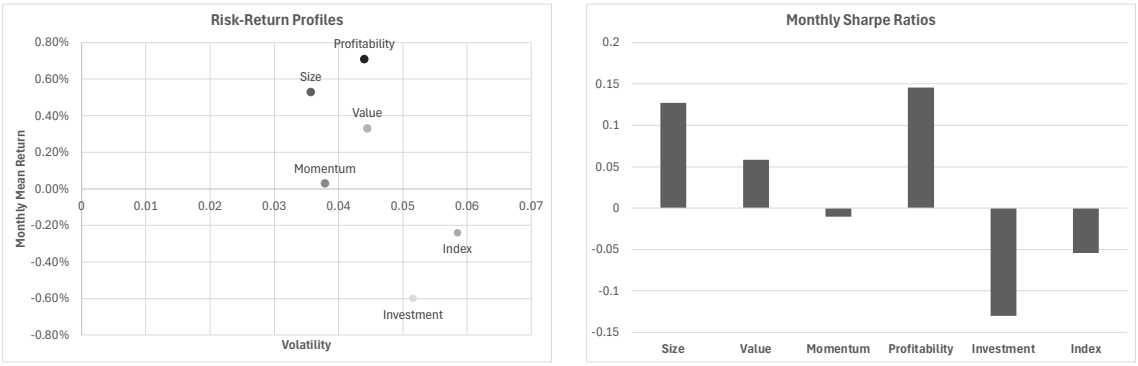

Figure 1: Risk-Return Profiles and Sharpe Ratios

The distributions as visualized in Figure 2, highlight pronounced deviations from normality. Profitability is strongly right-skewed, signalling frequent large upside surprises, whereas Investment is markedly left-skewed, indicating an above-average incidence of deep drawdowns. Momentum shows moderate negative skew while size, value and the benchmark are somewhat symmetric. Tail thickness, as measured by kurtosis, is extreme for value and profitability, fat for momentum and investment, but below the Gaussian benchmark of three for size and mildly elevated for the index. These fat tails motivate formal normality tests such as the Jarque–Bera tests which decisively reject normality for every series except size which points only to mild non-normality.

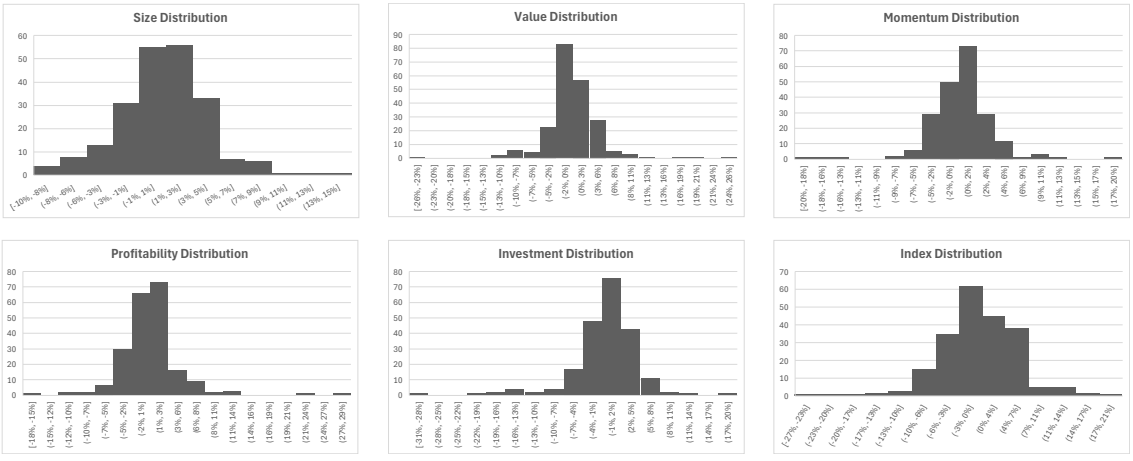

Figure 2: Distributions of Monthly Returns

The cumulative return paths in Figure 3 confirm that size and profitability were the most robust positive factors over the sample period. This is particularly evident for

profitability, which shows a strong and sustained upward trend, especially during periods of high volatility such as the Global Financial Crisis (GFC) during 2008 and 2009 and Covid-19 in 2020. However, in recent years the performance of this factor has turned negative while size and value have risen. Size performed well during the GFC too but remained somewhat stagnant until the recovery phase after Covid-19. Value followed a similar path with the difference that this factor pretty much collapsed once Covid-19 hit, but with a slow recovery after. In contrast, the investment factor exhibited a steady negative trend, visually confirming the counterintuitive finding. This factor seems to have been especially influenced by the GFC with its value dropping by half just in that period alone. Finally, the momentum factor appears to have taken a hit during the GFC while spiking during the Covid-19 crisis. The graph also highlights the challenging market environment with the benchmark having the second lowest cumulative return.

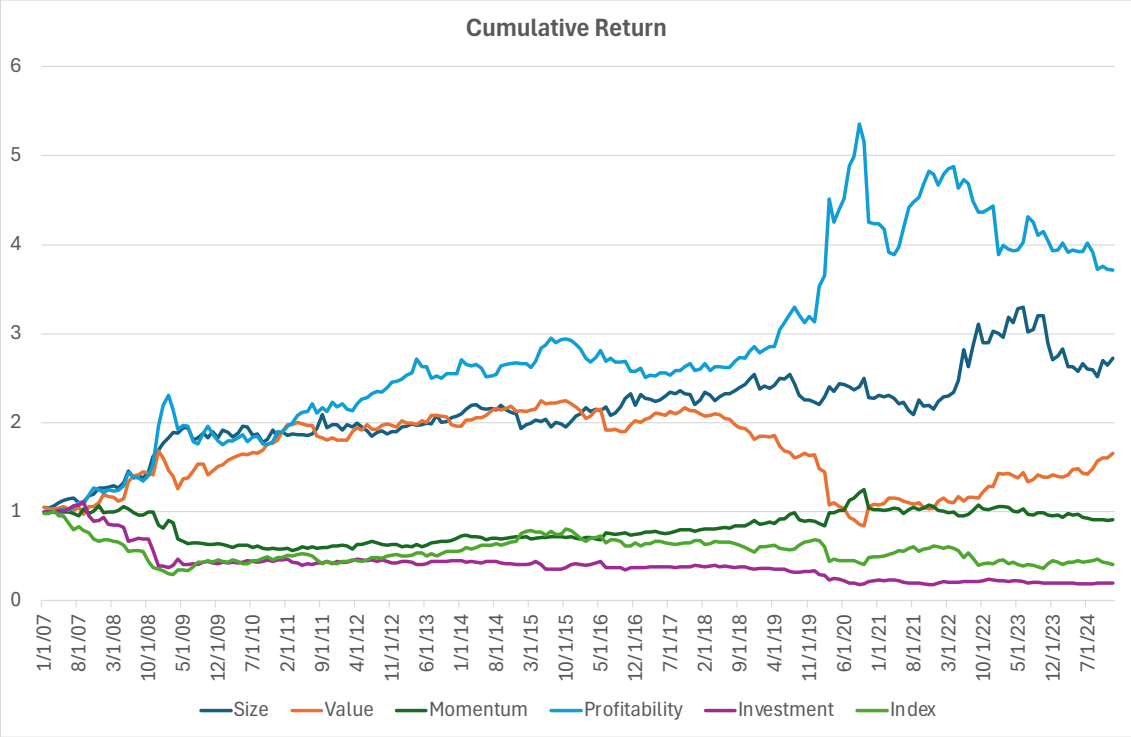

Figure 3: Cumulative Return of Factor Mimicking Portfolios

The co-movement structure as seen in Figure 4 suggests largely independent sources of return. The size spread exhibits a strong inverse correlation with the index, reflecting that small-cap REITs outperform when large-caps lag. Profitability and investment are negatively correlated while a moderate correlation between value and momentum exist.

Besides that, no pair-wise correlations exceed 0.40 in absolute value, indicating that the five factors capture distinct dimensions of systematic variation.

	Size	*Value*	*Momentum*	*Profitability*	*Investment*	*Index*
Size	**1.00**					
Value	-0.08	**1.00**				
Momentum	0.17	-0.48	**1.00**			
Profitability	0.24	-0.26	0.21	**1.00**		
Investment	-0.22	0.09	-0.24	-0.66	**1.00**	
Index	-0.79	0.33	-0.38	-0.39	0.33	**1.00**

Figure 4: Correlation Matrix of Factor Portfolio Monthly Returns (2006-2024)

5. DISCUSSION

The statistically significant positive size premium supports H1 and aligns with U.S. REIT findings (Andronoudis et al. (2024) and Mcintosh et al. (1991)), likely reflecting compensation for risks commonly found in smaller firms such as lower liquidity, higher information asymmetry, and greater sensitivity to economic downturns. In the Western European context, smaller REITs might also possess greater operational flexibility or focus on niche property types or geographies that offer higher growth potential not fully appreciated by the market. The strong inverse correlation between the size factor and the benchmark indicates that small-cap REITs tend to move countercyclically to large caps, providing diversification during downturns and outperformance when large REITs struggle. The factor's low kurtosis suggests its return distribution has thinner tails compared with other factors, implying a milder extreme event risk profile. The size factor also has the second highest Sharpe ratio, showing a strong risk-adjusted performance.

Table 3: Comparison between Results and existing Literature Size Factor

Factor	Result	U.S.	Europe	Interpretation
Size	H1 confirmed. Statistically significant positive premium.	Generally positive and significant premium.	Positive premium in Spanish REITs. Equity premium correlates with U.S. counterparts.	The factor generalises well. The premium is consistent with a risk-based explanation (lower liquidity and higher information asymmetry), though mispricing cannot be ruled out.

The emergence of a strong and statistically significant profitability premium is a key finding, echoing the importance of this factor in general equities and supporting H4.

While the U.S. REIT literature presents a mixed picture, with Bond & Xue (2017) finding a significant premium but Andronoudis et al. (2024) not, this study's result is clear. Highly profitable REITs likely exhibited superior operational efficiencies, stronger balance sheets, better asset quality, or more effective management, leading to sustained cash flow generation that the market rewards. Not only is the raw return noteworthy but also the fact that the profitability factor exhibits the highest Sharpe ratio, therefore providing excellent risk-adjusted returns compared to the benchmark and the other factors. The pronounced right-skewness of the profitability factor's returns suggests that while the strategy already delivers positive returns, it is also characterized by occasional exceptionally large positive outcomes. These could arise from specific REITs significantly exceeding earnings expectations or achieving successful strategic initiatives that lead to substantial revaluations. This aligns with the risk-based view from valuation theory, where higher profitability implies higher expected returns, all else equal.

Table 4: Comparison between Results and existing Literature Profitability Factor

Factor	Result	U.S.	Europe	Interpretation
Profitability	H4 confirmed. Strong, statistically significant positive premium.	Evidence is mixed, some studies find a significant premium, while others do not.	No specific REIT studies found.	The finding provides strong evidence of generalization. It is consistent with valuation theory, where higher expected future earnings imply higher returns. The strong right-skewness suggests it captures rewards for identifying exceptionally successful firms.

The investment factor yielded a marginally significant negative premium, implying that contrary to the typical "asset growth anomaly", aggressively investing REITs outperformed conservative ones. This result supports H5, confirming a significant premium and identifying its direction as negative. This is a particularly noteworthy finding and deviates from the positive premium often documented in general U.S. equity and REIT markets, including the findings of Bond & Xue (2017) and Andronoudis et al. (2024). This reversal is not explained by standard asset pricing theory, but several alternative explanations might apply in the Western European REIT context. First, REITs that were well-positioned to aggressively acquire distressed assets after the GFC or undertake development projects at lower funding costs given the low EURIBOR might

have generated superior returns. Second, "aggressive investment" for REITs might capture value-enhancing development pipelines or strategic acquisitions that led to significant Net Asset Value growth, particularly if undertaken in high-demand sectors or locations within Western Europe. Third, the nature of the European REIT market, which in some countries is less mature than the U.S. market, might offer more opportunities for gradual growth through active investment.

Table 5: Comparison between Results and existing Literature Investment Factor

Factor	Result	U.S.	Europe	Interpretation
Investment	H5 confirmed. Marginally significant negative premium. Aggressively investing REITs outperform.	A positive premium is typically documented.	No specific REIT studies found.	This finding directly contradicts established U.S. evidence and theory. It may reflect a market-specific dynamic where aggressive, value-enhancing acquisitions were rewarded.

The observed negative correlation between profitability and investment is also insightful. It implies that as profitability increases, the investment factor tends to decrease. Therefore, more profitable Western European REITs tended to be more aggressive investors. This suggests that profitable REITs may have had the resources and perhaps the market confidence to pursue growth opportunities more actively. If these aggressive investments by profitable firms were indeed significant drivers of their returns, it suggests that growth-oriented, high-profit REITs led performance while they also faced greater volatility and tail risk stemming from those investment activities.

The value premium was modest and insignificant. This finding is in line with H2, which hypothesized that the value premium would be weak or inconsistent. This weakness compared to U.S. literature (e.g. Ooi et al. (2007)) is striking though it is consistent with the negative value premium Su & Taltavull (2021) found in Spain. This result could be influenced by the accounting standards for investment properties under IFRS. As mentioned in the literature review, IFRS allows for fair value accounting of investment properties, with changes recognized in profit or loss (IAS 40), whereas under US GAAP real estate is booked at historical cost, minus depreciation and any impairments. If book values of equity for Western European REITs already reflect current property market values to a significant extent, traditional book-to-market ratios might

have less power to identify mispricing compared to markets where historical cost accounting is more prevalent for tangible assets. This potentially mutes the book-to-market based value premium. The extreme kurtosis of the value factor highlights that while the average risk-adjusted return is low, the strategy is prone to infrequent but very large return deviations, making it a particularly volatile factor from a tail-risk perspective.

Table 6: Comparison between Results and existing Literature Value Factor

Factor	Result	U.S.	Europe	Interpretation
Value	H2 confirmed. Weak, statistically insignificant premium.	Generally positive premium.	Negative premium found in Spanish REITs.	This factor does not translate from the U.S. market. This weakness could be linked to IFRS fair value accounting rules that reduce the book-to-market ratio's power to signal mispricing.

The absence of a momentum premium is a significant deviation from many equity markets, and particularly from the U.S. REIT market where studies like Chui et al. (2003b) and Hung & Glascock (2008) found it to be an important factor. This result fails to support H3, which hypothesized a positive momentum effect based on U.S. evidence. The turbulent nature of the 2006-2024 period could have "cancelled out" or severely disrupted momentum effects as momentum strategies typically suffer during periods of high volatility and sharp market reversals. The observed moderate negative skew for the momentum factor is consistent with it experiencing such drawdowns, where past trends abruptly reverse, leading to losses for the strategy. This result also fails to support the behavioural theories of investor under- and over-reaction (e.g. Hong & Stein (1999)) in the context of Western European REITs for this period. Several other reasons could explain this absence in the Western European REIT market. First, REIT returns are substantially driven by underlying property valuations and rental income streams, which tend to be smoother and less prone short-term trending behaviour that often creates momentum in more liquid equities. Second, transaction costs in the underlying direct property markets and potentially for some REITs in Europe could be higher, making it more difficult to profitably exploit short-term price trends. Third, this market might have greater efficiency in incorporating information from past price movements for this particular asset class or lower prevalence of behavioural biases like herding or disposition effects which could contribute.

Table 7: Comparison between Results and existing Literature Momentum Factor

Factor	Result	U.S.	Europe	Interpretation
Momentum	H3 rejected. No significant premium.	A strong and significant premium is well-documented.	A pan-European equity momentum factor exists. Has not been confirmed for REITs.	The momentum anomaly, prominent in U.S. REITs, appears absent. This contrast might be caused by the turbulent sample period which could have disrupted trend-following strategies or by different market behaviour and characteristics.

The non-normality across almost all factor portfolios and the benchmark index is a critical insight. For practitioners, this means that traditional risk management tools based on mean-variance optimization may be inadequate. The pronounced tail risk, evident in the high kurtosis for value, profitability, and investment factors, demands careful consideration when implementing those factors, possibly through measures like Value-at-Risk or expected shortfall that better capture extreme event likelihood. The generally low pairwise correlations among most of the identified factors suggest that they capture different underlying economic dimensions of risk and return. This points to the potential for diversification benefits when combining these factor strategies, an idea central to multi-factor investing approaches. The finding on the profitability-investment correlation, that more profitable REITs tended to invest more aggressively, is a key insight. It suggests a dynamic where successful, profitable firms fuel growth through investment, which, while potentially return-enhancing for the aggressive firms, also introduces specific risk characteristics captured by the investment factor.

6. ROBUSTNESS

The robustness analysis alters one design element at a time to verify that the main results are not due to a particular portfolio-formation combination. Across these single dimension checks as shown in Table 8, size and profitability remain positive in virtually every variant (though they lose significance in the strictly post-GFC window), investment is almost uniformly negative (and becomes more so when the early 2000s are included), value acquires significance when the cross-section is sliced into finer tails, and momentum is economically negligible throughout.

Table 8: Robustness Results (Monthly Mean Return in % with p-values)

Factor	Baseline	Post-GFC	Full Sample	Monthly	Annual	30/40/30	Quintile	Equal Weight
Size	0.53**	0.28	0.41**	0.32	0.30	0.48	0.46	0.37**
	(0.018)	(0.197)	(0.026)	(0.115)	(0.149)	(0.105)	(0.123)	(0.049)
Value	0.33	0.13	0.47*	0.11	-0.17	0.79*	0.82	0.42*
	(0.293)	(0.681)	(0.060)	(0.720)	(0.593)	(0.066)	(0.117)	(0.084)
Momentum	0.03	0.27	-0.14	0.12	0.14	0.01	0.03	-0.07
	(0.903)	(0.226)	(0.479)	(0.652)	(0.630)	(0.964)	(0.946)	(0.779)
Profitability	0.71**	0.48	0.57**	0.63**	0.12	1.08**	1.38***	0.48**
	(0.038)	(0.104)	(0.027)	(0.030)	(0.671)	(0.010)	(0.003)	(0.012)
Investment	-0.60*	-0.34	-0.74**	-0.29	0.05	-0.45*	-0.42	-0.64***
	(0.093)	(0.263)	(0.012)	(0.646)	(0.871)	(0.064)	(0.128)	(0.009)

Notes: Significance levels based on Newey-West p-values: * p < 0.1, ** p < 0.05, *** p < 0.01 (approximate for display; actual p-values shown). "Monthly Rebalance" for Momentum is quarterly. Baseline sorting frequency is quarterly (for Momentum monthly). Baseline split is median. Baseline is value weighted.

Restricting the window to December 2009 to December 2024 reduces all factor means and makes them statistically insignificant. For comparison, the FTSE EPRA Nareit Developed Europe index returns 0.12% per month over the same horizon, although its distribution remains decisively non-normal. Extending the factor sample back to January 1999 restores the original premium ordering and makes all but the momentum factor statistically significant. Hence, the positive size and profitability premia and the negative investment spread are not just creations of the 2006–2024 window but they are muted in the purely post-GFC environment.

When portfolios are rebalanced monthly (momentum then quarterly), both the size and investment premia weaken, while profitability remains the sole significant premium. Value and momentum stay economically small and statistically insignificant. Annual rebalancing compresses some spreads: both size and profitability weaken and become insignificant. The investment premium turns positive for the first and only time, while value and momentum are again somewhat irrelevant. Thus, quarterly updating appears to

capture most of the persistent cross-sectional signal in this sector and is therefore a good choice for the construction of the FMPs.

Replacing the median breakpoint with a 30/40/30 split increases the profitability premium and lifts the value premium to significance, while the size premium moderates and the negative investment premium weakens slightly compared to the baseline. Quintile splits accentuate the same pattern: the profitability premium jumps and becomes highly significant, the value premium strengthens further but loses its significance, while size holds steady and the investment premium continues to moderate. Momentum is negligible under both rules. This confirms that the profitability premium is concentrated in the extremes of the distribution and that value emerges the more those tails are isolated. This concentration in the tails for the value factor suggests that only REITs with very pronounced valuation discrepancies exhibit a subsequent return differential, lending support to behavioural mispricing theories like that of Lakonishok et al. (1994) who argue that the effect is driven by systematic investor error rather than fundamental risk. The size premium also slowly diminishes as the focus shifts to the outer tails of the distribution.

Adopting equal weights in the long and short legs leaves every spread's direction unchanged and generally tightens significance. The size and profitability premia decrease but remain significant, the value premium inches up to marginal significance, and the investment premium holds steady at a high level of significance. Momentum stays irrelevant. The equal-weighting check thus confirms that the dominance of large-cap REITs in the value-weighted construction is not driving the core findings.

To supplement the portfolio-sorting analysis and test the simultaneous explanatory power of the five factors, a Fama-MacBeth two-stage regression (Fama & Macbeth, 1973) is conducted using Python (Appendix B). This allows for a multivariate test of whether the characteristics command a risk premium. In the first stage, a cross-sectional regression of next month's excess REIT returns on the five firm sorting variables is run for each month in the 2006-2024 sample period. This yields a time series of estimated coefficients for each factor. In the second stage, the time-series average of these coefficients is calculated to determine the average risk premium (γ) associated with each factor. Statistical significance is assessed as before.

The results, presented in Appendix H, largely confirm the findings from the portfolio sorts. Both profitability and the investment factor are found to carry statistically significant positive premiums at the 10% level. The positive coefficient on investment growth confirms the counterintuitive result from the sorts where REITs with higher asset growth earned higher subsequent returns, even after controlling for other factors. This provides further evidence that this "aggressive investment premium" is a distinct feature of the European REIT market during this period. While value and momentum show positive coefficients, they are not statistically significant, which aligns with their weakness in the primary portfolio analysis. Contrary to the portfolio sorts, the size factor is not significant in the multivariate setting, suggesting its effect may be captured by the other factors.

7. Practical Implications

This chapter builds on the findings from the chapters above to address a practical question: could an investor have harnessed these factor premia to construct a viable, long-only investment strategy? To answer this, this section moves from descriptive analysis to an applied portfolio construction exercise.

The goal is to assess the out-of-sample performance of portfolios created by combining the five factor mimicking portfolios. Following the methodology of Andronoudis et al. (2024), five different allocation strategies are implemented. As this analysis is constrained to long-only portfolios and the investment factor produced a negative premium, the inverted factor is used (aggressive minus conservative) to ensure its contribution to the portfolio is based on a positive expected return.

The five allocation strategies can be summarized as follows: The Equally Weighted (EW) approach is a naive strategy where each of the five factor portfolios receives an equal weight of 1/5, rebalanced quarterly. This serves as a simple, non-optimized benchmark. By contrast, the Tangency Allocation (TA) is a classic mean-variance strategy that seeks to maximise the portfolio's Sharpe ratio. The weights are determined by solving for the tangency portfolio on the efficient frontier. The Minimum Variance Portfolio (MVP) sole objective is to minimise total portfolio variance given the covariance matrix of the factors. Moving from return-based and variance-based strategies

to a risk-based approach, Risk Parity (RP), allocates capital so that each factor contributes equally to the overall portfolio risk (variance). Following Qian (2005), one numerically solves for weights under a long-only constraint so that risk contributions are equalized. Finally, Maximum Diversification (MD) as introduced by Choueifaty & Coignard (2008), aims to maximise the portfolio's diversification ratio. That ratio is defined as the weighted average of individual volatilities divided by the total portfolio volatility and is equivalent to finding the portfolio where components contribute most equally to the overall volatility rather than strictly equalizing risk contributions.

Table 9 shows that all five strategies generated positive average monthly returns. This again stands in stark contrast to the benchmark and demonstrates that a diversified, factor-based approach could have turned a loss-making market exposure into a profitable one.

Table 9: Results of Multi-Factor Portfolios

2006 - 2024	**EW**	**TA**	**MVP**	**RP**	**MD**
Monthly Mean Return (%)	0.34	0.51	0.18	0.38	0.11
Monthly Std. Dev. (%)	2.11	3.13	1.71	2.29	1.85
Monthly Sharpe Ratio	0.159	0.161	0.1	0.164	0.058

Among the strategies, the RP portfolio delivered the highest risk-adjusted return. The TA produced the highest mean return, with a slightly lower Sharpe ratio due to its higher volatility. The simple EW portfolio performed comparably well, nearly matching the more complex optimized strategies. This finding is consistent with literature (e.g. Demiguel et al. (2009) and Andronoudis et al. (2024)) suggesting that simpler allocation methods can be as effective as complex optimization techniques that are sensitive to estimation errors in expected returns and covariances. The strategies MVP and MD produced the lowest returns. While they reduced volatility to the lowest levels they did so at the expense of returns, resulting in inferior Sharpe ratios.

A natural question is why an investor should adopt one of these multi-factor strategies rather than simply investing in the single best-performing factor. While individual factors like profitability and size offered higher raw returns than many of the combined strategies, this came at the cost of higher risk. The key advantage of the multi-factor portfolios lies in diversification. The RP strategy for instance achieved the highest Sharpe ratio of any approach, surpassing the best single factor profitability. It accomplished this by

combining the different, imperfectly correlated factors to significantly lower overall portfolio volatility. The RP portfolio's volatility is substantially lower than that of the individual size and investment factors, leading to a smoother return profile. Furthermore, a multi-factor approach avoids the hazard of "factor timing". An investor betting on a single factor risks long periods of underperformance, whereas a diversified portfolio provides a more robust approach by harvesting returns from multiple sources.

The performance during different economic cycles as seen in Figure 5 further highlights the value of diversification. During the GFC in 2008-2009, only the MVP and MD strategies experienced drawdowns but they are far less severe than the crash of the Index. In the subsequent recovery, the Tangency, EW and RP portfolios performed well but all strategies were outperformed by the market during that period. This shows that while the strategies protect the downside of the investment, they don't quite manage to capture all the upside. However, while the market fell after the peak in 2015 all five strategies remained with a consistent positive trend. During the sudden volatility spike of the COVID-19 pandemic, all strategies again offered protection relative to the market, with the TA, EW and RP portfolios even benefiting from it.

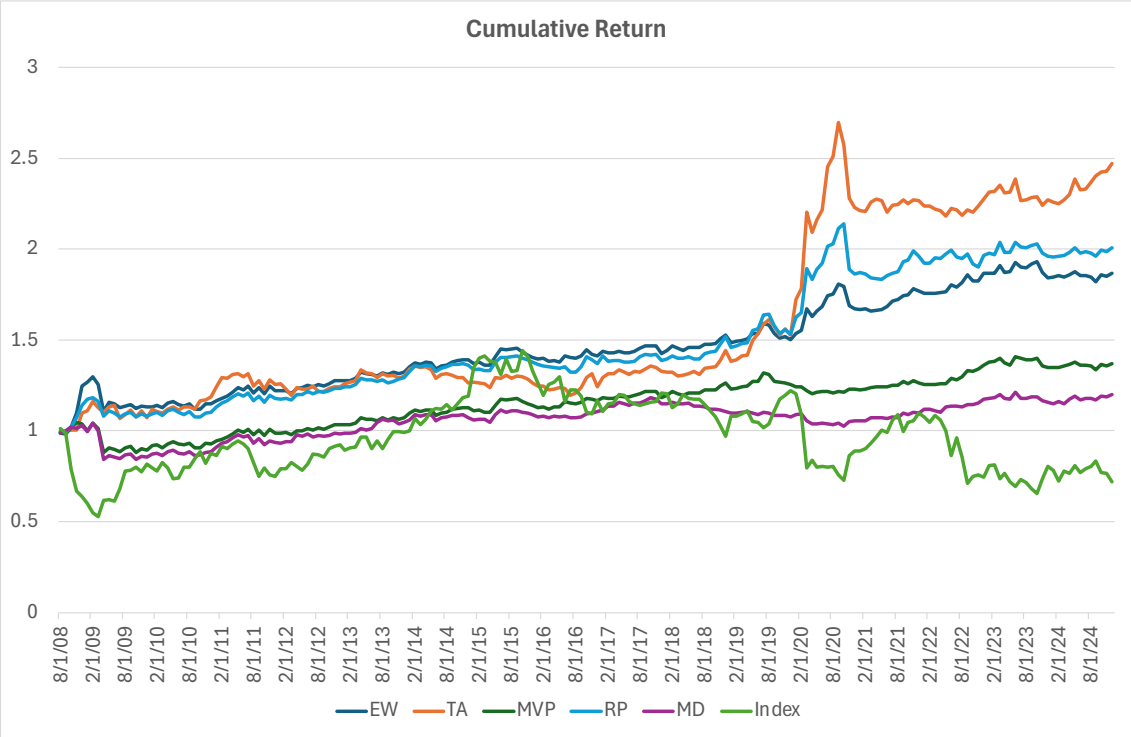

Figure 5: Cumulative Return of Multi-Factor Portfolios

Figure 6 shows the time varying weights employed across different strategies for each factor. It indicates the importance of including all factors in the analysis and construction of these portfolios, as the visual evidence demonstrates that almost all factors are typically utilized by the various strategies to capture diverse sources of risk and return. The dynamic nature of these weights across different strategies underscores the adaptability required in factor investing, acknowledging that optimal factor exposures can shift with market dynamics and investment objectives. The inclusion and careful weighting of these factors is therefore essential for constructing robust portfolios that aim to capture their intended risk premia across diverse market conditions.

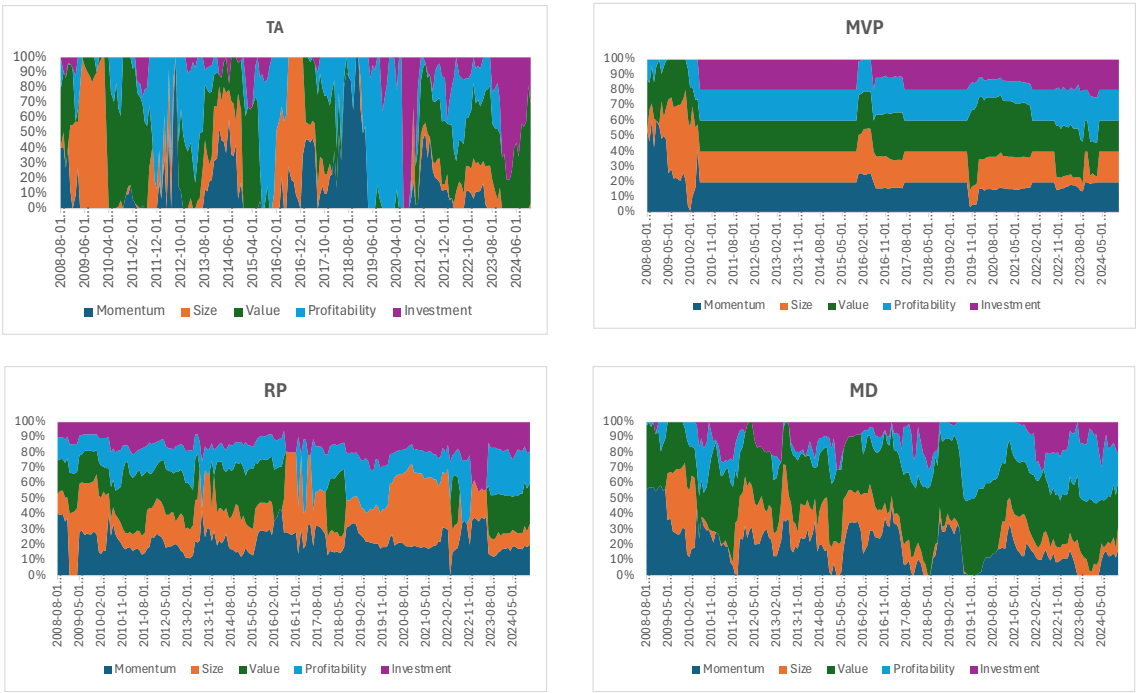

Figure 6: Weights of Multi-Factor Portfolios

Overall, an investor could have systematically constructed long-only, multi-factor portfolios that delivered positive and improved risk-adjusted returns against the individual factors and during a period when the broader European REIT market struggled. The success of the relatively simple Risk Parity and Equally Weighted strategies shows that practical, robust methods can be highly effective for harnessing these sources of return.

8. CONCLUSION

This thesis investigated the applicability of five U.S. REIT pricing factors to the Western European market. It set out to determine if these factors generate statistically significant premia, how they compare to U.S. findings, and if the results are robust. Using a descriptive portfolio-sorting approach across 218 REITs from seven European countries between 2006 and 2024, this analysis provides the following answers and generally supports the initial hypotheses, with some notable exceptions.

In response to RQ1, the findings confirm that U.S. factor premia do not uniformly apply to Western European REITs. As hypothesized, significant positive premiums were found for size (H1) and profitability (H4), while the value factor was weak (H2). Contrary to expectations, the momentum premium was absent (H3 rejected). Finally, a significant investment premium was found, but its direction was negative, with aggressive investors outperforming conservative ones (H5 supported).

Addressing RQ2, the comparison with U.S. REIT market literature reveals important differences. While the size premium is broadly consistent, the profitability premium in Western Europe appears more consistently strong than the mixed evidence from the U.S. REIT sector suggests. The most striking contrasts are the negative investment factor premium, which is a reversal of the typical U.S. finding, and the absence of a momentum premium, which is a well-documented phenomenon in U.S. REITs. The weakness of the value factor also aligns with some region-specific European findings and contrasts with the more general U.S. value premium.

Regarding RQ3, the robustness checks confirmed that the size and profitability premia were relatively stable across various portfolio construction methodologies and sample periods, although their statistical significance diminished in the post-GFC window. However, the size effect was not significant in a multivariate regression setting, suggesting it may be partly captured by other factors. The negative investment premium also showed robustness, particularly when extending the sample period. Value's significance emerged mainly with more granular sorting, while momentum remained negligible throughout all tests.

These findings carry several implications for REIT pricing theory in Europe. They suggest that while some pricing anomalies like profitability and to a certain extent size

appear to exist, reflecting potentially fundamental risk characteristics or behavioural patterns, other factors are highly context dependent. For example, the different behaviour of value and investment factors may point to the significant influence of institutional and accounting differences such as IFRS fair value accounting rules, which potentially alter how information is incorporated into book values and growth metrics in Europe compared to the U.S. GAAP environment. In terms of market efficiency and investor behaviour, the weakness or absence of factors like value and momentum could suggest several possibilities. It might indicate that European REIT markets are efficient in different ways than U.S. markets, or that investor behaviour, perhaps influenced by different institutional structures or market liquidity, does not give rise to the same kind of persistent mispricing often cited in U.S. studies (trend-following for momentum or extrapolation for value). The counterintuitive investment premium, where aggressive investment pays off, could reflect a period where growth opportunities in a developing and recovering European REIT market were particularly rewarding, or that "aggressive" investment captured value-enhancing development rather than value-destroying overexpansion.

For practitioners, these findings underscore the importance of empirical validation before transposing investment strategies across markets. Specifically, investors in European REITs might enhance risk-adjusted performance by tilting portfolios towards smaller and more profitable firms. However, they should exercise caution in expecting traditional value or momentum premia without region-specific evidence. The unexpected negative investment premium also signals that factor definitions and their expected outcomes may require careful adaptation to the European economic and institutional landscape, rather than direct replication of U.S. models. Furthermore, constructing diversified long-only multi-factor portfolios showed the potential to deliver improved risk-adjusted returns, outperforming the benchmark and individual factors during the studied period. This suggests that a systematic, factor-based approach, when tailored to regional specifications, can be a viable strategy for investors.

This thesis contributes to the academic conversation by providing a descriptive analysis of five key U.S. REIT pricing factors within a multi-country Western European context, using a transparent portfolio-sorting methodology. It provides empirical evidence that factor generalizability is not a given, with the reversed investment premium

and absent momentum premium challenging the universal applicability of U.S. models and highlighting divergent market dynamics.

However, this thesis is not without limitations. The relatively small and concentrated nature of the European REIT universe could limit the statistical power of certain analyses, particularly in the smaller post GFC period. A second limitation is the exclusion of transaction costs associated with rebalancing the portfolios. The net profitability of the reported premia in real-world implementation could therefore be lower, particularly for strategies requiring more frequent trading like the monthly rebalanced momentum factor. Furthermore, while a Fama-MacBeth regression was conducted to test for simultaneous effects, the primary analysis relies on one-way portfolio sorts, meaning more complex factor interactions (e.g. through two-way sorts) remain largely unexplored. However, the simplicity and transparency of the one-way sort methodology used here allows for clear interpretation of raw return patterns, which is consistent with the study's applied motivation.

Future research could extend this work in several directions. As the European REIT market continues to evolve, larger and more comprehensive datasets may allow for more refined portfolio constructions, including two-way sorts or country-specific segmentation. Another natural extension would be to explore alternative sorting variables for each factor (for example, using operating cash flow instead of accounting earnings for profitability, or alternative asset growth proxies for investment). Lastly, building on the preliminary regression analysis in this thesis, future work could apply more advanced econometric models to more formally quantify factor exposures and decompose risk premia.

In conclusion, this thesis confirms that the initial expectation of mixed applicability holds true: only some of the U.S. REIT factor premia extend robustly to Western Europe. While profitability and to a certain extent also size prove to be persistent and meaningful return drivers, other factors either invert (investment), weaken (value), or disappear (momentum). These results highlight the need for regionally grounded factor analysis and suggest that a direct transfer of U.S. factor strategies to European REITs may not be guaranteed without careful adaptation and further investigation.

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Appendix A: Field descriptions of fields collected from Bloomberg

Name	Sign	Definition
Total Equity	TOTAL_EQUITY	Firm's total assets minus its total liabilities. Common Equity + Minority Interest + Preferred Equity
Total Assets	BS_TOT_ASSET	Total Assets is the sum of Net Real Estate Investments, Cash and Equivalents, Other Investments, Receivables, Other Assets and Restricted Assets.
Cash and Cash Equivalents	BS_CASH_NEAR_CASH_ITEM	Cash, cash equivalents and marketable securities with maturities of 90 days or less.
Preferred Equity	PFD_EQTY_HYBRID_CAPITAL	Preferred equity is shown at liquidation value, when disclosed. If the liquidation value is not disclosed, preferred equity is stated at book value.
Market Cap	HISTORICAL_MARKET_CAP	Total market value of all of a company's outstanding shares at period-end date stated in the company's fundamental currency. Calculated as: Shares Outstanding * Last Closing Price
Price	PX_LAST	Last price for the security.
Shares Outstanding	BS_SH_OUT	All the shares of a corporation that have been authorized, issued, purchased, and held by investors as of period end date.
Income	IS_INC_BEF_XO_ITEM	Income (loss) before Extraordinary Items excludes the effects of discontinued operations, accounting standards changes, and natural disasters.
Dividends	EQY_DPS	Outside of the US, this is the dividend attributable to the period, which may include either proposed or paid dividends. For REITs, this field also refers to distribution per unit/share.

Appendix B: Source Code Repository

The complete source code used for data processing and analysis is hosted at: https://github.com/LeonikWadehn/MFW

The repository contains the following:

1. Read Data and Forward Filling
2. Total Return Calculation
3. Factor Mimicking Portfolios
   3.1. Size
   3.2. Value
   3.3. Profitability
   3.4. Investment
   3.5. Momentum
4. Benchmark Index
5. Multi-Factor Portfolios
6. Fama-MacBeth Regression

Appendix C: Full Results Main Analysis

2006 - 2024	Size	Value	Momentum	Profitability	Investment	Index
Sorting	Quarterly	Quarterly	Monthly	Quarterly	Monthly	-
Split	Median	Median	Median	Median	Median	-
Weighting	Value	Value	Value	Value	Value	-
Mean	0.0053	0.0033	0.0003	0.0071	-0.006	-0.0024
p-value	0.031	0.272	0.914	0.019	0.09	-
Median	0.007	0.0003	0.0014	0.0053	-0.0014	-0.0017
Volatility	0.0357	0.0445	0.0379	0.044	0.0516	0.0585
Skewness	0.0919	0.3829	-0.5652	1.4427	-1.6015	-0.4179
Kurtosis	1.253	11.5542	7.7053	10.6946	8.0606	2.59
Sharpe Ratio	0.1273	0.0584	-0.0103	0.1455	-0.1303	-0.0542
Jarque-Bera Stat	13.19	1146.47	502.51	1035.94	635.92	62.57
p-value	0.001	0	0	0	0	0
Newey-West t-stat	2.37	1.05	0.12	2.08	-1.68	-
p-value	0.018	0.293	0.903	0.038	0.093	-

Appendix D: Full Robustness Checks (Sample Period)

2009 - 2024	Size	Value	Momentum	Profitability	Investment	Index
Mean	0.0028	0.0013	0.0027	0.0048	-0.0034	0.0012
p-value	0.279	0.652	0.287	0.087	0.272	-
Median	0.0033	-0.0006	0.0043	0.0048	-0.0016	0.0012
Volatility	0.0346	0.04	0.0332	0.0369	0.0041	0.0549
Skewness	0.0595	-0.1084	0.3909	0.7192	-0.829	-0.5925
Kurtosis	1.5163	18.5122	7.7646	11.6061	3.2902	3.2404
Sharpe Ratio	0.0697	0.0242	0.0692	0.1187	-0.0922	0.0141
Jarque-Bera Stat	15.68	2421.92	413.14	947.92	93.78	83.76
p-value	0	0	0	0	0	0
Newey-West t-stat	1.29	0.41	1.21	1.62	-1.12	-
p-value	0.197	0.681	0.226	0.104	0.263	-

1999 - 2024	Size	Value	Momentum	Profitability	Investment	-
Mean	0.0041	0.0047	-0.0014	0.0057	-0.0074	-
p-value	0.047	0.05	0.506	0.016	0.012	-
Median	0.0058	0.0024	0.0004	0.0078	-0.0021	-
Volatility	0.0356	0.0414	0.0361	0.0407	0.05	-
Skewness	-0.177	0.3205	-0.5855	1.2513	-1.7452	-
Kurtosis	1.6875	11.1513	7.1254	10.861	8.645	-
Sharpe Ratio	0.0795	0.0833	-0.0722	0.1102	-0.1716	-
Jarque-Bera Stat	35.15	1502.87	614.21	1482.68	1017.4	-
p-value	0	0	0	0	0	-
Newey-West t-stat	2.22	1.88	-0.71	2.21	-2.5	-
p-value	0.026	0.06	0.479	0.027	0.012	-

Appendix E: Full Robustness Checks (Sorting Frequency)

2006 - 2024	Size	Value	Momentum	Profitability	Investment
Sorting Frequency	Monthly	Monthly	Quarterly	Monthly	Monthly
Mean	0.0032	0.0011	0.0012	0.0063	-0.0029
p-value	0.173	0.699	0.674	0.018	0.683
Median	0.0057	0.0008	0.0032	0.0064	0.0005
Volatility	0.0342	0.0413	0.0427	0.0389	0.0633
Skewness	0.0129	0.1268	-1.2313	0.264	-0.9041
Kurtosis	1.2156	12.5841	12.9168	6.6579	4.3893
Sharpe Ratio	0.071	0.0083	0.0132	0.1447	-0.0557
Jarque-Bera Stat	12.12	1354.9	1437.67	374.48	65.05
p-value	0.002	0	0	0	0
Newey-West t-stat	1.57	0.36	0.45	2.17	-0.46
p-value	0.115	0.72	0.652	0.03	0.646
Sorting Frequency	Annual	Annual	Annual	Annual	Annual
Mean	0.003	-0.0017	0.0014	0.0012	0.0005
p-value	0.218	0.58	0.631	0.648	0.859
Median	0.0061	-0.0021	0.0052	0.0036	0
Volatility	0.0357	0.044	0.0409	0.0389	0.0417
Skewness	0.0596	0.6479	-2.3296	-1.0691	0.6478
Kurtosis	0.6326	14.2443	17.1038	8.6836	7.9837
Sharpe Ratio	0.0663	-0.0536	0.0167	0.0141	0.0008
Jarque-Bera Stat	3.16	1699.96	2619.01	664.17	509.59
p-value	0.206	0	0	0	0
Newey-West t-stat	1.44	-0.53	0.48	0.42	0.16
p-value	0.149	0.593	0.63	0.671	0.871

Appendix F: Full Robustness Checks (Split Method)

2006 - 2024	Size	Value	Momentum	Profitability	Investment
Split Method	30/40/30	30/40/30	30/40/30	30/40/30	30/40/30
Mean	0.0048	0.0079	0.0001	0.0108	-0.0045
p-value	0.137	0.057	0.967	0.006	0.056
Median	0.0043	0.0038	0.0034	0.0096	-0.0003
Volatility	0.0476	0.0602	0.0511	0.0566	0.0341
Skewness	0.8047	1.0366	-1.106	0.4679	-2.5998
Kurtosis	3.8924	13.5938	8.3325	7.4753	15.535
Sharpe Ratio	0.0861	0.1184	-0.0104	0.179	-0.1527
Jarque-Bera Stat	151.26	1619.05	617.27	477.11	2272.15
p-value	0	0	0	0	0
Newey-West t-stat	1.62	1.84	0.04	2.56	-1.85
p-value	0.105	0.066	0.964	0.01	0.064

Split Method	Quintiles	Quintiles	Quintiles	Quintiles	Quintiles
Mean	0.0046	0.0082	0.0003	0.0138	-0.0042
p-value	0.159	0.099	0.951	0.002	0.139
Median	0.0068	0.0041	0.0017	0.0101	-0.0009
Volatility	0.0476	0.0726	0.0609	0.0631	0.0409
Skewness	0.1151	0.9695	-1.5023	0.5991	-0.5824
Kurtosis	0.1305	13.3584	8.173	6.3615	4.9689
Sharpe Ratio	0.0807	0.1028	-0.0068	0.2071	-0.1192
Jarque-Bera Stat	0.56	1559.87	631.05	352.08	218.49
p-value	0.756	0	0	0	0
Newey-West t-stat	1.54	1.57	0.07	2.99	-1.52
p-value	0.123	0.117	0.946	0.003	0.128

Appendix G: Full Robustness Checks (Equal Weighting)

2006 - 2024	Size	Value	Momentum	Profitability	Investment
Mean	0.0037	0.0042	-0.0007	0.0048	-0.0064
p-value	0.093	0.067	0.765	0.012	0.013
Median	0.003	0.0025	0.0027	0.0059	-0.005
Volatility	0.0321	0.0332	0.0332	0.0276	0.0374
Skewness	0.2827	1.4295	-1.741	-1.5636	0.2612
Kurtosis	0.6304	10.1909	9.8236	10.7628	4.406
Sharpe Ratio	0.0917	0.1024	-0.0412	0.1479	-0.1904
Jarque-Bera Stat	5.95	959.79	904.74	1061.02	164.6
p-value	0.051	0	0	0	0
Newey-West t-stat	1.97	1.73	-0.28	2.5	-2.6
p-value	0.049	0.084	0.779	0.012	0.009

Appendix H: Full Robustness Checks (Fama-MacBeth Regression)

2006 - 2024	Constant	Size	Value	Momentum	Profitability	Investment
Coefficient (γ)	-0.0029	0	0.0041	0.0151	0.0214	0.0143
Newey-West SE	0.0035	0	0.003	0.0111	0.0112	0.0075
Newey-West t-stat	-0.8477	-0.2276	1.3844	1.3642	1.9117	1.9109