Dissecting the Value Premium

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vorgelegt von
Halil Ibrahim Memis

Berichterstatter
Prof. Dr. Steffen Sebastian
Prof. Dr. Klaus Röder

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Chapter 1

Introduction

Motivation and area of research

This dissertation explores the value premium and its impact and dynamics within both nonfinancial and the real estate equities. The three research papers included provide a comprehensive analysis of the subject matter. These papers cover various aspects of financial research, including an analysis of value-growth strategies based on expectation errors, an examination of the cash premium in the real estate market, and a comprehensive decomposition of the value premium of real estate equities. The first study starts with a detailed analysis of the value premium, which is typically attributed to risk factors but is increasingly understood through the lens of behavioural biases and mispricing.

Recognising that most financial research primarily focuses on the US, as identified by Andrew Karolyi (2016), this thesis begins by examining developed capital markets outside of the US, specifically looking at nonfinancial sectors and excluding real estate data for a broad initial analysis. The subsequent studies, however, mark a shift towards the real estate market, concentrating exclusively on real estate data from both global and US markets to fill a significant gap in the literature. In the case of these real estate-focused studies, we include the US given its role as a major real estate market. The introduction will next outline the motivations, content, and contributions of these three studies, emphasising their relevance to the real estate field.

Research paper I – *Dissecting Value-Growth Strategies Conditioned on Expectation Errors*

The the value premium, which highlights the outperformance of firms with high book-to-market (BM) ratios compared to those with lower BM ratios, has been a focal point of financial research. Initially, Fama and French (1993) attributed the value premium to risk factors, but the viewpoint that the anomaly stems from investors' behavioural biases has increasingly gained support in recent years. Piotroski and So (2012) present a compelling case for a mispricing-based explanation by leveraging the $FSCORE$, a measure of a firm's fundamental strength. They show that the value premium only exists in firms whose market expectations, as implied by their BM ratios, do not match their actual fundamental strength. Subsequent studies have reinforced the significance of the $FSCORE$, showcasing its effectiveness in explaining the value premium, as well as other premia motivated by fundamentals, and even the momentum premium (see, for example, Walkshäusl, 2017; Tikkanen and Äijö, 2018; and Ahmed and Safdar, 2018).

In Chapter 2, the first study examines how the $FSCORE$ affects the value premium using the present value model initially proposed by Cohen et al. (2003). According to their results, firms move between value and growth because of changes in expected profitability rather than from changes in expected returns. Given that the $FSCORE$ strongly correlates with a firm's profitability, Cohen et al.'s (2003) work indirectly questions the mispricing hypothesis posits by Piotroski and So (2012), which hinges on the premise of differing expected returns. Later in the discussion, we apply the decomposition method introduced by Fama and French (2008) to further dissect the value premium. The second present value model decomposes the BM ratio into past changes in price, past changes in book equity, and past change in BM ratio, examining whether those components can predict stock return.

Initially, our research establishes that the presence of the value premium is closely linked to a firm's fundamental strength proxied by the $FSCORE$, aligning with prior findings. Specifically, this indicates that the superior performance associated with value firms stem from value firms with strong fundamentals, whereas the weak performance seen in growth firms can be attributed to growth firms with weak fundamentals. Moreover, when analysing both value and growth firms, we corroborate Cohen et al.'s (2003) findings that firms move between value and growth because of changes in expected profitability. Yet, when we factor in the $FSCORE$, we observe that the expected return component significantly varies between the different value-growth samples. Additionally, by applying the decomposition approach by Fama and French (2008), we show that the ability to predict stock returns based on price changes is more pronounced than that based on changes in book equity, particularly in firms affected by expectation errors. These findings strongly supports the market expectation errors hypothesis proposed by Piotroski and So (2012) and dismisses the notion that variations in BM ratios are rooted in changes in expected profitability.

Research paper II – *The Cash Premium: Evidence from Real Estate Equities*

The cash premium, which highlights the outperformance of firms with high levels of cash holdings compared to those with lower levels, is a topic of substantial interest within asset pricing research. Evidence of this premium has been observed in both US and global markets (see, for example, Palazzo, 2012; Walkshäusl, 2018; and Li and Luo, 2017). Reasons for this premium remain debated. Initially, Palazzo (2012) attributed the strong stock return performance of high-cash firms to risk factors. However, the explanation that this anomaly is driven by investors' behavioural biases has been gaining traction. Recent research by Li and Luo (2017) suggests that investor sentiment may play a crucial role, particularly highlighting that the cash premium is more pronounced during periods of low sentiment, possibly due to behavioural biases among investors.

In Chapter 3, our research expands on this topic by examining the cash premium in the context of real estate equities, a sector previously excluded on this topic. This approach provides a valuable hold-out sample for testing the robustness of existing findings. We analyse data from both US and international markets to determine if the cash premium observed in nonfinancial firms is also present in real estate equities, which have experienced a worldwide increase in cash holdings over the last thirty years. Moreover, we examine whether the cash premium can be attributed to mispricing, employing the misvaluation variable $XFIN$ proposed by Bradshaw et al. (2006), based on the opportunistic financing theory. This theory suggests that firms are likely to issue new equity when valuations are high and buy back shares when valuations are low. Additionally, we investigate the role of investor sentiment, as constructed by Baker and Wurgler (2006), in our analysis. This is motivated by the hypothesis from Stambaugh et al. (2012) suggesting that long-short investment strategies, which are at least partly related to the exploitation of mispricing, should be affected by the level of investor sentiment.

Our initial results confirm the presence of a cash premium within the real estate equity market. Additionally, our research finds that this cash effect exists solely among mispriced real estate firms. In essence, this means that the superior returns of firms with high cash holdings are due to these firms being undervalued, while the inferior returns of firms with low cash holdings are a result of these firms being overvalued. Furthermore, our findings indicate that investor sentiment only affects the cash premium when the underlying firms are mispriced. This suggests that behavioural biases significantly contribute to the cash premium observed in real estate equities.

Research paper III – *Decomposing the Value Premium in Real Estate Equities*

Exploring the origins of the value premium, particularly whether it is driven by changes in expected returns or expected profitability, gains additional relevance when applied to real estate equities, a sector frequently omitted from financial research. Typically, value firms with high BM ratios are often presumed to possess weaker fundamentals, while growth firms with low BM ratios are associated with stronger fundamental attributes. Therefore, the decomposition of an investment approach that incorporates fundamental strength into the value process presents a particularly compelling analysis. By employing this interaction approach, we not only aim to identify expectation errors in value-growth investment strategies and their subsequent price corrections (e.g., Piotroski and So, 2012), but also seek to provide evidence supporting a mispricing-based explanation for the value premium in real estate equities. Real estate equities offer a unique perspective due to their transparent business models and the direct impact of rental income on stock prices. This transparency, while beneficial for valuation assessments, poses challenges for expectation error-based investment strategies since investment strategies based on expectation errors requires that prices do not timely and accurately reflect the future cash flow implications. This raises the question of the applicability of existing research to the real estate equities. This study aims to reconcile the characteristic transparency of real estate equities with the effectiveness of such strategies, providing insights into the application of existing research to the real estate market.

In Chapter 4, we clarify why international and US real estate firms transition between value and growth using the present value model initially introduced by Cohen et al. (2003). We extend our analysis to employ decomposition model to decompose the cross-sectional variance of BM ratios of high-profit and low-profit real estate firms. Finally, we conduct a decomposition approach conditional on both firm characteristics, BM and firm profitability.

Our initial results align with Cohen et al. (2003), indicating that firms move between value and growth based on changes in expected profitability, rather than expected returns. The difference in BM ratio between high-profit and low-profit real estate firms is due to opposite reasons than value, primarily because the market deems these profitable firms as overvalued, resulting in a subsequent decline in their valuation. Yet, when analysing the interactions between BM ratios and firm profitability, we notice significant differences in the expected return component across various value-growth samples. For real estate firms that exhibit attributes in their business fundamentals contrary to market expectations, we find that changes in current BM ratios are not solely linked to expected profitability, but to a higher magnitude to variations in expected return supporting that mispricing drives the value premium.

The first research study presented below is published in an academic journal, while the last two papers are under review at the date of the submission of this thesis. Minor formal differences in the presentation of the three papers may be present, which is due to differences regarding style requirements employed by the respective journal.

Contributions

Contribution paper I – *Dissecting Value-Growth Strategies Conditioned on Expectation Errors*

The study contributes to the field of asset pricing by providing empirical support for a mispricing-based explanation of the value premium in non-US equity markets. A key finding of our study is the importance of Piotroski and So's (2012) market expectation errors approach to value-growth investing across equity markets. By decomposing the BM ratios of value and growth firms, the study — to the best of our knowledge — is the first that differentiates the impacts of cash-flow expectations from mispricing incorporating $FSCORE$ with BM ratios.

The research tests two main hypotheses: the first hypothesis tests that an investment strategy favouring value firms with strong fundamentals over growth firms with weak fundamentals would yield superior returns. The second hypothesis suggests that the cross-sectional variation in BM ratios, particularly among firms exposed to expectation errors, reflects differences in expected returns rather than expected profitability. This indicates that the observed value premium arises from market corrections.

The findings underscore that the value premium stems from corrections in mispricing rather than merely from differences in expected profitability. This insight offers a practical approach for investors aiming to capitalise on this anomaly by focusing on firms' fundamental strengths. In essence, the study enriches the asset pricing debate by affirming that the value premium in international markets is attributable to mispricing arising from the reversal of investors' expectation errors. In particular, value firms with strong fundamentals outperform growth firms with weak fundamentals by more than 16% per year, a margin significantly higher than the typical return premium linked to the traditional value-growth strategy that relies solely on BM. Thus, our findings hold considerable importance for portfolio managers.

Contribution paper II – *The Cash Premium: Evidence from Real Estate Equities*

The study presents an analysis of the cash premium in real estate equities, building on previous research that mainly examined nonfinancial firms. It confirms the substantial outperformance of firms with high cash holdings, a trend that is consistent across 21 developed markets globally, including the international and US real estate markets from 1990 to 2018. The positive relationship between cash and return demonstrates a similar market mechanism between real estate and nonfinancial equities. Real estate equities, with their unique characteristics such as transparency, homogeneity of earnings, and the strategic advantage of holding cash in an inherently illiquid market, have specific implications for this relationship.

The research tests two main hypotheses: the first hypothesis tests that real estate equities with high cash holdings outperform those with low cash holdings. The study confirms the positive cash-return relation through cross-sectional regression analysis. The second hypothesis tests the role of mispricing in this cash-return relationship, suggesting that the outperformance of firms with high cash holdings could be attributed to systematic mispricing. The study finds significant return effects for mispriced strategies, particularly when investor sentiment is low, thus supporting a mispricing-based explanation for the cash premium.

This work contributes to the literature by demonstrating the cash premium's presence beyond nonfinancial sectors, specifically within real estate equities, and suggests that the phenomenon can be attributed to mispricing rather than risk factors. To the best of our knowledge, this paper is the first to demonstrate this phenomenon for real estate equities. Moreover, this study offers novel insights into the cash-return effect in real estate, suggesting a broader applicability of the cash premium puzzle and highlighting the importance of considering mispricing and investor sentiment in understanding market behaviours. This has implications for investors, executives, and policymakers, providing a basis for more informed decision-making in portfolio management, corporate strategy, and regulation.

Contribution paper III – *Decomposing the Value Premium in Real Estate Equities*

This study investigates the value premium in real estate equities, focusing on the role of BM ratios and whether the premium is driven by differences in expected earnings or mispricing. By analysing real estate firms, which have been largely excluded from prior research, the paper aims to understand the dynamics behind firms transitioning between value and growth statuses.

The research employs a decomposition approach, considering BM ratios and firm profitability, to examine if the value premium results from accurate market expectations about future earnings or from systematic mispricing related to firms' fundamental strengths. To the best of my knowledge, this paper is the first to decompose the BM ratio of real estate equities. Real estate equities, known for their transparent business models and cash flows based on rental income, serve as a test case for evaluating the applicability of expectation error-based investment strategies in markets known for their transparency.

The study tests two main hypotheses: the first hypothesis tests that market prices reflect differences in expected earnings growth, supporting the idea that firms transition between value and growth due to expected profitability. The second hypothesis tests that mispricing, especially in the presence of expectation errors regarding firms' fundamentals, drives the value premium.

The paper underscores the significance of considering fundamental strengths in distinguishing between value and growth firms, suggesting that mispricing contributes to the value premium in real estate equities similar to nonfinancial equities. This insight is vital for real estate portfolio managers, highlighting the importance of incorporating firm fundamentals into valuation processes for optimised portfolio construction.

Structure

This thesis is comprised of three distinct research papers, the first two with different co-authors. The details regarding the co-authors and the current status of the research papers are provided at the beginning of each respective chapter. Chapter 2 introduces the first paper, titled *Dissecting Value-Growth Strategies Conditioned on Expectation Errors.* Chapter 3 discusses the second paper, *The Cash Premium: Evidence from Real Estate Equities.* The third paper, *Decomposing the Value Premium in Real Estate Equities*, is presented in Chapter 4. The concluding chapter summaries the findings of these papers and offers an outlook on future research directions.

Chapter 2

Dissecting Value-Growth Strategies Conditioned on Expectation Errors

This chapter is joint work with Ulrich Wessels and published as:

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We examine the previously documented effect between a firm's FSCORE and book-to-market ratio proposed by Piotroski and So (2012) and analyze the authors' expectation errors hypothesis from a present value perspective. We find a strong value premium which is concentrated among firms where book-to-market implied expectations are incongruent with underlying fundamental strength. Using the decomposition of variation in book-to-market ratios motivated by Cohen et al. (2003), we show that the observed effect between a firm's FSCORE and book-to-market ratio is attributable to mispricing as the variation is mostly due to variation in expected returns rather than variation in expected profitability.

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2.1. Introduction

The empirical observation that firms with high book-to-market (BM) ratios outperform firms with low BM ratios — defined as the value premium — dates almost 30 years back to the seminal paper of Fama and French (1992). Since then, the value premium has been one of the most examined return anomalies in asset pricing history. Despite this enormous effort, the explanation for the existence of the value premium is still an ongoing debate. Contrary to the risk-based explanation motivated by Fama and French (1992), a growing strand of literature, starting with Lakonishok et al. (1994), provides evidence that the value premium is the result of behavioral biases of market participants. A prominent behavioral explanation is that high (low) values on BM signal pessimistic (optimistic) expectations concerning a firm's future earnings performance, reflecting investor's tendencies to over-react to past fundamentals. These biased expectations systematically reverse in response to latest information, giving rise to positive value-growth returns (see, Porta et al., 1997; Griffin and Lemmon, 2002; Ali et al., 2003, among others).

Building upon the findings that the value premium is attributable to systematic errors in expectation and subsequent price correction, Piotroski and So (2012) propose a seminal investment strategy approach that combines firms' BM ratio with Piotroski's (2000) accounting-based measure FSCORE. The FSCORE serves as an indicator of a firm's fundamental strength, where strong fundamentals are expressed by high values on FSCORE and weak fundamentals by low values on FSCORE. Defining investors' systematic errors in expectation as market expectation errors, revisions of these expectation errors are shown to be ex ante existent when expectations implied by the BM ratio are incongruent with the actual fundamental strength of the firm. Analyzing the US market, Piotroski and So (2012) document that the value premium is most pronounced among firms exposed to expectation errors but absent among firms without these expectation errors.

Since then, the application of the FSCORE to proxy for a firm's underlying fundamental strength has become increasingly popular. For example, Ng and Shen (2016) and Walkshäusl (2017) provide extensive out-of-sample evidence in favor of the results of Piotroski and So (2012) for international markets, suggesting that investor's expectation errors indeed explain the value premium. Tikkanen and Äijö (2018) show that a similar effect can be observed when the FSCORE is combined with other fundamental valuation ratios. Besides beneficial interaction effects, Hyde (2018), Ng and Shen (2019), and Walkshäusl (2020) provide evidence that the FSCORE itself is informative regarding expected returns. Finally, a FSCORE-based investment strategy is even able to explain priced-based anomalies such as momentum among US (Ahmed and Safdar, 2018) and European stocks (Walkshäusl, 2019).

Piotroski and So (2012) argue for a mispricing-based explanation for the observed value-growth returns, as expectation error-based value premium cannot be explained by common risk factors but is related to a correction of market expectations. However, given that the FSCORE captures information about a firm's fundamental strength, the FSCORE strongly correlates with a firm's expected profitability (Piotroski, 2000). This, in turn, raises the question whether the observed value premium is ultimately due to mispricing or just the result of differences in expected profitability. Cohen et al. (2003) confirm such a relationship between the BM ratio and expected profitability among value-growth firms, as market valuations are assumed to be driven by rational cashflow expectations rather than by expected stock returns and thus by mispricing. The present value model, proposed by Cohen et al. (2003), allows us to decompose a firm's current BM ratio into the following components: expected stock return, expected profitability, and future BM ratio. Building upon the clean-surplus accounting relations, they derive an approximation:

$$bm_{t-1} = \sum_{j=1}^{N} \rho^j r_{t+j} - \sum_{j=1}^{N} \rho^j e_{t+j} + \rho^{N+1} bm_{t+N} \tag{2.1}$$

where bm, r and e are the log BM ratio, log stock return, and the log clean-surplus accounting profitability, respectively, while ρ represents a positive discounting parameter close to one.[1] According to their framework, most of the cross-sectional variation in BM ratios can be linked to differences in expected profitability, proxied by the clean-surplus profitability measure, suggesting that firm-level stock returns are mainly driven by changes in cash-flow expectations, not by changes in expected returns.

Given that the value premium is stronger among those firms exposed to expectation errors, it becomes unlikely that rational cashflow expectations alone account for the ob-

[1] A detailed derivation of this expression is provided in the Appendix.

served value effect. Investors expecting value stocks with strong fundamentals to have higher cashflow expectations compared to growth stocks with weaker fundamentals seem unlikely. Thus, the interaction of BM and FSCORE as part of the BM decomposition approach could provide supportive evidence that mispricing drives the value premium. In particular, we adopt two different present value model approaches to ascertain whether the observed return behavior in non-US equities is consistent with the mispricing-based interpretation or due to differences in expected profitability. We pursue explanations based on the BM decomposition approach of Cohen et al. (2003) and the decomposition approach of Fama and French (2008). Fama and French (2008) decomposes the BM ratio into past changes in price, past changes in book equity, and past change in BM ratio, examining whether those components can predict stock return.

Beginning with the BM decomposition approach of Cohen et al. (2003), we decompose the BM ratios of value and growth firms to analyze the value premium from a cashflow-driven perspective and then expand on these decomposition results by examining how the FSCORE affects value-growth portfolios. Next, employing the Fama and French (2008) decomposition, we examine whether the components of the BM itself, in terms of past changes in price and book equity can predict expected returns. Specifically, we examine which of the components are distinct and which have little marginal ability to explain the expectation error-based value premium.

Specifically, we test the following two hypotheses in non-US equity markets. The first hypothesis directly addresses the finding that the value premium should be present among firms exposed to expectation errors but absent among firms without these expectation errors.

H1: A strategy which buys value firms with strong fundamentals and sells growth firms with weak fundamentals will outperform a strategy which buys value firms with weak fundamentals and sells growth firms with strong fundamentals.

To determine whether the observed value premium is due to mispricing or just the result of differences in expected profitability, we analyze the relationship between FS-CORE and the value from a present value perspective. If expectation error-based value premium is indeed due to mispricing, the BM ratios of value and growth firms exposed to expectation errors should not only contain information about cash-flow expectations but also about expected stock returns due to correction of market expectations. Therefore, we formulate our second hypothesis as follows.

H2: Cross-sectional variation in BM ratios of value firms with strong fundamentals and growth firms with weak fundamentals is due to cross-sectional variation in expected returns rather than cross-sectional variation in expected profitability.

Our key empirical result is that the cross-sectional variation in the BM ratio is not solely linked to expected profitability, but also to variation in expected return among firms exposed to expectation errors. Moreover, the power of explaining expected returns through changes in prices surpasses that of changes in book equity among firms exposed to expectation errors. These findings provide supportive evidence to a mispricing-based explanation which is central to our paper.

The remainder of the paper is organized as follows: The next section describes the data and variables used in this study. The subsequent sections test the outlined hypotheses, discuss the outlined methodology, and present the empirical results. The final section concludes.

2.2. Data and variables

Motivated by the well-known stock market benchmark MSCI EAFE (Europe, Australia, and the Far East), our sample comprises firms from 20 developed non-US equity markets, which represents an adequate dataset to proxy for foreign stock market performance outside of North America. We collect monthly total return data on common stocks from Datastream and corporate-level accounting data from Worldscope. To ensure that our empirical analysis does not suffer from a lookahead bias, we employ a six-month time lag and match the latest accounting information for the fiscal year ending of the previous year with stock returns from July of the current year to June of the subsequent year throughout the paper. All data are denominated in US dollars. In line with Ang et al. (2009), we exclude 5% of firms with the lowest market value of equity in each country per year to reduce the possibility that our results are biased by tiny and illiquid stocks. Additionally, as in Fama and French (1992), we treat firm-year observations with negative book equity as missing values and exclude financial firms with Standard Industrial

Table 2.1: Summary statistics

Panel A: Sample countries

Country	Firms	Country	Firms
Australia	506	Japan	1645
Austria	30	Netherlands	88
Belgium	43	New Zealand	48
Denmark	72	Norway	84
Finland	69	Portugal	26
France	330	Singapore	258
Germany	258	Spain	59
Hong Kong	405	Sweden	158
Ireland	29	Switzerland	109
Italy	127	United Kingdom	818

Panel B: Variables

	SZ	BM	FSCORE	OP	INV
Mean	1352	0.91	5.60	0.75	0.10
25th	48	0.42	4.55	0.28	−0.04
50th	163	0.73	5.69	0.54	0.05
75th	681	1.20	6.79	0.94	0.16

This table shows summary statistics for the countries covered in the international (EAFE) sample and the variables used in the study. Panel A reports the average amount of firms per month within a country over the sample period from July 1990 to June 2018. Panel B reports the distribution of the variables. The statistics include mean, 25th percentile, median, and 75th percentile. Firm size (SZ) is measured as market value of equity (stock price multiplied by the number of shares outstanding) as of the end of June of each year in million US dollars. Book-to-market (BM) measures the ratio of a firm's book equity to market equity at the fiscal year-end. FSCORE is an aggregate accounting-based measure of the firm's fundamental strength. Operating profitability (OP) is revenues minus cost of goods sold and interest expense, all divided by book equity. Investment (INV) is the annual change in total assets scaled by total assets.

Classification (SIC) codes between 6000 and 6999 from the sample. Finally, we require that all accounting information necessary to calculate the FSCORE is available for the fiscal year ending in the previous year to be included in the sample. Our data sample covers the period from July 1990 to June 2018 (henceforth 1990–2018) and, on average, consists of 5162 firms per year. Panel A of Table 2.1 contains the summary information regarding the distribution of firms across countries.

We define a firm's size as its market equity (calculated by multiplying the stock price by total outstanding shares) measured as of June each year in million US dollars. BM is a firm's book equity relative to its market equity at the fiscal year-end. Operating profitability (OP) is revenues minus operating expenses (cost of goods sold and interest expense) scaled by book equity Fama and French (2015). Investment (INV) is the annual change in total assets scaled by the prior year's total assets. Following Piotroski (2000), the FSCORE indicator comprises nine individual binary signals measuring various aspects of a firm's fundamental strength. A signal is equal to one if the underlying condition is favorable and zero otherwise. The nine signals are defined as follows. (1) return-on-assets (net income before extraordinary items scaled by lagged total assets) is positive, (2) annual change in return-on-assets is positive, (3) operating cash flow scaled by lagged total assets is positive, (4) operating cash flow is greater than net income before extraordinary items, (5) the annual change in long-term debt scaled by average total assets is negative, (6) the annual change of a firm's current ratio (current assets to current liabilities) is positive, (7) a firm did not issue equity, (8) the annual change of a firm's gross margin (sales minus cost of goods sold scaled by sales) is positive, and (9) the annual change in a firm's asset turnover (total sales scaled by lagged total assets) is positive.

Panel B of Table 2.1 summarizes the distributional statistics of the variables outlined before over the 1990–2018 sample period. A typical firm in our international sample has a size of $1352 million in terms of market equity, an average relative valuation based on book-to-market of 0.91, and an average FSCORE of around five, which signals a medium fundamental strength.

2.3. Return behavior of value-growth strategies conditioned on expectation errors

In this section, we test hypothesis H1 that value-growth firms exposed to expectation errors outperform value-growth firms with no exposure to expectation error. Thus, we examine whether the correction of market expectations leads to the realization of the value premium.

We begin our analysis at the portfolio level using univariate and bivariate sorts. Applying univariate portfolio sorts based on the BM ratio and FSCORE allows us to assess return premia associated with value and a firm's fundamental strength in international equity markets on a standalone basis. Then, using bivariate portfolio sorts based on the BM ratio and FSCORE, value-growth returns are evaluated upon the degree to which implied expectations are consistent with underlying fundamentals. Portfolios are formed annually at the end of June of the current year by ranking stocks based on BM, FSCORE, and both variables from fiscal year ending in the previous year. A firm is designated as a growth, neutral, or value stock if its BM is in the bottom 30th percentile, between the 30th percentile and 70th percentile, or in the top 70th percentile, respectively. A firm is designated as a weak, medium, or strong stock if its FSCORE is below three, between four and six, or above six, respectively. We track the subsequent equal-weighted monthly returns for each portfolio from July of the current year to June of the subsequent year.

Panel A of Table 2.2 shows average monthly equal-weighted returns and firm characteristics for the single portfolio sorts. When portfolios are sorted by BM or FSCORE, we find statistically significant and economically large return spreads in international equity markets. Value firms with high BM ratios outperform growth firms with low BM ratios by 0.58% per month over the whole sample period. Fundamentally strong firms with a high FSCORE generate a significant return spread of 0.64% per month over fundamentally weak firms with a low FSCORE. In line with prior research, value firms, on average, display a smaller market capitalization, lower profitability, and lower investments compared to growth firms (e.g., Fama and French, 2015). Considering the portfolio sorts on the FSCORE characteristic, fundamentally strong firms are larger in terms of market equity and display higher profitability than fundamentally weak firms (e.g., Fama and French, 2006), whereas investment does not differ meaningfully within the sorts. However, both portfolio sorts indicate that there is no meaningful relation between the BM and FSCORE characteristic.

To examine the impact of market expectation errors, we further study the interaction of BM with FSCORE using bivariate sorts. We follow Piotroski and So (2012) and build value-growth portfolios alongside different dimensions of expectation errors. Firms with high BM ratios are generally expected to have weak fundamentals, while firms with low BM ratios are expected to have strong fundamentals. Therefore, a strategy which takes a long position in value firms with weak fundamentals and a short position in growth firms with strong fundamentals is not exposed to expectation errors. Contrary to that, a strategy which takes a long position in value stocks with strong fundamentals and a short position in growth stocks with weak fundamentals is exposed to expectation errors. In between, value firms with medium fundamental strength and growth firms with medium fundamental strength are potentially exposed to expectation errors.

Table 2.2: Portfolio sorts

Panel A: Univariate Sorts								
Book-to-Market								
Portfolio	Return	*(t-stat)*	Characteristics					
			BM	SZ	OP	INV	FSCORE	Firms
Growth	0.62		0.29	2026	1.12	0.20	5.46	1549
Neutral	0.83		0.74	1354	0.70	0.11	5.70	2065
Value	1.20		1.76	380	0.48	0.04	5.60	1549
V-G	0.58	*(4.27)*						
FSCORE								
Weak	0.47		0.95	576	0.60	0.10	2.54	646
Medium	0.84		0.91	1331	0.77	0.12	5.15	2856
Strong	1.10		0.91	1360	0.82	0.11	7.47	1660
S-W	0.64	*(3.99)*						
Panel B: Bivariate Sorts								
Growth × Weak	0.18		0.26	723	0.98	0.18	2.51	236
Growth × Medium	0.62		0.29	2109	1.16	0.21	5.13	870
Growth × Strong	0.84		0.31	2452	1.19	0.18	7.44	443
Value × Weak	0.77		1.90	257	0.34	−0.01	2.56	193
Value × Medium	1.11		1.77	421	0.48	0.04	5.15	846
Value × Strong	1.36		1.70	336	0.55	0.05	7.49	510
No Expectation Errors	−0.07	*(−0.40)*						
Potential Expectation Errors	0.49	*(3.72)*						
Existent Expectation Errors	1.19	*(5.11)*						

This table shows average monthly equal-weighted returns in percent. In Panel A, we sort stocks based on BM or FSCORE. In Panel B, we sort stocks based on BM and FSCORE. For both panels, the portfolio formation is based on the relevant variable(s) at the ending of the fiscal year in the preceding calendar year. A firm is characterized as Growth, Neutral, or Value if its BM ratio is below the 30th percentile, between the 30th and 70th percentiles, or above the 70th percentile, respectively. A firm is characterized as Weak, Medium, or Strong if its FSCORE is less than or equal to three, between four to seven, or greater than or equal to seven, respectively. The standard value strategy (V-G) takes a long position in value firms and a short position in growth firms. The standard FSCORE strategy (S-W) takes a long position in fundamentally strong firms and a short position in fundamentally weak firms. A stock is assigned to the no expectation errors portfolio if its BM is congruent with the fundamental strength (Growth × Strong or Value × Weak). A stock is assigned to the existent expectation errors portfolio if its BM is incongruent with the fundamental strength (Growth × Weak or Value × Strong). Growth and value stocks with medium FSCORE are assigned to the potential expectation errors portfolio. Newey and West (1987) adjusted t-statistics for the return premia are given in parentheses. The table also reports average firm characteristics as well as the average amount of firms observed per month.

Panel B of Table 2.2 reports average monthly equal-weighted returns for bivariate sorts based on BM and FSCORE and the return spreads for the three different value-growth portfolios. We observe that bivariate FSCORE sorts induce significant return variation within value firms as well as growth firms. The return spreads between firms with value and weak fundamentals are significantly different from zero regardless of the BM categorization. Likewise, value firms significantly outperform growth firms after controlling for FSCORE. The results imply that the information about expected returns contained in the BM ratio and FSCORE is different. Turning to the results for the three value-growth portfolios with different degrees of implied expectation errors, we observe that the combination of BM and FSCORE has major influence on the value-growth relationship in international equity markets. If a firm's fundamental strength is congruent with its BM implied expectations, that is value firms which are expected to have weak fundamentals actually have a low FSCORE and growth firms which are expected to have strong fundamentals actually have a high FSCORE, the previously observed return spread between value-growth firms decreases from 0.58% to −0.07% per month and is no longer distinguishable from zero. Contrary to that, if we consider the value-growth strategy with existent expectation errors, the return spread even increases to a highly significant premium of 1.19% per month. In line with the expectation error hypothesis, the portfolio consisting of value and growth firms with a medium FSCORE which implies that there exist potential expectation errors, generates a significantly positive return premium of 0.49% per month. To summarize our results, which are consistent with prior evidence for the US and Europe, the combination of BM and FSCORE allows one to ex ante identify value and growth firms with existent market expectation errors, enhancing the returns compared to a traditional value-growth strategy in international equity markets by 0.61% per month.

As described above, there is considerable variation regarding the average firm characteristics induced by bivariate FSCORE sorts, which ultimately raises the question whether the observed return effects are potentially biased by other well-known return determinants. It is conceivable that these firm characteristics could at least explain parts of the premium. Thus the identified FSCORE effect would no longer be pronounced on a risk-adjusted basis. To address this concern, we further study the interaction effects of BM and FSCORE in a cross-sectional setting at the individual firm-level by using the methodology proposed by Fama and MacBeth (1973). In line with our motivation to decompose

BM ratios, we are particularly interested in how the BM ratios of the three value-growth portfolios displayed in Table 2.2 are priced in a cross-sectional setting. Therefore, we estimate the following cross-sectional regression within four restricted specifications:

$$\begin{aligned} r_{i,t} = a_{0,t} + a_{1,t}BM_{i,t} + a_{2,t}\ln(SZ_{i,t}) + a_{3,t}OP_{i,t} \\ +a_{4,t}INV_{i,t} + CountryDummies_{i,t} + e_{i,t} \end{aligned} \tag{2.2}$$

Based on the univariate BM sorts, specification (1) comprises all value and growth firms in our overall data sample. We further split up this sample based on a firm's FSCORE categorization to create three subsamples with similar distributional statistics regarding BM ratios but with varying degrees of expectation errors which resemble the three value-growth strategies outlined in Table 2.2. Specification (2) comprises value firms with weak fundamentals and growth firms with strong fundamentals. Accordingly, expectation errors due to the misalignment of BM implied fundamentals and actual fundamentals should not exist. Contrary to that, specification (4) is constructed on the premise to maximize expectation errors and, therefore, includes value firms with strong fundamentals and growth firms with weak fundamentals. In between, specification (3) captures all value and growth firms with medium fundamentals and contains potential expectation errors. The purpose of conducting these various cross-sectional regressions with independent samples is to demonstrate how firm characteristics are priced in the different value-growth strategies. Based on our observation in Table 2.2, we also conduct difference-of-means tests on cross-sectional regression estimates to examine whether the observed return-variable relations differ across the subgroups. Following the most recent developments in asset pricing, the set of common firm characteristics includes firm size, BM, operating profitability, and investments (Fama and French, 2015). To control for possible country effects, we include country dummies in all regression specifications. The explanatory variables are updated annually at the end of each June in the previous calendar year.

We start by discussing specification (1) of Table 2.3, which relates the conventional value-growth returns to firm characteristics. For the standard value strategy, all coefficient estimates are significant except for firm size, indicating that most explanatory variables provide useful information about the cross-section of value-growth returns. Unsurprisingly, we find that returns are positively associated with BM and profitability, while they are negatively associated with corporate investments, which is consistent with recent international evidence (e.g., Fama and French, 2012; Fama and French, 2017). In a second step, we examine the return behavior of value-growth strategies formed along market expectation errors. Specification (2) presents the results for the value-growth subsample, which is not exposed to expectation errors, while specification (3) includes the value-growth subsample which is potentially exposed. Finally, specification (4) shows the results for the value-growth subsample with existing expectation errors. First, we observe a strong relationship between the level of implied expectation errors and the value premium after controlling for common return determinants. The BM coefficient estimate in specification (2) is statistically indistinguishable from zero, which implies that, although the subgroup solely consists of firms categorized as value and growth firms, there exists no value premium if implied expectations are aligned with a firm's fundamental strength. In contrast, the BM coefficient estimate becomes positive and statistically significant for value and growth firms within the potential-mispricing and mispricing subsample, indicating that the existence of a value premium strongly relates to market expectation errors. Second, the difference-of-means tests in the last three columns of Table 2.3 show that the average book-to-market estimates within the three subgroups of value-growth firms are statistically different from each other, while the return premia associated with the other firm characteristics do not differ across the subgroups, indicating that the relation between the value-premium and market expectation errors is not driven by other return effects. The sole exception is firm size in the case of specification (4), suggesting a statistically negative impact on expected returns when value and growth firms implied expectation is incongruent to underlying fundamentals. Taken together, the results in Section 2.3 strongly support hypothesis H1. Similar to Piotroski and So (2012), our results indicate that the value premium is strongest for firms with expectation errors, while it is absent for firms without these expectation errors.

2.4. Analysis of expectation errors from a present value perspective

In this section, we test hypothesis H2 that variation in the current BM ratio is attributable to variation in expected stock returns among firms with existent expectation error. To determine whether the observed value premium is due to mispricing or merely the result

Table 2.3: Regressions of value-growth return differences on firm characteristics

	Regression estimates				Difference-of-means tests		
Specification	(1)	(2)	(3)	(4)	(4)−(2)	(4)−(3)	(3)−(2)
Sample	Value & Growth	No Expectation Errors	Potential Expectation Errors	Existent Expectation Errors			
BM	0.34	0.13	0.35	0.57	0.44	0.21	0.22
	(5.00)	*(1.32)*	*(5.42)*	*(5.13)*	*(3.16)*	*(2.40)*	*(2.81)*
SZ	−0.01	−0.02	−0.01	−0.08	−0.07	−0.07	0.01
	(−0.50)	(−0.57)	(−0.44)	(−2.52)	(−2.25)	(−2.99)	(0.25)
OP	0.07	0.08	0.05	0.10	0.02	0.05	−0.03
	(2.99)	*(2.63)*	*(1.97)*	*(2.35)*	*(0.42)*	*(1.36)*	*(−1.04)*
INV	−0.35	−0.40	−0.31	−0.50	−0.10	−0.19	0.08
	(−4.52)	*(−2.90)*	*(−3.39)*	*(−4.19)*	*(−0.62)*	*(−1.46)*	*(0.75)*
R^2	0.08	0.10	0.09	0.10			
Firms	3098	636	1716	746			

This table shows average coefficient estimates and their corresponding Newey-West adjusted t-statistics (in parentheses) from cross-sectional regressions. We report return differences for each value strategy, as well as difference-of-means tests on the average slopes between the strategies. All regressions are estimated monthly, using firm characteristics at the end of June to explain returns for July through to June of the subsequent year. The set of firm characteristics includes book-to-market (BM), firm size (SZ), operating profitability (OP), investment (INV), and country dummies. The R^2 value is adjusted for degrees of freedom. The final row reports the average number of sample firms for each year. A stock is assigned to the no expectation errors portfolio if its BM is congruent with the fundamental strength (Growth × Strong or Value × Weak). A stock is assigned to the existent expectation errors portfolio if its BM is incongruent with the fundamental strength (Growth × Weak or Value × Strong). Growth and value stocks with medium FSCORE are assigned to the potential expectation errors portfolio.

of differences in expected profitability, we first decompose the BM ratios of value and growth firms to analyze the value premium from a cashflow-driven perspective and then extend the decomposition results by examining how the FSCORE affects value-growth portfolios using the present value model, which explicitly proxies for systematic mispricing.

We use a similar decomposition approach as in Cohen et al. (2003) to relate a firm's current BM ratio to its expected return, expected profitability, and future BM ratio. Using Equation (2.1), the firm-level variance of BM equals

$$var(\tilde{bm}) \approx \sum_{j=1}^{N} cov\left(\tilde{r}_{t+j}, \tilde{bm}_{t-1}\right) + \sum_{j=1}^{N} cov\left(-\tilde{e}_{t+j}, \tilde{bm}_{t-1}\right) + \rho^{N+1} cov\left(\tilde{bm}_{t+N}, \tilde{bm}_{t-1}\right) \tag{2.3}$$

Scaling both sides by the cross-sectional variance of $\tilde{bm}_{t-1}$ gives each determinant's percentage weight, i.e., the extent to which differences in valuation ratios are associated with expected profitability and stock returns. We use tildes to denote cross-sectionally demeaned quantities in Equation (2.1) and use the Fama and MacBeth (1973) methodology to estimate the covariances in Equation (2.3).

Table 2.4 shows the average coefficient estimates of the decomposition for all value and growth firms within our data sample to gain a first impression as to what kind of information is priced into current BM ratios. The first column presents the increasing time horizon N, while the remaining three columns relate to the three components of the BM function presented in Equation (2.1). We estimate the average coefficients of Equation (2.1), beginning at the one-year horizon ($N = 1$) up to a five-year horizon ($N = 5$), to examine how the decomposition results vary over time. At the one-year horizon, 91% of the cross-sectional variation in BM ratios is due to variation in future BM ratio, 11% is due to variation in expected profitability, and −2% is due to variation in expected returns. The negative sign on the expected return component indicates that an increase in expected returns entails, on average, an even stronger increase in cash flow expectations, thereby resulting in a lower BM ratio today. Not surprisingly, the statistical significance of these weights varies considerably. The table shows that the components concerning

Table 2.4: Decomposition of cross-sectional variation of BM ratios

Estimated weightings	$\rho = 0.91, var(bm) = 0.69$		
Horizon (N)	Expected returns	(−) Expected profitability	Future BM
1	−0.019 *(−1.83)*	0.105 *(18.91)*	0.907 *(100.87)*
2	0.018 *(1.22)*	0.190 *(24.93)*	0.772 *(57.30)*
3	0.039 *(2.06)*	0.256 *(27.85)*	0.673 *(38.04)*
4	0.056 *(2.64)*	0.309 *(31.28)*	0.595 *(32.08)*
5	0.070 *(2.97)*	0.356 *(33.97)*	0.525 *(28.08)*

This table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international (EAFE) sample during the period from 1990 to 2018. The first row presents a one-year decomposition, the second row a two-year decomposition, and so forth. Each estimate is the percentage of variation explained by the factor indicated by the column. We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. Robust Newey and West (1987) t-statistics for the average estimates are given in parentheses.

expected profitability and future BM ratio are statistically significant, while the negative variation with expected returns is not statistically different from zero. At the five-year horizon, about half of the variation (53%) is due to future BM ratios, 36% is due to profitability and only 7% is due to stock returns. Hence, most of the cross-sectional variation in BM ratios is still explained by future BM ratios. However, as the time horizon of our decomposition increases, the future BM component is steadily losing its importance and we observe a substantial increase in the fraction of variation in expected profitability that can be explained by variation in current BM ratios. The relative contribution of expected returns increases as well, however, it plays only a minor role compared to expected profitability as the horizon lengthens. As a result, the three weights are statistically significant, despites considerable differences in the magnitude of these weights. Our baseline decomposition is consistent with prior US evidence. Cohen et al. (2003) report that, at the 5-year horizon, 50% of BM information is about future BM ratios, 38% about expected profitability, and the remaining 12% about expected returns. From a price-level perspective, our results suggest that most of a value (growth) stock's valuation is due to low (high) expected profitability rather than due to a high (low) expected return.

After having established that a major part of the cross-sectional variation in BM ratios can generally be attributed to variation in expected profitability as the horizon lengthens, we now examine the influence of a firm's FSCORE on the decomposition results of

BM ratios. The way FSCORE is designed to capture a firm's fundamental strength, a high FSCORE strongly correlates with a firm's expected profitability. This raises the question whether the observed value premium among value firms with strong fundamentals and growth firms with weak fundamentals versus the non-existent value premium among value firms with weak fundamentals and growth firms with strong fundamentals is ultimately due to mispricing or simply the result of differences in expected profitability.

Table 2.5 shows the average coefficient estimates of the BM decomposition for our three subsamples. The results for the portfolio consisting of value and growth firms which are potentially exposed to expectation errors are similar to the decomposition results for the full sample shown in Table 2.4 and confirm the observation that, in general, expected profitability is more informative about the variation in current BM ratios. However, when inspecting the two subgroups of value and growth firms with no expectation errors and existent expectation errors, respectively, strong differences become clear. First, for value and growth stocks exposed to expectation errors, 31% of the variation in current BM ratios is due to expected stock returns at the five-year horizon. The corresponding number for value and growth stocks which are not exposed to expectation errors is only 4% and not statistically different from zero.

Second, for exposed stocks, the importance of expected profitability remains relatively low. Between the time horizon of one to five years, zero to 18% of the variation in current BM ratios is attributable to expected cash-flows, respectively. In contrast, for stocks without expectation errors, the contribution of expected profitability increases from 20% to 44% as the forecasting horizon lengthens from one to five years.

As the return component in the decomposition is given by the product $b(\tilde{r}, N)\tilde{bm}_{k,t-1}$, a large variation in expected returns is either the result of $b(\tilde{r}, N)$ or the result of a large variance in $\tilde{bm}_{k,t-1}$.[2] This implies that our results could be driven by differences in the average cross-sectional variance of BM ratios in the three subsamples. Consequently, stocks in our mispriced portfolio show a stronger value premium because their BM ratios are more dispersed compared to the other subsamples and not because their BM ratios are more informative about expected returns. However, the difference in variance between the non-mispriced portfolio and mispriced portfolio is not substantial in our case as the average cross-sectional variance of BM ratios equals 0.55 and 0.51, respectively.

[2]See Equation (2.10) in the Appendix.

Table 2.5: Conditional decomposition of cross-sectional variation of BM ratios

	No Expectation Error $\rho = 0.90, var(bm) = 0.55$			Potential Expectation Error $\rho = 0.91, var(bm) = 0.69$			Existent Expectation Error $\rho = 0.94, var(bm) = 0.51$		
Horizon (N)	Expected returns	(−)Expected profitability	Future BM	Expected returns	(−)Expected profitability	Future BM	Expected returns	(−)Expected profitability	Future BM
1	−0.068	0.196	0.869	−0.024	0.104	0.913	0.175	0.000	0.819
	(−3.38)	*(20.89)*	*(55.50)*	*(−2.45)*	*(20.81)*	*(98.99)*	*(12.11)*	*(−0.03)*	*(51.77)*
2	−0.014	0.274	0.715	0.009	0.195	0.775	0.240	0.076	0.667
	(−0.68)	*(27.92)*	*(45.90)*	*(0.60)*	*(25.42)*	*(56.82)*	*(10.72)*	*(6.22)*	*(32.52)*
3	0.010	0.338	0.616	0.030	0.263	0.672	0.274	0.124	0.586
	(0.40)	*(28.28)*	*(33.12)*	*(1.49)*	*(26.68)*	*(36.79)*	*(10.40)*	*(7.38)*	*(27.18)*
4	0.012	0.401	0.551	0.051	0.315	0.591	0.302	0.158	0.535
	(0.44)	*(28.49)*	*(26.98)*	*(2.32)*	*(28.29)*	*(31.20)*	*(11.40)*	*(9.83)*	*(23.93)*
5	0.038	0.435	0.476	0.062	0.364	0.521	0.311	0.184	0.493
	(1.22)	*(28.77)*	*(21.91)*	*(2.54)*	*(29.59)*	*(27.98)*	*(10.85)*	*(10.53)*	*(20.13)*

This table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international (EAFE) sample during the period from 1990 to 2018. The first row presents a one-year decomposition, the second row a two-year decomposition, and so forth. Each estimate is the percentage of variation explained by the factor indicated by the column. We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. Robust Newey and West (1987) t-statistics for the average estimates are given in parentheses.

Using the BM decomposition, our results indicate that the observed interaction effect of the BM ratio and FSCORE is due to variation in expected return rather than expected profitability, and thus arguably due to mispricing. Taken together, the results in Section 2.4 strongly support hypothesis H2.

2.5. Dissecting value-growth returns and mispricing

This section presents results obtained using the Fama and French (2008) decomposition approach to identify which components of the BM, in terms of past changes in price and book equity, can explain the expectation error-based value premium. We expect that past changes in price will show distinctive patterns, while past changes in book equity will have little marginal ability to explain the average return among firms with existent expectation error, supporting our second hypothesis and serving as a robustness test for our findings.

The results are reported in Table 2.6 We estimate the Fama and MacBeth (1973) regressions for all value and growth stocks in specifications (1) and (2), and for value and growth stocks which are not exposed to expectation errors in specifications (3) and (4), and those which are exposed to expectation errors in specifications (5) and (6). Estimating separate regressions conditional of expectation errors allows for difference-of-means tests of whether the relations between average returns and different parts of the BM ratio differ across the two groups.

The explanatory variables are updated annually at the end of June to predict monthly returns in excess of the risk-free rate from July to June of the following year. The regression in specifications (1), (3), and (5) predicts the cross-section of monthly stock using the natural log of firm size (SZ) and the natural log of book-to-market (BM) as defined in Table 2.1. The regression in specifications (2), (4), and (6) adds the one-year changes in the logs of price (dme) and book equity (dbe) for the preceding fiscal year. Fama and French (2008) argue that changes in market and book equity include net share issues and, therefore, contains information about future profitability and expected return. Hence, the results of Fama and French (2008) lead us to add the one-year change in the logs of split-adjusted shares outstanding (NS) which controls for net share issues. Positive values on NS indicate issues, and negative values indicate repurchases. In our context, we

Table 2.6: Regression of value-growth returns on BM components

	Regression estimates						Difference-of-means tests
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(6)−(4)
Sample	Value & Growth		No Expectation Errors		Existent Expectation Errors		
Intercept	1.01	1.09	1.03	1.03	1.40	1.38	0.35
	(3.14)	*(3.76)*	*(2.70)*	*(3.00)*	*(3.74)*	*(4.02)*	*(1.73)*
SZ	−0.06	−0.05	−0.08	−0.09	−0.11	−0.11	−0.02
	(−1.70)	*(−1.58)*	*(−2.49)*	*(−2.89)*	*(−2.24)*	*(−2.37)*	*(−0.55)*
BM	0.28	0.26	−0.40	−0.43	0.83	0.77	1.20
	(3.11)	*(3.41)*	*(−4.05)*	*(−4.12)*	*(5.84)*	*(5.88)*	*(7.48)*
dme		−0.21		−0.11		−0.34	0.23
		(−2.44)		*(−0.71)*		*(−2.84)*	*(2.20)*
dbe		0.35		0.52		0.27	−0.25
		(2.89)		*(2.77)*		*(1.67)*	*(−1.42)*
NS		−1.67		−1.54		−1.73	0.19
		(−4.97)		*(−3.76)*		*(3.17)*	*(0.21)*
R^2	0.02	0.02	0.03	0.05	0.04	0.06	

This table shows the average coefficient estimates and their Newey-West adjusted t-statistics (in parentheses) from monthly cross-section regressions to predict stock returns for value and growth stocks, as well as for the no expectation errors and expectation errors portfolio between 1990 and 2018. We report difference-of-means tests on the average slopes between the strategies in the last column. All regressions are estimated monthly, using variables at the end of June to explain returns for July through June of the subsequent year. The variables used to predict returns include the natural log of firm size (SZ) and the natural log of book-to-market (BM) as defined in Table 2.1; *dme* is the change in the logs of price, *dbe* is the change in the logs of book equity, and NS is the change in the logs of split-adjusted shares outstanding. The R^2 value is adjusted for degrees of freedom. A stock is assigned to the no expectation errors portfolio if its BM ratio is congruent with the fundamental strength (Growth × Strong or Value × Weak). A stock is assigned to the existent expectation errors portfolio if its BM ratio is incongruent with the fundamental strength (Growth × Weak or Value × Strong).

suppose that considering NS will enhance the dissection of information about expected cashflows and expected returns.

We start by discussing specification (1) in Table 2.6 For all value and growth stocks, the average estimate BM is strongly positive (t=3.11). Unsurprisingly, we do not find that firm size, SZ, has significant power to predict returns during the sample period. Next, adding the change variables in specification (2), the average estimates on firm size and BM remain similar in magnitude to those in specification (1). The average estimate for changes in price, dme, is strongly negative (t=−2.44) and the average estimate for changes in book equity, dbe, is strongly positive (t=2.89). The remaining variable NS shows strong explanatory power (−1.67, t=−4.97), suggesting that net issues of stocks are associated with lower future return. In line with Fama and French (2008), the estimates for unconditional value and growth stocks favor the conclusion that average returns relate to net share issues since both changes in price and book equity are equally informative about future returns.

The average estimates from (3) to (6) provide tests for value and growth samples conditional on expectation errors. When comparing the two subgroups of value and growth firms with no expectation errors and existent expectation errors, our focus centers on specifications (4) and (6) which include the three change variables. These specifications help us discern the anomalies related to changes in price and book equity which contribute to the value premium.

First, for both subgroups, we now find that firm size has significant power to predict returns as opposed to the unconditional setting. The average estimates are −0.09 (t=−2.89) and −0.11 (t=−2.37) for non-mispriced and mispriced firms and they do not differ across both subgroups. Second, for both subgroups we find the lagged BM ratio has significant power to predict returns, however, with opposite signs. The average estimates are −0.43 (t=−4.12) and 0.77 (t=5.88) for non-mispriced and mispriced firms and they do differ across subgroups, indicating that the relation between the value-premium and market expectation errors is not driven by firm size but rather BM ratio.

Among the remaining three change variables, only net stock issues show strong marginal explanatory power in both subgroups. Meanwhile, changes in price and book equity display distinct marginal ability to explain average returns across these subgroups. Consequently, this suggests that both changes in price and book equity diverge in their informativeness regarding average returns. The average estimate for changes in price for firms without expectation errors (-0.11, t=-0.71) is less than one-third produced by firms with expectation errors (-0.34, t=-2.84), and the average estimate for firms with expectation errors is more than 2 standard errors below firms without expectation errors. In short, for value and growth firms without expectation errors, changes in price are now uninformative about average returns and changes in price draw much of its power from mispriced stocks. This aligns with the findings in Table 2.5, where the BM decomposition suggests that variation in current BM ratios is mostly due to expected returns for mispriced stocks.

Finally, the relationship between average return and change in book equity is also not consistently strong among both subgroups. For mispriced value and growth firms, the average estimate for past changes in book equity demonstrates little marginal ability to predict returns (t=1.67). In contrast, for stocks without expectation errors, average returns strongly relate to past changes in book equity (t=2.77), indicating that the profitability effect is stronger among non-mispriced stocks. These results closely resemble those obtained from the BM decomposition in Table 2.5.

Using the Fama and French (2008) decomposition, we document that the observed interaction effect of the BM ratio and FSCORE is due to past changes in price, rather than changes in book equity, and, therefore, arguably due to mispricing. Similar to the BM decomposition, the results in Section 2.5 strongly support hypothesis H2.

2.6. Conclusions

This paper examines the market expectation errors hypothesis proposed by Piotroski and So (2012). Specifically, we analyze the previously documented interaction effects between FSCORE and a firm's BM ratio in the context of Cohen et al.'s (2003) present value model, which relates a firm's current BM ratio to its future BM ratio, expected return, and expected profitability. This methodology allows us to examine whether the observed return effect is the result of mispricing or due to differences in expected profitability.

In line with prior evidence, when expectations implied by a firm's BM ratio differ from a firm's underlying fundamental strength, i.e., high (low) BM firms with strong (weak) fundamentals, expectation errors arise, leading to a positive and significant realization of the value premium. If, however, firms with high (low) BM ratios and weak (strong) fundamentals are considered, there exists no value premium. All results are robust when simultaneously controlling for further firm characteristics known to be informative about the cross-section of expected returns.

Using the present value model proposed by Cohen et al. (2003), we show that variation in current BM ratios is mostly due to differences in expected cash-flows rather than expected returns. This means that the high (low) BM ratio of a value (growth) firm is rather due to low (high) expected profitability and not due to high (low) expected returns. However, taking the FSCORE into account, our decomposition results significantly vary. In the case of firms where BM implied expectations are incongruent to the underlying fundamental strength, the fraction explained by the expected return component significantly increases while the expected profitability component decreases. Contrary to that, for firms where BM implied expectations are aligned with a firm's fundamental strength, the effect of the expected return component almost diminishes. Our results suggest that the previously observed interaction effect of the BM ratio and FSCORE is indeed the result of mispricing which supports the proposed market expectation errors hypothesis proposed by Piotroski and So (2012).

In summary, our empirical findings lend support to the notion that investors tend to treat value and growth firms similarly, often overlooking the distinctive fundamental strengths of individual firms. Through the decomposition of BM ratios, our results reconfirm the gradual assimilation of fundamental information into stock prices, a theory initially proposed by Piotroski (2000) two decades ago. This behavior is expected to result in predictable price corrections whenever the BM ratio is incongruent with the actual fundamental strength of the firm. Overall, our results imply that the interaction effects between FSCORE and a firm's BM ratio remain a global phenomenon. Consequently, our results are relevant to portfolio managers who utilize the market expectation errors-based approach to value-growth investing. This approach can be considered to be an additional criterion in the construction of well-optimized value portfolios.

2.7. Appendix

This appendix contains the derivation of Cohen et al.' (2003) BM decomposition that shows how the current BM ratio is related to future variables. We decompose the BM ratio of stocks to derive a cross-sectional link between current BM and future stock returns, future profitability, and future BM.

Following Cohen et al. (2003), the BM decomposition is derived from the accounting clean-surplus relation, which relates the annual change in book value of equity (BE) to earnings (X) less dividends (D) as follows:

$$BE_t - BE_{t-1} = X_t - D_t. \tag{2.4}$$

Frequent deviations in reported earnings, dividends, and book values are responsible for Equation (2.4) not always being satisfied. Therefore, we construct the earnings as the sum of annual change in book value of equity plus dividends ($X_t = BE_t - BE_{t-1} + D_t$) to satisfy the clean-surplus assumption. Based on this approach, we define our log clean-surplus return on equity (e) as

$$e_t = \log\left(1 + \frac{\Delta BE_t + D_t}{BE_{t-1}}\right). \tag{2.5}$$

We define bm_t as the log BM ratio and log stock return (r_t) as

$$r_t = \log\left(1 + \frac{\Delta ME_t + D_t}{ME_{t-1}}\right), \tag{2.6}$$

where ME_t is defined as market equity. Approximating stock and accounting returns by a Taylor series approximation, Cohen et al. (2003) show that

$$bm_{t-1} = r_t - e_t + \rho bm_t + k_t, \tag{2.7}$$

where ρ represents a positive discounting parameter and k_t an approximation error. If $D_t \neq 0$, then $\rho < 1$, and $\rho = 1$ if $D_t = 0$. Multiplying both sides of Equation (2.7) by the cross-sectional variance of bm_{t-1} eliminates the approximation error. Then the variance decomposition can be obtained from (2.7) by taking the unconditional expectations:

$$var(\tilde{bm}) \approx \sum_{j=0}^{N} \rho^j cov\left(\tilde{r}_{t+j}, \tilde{bm}_{t-1}\right) + \sum_{j=0}^{N} \rho^j cov\left(-\tilde{e}_{t+j}, \tilde{bm}_{t-1}\right) + \rho^{N+1} cov\left(\tilde{bm}_{t+N}, \tilde{bm}_{t-1}\right) \tag{2.8}$$

Using tildes to denote cross-sectionally demeaned quantities, we scale both sides by the unconditional variance of $\tilde{bm}_{t-1}$ which gives each determinant's percentage weight to the current BM ratio, i.e., the extent to which differences in current valuation ratios are associated with future earnings and stock returns:

$$1 \approx \frac{\sum_{j=0}^{N} \rho^j cov\left(\tilde{r}_{t+j}, \tilde{bm}_{t-1}\right)}{var\left(\tilde{bm}\right)} + \frac{\sum_{j=0}^{N} \rho^j cov\left(-\tilde{e}_{t+j}, \tilde{bm}_{t-1}\right)}{var\left(\tilde{bm}\right)} + \frac{\rho^{N+1} cov\left(\tilde{bm}_{t+N}, \tilde{bm}_{t-1}\right)}{var\left(\tilde{bm}\right)}. \tag{2.9}$$

The equation above shows that the sum of these three factors is 1 so that we can interpret these as the relative importance to cross-sectional differences in firms' BM ratio. We estimate each of the three contributing factors by regressing the following cross-sectional regressions with no intercept:

$$\begin{aligned} \sum_{j=0}^{N-1} \rho^j \tilde{r}_{k,t+j} &= b(\tilde{r}, N)\tilde{bm}_{k,t-1} + \varepsilon(\tilde{r}, N, k, t+N-1), \\ \sum_{j=0}^{N-1} \rho^j (-\tilde{e}_{k,t+j}) &= b(-\tilde{e}, N)\tilde{bm}_{k,t-1} + \varepsilon(-\tilde{e}, N, k, t+N-1), \\ \rho^N \tilde{bm}_{k,t+N-1} &= b(\tilde{bm}, N)\tilde{bm}_{k,t-1} + \varepsilon(\tilde{bm}, N, k, t+N-1). \end{aligned} \tag{2.10}$$

Finally, the estimated average coefficients in Equation (2.10) represent the percentage weight to the current BM ratio, which are presented on the right-hand side of Equation (2.9).

Chapter 3

The Cash Premium: Evidence from Real Estate Equities

This chapter is joint work with Dominik Wagner and corresponds to a working paper. The working paper has been submitted to the *The Quarterly Review of Economics and Finance* and is currently under review.

This article tests the mispricing-based explanation for the cash premium in international and US real estate equities. We document that high cash-to-market (CM) firms outperform their low CM counterparts, highlighting a similar market mechanism between real estate and nonfinancial equities. Controlling for firm- and country-specific characteristics, the return effect averages at 8.6% per year internationally and 6.7% per year for US firms during the period of 1990-2018. Moreover, we show that the cash premium is solely concentrated among mispriced firms and non-existent among nonmispriced firms. Likewise, investor sentiment only affects the cash effect when employing a mispriced strategy. Consequently, our results indicate that the cash premium in real estate equities is attributable to a systematic exploitation of cross-sectional mispricing.

JEL classifications: G11, G12, G15, G30, G41

Keywords: Mispricing, Corporate finance, Financial markets, Real estate, Sentiment

3.1. Introduction

It is well acknowledged that firms with high levels of corporate cash holdings tend to have high future returns whereas firms with low cash holdings tend to have low future returns, giving rise to the so-called cash premium around the world.[1] Interpreting the cause of this return premium, however, remains a subject of ongoing debate.

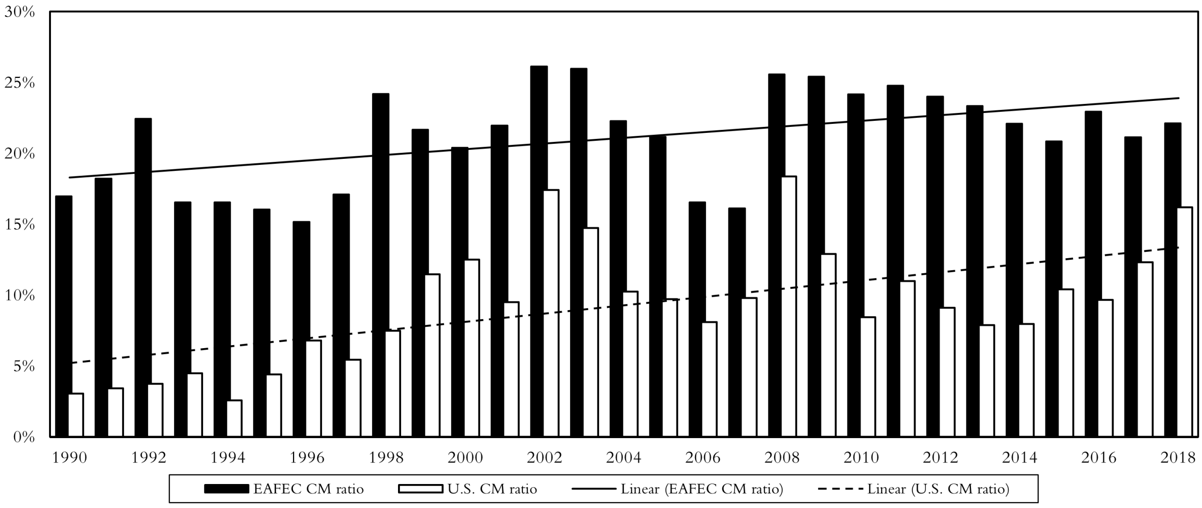
In a recent study, Li and Luo (2017) provide an investor sentiment-related mispricing-based explanation for the cash premium. Studying the US equity market, they find that the positive cash-return relation is significantly dependent on the level of investor sentiment constructed by Baker and Wurgler (2006). In particular, the cash premium is significant only when sentiment is low, suggesting that the cash anomaly is due to behavioural biases among investors. Their explanation is based on investors overreacting to the agency problem related to high cash firms and underreacting to the potential risks of illiquidity associated with low cash firms.[2] However, given that the cash holding captures information about a firm's financial distress, the cash holding correlates with the expected profitability of the firm (Palazzo, 2012). This, in turn, raises the question of whether the observed cash premium is ultimately due to mispricing or simply the result of differences in expected profitability. Given that the cash premium is stronger when sentiment is low, it is unlikely that risk drives the observed cash effect because it seems implausible that high cash firms are considered riskier when sentiment is low on part of investors.

This paper draws insights from empirical research conducted on nonfinancial firms to provide an explanation for the cash premium in real estate equities. First of all, the studies previously conducted do not include financial firms, such as real estate equities, which provides a useful hold-out sample to assess the reliability of the results. This helps to reduce the risk of data snooping and improves the overall quality of the literature (Barber and Lyon, 1997). Secondly, by leveraging new data from both the international and US markets, we examine the cash anomaly in 21 developed markets around the world and provide direct evidence that there are considerable similarities among the observed

[1] See, for example, Faulkender and Wang (2006), Opler et al. (1999), Palazzo (2012), Li and Luo (2017) for US evidence, along with Walkshäusl (2018) for non-US evidence.

[2] For an extended review of the agency problem literature, see, for example, Harford et al. (2014) and Harford et al. (2008).

Figure 3.1: International and US CM ratios



This figure shows average cash-to-market (CM) ratios for the international real estate equity sample (solid bars) and corresponding long-term trend (solid lines) along with the US real estate equity sample (clear bars) and corresponding long-term trend (dashed lines). CM is the firms' cash and short-term investments divided by market value of equity at the fiscal year-end.

cash premiums between real estate and nonfinancial firms. Thirdly, Figure 3.1 shows the average cash-to-market (CM) ratio for international real estate along with US real estate equities between 1990 and 2018 (we provide a more comprehensive description of our data below). Cash holdings in real estate equities appear to have been steadily increasing globally over the past three decades. Figure 3.1 indicates that the cash premium in the real estate equity markets deserves further investigation.

What makes real estate particularly interesting compared to other excluded financial firms, such as banks and insurance companies? The answer is two-fold. The business model of real estate holding companies is more transparent and homogeneous and, therefore, easier for market participants to assess compared to financial or nonfinancial firms. This makes them ideal candidates for a comparative analysis assessing the cash-return effect. Given the substantial variations in cash ratios across various industries, this consideration gains additional weight. For example, Bates et al. (2009) report that the average CM of high-tech firms is, on average, 1.5 times greater than that of manufacturing firms. Thus our focus on a particular industry allows us to minimise the impact of industry-specific unobservable heterogeneity which may affect the cash premium. In addition, unlike nonfinancial firms, banks, and insurances, real estate stocks enjoy a distinctive benefit when holding cash. One significant benefit is the ability to fulfill obligations without liquidating assets. This aspect is important when factoring the inherent illiquidity of real estate, characterised by prolonged sale periods and transaction uncertainties.

For this reason, we gather a broad sample which includes all listed property companies, including real estate investment trusts (REITs). On average, our sample consists of 400 internationally listed property companies across 20 countries and 101 US firms per year during the 1990-2018 period. Our sample selection criteria yield a qualitatively representative cross-section of real estate holding companies. We test the cash-return effect among these firms, using international and US samples separately due to distinguishing accounting standards. On the one hand, this approach allows us to draw causal inference from a representative sample of real estate equities, using firm characteristics based on IFRS reporting standards to ensure data quality and comparability across countries. On the other hand, the US sample captures the largest real estate market and serves as a robustness test for our findings.

In particular, we test the following two hypotheses within both the international and the US real estate equity markets. Our first hypothesis directly addresses the notion that the cash premium may be present among real estate equities, conforming to the same pattern as observed in nonfinancial stocks.

H1: Real estate equities with high cash holdings outperform real estate equities with low cash holdings.

We find a positive impact of cash holdings on future returns. Using Fama and MacBeth (1973) cross-sectional regression techniques, we estimate an average size-adjusted return of 0.69% (8.6%) for our international sample and 0.54% (6.7%) per month (per year) for US firms after controlling for firm size, book-to-market, profitability, and investments.

In light of this finding, our attention is focused on the underlying reasons driving the cash premium. Although this study does not aim to find complete explanations, we suspect a mispricing-based explanation, in line with the observation by Li and Luo (2017). Accordingly, we test whether mispricing plays an important role in understanding the positive cash-return behaviour. We formulate our second hypothesis as follows:

H2: The return difference between real estate equities with high cash levels and low cash levels can be attributed to mispricing.

If the outperformance of high CM property firms over low CM property firms does indeed indicate a mispricing, then contraints according to their direction of mispricing should affect the magnitude of the cash premium between mispriced and nonmispriced stocks. This, in turn, would provide supportive evidence for the mispricing-based explanation. To proxy for systematic mispricing across real estate equities, we employ a two-step procedure and use book-to-market (BM) as well as the firm's prior external financing activities ($XFIN$) to identify potentially undervalued and overvalued firms (Bradshaw et al., 2006). The misvaluation variable $XFIN$ is motivated by opportunistic financing theory postulating that firms raise external equity when valuations are high and repurchase shares when valuations are low. This translates into signals of potential misperceptions based on the management's assessment of the firm's relative under- or overpricing (Ikenberry et al., 1995; Loughran and Ritter, 1995; Ota et al., 2022). Assigning the sample firms in under- and overvalued samples reveals a significant return effect only for the mispriced strategy, that is, when undervalued high CM stocks and overvalued low CM stocks are considered whereas the nonmispriced strategy that constitutes overvalued high CM stocks and undervalued low CM stocks yields an inferior performance. As such prior external financing activities can explain the cash premium.

The argument presented by Stambaugh et al. (2012) suggests that long-short investment strategies, which are at least partly related to the exploitation of mispricing, should be affected by the level of investor sentiment. Accordingly, we finally test whether the cash premium is influenced by the level of investor sentiment. In particular, using the $XFIN$ misvaluation framework, we expect that the observed return difference of the mispriced strategy should be affected by investor sentiment whereas the return difference of the nonmispriced strategy should not be. For both the international and US samples, we find that the return difference in the mispriced strategy is significant while the nonmispriced strategy is not significantly affected by investor sentiment.

Our paper contributes to several strands of the literature. We demonstrate that real estate firms with high cash holdings exhibit similar future return characteristics compared to listed firms from nonfinancial sectors. This implies a broader range of the cash-return-puzzle than expected to date. Besides, drawing from a homogeneous, readily assessable listed sector, we find a comparatively high cash-return-effect. Given the interaction to mispricing, a higher effect may be arguably unexpected, at least in such transparent markets.

A key contribution to the literature is the novel fact that the observed cash premium can be attributed to mispricing. In this regard, our approach and results differ from Li and Luo (2017). These authors start from the observation that cash holdings predict future returns and subsequently examine the effect of investor sentiment on the cash premium. In contrast, we condition the cash premium on mispricing. This confirms the notion that the cash-return-effect depends on the existence of mispricing which can be identified when a firm's cash holding is congruent with its perceived misvaluation. This means that the high cash return is associated with undervalued high CM and overvalued low CM firms. Inversely, a low cash return is induced by overvalued high CM firms and undervalued low CM firms. In this regard, our findings also complement the literature in real estate economics (Ametefe et al., 2016; Wang et al., 2022; Freybote and Seagraves, 2018; Hill et al., 2010) in evaluating the cash premium in this field. The present study complements the findings by conditioning the effect of investor sentiment on the cash-return-relation.

Therefore, our article sheds new light on the cash premium puzzle among financial markets by using the uniqueness of real estate markets. Our results may be of interest to academics and a variety of market participants alike. This includes investors, i.e. indirect real estate investors, seeking attractive firms for optimising portfolio allocations; also, executives striving to understand the interaction of cash holdings on returns and deal efficiency as well as limitations of external influence and dependence in corporate market valuations. Additionally, it may raise the attention of policy makers from a regulative perspective because mispricing affects a broader market range than expected so far.

The remainder of the paper is organised as follows. Section 3.2 describes the data and the variables. Sections 3.3 and 3.4 test the hypotheses and present the results obtained from the international data. Section 3.5 reports corresponding results obtained from US data. Section 3.6 provides further tests addressing the influence of time-varying effects of investor sentiment. Section 3.7 concludes.

3.2. Data description

Our sample consists of firms from 20 developed international and from the US real estate stock markets. The sample resembles the countries included in the EAFEC (Europe, Australia, the Far East, and Canada) stock market benchmark from MSCI. We collect monthly total return data from Datastream and firm-level accounting data from Worldscope. We identify listed real estate institutions using Industry Classification Benchmark (ICB) codes. Following the ICB definition used by FTSE, Dow Jones, and Worldscope, the real estate sector includes real estate services, real estate holding and development and equity REITs. For the US market, we collect monthly total return data and firm-level accounting data from the S&P Capital IQ database.[3] We exclude real estate services, which primarily include agencies, brokers, leasing companies, management companies, and consulting services. Sample companies with at least half of their total assets allocated to rental properties remain on our data basis.[4] The logic behind this restriction is to separate real estate holding and development firms because ICB classifies both into a single code. As a result, the sample is limited to stocks that hold property.

We conduct our analyses with a conservative information lag of six months throughout the paper. This allows us to match the latest accounting information for the fiscal year ending in the previous calendar year with stock returns from July of the current year to June of the subsequent year. The rational of this 6-month lag structure is to rule out foresight bias because accounting information is known before the returns are calculated. All values of firm characteristics in our international sample are denominated in US dollars. Following Ang et al. (2009), we exclude 5% of the smallest firms with the lowest market value of equity in each country from our sample due to possible illiquidity problems. As in Fama and French (1992), we treat firm-year observations with negative book equity values as missing. Finally, we require that all accounting information necessary to calculate the CM ratio is available for the fiscal year ending in the previous year to be included in the sample. The observation horizon covers the period from July 1990 to June 2018 (henceforth 1990–2018).

[3]Detailed data sources by code and variable definitions by formula are provided in the Appendix.

[4]For comparison, the FTSE EPRA NAREIT and Global Property Research indices apply a similar classification of their constituents. Corresponding variation does not have a significant impact on our sample composition.

Table 3.1 reports summary statistics. Panel A shows the average number of firms per month across countries. Our sample consists of an average of 400 firms (with a total of 11,604 observations) within the international sample, and an average of 101 firms (with a total of 2,933 observations) within the US sample. The average number of firms from EAFEC (US) per year starts from 75 (8) and constantly increases to 788 (190) throughout the sample period (Figure 3.2). The key explanatory variable and the control variables derived from the literature used in this study are defined as follows. We measure a firm's cash-to-market (CM) as cash and short-term investments relative to its market equity at the end of fiscal year (Faulkender and Wang, 2006).[5] We measure a firm's size (SZ) as its market equity (calculated by multiplying the price of the stock by the total number of shares) measured in million US dollars in June each year. Book-to-market (BM) is a firm's book equity relative to its market equity at the end of the fiscal year. Additionally, we measure a firm's profitability (PRO) based on the return on assets which is equal to net income before extraordinary items divided by the total assets of the previous year. Investment (INV) is the year-to-year change in total assets scaled by the total assets of the previous year.

In our second set of analyses, we use book-to-market as well as equity and debt financing separately to identify systematic mispricing across property firms. In this context, we employ the external financing-based misvaluation measure proposed in Bradshaw et al. (2006). The external financing ($XFIN$) measure is defined as the sum of net equity financing and net debt financing, scaled by the total assets of the previous year. Net equity financing is the sale of equity less the purchase of equity and less dividends. Net debt financing is the offering of long-term debt minus the reduction in long-term debt.

In our last set of analyses, we use a monthly sentiment index ($SENT$) developed by Baker and Wurgler (2006). This index is used to identify the influence of the time-varying relationship between investor sentiment and cash premium. The sentiment measures are obtained from Jeffrey Wurgler's website at `https://pages.stern.nyu.edu/~jwurgler/`.

Panel B of Table 3.1 summarises the distributional statistics of the explanatory variables over the 1990 to 2018 period in the international sample. We observe a mean

[5] Using total assets instead of market equity does not change the paper's general findings as cash-to-assets still has reliable predictive power for stock returns (e.g. Palazzo, 2012; Simutin, 2010; Li and Luo, 2017).

Table 3.1: Summary statistics

Panel A: Sample countries: International and US

Country	Firms	Country	Firms
Australia	1124	Japan	1417
Austria	85	Netherlands	221
Belgium	221	New Zealand	145
Canada	774	Norway	46
Denmark	123	Singapore	1029
Finland	90	Spain	239
France	750	Sweden	351
Germany	380	Switzerland	215
Hong Kong	2618	UK	1638
Ireland	8	US	2933
Italy	130		

	Mean	25th	Median	75th
Panel B: Variables from international sample				
CM	0.21	0.03	0.12	0.32
SZ	739	40	157	540
BM	1.24	0.75	1.12	1.61
PRO	0.04	0.01	0.04	0.07
INV	0.12	−0.03	0.09	0.26
XFIN	0.04	−0.03	0.00	0.09
Panel C: Variables from US sample				
CM	0.11	0.01	0.02	0.07
SZ	2084	132	809	2300
BM	0.74	0.37	0.57	0.84
PRO	0.03	0.01	0.03	0.06
INV	0.15	−0.02	0.06	0.20
XFIN	0.07	−0.04	0.01	0.11
SENT	0.08	−0.28	−0.06	0.36

The table presents summary statistics of countries covered in the international and US sample and respective variables used in the study. Panel A reports the average number of firms per month in each country during the sample period from July 1990 to June 2018. Panels B and C report the arithmetic mean, 25th percentile, median, and 75th percentile of the variables. Cash-to-market (CM) ratio is the firms' cash and short-term investments divided by market value of equity at the end of the fiscal year. Firm size (SZ) is measured as market value of equity measured in millions of US dollars in June each year. Book-to-market (BM) ratio is the firms' book equity to market equity at the end of fiscal year. Profitability (PRO) is defined as net income before extraordinary items divided by total assets of the previous year. Investment (INV) is the annual change in total assets divided by total assets from the previous year. External financing ($XFIN$) is the total of net equity financing and net debt financing divided by the total assets of the previous year. SENT is the sentiment index developed by Baker and Wurgler (2006).

(median) CM ratio equivalent to 21% (12%), respectively, indicating that some real estate equities hold substantially more cash than others in the sample. $XFIN$ depicts a balanced finance activity (median of 0.00) among our sample firms with a tendency towards external financing (mean of 0.04) which hints at a market-sided overvaluation. A typical property firm in our international sample has a size of $739 million in terms of market equity. The control variables vary in plausible bandwidth.

Analogically Panel C of Table 3.1 contains the distributional statistics of the US sample firms. We observe a mean (median) CM ratio of 11% (2%). Li and Luo (2017) report a mean CM ratio of 17% for US industry stocks over the earlier 1972-2011 period. Our observation of lower cash levels for real estate firms compared to all public firms is consistent with previous observations. For example, Hardin et al. (2009) document that publicly traded REITs carry about 2% cash, albeit with a wide spread of cash holdings. The explanatory variables show similar peculiarities, albeit different point estimates, as in the observable international sample. We observe a mean (median) level of $SENT$ of 0.08 (-0.06) during the sample period.

The summary statistics reveal a wide dispersion of our key variables CM, $XFIN$, and $SENT$ along the sample period and across sample firms. We also measure numerical differences of explanatory return variables in both sample compositions. Consequently, we control for those relevant firm characteristics throughout the analyses.

3.3. Abnormal returns

In this section, we test hypothesis H1 that the cash premium may be present among international real estate equities from EAFEC countries. We employ a portfolio-sorting approach and measure the statistical difference in returns. Portfolios are formed annually at the end of June of the current year by ranking stocks based on CM ratios from the fiscal year ending in the previous year. A firm is classified as a low, medium, or high stock if its CM ratio is in the lower 20th quintile, between the 20th quintile and the 80th percentile, or in the upper 80th quintile.[6]

[6] Our results are robust to varying portfolio distributions. Using the upper/lower 30th percentile instead of the upper/lower 20th quintile does not change the fact that the average return still increases monotonically with higher levels of CM.

Table 3.2: Portfolio sort based on CM ratios and return differences

	Return	Characteristics					
Portfolio		CM	SZ	BM	PRO	INV	Firms
Low	−0.32	0.01	1141	1.05	0.05	0.12	82
Medium	−0.23	0.15	1241	1.18	0.04	0.12	236
High	0.39	0.59	433	1.62	0.03	0.10	82
High−Low	0.71						
(t-stat)	*(2.74)*						

The table presents average monthly size-adjusted returns in percent for portfolios sorted on CM ratios for the full sample period. A firm is allocated into Low, Medium, or High portfolio if the firm's CM ratio in the previous year is below the 20th quintile, between the 20th and 80th quintile, or above the 80th quintile, respectively. For the size-adjustment, the monthly return on a stock is measured in excess of the return of its corresponding country-specific size quintile portfolio. The standard cash strategy (High−Low) takes a long position in high CM property firms and a short position in low CM property firms. The t-statistic for the average monthly return is given in parentheses. The table also reports the average firm characteristics for portfolios based on size (SZ), book-to-market (BM), cash-to-market (CM) profitability (PRO), investment (INV), and the average amount of firms observed per month.

Monthly size-adjusted returns on the equal-weighted portfolios are computed from July of the current year to June of the subsequent year, with an annual rebalancing. For the size-adjustment, we measure each stock's monthly raw return in excess of the return of its corresponding country-specific size quintile portfolio. The size benchmark portfolios are formed in June of each year by sorting all stocks in a given country into quintiles based on their firm size. The subsequent twelve-month raw returns on the equally weighted size portfolios are then calculated monthly, and we rebalance the portfolios on a yearly basis.

Table 3.2 shows average monthly size-adjusted returns and firm characteristics for the univariate portfolio sorts. We calculate the difference of the high and low CM portfolios as presented in the last row. We find statistically significant and economically large return spreads in international real estate equity markets. Property firms with high CM ratios outperform property firms with low CM ratios by 0.71% per month throughout the sample period, indicating the existence of a cash premium in real estate markets. Furthermore, high CM property firms, on average, display a smaller market capitalisation, lower market valuations (high BM ratios), as well as slightly lower profitability and investments compared to low CM firms.[7]

[7] The use of raw returns leads to qualitatively similar results, yielding 0.51% per month. The results are available from the authors upon request.

The average portfolio characteristics are consistent with prior results documented in the literature. Li and Luo (2017) calculate a monthly cash premium of 0.57%, observing a US sample spanning from 1972 to 2011. Walkshäusl (2018) measures a cash premium of 0.45% per month across an international sample from 1990 to 2016. High CM firms are generally smaller than low CM firms in terms of market equity, signal poor profitability, and show low investments along with a high BM ratio (e.g. Opler et al., 1999). Given the differences in the characteristics of average firms, the question is whether the observed return spreads may be biased due to other known return determinants. It is conceivable that these firm characteristics could at least explain parts of the premium, and thus the identified cash premium would no longer be pronounced on a risk-adjusted basis. To address this concern, we further study the cash-return relation in a cross-sectional setting at the individual firm-level by using the Fama and MacBeth (1973) regression techniques.

In particular, we estimate the following firm-level cross-sectional regression, where the monthly size-adjusted return r_{it} of the firm i in month t is regressed on low and high CM indicator variables (Low_{it} and $High_{it}$) and on control variables:

$$\begin{aligned} r_{it} = \beta_{1t} Low_{it} + \beta_{2t} High_{it} + \beta_{3t} BM_{it} + \beta_{4t} ln(SZ)_{it} + \beta_{5t} PRO_{it} \\ + \beta_{6t} INV_{it} + CountryControls_{it} + \epsilon_{it} \end{aligned} \tag{3.1}$$

The indicator variables are equal to one if the firm's CM ratio is below the 20th quintile and above the 80th quintile, respectively, and zero otherwise. These dichotomous variables are updated each June to predict monthly stock returns from July of the current year to June of the subsequent year. Thus the coefficients, β_{1t} and β_{2t}, measure abnormal returns associated with the low and high CM firms in the sample, respectively. We use indicator variables to interpret the coefficients in terms of returns denoted in percentage as well as to calculate the return spread, which represents the average premium difference between high and low firms, i.e., the cash premium. The set of control variables includes firm size, book-to-market, profitability, and investment to measure benchmark-adjusted returns and reflect the most recent developments in asset pricing (e.g., Fama and French, 2015; Bond and Xue, 2017). To control for possible country effects, we include dichotomous country classifiers in all regression specifications. The control variables are

Table 3.3: Monthly cross-sectional return regressions with controls

Specification	(1)	(2)	(3)
Period	Full	Earlier	Later
Low	−0.14 *(−0.84)*	−0.05 *(−0.22)*	−0.19 *(−0.84)*
High	0.55 *(2.84)*	0.57 *(2.34)*	0.54 *(2.22)*
SZ	−0.15 *(−2.88)*	−0.24 *(−4.28)*	−0.30 *(−1.09)*
BM	0.16 *(1.80)*	0.17 *(1.91)*	0.15 *(1.62)*
PRO	0.14 *(0.38)*	0.12 *(0.33)*	0.16 *(0.42)*
INV	−0.15 *(−0.62)*	−0.05 *(−0.19)*	−0.30 *(−1.09)*
Country Dummy	Yes	Yes	Yes
R^2	0.16	0.16	0.16
Firms	400	212	589
High−Low	0.69 *(2.78)*	0.62 *(2.64)*	0.73 *(2.89)*

The table shows average coefficient estimates from cross-sectional regressions of monthly size-adjusted returns on binary indicator and control variables. All returns are denoted as percentages. Newey-West adjusted t-statistics for average estimates are given in parentheses. The binary indicator includes the cash indicators Low and High which take the value of one if the underlying condition holds for a property firm and zero otherwise. Control variables compromise common firm characteristics including firm size (SZ), book-to-market (BM), profitability (PRO), investment (INV), and country dummies. Regressions are estimated monthly while dependent variables are updated at the end of June each year to explain monthly returns from July to June of the subsequent year. The results are presented for the full period and for two equally long periods. The full period ranges from July 1990 to June 2018. The earlier subperiod ranges from July 1990 to December 2004 (168 months), while the later subperiod is from January 2005 to June 2018 (168 months). For the size-adjustment, the monthly return on a stock is measured in excess of the return of its corresponding country-specific size quintile portfolio. The R^2 value is adjusted for degrees of freedom. The last two rows contain the average number of sample firms for each year and the average return spread in percent per month, associated with the standard long-short cash strategy.

updated annually at the end of each June in the previous calendar year.

Table 3.3 presents the respective average coefficient estimates from our firm-level cross-sectional regression. Of primary interest is specification (1), which presents the baseline results for the full sample. First, we observe that the average coefficients for the indicator variables reflect the typical cash-return pattern. The average return spread of 0.69% per month in the last row is economically large and statistically significant after controlling for firm size, book-to-market, profitability, and investment. The estimates of our control variables are consistent with documented results from the literature. The results report a positive relationship between book-to-market, profitability, and real estate returns whereas size and investment exhibit an inverse relationship with returns.[8] In line

[8]Controlling for real estate-specific classification including the regulatory REIT framework does not

with Fama and French (2002), we do not find a significant relationship between firm size and returns.

Specifications (2) and (3) report subperiod results. The earlier subperiod ranges from July 1990 to December 2004 (168 months) while the later subperiod ranges from January 2005 to June 2018 (168 months). The cash premium is persistent over both subperiods. The similarity between the regression-based results presented here and the market-wide portfolio sorts shown in Table 3.2 suggest that our baseline results may not be attributed to firm-specific or country-specific effects. In sum, the results in Section 3.3 support hypothesis H1.

3.4. A mispricing-based explanation

We elaborate on previous findings and test the second hypothesis to determine whether the positive return difference between high CM firms and low CM property firms can be attributed to mispricing. If mispricing drives the cash premium, employing a strategy which separates cash stocks based on congruent and incongruent perceptions of misvaluation should result in notably distinct cash premiums. Hence, in our context, we suppose that the cash premium should be concentrated among undervalued high CM firms and overvalued low CM firms where a firm's cash holding is congruent with the perceived misvaluation. In contrast, we suppose that the cash premium should be absent among overvalued high CM firms and undervalued low CM firms where a firm's cash holding is incongruent with the perceived misvaluation.

To examine whether the observed cash premium among international property firms can be attributed to the systematic exploitation of mispricing, we estimate firm-level cross-sectional regressions based on Equation (3.1) for two distinct subsample variants, both conditional on mispricing, with each variant involving a different mispricing proxy setting. First, we use book-to-market (BM) as a well-documented candidate for market assessment. Lower (higher) values of BM indicate higher (lower) market valuations. A firm is characterised as low BM, or high BM stock if its BM ratio is below the 20th

change the paper's findings. For an alternative calculation of real estate specific variables see, for example, Bond and Xue (2017).

percentile, or above the 80th percentile, respectively. Low BM ratios indicate an overvaluation while high BM ratios indicate an undervaluation (Lakonishok et al., 1994). Given a potential ambiguous interpretation of BM, we additionally use external financing activities of a firm to capture systematic mispricing. Documented empirical research suggests an inverse relationship between future stock returns and equity offerings (Loughran and Ritter, 1995) and debt offerings (Spiess and Affleck-Graves, 1999). In contrast, there is a positive relationship between future stock returns and equity buybacks (Ikenberry et al., 1995). According to the opportunistic financing hypothesis (Ikenberry et al., 1995; Loughran and Ritter, 1995; Ota et al., 2022), firms tend to issue equity or debt when they are overvalued and tend to buy back equity or reduce debt when they are undervalued. In other words, corporate managers make financing decisions to exploit temporary mispricing. Therefore, as a second proxy setting of mispricing, we employ a measure of net external financing developed by Bradshaw et al. (2006). External financing ($XFIN$) is defined as the sum of net equity financing and net debt financing divided by total assets of the previous year. Net equity financing is the sale of equity minus the purchase of equity minus dividends. Net debt financing is the offering of long-term debt minus the reduction in long-term debt. Positive values on $XFIN$ indicate issues and, as such, an overvaluation while negative values indicate repurchases and thus an undervaluation.

Panel A of Table 3.4 shows the average coefficient estimates based on two mispricing settings. The first mispricing proxy variable is BM and the second is $XFIN$. Specification (1) in each proxy setting comprises high and low CM property stocks with low BM ratios and positive $XFIN$ values, both representing firms which are perceived as overvalued, respectively. Contrary to that, specification (2) in each proxy setting comprises high and low CM property stocks with high BM ratios and with negative $XFIN$ values, both representing firms which are perceived to be undervalued, respectively. Panel B reports the difference-of-means tests on the average return spread for the mispriced and nonmispriced strategies. The return spread [*Overvalued* × *High CM*] − [*Undervalued* × *Low CM*] provides the return differences on the nonmispriced strategy where a firm's cash holding is incongruent with the perceived misvaluation. The return spread [*Undervalued* × *High CM*] − [*Overvalued* × *Low CM*] provides the return differences on the mispriced stratgey where a firm's cash holding is congruent with the perceived misvaluation. The Difference reports the average return spread between the mispriced and nonmispriced strategies. The estimates on the common controls and dichotomous country classifiers remain untabulated.[9]

Firstly, irrespective of the applied mispricing proxy, the results consistently indicate that higher levels of the CM ratio are positively associated with an increase in average estimates. Secondly, the difference-of-means test in Panel B shows that conditioning CM on mispricing has a major influence on the observed cash premium. Both mispriced strategies earn a large and highly significant premium of 1.65% and 0.99% per month, respectively, conditional on BM and $XFIN$. In contrast, both nonmispriced strategies experience a premium of -0.09% and 0.35% per month, respectively, conditional on BM and $XFIN$ which is statistically indistinguishable from zero. Thirdly, the difference between mispriced and nonmispriced cash premiums is statistically highly significant and amounts to more than 1.74% and 0.64% per month, respectively, conditional on BM and $XFIN$. Given the strong performance of the mispriced strategy and the weak performance of the nonmispriced strategy, our results suggest that mispricing drives the positive cash-return relation in international real estate equity markets. Overall, the results in Section 3.4 provide evidence to support hypothesis H2.

3.5. Return effects and mispricing – US evidence

In this section, we test both hypotheses using a sample from the US real estate market. The initial hypothesis tests whether there is a cash premium among US real estate stocks and the second hypothesis tests if the performance of the cash strategy is attributable to mispricing. The goal is to capture the largest real estate market, properly cope with different reporting standards, and examine the robustness of our results, i.e. data snooping. As the accounting rules for US-GAAP and IFRS vary (Woltering et al., 2018), we re-estimate the cash premium for an independent sample. We expect to find similar results for the US sample, providing an out-of-sample test of our findings on positive cash-return effects.

Panel A of Table 3.5 presents average coefficient estimates from the firm-level cross-sectional regressions based on Equation (3.1) for two distinct specifications among the US sample. Specification (1) covers the standard (unconditional) cash strategy whereas specification (2) accounts for property firms with positive and negative prior external financing

[9] The full results are available from the authors upon request.

Table 3.4: Regression results on mispricing-based returns

Panel A: Regression estimates				
Mispricing setting	Book-to-Market		External Financing	
Specification	(1)	(2)	(1)	(2)
Strategy	Overvalued (low BM)	Undervalued (high BM)	Overvalued (positive XFIN)	Undervalued (negative XFIN)
Low	−0.63 *(−2.48)*	0.57 *(0.94)*	−0.28 *(−1.59)*	0.05 *(0.38)*
High	0.48 *(0.87)*	1.01 *(3.40)*	0.40 *(2.12)*	0.71 *(2.70)*
Controls	Yes	Yes	Yes	Yes
R^2	0.15	0.15	0.15	0.15
Firms	82	82	208	192
Panel B: Difference-of-means tests				
Nonmispriced ($\text{H}_{OVER} - L_{UNDER}$)	−0.09 *(−0.11)*		0.35 *(1.38)*	
Mispriced ($\text{H}_{UNDER} - L_{OVER}$)	1.65 *(3.97)*		0.99 *(2.91)*	
Difference	1.74 *(4.52)*		0.64 *(2.57)*	

The table shows average coefficient estimates from cross-sectional regressions of monthly size-adjusted returns on binary indicator and control variables based on two sample specifications (Panel A). All returns are quoted as percentages. The sample in specification (1) includes firms with high and low *BM* ratios, while the sample in specification (2) includes firms with positive and negative prior external financing. Newey-West adjusted t-statistics for average estimates are given in parentheses. The binary indicator includes the cash indicators Low and High which take the value of one if the underlying condition holds for a property firm and zero otherwise. The control variables are untabulated, see Appendix for detailed description. The regressions are estimated monthly while the dependent variables are updated at the end of June each year to explain monthly returns from July to June of the subsequent year. Results are shown for July 1990 to June 2018. For the size-adjustment, the monthly return on a stock is measured in excess of the return of its corresponding country-specific size quintile portfolio. The R^2 value is adjusted for degrees of freedom. The last two rows contain the average number of sample firms for each year and the average return spread in percent per month, associated with the standard long-short cash strategy. Panel B reports the difference-of-means tests on the average return spread for the mispriced and nonmispriced strategies. The return spread on the nonmispriced strategy is derived from the coefficients [*Overvalued* × *High CM*] − [*Undervalued* × *Low CM*]. The return spread on the mispriced strategy is derived from the coefficients [*Undervalued* × *high CM*] − [*Overvalued* × *Low CM*]. Difference reports the average return spread between the mispriced and nonmispriced strategies.

activities to capture systematic mispricing. Panel B of Table 3.5 presents difference-of-means tests to assess whether the cash strategy conditional on mispricing in specification (2) produces significantly different premiums between the mispriced and the nonmispriced strategies. The estimates on our control variables remain untabulated.[10]

The results make clear that the cash premium exists among the US real estate stocks and is attributable to mispricing. Firstly, similarly to our international findings, we observe that the high and low CM firms produce the typical cash return pattern, as indicated by the positive and negative coefficient estimates on $High$ and Low in both specifications. Secondly, as indicated by the return spread for the plain-vanilla cash strategy in the last row of Panel A in specification (1), the cash premium amounts to 0.54% per month and is statistically significant and robust to traditional controls. Thirdly, the difference-of-means test in Panel B shows that conditioning CM on mispricing has a major influence on the observed cash premium. The mispriced strategy earns a large and highly significant premium of 1.21%. In contrast, the nonmispriced strategy experiences a premium of 0.20% per month which is statistically indistinguishable from zero. Finally, the difference between the mispriced and nonmispriced cash premium in the last row reinforces the fact that the two strategies produce significantly different cash premiums.

In summation, both the positive cash-return effect and the conditioning impact of existent mispricing on the realised cash profits in the US back up our findings on an international scale, concluding that the cash premium is a global phenomenon driven by mispricing.

3.6. The influence of investor sentiment

This section investigates the relationship between the observed cash premium and investor sentiment. According to Stambaugh et al. (2012), any long-short investment strategy that seeks to exploit mispricing is affected by investor sentiment to some extent. Especially, the returns on long-short investments which exploit mispricing should be higher when sentiment is low as valuations which have deviated from fundamentals tend to revert to

[10]Note: Given the qualitative similar results of BM and $XFIN$, we report the latter. The full results are available from the authors on request.

Table 3.5: US returns on standard and mispricing strategies

Panel A: Regression estimates			
Specification	(1)	(2)	
Strategy	Standard (unconditional)	Overvalued (pos. XFIN)	Undervalued (neg. XFIN)
Low	−0.14 *(−1.37)*	−0.20 *(−0.93)*	0.03 *(0.14)*
High	0.40 *(2.05)*	0.23 *(0.73)*	1.01 (2.82)
Controls	Yes	Yes	Yes
R^2	0.12	0.12	0.13
Firms	101	61	40
High−low	0.54 (2.45)		
Panel B: Difference-of-means tests			
Nonmispriced ($H_{OVER} - L_{UNDER}$)		0.20 *(0.66)*	
Mispriced ($H_{UNDER} - L_{OVER}$)		1.21 *(3.46)*	
Difference		1.01 *(3.07)*	

The table shows average coefficient estimates from cross-sectional regressions of monthly US size-adjusted returns on binary indicator and control variables (Panel A). All returns are quoted as percentages. Panel A reports return differences for three restricted specifications. Based on the specifications under consideration, the portfolio restrictions are defined as follows: Standard (comprises all high CM and low CM property firms in our overall data sample), Overvalued (restricts to high CM and low CM property firms with positive prior external financing), Undervalued (restricts to high CM and low CM property firms with negative prior external financing). Newey-West adjusted t-statistics for average estimates are given in parentheses. The binary indicator includes the cash indicators Low and High which take the value of one if the underlying condition holds for a property firm and zero otherwise. The control variables are untabulated, see Appendix for detailed description. The regressions are estimated monthly, while the dependent variables are updated at the end of June each year to explain monthly returns from July to June of the subsequent year. Results are shown for July 1990 to June 2018. For the size-adjustment, the monthly return on a stock is measured in excess of the return of its corresponding country-specific size quintile portfolio. The R^2 value is adjusted for degrees of freedom. The last two rows contain the average number of sample firms for each year and the average return spread in percent per month associated with the long-short cash strategy. Panel B reports the difference-of-means tests on the average return spread for the mispriced and nonmispriced strategies. The return spread on the nonmispriced strategy is derived from the coefficients [*Overvalued* × *High CM*] − [*Undervalued* × *Low CM*]. The return spread on the mispriced strategy is derived from the coefficients [*Undervalued* × *high CM*] − [*Overvalued* × *Low CM*]. Difference reports the average return spread between the mispriced and nonmispriced strategies.

normal following high levels of valuation. Consequently, we expect that market sentiment negatively correlates with, and thus increases, the return spread of mispriced high and low CM real estate firms.

We use the monthly sentiment index constructed by Baker and Wurgler (2006) to explore the time-varying relationship of investor sentiment. The sentiment index is based on six known sentiment proxies: trading volume, dividend premium, closed-end fund discount, equity shares in new issues, the volume, and the average first-day returns on initial public offerings. These variables are orthogonalised to macroeconomic conditions to remove variation in the business cycle. The sentiment index developed by Baker and Wurgler (2006) is often used in studies which focus mainly on public equity markets (e.g., Han, 2008; Fong and Toh, 2014; Stambaugh and Yuan, 2017). In the context of real estate, Letdin et al. (2022) document a strong relationship between sentiment and mispricing-driven investment strategies in equity markets using the sentiment index developed by Baker and Wurgler (2006). On a global scale, Baker et al. (2012) construct a global sentiment index that covers six major international stock markets. The authors find that investor sentiment is contagious across countries and is particularly influenced by sentiment in the US. This is of particular interest for our study because we consider both global and US perspectives in our investment strategy.

In particular, we estimate time-series regressions of monthly return spreads between high CM firms and low CM firms on investor sentiment from the previous month. The monthly excess return between the long leg $r_{t,High}$ and the short leg $r_{t,Low}$ in month t is regressed on the lagged level of Baker-Wurgler sentiment index, $SENT_{t-1}$.[11]

Our regression model is as follows:

$$\begin{aligned} r_{t,High} - r_{t,Low} &= \alpha + \gamma SENT_{t-1} \\ +\beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t &+ \beta_4 UMD_t + \epsilon_t \end{aligned} \tag{3.2}$$

Optionally, we include conventional factors based on the four-factor model of Fama

[11]Regressing monthly return spreads on investor sentiment from the previous year, instead of the previous month, maintains the paper's overall findings unchanged.

and French (1993) and Carhart (1997) in the regression to adjust for stock market risk. We define the market risk premium (MKT) as the value-weighted portfolio of all property stocks in our sample minus the US one month T-bill rate. The construction of the remaining factors (size – SMB, value – HML, and momentum – UMD) follows the standard approach of Fama and French.

Table 3.6 presents the results of monthly time-series regressions on investor sentiment over the period of 1990-2018. Specification (1) displays international results while specification (2) displays US results. In Panel A, we first present the regression results based on the standard cash strategy. We present the regression results conditional on mispricing cash strategies in Panel B. The regression results based on the portfolios underlying the mispricing strategies are presented in Panel C.

The results in Table 3.6 show that the level of investor sentiment influences the cash premium. In a first step, we examine whether investor sentiment affects the cash premium. Like Li and Luo (2017), we observe that sentiment significantly affects the return spread between high CM and low CM property firms in both the international and US samples. In particular, the return difference of the standard cash strategy is pronounced when the sentiment index is low, indicated by the negative coefficient estimates. In multivariate settings, we find that the identified relationship generally holds. However consistent with the findings of Baker and Wurgler (2006), risk adjustment reduces the influence of sentiment.

The novel evidence is that, conditioning CM on mispricing in Panel B, investor sentiment significantly affects the return spread only when mispriced high CM and low CM property firms are considered in both samples, consistent with our previous predictions. In contrast, the nonmispriced strategy remains unaffected in both samples. Once again, risk adjustment reduces the influence of sentiment on both samples whereas the identified relations generally remain robust. Finally, in line with the finding of Stambaugh et al. (2012) on the asymmetric pricing effect of sentiment, the results in Panel C reveal that the sentiment-related variation in the performance of the mispricing strategy is mainly due to its short position. Overvalued low CM property firms with positive $XFIN$ values exhibit significantly lower returns when the sentiment index is low while sentiment does not play much of a role for undervalued high CM firms with negative $XFIN$ values.

Table 3.6: Time series regressions on investor sentiment

Specification	(1)				(2)			
Sample	International				US			
Panel A: Regressions of standard cash strategy on sentiment								
Strategy	High-Low				High-Low			
Intercept		0.80 *(2.93)*		0.68 *(2.60)*		0.68 *(2.93)*		0.52 *(2.05)*
SENT		−1.07 *(−3.24)*		−0.54 *(−1.30)*		−1.44 *(−2.28)*		−0.98 *(−1.44)*
Risk-adjusted		No		Yes		No		Yes
Panel B: Regressions of conditional mispricing cash strategies on sentiment								
Strategy	Nonmispriced		Mispriced		Nonmispriced		Mispriced	
Intercept	0.37	0.38	1.20	1.35	0.21	0.06	1.41	1.05
	(0.21)	*(0.22)*	*(4.02)*	*(4.37)*	*(0.64)*	*(0.19)*	*(3.09)*	*(2.66)*
SENT	−0.27	−0.27	−2.36	−0.99	−0.15	−0.16	−2.07	−1.58
	(−0.61)	*(−0.19)*	*(−2.98)*	*(−1.71)*	*(−0.30)*	*(−0.30)*	*(−2.01)*	*(−1.64)*
Risk-adjusted	No	Yes	No	Yes	No	Yes	No	Yes
Panel C: Regressions for strategy portfolios on sentiment								
CM	Low	High	Low	High	Low	High	Low	High
XFIN	Positive	Positive	Negative	Negative	Positive	Positive	Negative	Negative
Intercept	−0.71	0.48	0.21	0.85	−0.63	0.11	0.05	0.92
	(−2.04)	*(0.90)*	*(0.53)*	*(2.74)*	*(−2.58)*	*(0.33)*	*(0.21)*	*(2.94)*
SENT	−2.07	0.59	0.55	−0.77	−1.23	0.52	0.68	−1.84
	(−2.32)	*(1.04)*	*(0.56)*	*(−1.33)*	*(−2.13)*	*(0.94)*	*(1.85)*	*(−1.75)*

This table reports estimates from time series regressions of monthly return spreads between high CM firms and low CM firms on the prior-month level of the investor sentiment. The nonmispriced strategy involves taking a long position in high CM property firms with positive external financing and a short position in low CM property firms with negative external financing. The undervalued strategy involves taking a long position in high CM property firms with negative external financing, and a short position in low CM property firms with positive external financing. Specification (1) displays international results while specification (2) displays US results. Panel A reports results of regressing the return spread of the standard high-minus-low cash portfolio on investor sentiment. Panel B reports the results of regressing the return spread of conditional mispricing cash strategies on investor sentiment. In the second stage of Panel A and B, we include conventional factors based on the four-factor model in the regression to adjust for risk. Panel C reports the results of regressing the returns of the portfolios underlying the strategies on sentiment index, and the contemporaneous common risk factors of the four-factor model. Newey-West adjusted t-statistics for the coefficients are given in parentheses. Results are shown for July 1990 to June 2018.

The obtained results support the notion that during periods of high sentiment, asset mispricing occurs, and short-sale constraints obstruct the immediate elimination of overvaluation. Conversely, low sentiment levels reflect pessimism, leading to a reversal in investor expectations and resulting in a notable return difference in the standard cash strategy, particularly on the short leg.

Hence, our results indicate that mispricing, as reflected in time-varying investor sentiment, significantly influences the cash premium among mispriced property firms.

3.7. Conclusion

In this article, we test the cash-return effect in real estate equities, which has been excluded from previous research. Our findings reveal that the relation between cash-to-market (CM) and future returns is similar for real estate firms and nonfinancial firms. Our analyses, which are based on a global stock sample of real estate markets from 1990 to 2018, estimate a significantly positive cash-return relation. The superior performance of high CM property firms versus low CM property firms is not captured by typical cross-sectional return determinants.

We present evidence that the cash effect in real estate equities exists solely among mispriced firms. Our approach is to assign firms in two groups dichotomously based on misvaluation proxied by a firm's external financing behaviour. Thus a mispriced cash strategy which buys undervalued high CM firms and sells overvalued low CM firms yields significantly larger cash profits than a nonmispriced cash strategy which buys overvalued high CM firms and sells undervalued low CM firms.

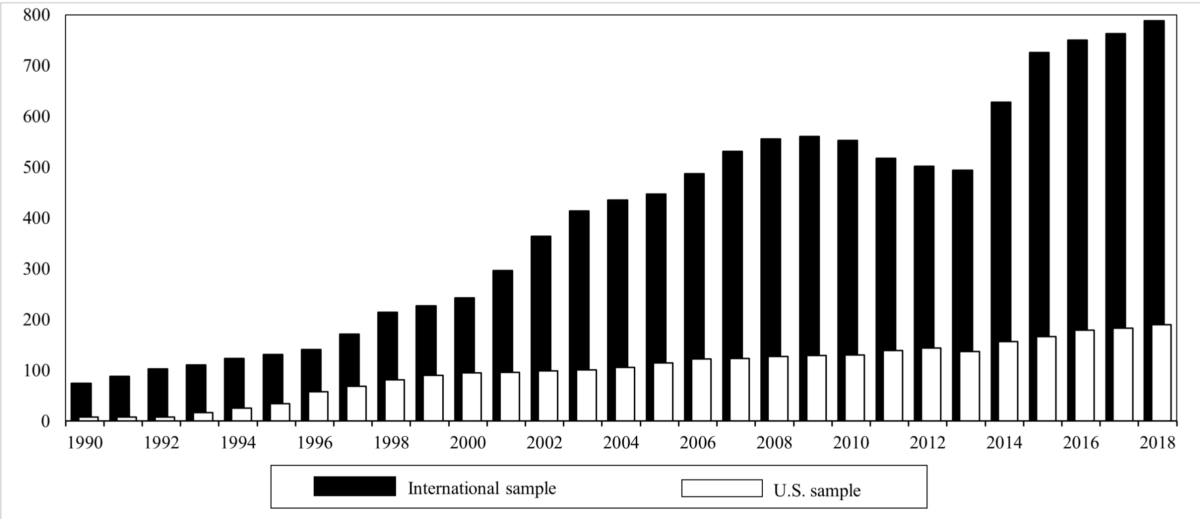
Expanding on congruent strategy results from nonfinancial sectors, our findings document that investor sentiment significantly affects the cash-return relation in global real estate markets. Moreover, we present evidence that investor sentiment only affects the cash premium when the underlying firms are mispriced, which is in line with the investor sentiment hypothesis.

Taken together, our results show a positive cash-return relation among real estate equities. This may be attributed to a systematic exploitation of cross-sectional mispricing.

3.8. Appendix

Appendix figures

Figure 3.2: Average number of international and US firms



This figure shows the average number of firms per year for the international and US real estate equity sample.

Data sources

The following ICB codes are used to form our sample:

- Real estate services (35101015)
- Real estate holding and development (35101010)
- Equity REITs (351020)

The Worldscope keyfields used in the international analysis are as follows:

- Cash and Short Term Investment (WC02001),
- Total Assets (WC02999),
- Common Equity (WC03501),

- Market Capitalization (WC08001),
- Net Income before Extraordinary Items (WC01551),
- Net Proceeds from Sale/Issue of Common and Preferred (WC04251),
- Common and Preferred Purchased (WC04751),
- Long Term Borrowings (WC04401),
- Long Term Borrowings (WC04401),
- Reduction in Long Term Debt (WC04701),
- Common Dividends Paid (WC05376).

The S&P Capital IQ keyfields used in the US analysis are as follows:

- Cash and Short Term Investment (IQ_CASH_ST_INVEST),
- Total Assets (IQ_TOTAL_ASSETS),
- Common Equity (IQ_TOTAL_COMMON_EQUITY),
- Market Capitalization (SP_MARKETCAP),
- Net Income before Extraordinary Items (SNL_NI_BEFORE_EXTRA),
- Net Proceeds from Sale/Issue of Common Equity (IQ_COMMON_ISSUED),
- Net Proceeds from Sale/Issue of Preferred Equity (IQ_PREF_ISSUED),
- Common Equity Purchased (IQ_COMMON_REP),
- Preferred Equity Purchased (IQ_PREF_REP),
- Long Term Debt Borrowings (IQ_LT_DEBT_ISSUED),
- Reduction in Long Term Debt (IQ_LT_DEBT_REPAID),
- Common Dividends Paid (IQ_COMMON_DIV_PAID_CF).

Variable definitions

- Cash-to-market $CM_{i,t} = \dfrac{Cash\ and\ Short\ Term\ Investment_{i,t}}{Market\ Capitalization_{i,t}}$

- Book-to-market $BM_{i,t} = \dfrac{Common\ Equity_{i,t}}{Market\ Capitalization_{i,t}}$

- Investment $INV_{i,t} = \dfrac{Total\ Assets_{i,t} - Total\ Assets_{i,t-1}}{Total\ Assets_{i,t-1}}$

- Profitability $PRO_{i,t} = \dfrac{Net\ Income\ before\ Extraordinary\ Items_{i,t}}{Total\ Assets_{i,t-1}}$

- Net External Financing
  $XFIN_{i,t} = \dfrac{(Issue\ Equity_{i,t} - Purchase\ Equity_{i,t} - Dividends_{i,t}) + (Borrowings_{i,t} - Debt\ Repaid_{i,t})}{Total\ Assets_{i,t-1}}$

Chapter 4

Decomposing the Value Premium in Real Estate Equities

This chapter corresponds to a working paper. The working paper has been submitted to the *The Quarterly Review of Economics and Finance* and is currently under review.

This article decomposes the book-to-market ratio of international and US real estate equities. In theory, firms move between value and growth because of changes in either expected return or expected profitability. We document that, for real estate equities across both international and US markets, the value premium predominantly arises from changes in expected profitability, highlighting a similar market mechanism between real estate and nonfinancial equities. However, consistent with a mispricing-based explanation, expected return predominates expected profitability in scenarios in which book-to-market interacts with a firm's fundamental strength.

JEL classifications: G11, G12, G14

Keywords: Stock valuation; Decomposition; Mispricing; Real estate

4.1. Introduction

Empirical research suggests that average returns increase with higher book-to-market (BM) ratios, a phenomenon known as the *value premium*.[1] Theoretically, both expected return and expected profitability affect a firm's stock price, and consequently, its BM ratio. However, the primary driver of the value premium – whether differences in expected returns or future earnings growth – remains a subject of ongoing debate.

This paper draws insights from empirical research conducted on nonfinancial firms to provide an explanation for the driving forces behind the value premium. Previous studies have largely excluded financial firms, including real estate equities, providing a useful hold-out sample to assess the reliability of the results. This article intends to mitigate the risk of data snooping and enhances the overall quality of the literature (Barber and Lyon, 1997). Our primary objective is to decompose the BM ratio of real estate equities to identify the key driver behind cross-sectional variations in current BM ratios of real estate firms. In doing so, we aim to understand the dynamics of real estate firms transitioning between value and growth.

In addition, we conduct a decomposition approach conditional on two firm characteristics, BM and firm profitability, as average returns are positively related to these characteristics (e.g., Fama and French, 2006; Bond and Xue, 2017). Typically, value firms with high BM ratios are often presumed to possess weaker fundamentals, while growth firms with low BM ratios are associated with stronger fundamental attributes. Therefore, an investment approach that incorporates fundamental strength into the value process presents a particularly compelling strategy. By employing this interaction approach, we not only aim to identify expectation errors in value-growth investment strategies and their subsequent price corrections (e.g., Piotroski and So, 2012), but also seek to provide evidence supporting a mispricing-based explanation for the value premium in real estate equities, which is a pivotal aspect of our investigation. In this context, an expectation error-based investment strategy arises when expectations implied by the BM ratio do not align with a firm's actual fundamental strength.

Real estate equities are particularly intriguing compared to other financial firms, such

[1] See, for example, Fama and French (1992) for US evidence along with Fama and French (1998, 2012) and Rouwenhorst (1999) for numerous non-US evidences.

as banks and insurance companies, due to their more transparent and homogeneous business model. This transparency allows for a clearer assessment of market valuations against firm fundamentals, making real estate firms ideal candidates for a comparative analysis. Moreover, the cash flows of real estate stocks, heavily dependent on rental income, are expected to be directly reflected in their prices. However, the success of investment strategies based on expectation errors requires that prices do not timely and accurately reflect the future cash flow implications. Consequently, this raises the question about the applicability of existing research conclusions to the listed property market, considering the contradiction between the requirement for expectation error-based strategies and the characteristic transparency of real estate equities.

We hypothesise that irrational investors may make systematic errors when they value firms with different levels of fundamental strengths as high (low) values on BM signal pessimistic (optimistic) expectations concerning a firm's future earnings performance. As a result, these biased expectations systematically reverse in response to latest earnings information, leading to positive value-growth returns. We therefore examine two important questions: (i) Are differences in expected earnings the source that separates value from growth, underscoring the market's ability to accurately incorporate differences in expected earnings growth into stock prices? (ii) Are market participants systematically biased in their expectations of firm's future earnings performance such that when these biased expectations reverse, swings in expected return explain the expectation error-based value premium?

Our decomposition approach is based on Cohen et al.'s (2003) present value model, which decomposes a firm's current BM ratio into expected stock return, expected profitability, and future BM ratio. The variance decomposition methodology, introduced by Campbell and Shiller (1988) for identifying stock price variation sources, has been widely applied, particularly at the aggregate market level. Extending this approach to the firm level, Vuolteenaho (2002), Cohen et al. (2003), and more recently Donangelo (2021) conducted cross-sectional variance decomposition analysis on US non-financial equity portfolios.

Consistent with Cohen et al. (2003), we show that changes in current BM ratios is mostly due to differences in expected cash-flows rather than expected returns. That means that firms move between value and growth rather due to shifts in expected profitability and not due to shifts in expected returns. This is in line with the first hypothesis that the market incorporate differences in earnings growth into prices. However, taking a firm's fundamental strength into account, our decomposition results significantly vary. In the case of firms exposed to expectation error, that is, real estate value (growth) firms having the opposite attributes in their business fundamentals against the expectation, changes in current BM ratios is not solely linked to expected profitability, but to a higher magnitude to variations in expected return supporting the second hypothesis that mispricing drives the value premium.

Our study sheds new light on a critical aspect often overlooked by investors: the tendency to treat value and growth firms as a homogeneous group, thereby neglecting the distinctive fundamental strengths inherent in individual firms. The evidence in this paper documents that the similarities between a real estate firms moving between value and growth maybe greater than previously thought. By dissecting the BM ratios, our paper reconfirms how stock prices integrate fundamental information. These findings hold particular relevance for real estate portfolio managers who factor in a firm's business quality within their valuation process. Adopting this perspective as an additional criterion can significantly refine the construction of optimised real estate value portfolios.

The remainder of the paper is organised as follows. Section 4.2 describes the BM decomposition framework. Section 4.3 describes the data and the variables. Section 4.4 presents the results. Section 4.5 concludes.

4.2. Methodology

We decompose the BM ratio of real estate equities to derive a cross-sectional link between current BM and future stock returns, future profitability, and future BM using Cohen et al.'s (2003) variance decomposition framework.

Following Cohen et al. (2003), the BM decomposition is derived from the accounting clean-surplus relation, which relates the annual change in book value of equity (BE) to earnings (X) less dividends (D) as follows:

$$BE_t - BE_{t-1} = X_t - D_t \tag{4.1}$$

Deviating in reported earnings, dividends, and book values are responsible that Equation (4.1) is not always satisfied. To adhere to the clean-surplus assumption, we calculate earnings by adding the annual change in book value to dividends ($X_t = BE_t - BE_{t-1} + D_t$). Utilising this methodology, we then define our log clean-surplus return on equity (e) as

$$e_t = \log\left(1 + \frac{X_t}{BE_{t-1}}\right). \tag{4.2}$$

We define bm as the log BM ratio and log stock return is defined as (r)

$$r_t = \log\left(1 + \frac{ME_t - ME_{t-1} + D_t}{ME_{t-1}}\right), \tag{4.3}$$

where ME_t is defined as market equity. Utilising a Taylor series approximation to approximate stock and accounting returns, Cohen et al. (2003) show that,

$$bm_t = r_{t+1} - e_{t+1} + \rho bm_{t+1} + k_{t+1}, \tag{4.4}$$

where ρ represents a positive discounting parameter and k_t an approximation error. When D_t is nonzero, ρ takes a value less than 1, whereas ρ equals 1 in the case where D_t is zero. By multiplying both sides of Equation (4.4) with the cross-sectional variance of bm_t, any approximation errors are negated. Consequently, the variance decomposition is derived from equation Equation (4.4) by taking the unconditional expectations:

$$\begin{aligned} var(bm_t) = \sum_{s=1}^{N} cov\left(\rho^s r_{t+s}, bm_t\right) + \sum_{s=1}^{N} cov\left(\rho^s(-e_{t+s}), bm_t\right) \\ + cov(\rho^{1+N} bm_{t+1+N}, bm_t) \end{aligned} \tag{4.5}$$

By dividing both sides of the equation with the unconditional variance of bm_t, we can determine the percentage contribution of each determinant to the current BM ratio. This reveals the degree to which variations in current valuation ratios are explained with future earnings and stock returns:

$$1 = \frac{\sum_{s=1}^{N} cov\left(\rho^s r_{t+s}, bm_t\right)}{var(bm_t)} + \frac{\sum_{s=1}^{N} cov\left(\rho^s(-e_{t+s}), bm_t\right)}{var(bm_t)} + \frac{cov(\rho^{1+N} bm_{t+1+N}, bm_t)}{var(bm_t)} \tag{4.6}$$

The equation above indicates that the aggregate of these three elements equals 1, allowing us to interpret them as indicative of their relative significance in explaining cross-sectional differences in firms' BM ratios. To estimate the contribution of each factor, we conduct the following cross-sectional regressions without an intercept:

$$\begin{aligned} \sum_{s=1}^{N} \rho^s \tilde{r}_{t+s} &= \beta^{\tilde{r}}_{N,t} \tilde{bm}_t + \varepsilon^{\tilde{r}}_{N,t}, \\ \sum_{s=1}^{N} \rho^s (-\tilde{e}_{t+s}) &= \beta^{\tilde{e}}_{N,t} \tilde{bm}_t + \varepsilon^{\tilde{e}}_{N,t}, \\ \rho^{1+N} \tilde{bm}_{t+1+N} &= \beta^{\tilde{bm}}_{N,t} \tilde{bm}_t + \varepsilon^{\tilde{bm}}_{N,t}. \end{aligned} \tag{4.7}$$

Using tildes to denote cross-sectional demeaned quantities, we use the Fama and MacBeth (1973) methodology to estimate the covariances in Equation (4.5) from cross-sectional regressions.

4.3. Data Description

Our study includes firms from 20 developed international and in addition the US real estate stock markets. The sample resembles the countries featured in the MSCI EAFEC (Europe, Australia, the Far East, and Canada) stock market benchmark. We collect firm-level accounting data from Worldscope and identify listed real estate institutions using Industry Classification Benchmark (ICB) codes. Per the ICB categorisation adopted by FTSE, Dow Jones, and Worldscope, the real estate sector includes real estate services, real estate holding and development and equity REITs. For the US market, firm-level accounting data are gathered from from the S&P Capital IQ database. Our sample omits real estate services, such as agencies, brokers, and management companies, focusing on firms with at least half of their total assets allocated to rental properties.[2] This exclusion is designed to distinguish real estate holding and development firms, which the ICB groups under a single code, thereby ensuring our sample predominantly consists of property-holding stocks.

In line with the approach adopted by Cohen et al. (2003), we consider firm-year observations with negative or zero book equity as missing data. Additionally, for a firm to be included in our sample, all necessary accounting information to compute the BM

[2]This restriction is similar to that used by FTSE EPRA NAREIT and Global Property Research indices, with variations not significantly affecting our sample composition.

ratio for the fiscal year ending in the previous year must be available. The variables used in this study are defined as follows. A firm's size is determined by its market equity, which is the product of the stock price and the total number of outstanding shares, and is measured in millions of US dollars. The BM ratio represents the proportion of a firm's book equity to its market equity at the end of the fiscal year. Profitability (PRO) is defined as the ratio of as net income before extraordinary items to the total assets from the previous year. Our data spans from 1990 to 2019, and all firm characteristic values in the international sample are expressed in US dollars.

Table 4.1 reports summary statistics. Panel A details the average number of firms per year across countries. In the international sample, we have an average of 643 firms, totalling 19,296 observations, and in the US sample, an average of 84 firms, amounting to 3,233 observations. The average number of firms per year from EAFEC (US) steadily increases from 174 (9) to 967 (183) over the sample period.

Panel B of Table 4.1 provides distributional statistics for both samples from 1990 to 2019. In the international sample, the mean (median) BM ratio is 1.32 (0.99), reflecting the variation in current valuations. A typical firm in this sample has a size of \$664 million in terms of market equity. PRO is, on average, positive with a value of 0.04, indicating that the typical real estate firm in the international sample is profitable.

In contrast, the US sample exhibits a mean (median) BM ratio of 0.70 (0.60). The average size of a typical US property firm is significantly larger at \$3057 million, with an average PRO of 0.03

These summary statistics demonstrate a broad yet reasonable dispersion in our variables over the sample period and across the firms included in the study.

4.4. Results and Discussion

We begin our analysis by confirming the first hypothesis that most of the cross-sectional variation in BM ratios can be attributed to future profitability, thus highlighting the market's ability in identifying differences in firms' fundamental strengths. To elucidate the factors influencing current BM ratios, we initially present baseline results for our

Table 4.1: Summary statistics

Panel A: Sample countries: International and US

Country	Firm observations	Country	Firm observations
Australia	1519	Japan	2839
Austria	185	Netherlands	332
Belgium	461	New Zealand	313
Canada	1361	Norway	94
Finland	118	Singapore	1403
France	1513	Spain	530
Germany	1215	Sweden	643
Hong Kong	3426	Switzerland	346
Ireland	24	UK	1863
Israel	1013	US	3233
Italy	200		

Panel B: Variables

	International market			US market		
	SZ	BM	PRO	SZ	BM	PRO
Mean	664	1.32	0.04	3057	0.70	0.03
25th	316	0.63	0.01	545	0.42	0.01
Median	574	0.99	0.04	1306	0.60	0.03
75th	893	1.49	0.08	3255	0.85	0.07

The table presents summary statistics of countries covered in the international and US sample and respective variables used in the study. Panel A reports the total number of firm-year observations in each country during the sample period from 1990 to June 2019. Panel B reports the arithmetic mean, 25th percentile, median, and 75th percentile of the variables. Firm size (SZ) is measured as market equity at the end of fiscal year. Book-to-market (BM) ratio is the firms' book equity to market equity at the end of fiscal year. Profitability (PRO) is defined as net income before extraordinary items divided by total assets from the previous year.

sample of international real estate firms. Subsequently, we explore the persistence of these findings across two distinct time periods and within the US real estate market. Finally, we evaluate how the sensitivity of BM determinants varies when analysing the decomposition conditioned on expectation error. This directly addresses our second hypothesis, positing that the value premium in scenarios driven by expectation errors is predominantly influenced by changes in expected return.

4.4.1. Baseline Decomposition

Our analysis starts with a baseline decomposition using the entire international real estate sample. This baseline approach provides a first impression into how swings in future BM determinants are incorporated in current valuations. Table 4.2 shows the average coefficient estimates of this baseline decomposition. The first column presents an increasing time horizon N, ranging from one to five years, while the remaining three columns relate to the three components of the BM function presented in Equation (4.5). We estimate the average coefficients for each time horizon, based on equation (4.7), to quantify the variations of the BM determinants.

At the one-year horizon, 79% of the cross-sectional variation in BM ratios is due to variation in future BM ratio, 12% due to expected profitability, and the remaining 8% is due expected return. As expected, real estate equity valuations are relatively persistent and therefore explaining the largest fraction of current BM ratios. However, the next year's BM ratio also reflects expectations for future profits and stock returns beyond the one-year window. At a five-year horizon, the contribution shifts: 44% of the variation is now due to future BM ratios, 32% is due to profitability, and 23% is due to stock returns. This shift suggests that for longer horizons, the importance of the future BM component diminishes, while the role of expected profitability grows. Figure 4.1 contrasts these average coefficients across different forecast horizons.[3]

Assuming that the five-year ahead pricing multiple mirrors expectations beyond this period, while remaining informative about expected profitability, suggests a growing dominance of the expected profitability component over the expected return component. This aligns with the understanding that real estate equity prices become more informative for

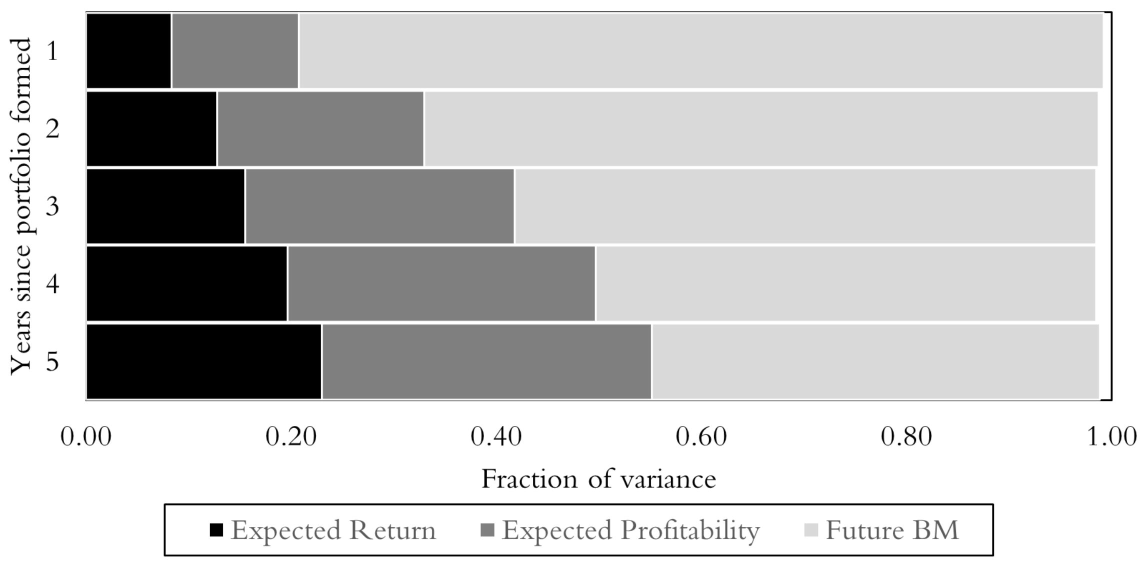
[3]Adjusting each BM determinant (return, profitability, and BM) for country-specific factors by subtracting the value-weighted country measure yields similar results. Detailed outcomes of this adjustment are available upon request from the authors.

Table 4.2: Baseline BM decomposition

Horizon (N)	Expected returns	(−) Expected profitability	Future BM	Sum of the weights
1	0.08 (*0.01*)	0.12 (*0.01*)	0.79 (*0.01*)	0.99
2	0.13 (*0.02*)	0.20 (*0.01*)	0.66 (*0.02*)	0.99
3	0.16 (*0.02*)	0.26 (*0.02*)	0.57 (*0.02*)	0.99
4	0.20 (*0.03*)	0.30 (*0.02*)	0.49 (*0.02*)	0.99
5	0.23 (*0.03*)	0.32 (*0.02*)	0.44 (*0.02*)	0.99

The table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international sample during the sample period from 1990 to 2019. The first row presents a one-year decomposition, the second row a two-year decomposition, and so forth. Each estimate is the percentage of variation explained by the factors indicated by the column. The last column reports the sum of the three components. This methodology follows the methodology introduced by Cohen et al. (2003). We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. We estimate the covariances from cross-sectionally demeaned annual panel data. Newey and West (1987) adjusted Standard errors for the average estimates are given in parentheses. The number of lags matches the time-horizon N in the specification.

Figure 4.1: Baseline BM Decomposition



This figure shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international sample during the sample period from 1990 to 2019.

future profitability as the forecast horizon lengthens.

Our baseline decomposition echoes prior US evidence on nonfinancial stocks by Cohen et al. (2003), showing that at the five-year horizon, expected return, expected profitability, and future BM contribute to BM ratio variation by 12%, 38%, and 50%, respectively. Donangelo (2021) further validate these findings, emphasising the similarities in the determinants that explain variations in BM ratios between real estate and nonfinancial firm.

4.4.2. Evolution of the BM Decomposition

To explore the temporal evolution of the BM ratio decomposition, we split our full sample into two subperiods and examine whether any significant differences in terms of information content of the BM ratio emerged between them. The earlier subperiod ranges from 1990 to 2004 while the later subperiod ranges from 2005 to 2019. Panels A and B of Table 4.3 provide the estimates for the earlier and later subperiod, respectively. Additionally, Panel C of Table 4.3 presents difference-of-means tests to assess whether there has been a significant change in the components of the BM ratio over time.

At the five-year horizon, we observe a significant increase in the swings in future profitability, rising from 26% in the earlier period to 34% in the later period. At the same time, there is a smaller increase in the expected return component, countered by a significant decrease in the future BM ratio component. These trends suggest that, over time, the BM ratio has become less persistent and increasingly predictive of future profitability.

4.4.3. US Results

In this subsection, we re-estimate the BM decomposition using data from the US real estate market, the largest in the world. This approach is designed to account for the differences in reporting standards between international markets and the US, as exemplified by the distinct accounting practices of US-GAAP and IFRS. Such differentiation, highlighted by Woltering et al. (2018), necessitates a separate analysis for the US market. By conducting this analysis, we not only account for these reporting differences, but also aim to examine the robustness of our results, particularly with regard to data snooping.

Table 4.3: BM decomposition for two subperiods

Horizon ($N = 5$)	Expected returns	(−) Expected profitability	Future BM	Sum of the weights
Panel A: 1990–2004				
	0.20 (*0.05*)	0.26 (*0.04*)	0.53 (*0.02*)	0.99
Panel B: 2005–2019				
	0.26 (*0.04*)	0.36 (*0.02*)	0.37 (*0.02*)	0.99
Panel C: Difference				
	0.06 (*0.02*)	0.10 (*0.01*)	−0.16 (*0.02*)	

The table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international sample in two subperiods: 1990–2004 (Panel A) and 2005-2019 (Panel B), at the five-year horizon. Each estimate is the percentage of variation explained by the factors indicated by the column. The last column reports the sum of the three components. Panel C reports the difference-of-means tests on the average coefficient for the earlier and later subperiods. We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. We estimate the covariances from cross-sectionally demeaned annual panel data. Newey and West (1987) adjusted Standard errors for the average estimates are given in parentheses. The number of lags matches the time-horizon N in the specification.

We expect that the US sample will yield results similar to our international data, thereby providing a robust out-of-sample validation of our research.

Table 4.4 shows the average coefficient estimates for the US sample. The results make clear that differences in the current BM ratio occur due to future profitability, especially over extended decomposition horizons. At the one-year horizon, mirroring our international results, 75% of the cross-sectional variation in BM ratios is due to future BM ratio, 12% due to expected profitability, and 11% due to expected return. At the five-year horizon, the composition shifts: 43% of the variation is attributed to future BM ratio, 39% to profitability, and only 16% to returns.

In conclusion, the BM decomposition for the US real estate market, across both short and extended horizons, supports our international findings, concluding that existing differences in future earnings for real estate firms are incorporated into equity prices. Taken together, our findings from Sections 4.4.1 to 4.4.3 provide strong support for our first hypothesis.

Table 4.4: BM decomposition for the US sample

Horizon (N)	Expected returns	(−) Expected profitability	Future BM	Sum of the weights
1	0.11 (*0.02*)	0.12 (*0.01*)	0.75 (*0.02*)	0.98
3	0.14 (*0.02*)	0.27 (*0.02*)	0.57 (*0.03*)	0.98
5	0.16 (*0.03*)	0.39 (*0.03*)	0.43 (*0.04*)	0.98

The table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the US sample during the sample period from 1990 to 2019. The first row presents a one-year decomposition and the second row a five-year decomposition. Each estimate is the percentage of variation explained by the factors indicated by the column. The last column reports the sum of the three components. We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. We estimate the covariances from cross-sectionally demeaned annual panel data. Newey and West (1987) adjusted Standard errors for the average estimates are given in parentheses. The number of lags matches the time-horizon N in the specification.

4.4.4. BM Decomposition Conditional on Expectation Error

In this subsection, following the observation that expected profitability largely explains the difference in BM ratios, we conduct a portfolio-level decomposition of the BM ratio, utilising both univariate and bivariate sorts. This process involves sorting real estate firms based on their BM and PRO ratios, as substantial evidence indicates that average returns are positively related to these firm characteristics (e.g., Fama and French, 2006).[4] The univariate sorts enable us to examine the swings in cross-sectional decomposition relative to value and firm fundamentals within international real estate equity markets, thereby assessing the variable's sensitivity to changes in the BM ratio. The subsequent bivariate sorts aim to understand how this sensitivity shifts when value interacts with a firm's fundamental strength. We classify a firm as a real estate growth stock if its BM ratio is below the 30th percentile, and as a value stock if it is above the 70th percentile. Similarly, a real estate firm is labelled as strong or as weak based on whether its PRO is above the 70th percentile or below the 30th percentile, respectively.

Panel A of Table 4.5 shows the average coefficient estimates for the univariate portfolio sorts for the international sample.[5] When portfolios are sorted by BM or PRO, we

[4]The inclusion of real estate-specific classifications, such as the regulatory REIT framework, does not alter the findings of this paper. For an alternative approach to calculating real estate-specific variables, see, for example, Bond and Xue (2017).

[5]We only report results for the international sample due to their qualitative similarity to the US sample. While the US sample's limited observations reduce the statistical precision of our estimates, they support the conclusions drawn from the international sample. The US results are available upon

observe variations in the BM decomposition based on these firm characteristics. Firstly, when examining real estate value stocks, a distinct pattern emerges where the expected profitability component appears to be less relevant in explaining the variation in BM ratios. Instead, at the five-year horizon, 53% percent of the variation in value stocks is due to expected return. For real estate growth stocks this proportion is only 35%. In contrast, for real estate growth stocks, the decomposition points to a different conclusion, aligning with the baseline decomposition, where expected profitability plays a more significant role in explaining differences in the BM ratio. At the five-year horizon, 41% of the variation is due to expected profitability growth stocks, while for value stocks this figure is only 13%. Secondly, *Value−Growth* illustrates the difference on the average estimates for the three component of BM. At the five-year horizon, there is a substantial spread in swings regarding expected profitability between value and growth stocks, amounting to −28%. In contrast, there is a spread in swings of 18% in the expected return component. This discrepancy indicates that real estate growth stocks exhibit a higher sensitivity to changes in expected profitability compared to value stocks, underscoring the market's ability to accurately incorporate differences in expected earnings growth into stock prices. However, the more interesting finding is that the variation in BM ratios for real estate value firms is primarily driven by higher expected return variations, despite being associated with weaker underlying fundamentals.

Moving on to the portfolio sort based on PRO, our analysis reveals that fluctuations in the BM ratio are due to opposite reasons than value. Notably, fundamentally strong real estate firms demonstrate a significantly higher sensitivity to changes in expected profitability compared to weak firms. At the five-year horizon, the spread in swings in expected profitability between strong and weak firms amounts 7%, while we observe a negative spread of swings of −19% in the expected return component. However, the more notable finding is the limited relevance of the expected return component for strong real estate firms, accounting for only 1% of the total variation. This suggests that when expected earnings rise, expected returns, on average do not correspond, thereby resulting in a lower BM ratio. Essentially, even with strong fundamentals, the market views these highly profitable real estate firms as expensive, resulting in a subsequent decline in their valuations which is in line with the growth investing ideology.

The analysis of the portfolio characteristics reveals trends in line with expectations.

request from the authors.

Table 4.5: BM decomposition on firm characteristics

Portfolio	Decomposition				Characteristics	
Horizon ($N = 5$)	Expected returns	(−) Expected profitability	Future BM	Sum	BM	PRO
Panel A: Single sort						
Book-to-market						
Value	0.53 (*0.02*)	0.13 (*0.02*)	0.31 (*0.02*)	0.97	2.28	−0.01
Growth	0.35 (*0.03*)	0.41 (*0.02*)	0.21 (*0.02*)	0.97	0.52	0.06
Value − Growth	0.18 (*0.01*)	−0.28 (*0.01*)	0.10 (*0.01*)			
Fundamentals						
Strong	0.01 (*0.04*)	0.45 (*0.01*)	0.51 (*0.02*)	0.97	1.13	0.08
Weak	0.20 (*0.03*)	0.38 (*0.03*)	0.39 (*0.02*)	0.97	1.52	−0.06
Strong − Weak	−0.19 (*0.01*)	0.07 (*0.01*)	0.12 (*0.01*)			
Panel B: Double sort						
Value x Strong	0.33 (*0.03*)	0.28 (*0.03*)	0.37 (*0.03*)	0.98	2.17	0.02
Growth x Weak	0.08 (*0.03*)	0.45 (*0.03*)	0.45 (*0.02*)	0.98	0.48	0.04
VxS − GxW	0.25 (*0.02*)	−0.17 (*0.02*)	−0.08 (*0.01*)			

The table shows the results of the variance decomposition of current BM ratios into future expected return, future expected profitability, and future BM ratio for the international sample during the sample period from 1990 to 2019 at the five-year horizon. The table also reports average firm characteristics. The portfolios are formed based on two firm characteristics, book-to-market (BM) and profitability (PRO). BM ratio is the firms' book equity to market equity at the end of fiscal year. PRO) is defined as net income before extraordinary items divided by total assets from the previous year. In Panel A, we sort stocks based on BM or PRO. In Panel B, we sort stocks based on BM and PRO. A firm is characterised as Growth or Value if its BM ratio is below the 30th percentile or above the 70th percentile, respectively. Similarly, a firm is characterised as Weak or Strong if its PRO is below the 30th percentile or above the 70th percentile, respectively. The standard value strategy *Value−Growth* and the standard fundamental strategy *Strong−Weak* illustrate the difference on the average estimates for the three component of BM. The expectation error-based investment strategy is considered when the BM ratio's implied expectations do not align with a firm's actual fundamental strength, particularly in cases where BM and PRO interact, identifying firms as either $Value \times Strong$ or $Growth \times Weak$. We use the Fama and MacBeth (1973) methodology to estimate the covariances from cross-sectional demeaned regressions. We estimate the covariances from cross-sectionally demeaned annual panel data. Newey and West (1987) adjusted Standard errors for the average estimates are given in parentheses. The number of lags matches the time-horizon N in the specification.

Typically, real estate value firms like their non-financial peers, on average, are less profitable, compared to growth firms (e.g. Fama and French, 2015, Bond and Xue, 2017), and fundamentally strong real estate firms display higher profitability than fundamentally weak firms (e.g. Fama and French, 2006).

Next, we focus on the joint relationship between value and fundamentals among real estate equities. Typically, firms with high BM ratios are often presumed to possess weaker fundamentals, while those with low BM ratios are associated with stronger fundamental attributes. Consequently, a investment approach that incorporates fundamental strength into the value process, rather than assessing the attractiveness of an asset based on its market price, presents a particularly compelling strategy.

Panel B of Table 4.5 shows the average coefficient estimates for the bivariate portfolio sort. Based on the interaction of BM and PRO, a real estate stock is assigned to the expectation errors portfolio if its BM is incongruent with the fundamental strength ($GrowthWeak$ or $ValueStrong$). When compared to the standard unconditional long-short value strategy, the long-short value strategy conditioned on expectation error demonstrates an increased sensitivity to changes in expected return and a lessened negative sensitivity to changes in expected profitability. Notably, the spread in expected profitability narrowed from -28% in the unconditional portfolio to -17% in the conditional one. This reduction indicates that real estate value firms were not as fundamentally weak as real estate growth firms when when expectations implied by the BM ratio do not align with a firm's actual fundamental strength. Additionally, the spread in expected return increased from 18% to 25%, surpassing the spread in expected profitability and compensating for a significant drop in valuations. This aligns with Piotroski and So's (2012) perspective that strategies based on incongruent expectations effectively capture predictable price corrections following the reversal of investors' expectation errors.

The return component in our decomposition, as outlined in Equation (4.7), is represented by the product $\beta^{\tilde{r}}_{N,t}\tilde{bm}_t$. Therefore, substantial variations in expected returns could stem either from changes in $\beta^{\tilde{r}}_{N,t}$ or from significant variances in $\tilde{bm}_t$. This suggests that our results might be influenced by differences in the average cross-sectional variance of BM ratios. As a result, strong real estate value stocks may exhibit high sensitivity to expected return not necessarily because their BM ratios provide greater insights into expected returns, but due to their BM ratios being more dispersed compared to those of weaker real estate growth stocks. However, it's important to note that the variance differences between the long and short positions in our analysis are not particularly pronounced.

In conclusion, our results suggest that the observed interaction effect between the BM ratio and PRO is predominantly driven by variations in expected return rather than expected profitability. Indeed, the predominance of expected return is particularly evident in the conditional cases, where its contribution exceeds that of expected profitability. In the unconditional scenario, on the other hand, we observe a higher spread of expected profitability. This shift suggests that the contribution of expected return becomes more pronounced when conditioning on expectation errors, implying that mispricing is likely to play a significant role. Taken together, the analyses presented in section 4.4 provide robust support for our second hypothesis.

4.5. Conclusion

In this article, we decompose the well-documented positive relation between book-to-market (BM) ratios and stock returns in real estate equities, which has been excluded from previous research. Our analysis, based on a global sample of real estate markets from 1990 to 2019, shows that the cross-sectional differences in BM ratios closely mirror those for non-financial firms. In particular, we find that changes in current BM ratios are driven more by shifts in expected profitability than by expected returns.

Yet, factoring in a firm's fundamental strength significantly alters the dynamics of our decomposition findings. In the case of firms are subject to expectation errors, the contribution of the expected return component to the BM ratio significantly escalates, while the influence of expected profitability diminishes, arguable due to mispricing.

Expanding on expectation error approach from nonfinancial sectors, our findings document that market mispricing significantly affects the value premium in global real estate markets and emphasise the importance of expectation error approach across equity sectors.

Chapter 5

Conclusion

Discussions on return behaviours continue to evolve regarding the topics of value and cash premiums, both of which attract a large amount of interest. However, the international literature addressing these subjects remains limited, particularly in terms of coverage of the real estate sector. This thesis contributes to the existing literature by examining the expectation error based value premium and cash premiums across a wide array of international nonfinancial and real estate markets. To this end, the most recent trends and methods in asset pricing are considered and taken into account.

The first paper examines the market expectation errors explanation by Piotroski and So (2012) that the value premium is linked to mispricing, using a present value perspective. Analysing a broad sample from non-US and nonfinancial international equity markets, we find that the value premium is only present for firms with a misalignment between BM implied expectations and actual fundamentals, as indicated by the $FSCORE$. Where these expectations align with fundamentals, the premium disappears. Decomposing BM ratios into their components – expected return, expected profitability, and future BM – challenges Piotroski and So's (2012) mispricing explanation by showing the premium generally stems from expected profitability differences. Yet, when analysing firms exposed to expectation errors, variations in BM are primarily driven by expected returns rather than profitability, strongly supporting the mispricing-based explanation proposed by Piotroski and So (2012).

The second paper examines the explanation that mispricing drives the cash premium observed in both international and US real estate equities. Our results suggest that firms with a higher ratio of cash-to-market (CM) outperform their counterparts with a lower CM ratio, suggesting a similar market dynamic to that observed in nonfinancial equities. Additionally, our analysis reveals that the cash premium is only present in mispriced real estate firms and does not exist in firms that are not mispriced. Similarly, the impact of investor sentiment on the cash premium is only significant when a mispriced strategy is employed. Therefore, the findings suggest that the cash premium in real estate equities can be attributed to the systematic exploitation of cross-sectional mispricing.

The last paper decomposes the BM ratio of international and US real estate equities using Cohen et al.'s (2003) decomposition approach. Our findings indicate that in real estate equity markets, both internationally and in the US, the value premium is primarily driven by differences in expected profitability, highlighting a similar market mechanism between real estate and nonfinancial equities. However, in cases where the BM ratio is misaligned with a firm's profitability, expected return takes precedence over expected profitability, consistent with a mispricing-based explanation.

The studies collectively support the notion that investors frequently exhibit a homogeneous approach towards valuing both value and growth firms, thereby neglecting the distinctive fundamental strengths of individual firms. The analysis of cash premiums in real estate equities reveals a similar pattern of cross-sectional mispricing, highlighting the broader applicability of mispricing theories beyond nonfinancial stocks. This observation underscores the potential for systematic exploitation of mispricing within the real estate sector, offering a novel approach for adding value through informed investment strategies.

The findings advocate a more nuanced consideration of firm-specific characteristics and market conditions in developing investment strategies, providing valuable perspectives for both academic researchers and financial practitioners. This research enriches the existing literature on asset pricing and provides a practical framework for investors seeking to navigate the complexities of international markets, demonstrating the potential for achieving a pure value and cash premium through the exploitation of cross-sectional mispricing.

Future studies could explore the impact of emerging technologies and data analytics on the accuracy of market expectation models and their ability to better predict mispricing. Also, examining the influence of global economic shifts could provide a deeper understanding of market dynamics.

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