Betting Against the Sentiment in REIT NAV Premiums*

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Abstract

We dissect NAV premiums in REITs and examine the relation to expected returns. We find that 58% of cross-sectional variation in NAV premiums is explained by observable company fundamentals. NAV premiums are driven in large part by size, market share, profitability, and leverage. The proportion of NAV premiums unexplained by fundamentals is transient in nature and highly influenced by investor sentiment and market-wide uncertainty. Future returns are positively related to the fundamental component of NAV premiums but negatively related to the sentiment component. A long-short portfolio that purchases (sells short) REITs with the lowest (highest) sentiment-driven NAV premiums generates nearly 14% per year.

Introduction

Numerous studies have examined the price premium/discount to net asset value (NAV) as a determinant of REIT returns.[1] Some argue that market prices might at times disconnect from underlying asset values and cause distortions in NAV premiums, as did Van Nieuwerburgh (2019) in a recent piece called "Why are REITs Currently So Expensive?". Much of the debate has centered on whether non-fundamental factors, such as investor sentiment, can influence market prices enough to have a measurable impact on realized returns. We examine whether REIT shareholders are at all "dillusional" as questioned by Riddiough (2019) and provide new perspective on the relation between REIT NAV premiums and returns. We explore the cross-section of NAV premiums, and after accounting for a myriad of observable firm fundamentals, our empirical tests show that more than 40% of variation in NAV premiums remains unexplained. This "non-fundamental" portion of the NAV premium is transient in nature and strongly negatively related to returns.

Value investing, the practice of buying "cheap" and selling "expensive" , has been proven to be a profitable investment strategy in many asset classes. Among REITs, it has generally been found that lower NAV premiums correlate to higher returns. What drives this phenomenon? A risk-based view might posit that poor fundamentals drive prices down and, as such, investors are rewarded for bearing the additional risk of firms with lower NAV premiums. An alternative argument is that non-fundamental factors impact expected returns. For instance, excessive investor pessimism toward a firm may lead to underpricing and higher-than-expected returns. Deciphering between these two viewpoints is not trivial because both

[1] Including Barkham and Ward (1999), Clayton and MacKinnon (2003), Anderson et al. (2005), Ling and Naranjo (2006), Chiang (2009), Brounen et al. (2013), Yavas and Yildirim (2011), and Pattitoni et al. (2013) among others.

generally imply a negative relation between NAV premiums and returns. To address this, we draw novel insights by first anchoring NAV premiums to fundamentals and then reevaluating the relationship to returns.

Our results can be summed up in several main points. First, in our examination of the degree to which fundamentals drive cross-sectional variation in NAV premium, we find that firm size, market share, profitability, and leverage are among the most important determinants. Second, using cross-sectional regressions, we empirically decompose NAV premiums into "fundamental" (predicted) and "sentiment" (residual) components. Importantly, we find that it is the sentiment component of the NAV premium that drives the negative relationship to returns. We introduce a novel long-short investment strategy that purchases (sells short) REITs with low (high) sentiment-driven NAV premiums. Remarkably, this strategy generates annual returns of roughly 14% per year and outperforms a simple price-to-NAV strategy by 4.4% per year. Furthermore, we show that the fundamental-driven portion of the NAV premium is actually *positively* related to returns. Third, we investigate the mechanism underlying our findings. If the results are induced by behavioral tendencies of investors, then our sentiment-based NAV premium investment strategy might exhibit a strong tie to investor sentiment measures. Indeed, we confirm this using multiple sentiment measures, namely, Baker and Wurgler (2006) sentiment, commercial real estate lender survey, market volatility, and REIT analyst dispersion of opinion.

This paper contributes to the broad literature on the cross-section of REIT returns (a comprehensive review of the related literature is given in Section I). Our results closely relate to recent research on firm fundamentals and returns. For instance, Bond and Xue (2017) show that both profitability and investment have power to predict future REIT returns, and

Glascock and Lu-Andrews (2014) provide evidence that greater operating profitability leads to higher REIT returns.

The rest of the paper is organized as follows. Section I reviews related literature. Section II describes the sources of data used in the study. Section III reports our methodology and findings. Section IV provides results of additional robustness tests. Section V concludes.

I Related Literature: Risk and Return in Real Estate

We contribute to two important questions in the investments literature. How should an asset's risk be measured? How is risk priced in assets? A number of studies have examined these questions for real estate assets by considering the relationship of REIT returns and volatility of REIT returns. Ross and Zisler (1991) find that equity REITs exhibit greater returns thah regular stocks yet similar volatility of returns. Stevenson (2002) finds that volatility in the REIT sector is influenced by volatility in small cap stocks. Anderson et al. (2005) dispute these findings and show that REIT return volatility is not highly related to small capital growth stocks. Jirasakuldech et al. (2009) provide further evidence that REIT and small stock volatility differ. Further they show that REIT volatility is conditional on the volatility in key macroeconomic variables.

Fei et al. (2010) find a strong relationship between the correlation and volatility of REITs, stocks, and direct real estate returns. Ang et al. (2014) find that the estimated time series of private equity returns is more volatile than the standard industry indexes. Ooi et al. (2009) find that idiosyncratic risk dominates the volatility of REIT returns and that conditional idiosyncratic volatility is significant in explaining the cross-sectional returns of

REIT stocks. Yang et al. (2012) find that returns across CMBS, (both equity and mortgage) REITs, stocks, and corporate bonds all the asset returns exhibited asymmetric volatilities, REIT returns exhibited stronger asymmetric volatilities, presumably because of their higher leverage characteristics.

I.A Predictability of REIT Returns

The literature on forecasting REIT returns has primarily focused on identifying factors that drive REIT returns, and in some cases, using those factors to predict future performance. Litt et al. (1999) bring together two REIT return models to assess risk adjusted return for REITs. The first model is a three factor CAPM where the factors are the general stock market, the bond market, and the REIT market. The second model is a sum of dividend yield and the average of actual and forecasted growth rate. In the first model, the authors find that only the REIT factor is significant and risk is subsequently separated into systematic and firm specific. Firm size is a determinant of firm-specific risk (smaller firms are higher risk) and high pay out firms have lower systematic risk. On average, 34% of REIT excess returns is attributed to systematic risk and the remainder to firm specific risk. A more recent study by Ooi et al. (2009) shows that idiosyncratic risk drives REIT returns and once it's taken into account, other factors such as size and book to market cease to be significant.

Allen et al. (2000) also consider a multifactor model and its determinants; however the factors in their study are the general stock market and long and short term interest rates. They find that leverage has a positive relationship with the market beta whereas a self-managed indicator has a negative relationship with market beta. No significant interest rate

sensitivity characteristics are identified. Bredin et al. (2007) explore the effect of interest rate announcements from the Federal Open Market Committee. Their results show that there is a significant impact on REIT returns from changes in the Fed Funds Futures rate [a proxy for unanticipated changes in interest rates].

Benefield et al. (2009) study whether property type diversification is priced at a premium in REITs by using the Sharpe Ratio, Jensen's Alpha and the Treynor Index. Their results vary depending on overall market performance. During subperiods of good performance, Jensen's Alpha rankings are higher at property-type diversified REITs while during times of down markets there is no significance. In a follow up work, Ro and Ziobrowski (2011) show that, while diversified REITs have higher Jensen's alpha than specialized REITs, the difference is not statistically significant.

Dempsey et al. (2012) show that financial opacity is negatively related to reported firm performance. After controlling for risk factors, opacity still contains information with significant explanatory power for REIT returns.

On the consistency of predictability of REIT returns, Li and Wang (1995), Nelling and Gyourko (1998) and Ling et al. (2000) show that REIT returns are not reliably predictable and in specifications where they are, incorporating transaction costs removes opportunity for arbitrage. Chiang (2015) shows that dividend yield consistently predicts excess REIT returns from 3 to 36 months time horizon. Bond and Xue (2017) show that by constructing an investment factor and a profitability factor, which reflect REIT fundamentals, returns can be predicted. The significance of the profitability factor was previously established by Novy-Marx (2013) for the general stock market. These findings could be related to work by Cici et al. (2011) which shows that REIT mutual fund managers outperform a general

REIT portfolio, and the expertise could not be explained by REIT property type, return momentum, firm size, geographic concentration, NAV-to-price ratios, income, or leverage of the underlying REITs. This implies that returns are indeed predictable, given REIT expertise.

I.B The Role of Investor Sentiment

Investor sentiment has been shown to play a significant role in explaining both private and securitized real estate returns. Using a noise trader approach, Barkham and Ward (1999) show that investor sentiment is a primary factor in price discounting of market value from net asset value. Gallimore and Gray (2002) use results of a survey to confirm that investor sentiment is an important factor in property investment decision making. Clayton et al. (2009) show that while fundamentals are the main driver of capitalization rates, investor sentiment is also a factor. Ling et al. (2014) show that sentiment based mispricing is a significant component of private commercial real estate markets while Jin et al. (2014) have similar findings in the pricing of U.S. residential real estate. Marcato and Nanda (2016) consider both the residential and commercial real estate sectors and find that investor sentiment only affects the residential sector. Clayton and MacKinnon (2003) demonstrate a presence of price to NAV premium and show that it's drivers include sentiment-based trading.

Ambrose et al. (2007) find that investor sentiment drives spillover effect in REIT returns as shown by REIT return correlations. Lin et al. (2008) show that REIT returns are related to investor sentiment with high returns corresponding to periods of optimistic sentiment and low returns to periods of pessimistic sentiment. Das et al. (2015) find evidence of

institutional sentiment, where since the financial crisis, there has been a flight to more liquid REITs. Their findings show that "institutional real estate investor sentiment introduces a non-fundamental component into REIT pricing". Similarly, Huerta et al. (2015) find that institutional investor sentiment is a significant factor in REIT returns.

I.C The Role of Financial Leverage

Several studies have shown that REIT leverage contributes to volatility in REIT returns. Allen et al. (2000) show that REITs with higher leverage have higher market beta. Chaudhry et al. (2004) find that it is specifically REIT idiosyncratic risk is affected by financial leverage. Sun and Yung (2009) confirm their findings and show a significant positive relationship between idiosyncratic volatility and expected returns in REITs. Sun et al. (2015) focus on the downside of leverage in a crisis period and show that REIT with greater leverage had more volatility during the financial crisis. Giacomini et al. (2015) confirm the crisis and leverage results of Sun et al. (2015) and also show that post-crisis recovery was more volatile for REITs with higher leverage.

I.D REITs and NAV

The literature on Net Asset Values has documented the variation in NAV to price premiums and discounts and has used those findings to reach conclusions of causality between real estate property and stock markets. Anderson et al. (2005) consider the contribution of small cap value stocks, small cap growth stocks, a REIT NAV index and bonds to REIT returns and find that REITs have the most substantial exposure to small value stock valuations.

Ling and Naranjo (2006) examine REIT mutual fund capital flows and whether or not these are influenced by REIT returns and NAVs. They find that REIT returns predict fund flows, i.e. capital inflows follow positive REIT returns. Capital flows are also shown to be closely correlated to NAV premiums. Chiang (2009) decomposes REIT returns into changes in NAVs (real estate component) and stock market valuation (public returns) by using Green Street Advisors NAV and premium/discount to NAV data. By utilizing a Granger causality test, he shows that public market returns lead real estate market returns. Yavas and Yildirim (2011) explicitly study the NAV premium/discount in REITs and the efficiency of price discovery at the firm level. The authors utilize dynamic conditional correlation GARCH tests to determine that causality of real estate versus stock market leading returns varies across different property types and for different firms. Pattitoni et al. (2013) explore the potential miscalculations in NAV of REITs as an alternative explanation for the mispricing. Using a sample of Italian REITs they find a systematic understatement of NAV values by property appraisers but that it does not explain the NAV discount observed in the stock market.

II Data

We assemble a data set consisting of 348 U.S. REITs over the time period January 2001 to December 2015. We obtain stock price information from CRSP and firm fundamentals from Compustat and S&P Global. The NAV is the quarterly NAV estimate provided by S&P Global Market Intelligence according to capitalization rates from Real Capital Analytics (see Appendix). NAV forecast dispersion is also acquired from S&P Global. Time series of

stock market factors are obtained from Ken French's website. The measure of commercial real estate financing sentiment is obtained from the St. Louis Federal Reserve survey of loan officers. Institutional ownership data is obtained from Thompson Reuters.

The definitions of firm characteristics are as follows. *Ln(Size)* is the log of the equity market capitalization (share price multiplied by shares outstanding). *Market share* is market capitalization divided by REIT property type total market capitalization. *FFO/NAV* is funds from operations (FFO) divided by lagged NAV. *FFO/NAV Volatility* is the standard deviation of FFO/NAV over the past eight quarters. *Operational efficiency* is revenues over operating expenses less depreciation. *Leverage ratio* is total debt divided by total assets. *Interest coverage* is pretax income over interest expense. *Current ratio* is current assets over current liabilities. *ST debt fraction* is short-term debt over total debt. *Tobin's q* is market capitalization plus total liabilities over total assets. *Asset growth* is the one-year change in total assets divided by one-year lagged total assets. *Revenue growth* is one-year change in revenues divided by one-year lagged revenues. *Intangibles fraction* is intangible assets over total assets. *Stock return* is the one-year stock return. *Return volatility* is the standard deviation in weekly returns over the past year. *Dividend yield* is the previous per-share dividend paid over share price. *Ln(Bid-ask spread)* is the ask price minus bid price, divided by the mid-point. *Volume turnover* is the prior month share volume over shares outstanding.

Table 1 summarizes our data. Panel A describes the number of firms in each year, and Panel B provides sample statistics. On average, during our sample period, REITs trade at a three percent premium to its NAV. Panel C displays correlation statistics. The NAV premium exhibits a positive correlation with company size, market share, asset and revenue growth, and turnover. It exhibits a negative correlation with leverage-related variables,

volatility, and bid-ask spread.

III Methodology and Results

We begin our analysis with Fama-Macbeth regressions explaining cross-sectional variation in the NAV premium, defined as the percentage price-to-NAV ratio. Table 2 presents the results. Our primary objective in this exercise is to simply examine how much of the NAV premium we can explain with fundamentals. As the average adjusted R^2 shows, the large collection of firm characteristics explains about 58% of cross-sectional variation in the NAV premium. The sign and statistical significance of the coefficients shed light on how the market assigns NAV premiums. For instance, the NAV premium relates positively with firm size, market share, and asset growth, and it relates negatively with profitability, cash flow volatility, leverage, and interest coverage.

Next, we consider the implications of our findings for the relation between NAV premiums and returns. To do this, we perform Fama-Macbeth regressions to predict upcoming one-month stock returns using three variations of the NAV premium. First, the raw value. Second, the value predicted by a regression using the collection of firm characteristics in column 3 of Table 2 on a month-by-month basis. Third, the residual of that regression. By doing this, we shed light on whether any NAV premium effect in returns is driven by readily observable firm characteristics or something less obvious or non-fundamental in nature. As an initial test, Figure 1 displays a correlogram, a visual representation of the persistence of the fundamental (predicted) and non-fundamental (residual) NAV premium measures. One can quickly see the transient nature of the non-fundamental component.

The results are presented in Table 3. In columns 1 and 2, we find that the raw NAV premium is weakly negatively related to returns. Only in column 2 in which we control for size, profitability, and past 12-month stock performance does the negative coefficient on the NAV premium become statistically significant at the 10% level. Next, in columns 3 and 4, we find that the portion of the NAV premium explained by fundamentals is actually statistically *positively* related to returns. That is, REITs with the fundamentals to support a higher price-to-NAV ratio exhibit particularly strong stock performance. Lastly, in columns 5 and 6, we find that the residual NAV premium is strongly negatively related to returns with greater statistical significance than the raw value. This suggests that the negative relation between NAV premiums and returns documented here and in prior literature are likely driven more by the non-fundamental, sentiment-driven portion of the NAV premium.

To further explore this idea, we examine the returns of portfolios based on variations in the NAV premium. Rebalancing on a month-to-month basis, we sort all available REITs by their NAV premiums and create five equally-sized portfolios. The monthly portfolio returns are presented in Table 3. Because a typical long/short value strategy purchases the cheapest and sells short the most expensive, the return differential between the two extreme portfolios is presented as Low minus High. Part (*i*) is based on the raw NAV premium, part (*ii*) is based on the fundamentals-driven portion of the NAV premium (predicted by a regression using the collection of firm characteristics in column 3 of Table 2 on a month-by-month basis), and part (*iii*) is based on the residual sentiment-driven portion of the NAV premium. The long/short strategy based on the residual NAV premium exhibit the greatest returns of nearly 14% per year (1.16% per month with a t-statistic of 2.99) and an annualized Sharpe ratio of 0.82. Furthermore, the difference between long/short strategies (*iii*) and (*i*) is positive

and statistically significant at the 10% level, suggesting that isolating the non-fundamental portion of the NAV premium improves performance. The fundamentals-driven portion of the NAV premium works against the value investor, generating a long/short return of -0.43% per month with a t-statistic of -2.20. Figure 2 provides a visual representation of cumulative performance, showing that a $1 investment in the sentiment-driven NAV premium strategy proved to be the top performer during our sample period.

III.A Exposures to Real Estate and Stock Market Factors

This subsection examines whether the performance gains of our three NAV Premium strategies can be explained by various real estate and stock market factors. We focus on the three long/short strategies presented in Table 3, which buy the lowest, "cheapest" quintile and sell short the highest, "most expensive" quintile. We regress the time series of returns of each strategy on a general REIT market factor (denoted REIT), the Fama-French five factor model stock market factors (denoted MKT, SMB, HML, RMW, and CMA), and the momentum factor (denoted UMD). The REIT factor is the REIT market excess return using the NAREIT all-REIT index minus the risk-free rate. The Fama-French five factors are from Ken French's website and include market, size, value, profitability, and investment factors. The momentum factor, UMD, is calculated as the difference in performance between stocks with the highest and lowest 12-month returns.

Table 5 reports the alpha and beta coefficients of these time series regressions. Part (*i*) represents the long/short strategy based on the raw NAV premium. Parts (*ii*) and (*iii*) represent strategies based on the fundamentals-driven and residual portions of the

NAV premium, respectively. While the alpha coefficient of the raw NAV premium strategy is weakly positive (see columns 1 and 2), purging fundamentals from the NAV premium generates a much more robust investment strategy (see columns 5 and 6). Furthermore, in the direct comparison of columns 3 and 4 to 5 and 6, it is apparent that only the residual portion of the NAV premium is related to sensitivity to broad REIT market fluctuations. Specifically, REITs with a low residual price-to-NAV (for which investors are particularly pessimistic) have higher REIT market betas. When all real estate and stock market factors are included (in column 6), the residual NAV premium investment strategy is reduced by roughly 25% (=0.87/1.16 – 1).

III.B Earnings Announcement Returns

Market prices are determined according to investors' expectations regarding future cash flows. Regardless of the strength of a firm's fundamentals today, investors may discount the stock price in anticipation of lower earnings in the future. This may explain why some firms exhibit low price-to-NAV ratios even after accounting for observed fundamentals. Because the expectation of poor earnings is already accurately compounded into the stock price, the market is not surprised when the firm announces poor earnings. On the other hand, if prices are influenced by excessive optimism or pessimism unrelated to future fundamentals, then one would find that investors are systematically surprised when earnings are released that do not support their sentiment.

To investigate this, we compute three-day cumulative abnormal returns (CARs) around earnings announcement dates in portfolio quintiles based on the NAV premium. The pur-

pose of this is to examine whether investors tend to be surprised by the outcome of the next earnings announcement. Part (*i*) examines portfolio quintiles based on the raw NAV premium. Parts (*ii*) and (*iii*) examine portfolio quintiles based on the fundamentals-driven and residual portions of the NAV premium, respectively.

Table 6 presents the results. By directly comparing parts (*ii*) and (*iii*), we can see that only the residual NAV premium is related to earnings surprises. Positive (negative) surprises are more common among REITs with a low (high) residual NAV premium for which the market is particularly pessimistic (optimistic) even after factoring in fundamentals. As seen in part (*iii*), the difference in the three-day CAR between low and high residual NAV premium portfolios is 0.55% with a t-statistic of 3.45. By contrast, part (*ii*) shows that the CAR difference between the high and low fundamental-driven NAV premium portfolios is a statistically insignificant -0.059%. These results suggest that the residual NAV premium is substantially driven by a non-fundamental sentiment source.

III.C Investor Sentiment and Uncertainty

We next examine the extent to which the returns on our fundamental-driven and sentiment NAV Premium strategies exhibit ties to the time-varying "mood" of the market. To test this, we draw from real estate and stock market data sources to capture aspects of both uncertainty (calm vs. anxious) and sentiment (pessimistic vs optimistic). This analysis is motivated by existing studies that find a relation between sentiment and returns (see a literature review in Section 2). The two long/short strategies of interest correspond to parts (*ii*) and (*iii*) presented in Table 3, which buy the "cheapest" REITs and sell short the "most

expensive" REITs. To assess sensitivity, we analyze the beta coefficient and R^2 of multiple univariate time series regressions of each strategy's returns on the sentiment measure. We further examine performance within subperiods.

The uncertainty and sentiment measures are as follows. NAV forecast dispersion is a monthly time series of the average firm-level NAV dispersion of firms in the sample. NAV dispersion at the firm-level is the standard deviation of NAV estimates among analysts scaled by the mean of NAV estimates (from Letdin et al. (2019)). VIX is the CBOE option-implied volatility index (based on stocks in the S&P 500). KCFSI is the Kansas City Federal Reserve Financial Stress Index. Michigan ICS is the Index of Consumer Sentiment published by the University of Michigan. SENT and orthogonalized SENT are investor sentiment measures from Baker and Wurgler (2006). "Real Estate" is an investor sentiment measure based on loan officer surveys regarding perceived demand for commercial real estate mortgages. To isolate the real estate non-economic component, we orthogonalize "Real Estate" with respect to macroeconomic and other variables, namely, growth in the industrial production index, growth in consumer durables, nondurables, and services, an NBER recession indicator, a bear market indicator (equal to one when the previous two-year stock market index return is negative), stock market volatility, the 10-year Treasury rate, and the Baker and Wurgler (2006) sentiment measure.

Table 7 presents the results. In Panel A, an immediate observation between the two strategies is that only the residual NAV premium exhibits a strong link to the uncertainty and sentiment measures. In general, the returns tend to be greater during times of high uncertainty and negative sentiment. NAV forecast dispersion, VIX, and the KCFSI display a positive relation to investment performance. Michigan ICS, SENT, and Real Estate (both

raw and orthogonalized) exhibit a negative relation to performance. For both SENT and Real Estate, the relationship is stronger after orthogonalizing. Lastly, the multivariate R^2 of 25.6% in which all sentiment and uncertainty variables are included demonstrates how closely they are related to the residual NAV premium.

In Panel B of Table 7, we bifurcate our sample in three ways. First, we consider the period of the financial crisis, identified as July 2007 to June 2009. We find that the NAV sentiment-based strategy generated particularly large (2.97% per month) but statistically insignificant (i.e., very volatile) returns during the crisis period. Next, we consider NBER economic recessionary versus non-recessionary periods. Similar to the financial crisis findings, we show that investor sentiment-based overpricing is not significant during recessionary periods. Lastly, we consider periods of positive and negative sentiment. Contrary to the prior results, sentiment-based investing generates positive and statistically significant return during both positive and negative sentiment periods.

IV Robustness and Additional Tests

In this section, we examine how the performance of the residual NAV premium strategy varies across subsamples. Sentiment may play a more prominent role in the NAV premium among firms that are more difficult to value, less liquid, or neglected by institutional investors. To analyze this, we consider firm size, bid-ask spread, and institutional ownership. The results are provided in Table 8. We find that both large and small REITs generate positive statistically significant long/short returns. Returns on the smaller group are statistically larger than those on the larger group. Next, we find that while more illiquid stocks show

slightly higher returns (1.51% versus 1.09% per month), the difference is not statistically significant. Finally, we examine institutional ownership, defined as the percentage of outstanding common stock shares own by institutional investors and obtained from Thompson Reuters database. REITs with low institutional ownership generate higher returns (1.29% versus 0.79% per month), but the difference is not statistically significant.

V Conclusion

This study presents an examination of mechanisms behind REIT investment strategies that are based on the NAV premium (price-to-NAV). Specifically, we show that a sentiment-driven strategy substantially outperforms a fundamentals-driven strategy. We find that orthogonalizing the NAV premium to our fundamentals measures improves its ability to predict future returns. It is the portion of the NAV premium that is *not* explained by fundamentals but is rather sentiment-driven that is most predictive of future returns.

This new strategy is roughly 5% per year more profitable than a strategy simply based on the REIT's NAV premium alone and is robust to various real estate and stock market risk factors. In fact, orthogonalizing the real estate sentiment measure to stock market sentiment, economic conditions, market distress, and interest rate levels only strengthens its relation to our strategy. These results shed light on how REIT prices may evolve independently of general stock markets.

This paper has important implications for all investors that consider publicly traded real estate in their investment portfolio. If investor behavior influences REIT prices, passive investors in REIT indices may reconsider weighting by equity market capitalization, and in-

stead weight by some other proxies. Investors that seek to manage risk or exploit mispricing may find this paper useful to understand the mechanisms underlying the positive returns to NAV-premium-based strategies. We leave these questions to be answered by future research in this area.

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Table 1. Descriptive Statistics

This table reports the number of REITs in our sample (Panel A), summary statistics (Panel B), and a correlation table (Panel C). Data are monthly from April 2001 to April 2015. REIT data are obtained from CRSP, Compustat, and SNL REIT.

Panel A. Sample Size

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
N	161	154	153	172	170	192	178	153	144	148
Year	2011	2012	2013	2014	2015					
N	159	165	195	201	215					

Panel B. Summary Statistics

	Mean	**S.D.**	**P5**	**P50**	**P95**
NAV Premium (%)	103.1	92.47	31.83	92.42	196.4
Size (Market Cap)	2,675	4,490	58.73	1,313	11,054
Leverage Ratio (Debt/Assets)	0.629	0.632	0.368	0.632	0.909
FFO/NAV	3.796	4.234	-10.093	4.234	16.137
Tobin's q	1.346	1.273	0.906	1.273	2.025
Stock Return (1Y)	1.084	1.092	0.593	1.092	1.495
Return Volatility	28.392	21.679	12.314	21.679	74.292
Dividend Yield	0.061	0.052	0.000	0.052	0.139
Bid-Ask Spread (Scaled by Size)	0.005	0.001	0.000	0.001	0.020
Volume Turnover (Volume/Size)	0.101	0.151	-1.359	0.151	1.373
FFO/NAV Volatility	0.013	0.006	0.001	0.006	0.046
Asset Growth (1Y)	0.132	0.053	-0.094	0.053	0.677
Revenue Growth (1Y)	13.935	6.403	-13.736	6.403	69.104
Market Share (by REIT Type)	0.167	0.058	0.006	0.058	1.000
Operational Efficiency	1.430	1.483	0.945	1.483	2.673
Intangibles Fraction	0.147	0.113	0.036	0.113	0.315
Interest Coverage	0.789	0.644	-0.963	0.644	2.865
Current Ratio	0.244	0.015	0.001	0.015	0.676
S.T. Debt Fraction	0.098	0.042	0.000	0.042	0.435

Panel C. Correlation Table

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) NAV Premium	1.00																		
(2) Size	0.14	1.00																	
(3) Market Share	0.08	0.15	1.00																
(4) FFO/NAV	-0.09	0.12	-0.04	1.00															
(5) FFO/NAV Volatility	0.01	-0.23	-0.01	-0.24	1.00														
(6) Operational Efficiency	-0.06	-0.03	-0.11	0.08	0.04	1.00													
(7) Leverage Ratio	-0.12	0.10	-0.03	-0.10	0.23	0.05	1.00												
(8) Interest Coverage	-0.09	-0.08	0.03	0.48	-0.11	-0.04	-0.39	1.00											
(9) Current Ratio	0.07	0.02	0.06	0.02	-0.03	-0.19	-0.14	0.22	1.00										
(10) ST Debt Fraction	-0.02	-0.14	-0.00	-0.17	0.15	0.01	0.06	-0.09	-0.09	1.00									
(11) Tobin's q	0.27	0.10	0.07	0.38	-0.03	-0.04	0.08	0.29	0.09	-0.12	1.00								
(12) Asset Growth	0.14	-0.08	0.06	-0.01	-0.03	0.02	-0.09	-0.03	0.10	0.01	-0.03	1.00							
(13) Revenue Growth	0.11	-0.12	0.08	-0.08	-0.03	0.00	-0.11	-0.11	0.06	0.05	-0.05	0.66	1.00						
(14) Intangibles Fraction	0.04	-0.19	-0.00	-0.16	0.32	0.05	-0.04	-0.03	0.13	0.16	-0.01	0.03	0.05	1.00					
(15) Stock Return	0.24	0.03	-0.01	0.06	0.01	-0.01	-0.01	-0.06	0.04	0.00	0.21	0.02	-0.01	-0.03	1.00				
(16) Return Volatility	-0.11	0.03	-0.03	-0.24	0.22	-0.03	0.24	-0.13	0.02	0.07	-0.27	-0.14	-0.14	0.09	-0.34	1.00			
(17) Dividend Yield	-0.18	-0.12	-0.07	-0.01	0.06	-0.00	0.03	0.14	-0.02	-0.05	-0.26	-0.16	-0.18	-0.04	-0.33	0.46	1.00		
(18) Bid-Ask Spread	-0.21	-0.52	-0.03	-0.15	0.25	0.05	0.13	-0.02	-0.05	0.13	-0.30	-0.01	0.00	0.14	-0.18	0.16	0.25	1.00	
(19) Volume Turnover	0.12	0.55	-0.01	0.02	-0.18	-0.06	-0.01	-0.12	0.05	-0.13	0.06	-0.05	-0.05	-0.20	-0.07	0.26	0.05	-0.46	1.00

Table 2. The NAV Premium and Firm Characteristics

This table presents Fama-Macbeth cross-sectional regressions explaining variation in the NAV premium, as measured by the percentage price-to-NAV ratio. Explanatory variables are calculated from CRSP, Compustat, and SNL REIT data. Detailed variable descriptions are provided in Section 2. All regressions include fixed effects for REIT type as reported by CRSP. Data are monthly from January 2001 to December 2015. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: NAV Premium			Standardized
	(1)	(2)	(3)	(4)
Ln(Size)	8.14***	7.28***	7.28***	15.4***
	(12.28)	(11.71)	(9.35)	(9.35)
Market Share		9.30***	10.2***	4.32***
		(4.12)	(4.67)	(4.67)
FFO/NAV	-166.4***	-132.7***	-120.9***	-18.4***
	(-14.78)	(-8.54)	(-7.62)	(-7.62)
FFO/NAV Volatility		-105.4**	-127.4***	-5.17***
		(-2.36)	(-2.94)	(-2.94)
Operational Efficiency		-0.19	-0.33	-0.92
		(-0.24)	(-0.38)	(-0.38)
Leverage Ratio	-76.1***	-64.4***	-67.3***	-17.8***
	(-23.40)	(-14.79)	(-13.51)	(-13.51)
Interest Coverage		-4.87***	-4.61***	-11.1***
		(-7.71)	(-6.99)	(-6.99)
Current Ratio		2.28***	1.72***	3.17***
		(3.36)	(3.17)	(3.17)
ST Debt Fraction		17.4***	22.9***	6.15***
		(4.31)	(5.60)	(5.60)
Tobin's q	77.7***	78.8***	76.9***	44.2***
	(36.72)	(29.10)	(23.83)	(23.83)
Asset Growth (1Y)		27.9***	27.7***	12.8***
		(5.30)	(5.03)	(5.03)
Revenue Growth (1Y)		0.34	-0.73	-0.39
		(0.07)	(-0.14)	(-0.14)
Intangibles Fraction		25.0***	24.3***	5.24***
		(3.78)	(3.95)	(3.95)
Stock Return (1Y)			5.67	2.59
			(1.29)	(1.29)
Return Volatility			17.1*	5.82*
			(1.71)	(1.71)
Dividend Yield			-71.8**	-6.18**
			(-2.51)	(-2.51)
Ln(Bid-Ask Spread)			0.25	0.56
			(0.38)	(0.38)
Volume Turnover			-1.55	-2.14
			(-1.23)	(-1.23)
Constant	-69.2***	-72.5***	-68.6***	-7.97***
	(-8.11)	(-8.23)	(-5.73)	(-2.70)
Property Type F.E.	Yes	Yes	Yes	Yes
N	24,492	23,200	23,045	23,045
Adj. R^2	0.340	0.521	0.577	0.577

Table 3. Fama-Macbeth Cross-Sectional Regressions

This table presents Fama-Macbeth cross-sectional regression explaining future one-month returns. Key explanatory variables include the NAV Premium, the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 3 in Table 2), and the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2). Other explanatory variables include log of size, FFO/NAV, and the past one-year stock return. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Future One-Month Return					
	(1)	(2)	(3)	(4)	(5)	(6)
NAV Premium (Raw Value)	-0.50	-0.32*				
	(-1.47)	(-1.82)				
$\widehat{\text{NAV}}$ Premium (Predicted by Fundamentals)			0.65**	0.56**		
			(2.09)	(1.98)		
$\text{NAV}^{\perp}$ Premium (Residual)					-0.82**	-0.52**
					(-1.98)	(-2.51)
Ln(Size)		-0.023		-0.094		-0.047
		(-0.25)		(-1.06)		(-0.53)
FFO/NAV		0.10		0.20		0.098
		(0.60)		(1.27)		(0.62)
Stock Return (1Y)		1.06		0.67		0.97
		(1.02)		(0.59)		(0.97)
Constant	1.09*	-0.18	0.24	0.42	0.76	-0.0045
	(1.72)	(-0.17)	(0.48)	(0.39)	(1.29)	(-0.00)
N	23,045	23,045	23,045	23,045	23,045	23,045
Adj. R^2	0.029	0.143	0.032	0.146	0.037	0.149

Table 4. NAV Premium and Future REIT Returns

This table presents average monthly portfolio percentage returns of investment strategies based on the NAV premium. Reported are the returns of quintile portfolios as well as the return difference ("cheap" or low NAV premium minus "expensive" or high NAV premium). Part (*i*) is based on the raw NAV premium. Part (*ii*) is based on the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 3 in Table 2). Part (*iii*) is based on the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2). The annualized Sharpe ratio is presented in *italics*. Data are monthly from January 2001 to December 2015. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

Quintile Portfolios					Long/Short Strategy	
Low	2	3	4	High	Low-High	*Sharpe*
Average monthly return (%)						
(i) NAV Premium (Raw Value)						
1.51*	1.16**	1.18**	1.05**	0.72	0.79*	*0.46*
(1.95)	(2.12)	(2.26)	(2.09)	(1.25)	(1.71)	
(ii) $\widehat{\text{NAV}}$ Premium (Fundamentals-driven)						
0.93	1.08**	1.16**	1.35**	1.35**	-0.43**	*-0.40*
(1.46)	(2.03)	(2.15)	(2.01)	(2.22)	(-2.20)	
(iii) $\text{NAV}^{\perp}$ Premium (Sentiment-driven)						
1.64**	1.34**	1.29**	0.96*	0.48	1.16***	*0.82*
(2.16)	(2.19)	(2.28)	(1.93)	(0.79)	(2.99)	
			Differences			
			(i) - (ii)		1.21***	*0.73*
					(2.61)	
			(iii) - (i)		0.37*	*0.45*
					(1.84)	
			(iii) - (ii)		1.59***	*0.92*
					(3.60)	

Table 5. Alpha and Factor Exposures

This table presents alpha and factor exposures of long/short investment strategies based on the NAV premium. Each strategy sorts REITs into quintiles of the NAV premium and purchases REITs in the lowest quintile ("cheapest") while selling short REITs in the highest quintile ("expensive"). Portfolios weight REITs by market capitalization and are rebalanced monthly. The strategy in part (*i*) is based on the raw NAV premium. The strategy in part (*ii*) is based on the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 3 in Table 2). The strategy in part (*iii*) is based on the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2). The REIT factor is a value-weighted composite. The general stock market factors are from Ken French's website. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

	(i) NAV Premium (Raw Value)		*(ii)* $\widehat{\text{NAV}}$ Premium (Fundamentals-driven)		*(iii)* $\text{NAV}^{\perp}$ Premium (Sentiment-driven)	
	(1)	(2)	(3)	(4)	(5)	(6)
α	0.53	0.50*	-0.39*	-0.45*	0.90***	0.87***
	(1.44)	(1.69)	(-1.78)	(-1.66)	(2.81)	(2.94)
β_{REIT}	0.54*	0.39**	-0.016	-0.012	0.48**	0.37***
	(1.95)	(2.37)	(-0.15)	(-0.09)	(2.54)	(3.62)
β_{MKT}	-0.23	-0.35*	-0.049	-0.099	-0.14	-0.17
	(-1.43)	(-1.86)	(-0.34)	(-0.61)	(-1.46)	(-1.51)
β_{SMB}		0.33		0.16		0.19
		(1.28)		(1.06)		(0.89)
β_{HML}		0.093		-0.29		0.15
		(0.48)		(-0.89)		(1.24)
β_{RMW}		0.56		0.18		0.41
		(1.62)		(0.89)		(1.46)
β_{CMA}		-0.049		0.18		-0.18
		(-0.26)		(0.79)		(-1.16)
β_{UMD}		-0.67**		-0.17**		-0.39*
		(-2.42)		(-2.17)		(-1.79)

Table 6. NAV Premium and Future Earnings Announcement Returns

This table reports the average three-day cumulative abnormal return (CAR) around the next quarterly earnings announcement. Part (*i*) is based on quintiles of the raw NAV premium. Part (*ii*) is based on quintiles of the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 3 in Table 2). Part (*iii*) is based on quintiles of the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2). To be included, the next quarterly earnings announcement must occur within three months of portfolio formation. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

Quintile Portfolios					
Low	2	3	4	High	Low-High
3-Day Cumulative Abnormal Return (%)					
(i) NAV Premium (Raw Value)					
0.19	0.11	0.029	-0.043	-0.13	0.32*
(1.18)	(0.92)	(0.22)	(-0.35)	(-0.95)	(1.67)
(ii) $\widehat{\text{NAV}}$ Premium (Fundamentals-driven)					
-0.020	-0.023	-0.065	0.040	0.040	-0.059
(-0.16)	(-0.16)	(-0.54)	(0.32)	(0.28)	(-0.42)
(iii) $\text{NAV}^{\perp}$ Premium (Sentiment-driven)					
0.34**	0.052	0.018	-0.083	-0.21*	0.55***
(2.27)	(0.42)	(0.49)	(-0.67)	(-1.71)	(3.45)

Table 7. Time-Varying Performance: Relation to Market Uncertainty and Sentiment

This table displays results on time-varying performance. Panel A reports beta coefficients and R^2s of univariate time series regressions explaining future NAV premium strategy returns on current measures of uncertainty and market sentiment. Also reported is the R^2 of a multivariate regression with all independent variables. NAV Dispersion is a monthly time series of the average NAV dispersion across firms. NAV dispersion at the firm-level is the standard deviation of NAV estimates among analysts scaled by the mean of the NAV estimates. VIX is the CBOE option-implied volatility index (based on stocks in the the S&P500). KCFSI is the Kansas City Federal Reserve Financial Stress Index. Michigan ICS is the Index of Consumer Sentiment published by the University of Michigan. "SENT" and "SENT$^{\perp}$" are investor sentiment measures from Baker and Wurgler (2006)—the latter is orthogonalized to various macroeconomic indicators. "Real Estate" is an investor sentiment measure based on loan officer surveys regarding perceived demand for commercial real estate mortgages. "Real Estate" is the residual value of a time series regression of "Real Estate" on various macroeconomic indicators. Panel B reports performance by sub-period based on an indicator variable. The 2008-09 Financial Crisis equals one during July 2007 to June 2009. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Univariate Time-Series Regressions

	(i) $\widehat{\text{NAV}}$ Premium			*(ii)* NAV$^{\perp}$ Premium		
	β	(t-stat)	R^2	β	(t-stat)	R^2
Univariate Regressions						
NAV Dispersion	0.04	(0.86)	0.4%	0.32***	(3.44)	16.4%
VIX	-0.01	(-0.45)	0.1%	0.10**	(2.34)	3.2%
KCFSI	-0.06	(-0.24)	0.0%	0.70**	(2.33)	3.1%
Michigan ICS	0.01	(0.20)	0.0%	-0.10*	(-1.72)	5.2%
SENT	-0.02	(-0.05)	0.0%	-1.33*	(-1.72)	1.7%
SENT$^{\perp}$	-0.16	(-1.48)	0.1%	-1.64**	(-2.10)	2.5%
Real Estate	-0.11	(-0.13)	0.4%	-2.34**	(-1.98)	2.2%
Real Estate$^{\perp}$	-0.54	(-0.59)	0.1%	-2.96**	(-2.07)	2.6%
	Multivariate R^2: 0.9%			*Multivariate* R^2: 25.6%		

Panel B. Sub-Period Performance of NAV$^{\perp}$ Premium Strategy

Time Period Indicator	$\mathbf{I} = 0$		$\mathbf{I} = 1$	
	Low-High	*Sharpe*	Low-High	*Sharpe*
2008-09 Financial Crisis	0.86***	*1.16*	2.97	*0.91*
	(3.56)		(1.53)	
NBER Economic Recession	0.92***	*1.20*	2.52	*0.80*
	(3.77)		(1.42)	
SENT < 0	0.71**	*0.96*	1.36**	*0.84*
	(2.24)		(2.55)	

Table 8. Residual NAV Premium Strategy: Sub-Sample Performance

This table presents average monthly portfolio percentage returns of investment strategies based on the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2) within particular sub-samples. For each variable of interest (i.e., firm size, stock liquidity, or institutional ownership), we first divide the entire sample into two groups based on each date's median value and then implement the investment strategy. Firm size refers to equity market capitalization. Stock liquidity refers to the ask price minus the bid price, divided by the midpoint. Institutional ownership is defined as the percentage of common shares owned by institutional investors, as reported by Thompson. Reported are the long/short return difference ("cheap" or low residual NAV premium minus "expensive" or high residual NAV premium). Data are monthly from January 2001 to December 2015. The six-lag Newey-West t-statistic is provided in parenthesis, and *, **, and *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

	$NAV^{\perp}$ Premium Sub-Sample Performance		Difference
Firm Size	*Small*	*Large*	
	1.89***	0.73*	1.16***
	(2.83)	(1.66)	(2.73)
Stock Liquidity†	*Illiquid*	*Liquid*	
	1.51**	1.09**	0.42
	(2.29)	(2.05)	(0.81)
Institutional Ownership†	*Low*	*High*	
	1.29***	0.79**	0.50
	(2.87)	(1.99)	(1.51)

†Orthogonalized to firm size

Figure 1. Persistence in the NAV Premium: Predicted versus Residual

This figure displays a correlogram of the predicted and residual components of the NAV premium. The y-axis represents the beta coefficient of the current value on the lagged value (i.e., a higher value indicates greater month-to-month persistence in the value). "NAV Premium, Predicted" represents the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 2 in Table 2). "NAV Premium, Residual" represents the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2).

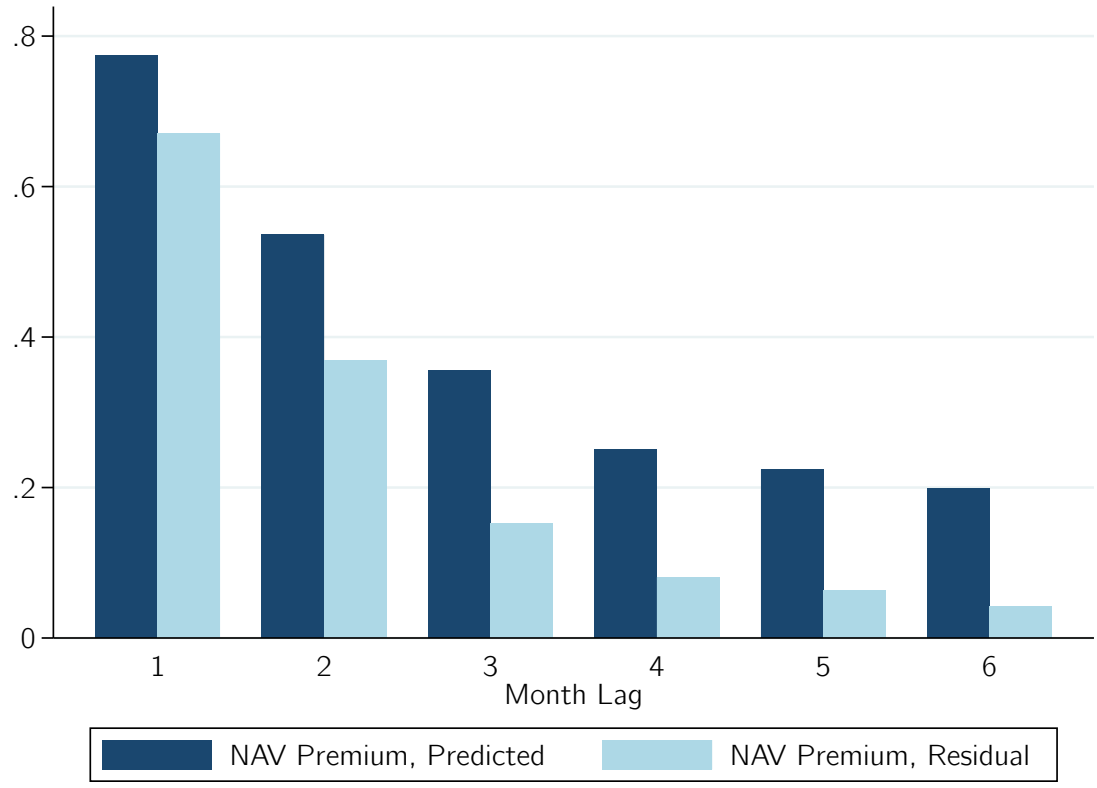

Figure 2. Performance of Investment Strategies based on NAV Premium

This figure displays the growth of a $1 investment in several long/short investment strategies based on the NAV premium (purchasing low NAV premium REITs while selling short high NAV premium REITs). Each strategy is based on quintile portfolios of the NAV Premium. "NAV Premium, Raw" is based on quintiles of the raw NAV premium. "NAV Premium, Predicted" is based on quintiles of the fundamentals-driven, predicted portion of the NAV premium (fitted values from specification 2 in Table 2). "NAV Premium, Residual" is based on quintiles of the unexplained, residual portion of the NAV premium (residual values from specification 3 in Table 2).