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Fama–French–Carhart Factor-Based Premiums in the US REIT Market: A Risk Based Explanation, and the Impact of Financial Distress and Liquidity Crisis from 2001 to 2020

Mohammad Sharik Essa and Evangelos Giouvris *

School of Business and Management, Royal Holloway, University of London, Egham TW20 0EX, UK
* Correspondence: evangelos.giouvris@rhul.ac.uk

Abstract: The study investigates the impact of financial distress (credit spread) and liquidity crises (TED spread) on size, value, profitability, investment and momentum premiums within the US Real Estate Investment Trust market. Using daily data from 2001 to 2020, we examine the presence, magnitude and significance of these premiums, along with assessing if these premiums are associated with higher risk. The study then employs Auto-regressive distributed lag and Error Correction Modeling to establish the long/short-run impact of financial distress and liquidity crisis on these premiums during recessionary and non-recessionary phases, including COVID-19. Premiums associated with all five factors are positive and significant. Secondly, in contradiction to the Efficient Market Hypothesis, we find that value and momentum portfolios provide superior returns without exposing investors to higher risk while portfolios based on size, profitability and investment, do tend to expose investors to a higher risk. Thirdly, in contradiction to the risk based explanation of Fama–French/Carhart (2015/1997), we find significant evidence of a fall in profitability and momentum premiums with an uptick in financial distress and liquidity crisis. On the other hand, size, value and investment premiums rise with financial distress/liquidity crisis, only during the recessionary phases. This impact is insignificant during non-recessionary phases.

Keywords: real estate investment trusts (REITs); default risk; REIT premiums; liquidity crisis; risk factors; portfolio performance

JEL Classification: R3; G12; G32; G11

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1. Introduction

Real estate investment trusts (REITs) are income generating instruments, that are diversified, liquid, and provide investors with the ease of incorporating the real estate sector within their portfolios at relatively lower costs compared to conventional real estate investments (Hoesli et al. 2004; Nazlioglu et al. 2016; Zhang and Hansz 2019)[1].

Early studies on REITs considered these instruments similar to bonds in terms of their ability to generate stable streams of income (Karolyi and Sanders 1998). REIT returns were strongly correlated with bond returns up until the 1990s (Shen et al. 2020). After the structural changes within the REIT market in the early 1990s, REITs became similar to stocks (Glascock et al. 2000), and their returns became more sensitive to factors, which impact small cap stocks and real estate specific drivers (Clayton and MacKinnon 2003). Following the structural changes within the REIT market, the ownership structures have drastically changed as well. Post 1990, institutional ownership within REITs has increased significantly (Chen and Zhang 1998). As participation within REITs increases, and as their returns behavior, relative to other financial assets, transitions overtime, it is expected that investors would put more focus on finding out if factor based investment strategies that generate positive premiums within the stock market, can also be used to generate excess returns within REITs.

Although REITs and certain segments of stocks have behaved in a similar manner after the structural changes within the REIT market, there are still essential differences between REITs and other equities (Zhang and Hansz 2019), which has resulted in REITs typically being excluded from most asset pricing studies, and still makes REITs a unique asset class. Firstly, certain stocks might not pay any dividends, but REITs are required by law to distribute 90% of their taxable income as dividends in order to maintain their REIT status[2] (Boudry 2011). Second, although common stocks are subject to corporate or trust taxation, REITs are exempt, and the only tax that is levied is on dividends and is according to the investors' personal tax rate (Gyourko and Keim 1992). Third, REITs pass their profits directly through to the individual tax returns of their shareholders, eliminating potential benefits of debt financing. Given the fact that REITs hold relatively large illiquid assets, accumulation of debt provides no tax benefit and magnifies potential bankruptcy costs (Harrison et al. 2011). Therefore, REITs, relative to corporations, are associated with lower debt levels (Zhang and Hansz 2019). Fourth, REIT prices tend to fluctuate more with interest rate changes, relative to dividend stocks (Titman and Warga 1986). Fifth, general stocks are usually not treated as an inflation hedge, but investors tend to consider REITs as an inflation hedge (Liu et al. 1997). Given the unique nature of REITs relative to general stocks, it is important to test asset pricing models, and factor based investment strategies within the REIT market, when historically most empirical testing of these models and strategies has focused on general stocks.

Fama and French (1992) identify a value and size premium in US stocks. Value stocks, in terms of average returns, seem to outperform growth stocks, while small stocks tend to have a higher average return relative to big stocks. Fama and French label the excess returns on value stocks relative to growth stocks as HML (high minus low), while they label the excess returns on small stocks relative to big stocks as SMB (small minus big)[3].

Carhart (1997) extends on the Fama–French three factor model by adding a fourth factor called momentum, to explain cross-section of stock returns. The WML (winners minus losers) factor is computed using historical returns.

Following the work of Titman et al. (2004), and Novy-Marx (2013), who conclude that the Fama–French three factor model is an incomplete model in explaining expected stock returns, Fama and French (2015) add two further factors to the model, namely, profitability and investment. RMW (robust minus weak) is the difference between average returns on stocks with robust profitability and weak profitability. While the CMA (conservative minus aggressive) factor is the difference between average returns on stocks with low and high investment.

Style based investment strategies have been used consistently by investors in the stock market to potentially earn higher returns or reap the rewards of risk premia (Said and Giouvris 2017). Each risk factor such as size, value, profitability, investment and momentum, drives a specific risk premium. Investors capture the premium associated to these factors by going long on assets with positive factor exposure, and shorting assets with negative factor exposure (Idzorek and Kowara 2013). The merits of factor-based investment strategies, specifically from a size, value and momentum perspective, comes from empirical evidence mainly within the stock market. The results of these have been varying, not only in terms of the existence of these premiums, but also the risk associated to them (Eun et al. 2010). Furthermore, profitability and investment factors have not yet been extensively researched in terms of their usefulness as investment styles and their ability to generate excess returns, along with their interpretation from a risk compensation perspective. Owing to these gaps in literature, this paper looks to examine the presence, magnitude and significance of SMB, HML, RMW, CMA and WML premiums within the US REIT market, using daily returns data from July 2001 to June 2020, and constructing long and short portfolios based on these factors. We find all these premiums to be significant and positive within the REIT market.

We then look to examine if these strategies that yield superior returns, expose investors to a higher risk. Efficient market hypothesis would suggest that the higher returns associated with these strategies is a compensation for exposing investors to higher risk. Previous studies, such as Ooi et al. (2007), find that HML investment strategy provides significant positive returns without exposing investors to higher risk. Consistent with the results of Ooi et al. (2007), we also find that the HML strategy provides excess returns, and we fail to detect any significant relative rise in systematic risk within portfolios containing value REITs versus those of growth REITs. Additionally, we find similar results for the WML strategy, that is, it provides significantly positive returns without any significant increase in investors' risk. This potentially suggests systematic mispricing of value and high momentum REITs, which is in contradiction to the market efficiency hypothesis. For the SMB, RMW and CMA strategies, we find that excess returns are associated with a significant rise in systematic risk, indicating that these premiums might serve as compensation for exposing investors' to higher risk.

We further analyze the relationship between risk and return associated to these factor based investment strategies by assessing two risk-adjusted performance measures, namely, the Sharpe ratio[4] and Treynor ratio[5]. Apart from the RMW strategy, we fail to find significantly weaker risk adjusted performance for SMB, HML, CMA and WML strategies.

Lastly, we look to test the impact of default risk, liquidity crises and stock market index, on the SMB, HML, RMW, CMA and WML premiums within the US REIT market. This study goes through three phases of financial crises, which correspond to an increase in the risk of corporate default. Although Fama and French (1996) and modern finance theory suggest that investors require a higher return on small/value stocks relative to big/growth as a compensation for their enhanced vulnerability as a consequence of an uptick in financial distress, the fact that there is mixed evidence in literature regarding the impact of default risk on value and size premiums, adds more relevance to this study. Certain studies, such as Griffin and Lemmon (2002), Vassalou and Xing (2004) and, Penman et al. (2007), conclude that investors require a higher return on value stocks relative to growth stocks during periods of high financial distress, while other studies, such as Mohanram (2005) and Huang et al. (2013), either argue that default risk only impacts the return of stocks within a certain book-to-market threshold or that factor premiums do not appear to be driven by financial distress. Furthermore, REITs are regulated by the fact that they have to distribute 90% of their taxable earnings as dividends. This could make REITs more prone to default risk relative to similar firms in other sectors (Chung et al. 2016). This mixed evidence on the impact of financial distress on factor premiums within general stocks, and the unique nature of REITs, provides more rationale for exploration of the impact of default risk on factor premiums within the US REIT market.

Most of these previous studies omit liquidity crises when assessing the impact of financial distress. Caballero and Krishnamurthy (2009) use the 2007 crisis to link changes in interest rates, credit market conditions, leverage and risk premiums, with the liquidity crisis. They conclude that the liquidity crisis resulted in a fall in interest rates, a rise in leverage and risk premiums, and an increase in the vulnerability of the financial sector to shocks. Hahn and Lee (2006) conclude that factor premiums are compensations for higher risk due to changes in interest rate and credit market conditions. In connection with our previously stated links between financial distress and factor premiums, this adds further support for us to study the relationship between liquidity crisis, default risk and factor premiums.

The idea of controlling for the stock market stems from the fact that REITs exhibited low correlation with the US stock market in the late 1990s, and hence would offer diversification benefits to investors holding a multi-asset portfolio, which includes exposure to the stock market (Stephen and Simon 2005). This benefit is further supported by Chaudhry et al. (1999) who find an inverse long-term relationship between stocks and real estate. For this purpose, previous studies, such as Hoesli et al. (2004), conclude that the optimal allocation to real estate in a multi-asset portfolio is 15 to 25%. This makes our research extremely useful for investors with style based exposures within REITs, along with stock market investments, as part of their portfolio. The results will help us to assess how factor based

REIT investments perform under varying market conditions, along with identifying if the directional relationship of the factor based REIT investments and stock market returns are positive or negative, assisting in the understanding of optimal portfolio diversification in a multi-asset setting.

Glascock et al. (2000) find a significant long-term relationship between REITs and the private real estate market. Clayton and MacKinnon (2003) show a stronger co-integration relationship between the two since the 1990s. This indicates a higher relative integration between REITs and the real estate market than with financial assets, further consolidating the diversification perks of REITs in a multi-asset portfolio. Furthermore, Stephen and Simon (2005) stress that REITs are a unique asset class, and their returns cannot be replicated by other asset classes.

By way of preview, we find that during the recessionary phases, credit spread, which is a proxy for financial distress, and TED spread, which acts as a proxy for the probability of a liquidity crisis, have a positive and significant impact on size, value and investment premiums, while this impact is mostly insignificant during non-recessionary phases. Small, value, and conservative investment REITs are more vulnerable to default and liquidity risks, and with a rise in general risk levels within the economy during recessionary phases, investors demand a higher compensatory return on these REITs. This result is consistent with the risk based explanation of Fama and French (1996) who imply that factor premiums are a compensation for a non-diversifiable risk factor.

For momentum and profitability premiums, we do find significant evidence of a fall in these premiums corresponding to a rise in the probability of financial default and liquidity crisis. With a rise in default risk and in probability of a liquidity crisis, investors might be more inclined to channel their funds towards REITs with robust profitability and a healthy historical performance (REITs that have seen higher returns in the short- and medium-term). This injection in demand towards robust profitability and winner REITs implies a fall in compensatory premiums required to incentivize investors to channel their funds towards these instruments. Based on Fama and French (2015) and Carhart (1997), RMW and WML are common risk factors. A fall in these premiums following a rise in financial distress and probability of liquidity crisis, contradicts Fama and French (1996) and the Efficient Market Hypothesis. These results also fail to support the systematic risk explanation for RMW and WML factors.

We also find that the S&P 500 index has a significant and negative impact on all premiums in the non-recessionary states. A rise in the index might make investors more optimistic about the future state of the economy (Essa and Giouvris 2020), hence resulting in a fall in premiums needed to incentivize investors to park their funds within these riskier REITs. Within a multi-asset portfolio setting, investors can then associate a bullish stock market to a fall in factor premiums within REITs. This impact is reversed for all premiums apart from WML during the recessionary states. A rise in returns of the largest 500 stocks could result in a channeling of funds towards these large stocks, and hence requiring a larger compensatory premium in order to incentivize investors to route their funds within riskier REITs. These results could have a significant bearing on optimal diversification within recessionary and non-recessionary states, for investors constructing a multi-asset portfolio.

Ooi et al. (2007) test the risk based explanation suggested by Fama and French (1992) that superior returns associated with value strategy would be accompanied by higher risk. For their risk indicators they use standard deviation, beta from the CAPM model, and factor loadings from the Fama–French three factor model. We extend on this study by testing this risk based explanation for not just the value premium but also for SMB, RMW, CMA, and WML strategies. We not only use the risk measures as suggested by Ooi et al. (2007), but also use the factor loadings on the Fama–French five factor, and the Carhart four factor model as a robustness measure, and in doing so, we test the risk based explanation of Fama and French (1996) and the Efficient Market Hypothesis. If these strategies that produce superior returns, are accompanied by a higher systematic risk, then we can conclude that the premiums are a compensation for exposing investors to a higher risk. For any strategy, if we fail to find a significant rise in systematic risk, we then look to explore the role of mispricing in the existence of these premiums. But why would mispricing persist in the presence of professional arbitrageurs? Ali et al. (2003) argue that idiosyncratic volatility is of relatively more concern to specialized arbitrageurs, adding that their motivation to keep the ratio of reward-to-risk low in the short term, deters arbitrage activity in high volatility stocks. Following the work of Ooi et al. (2007), for factor strategies where we do not find a significant rise in systematic risk, we use the square root of the residual variance form the CAPM model, as a measure of idiosyncratic return volatility, and a proxy for arbitrage risk, in order to assess the impact of mispricing on the existence of these premiums.

Furthermore, the research looks to gauge the risk-adjusted performances of these factor based strategies within the REIT market using Sharpe and Treynor ratios. Lastly, this paper is unique as it looks at the impact of default risk, liquidity crises, and the stock market index, on these premiums, establishing long- and short-run relationships using Auto-Regressive Distributed Lag (ARDL) modeling and Error Correction Modeling (ECM), for three recessionary phases, and two non-recessionary phases, namely the dot-com crash, the expansionary phase following the dot-com crash, the 2007/08 financial crisis, the expansionary period following the financial crisis, and the COVID-19 phase. Furthermore, the uniqueness of these three recessionary phases, allows us to establish a deep understanding of the surrounding macroeconomic environment on these premiums. The research also incorporates significant observations (104) during the most recent COVID-19 phase, and hence provides academics and investors with an extremely up-to-date outlook on factor based investment strategies within the REIT market.

The structure of this paper is as follows. Section 2 presents a literature review. Section 3 describes the data and methodology. Section 4 presents the empirical analysis and results. Section 5 presents practical implications for REIT investors. Finally, Section 6 concludes.

2. Literature Review

2.1. SMB and HML Premiums; Empirical Evidence from Stock/REIT Market and Extrapolation Theory

Fama and French (1992) add size and book-to-market factors to the existing market factor within the Sharpe-Linter's CAPM model, and show that these capture much of the average stock returns. Fama and French conclude that these two additional factors must proxy for common risk factors in returns. They contend that small stocks are riskier than big stocks, and value stocks are riskier than growth stocks. Consequently, the superior returns associated with small and value stocks is merely a compensation for exposing investors to higher risk. Chen and Zhang (1998) highlight that value stocks (i) are riskier than growth stocks because they are usually firms in financial distress, (ii) are highly leveraged, and (iii) are associated with higher uncertainty regarding future earnings.

In contrast, Lakonishok et al. (1994), and Skinner and Sloan (2002) find no evidence of value stocks being exposed to a higher risk relative to growth stocks. They associate superior returns to systematic mispricing of value and growth stocks by investors. Investors tend to be overly optimistic about future prospects of growth stocks, while they tend to be overly pessimistic about prospects of value stocks, and when these expectations are not realized, it results in a higher return on value stocks and a lower return on growth stocks (Ooi et al. 2007). This is referred to as extrapolation theory.

The persistence of these premiums might then be due to transaction costs and arbitrage risk. Shleifer and Vishny (1997), and Ali et al. (2003) conclude that value premiums cannot be easily arbitraged away due to idiosyncratic risk. Although most previous studies on asset pricing have focused on the general stock market and have excluded REITs due to their unique nature, Ooi et al. (2007) find value premiums to be prevalent within the REIT market, along with finding mixed results for risk adjusted performance of value REITs relative to growth REITs. They do find higher arbitrage risk associated with value REITs relative to growth REITs, leaving value REITs relatively more prone to mispricing.

Furthermore, they do not find significant evidence of investors being exposed to a higher risk while parking funds within value REITs relative to growth REITs.

2.2. RMW and CMA Premiums: Empirical Evidence from Stock/REIT Market and Sound Mind Effect

Fama and French (2015) add two further factors to their three factor model, namely, robust-minus-weak profitability (RMW) and conservative-minus-aggressive (CMA) investment factors. They conclude that this five factor model works better in defining expected returns relative to the three factor model. Although these are few in number, most studies that look to test the effectiveness of RMW and CMA factors on expected returns have been conducted on general stocks rather than REITs. However, Glascock and Lu-Andrews (2014) show that a profitability factor based on gross profit or net operating income has significant predictive power on REIT returns. Bond and Xue (2016) construct investment and profitability factors, and show that both display significant predictive power for REIT returns.

Factors included in the Fama and French model depict risk attributes for which investors are compensated in the form of expected returns. The initial factors, market risk, SMB and HML fit this risk based description quite well from an interpretation perspective. Although both new factors, RMW and CMA, derive nicely from the dividend discount model, their economic interpretation is not very clear. The risk based interpretation for RMW would be that historically profitable firms carry a higher risk and therefore provide compensation to their investors. But why should a more profitable firm be risker and therefore provide extra compensation to investors?

Ali and Ülkü (2019) conclude that the RMW factor seems to combine value with earnings momentum, thus capturing a 'neglected value' effect. Ülkü (2017) look to test whether the RMW factor captures behavioral mispricing or a rationally-priced risk. They believe that if the RMW factor does represent mispricing, then it should have a strong, consistent and significant weekend effect, where returns on the RMW portfolio are stronger during the beginning of the week. This could potentially be a result of underreaction by investors to earnings information due to the Uncertain Information Hypothesis (Brown et al. 1988). This private information accumulation will result in abnormal returns on the RMW portfolio, and this accumulation is generally larger during the weekend (Foster and Viswanathan 1990). These abnormal returns could also be down to the behavior of institutional investors who tend to trade on the wrong side during the creation of value-type anomalies, and contribute to mispricing away from value via noise trading through the week (Edelen et al. 2016). It would then take a weekend of 'sound mind' to recognize value. Ülkü (2017) find that this Monday effect on RMW premiums is significant and strengthens overtime, confirming the role of mispricing within RMW portfolios, and provides further support for the 'sound mind' effect explanation.

2.3. WML Premium: Empirical Evidence from Stock/REIT Market and Their Interpretation

Carhart (1997) show that a momentum factor is significant in explaining expected asset returns, when included as a factor along with market beta, SMB and HML, within the Fama and French three-factor model. Although significant amount of research has been conducted on assessing the predictive power of the WML factor on expected returns within general stocks, with regards to REITs, the amount of research is still quite limited. Chui et al. (2003) test the predictive power of Momentum, size, value and turnover on REIT returns, over two sub-samples, pre- and post-1990. They find evidence that momentum, size and value effects are significant pre-1990, while only the momentum factor is significant in defining expected REIT returns post-1990. Hung and Glascock (2008), and Goebel et al. (2012) show that the momentum factor is significant in explaining the cross-section of REIT returns. They also conclude that the momentum factor is more prevalent in the real estate market rather than in the equity market.

Similar to the RMW factor, the economic interpretation for the momentum factor is still unclear: why should a firm which has had consistently higher returns in the past be riskier and offer extra compensation for risk? Carhart (1997) state that they leave the risk interpretation of their momentum factor to the reader. Johnson (2002), and Liu and Zhang (2008) conclude that the expected growth risk increases with expected growth, supporting the argument that the momentum factor within asset pricing does represent an element of systematic risk that investors might be exposed to. On the other hand, Jegadeesh and Titman (1993) do not find any evidence that excess returns on a momentum based strategy is due to their systematic risk. They interpret the momentum premium as excess returns generated due to investor behavior and an under-reaction from the market to information.

2.4. Impact of Financial Distress and Liquidity Crisis on Factor Premiums

Fama and French (1996) and Chan and Chen (1991) relate common risk factors, i.e., size and value, to financial distress in a firm, indicating that financial distress is a systematic risk and should be compensated with a positive premium. Past studies have shown mixed results for the impact of default risk on value and size premiums. Ivaschenko (2003), Garlappi and Yan (2011), and Elgammal and McMillan (2014) find significant evidence that value premiums in the stock market increase with default risk and financial distress, while Elgammal et al. (2016) find that both size and value premiums within the US stock market, rise with default risk. This is consistent with the argument put forward by Fama and French (1996) and modern finance theory that investors require a higher return on small/value stocks relative to big/growth as a compensation for their enhanced vulnerability as a consequence of financial distress. Moreover, various studies, such as Vassalou and Xing (2004), Campbell et al. (2008), find a negative relationship between default risk and stock returns, which contradicts the belief that investors require higher returns for bearing higher risk. Other researchers, such as Piotroski (2000), find that only high book-to-market stocks with a lower financial health, earn relatively lower returns, while Huang et al. (2013) conclude that financial distress does not have any significant influence on size and value premiums within the Chinese stock market. Due to this mixed evidence of the impact of default risk on factor premiums, the unique nature of REITs and their specific regulatory requirements, along with the fact that financial distress risks are heightened during recessionary phases (this paper covers three unique phases within the data set), provides a clear justification for assessing its impact on factor based premiums within the REIT market.

Acharya and Pendersen (2005), Galariotis and Giouvris (2007, 2009) and Lim and Giouvris (2017) discuss the idea that liquidity is not only risky but also has commonality. There has been an increased focus on liquidity and liquidity risk as this was considered as a major source of the 2007/08 financial crisis (Brunnermeier 2009; Crotty 2009). This resulted in investors practicing a "flight-to-safety" strategy with regards to their investments, and in central banks practicing an expansionary monetary policy in order to inject and enhance liquidity within the market. Therefore, liquidity impacts credit conditions and interest rates within the economy. Hahn and Lee (2006) conclude that size and value premiums are compensations for exposing investor to higher risks related to changing market conditions and interest rates. Based on this argument, we feel that there are merits to including liquidity crisis, along with financial distress, when studying the impact on factor based premiums within the REIT market.

Campbell et al. (2008), and Elgammal et al. (2016), use credit spread as a proxy for financial distress and default risk. They define credit spread as the difference between yields on BAA corporate bonds and AAA corporate bonds. Tang and Yan (2010) discuss the counter-cyclical nature of credit spreads, increasing during recessions and contracting during expansionary phases. Longstaff and Schwartz (1995) conclude that this cyclical nature results in a negative correlation between credit spreads and interest rates. Tang and Yan (2010) state that, across firms, credit spread falls with growth in firm's cash flow. The growth rate in firm's cash flow is generally positively related to economic growth, and hence Tang and Yan (2010) conclude that credit spread tends to widen during economic downturns, as these periods are also generally associated with cash flow shortages and an uptick in the probability of default. Furthermore, Tang and Yan (2010) link economic downturns with a rise in investor risk aversion. This would mean that investors would require a higher risk premium for holding riskier assets, impacting risk premiums and credit spreads. Given the fact that risk aversion and credit spread tend to inflate during recessionary times, and since factor premiums are based on empirically established risk factors, efficient market hypothesis would suggest that these factor premiums would be significantly impacted by credit spread. Hence, we see merit in including this factor within our research of the impact of financial distress and liquidity crisis on factor premiums within the REIT market.

Akdi et al. (2020) define the TED spread as the difference between the 3-month LIBOR rate on Eurodollars (LIBOR) and the 3-month US Treasury Bill Rate. They argue that the TED spread is an accurate proxy for fluctuations in global liquidity levels and perceived risk. This is consistent with the findings of Tse and Booth (1996) and Cesa-Bianchi et al. (2015). Miranda-Agrippino and Rey (2015) argue that the TED spread is a powerful index for explaining Global Financial Cycles, which include aspects, such as global risk appetite, global liquidity and global systematic risk. Elgammal et al. (2016) conclude that during recessionary times, as default risk rises, TED spread tends to widen and is accompanied by a fall in investors' confidence. On the other hand, they conclude that during expansionary times, the TED spread narrows and investor confidence is enhanced. Breen et al. (1989) provide evidence of TED spread's ability to forecast performance of the stock market. Similarly, Tse and Booth (1996) show that changes in TED spread have a significant influence on stock price volatility. Since historical research has shown that the TED spread significantly impacts equity prices and factor premiums via investor sentiments, we feel that it is essential to test the impact of TED spread on REIT factor premiums, during recessionary and non-recessionary phases.

2.5. The Effect of Stock Market Returns

The impact of financial distress and liquidity crisis on REIT factor premiums cannot be studied in isolation, therefore we incorporate for stock market changes that might impact these premiums. Karolyi and Sanders (1998) conclude that variations in both stock and bond returns have significant predictive power in explaining REIT returns. Bouri et al. (2020) test the relationship between the equity market and REITs in 19 countries during the dot-com crisis, the 2007/08 financial crisis, European sovereign debt crisis and the Brexit period in the UK. They find a significant impact of equity markets over REITs, in not only the developed markets, but also in the emerging REIT markets. These relationships are particularly strong during the global financial crisis and the sovereign debt crisis. Allen et al. (2000) use a sample of publicly traded REITs and show that their returns are sensitive to changes in the stock market. They conclude that this sensitivity factor becomes stronger for REITs with a high financial leverage. Clayton and MacKinnon (2003) show the transition within REITs from being primarily influenced by economic factors that drive large cap stocks through the 1970s and 1980s, to being more strongly impacted by small cap stocks and real estate specific factor in the 1990s. Given the transitioning nature of this relationship, we feel including the stock market index as an explanatory variable, adds usefulness for investors looking to create mixed-asset portfolios, specifically investors that have factor-based REIT investments. These investors would then see value in assessing the impact of stock market movements on factor premiums within the REIT market, during recessionary and non-recessionary phases.

3. Data and Methodology

3.1. Measuring Factor Premiums and Construction of Factor-Based Portfolios

We collect daily data for REIT returns, inclusive of dividends, since REITs are required by law to distribute 90% of their annual taxable income in the form of dividends to shareholders, from July 2000 to June 2020, using the Bloomberg database. This includes a universe of 246 REITs and 4753 observations. We download only securities that are identified as United States REITs, including both equity and mortgage REITs. The sample also includes REITs that ceased to exist during the sample period.

To reduce the influence of Bloomberg errors, we apply a combination of filters following the methods of Ince and Porter (2006), Lee (2011) and, Amihud et al. (2015). Daily returns are set as missing if they are greater than 200% or less than −100%.

We construct portfolios based on size, value, profitability, investment and momentum. We follow the methodology introduced by Fama and French (1992, 2015) to rank and divide the REITs in our sample into five quintiles, for each of the above-mentioned factors. This means we match returns from July of year t to June of year t + 1, against annual accounting data of a REIT for the fiscal year ending in the calendar year t − 1. This ensures that accounting information is available prior to information on returns. For reasons of brevity, the methodology for constructing factor portfolios has been included within the Appendix A.

Apart from momentum portfolios, which are rebalanced monthly, all other factor portfolios are rebalanced annually. This has been done to make the portfolio selection process more realistic. Firstly, Lakonishok et al. (1994), and Ooi et al. (2007) point out that investors need a long time-horizon for certain style-based strategies to pay off, such as "a value strategy", and they conclude that in the short-term these strategies may underperform the market. Secondly, portfolio rebalancing might involve high transaction costs, which may deter investors from rebalancing at a high frequency (Carhart 1997; Kaplan and Schoar 2005). Thirdly, investors may face high borrowing costs or a lack of leverage to fund these portfolio rebalancing activities. Finally, since higher compensation on these strategies might be due to higher risk, the possibility of not being able to trade these REITs optimally due to their risk association is a realistic prospect (Ibbotson et al. 2013). The methodology of using the prior year (t − 1) measure for factors to construct quintiles, which are then used to calculate portfolio returns in a given year (t) also helps us to meet one of the criteria for Sharpe's (Sharpe 1992) specification of a portfolio benchmark, that is "identifiable before fact".

To reduce the impact of extreme values, we remove REITs with market cap, B/M, profitability and investment values in the top and bottom 1% in each twelve-month window. Furthermore, we remove extreme values of momentum by excluding REITs with momentum in the top and bottom 1% in each one-month window. The average number of REITs per portfolio was 30, the maximum number was 44 (220 REITs over 5 portfolios) in 2019/20, while the minimum per portfolio was 20 (100 REITs over 5 portfolios) in 2001/02, ensuring that all quintile portfolios were diversified.

3.2. Gauging Risk and Risk Adjusted Performance of Factor-Based Strategies

According to Fama and French (1992), superior returns derived from factor strategies are a compensation for exposing investors to a higher risk. To test this hypothesis, we use several conventional risk measures including the standard deviation, beta derived from the Sharpe-Linter's CAPM model (Equation (1)), factor loadings from the Fama and French three factor model (Equation (2)), and factor loadings from the Fama and French five factor model (Equation (3)). As a robustness measure, we also assess the factor loadings from the Carhart (1997) four factor model (Equation (4)).

$$R_i - R_f = a_i + b_i(R_m - R_f) + e_i \quad (1)$$

$$R_i - R_f = a_i + b_i(R_m - R_f) + s_i SMB + h_i HML + e_i \quad (2)$$

$$R_i - R_f = a_i + b_i(R_m - R_f) + s_i SMB + h_i HML + r_i RMW + c_i CMA + e_i \quad (3)$$

$$R_i - R_f = a_i + b_i(R_m - R_f) + s_i SMB + h_i HML + w_I WML + e_i \quad (4)$$

where R_i is the daily portfolio return for each quintile within each factor, R_f is the daily one-month Treasury bill rate, R_m is the value-weighted daily return on all NYSE and NASDAQ stocks, a_i is the average excess return on the portfolio after adjusting for the known risk factors, SMB (small minus big), HML (high minus low), RMW (robust minus weak), CMA (conservative minus aggressive), and WML (winners minus losers) are obtained from French's website. Risk associated with each portfolio is then assessed using the coefficients corresponding to excess returns on the market, SMB, HML, RMW, CMA and WML. If the risk-based explanation is correct then small, value, robust profitability, conservative investment and winner REITs should exhibit significantly higher risk relative to big, growth, weak profitability, aggressive investment and loser REITs.

Next, we use the Treynor ratio and the Sharpe ratio, to gauge the risk-adjusted performance of each portfolio. Furthermore, following Shleifer and Vishny (1997), Ali et al. (2003), and Ooi et al. (2007), we calculate the arbitrage risk associated with each portfolio, and this is represented by the idiosyncratic return volatility (captured by the square root of the residual variance derived from the CAPM model). This potentially will provide us with evidence on the role of arbitrage risk in deterring arbitrageurs from exploiting potential mispricing related to these factor-based premiums.

3.3. Explanatory Variables

Following Elgammal et al. (2016), we define credit spread as the difference between the Moody's BAA index and AAA index as reported by Bloomberg. Credit spread acts as a proxy for financial distress, and the change in credit spread can be interpreted as the excess return on a portfolio of corporate bonds (Hull et al. 2004; Huang and Huang 2012).

The TED spread is derived as the difference between the yields on 3-month LIBOR and 3-month T-Bills, and is calculated on a daily frequency using data from Bloomberg. The TED spread acts as a proxy for the probability of a liquidity crisis and represents the perceived risk in the global financial system (Elgammal et al. 2016). As the TED spread widens, investors perceive credit risk and default risk to rise, leading them to withdraw liquidity. Daily S&P 500 index values are from Datastream.

Due to the presence of significant correlation between our explanatory variables, we orthogonalize the variables to avoid any issues of multicollinearity. To conduct this, we set up the following regressions and extraction procedure for our explanatory variables[6]:

$$\text{Credit Spread}_t = \alpha_0 + \text{TED Spread}_t + \Delta\ \text{S\&P}_t + \varepsilon_{CS} \quad (5)$$

$$\text{TEDSpread}_t = \alpha_0 + \Delta\text{S\&P}_t + \varepsilon_{TED} \quad (6)$$

The residual term from Equation (5) is then used in place of credit spread, while the residual term from Equation (6) is used in place of TED Spread, within our model to test the impact of default risk, liquidity crisis and the stock market, on REIT factor premiums.

3.4. Bounds Test for Cointegration/Long-Run and Short-Run Elasticity: The Long-Run ARDL Model and the Short-Run Error Correction Model

The factor premiums and our explanatory variables are a mix of I(0) and I(1), therefore we use an Autoregressive distributed lag (ARDL) bounds test as proposed by Pesaran et al. (2001), to test for cointegration and establish a long-run relationship between our variables. The ARDL bounds test can be used regardless of whether the time series are I(0) or I(1), and thus removes uncertainties that might be created by unit root tests. Another advantage of using the bounds test is that it can be adjusted to address potential issues of endogeneity within the explanatory variables (Shahe Emran et al. 2007).

To test the cointegration relationship between credit spread, TED spread and the S&P 500 index on our factor premiums (SMB, HML, RMW, CMA, WML), we set up the bounds test as follows:

$$\begin{aligned} R_{Premium,t} &= \alpha_0 + \sum_{i=1}^{p} \beta_{1,i}\ R_{Premium,t-i} + \sum_{i=0}^{p} \beta_{2,i}\ \Delta CS_{t-i} + \sum_{i=0}^{p} \beta_{3,i}\ \Delta TED_{t-i} + \\ &\sum_{i=0}^{p} \beta_{4,i} \Delta\ \ln S\&P_{t-i} + \beta_5 R_{Premium,t-i} + \beta_6 CS_{t-i} + \beta_7 TED_{t-i} + \beta_8 \ln S\&P_{t-i} + \varepsilon_t \end{aligned} \quad (7)$$

where $R_{Premium}$, denotes each of the five premiums defined in Section 3.1, Δ CS and Δ TED are the first-differences of the residual terms extracted from Equations (5) and (6), respectively, and Δ ln S&P is the first differences of natural logs for the S&P 500 index. CS and TED are the residual terms from Equations (5) and (6), respectively, while ln S&P is the natural log for the S&P 500 index, e is the error term, and t is the time.

We follow the procedure specified by Pesaran et al. (2001) to examine the existence of a long-run relationship among the variables in Equation (7). We do this by performing an F-test for the joint significance of the coefficients as set up in the following hypothesis;

H0. $\beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$.

H1. $\beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$.

For a given level of significance, if the F-statistic is higher than the upper critical bound level, then the null hypothesis of no cointegration is rejected, while if the F-statistic is lower than the lower critical bound value, the null hypothesis of no cointegration cannot be rejected.

Once the long-run relationship has been established, we set up an ARDL model to analyze the long-run elasticity of financial distress, liquidity crises and the stock market on our five factor premiums[7]:

$$R_{Premium,t} = \alpha_0 + \sum_{i=1}^{p} \beta_{1,i} R_{Premium,\ t-i} + \sum_{i=0}^{p} \beta_{2,i} CS_{t-i} + \sum_{i=0}^{p} \beta_{3,i} TED_{t-i} + \sum_{i=0}^{p} \beta_{4,i} \ln S\&P_{t-i} + \varepsilon_t \quad (8)$$

We then proceed to analyze the short-run elasticity between the explanatory variables and illiquidity premiums using the error correction model:

$$R_{Premium,t} = \alpha_0 + \sum_{i=1}^{p} \beta_{1,i} R_{Premium,t-i} + \sum_{i=0}^{p} \beta_{2,i} \Delta CS_{t-i} + \sum_{i=0}^{p} \beta_{3,i} \Delta TED_{t-i} + \sum_{i=0}^{p} \beta_{4,i} \Delta \ln S\&P_{t-i} + \beta_5 ecm_{t-i} + \varepsilon_t \quad (9)$$

where ecm is a vector of residuals from the ARDL long-run model (Equation (8)), and the coefficient for ecm_{t-1} indicates whether the mechanism of reverting to the long-run equilibrium is effective. A significantly negative coefficient implies that the reverting mechanism to sustain the long-run equilibrium between the explanatory variables and each of our factor premiums is effective.

3.5. Subperiods

To test the impact of financial distress, liquidity crises and the stock market, on each of our factor premiums, during recessionary and non-recessionary phases, we use recession dates as provided by the NBER to create sub-samples within our full sample, which runs from July 2001 to June 2020. The dot-com crash period runs from July 2001 to November 2001 and is referred to as period 1. The non-recessionary phase that follows the dot-com crash runs from December 2001 to November 2007 and is referred to as period 2. The third sub-sample is the 2007/08 financial crisis, which runs from December 2007 to June 2009, is referred to as period 3. The fourth sub-sample is the non-recessionary phase that follows the 2007/08 crisis, runs from July 2009 to January 2020, and is referred to as period 4. Finally, the period from February 2020 to June 2020 corresponds with the COVID-19 phase, and is referred to as period 5. The unique nature of all of these recessionary periods, in terms of their causes and ramifications, justifies merit in studying these phases in isolation.

Although we have significant number of observations within each of our recessionary phase, 100, 394 and 103, the bounds test provides an advantage as it can be applied to small sample sizes. Therefore, it works well especially for our analysis within the financial crises periods. Furthermore, the approach allows us to identify the significance and direction of the influence of each variable, within the month and within their lags. We choose the optimal lag length using the Akaike information criterion (AIC).

4. Empirical Results

4.1. Significance, Direction and Magnitude of Factor Premiums

Table 1 shows daily summary statistics for our five factor premiums namely, SMB, HML, RMW, CMA and WML. All five factor premiums are positive and significantly different from zero. The mean daily-after-formation return for REIT portfolios formed based on size and value are 0.8221% and 0.4811%, respectively. Both SMB and HML portfolios have positive skewness[8] and a kurtosis level significantly higher than 3[9]. The positive skewness would imply an increase in the probability of small loses accompanied by a few large gains but would reduce the occurrence of large loses. The high kurtosis levels translate to an increase in the probability of extreme outcomes.

Table 1. Descriptive Statistics for Factor Premiums.

Variables	Mean	SD	Min	Max	Skewness	Kurtosis	Jarque–Bera (*p*-Value)
SMB	0.0082 ***	0.0429	−0.1957	0.3837	3.0162	20.2315	0.0000 ***
HML	0.0048 ***	0.0285	−0.1292	0.3377	5.1486	51.5316	0.0000 ***
RMW	0.0005 *	0.0193	−0.0908	0.1033	−0.1349	6.2990	0.0000 ***
CMA	0.0008 ***	0.0142	−0.0844	0.0918	0.9882	8.5094	0.0000 ***
WML	0.0010 ***	0.0150	−0.1346	0.1008	−0.1195	9.9946	0.0000 ***

This table provides descriptive statistics for the SMB, HML, RMW, CMA and WML premiums for the full sample from July 2001 to June 2020. Significance is shown at 10% (*) and 1% (***) levels.

The mean daily-after-formation return for REIT portfolios formed based on profitability and momentum are 0.0464% and 0.1038%, respectively. Both RMW and WML portfolios have a negative skewness. This implies an uptick in the probability of frequent small gains, but these are accompanied by few large loses. Although kurtosis levels for these two portfolios is still relatively lower compared to the SMB and HML portfolios, it is still significantly greater than 3, implying a high probability for extreme outcomes.

The mean daily-after-formation return for the REIT portfolio formed based on investment is 0.0819%. Similar to the SMB and HML portfolios, the CMA portfolio has a positive skewness, translating to frequent small losses accompanied by a few large gains. The kurtosis level for the CMA portfolio is similar to the levels observed within the RMW and WML portfolios, and this is significantly lower than those of the SMB and HML portfolios. Therefore, relative to the SMB and HML portfolios, the CMA portfolio is less prone to extreme outcomes. We use a Jarque–Bera test to check for normality of the distribution and reject the null hypothesis of normal distribution at 1% significance for all five factor-based portfolios.

Figures 1–5[10] show the time series variation in all 5 factor premiums, with percentage returns for each factor based portfolio on the vertical axis (Recessionary phases have been shaded in grey). The CMA and WML portfolios seem to be relatively less volatile, while the SMB portfolio seems to have the most returns volatility. This is signified by the standard deviations associated to each of these portfolios. For all factor-based portfolios, returns seem to spike during the recessionary phases, and these seem most pronounced during the 2007/08 crisis and the COVID-19 phase.

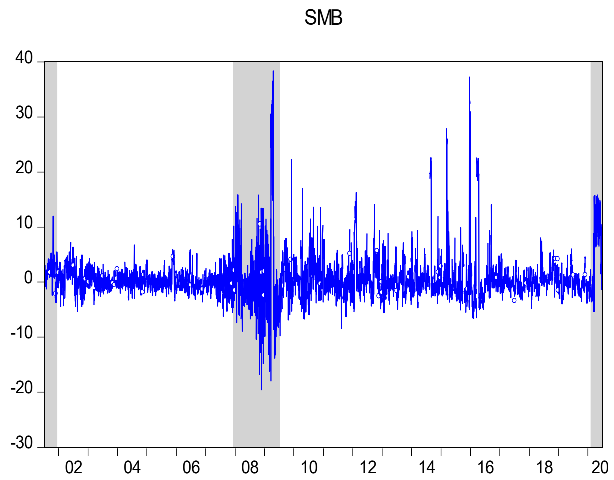

Figure 1. Time series variation in SMB premiums.

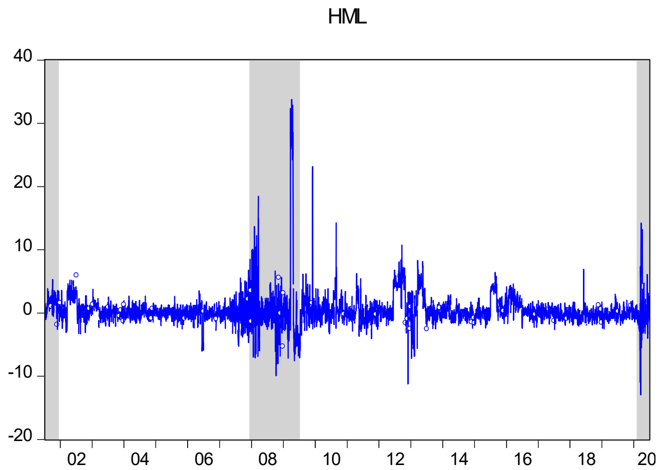

Figure 2. Time series variation in HML premiums.

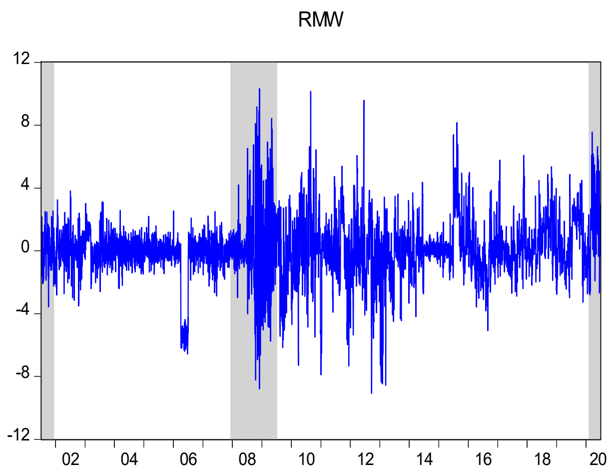

Figure 3. Time series variation in RMW premiums.

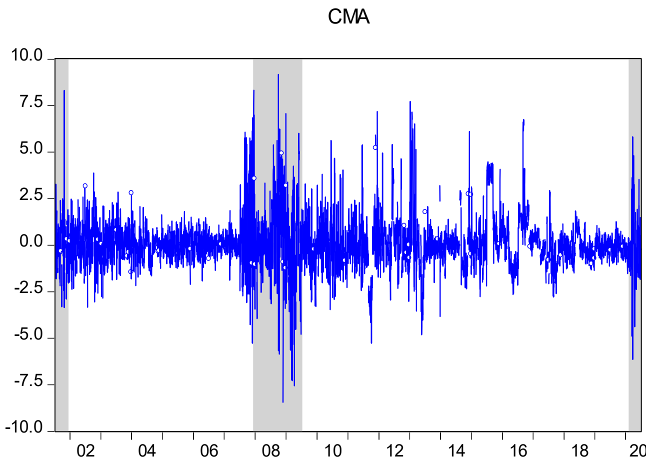

Figure 4. Time series variation in CMA premiums.

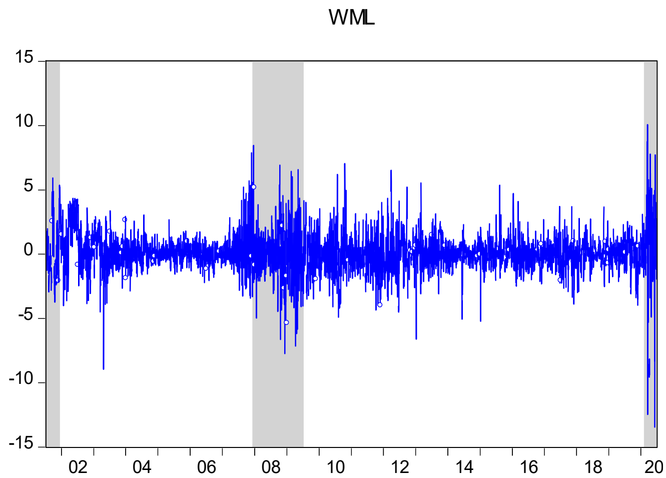

Figure 5. Time series variation in WML premiums.

4.2. Risk Associated with Factor-Based Strategies

4.2.1. SMB

In Tables 2–6, no additional information is gained from the factor loadings from the Fama–French three factor model, relative to the factor loadings on the five factor model, hence only the latter is shown.

Table 2 presents the results for risks associated with portfolios constructed using small REITs (Q1) relative to portfolios of big REITs (Q5), along with their ability to generate abnormal returns. The mean excess daily-after-formation return for small REITs is higher than big REITs (0.8320% vs. 0.0099%), equating to an average SMB premium of 0.8221% (=0.8320% − 0.099%). The standard deviation for small REITs (4.1054%) is significantly higher than that of big REITs (1.8732%), indicating a higher relative volatility for returns on the small portfolio. The risk-adjusted performance indicators, i.e., the Sharpe and Treynor ratios show a better risk adjusted performance for small REITs.

The average systematic risk of the small portfolio (0.17) is higher than that of the big portfolio (0.16). After adjusting for the five known risk factors in panel B, excess returns for the small portfolio (Q1) averaged 0.78%, as compared to 0.04% for the big portfolio (Q5). Consistent with the Efficient Market Hypothesis and the risk-based argument of Fama and French, a higher alpha observed for the small portfolio (Q1) is accompanied by a higher systematic risk. Therefore, although the SMB portfolio achieves positive excess returns, it does expose investors to a higher risk as well.

Table 2. Risk measures for Small and Big REIT portfolios (2001–2020).

Panel A: Summary Statistics	**Q1 (Small)**	**Q2**	**Q3**	**Q4**	**Q5 (Big)**
Excess Means	0.8320	0.0251	0.0028	0.0137	0.0099
Standard Deviation	4.1054	1.7094	1.8459	1.9179	1.8732
CAPM Beta (Univariate)	0.1702 ***	0.1211 ***	0.1491 ***	0.1587 ***	0.1605 ***
Sharpe Ratio	0.2027	0.0147	0.0015	0.0071	0.0053
Treynor Ratio	0.0489	0.0021	0.00002	0.0009	0.0006
$\sqrt{Var(e)}$ (Involatility)[11]	4.0877	1.6826	1.8067	1.8752	1.8283
Panel B: Fama and French Five Factor Model: $\mathbf{R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + e_i}$	**Q1 (Small)**	**Q2**	**Q3**	**Q4**	**Q5 (Big)**
a_i	0.7752 ***	−0.0163	−0.0476 *	−0.0400	0.0440 *
Beta	0.1698 ***	0.1209 ***	0.1486 ***	0.1582 ***	0.1599 ***
SMB	0.0321	0.1051 **	0.0966 ***	0.0954 **	0.0783 *
HML	0.0878	0.1233 ***	0.1369 ***	0.1381 ***	0.1189 ***
RMW	−0.0702	0.0262	0.0048	0.0036	−0.0211
CMA	−0.0477	−0.1412 ***	−0.1799 ***	−0.1636 ***	−0.1724 ***

This table provides summary statistics, and results from the univariate CAPM model and multivariate Fama–French five factor models, for small (Q1) and big (Q5) REIT portfolios. Involtility has been calculated using the square root of the residual variance derived from the CAPM model. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 3. Risk measures for Value and Growth REIT portfolios (2001–2020).

Panel A: Summary Statistics	**Q1 (Value)**	**Q2**	**Q3**	**Q4**	**Q5 (Growth)**
Excess Means	0.4379	0.0301	0.0052	0.0870	−0.0432
Standard Deviation	3.0111	1.7988	1.7861	1.8996	1.7315
CAPM Beta (Univariate)	0.0888 ***	0.1326 ***	0.1287 ***	0.1442 ***	0.1370 ***
Sharpe Ratio	0.1454	0.0167	0.0029	0.0458	−0.0250
Treynor Ratio	0.0493	0.0023	0.0004	0.0060	−0.0032
$\sqrt{Var(e)}$ (Involatility)	3.0064	1.7680	1.7554	1.8653	1.6939
Panel B: Fama and French Five Factor Model: $\mathbf{R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + e_i}$	**Q1 (Value)**	**Q2**	**Q3**	**Q4**	**Q5 (Growth)**
a_i	0.4088 ***	−0.0153 ***	−0.0382	0.0388	−0.0894 ***
Beta	0.0885 ***	0.1324 ***	0.1283 ***	0.1436 ***	0.1366 ***
SMB	0.0346 ***	0.0869 **	0.0891 ***	0.0932 **	0.0744 *
HML	0.2412 ***	0.1543 ***	0.1273 ***	0.1128 ***	0.0886 ***
RMW	0.0032	0.0357	−0.0038	−0.0321	−0.0160
CMA	−0.1340	−0.1537 ***	−0.1433 ***	−0.1576 ***	−0.1380 ***

This table provides summary statistics, and results from the univariate CAPM model and multivariate Fama–French three factor and five factor models, for value (Q1) and growth (Q5) REIT portfolios. Involatility has been calculated using the square root of the residual variance derived from the CAPM model. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 4. Risk measures for Robust and Weak Profitability REIT portfolios (2001–2020).

Panel A: Summary Statistics	**Q1 (Robust)**	**Q2**	**Q3**	**Q4**	**Q5 (Weak)**
Excess Means	0.1513	0.0083	0.2534	0.0863	0.1049
Standard Deviation	1.9689	1.8534	1.9755	1.7389	1.8390
CAPM Beta (Univariate)	0.1712 ***	0.1451 ***	0.1158 ***	0.1206 ***	0.0902 ***
Sharpe Ratio	0.0768	0.0045	0.1283	0.0496	0.0570
Treynor Ratio	0.0088	0.0006	0.0219	0.0072	0.0116
$\sqrt{Var(e)}$ (Involatility)	1.9207	1.8158	1.9387	1.7119	1.8218
Panel B: Fama and French Five Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + e_i$	**Q1 (Robust)**	**Q2**	**Q3**	**Q4**	**Q5 (Weak)**
a_i	0.0925 ***	−0.0404	0.2142 ***	0.0445 *	0.0740 ***
Beta	0.1710 ***	0.1445 ***	0.1155 ***	0.1207 ***	0.0901 ***
SMB	0.0742 *	0.1060 ***	0.0779 *	0.1082 ***	0.0326
HML	0.1170 ***	0.1431 ***	0.1190 ***	0.1378 ***	0.1050 ***
RMW	0.0278	−0.0113	0.0081	0.0462	0.0210
CMA	−0.1275 **	−0.1915 ***	−0.1462 ***	−0.1075 **	−0.0758

This table provides summary statistics, and results from the univariate CAPM model and multivariate Fama–French three factor and five factor models, for robust profitability (Q1) and weak profitability (Q5) REIT portfolios. Involatility has been calculated using the square root of the residual variance derived from the CAPM model. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 5. Risk measures for Conservative and Aggressive Investment REIT portfolios (2001–2020).

Panel A: Summary Statistics	**Q1 (Conservative)**	**Q2**	**Q3**	**Q4**	**Q5 (Aggressive)**
Excess Means	0.0369	0.0104	0.0436	0.1854	−0.0450
Standard Deviation	1.8521	1.7424	1.7496	1.8793	1.6339
CAPM Beta (Univariate)	0.1014 ***	0.1398 ***	0.1308 ***	0.1235 ***	0.1264 ***
Sharpe Ratio	0.0199	0.0059	0.0249	0.0987	−0.0275
Treynor Ratio	0.0036	0.0007	0.0033	0.0150	−0.0036
$\sqrt{Var(e)}$ (Involatility)	1.8346	1.7062	1.7202	1.8473	1.6010
Panel B: Fama and French Five Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + e_i$	**Q1 (Conservative)**	**Q2**	**Q3**	**Q4**	**Q5 (Aggressive)**
a_i	0.0023	−0.0370	−0.0010	0.1427 ***	−0.0875 ***
Beta	0.1014 ***	0.1393 ***	0.1305 ***	0.1235 ***	0.1259 ***
SMB	0.0887 **	0.0952 **	0.0989 **	0.1066 **	0.0622 *
HML	0.1429 ***	0.1319 ***	0.1186 ***	0.1352 ***	0.1100 ***
RMW	0.0189	0.0076	0.0215	0.0451	−0.0020
CMA	−0.0949 *	−0.1667 ***	−0.1582 ***	−0.1132 **	−0.1614 ***

This table provides summary statistics, and results from the univariate CAPM model and multivariate Fama–French three factor and five factor models, for conservative investment (Q1) and aggressive investment (Q5) REIT portfolios. Involatility has been calculated using the square root of the residual variance derived from the CAPM model. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 6. Risk measures for Winner and Loser REIT portfolios (2001–2020).

Panel A: Summary Statistics	**Q1 (Winner)**	**Q2**	**Q3**	**Q4**	**Q5 (Loser)**
Excess Means	0.1599	0.0068	0.0147	0.0073	0.0560
Standard Deviation	1.6832	1.6312	1.6552	1.6301	1.8184
CAPM Beta (Univariate)	0.1132 ***	0.1285 ***	0.1309 ***	0.1315 ***	0.1217 ***
Sharpe Ratio	0.0950	0.0041	0.0089	0.0045	0.0308
Treynor Ratio	0.0141	0.0005	0.0011	0.0006	0.0046
$\sqrt{\text{Var(e)}}$ (Involatility)	1.6581	1.5984	1.6218	1.5959	1.7935
Panel B: Fama and French Five Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + r_iRMW + c_iCMA + e_i$	**Q1 (Winner)**	**Q2**	**Q3**	**Q4**	**Q5 (Loser)**
a_i	0.1215 ***	−0.0369	−0.0297	−0.0376	0.0153
Beta	0.1129 ***	0.1281 ***	0.1305 ***	0.1312 ***	0.1211 ***
SMB	0.0665 *	0.0894 **	0.0831 **	0.0879 **	0.0905 **
HML	0.0976 ***	0.0973 ***	0.1332 ***	0.1181 ***	0.1247 ***
RMW	0.0015	0.0076	0.0158	0.0211	−0.0099
CMA	−0.1113 **	−0.1458 ***	−0.1582 ***	−0.1379 ***	−0.1701 ***

This table provides summary statistics, and results from the univariate CAPM model and multivariate Fama–French three factor and five factor models, for winner (Q1) and loser (Q5) REIT portfolios. Involatility has been calculated using the square root of the residual variance derived from the CAPM model. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

4.2.2. HML

Table 3 shows that the mean excess daily-after-formation return for value REITs is higher than growth REITs (0.4379% vs. −0.0432%), equating to a daily average value premium of 0.4811% [=0.4379% − (−0.0432)]. The standard deviation for the value portfolio is 3.011% compared to 1.7315% for the growth portfolio, indicating that returns on the value portfolio are significantly more volatile relative to the growth portfolio. Both the Sharpe ratio and Treynor ratio indicate a relatively better risk-adjusted performance for value REITs.

The CAPM beta in Table 3 for the value portfolio is 0.09 versus 0.14 for the growth portfolio, indicating a lower market risk on the value portfolio. After adjusting for the five known risk factors in panel B of Table 3, excess returns of the value portfolio over the growth portfolio is 0.4982% (=0.4088 − (−0.0894)). Overall, the lower systematic risk and higher alphas associated to Q1 relative to Q5 may indicate that a value strategy within the REIT market is able to produce abnormal returns without exposing investors to more risk. This is inconsistent with the risk based argument of Fama and French.

The HML factor loading for value REITs is higher and significant than growth REITs (0.24 vs. 0.09), indicating that value REITs returns might be more sensitive to changes in the value premium within the market, relative to growth REITs. The SMB factor loading for value REITs is relatively lower (0.03 vs. 0.07), indicating that value REITs might be relatively less sensitive to changes in the size premium within the market.

Authors such as Shleifer and Vishny (1997), and Ali et al. (2003) have argued that the value premium of stocks with high idiosyncratic risk cannot easily be arbitraged away and as a result, these stocks are exposed to more systematic mispricing. Idiosyncratic return volatility (measured by square root of variance derived from the CAPM model) is a representation of arbitrage risk (Ooi et al. 2007). Panel A demonstrates that the idiosyncratic risk (Involatility) decreases from the value REIT portfolio (3.0064%) to the growth REIT portfolio (1.6956%), but the idiosyncratic risk of REITs does not decrease monotonically with B/M ratio. This potentially provides an explanation for the role of arbitrage risk in preventing arbitrageurs from exploiting mispricing related to value REITs. Consistent with their lower idiosyncratic risk, growth REITs are less prone to mispricing relative to value REITs.

4.2.3. RMW

Table 4 shows the mean excess daily-after-formation return for REITs with robust profitability is higher than returns for REITs with weak profitability (0.1513% vs. 0.1049%), equating to an average RMW premium of 0.0464% (=0.1513% − 0.1049%). The standard deviation for REITs with robust profitability (1.9689%) is significantly higher than that of REITs with weak profitability (1.8390%). The Sharpe ratio shows a better volatility adjusted performance for the robust profitability portfolio, but the Treynor ratio shows a relatively superior systematic risk adjusted performance for the weak profitability portfolio.

The average systematic risk for the robust profitability portfolio (0.17) is higher than that of the weak profitability portfolio (0.09), indicating a higher market risk associated with the robust profitability portfolio. After adjusting for the five known risk factors in panel B, excess return for the robust portfolio (Q1) averaged 0.0925%, as compared to 0.0740% for the weak portfolio (Q5). Overall, a higher alpha observed for Q1, accompanied by a higher systematic risk indicates that a robust profitability strategy is able to produce abnormal returns, but it does expose investors to a higher risk. This is consistent with the risk-based explanation of Fama and French.

4.2.4. CMA

Table 5 shows that the mean excess daily-after-formation return for conservative investment REITs is higher than for aggressive investment REITs (0.0369% vs. −0.0450%), equating to a daily average CMA premium of 0.0819% [=0.0369% − (−0.0450%)]. The standard deviation for the conservative investment portfolio (1.8521%) is higher than that of the aggressive investment portfolio (1.6339%) indicating a higher relative volatility on the conservative investment portfolio. Both risk adjusted measures show a better performance for the conservative investment portfolio.

Table 5A shows the beta associated with conservative investment REITs is significantly lower than that of aggressive investment REITs (0.10 versus 0.13), translating to a relatively lower market risk for the conservative investment portfolio.

After adjusting for the five known risk factors in panel B, the intercept for the conservative investment portfolio (Q1) is not statistically significant, indicating that there are no abnormal returns to be gained from holding this portfolio. The insignificant alpha for the conservative portfolio (Q1) implies that excess returns on this portfolio are completely explained by the Fama and French (2015) risk factors. Panel B also shows significantly higher loadings for SMB (0.09 vs. 0.06), HML (0.14 vs. 0.11) and CMA (−0.09 vs. −0.16) factors on the conservative investment portfolio, relative to the aggressive investment portfolio. The higher factor loadings provide justification that the existence of a positive CMA premium is accompanied by a higher systematic risk, and therefore, investors looking to avail CMA premiums within US REITs would be exposed to a higher risk.

4.2.5. WML

Table 6 shows the mean excess daily-after-formation return for winner REITs is higher than loser REITs (0.1599% vs. 0.0560%), equating to a daily average WML premium of 0.1038% (=0.1599% − 0.0560%). The standard deviation for the winner REITs portfolio is 1.6832% versus 1.8184% for the loser REITs portfolio, indicating that returns on the winner portfolio are associated with significantly less volatility relative to the loser portfolio. Both the Sharpe ratio and Treynor ratio show that the risk-adjusted performance for winner REITs is superior to that of loser REITs.

The average systematic risk for the winner portfolio (0.11) is lower than that for the loser portfolio (0.12). Panel B reveals that the alpha for the winner portfolio is positive and statistically significant. The intercept for the other quintile portfolios (Q2, Q3, Q4 and Q5) are not statistically significant, indicating that there are no abnormal returns to be gained from holding these portfolios. After adjusting for the five known risk factors, the excess return on the winner portfolio (Q1) averaged 0.1215%. Although the five factor model (panel B in Table 6) indicates a relatively higher CMA factor loading associated to winner stocks (−0.11 vs. −0.17), the model does indicate a lower and significant SMB (0.07 vs. 0.09) and HML (0.10 vs. 0.12) factor loadings for winner REITs. The lower systematic risk and higher alpha for Q1 indicates that a winner strategy is able to produce higher abnormal returns, without exposing investors to a higher risk. This is in contradiction with the risk based argument which implies that WML is a common risk factor, and the associated premium is a compensation for exposure to a non-diversifiable risk.

Owing to the fact that the existence of a higher return on winner REITs is not associated with a higher systematic risk, we look to assess if mispricing has a role to play in the existence of WML premiums. A higher idiosyncratic (arbitrage) risk would imply that arbitrageurs are deterred from exploiting mispricing related to winner REITs. Our results indicate that the idiosyncratic risk of winner REITs (1.6581%) is lower than the corresponding idiosyncratic risk on loser REITs (1.7935%), implying that winner REITs are relatively less prone to mispricing. One potential explanation for our results then might be the argument put forward by Jegadeesh and Titman (1993) that the momentum premium might be interpreted as excess returns generated due to investor behavior and an under-reaction from the market to information, potentially due to transaction costs, but resulting in a consistently positive and significant return on momentum strategy.

4.3. Robustness Check for Excess Returns and Risk

In addition to the CAPM and Fama–French models, we use the Carhart four factor model as a robustness measure to gauge the ability of our factor based strategies to extract abnormal returns, along with assessing the relative risks associated with these strategies. These results are displayed in Tables 7–11. From a risk perspective, we find results that are in-line with our previous findings in terms of relative betas and factor loadings, for each strategy.

Table 7. Robustness check for Small and Big REIT portfolios (2001–2020).

Carhart Four Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + w_iWML + e_i$	**Q1 (Small)**	**Q2**	**Q3**	**Q4**	**Q5 (Big)**
a_i	0.7775 ***	−0.0143	−0.0460 *	−0.0383	−0.0431
Beta	0.1659 ***	0.1188 ***	0.1464 ***	0.1560 ***	0.1582 ***
SMB	0.0897	0.1194 ***	0.1193 ***	0.1187 ***	0.1049 ***
HML	−0.0174	0.0222	0.0284	0.0322	0.0311
WML	−0.2376	−0.1370 ***	−0.1544 ***	−0.1549 ***	−0.1338 ***

This table provides results from the Carhart four factor model for small (Q1) and big (Q5) REIT portfolios. Significance is shown at 10% (*) and 1% (***) levels.

Table 8. Robustness check for Value and Growth REIT portfolios (2001–2020).

Carhart Four Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + w_iWML + e_i$	**Q1 (Value)**	**Q2**	**Q3**	**Q4**	**Q5 (Growth)**
a_i	0.4118 ***	−0.0131	−0.0366	0.0398	−0.0887 ***
Beta	0.0847 ***	0.1303 ***	0.1261 ***	0.1416 ***	0.1352 ***
SMB	0.0698	0.0988 ***	0.1133 ***	0.1257 ***	0.0955 ***
HML	0.1027 *	0.0469	0.0306	0.0224	0.0179
WML	−0.2272 ***	−0.1392 ***	−0.1480 ***	−0.1508 ***	−0.1075 ***

This table provides results from the Carhart four factor model for value (Q1) and growth (Q5) REIT portfolios. Significance is shown at 10% (*), 5% and 1% (***) levels.

Table 9. Robustness check for Robust and Weak Profitability REIT portfolios (2001–2020).

Carhart Four Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + w_iWML + e_i$	**Q1 (Robust)**	**Q2**	**Q3**	**Q4**	**Q5 (Weak)**
a_i	0.0938 ***	−0.0392	0.2155 ***	0.0467 *	0.0761 ***
Beta	0.1697 ***	0.1426 ***	0.1139 ***	0.1187 ***	0.0880 ***
SMB	0.0801 *	0.1320 ***	0.0937 **	0.1140 ***	0.0456
HML	0.0428	0.0422	0.0342	0.0448	0.0223
WML	−0.0877 ***	−0.1470 ***	−0.1161 ***	−0.1177 ***	−0.1241 ***

This table provides results from the Carhart four factor model for robust profitability (Q1) and weak profitability (Q5) REIT portfolios. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 10. Robustness check for Conservative and Aggressive Investment REIT portfolios (2001–2020).

Carhart Four Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + w_iWML + e_i$	**Q1 (Conservative)**	**Q2**	**Q3**	**Q4**	**Q5 (Aggressive)**
a_i	0.0039	−0.0351	0.0007	0.1446 ***	−0.0864 ***
Beta	0.0997 ***	0.1370 ***	0.1286 ***	0.1218 ***	0.1242 ***
SMB	0.1003 **	0.1181 ***	0.1132 ***	0.1101 ***	0.0825 **
HML	0.0670 *	0.0220	0.0204	0.0500	0.0205
WML	−0.1067 ***	−0.1593 ***	−0.1295 ***	−0.1018 ***	−0.1276 ***

This table provides results from the Carhart four factor model for conservative investment (Q1) and aggressive investment (Q5) REIT portfolios. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

Table 11. Robustness check for Winner and Loser REIT portfolios (2001–2020).

Carhart Four Factor Model: $R_i - R_f = a_i + b_i(R_m - R_f) + s_iSMB + h_iHML + w_iWML + e_i$	**Q1 (Winner)**	**Q2**	**Q3**	**Q4**	**Q5 (Loser)**
a_i	0.1223 ***	−0.0358	−0.0281	−0.0359	0.0173 *
Beta	0.1119 ***	0.1267 ***	0.1287 ***	0.1294 ***	0.1184 ***
SMB	0.0785 **	0.1042 ***	0.0993 ***	0.1013 ***	0.1227 ***
HML	0.0388	0.0165	0.0358	0.0268	0.0057
WML	−0.0804 ***	−0.1088 ***	−0.1318 ***	−0.1226 ***	−0.1877 ***

This table provides results from the Carhart four factor model for winner (Q1) and loser (Q5) REIT portfolios. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

The WML factor is unique to the Carhart four factor model, relative to the univariate CAPM model and multivariate Fama–French models. We find a lower WML factor loading for our HML and WML strategies, while we observe a higher WML factor loading for our RMW and CMA strategies. This result provides further credence to the fact that value and momentum strategies might help to generate abnormal excess returns without exposing investors to a higher relative risk, while the RMW and CMA strategies might be associated with a rise in relative risk for investors.

4.4. Statistical Analysis for Explanatory Variables

We report the main summary statistics in Table 12. Daily statistics are provided for mean values along with their respective skewness and kurtosis levels. Overall, the skewness and kurtosis levels of the variables signifies non-normality. Our data set runs through the dot-com crash, the non-recessionary phase following the dot-com crash, the 2007/08 crisis, the non-recessionary phase following the 2007/08 crisis, and the COVID-19 phase. These variations in phases become apparent by observing the large standard deviation levels associated with all our explanatory variables.

Table 12. Descriptive Statistics for Explanatory Variables.

Variables	Mean	SD	Min	Max	Skewness	Kurtosis
DCS	0.0000905	0.024616	−0.300000	0.470000	3.096665	70.96143
DTED	0.0000261	0.049873.	−0.800000	0.996250	0.758200	88.69920
DSNP	0.394754	20.42972	−324.8900	230.3800	−1.331192	39.33516

This table provides descriptive statistics for all variables for the full sample from July 2001 to June 2020. DCS denotes the daily change in credit spread, DTED denotes the daily change in the TED spread, DSNP represents the daily change in the S&P 500 index.

Figure 6 shows time series volatility for Credit Spread, TED Spread and S&P 500 index (left) and first difference (right) for the full sample between July 2001 and June 2020. Both credit spread and TED spread rise together during the 2007/08 crisis, peaking in 2008. Furthermore, they both rise in unison during the COVID-19 phase. This is an expected result as financial distress and the possibility of a liquidity crisis are both anticipated to rise during a financial crisis. The first difference plots suggest that changes in TED spread tend to be more volatile relative to changes in credit spread during the 2007/08 crisis, but during the COVID-19 phase, credit spread seems to be relatively more volatile. This is further backed by the argument that illiquidity and liquidity risk was a major source for the 2007/08 financial crisis (Brunnermeier 2009; Crotty 2009). Both TED spread and Credit spread seem to move in the opposite direction to the S&P 500 index, during the financial crisis of 2008, and the COVID-19 phase. A rise in the probability of liquidity crisis and default risk during these recessionary phases might negatively impact investor sentiments within the economy, which might result in channeling of funds from the stock market to safe haven investments, such as the US Dollar.

Due to the significant correlation levels, we orthogonalize our variables using the system set out in Equations (5) and (6). Table 13 then confirms no significant correlations between our explanatory variables.

Table 13. Correlation after Orthogonalization.

Correlation Probability	CS	TED	DSNP
CS	1.000000 ——		
TED	-8.71×10^{-16} 1.0000	1.000000 ——	
DSNP	-2.10×10^{-15} 1.0000	8.32×10^{-16} 1.0000	1.000000 ——

The table provides correlation of the variables for the full sample from July 2001 to June 2020. CS and TED are the residual terms from Equations (5) and (6), respectively, while DSNP represents the daily change in the S&P 500 index.

Theoretically, one could argue that the macroeconomy drives credit spread and TED spread, via sovereign and corporate bond yields and the perceived risk on corporate debt. One could also argue that a causation may exist the other way, i.e., credit spread and TED spread causing movements within macroeconomic factors, via changes in the probability of financial distress, liquidity crisis and default risk. We therefore look to test the direction of the causality, if present, between credit spread, TED spread and the S&P 500 index.

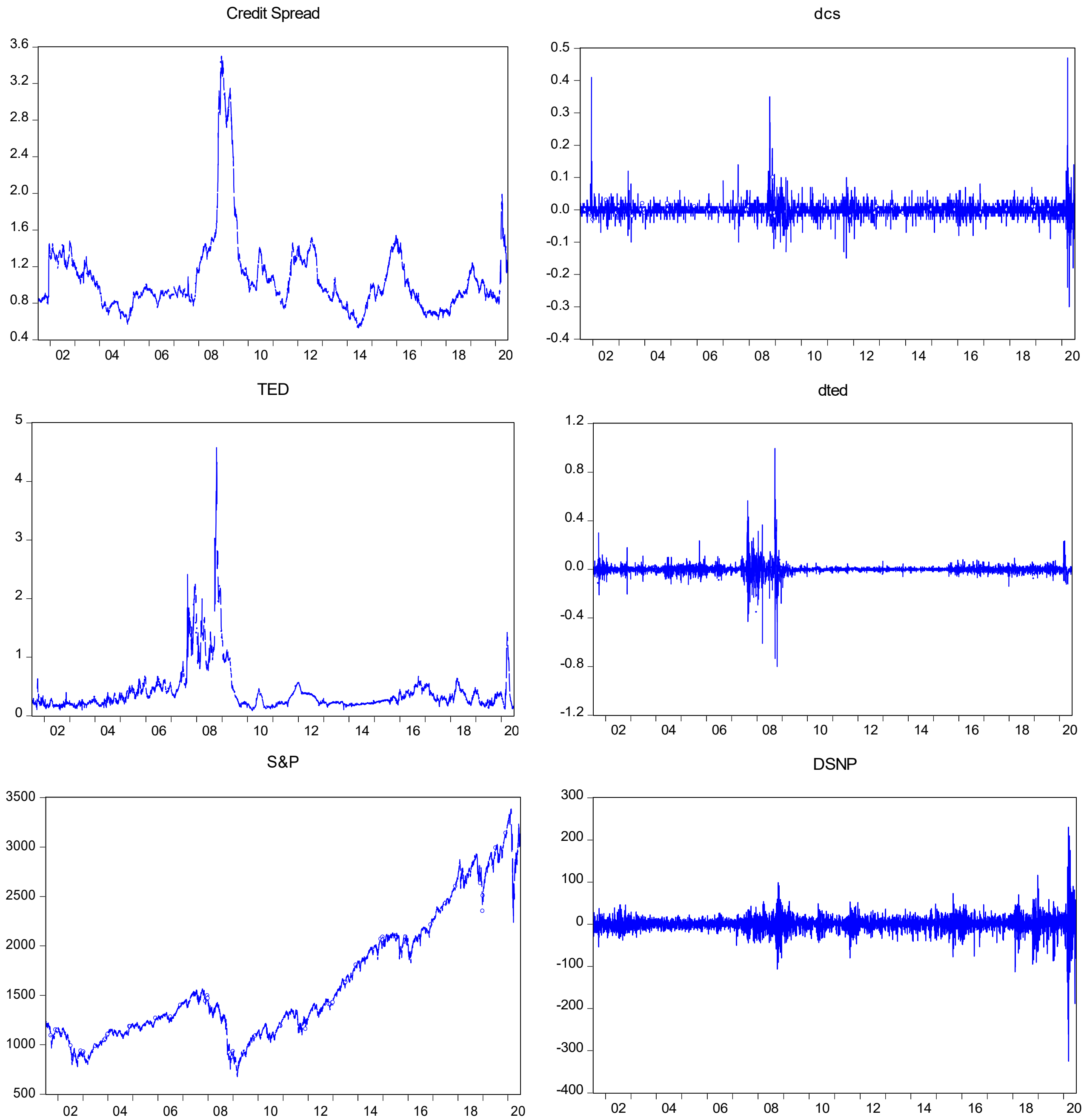

Figure 6. Time series volatility for Credit Spread, TED Spread, S&P 500 index levels (**left**) and returns (**right**) for the full sample between July 2001 to June 2020.

Table 14 reports results for Granger causality. Our results suggest that a significant two-way causality exists between credit spread and TED spread, and between TED spread and the S&P 500 index. Furthermore, the S&P 500 index causes movements within credit spread.

Table 14. Granger Causality.

Null Hypothesis:	F-Statistic	Prob.
DTED does not Granger Cause DCS	7.2165	0.0007 ***
DCS does not Granger Cause DTED	2.9158	0.0543 *
DSNP does not Granger Cause DCS	25.0571	0.0000 ***

Table 14. *Cont.*

Null Hypothesis:	F-Statistic	Prob.
DCS does not Granger Cause DSNP	1.5750	0.2071
DSNP does not Granger Cause DTED	5.3350	0.0048 ***
DTED does not Granger Cause DSNP	3.0718	0.0464 **

The table reports only the Granger Causality test results between credit spread, TED spread, S&P 500 index, for the full sample between July 2001 and June 2020. Significance is shown at 10% (*), 5% (**) and 1% (***) levels.

4.5. Bounds Test for Cointegration

Tables A1–A5[12] report the results of the bounds test for cointegration between SMB, HML, RMW, CMA and WML premiums, and our explanatory variables, for the three recessionary periods and the two non-recessionary periods. The computed F-statistic is significantly greater than the critical upper bound values at the 5% and 10% levels of significance. This indicates that a cointegration relationships exists between each of our factor premiums, and credit spread, TED spread, S&P 500 index, during all five periods.

Once a long-run relationship has been established between our factor premiums and the examined variables, we use the long-run ARDL model and short-run ECM model as specified in Equations (8) and (9), to estimate long-run and short-run elasticities for the variables in the model, during recessionary and non-recessionary phases.

4.6. The Long-Run ARDL Model and the Short-Run Error Correction Model

4.6.1. SMB, HML and CMA

Recession

Tables 15–17 show that credit spread, and TED spread have a significant and positive impact on both SMB, HML and CMA premiums, both in the short- and long-run, during recessionary states. These results are consistent with the risk-based explanation of Fama and French (1996, 2015), that SMB, HML and CMA premiums are proxies for systematic risk. Therefore, with a rise in general risk levels within the economy, investors demand a higher compensatory return on these REITs.

Table 15. Long-run ARDL model and short-run error correction model for SMB (Recession).

Variable	Long Run			Short-Run		
	Dot-Com	2007/08	COVID-19	Dot-Com	2007/08	COVID-19
	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)
Con	**72.06 (0.01)**	−23.45 (0.29)	29.44 (0.65)	−0.14 (0.75)	−0.02 (0.94)	0.39 (0.57)
SMB (−1)	**0.21 (0.03)**	**0.35 (0.00)**	**0.39 (0.00)**	**1.07 (0.00)**	**1.31 (0.01)**	**0.95 (0.00)**
CR	23.72 (0.11)	2.13 (0.75)	8.24 (0.11)	16.61 (0.24)	4.99 (0.44)	2.69 (0.57)
CR (−1)		**20.79 (0.02)**			**24.32 (0.00)**	
TED	6.10 (0.44)	−1.43 (0.71)	1.60 (0.86)	4.94 (0.50)	−0.61 (0.87)	−1.92 (0.80)
TED (−1)		**17.27 (0.00)**			**19.42 (0.00)**	
S&P	**−57.93 (0.00)**	**−152.86 (0.00)**	**−42.25 (0.00)**	**−56.36 (0.00)**	**−156.95 (0.00)**	**−24.67 (0.08)**
S&P (−1)	**48.17 (0.00)**	**237.68 (0.00)**	**38.38 (0.01)**	**39.22 (0.03)**	**235.16 (0.00)**	**45.06 (0.00)**
ECM (−1)				**−0.87 (0.00)**	**−0.99 (0.05)**	**−0.55 (0.00)**

This table represents results for the three recession periods, the dot-com crash (July 2001 to November 2001), the 2007/08 crisis (December 2007 to June 2009), and COVID-19 (February 2020 to June 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index *p*-values are listed next to the coefficients. Bold figures mean significant.

Table 16. Long-run ARDL model and short-run error correction model for HML (Recession).

Variable	Long-Run			Short-Run		
	Dot-Com	2007/08	COVID-19	Dot-Com	2007/08	COVID-19
	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)
Constant	**29.47 (0.09)**	−33.14 (0.10)	−161.02 (0.12)	**0.51 (0.09)**	0.01 (0.97)	−0.06 (0.84)
HML (−1)	**0.43 (0.00)**	**0.76 (0.00)**	**0.18 (0.09)**	**0.66 (0.00)**	**0.99 (0.00)**	**0.59 (0.03)**
CR	**17.19 (0.08)**	6.16 (0.32)	**19.37 (0.00)**	13.09 (0.16)	5.26 (0.28)	**16.82 (0.01)**
CR (−1)					**10.93 (0.03)**	
TED	4.35 (0.40)	1.04 (0.77)	−3.42 (0.68)	4.04 (0.41)	0.76 (0.79)	−10.73 (0.18)
TED (−1)			**23.21 (0.02)**		**11.92 (0.00)**	**15.47 (0.07)**
S&P	−10.66 (0.29)	**−42.36 (0.00)**	0.35 (0.98)	−5.99 (0.52)	**−40.01 (0.00)**	8.68 (0.53)
S&P (−1)		**46.98 (0.00)**	**51.16 (0.00)**		**70.93 (0.00)**	**47.76 (0.00)**
ECM (−1)				**−0.20 (0.09)**	**−0.51 (0.00)**	**−0.49 (0.09)**

This table represents results for the three recession periods, the dot-com crash (July 2001 to November 2001), the 2007/08 crisis (December 2007 to June 2009), and COVID-19 (February 2020 to June 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index p-values are listed next to the coefficients. Bold figures mean significant.

Table 17. Long-run ARDL model and short-run error correction model for CMA (Recession).

Variable	Long-Run			Short-Run		
	Dot-Com	2007/08	COVID-19	DOT-COM	2007/08	COVID-19
	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)
Constant	14.85 (0.58)	−20.56 (0.10)	−8.48 (0.76)	0.03 (0.85)	0.01 (0.90)	−0.09 (0.60)
CMA (−1)	0.15 (0.15)	**0.15 (0.00)**	**0.19 (0.06)**	0.45 (0.38)	**0.91 (0.00)**	**0.52 (0.09)**
CR	12.90 (0.23)	**−13.42 (0.03)**	**1.68 (0.07)**	11.43 (0.26)	**−10.34 (0.08)**	**6.28 (0.02)**
CR (−1)		**18.20 (0.03)**			**18.57 (0.00)**	
TED	−0.86 (0.31)	−0.95 (0.53)	0.02 (0.96)	−0.36 (0.66)	−1.26 (0.40)	0.44 (0.70)
TED (−1)		−0.87 (0.71)		**1.36 (0.09)**	−0.50 (0.75)	
TED (−2)		**4.58 (0.05)**			**3.95 (0.01)**	
S&P	7.49 (0.55)	**−37.16 (0.00)**	0.99 (0.78)	10.60 (0.39)	**−38.85 (0.00)**	**14.71 (0.01)**
S&P (−1)		**47.51 (0.00)**			**38.17 (0.00)**	
ECM (−1)				**−0.31 (0.08)**	**−0.77 (0.00)**	**−0.25 (0.00)**

This table represents results for the three recession periods, the dot-com crash (July 2001 to November 2001), the 2007/08 crisis (December 2007 to June 2009), and COVID-19 (February 2020 to June 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index p-values are listed next to the coefficients. Bold figures mean significant.

Fama and French (1996), Chan and Chen (1991), conclude that small stocks generally have poorer earnings and profitability relative to big stocks, and link size premiums to greater financial risk. They also conclude that value stocks carry a higher financial risk relative to growth stocks. Based on these factors, small and value REITs are more vulnerable to the risk of default, leading investors to demand a higher compensatory return on small and value REITs as leverage, default risk and credits spreads rise.

Elgammal et al. (2016) identify that value stocks are more vulnerable to default risk relative to growth stocks, since they have higher levels of leverage associated to them. They also find a positive relationship between credit spreads and HML premiums in the stock market. A rise in leverage, proxied by credit spread (Ivaschenko 2003; Molina 2005), increases the risk associated with value stocks, as these tend to be more levered than other firms. Therefore, investors require a higher return on value REITs when credit spreads rise. Furthermore, Vassalou and Xing (2004) suggest that book-to-market effects are concentrated within firms with a high risk of default, which is consistent with our findings of a positive relationship between credit spread and value premiums.

An up-tick in the probability of a liquidity crisis may reduce the availability of funds for leverage, therefore enhancing the risk of default and financial distress. This relationship is again consistent with the risk-based argument that investors would demand a higher return for being exposed to a higher risk. Bernanke (1983) and, Giesecke et al. (2014) conclude that small stocks are more vulnerable to liquidity risk relative to big stocks. In a scenario where there is sharp fall in liquidity during a financial crisis, larger firms might have access to credit alternatives, something small firms might not have access to, raising the risk associated with small REITs relative to big REITs, and thus investors demand a higher compensatory return, eventually enhancing the SMB premium.

Our result in Table 16 is also consistent with the argument that value premiums are proxies for systematic risk (Fama and French 1992, 2006), hence it is expected that a rise in the probability of a liquidity crisis will enhance value premiums, since it limits the availability of funds, and value stocks tend to be more leveraged than other firms (Elgammal et al. 2016), resulting in a higher compensatory return for investors if they choose to take an exposure on riskier value REITs.

Both credit spread and TED spread seem to have only a short-run impact on HML premiums during the 2007/08 crisis, as shown in Table 16. This is in contrast to the other two recession periods. One possible reason for this might be the depth of this recession, along with its significance in terms of impact on markets and investor sentiments. Given the extent of this recession, the uncertainty of the long-run would be something that would play a part in investors' decision making. Therefore, the stronger short-run influence might be a testament to the fact that during this phase, investors are primarily concerned with returns in the short-run.

Fama and French (2015) show that investment is a significant factor in defining average returns, identifying it as a risk factor, derived from the dividend discount model. Similar to our results within the REIT market, Fama and French (2015) find a positive CMA premium within general stocks. Based on their risk-based argument, this would mean that firms with conservative investment strategies have a higher risk associated to them, potentially due to lower prospects relative to firms with aggressive investment strategies, and therefore the CMA premium is a compensation for investors, for exposing them to higher risk. A rise in the probability of default and liquidity crisis implies a rise in general risk levels with the economy, resulting in a higher compensatory return for investors if they choose to take an exposure on conservative investment (weak prospects) REITs, hence raising CMA premiums.

Based on these results, it is clear that establishing and understanding the relationship between financial distress/liquidity crisis and size/value/investment premiums is crucial for investors and fund managers to derive an investment strategy during a crisis period.

The S&P 500 index has a significant and negative impact on SMB premiums in all three recessionary phases. A possible explanation for this stems from investor sentiments. A rise in the index might make investors more optimistic about the future state of the economy (Essa and Giouvris 2020), reducing the perceived risk associated with small stocks, and hence resulting in a fall in SMB premiums.

For lagged values of the S&P 500 index, the sign of the relationship between the stock market index and SMB premiums is reversed. We also find that the S&P 500 index overall has a positive and significant influence on HML and CMA premiums during recessionary phases. As returns on the index go up, this signifies higher returns on larger stocks, inducing investors' to channel funds towards these securities. This potentially reduces demand for riskier small/value/conservative (weaker prospects) REITs, which in-turn need to provide higher returns in order to incentivize investors, thus resulting in a rise in SMB/HML/CMA premiums.

So, for current values of S&P 500 index, investor sentiment tends to dominate the impact on SMB premiums, while the channeling of funds tends to dominate for lagged measures of the S&P 500 index.

We also find that lagged values of SMB, HML and CMA premiums have a positive and significant impact on current size, value and investment premiums respectively, implying that these might have some forecasting power. In summary, credit spread and TED spread have a significant and positive impact on SMB, HML and CMA premiums during recessionary phases. The S&P 500 has a mixed impact on SMB premiums, while it has a positive impact on HML and CMA premiums.

Non-Recession

Tables 18–20 show that credit spread has no significant impact on SMB, HML and CMA premiums during the non-recessionary phases. This is consistent with Huang et al. (2013) who argue that SMB premiums are not driven by financial distress risk. This would also suggest that during economic up-turns, investors are less concerned with financial distress, probability of default.

Table 18. Long-run ARDL model and short-run error correction model for SMB (Non-Recession).

Variable	Long-Run		Short-Run	
	Post Dot-Com	**Post 2007/08**	**Post Dot-Com**	**Post 2007/08**
	Coefficient (*p*-Value)	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**
Constant	2.13 (0.38)	2.47 (0.14)	0.02 (0.71)	**0.13 (0.03)**
SMB (−1)	**0.27 (0.00)**	**0.67 (0.00)**	**1.01 (0.00)**	**0.81 (0.00)**
CR	−0.48 (0.81)	2.31 (0.48)	−0.65 (0.75)	2.68 (0.40)
TED	0.51 (0.69)	**7.14 (0.06)**	0.43 (0.74)	5.91 (0.11)
S&P	**−58.87 (0.00)**	**−62.70 (0.00)**	**−58.45 (0.00)**	**−60.07 (0.00)**
ECM (−1)			**−0.75 (0.00)**	**−0.22 (0.00)**

This table represents results for the two non-recession periods, post dot-com crisis (December 2001 to November 2007) and post 2007/08 crisis (July 2009 to January 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index p-values are listed next to the coefficients. Bold figures mean significant.

Table 19. Long-run ARDL model and short-run error correction model for HML (Non-Recession).

Variable	Long-Run		Short-Run	
	Post Dot-Com	**Post 2007/08**	**Post Dot-Com**	**Post 2007/08**
	Coefficient (*p*-Value)	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**
Constant	1.08 (0.59)	**1.62 (0.05)**	−0.01 (0.65)	**0.07 (0.02)**
HML (−1)	**0.37 (0.00)**	**0.67 (0.00)**	**1.09 (0.00)**	**0.85 (0.00)**
CR	1.26 (0.45)	0.69 (0.66)	0.43 (0.78)	0.40 (0.80)
TED	0.83 (0.43)	−0.61 (0.74)	0.29 (0.76)	−0.50 (0.77)
S&P	**−24.29 (0.00)**	**−12.58 (0.00)**	**−23.71 (0.00)**	**−10.67 (0.00)**
ECM (−1)			**−0.84 (0.00)**	**−0.32 (0.00)**

This table represents results for the two non-recession periods, post dot-com crisis (December 2001 to November 2007) and post 2007/08 crisis (July 2009 to January 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index *p*-values are listed next to the coefficients. Bold figures mean significant.

Table 20. Long-run ARDL model and short-run error correction model for CMA (Non-Recession).

Variable	Long-Run		Short-Run	
	Post Dot-Com	Post 2007/08	Post Dot-Com	Post 2007/08
	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)
Constant	1.75 (0.28)	0.68 (0.24)	0.03 (0.31)	−0.00 (0.99)
CMA (−1)	**−0.09 (0.00)**	**0.46 (0.00)**	**0.30 (0.06)**	**1.27 (0.00)**
CR	0.77 (0.56)	1.04 (0.35)	0.62 (0.64)	1.20 (0.28)
TED	−0.03 (0.97)	0.12 (0.93)	−0.30 (0.72)	0.11 (0.93)
S&P	**−4.96 (0.05)**	3.56 (0.10)	**−5.04 (0.05)**	**3.69 (0.09)**
S&P (−2)				**−4.57 (0.04)**
ECM (−1)			**−0.39 (0.01)**	**−0.88 (0.00)**

This table represents results for the two non-recession periods, post dot-com crisis (December 2001 to November 2007) and post 2007/08 crisis (July 2009 to January 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index *p*-values are listed next to the coefficients Bold figures mean significant.

On the other hand, TED spread only has a significant positive impact on SMB premiums during the non-recessionary phase following the 2007/08 crisis, in the long-run (Table 18). A rise in the probability of a liquidity crisis might enhance investors' perceived risk on small REITs relative to big REITs, leading investors to demand a higher compensatory premium, in-turn increasing SMB premiums. This result supports the systematic risk explanation for size premiums. The impact of TED spread is insignificant on HML and CMA premiums.

Investor sentiments tend to dominate the impact of the S&P 500 index on SMB, HML and CMA premiums, during the non-recessionary phases. A rise in the index might make investors more optimistic about the future state of the economy (Essa and Giouvris 2020), reducing the perceived risk associated with small/value/conservative investment REITs, and hence resulting in a fall in SMB/HML/CMA premiums.

Overall, our results suggest that TED spread has a significant positive influence on SMB premiums, while the S&P 500 index has a significant negative influence on SMB, HML and CMA premiums in non-recessionary phases. Furthermore, we find evidence of lag premiums having forecasting power during both non-recessionary periods, both in the long- and short-run. Furthermore, we once again find that the coefficient for the error correction term is significantly negative.

4.6.2. RMW and WML

Recession

Although the RMW factor derives nicely as a risk factor from the dividend discount model, its economic interpretation is still unclear. The risk based argument would deem firms with robust profitability are relatively riskier and thus would offer a premium or compensation for that risk. Ülkü (2017) shows that RMW might be a proxy for capturing mispricing away from 'value'. Ali and Ülkü (2019) believe that investors may underreact to earnings because of uncertainty of information (Brown et al. 1988) and due to transaction costs (Ülkü 2017), and hence contribute to mispricing. Thus, when earnings information is persistent, accumulation of private information would translate into abnormal returns for the RMW portfolio.

Carhart (1997) show that a momentum factor is significant in explaining expected asset returns, when included as a factor along with market beta, SMB and HML, within the Fama and French three-factor model. The latter three factors represent risk attributes, which provide investors compensation for bearing them, however, the economic interpretation for the momentum factor is still unclear. One interpretation is that the expected growth risk increases with expected growth, supporting the argument that the momentum factor within asset pricing does represent an element of systematic risk that investors might be exposed to (Johnson 2002; Liu and Zhang 2008). On the other hand, momentum premium might be interpreted as excess returns generated due to investor behavior and an under-reaction from the market to information (Jegadeesh and Titman 1993). We find no significant evidence of winner REITs exposing investors to a higher risk relative to loser REITs, along with no significant presence of mispricing. Our results support the argument of an under-reaction from the market in connection to historical returns of winner REITs, potentially due to transaction costs, but resulting in a consistently positive and significant return on momentum strategy.

Tables 21 and 22 show that credit spread has a significant and negative relationship with RMW and WML premiums. Additionally, TED spread also has a significant and negative impact on RMW premiums. Sentiment based investor behavior tends to dominate the impact of mispricing for both of these relationships. With a rise in default risk and in probability of a liquidity crisis, investors might be more inclined to channel their funds towards REITs with robust profitability or REITs that have seen higher returns in the short- and medium-term, enhancing the price of these instruments, and having a downward impact on compensatory premiums required to incentivize investors. This result contradicts the argument that RMW and WML premiums are proxies for systematic risk.

Table 21. Long-run ARDL model and short-run error correction model for RMW (Recession).

	Long-Run			Short-Run		
	Dot-Com	**2007/08**	**COVID-19**	**Dot-Com**	**2007/08**	**COVID-19**
Variable	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**	**Coefficient (*p*-Value)**
Constant	−9.83 (0.53)	7.10 (0.44)	**102.38 (0.00)**	−0.02 (0.86)	−0.01 (0.91)	0.28 (0.36)
RMW (−1)	**0.34 (0.00)**	−0.08 (0.14)	**0.39 (0.00)**	**0.70 (0.01)**	**0.93 (0.01)**	**0.87 (0.00)**
CR	**−17.78 (0.06)**	**5.13 (0.07)**	−2.59 (0.39)	**−20.26 (0.02)**	4.36 (0.11)	−3.10 (0.22)
CR (−1)		**−14.51 (0.00)**			**−15.54 (0.00)**	
TED	−4.42 (0.36)	**4.57 (0.01)**	−0.54 (0.91)	−5.43 (0.23)	**4.36 (0.01)**	0.09 (0.98)
TED (−1)		**−10.72 (0.00)**			**−11.16 (0.00)**	
S&P	1.35 (0.89)	**59.57 (0.00)**	−2.77 (0.68)	2.26 (0.80)	**59.29 (0.00)**	3.58 (0.61)
ECM (−1)				**−0.33 (0.08)**	**−1.09 (0.01)**	**−0.52 (0.00)**

This table represents results for the three recession periods, the dot-com crash (July 2001 to November 2001), the 2007/08 crisis (December 2007 to June 2009), and COVID-19 (February 2020 to June 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index *p*-values are listed next to the coefficients. Bold figures mean significant.

The S&P 500 has a significant and positive relationship with RMW premiums during the 2007/08 crisis, both in the long- and short-run. This relationship tends to be dominated by mispricing rather than investor sentiments. We have already established in the last section that REITs with robust profitability tend to be associated with higher arbitrage risk (as shown in panel A of Table 4 where the idiosyncratic risk for the robust profitability portfolio is higher than that of the weak profitability portfolio). Therefore, taking advantage of this anomaly might not be a 'free for all' for investors. Given this scenario, as the S&P 500 index goes up, the arbitrage risk associated with robust profitability REITs might make investors underreact to earnings (Ali and Ülkü 2019), resulting in an accumulation of private information regarding the persistence of these returns, and resulting in an inflationary RMW premium.

The S&P 500 index has a significant and negative relationship with WML premiums during the recessionary phases. Jegadeesh and Titman (1993) associate the existence of the WML premium to an under-reaction from the market to information. A rise in the S&P 500 index might induce investors to channel their funds according to market information and historical returns of winner REITs, potentially enhancing demand for winner REITs and thus reducing WML premiums.

Table 22. Long-run ARDL model and short-run error correction model for WML (Recession).

Variable	Long-Run			Short-Run		
	Dot-Com	2007/08	COVID-19	Dot-Com	2007/08	COVID-19
	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)
Constant	13.77 (0.50)	**21.22 (0.02)**	**91.65 (0.09)**	0.02 (0.92)	−0.01 (0.92)	0.18 (0.63)
WML (−1)	**0.56 (0.00)**	−0.07 (0.16)	**0.19 (0.06)**	**0.79 (0.00)**	0.41 (0.13)	**0.53 (0.07)**
CR	2.68 (0.74)	**−1.13 (0.00)**	**−3.59 (0.02)**	5.20 (0.65)	−0.97 (0.71)	**−10.31 (0.03)**
TED	4.48 (0.34)	−0.05 (0.80)	−2.64 (0.10)	1.31 (0.83)	1.36 (0.39)	1.52 (0.84)
S&P	−1.74 (0.55)	**−2.96 (0.01)**	**−11.20 (0.09)**	**−28.33 (0.02)**	**−9.04 (0.05)**	**−28.04 (0.02)**
ECM (−1)				**−0.28 (0.07)**	**−0.47 (0.09)**	**−0.27 (0.02)**

This table represents results for the three recession periods, the dot-com crash (July 2001 to November 2001), the 2007/08 crisis (December 2007 to June 2009), and COVID-19 (February 2020 to June 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index p-values are listed next to the coefficients. Bold figures mean significant.

Overall, our results indicate that during recessionary phases credit spread has a negative influence on RMW and WML premiums, while TED spread only has a negative impact on RMW premiums. The S&P 500 index has a positive influence on RMW premiums while it has a negative influence on WML premiums.

Non-Recession

Table 23 shows that both Credit spread and TED spread have a positive and significant relationship with RMW premiums during the non-recessionary phase that follows the dot-com crisis, both in the long- and short-run. Additionally, credit spread also has a positive impact on premiums during the non-recessionary phase that follows the 2007/08 crisis. This result suggests that investors underreact to earnings (Ülkü 2017; Ali and Ülkü 2019) in non-recessionary phases, as default risk and the probability of liquidity crisis goes up. This results in an accumulation of information regarding future earnings, hiking up RMW premiums. This finding supports the risk based explanation for the profitability premium put forward by Fama and French (2015), that the profitability premium acts as a compensation for a non-diversifiable risk factor.

Table 23. Long-run ARDL model and short-run error correction model for RMW (Non-Recession).

Variable	Long-Run		Short-Run	
	Post Dot-Com	Post 2007/08	Post Dot-Com	Post 2007/08
	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)	Coefficient (p-Value)
Constant	1.05 (0.48)	**−2.10 (0.01)**	−0.01 (0.70)	0.02 (0.58)
RMW (−1)	**0.33 (0.00)**	**0.54 (0.00)**	**0.88 (0.01)**	**1.02 (0.00)**
CR	**2.46 (0.04)**	**3.31 (0.04)**	**2.41 (0.05)**	**3.39 (0.03)**
TED	**1.80 (0.02)**	1.65 (0.38)	**1.68 (0.03)**	2.09 (0.27)
S&P	**−10.21 (0.00)**	**−5.27 (0.09)**	**−9.92 (0.00)**	**−5.42 (0.09)**
S&P (−1)				**−8.50 (0.01)**
ECM (−1)			**−0.56 (0.08)**	**−0.48 (0.05)**

This table represents results for the two non-recession periods, post dot-com crisis (December 2001 to November 2007) and post 2007/08 crisis (July 2009 to January 2020). CR, TED, S&P denote credit spread, TED spread, S&P 500 index p-values are listed next to the coefficients. Bold figures mean significant.

The varying impact of credit spread on WML premiums during the two non-recessionary phases, as shown in Table 24, is a testament to the unique nature of these sub-periods. Similar to the recessionary phase, investor sentiments tend to dominate this relationship during the non-recessionary phase that follows the 2007/08 financial crisis. A rise in the probability of financial distress within the economy results in investors routing funds towards historically winner REITs, having a downward impact on compensatory premiums required to incentivize investors. Once again, this result contradicts the belief that WML premiums are proxies for systematic risk. On the other hand, results from the non-recessionary phase that follows the dot-com crash show evidence of investors underreacting to earnings (Jegadeesh and Titman 1993) in non-recessionary phases, as default risk goes up. This results in an accumulation of information regarding future earnings, resulting in an uptick in WML premiums. This finding supports the risk based explanation that the momentum premium acts as a compensation for a non-diversifiable risk factor. In this period, we also find that the WML premium rises with the probability of a liquidity crisis, adding further credibility to the risk based explanation (Johnson 2002; Liu and Zhang 2008).

Table 24. Long-run ARDL model and short-run error correction model for WML (Non-Recession).

Variable	Long-Run		Short-Run	
	Post Dot-Com	Post 2007/08	Post Dot-Com	Post 2007/08
	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)	Coefficient (*p*-Value)
Constant	0.42 (0.82)	**−1.76 (0.01)**	0.04 (0.33)	0.00 (0.84)
WML (−1)	**0.19 (0.00)**	**0.26 (0.00)**	**0.80 (0.00)**	**0.44 (0.00)**
CR	**3.56 (0.02)**	**−2.43 (0.06)**	**3.07 (0.05)**	**−2.58 (0.05)**
TED	**1.83 (0.06)**	0.40 (0.79)	1.57 (0.11)	0.29 (0.85)
S&P	**−10.54 (0.00)**	−2.18 (0.39)	**−9.90 (0.00)**	−2.41 (0.35)
ECM (−1)			**−0.62 (0.00)**	**−0.19 (0.01)**

This table represents results for the non-recession period (December 2001 to November 2007) and the second non-recession period (July 2009 to January 2020). CR, TED S&P denote credit spread, TED spread, S&P 500 index. *p*-values are listed next to the coefficients. Bold figures mean significant.

The S&P 500 has a significant and negative impact on RMW and WML premiums during the non-recessionary phase, both in the long- and short-run. This relationship is driven by investor sentiments rather than mispricing, which was the case during the recessionary phases. A rise in the index might make investors more optimistic about the future state of the economy (Essa and Giouvris 2020), therefore investors are willing to act on earnings information (even though robust profitability REITs carry a higher arbitrage risk), enhancing the price of profitable/winner REITs and having a downward impact on RMW and WML premiums.

To summarize, both credit spread and TED spread have a positive impact, on RMW premiums during expansionary phases. On the other hand, the impact of financial distress and liquidity crisis on WML premiums is mixed, and is dependent on the time period that is considered. We find evidence of lag RMW and WML premiums having forecasting power during both non-recessionary periods, both in the long- and short-run. We also find that the coefficient for the error correction term is significantly negative, implying that the reverting mechanism for sustaining the long-run relationship between the explanatory variables and RMW/WML premiums is extremely relevant.

5. Practical Implication for REIT Investors

We identify an inefficiency in the REIT market, that astute investors can take advantage of, to earn superior returns. Between 2001 and 2020, we find that the excess daily returns on HML and WML strategies within REITs equates to 0.4811% and 0.1038% respectively. Our risk analysis (from the CAPM and Fama–French five factor models) shows that superior returns on these strategies are not associated to a higher systematic risk. Investors can therefore take advantage of these superior returns without a significant uptick in their risk exposure.

While we find significant evidence of mispricing for value REITs, we find that growth REITs are less exposed to mispricing. This translates to the fact that the superior returns on value REITs are relatively stronger than the inferior returns on growth REITs. Barkham and Ward (1999) associate this asymmetry to the fact that growth REITs attract more institutional investors and therefore are less prone to mispricing. On the other hand, value REITs are mostly held by small investors (Ooi et al. 2007), who underestimate the growth potential of value REITs via naïve extrapolation[13].

From Figure 2 (Section 4.1) we can see that value REITs seem the most under-priced during the 2007/08 recession, with HML premiums peaking to a maximum value of 33.7674%. Although our results from the CAPM and Fama–French models may indicate most of this uptick in HML premiums is not due to a higher systematic risk but instead due to mispricing and naive extrapolation, we do find significant evidence of the probability of default risk and liquidity crisis being priced within these premiums during recessionary states. However, during non-recessionary states we find these factors to have no significant impact on HML premiums, contradicting the argument that value premiums are proxies for systematic risk. This is crucial for investors and fund managers that are looking to build a HML investment strategy during recessionary and non-recessionary periods.

WML premiums peaked to a maximum level of 10.0766% during the COVID-19 recessionary phase. Based on idiosyncratic returns volatility, we find no significant evidence of winner REITs being more prone to mispricing relative loser REITs. Furthermore, from our regression analysis over the five sub-samples, we find that the probability of default risk and liquidity crisis have a significant and positive impact on WML premiums only during the non-recessionary phase that follows the dot-com crash. For investors and fund managers, this provides crucial information on the ability of WML premiums to provide excess returns without a corresponding rise in risk, during recessionary periods.

Our results also provide useful benefits to investors from a portfolio diversification perspective. From our regression analysis, we find a significant and negative relationship between the S&P 500 index and WML premiums, both during recessionary and non-recessionary states. Investors with a multi-asset portfolio, with indexed exposure to the stock market, would benefit from diversification perks that a WML strategy within REITs can bring along. This diversification benefit is further supported by negative correlation levels[14]. between WML premiums and the S&P 500 index.

On the other hand, we only find a significant and negative relationship between the S&P 500 index and HML premiums, during non-recessionary phases. This again is supported by significant and negative correlation levels[15] between the two variables, and is useful information for investors and fund managers looking to diversify their portfolio.

In a nutshell, the WML strategy might assist investors in generating excess returns without a corresponding rise in risk during recessionary phases, while the HML strategy might only be able to achieve this for investors during non-recessionary states. As a diversification measure, within a multi-asset portfolio with indexed stock market exposure, the WML strategy provides diversification perks both during recessionary and non-recessionary phases, while the diversification benefits of the HML strategy are only really felt during non-recessionary phases.

6. Conclusions

In summary, this paper has contributed to a better understanding of the existence of factor based premiums within the REIT market, the risk associated with these premiums, and the impact of default risk and liquidity crisis on these premiums during recessionary and expansionary phases.

Currently, there is a lack of clear evidence in literature regarding the existence of positive and statistically significant SMB, HML, RMW, CMA and WML premiums within the US REIT market. This, coupled with the fact that the US REIT sector has a significantly rising market capitalization (an uptick in interest within the asset class), it has witnessed a hike in institutional investment (Chen and Zhang 1998), and the transitioning returns behavior within the sector relative to stocks, potentially providing diversification benefits in a multi-asset portfolio (Glascock et al. 2000), we feel that there are merits to conducting research on the existence of these premiums within the US REIT market.

Between July 2001 and June 2020, we find the presence of significant and positive premiums associated with size, value, profitability, investment and momentum based strategies. Astute investors can take advantage of these premiums to earn superior returns in the REIT market. Risk analysis reveals that the excess returns based on size, profitability and investment are associated with a higher systematic risk. This is consistent with the risk-based explanation of Fama and French (1996, 2015) and the Efficient Market Hypothesis. Our results for the value premium and momentum premiums contradict the risk-based explanation. We do find a higher idiosyncratic risk for value REITs relative to growth REITs, supporting the hypothesis that value REITs are systematically mispriced, potentially due to naive extrapolation by investors, and provides an explanation for why arbitrageurs might be deterred from exploiting this mispricing within value REITs. On the other hand, a relatively lower idiosyncratic risk associated with winner REITs implies that these REITs are less prone to mispricing compared to loser REITs. Our results support the argument of an under-reaction from the market in connection to historical returns of winner REITs (Jegadeesh and Titman 1993), potentially due to transaction costs, but resulting in a consistently positive and significant return on momentum strategy.

Finally, this paper examines the impact of financial distress and liquidity crisis, on factor based premiums within the US REIT market, controlling for stock market returns. Our data set spans from July 2001 to June 2020, which includes periods of significant shifts within financial distress and the probability of liquidity crisis. To capture this structural shift and its impact on factor premiums, we split our sample into five sub-samples, based on recessionary and non-recessionary periods as specified by NBER.

During recessionary phases, we find that both credit spread and TED spread have a significant and positive impact on SMB, HML and CMA premiums. As the probability of financial distress and liquidity crisis rises, the general risk levels within the economy rise, enhancing the relative risk associated with small, value and conservative investment (weak prospects) REITs. Therefore, investors demand a higher compensatory return on these REITs. These results are consistent with the risk-based explanation of Fama and French (1996, 2015). During non-recessionary phases, both credit spread and TED spread seem to have mostly an insignificant influence on these factor premiums.

For both RMW and WML, investor sentiments tend to dominate the impact of credit spread and TED spread on these premiums during recessionary phases. As the probability of financial distress and liquidity crisis goes up, investors' route more funds towards robust profitability and winner REITs, enhancing the price of these REITs, and having a downward or negative impact on compensatory premiums required to incentivize investors. This is in contradiction to the risk-based explanation of Fama and French (2015) and Carhart (1997). During expansionary phases, generally we find the effect of an under-reaction from investors dominate these relationships, resulting in inflated premiums with a rise in credit spread and TED spread.

The impact of the S&P 500 index is negative on all premiums, during the non-recessionary state, implying that investors with portfolio exposures to factor based REIT premiums and stock indexing, would see a fall in their premiums with a corresponding rise in the index or as a consequence of a bullish stock market. This impact is reversed for all premiums in the recessionary state, apart from WML, which still has a negative relationship with the S&P 500 index.

Factor based style investment strategies have been used extensively as a portfolio constructing mechanism within stocks, to beat the market. This paper looks to assess the ability of these strategies to generate abnormal returns within the US REIT market using daily returns and a data set that spans 19 years (4754 observations). In terms of the risk associated with these strategies, prior literature, such as Ooi et al. (2007), test the risk associated with value strategies within the REIT market using standard deviation, beta from the CAPM model, and factor loadings from the Fama–French three factor model. We extend on this study by testing this risk based explanation for not just the value premium but also for SMB, RMW, CMA, and WML strategies. Additionally, we not only use the risk measures as suggested by Ooi et al. (2007) but also use the factor loadings on the Fama–French five factor, and the Carhart four factor model as a robustness measure. Furthermore, we assess the role of arbitrage risk in deterring arbitrageurs from exploiting potential mispricing related to these factor-based premiums, hence providing us with a deeper understanding on the role of mispricing in the existence of these premiums.

Thirdly, this study is unique in terms of explicitly examining the relationship between default risk, liquidity crises, stock market index, and factor based REIT premiums, establishing long- and short-run relationships using Auto-Regressive Distributed Lag (ARDL) modeling and Error Correction Modeling (ECM), for three recessionary phases, and two non-recessionary phases. This provides us the opportunity to assess common risk factors as established within Fama and French (1992, 2015) and Carhart (1997), within the US REIT market, and test their interpretation as proxies for systematic risk. This study further adds value as it tests out these relationships during the recent COVID-19 phase, incorporating 104 observations during this time frame.

This research is useful for academics and practitioners looking to analyze the impact of default risk, liquidity crisis and the stock market on factor based premiums in the US REIT market, in the short- and long-run, within recessionary and non-recessionary phases. This can be extended on over other geographies, along with assessing the impact of other macroeconomic factors on these factor premiums. Another possible extension could be to assess role of mispricing and arbitrage risk within the existence of these premiums, especially within RMW and CMA premiums, as it is currently an under-researched segment, and would greatly assist in understanding the interpretation of these factor based premiums. This research will also be useful for practitioners looking to strategize efficiently during recessionary and expansionary phases, in terms of diversification in a multi-asset portfolio, balancing risk and return, and utilizing factor based investment strategies within portfolio optimization.

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Appendix A

Portfolio Formation

At the end of June, REITs are divided into five equal quintiles based on their market capitalisation[16]. The difference in returns between the small size and big size portfolios gives us the SMB factor. For our second factor, book-to-market ratio (B/M) is used as a sorting criterion to construct five different portfolios at the end of June each year. Book equity at the end of the fiscal year ending in year $t-1$, and market cap at the end of

December of year t − 1, is used to rank REITs for portfolio construction from July of year t to June of year t + 1. The REITs with negative book value are omitted from the portfolio construction. The difference in returns between the high B/M (value) and low B/M (growth) portfolios gives us the HML factor.

For our third factor, profitability, we rank REITs at the end of June in year t, based on accounting information for the fiscal year ending t − 1, and that is revenues minus cost of goods sold, minus selling, general and administrative expenses, minus interest expense all divided by book equity. The difference in returns between the robust and weak profitability portfolios gives us the RMW factor. Our fourth factor, investment, is constructed as the change in total assets from fiscal year ending in year t − 2 to the fiscal year ending t − 1, divided by total assets from the fiscal year ending in year t − 2. This investment factor is then used to rank REITs at the end of June in year t. The difference in returns between the conservative and aggressive investment portfolios gives us the CMA factor. Finally, following the work of Carhart (1997), the momentum factor in month t is calculated as the total return of each REIT from month t − 11 to t − 1. REITs are ranked in month t based on this momentum factor. The difference in returns between the winner and loser portfolios gives us the WML factor.

Table A1. The results of the bounds test for cointegration for SMB.

Computed F-Statistic	10% Critical I(0)	10% Critical I(1)	5% Critical I(0)	5% Critical I(1)	ARDL Specs	H0: No Cointegration
4.50259	2.12	3.23	2.45	3.61	(1,0,0,1)	Reject
127.15276	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
22.34528	2.12	3.23	2.45	3.61	(1,1,1,1)	Reject
78.040046	2.12	3.23	2.45	3.61	(1,0,1,0)	Reject
13.34180	2.12	3.23	2.45	3.61	(1,0,0,1)	Reject

This table represents results of the bounds test for the first period (July 2001 to November 2001), the second period (December 2001 to November 2007), the third period (December 2007 to June 2009), the fourth period (July 2009 to January 2020) and the fifth period (February 2020 to June 2020). The ARDL specs are the optimal lags for SMB premium, credit spread, TED spread and the S&P 500 index, as specified by the Akaike info criterion (AIC). The F-statistic is for a joint test of the following hypothesis as set up in Equation (5): H0: $\beta5 = \beta6 = \beta7 = \beta8 = 0$.

Table A2. The results of the bounds test for cointegration for HML.

Computed F-Statistic	10% Critical I(0)	10% Critical I(1)	5% Critical I(0)	5% Critical I(1)	ARDL Specs	H0: No Cointegration
7.97392	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
107.38706	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
7.74321	2.12	3.23	2.45	3.61	(1,1,1,1)	Reject
79.15930	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
13.55075	2.12	3.23	2.45	3.61	(1,0,1,1)	Reject

This table represents results of the bounds test for the first period (July 2001 to November 2001), the second period (December 2001 to November 2007), the third period (December 2007 to June 2009), the fourth period (July 2009 to January 2020) and the fifth period (February 2020 to June 2020). The ARDL specs are the optimal lags for HML premium, credit spread, TED spread and the S&P 500 index, as specified by the Akaike info criterion (AIC). The F-statistic is for a joint test of the following hypothesis as set up in Equation (5): H0: $\beta5 = \beta6 = \beta7 = \beta8 = 0$.

Table A3. The results of the bounds test for cointegration for RMW.

Computed F-Statistic	10% Critical I(0)	10% Critical I(1)	5% Critical I(0)	5% Critical I(1)	ARDL Specs	H0: No Cointegration
6.68511	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
41.47505	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
123.26916	2.12	3.23	2.45	3.61	(1,1,1,0)	Reject
80.04605	2.12	3.23	2.45	3.61	(1,0,0,1)	Reject
7.224149	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject

This table represents results of the bounds test for the first period (July 2001 to November 2001), the second period (December 2001 to November 2007), the third period (December 2007 to June 2009), the fourth period (July 2009 to January 2020) and the fifth period (February 2020 to June 2020). The ARDL specs are the optimal lags for RMW premium, credit spread, TED spread and the S&P 500 index, as specified by the Akaike info criterion (AIC). The F-statistic is for a joint test of the following hypothesis as set up in Equation (5): H0: $\beta5 = \beta6 = \beta7 = \beta8 = 0$.

Table A4. The results of the bounds test for cointegration for CMA.

Computed F-Statistic	10% Critical I(0)	10% Critical I(1)	5% Critical I(0)	5% Critical I(1)	ARDL Specs	H0: No Cointegration
11.78537	2.12	3.23	2.45	3.61	(1,0,1,0)	Reject
258.17366	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
51.30978	2.12	3.23	2.45	3.61	(1,1,2,1)	Reject
83.47141	2.12	3.23	2.45	3.61	(1,0,0,2)	Reject
13.05765	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject

This table represents results of the bounds test for the first period (July 2001 to November 2001), the second period (December 2001 to November 2007), the third period (December 2007 to June 2009), the fourth period (July 2009 to January 2020) and the fifth period (February 2020 to June 2020). The ARDL specs are the optimal lags for CMA premium, credit spread, TED spread and the S&P 500 index, as specified by the Akaike info criterion (AIC). The F-statistic is for a joint test of the following hypothesis as set up in Equation (5): H0: $\beta5 = \beta6 = \beta7 = \beta8 = 0$.

Table A5. The results of the bounds test for cointegration for WML.

Computed F-Statistic	10% Critical I(0)	10% Critical I(1)	5% Critical I(0)	5% Critical I(1)	ARDL Specs	H0: No Cointegration
3.67679	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
123.17816	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
64.07647	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
221.19466	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject
9.049073	2.12	3.23	2.45	3.61	(1,0,0,0)	Reject

This table represents results of the bounds test for the first period (July 2001 to November 2001), the second period (December 2001 to November 2007), the third period (December 2007 to June 2009), the fourth period (July 2009 to January 2020) and the fifth period (February 2020 to June 2020). The ARDL specs are the optimal lags for WML premium, credit spread, TED spread and the S&P 500 index, as specified by the Akaike info criterion (AIC). The F-statistic is for a joint test of the following hypothesis as set up in Equation (5): H0: $\beta5 = \beta6 = \beta7 = \beta8 = 0$.

Notes

1 According to the National Association of Real Estate Trusts (NAREIT), the 2021 REIT market cap was $1.74 trillion, which translates to 3.3% of the $53 trillion US stock market cap (NAREIT 2022b). The market cap of listed REITs globally has risen from $10 billion in 1990 to approximately $2.5 trillion today, operating within 41 countries and regions (NAREIT 2022a). This allows global investors to incorporate the real estate sector within multi-asset portfolios, as an investment vehicle and diversification tool. Based on market cap, the US accounts for approximately 70% of the global REIT market.

2 For this reason, we collect daily data for REIT returns inclusive of dividends.

3 These excess returns have given rise to style based investment strategies, where the size premium strategy involves buying small stocks and selling big stocks, while the value premium strategy involves buying value stocks and selling growth stocks.

4 Excess return earned by the portfolio (over the risk free rate) relative to its total risk.

5 Excess return earned by the portfolio (over the risk free rate) relative to its systematic risk.

6 We use an Augmented Dickey–Fuller unit root test to confirm that both credit spread and TED spread are stationary in levels while the S&P 500 index is stationary in first difference.

7 We use an Augmented Dickey–Fuller unit root test to confirm that all variables are stationary in returns (factor premiums associated with size, value, profitability, investment and momentum).

8 Most values are clustered on the left tail of the distribution, right tail is longer. The outliers of the distribution are further out towards the right.

9 Excess kurtosis means fat tails. This means that there are lots of outliers on both sides. This indicates instances of extremely small and extremely large values.

10 The x-axis shows years while the y-axis shows the premiums in percentage terms. Note that the scaling on the y-axis in these graphs varies based on the dispersion of these individual premiums.

11 The square root of the residual variance derived from the univariate CAPM model is used to represent idiosyncratic return volatility, and this is an indicator for arbitrage risk.

12 For reasons of brevity, these results are presented in the Appendix A section.

13 Investors tend to be overly optimistic about future prospects of growth stocks, while they tend to be overly pessimistic about prospects of value stocks, and when these expectations are not realized, it results in a higher return on value stocks and a lower return on growth stocks (Ooi et al. 2007).

14 We find a significant and negative correlation between the S&P 500 Index and WML premiums (−2.3%) for our full sample. For reasons of brevity, a table of these results has not been included in the main body of this paper.

15 We find significant and negative correlation between the S&P 500 Index and HML premiums during the non-recessionary phase that follows the dot-com crash (−13.5%) and the non-recessionary phase that follows the 2007/08 recession (−16%). For reasons of brevity, a table of these results has not been included in the main body of this paper.

16 Stock price multiplied by shares outstanding.

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