1. Introduction

A growing investment-based asset pricing literature shows that variations in asset prices and returns can be understood from the perspective of corporate investment decision (e.g., Cochrane, 1991; Berk, Green, and Naik, 1999; Zhang, 2005). The key insight is straightforward; corporate investment decisions reflect and affect the distribution of future cash flows. Therefore, we can extract information about the *unobservable* distribution of future cash flows from *observable* investment decisions. This insight is supported by empirical evidences (e.g., Cochrane, 1996; Liu, Whited, and Zhang, 2009; Hou, Xue, and Zhang, 2012). For example, Liu et al. (2009) show an investment-based model provides a better fit of the cross-sectional stock returns than many conventional models.

We propose incorporating the investment-based asset pricing into real estate research. As a starting point, we apply it to understand the expected returns of real estate investment trusts (REITs). The investment-based model suggests that two firm fundamentals, investment and profitability, provide information about discount rates (expected returns).[2] The economics is intuitive; firms will invest more when profitability is high and the discount rate is low. Controlling for profitability, high investment is associated with low expected return; while controlling for investment, high profitability signals high expected return. We show that investment and profitability have substantial predictive power for REIT returns. From 1994 to 2012, low-investment REITs beat high-investment REITs by 0.31% per month[3], while high-profitability REITs beat low-profitability REITs by 0.72% per month. The predictive power of investment and profitability cannot be captured by conventional models widely used in the REIT literature. For example, the return spread associated with profitability remains at 0.83% per month for the Fama-French three-factor model and 0.78% per month for the Carhart four-factor model.

[2] In the context of REITs, a good example of investment is property acquisition and profits are generated from property income and capital gain.

[3] Using a quintile sorting procedure.

We then show that the return predictability of investment and profitability can be useful for understanding the cross section of expected REIT returns. To illustrate, we construct a new three-factor model consisting of a market factor, an investment factor, and a profitability factor. Compared to the conventional models, the investment-based model does a better job summarizing return variations associated with price momentum, earnings surprise, idiosyncratic volatility, and share turnover. For example, the new model produces a high-minus-low pricing error of -0.31% per month (t=-0.66) across quintile portfolios sorted on idiosyncratic volatility. In contrast, the high-minus-low error is -1.11% per month (t=-3.66) for the Fama-French model and -0.67% per month (t=-1.79) for the Carhart model. Our findings suggest that merging the investment-based asset pricing into real estate research can be a promising direction.

Our study contributes to the real estate finance literature by bringing new economic insights and a new perspective in studying asset pricing questions in real estate. This study provides a new return model that can be useful in applications, such as assessing manager performance. It also contributes to our understanding of the source of price movements in the real estate market. For example, to the extent that many return patterns for REITs are consistent with firm fundamentals and investment decisions, these results provide a description of underlying return fundamentals consistent with rational models of behavior as opposed to models that attribute outcomes to inefficiency or mispricing.

Our work also adds to the asset pricing literature that studies the interaction between asset price and investment. Cochrane (1991, 1996) first applied the investment model to study asset prices. Berk, Green, and Naik (1999) construct real option models to explain stock return anomalies. More recently, Liu, Whited, and Zhang (2009) show that the investment model can explain stock returns related to earnings surprises, book-to-market, and corporate investment. Hou, Xue, and Zhang (2012) construct an investment-based factor model that outperforms conventional models in pricing a wide range of stock return anomalies. Our study differs by applying the investment model to the real estate market. Given the economic importance and scale of the real estate market, our study serves as a valuable extension. In addition, the real estate market may provide certain empirical advantages for testing the investment model. For example, non-real estate companies often invest in a wider range of tangible and intangible capitals. In contrast, investment decisions are more homogeneous for real estate companies.

The rest of the paper is organized as follows. We briefly review the relevant literature in the next section. We then discuss our methodology in Section 3 and data and measurement in Section 4. In Section 5, we document the empirical evidences that support the insights from investment-based asset pricing. Section 6 concludes and discusses future directions.

2. Literature

Given the extensive work on the cross-section of stock returns, it is surprising that there are a relatively limited set of papers on this topic in the real estate literature. Because of the unique regulatory structure of REITs, and along with many other types of financial stocks, REITs are typically excluded from asset pricing studies of common stocks. However, there are reasons to believe that REITs may yield useful insights into both asset pricing theory and the nature of the underlying asset class. In particular, REITs are financial claims associated with portfolios of investment-grade real estate assets. Such assets trade in reasonably well-developed markets with a high degree of informational transparency. This parallel asset market idea has been exploited by many other REIT studies and is postulated to reduce the information uncertainty associated with REITs (a least to a larger degree than most other commons stocks, see for instance, Hartzell, Muhlhofer and Titman 2010). Furthermore, REITs are required to hold 75% of their assets in real estate (or related assets) and the long-term relationships between REIT returns and the performance of the underlying assets is now well established, (see Bond and Chang 2013 for a recent review of this literature).

The prior literature in this area has identified two dominate features of the determinants of the cross-section of REIT returns: momentum and earnings drift. The importance of momentum was identified in Chui, Titman and Wei (2003a,b); and confirmed in Hung and Glascock (2008, 2010); Derwall, Huji, Brounen and Marquering (2009); and Goebel, Harrison, Mercer and Whitby (2013). This finding is pervasive and economically larger than found in studies of common stocks (Chui, et al. 2003b, and Derwall, et al. 2009).

Another feature of REIT returns that warrants additional investigation, and that seems inconsistent with the information transparency argument, is the finding of a significant post earnings announcement drift (Price, Gatzlaff, and Sirmans 2012). Furthermore, the magnitude of this effect is larger than found in common stocks.

The connection between these two findings has been developed further in Feng, Price and Sirmans (2013). The authors find that the two affects are negatively correlated and a strategy conducted around the earnings drift affects dominates a momentum strategy.

3. Methodology

The investment-based model suggests that two firm fundamentals, investment and profitability, provide information about discount rates (expected returns). The economics is intuitive: Firms will invest more when profitability is high and discount rate is low. Controlling for profitability, high investment is associated with low expected return; while controlling for investment, high profitability signals high expected return. Based on the intuition, we show that investment and profitability have substantial predictive power for REIT returns. Such predictability is not captured by the conventional models but can be useful for understanding the cross-sectional variations in expected REIT returns.

To illustrate the usefulness of the new insights, we construct a new three-factor model that consists of a REIT market factor (r_{MKT}), an investment factor (r_{INV}), and a profitability factor (r_{PROF}):

$$E[r] - r_f = \beta_{MKT}E[r_{MKT}] + \beta_{INV}E[r_{INV}] + \beta_{PROF}E[r_{PROF}] \qquad (1)$$

in which $E[r]$ is the expected return of a given REIT, r_f is the risk-free rate, β_{MKT}, β_{INV} and β_{PROF} are the factor loadings of the REIT return, and $E[r_{MKT}]$, $E[r_{INV}]$ and $E[r_{PROF}]$ are the expected factor premiums. The REIT market factor is defined as the excess return on the FTSE NAREIT All Equity REIT Index over risk-free rate (one-month T-bill rate). The investment factor is defined as the difference in returns between low-investment REITs and high-investment REITs, while the profitability factor is defined as the difference in returns between high-profitability REITs and low-profitability REITs.

The new model can be tested using the standard time-series factor regressions:

$$r - r_f = a + b * r_{MKT} + i * r_{INV} + p * r_{PROF} + e \qquad (2)$$

in which $r - r_f$ is the realized REIT return in excess of the risk-free rate, a is the intercept or pricing error, b, i, and p are the slopes or estimated factor loadings on the market factor, the investment factor, and the profitability factor, and e is the residual. To evaluate our new model, we form testing portfolios of REITs based on well-known return predictors and examine the model's ability to capture the resulting dispersions in future returns. If the model performs well, then the pricing error a should be both economically and statistically close to zero.

For comparison, we also examine the performance of three conventional models in the literature: The Capital Asset Pricing Model (CAPM), the Fama-French three-Factor model, and the Carhart four-factor model:

$$\text{CAPM: } E[r] - r_f = \beta_{MKT}E[r_{MKT}] \qquad (3)$$

$$\text{Fama-French: } E[r] - r_f = \beta_{MKT}E[r_{MKT}] + \beta_{SMB}E[r_{SMB}] + \beta_{HML}E[r_{HML}] \qquad (4)$$

$$\text{Carhart: } E[r] - r_f = \beta_{MKT}E[r_{MKT}] + \beta_{SMB}E[r_{SMB}] + \beta_{HML}E[r_{HML}] + \beta_{WML}\mathrm{E}[r_{WML}] \qquad (5)$$

in which β_{SMB}, β_{HML} and β_{WML} are the factor loadings of the REIT return on the size factor (r_{SMB}), the book-to-market (B/M) factor (r_{HML}) and the momentum factor (r_{WML}), and $E[r_{SMB}], E[r_{HML}]$ and $E[r_{WML}]$ are the corresponding expected factor premiums.

4. Data and Measurements

Our analysis focuses on the universe of equity REITs as identified by the National Association of Real Estate Investment Trusts (NAREIT). The sample includes 346 unique equity REITs traded on NSYE, AMEX, and NASDAQ from 1994 to 2012. Monthly return data are from CRSP and annual and quarterly accounting data are from Compustat. The conventional return factors are obtained from Ken French's website. Following the REIT literature, we also construct the REIT-based version of the conventional factors.[4]

We measure investment rate as the annual growth rate in total non-cash assets (Compustat item AT minus item CHE).[5] We choose growth in non-cash assets because it is a comprehensive measure of investments in different productive assets (e.g., fixed assets and working capital). We measure profitability as quarterly return on equity (ROE), defined as income before extraordinary items (item IBQ) divided by one-quarter-lagged book equity.[6] Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock. Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the carrying value of preferred stock (item PSTKQ), or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity. We use redemption value (item PSTKRQ) if available, or carrying value for

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[4] The constructions of the REIT-based conventional factors are detailed in Appendix B.

[5] Including cash holdings in total assets produces similar results. We exclude the cash holding component as it does not represent investments in productive assets. In addition, Cooper, Gulen, and Schill (2008) show that the cash holding component of total asset growth does not carry much information about future returns.

[6] The REIT industry often promotes the use of (adjusted) funds from operation (FFO). However, Vincent (1999) show that the GAAP net income provides (marginally) the most information about REIT performance among alternative measures of profitability.

the book value of preferred stock. Annual investment rate is considered to be known four months after the corresponding fiscal year end. Quarterly ROE is deemed available following its announced date (item RDQ).

Table 1 presents the summary statistics for our equity REIT sample. The unique number of REITs ranges from 98 in 2009 to 195 in 1997, while their average market capitalization grows steadily from 0.23 billion dollars in 1994 to 3.80 billion dollars in 2012. The median REIT in our sample has an annual investment rate of 21.24% and a quarterly ROE of 1.75%. Both investment and profitability vary substantially across REITs. For example, the top 5% REITs expand their assets by 96.62% while the bottom 5% REITs shrink their assets by 9.78%. Investment and profitability have a positive correlation of 0.19, consistent with the intuition that more profitability REITs generally invest more aggressively. In terms of the conventional characteristics, high-investment REITs tend to have lower B/M and lower recent past returns than low-investment REITs.[7] Meanwhile, high profitability REITs tend to be growth firms with good recent returns, positive earnings surprise, low idiosyncratic risk, and low recent trading activities.

4. Results

We first show that investment and profitability can predict future returns for REITs. Moreover, such predictability cannot be subsumed by the conventional models. We then construct new return factors based on investment and profitability, and show that an investment-based three-factor model can describe the cross section of expected REIT returns better than the conventional models.

[7] Detailed definitions for the conventional characteristics are documented in Appendix A.

4.1 Return Predictability Tests

4.1.1 The Return Predictability of Investment

At the beginning of each month, we rank REITs into five portfolios based on their annual investment rates. The portfolios are value-weighted and rebalanced each month.[8] Consistent with theory, Table 2 shows that high investments are associated with low average future returns. In Panel A, as investment increases, portfolio return decreases almost monotonically from 1.07% per month to 0.76% per month. Although statistically insignificant, the spread of 0.31% per month is economically meaningful.[9] In addition, both the capital asset pricing model (CAPM) and the Fama-French three-factor model have trouble explaining this negative predictability.[10] The high-minus-low error is -0.40% per month (t=-1.99) for the CAPM and -0.37% per month (t=-1.90) for the Fama-French model.

Theoretically, the relation between investment and expected return is *conditional* on holding profitability constant. Intuitively, investment and profitability are positively correlated, as more profitability firms generally invest more aggressively. As a result, the negative return predictability of investment tends to be offset by the positive predictability of profitability in *unconditional* portfolio sort. In our sample, the (rank) correlation between investment and profitability is 0.19. Thus, our unconditional sort may underestimate the true predictive power of investment.

Based on this intuition, we first classify REITs into two subsamples based on their profitability each month. Then, within each profitability subsample, we rank REITs into five groups based on their investment rates.

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8 Using annual portfolio sorting produces similar results, since the investment rates are based on annual accounting figures and thus are refreshed annually. We use monthly sorting for two reasons. First, the NAREIT equity REIT sample changes monthly. As a result, annual sorting (e.g., in each June) would reduce the number of REITs in portfolio tests. Second, the ending month of fiscal year varies across REITs. Thus, monthly sorting utilizes more updated information.

9 The lack of statistical significance is partly due to the relatively short sample period and the limited sample size.

10 For brevity, our discussion focuses on results using the REIT-based conventional factors. Using the common-equity-based conventional from Professor Kenneth French produces similar or stronger results in favor of our conclusions (results are available upon request).

The conditional investment rankings are then used to form five value-weighted portfolios. Panel B of Table 2 shows that holding profitability constant does help better reveal the predictive power of investment. The high-minus-low return spread increases in magnitude to -0.44% per month and is statistically significant at the 5% level. None of the three conventional models can subsume the power of investment. The model-adjusted return spread ranges from -0.42% per month (t=-2.14) for the Carhart model to -0.56% per month (t=-2.78) for the CAPM. In addition, both the CAPM and the Fama-French model are rejected at the 10% level by the Gibbons, Ross, and Shanken (1989, GRS) test on the null that the pricing errors are jointly zero across the portfolios.

4.1.2 The Return Predictability of Profitability

At the beginning of each month, we sort REITs into five portfolios based on their profitability as measured by quarterly ROE. The portfolios are value-weighted and rebalanced monthly. In Panel A of Table 3, more profitable firms earn higher future returns than less profitable firms. As profitability increases, portfolio return rises monotonically from 0.34% per month to 1.06% per month. The spread of 0.72% per month (t=2.95) is both economically and statistically significant, and widens further after benchmark adjustment. For example, high-profitability REITs "beat" low-profitability REITs by 0.78% per month (t=3.74) according to the Carhart model. All three conventional models are rejected by the GRS test, indicating their inability to capture the pricing information embedded in profitability.

Panel B of Table 3 shows that the return predictive power of profitability is better revealed by holding investment constant. At the beginning of each month, we first classify REITs into two subsamples based on their investment rates. Then, within each investment subsample, we rank REITs into five groups based on their profitability. Five value-weighted portfolios are formed using the conditional profitability rankings. Conditional sort increases the return spread across profitability portfolios to 0.89% per month (t=3.47). Not surprisingly, this causes even more trouble for the conventional models. The high-minus-low return error rises to 0.88% per month (t=3.88) for the Carhart model and over 1% for both the CAPM and the Fama-French model. Again, all three models are strongly rejected by the GRS test.

Overall, our evidences support the theoretical predictions of investment-based asset pricing: Two observable firm fundamentals, investment and profitability, contain valuable information about the expected returns of REITs. Moreover, such information is not captured by the existing models. Hence, our findings suggest that incorporating the pricing information in investments and profitability could be beneficial for understanding expected REIT returns.

4.2 An Investment-Based Three-Factor Model

To showcase the potential usefulness of the new insights from investment-based asset pricing, we construct a new factor model based on the return predictability of investment and profitability. We show that the new model performs well in describing the cross section of REIT returns.

We construct our new factors using a two-way independent sort on both investment and profitability, following Hou et al. (2012). [11] Specifically, at the beginning of each month we sort REITs into three groups based on their investment rates and independently into three groups based on their profitability. The two-way sort produces nine portfolios, which are value-weighted and rebalanced monthly. The investment factor (r_{INV}) is computed as the difference (low-minus-high) between the simple average of the returns on the three low-investment portfolios and the simple average of the returns on the three high-investment portfolios. The profitability factor (r_{PROF}) is computed as the difference (high-minus-low) between the simple average of the returns on the three high-profitability portfolios and the simple average of the returns on the three low-profitability portfolios.

[11] Hou et al. (2012) form 18 portfolios using a 2 by 3 by 3 independent sort on size, investment, and profitability, as the distribution of investment and profitability differ between small and big firms. Due to the limited sample size of REITs, we do not sort on size.

Table 4 summarizes the properties of our new factors. In Panel A, the investment factor has an average return of 0.36% per month (t=2.18), which is statistically significant at the 5% level. The standard benchmarks cannot subsume its return predictive power. For example, the Fama-French model explains only 9% of its variations and its model-adjusted mean increases to 0.42% per month (t=2.49). The investment factor has moderate correlations with the conventional factors, ranging from -0.25 to 0.23. Therefore, the investment factor seems to capture a "new" dimension of expected REIT returns.

Similarly, the profitability factor also captures return variations that are not taken into account by the conventional benchmarks. The profitability factor has a mean of 0.52% per month (t=2.91), which increases to 0.56% to 0.66% per month after controlling for exposures to the conventional factors. The profitability factor is correlated with the momentum factor (0.48) and the value factor (-0.48), but even the Carhart four-factor model can explain only 34% of its variations. The correlation between two new factors is only 0.04. Hence, they appear to capture independent variations in REIT returns.

In Panel B of Table 4, we show that the conventional (non-market) factors have much weaker return predictive power, compared with our new factors. The average monthly return is only 0.14% for the size factor and 0.06% for the book-to-market factor. The insignificant size and value premiums after 1990 are consistent with earlier evidences (e.g., Chui et al. (2003)). The momentum factor has a somewhat larger return of 0.26% per month (t=0.77), but is statistically insignificant.[12]

4.3 Testing the New Investment-Based Model

We form testing portfolios of REITs based on well-known return predictors and examine the model's ability to capture the resulting dispersions in future returns. Specifically, we form monthly value-weighted

[12] The relatively low momentum factor premium from 1994 to 2012 is consistent with the finding of Feng, Price, and Sirmans (2013) and can be partly attributed to a poor momentum return after the 2008 financial crisis.

quintile portfolios based on price momentum, earnings surprise, idiosyncratic volatility, and share turnover.[13] Chui, et al. (2003) show that the price momentum and to less extent share turnover are the important predictors of REIT returns. More recently, Price, Gatzlaff, and Sirmans (2012) and Feng, Price, and Sirmans (2013) document a strong earnings surprise effect. DeLisle, Price, and Sirmans (2013) show that the idiosyncratic volatility risk is priced in the cross section of REIT returns.

4.3.1 Price Momentum and Earnings Surprise

In Panel A of Table 5, past winners outperform past losers by 0.33% per month (t=0.75). Neither the CAPM nor the Fama-French model can explain the momentum effect. The model-adjusted return spread is 0.84% per month (t=2.43) for the CAPM and 0.98% per month (t=3.17) for the Fama-French model. In contrast, the new model performs as well as the Carhart model, reducing the high-minus-low spread to only 0.02% per month. The new model's success is consistent with the variations in investment and profitability. Past winners are significantly more profitable than past losers: Profitability increases monotonically from 1.48% to 2.53%. Consistently, the profitability factor loading increases by 0.89 across the portfolios. Meanwhile, investment rates are largely flat across the momentum portfolios. Therefore, the high expected returns of past winners can be inferred from their "moderate" investments relative to high profitability.

In Panel B of Table 5, earnings surprise is positively related to future returns, with a high-minus-low spread of 0.56% per month (t=2.49). Consistent with the findings of Price et al. (2012, 2013), none of the conventional models can capture the earnings surprise effect. The high-minus-low pricing error ranges from 0.62% per month (t=2.84) for the Carhart model to 0.76% per month (t=3.52) for the Fama-French model. All three conventional models are strongly rejected by the GRS test. In contrast, the investment-

[13] Other conventional characteristics such as B/M have weak predictive power of REIT returns after 1990 (e.g., Chui, et al. 2003). Hence, we do not report them for brevity.

based model produces a much smaller error of 0.32% per month (t=1.61), as well as the lowest average pricing error of 0.15% per month across the portfolios. The model's performance can be explained by the patterns in investment and profitability. Relative to low-earnings-surprise REITs, high-earnings-surprise REITs have substantially higher profitability but similar investment rates, indicating their higher expected returns (discount rates).

4.3.2 Idiosyncratic Volatility and Share Turnover

In Panel A of Table 6, high-IVOL firms earn lower future returns than low-IVOL firms. The raw return spread is -0.55% per month and widens after controlling for exposures to conventional factors. The investment-based model produces a statistically insignificant spread of -0.31% per month (t=-0.66), compared with -1.11% per month (t=-3.66) for the Fama-French model and -0.58% per month (t=-1.79) for the Carhart model. Although all four models are statistically rejected by the GRS test, the new model produces the smallest average pricing error of 0.16% per month. Again, the return variations associated with the idiosyncratic volatility risk are consistent with the variations of investment and profitability. As IVOL increases, investment rate increases from 23.48% to 33.20%, while profitability decreases from 2.45% to 1.23%. Therefore, High-IVOL firms are "expected" to have lower future returns because they invest more relative to their low profitability.

Panel B of Table 6 shows that measured by share turnover, more liquid REITs earn lower average returns than less liquid firms. The high-minus-low return spread is -0.27% per month, which increase to -0.62% per month (t=-3.40) for the CAPM, -0.60% per month (t=-3.41) for the Fama-French model, and -0.40% per month (t=-2.13%) for the Carhart model. The new model produces both a small high-minus-low pricing error of -0.19% (t=-1.13) and a small average pricing error of only 0.07% per month. The liquidity premium can largely be "explained" by firm fundamentals: More liquid REITs have higher investment but lower profitability.

In sum, the new investment-based model outperforms the conventional models in explaining well-known patterns in the cross section of REIT returns. The model's good performance is consistent with its theoretical motivation: Variations in the expected returns of REIT can be inferred from the variations in firm's investment decision and profitability.

5. Conclusion

Motivated by investment-based asset pricing, we show that two firm fundamentals, investment and profitability, have substantial predictive power for future REIT returns. The predictability is not explained by the conventional models but can be useful for understanding the cross of expected REIT returns. We construct a new three-factor model consisting of a market factor, an investment factor, and a profitability factor. The new model does well in capturing well-known variations in the cross-sectional REIT returns and outperforms the conventional models. Based on our findings, we see several interesting future directions. First, the investment-based model provides a useful expected return benchmark for empirical research and application. For example, the new model for REITs can be used to evaluate the performance of real estate fund managers. Alternatively, the model may be used to investigate market reaction to corporate events. Second, by linking asset prices to firm fundamentals, the investment-based model may help us better understand the source of price movements in the real estate market. For example, our results suggest that many well-known REIT "anomalies" could potentially be attributed to economic risk as opposed to inefficiencies or frictions. Finally, pinning down the precise economic risk behind the investment and profitability premiums is an important research question.[14]

[14] The investment-based model provides an effective way to extract information about unobservable risk from observable firm fundamentals. However, we are a bit "silent" about the specific types of economic risk behind investment and profitability, since its intuition applies to different types of economic risk (e.g., productivity, technology, and interest rates).

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Appendices

A. Variable Definitions

Market Equity, or size, is share price (item PRC) times the number of shares outstanding (item SHROUT) from CRSP.

Book-to-Market Equity (B/M) is book equity divided by market equity. Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock. Market equity is from Compustat (item PRCC_F times item CSHO) or CRSP at the fiscal year end. B/M is considered known four months after fiscal year end.

Momentum for month t is measured as the cumulative stock return from month t-12 to month t-2 (skipping month t-1).

Investment is measured as the annual growth rate in total non-cash assets (Compustat item AT minus item CHE). Annual investment rate is considered known four months after fiscal year end.

Profitability is measured as quarterly return on equity (ROE), defined as income before extraordinary items (Compustat item IBQ) divided by one-quarter-lagged book equity. Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock. Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the carrying value of preferred stock (item PSTKQ), or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity. We use redemption value (item PSTKRQ) if available, or carrying value for the book value of preferred stock. Quarterly ROE is deemed known after earnings announced date (item RDQ).

Earnings Surprise is measured as the standardized unexpected earnings (SUE). We calculate SUE as the change in the most recently announced quarterly earnings per share (Compustat item EPSPXQ) from its value announced four quarters ago divided by the standard deviation of this change in quarterly earnings over the prior eight quarters. We require a minimum of six quarterly observations of earnings change in calculating SUE. Earnings surprise is deemed known after earnings announced date (item RDQ).

Idiosyncratic Volatility (IVOL): Following Ang, Hodrick, Xing, and Zhang (2006), we measure a stock's idiosyncratic volatility as the standard deviation of the residuals from regressing the stock's returns on the Fama-French three factors. We require a minimum of 15 daily returns in calculating idiosyncratic volatility.

Share Turnover (TO) is the average daily share turnover during the past 6 months. Daily share turnover is the number of shares traded (CRSP item VOL) on a given day divided by the number of shares outstanding (item SHROUT) on the same day. Following Gao and Ritter (2010), we adjust the trading volume for REITs traded on NASDAQ before 2004. Specifically, we divide NASDAQ volume by 2 prior to February 2001, by 1.8 between February 2001 to December 2001, and by 1.6 between 2002 and 2003.

B. Constructions of the REIT-Based Conventional Factors

The REIT-based market factor (r_{MKT}), is defined as the return on the FTSE NAREIT All Equity REIT Index minus the one-month Treasury bill rate. The constructions of other conventional factors largely follow the standard Fama and French approach. At the beginning of each month, we sort all REITs into two portfolios based on their market equity. We define the size factor (r_{SMB}) as the return spread between the small-cap portfolio and the big-cap portfolio. Independently, we sort REITs into three portfolio based on their B/M. The two-way sort on size and B/M produces six portfolios. The B/M factor (r_{HML}) is defined as the return spread between the simple average of the small-value and big-value portfolios and the simple average of the small-growth and big-growth portfolios. Independently, we also sort REITs into three portfolios based on their return momentum. The two-way sort on size and momentum produces six portfolios. The momentum factor (r_{WML}) is the return spread between the return spread between the simple average of the small-winner and big-winner portfolios and the simple average of the small-loser and big-loser portfolios. Summary statistics for the REIT-based conventional factors are presented in Table A1.

Table 1: Descriptive Statistics for NAREIT Equity REIT Sample (1/1994 to 12/2012, 228 months)

Panel A lists the number of unique REITs in our NAREIT sample and their average market equity (in billion dollars) each year from 1994 to 2012. Panel B presents the time-series averages of cross-sectional mean, standard deviation (S.D.), and percentiles for REIT characteristics. The REIT characteristics include market equity (ME), book-to-market equity (B/M), price momentum (MOM), investment rate (INV), profitability (PROF), standardized unexpected earnings (SUE), idiosyncratic volatility (IVOL), and share turnover (TO). Detailed variable definitions are in Appendix A. Panel C reports the Spearman rank correlations between different REIT characteristics.

Panel A: Number of unique REITs

Year	#REITs	Mean ME ($B.)
1994	180	0.23
1995	190	0.25
1996	187	0.34
1997	195	0.57
1998	192	0.71
1999	182	0.74
2000	170	0.75
2001	162	0.87
2002	156	1.01
2003	156	1.10
2004	161	1.49
2005	161	1.81
2006	152	2.34
2007	132	2.99
2008	109	2.46
2009	98	1.77
2010	111	2.52
2011	125	3.27
2012	130	3.81

Panel B: Distributional statistics for REIT characteristics

	Mean	S.D.	p5	P25	P50	P75	p95
INV (%)	21.24	37.03	-9.78	1.59	10.53	27.17	96.62
PROF (%)	1.75	3.10	-2.14	0.77	1.63	2.51	5.64
ME ($B.)	1.50	1.95	0.08	0.33	0.82	1.74	6.18
B/M	0.72	0.41	0.23	0.46	0.64	0.88	1.51
MOM (%)	12.79	20.57	-18.00	0.86	11.84	23.68	45.63
SUE	0.08	1.53	-2.28	-0.51	0.03	0.61	2.62
IVOL (%)	1.52	0.83	0.76	1.05	1.31	1.70	3.11
TO (%)	0.55	0.28	0.15	0.36	0.56	0.71	0.98

Panel C: Correlations of REIT characteristics (Spearman)

	PROF	ME	B/M	MOM	SUE	IVOL	TO
INV	0.19	0.08	-0.13	-0.10	0.03	-0.08	-0.05
PROF		0.02	-0.32	0.12	0.37	-0.17	-0.25
ME			-0.45	0.13	-0.02	-0.28	0.56
B/M				-0.04	-0.04	0.20	-0.25
MOM					0.13	-0.26	-0.01
SUE						-0.04	-0.09
IVOL							0.01

Table 2: Monthly Average Returns of Investment Quintiles (1/1994 to 12/2012, 228 months)

In Panel A, we sort REITs into five value-weighted portfolios at the beginning of each month based on their investment rates. In Panel B, we first classify REITs into two subsamples based on their profitability. Then, within each profitability subsample, we rank REITs into five groups based on their investment rates. The conditional investment rankings are then used to form five value-weighted portfolios each month. For each set of portfolios, we report the mean monthly returns in excess of one-month T-bill rate, the CAPM regressions ($r - r_f = a_{CAPM} + b * r_{MKT} + e$), the Fama-French three-factor regressions ($r - r_f = a_{\mathrm{FF}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + e$), and the Carhart four-factor regressions ($r - r_f = a_{\mathrm{Carh}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + w * r_{WML} + e$). m.a.e. is the average magnitude of the pricing errors (i.e., regression intercept a) across a given set of testing portfolios. The numbers in the parentheses below m.a.e. are the p-values for the Gibbons, Ross, and Shanken (1989) tests on the null that the pricing errors across the portfolios are jointly zero. The t-statistics are adjusted for autocorrelations and heteroskedasticity.

	Panel A: Unconditional sort							***Panel B: Holding profitability constant***						
	Low	2	3	4	High	H-L	m.a.e.	Low	2	3	4	High	H-L	m.a.e.
$\overline{r - r_f}$	1.07	0.88	0.84	0.73	0.76	-0.31		1.09	0.86	0.78	0.81	0.65	-0.44	
$t_{\overline{r-r_f}}$	2.80	2.38	2.09	1.85	1.87	-1.62		2.99	2.27	1.99	2.10	1.56	-2.24	
a_{CAPM}	0.36	0.17	0.03	-0.07	-0.04	-0.40	0.13	0.40	0.13	0.00	0.01	-0.16	-0.56	0.14
b	0.91	0.91	1.04	1.02	1.02	0.11	(0.13)	0.88	0.94	1.00	1.01	1.04	0.16	(0.06)
$t_{a_{CAPM}}$	2.59	1.40	0.32	-0.60	-0.37	-1.99		3.05	1.02	-0.04	0.14	-1.41	-2.78	
t_b	24.75	25.64	24.51	23.53	33.44	1.79		27.68	23.95	49.52	24.52	28.86	2.49	
a_{FF}	0.33	0.17	0.01	-0.06	-0.04	-0.37	0.12	0.36	0.12	-0.01	0.02	-0.17	-0.53	0.14
b	0.91	0.92	1.03	1.01	1.03	0.12	(0.17)	0.89	0.95	0.99	1.00	1.05	0.16	(0.08)
s	0.22	-0.05	0.17	-0.06	-0.03	-0.25		0.27	-0.01	0.03	-0.04	-0.01	-0.28	
h	-0.08	-0.07	0.01	0.02	-0.13	-0.05		-0.10	-0.11	0.08	0.05	-0.13	-0.03	
$t_{a_{FF}}$	2.45	1.47	0.07	-0.53	-0.39	-1.90		2.90	1.01	-0.05	0.21	-1.44	-2.69	
t_b	24.68	32.56	29.43	27.91	40.74	2.17		24.65	30.33	47.75	33.10	32.12	2.75	
t_s	2.90	-0.73	1.70	-1.10	-0.70	-2.67		3.10	-0.09	0.63	-0.72	-0.18	-3.02	
t_h	-0.96	-0.73	0.13	0.25	-1.34	-0.30		-1.46	-1.17	1.41	0.48	-1.44	-0.21	
a_{Carh}	0.24	0.11	0.09	-0.06	0.00	-0.24	0.10	0.27	0.10	0.00	0.06	-0.15	-0.42	0.12
b	0.97	0.95	0.99	1.01	1.01	0.04	(0.31)	0.94	0.97	0.99	0.98	1.04	0.10	(0.24)
s	0.34	0.02	0.07	-0.07	-0.08	-0.42		0.39	0.03	0.03	-0.09	-0.04	-0.42	
h	-0.05	-0.05	-0.02	0.02	-0.14	-0.09		-0.07	-0.10	0.08	0.03	-0.14	-0.07	
w	0.12	0.08	-0.11	-0.01	-0.05	-0.18		0.12	0.03	0.00	-0.05	-0.03	-0.15	
$t_{a_{Carh}}$	1.77	0.97	0.95	-0.45	-0.01	-1.22		2.19	0.80	-0.01	0.50	-1.25	-2.14	
t_b	32.61	33.73	46.18	33.57	37.90	0.96		31.71	31.60	47.54	59.53	31.76	1.79	
t_s	5.46	0.22	1.22	-1.04	-1.15	-3.87		5.17	0.28	0.57	-1.29	-0.51	-3.91	
t_h	-0.67	-0.55	-0.34	0.24	-1.64	-0.67		-1.24	-1.09	1.39	0.37	-1.64	-0.55	
t_w	3.70	1.66	-2.24	-0.15	-1.12	-2.56		3.79	0.74	-0.12	-0.98	-0.56	-2.22	

Table 3: Monthly Average Returns of Profitability Quintiles (1/1994 to 12/2012, 228 months)

In Panel A, we sort REITs into five value-weighted portfolios at the beginning of each month based on their profitability. In Panel B, we first classify REITs into two subsamples based on their investment rates. Then, within each investment subsample, we rank REITs into five groups based on their profitability. The conditional profitability rankings are then used to form five value-weighted portfolios each month. For each set of portfolios, we report the mean monthly returns in excess of one-month T-bill rate, the CAPM regressions ($r - r_f = a_{CAPM} + b * r_{MKT} + e$), the Fama-French three-factor regressions ($r - r_f = a_{\mathrm{FF}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + e$), and the Carhart four-factor regressions ($r - r_f = a_{\mathrm{Carh}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + w * r_{WML} + e$). m.a.e. is the average magnitude of the pricing errors (i.e., regression intercept a) across a given set of testing portfolios. The numbers in the parentheses below m.a.e. are the p-values for the Gibbons, Ross, and Shanken (1989) tests on the null that the pricing errors across the portfolios are jointly zero. The t-statistics are adjusted for autocorrelations and heteroskedasticity.

	Panel A: Unconditional sort							*Panel B: Holding investment constant*						
	Low	2	3	4	High	H-L	m.a.e.	Low	2	3	4	High	H-L	m.a.e.
$\overline{r - r_f}$	0.34	0.70	0.79	0.85	1.06	0.72		0.19	0.71	0.86	0.84	1.09	0.89	
$t_{\overline{r-r_f}}$	0.67	1.67	2.14	2.48	2.77	2.95		0.37	1.69	2.33	2.52	2.81	3.47	
a_{CAPM}	-0.54	-0.13	0.06	0.14	0.29	0.83	0.23	-0.75	-0.08	0.11	0.15	0.31	1.06	0.28
b	1.13	1.06	0.93	0.91	0.98	-0.14	(0.01)	1.20	1.01	0.95	0.89	0.99	-0.22	(0.00)
$t_{a_{CAPM}}$	-2.95	-1.17	0.54	2.00	3.10	3.56		-3.70	-0.63	1.22	1.83	3.36	4.40	
t_b	25.04	31.01	32.72	20.37	26.21	-2.51		18.87	43.42	29.10	39.71	38.42	-3.03	
a_{FF}	-0.56	-0.13	0.07	0.17	0.26	0.83	0.24	-0.77	-0.08	0.13	0.16	0.30	1.06	0.28
b	1.08	1.03	0.94	0.91	1.02	-0.06	(0.00)	1.15	1.00	0.95	0.90	1.02	-0.13	(0.00)
s	0.29	0.03	-0.09	-0.19	0.12	-0.16		0.26	0.01	-0.11	-0.07	0.04	-0.22	
h	0.35	0.19	-0.04	-0.02	-0.30	-0.65		0.37	0.08	0.00	-0.07	-0.26	-0.63	
$t_{a_{FF}}$	-3.48	-1.15	0.65	2.25	2.97	4.13		-4.21	-0.61	1.40	1.89	3.32	5.01	
t_b	36.49	27.87	35.17	24.80	42.72	-1.52		27.62	40.81	34.52	41.91	46.22	-2.98	
t_s	3.92	0.90	-2.09	-1.94	2.00	-1.62		3.38	0.14	-2.56	-1.24	0.89	-2.09	
t_h	3.99	2.94	-0.76	-0.33	-6.19	-5.91		3.02	1.00	0.07	-1.47	-4.96	-4.09	
a_{Carh}	-0.51	-0.09	0.01	0.10	0.27	0.78	0.20	-0.61	-0.06	0.06	0.12	0.27	0.88	0.23
b	1.04	1.01	0.97	0.95	1.01	-0.03	(0.01)	1.06	0.99	0.99	0.92	1.03	-0.03	(0.00)
s	0.21	-0.02	-0.02	-0.09	0.11	-0.10		0.06	-0.01	-0.03	-0.02	0.07	0.01	
h	0.33	0.17	-0.03	0.00	-0.31	-0.64		0.31	0.07	0.03	-0.05	-0.25	-0.56	
w	-0.08	-0.06	0.07	0.10	-0.02	0.06		-0.22	-0.02	0.08	0.05	0.03	0.25	
$t_{a_{Carh}}$	-3.18	-0.80	0.14	1.20	2.79	3.74		-3.37	-0.48	0.73	1.46	2.96	3.88	
t_b	29.79	26.68	35.12	43.29	43.42	-0.62		26.35	31.53	44.30	40.62	36.63	-0.53	
t_s	2.11	-0.35	-0.44	-1.67	1.75	-0.77		0.49	-0.12	-0.47	-0.41	1.17	0.08	
t_h	3.92	2.87	-0.44	0.05	-5.92	-5.82		3.38	0.92	0.41	-1.14	-5.17	-4.69	
t_w	-1.47	-1.38	2.19	2.14	-0.39	0.88		-3.25	-0.40	2.88	1.40	0.95	2.99	

Table 4: Properties of the INV and PROF Factors (1/1994 to 12/2012, 228 months)

At the beginning of each month, we sort REITs into three groups based on their investment rates and independently into three groups based on their profitability. The two-way sort produces nine portfolios, which are value-weighted and rebalanced monthly. The investment factor (r_{INV}) is computed as the difference (low-minus-high) between the simple average of the returns on the three low-investment portfolios and the simple average of the returns on the three high-investment portfolios. The profitability factor (r_{PROF}) is computed as the difference (high-minus-low) between the simple average of the returns on the three high-profitability portfolios and the simple average of the returns on the three low-profitability portfolios. Panel A reports, for the new factors, their mean returns, the CAPM regressions ($r - r_f = a_{CAPM} + b * r_{MKT} + e$), the Fama-French three-factor regressions ($r - r_f = a_{\text{FF}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + e$), and the Carhart four-factor regressions ($r - r_f = a_{\text{Carh}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + w * r_{WML} + e$). Panel B reports, for the conventional factors, their mean returns and the new three-factor regressions ($r - r_f = a + b * r_{MKT} + i * r_{INV} + p * r_{PROF} + e$). Panel C reports the Pearson correlation between the new and conventional factors. The t-statistics are shown in parentheses and have been adjusted for autocorrelations and heteroskedasticity.

Panel A: New investment-based factors

	Mean	a	b	s	h	w	R^2
INV	0.36	0.45	-0.11				0.06
	(2.18)	(2.55)	(-1.52)				
		0.42	-0.12	0.16	0.02		0.09
		(2.49)	(-1.97)	(1.76)	(0.13)		
		0.29	-0.04	0.34	0.07	0.18	0.15
		(1.70)	(-1.02)	(3.15)	(0.44)	(2.76)	
$PROF$	0.52	0.66	-0.17				0.14
	(2.91)	(4.09)	(-3.71)				
		0.66	-0.12	-0.15	-0.39		0.31
		(4.41)	(-2.61)	(-1.72)	(-3.85)		
		0.56	-0.06	-0.03	-0.36	0.13	0.34
		(3.41)	(-1.18)	(-0.27)	(-4.00)	(2.14)	

Panel B: New factor regression for conventional factors

	Mean	a	b	i	p
SMB	0.14	0.22	-0.01	0.14	-0.23
	(1.00)	(1.56)	(-0.19)	(1.73)	(-2.62)
HML	0.06	0.22	0.06	0.03	-0.43
	(0.32)	(1.35)	(1.32)	(0.20)	(-5.11)
WML	0.26	0.09	-0.33	0.25	0.65
	(0.77)	(0.33)	(-2.50)	(1.83)	(3.11)

Panel C: Correlation matrix (Pearson)

	$PROF$	MKT	SMB	HML	WML
INV	0.04	-0.25	0.15	-0.02	0.23
	(0.60)	(0.00)	(0.02)	(0.82)	(0.00)
$PROF$		-0.37	-0.23	-0.48	0.46
		(0.00)	(0.00)	(0.00)	(0.00)

Table 5: Price Momentum Quintiles and Earnings Momentum Quintiles (1/1994 to 12/2012, 228 months)

In Panel A, we sort REITs into five value-weighted portfolios at the beginning of each month based on their momentum. In Panel B, we sort REITs into five value-weighted portfolios at the beginning of each month based on their earnings surprise. For each set of portfolios, we report the mean monthly returns in excess of one-month T-bill rate, the CAPM regressions ($r - r_f = a_{CAPM} + b * r_{MKT} + e$), the Fama-French three-factor regressions ($r - r_f = a_{\text{FF}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + e$), the Carhart four-factor regressions ($r - r_f = a_{\text{Carh}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + w * r_{WML} + e$), and the new three-factor regressions ($r - r_f = a + b * r_{MKT} + i * r_{INV} + p * r_{PROF} + e$). We also report the value-weighted mean investment rates (INV) and profitability (PROF) for each portfolio. m.a.e. is the average magnitude of the pricing errors (i.e., regression intercept a) across a given set of testing portfolios. The numbers in the parentheses are the p-values for the Gibbons, Ross, and Shanken (1989) tests on the null that the pricing errors across the portfolios are jointly zero. The t-statistics are adjusted for autocorrelations and heteroskedasticity.

	Panel A: Price Momentum							***Panel B: Earnings Surprise***						
	Low	2	3	4	High	H-L	m.a.e.	Low	2	3	4	High	H-L	m.a.e.
$\overline{r - r_f}$	0.57	0.79	0.80	0.99	0.90	0.33		0.53	0.56	0.81	1.01	1.09	0.56	
$t_{\overline{r-r_f}}$	0.95	1.93	2.02	2.81	2.58	0.75		1.18	1.36	1.98	2.69	3.25	2.49	
a_{CAPM}	-0.60	-0.05	0.03	0.29	0.23	0.84	0.24	-0.33	-0.23	0.04	0.27	0.38	0.71	0.25
b	1.49	1.07	0.98	0.89	0.85	-0.64	(0.09)	1.10	1.00	0.98	0.94	0.90	-0.20	(0.00)
$t_{a_{CAPM}}$	-2.49	-0.43	0.36	2.70	1.46	2.43		-2.25	-1.85	0.34	2.75	3.14	3.27	
a_{FF}	-0.71	-0.08	0.04	0.31	0.27	0.98	0.28	-0.37	-0.23	0.06	0.27	0.39	0.76	0.26
b	1.43	1.06	0.98	0.91	0.87	-0.56	(0.03)	1.11	1.01	0.96	0.95	0.92	-0.19	(0.00)
s	0.91	0.27	-0.05	-0.18	-0.32	-1.23		0.22	0.03	-0.08	0.00	-0.11	-0.33	
h	0.43	0.07	-0.03	-0.14	-0.13	-0.56		-0.08	-0.03	0.18	-0.09	-0.13	-0.05	
$t_{a_{FF}}$	-3.47	-0.71	0.42	2.94	1.68	3.17		-2.43	-1.87	0.52	2.80	3.46	3.52	
a_{Carh}	-0.13	0.14	0.05	0.14	-0.06	0.06	0.10	-0.29	-0.18	0.04	0.19	0.33	0.62	0.20
b	1.09	0.93	0.97	1.01	1.06	-0.03	(0.35)	1.07	0.97	0.97	1.00	0.95	-0.11	(0.00)
s	0.17	-0.01	-0.06	0.04	0.11	-0.06		0.12	-0.04	-0.05	0.10	-0.04	-0.15	
h	0.23	0.00	-0.04	-0.08	-0.01	-0.25		-0.11	-0.05	0.19	-0.06	-0.11	0.00	
w	-0.78	-0.30	-0.01	0.23	0.45	1.23		-0.11	-0.08	0.03	0.11	0.07	0.18	
$t_{a_{Carh}}$	-0.74	1.68	0.53	1.53	-0.55	0.38		-1.84	-1.31	0.33	1.97	3.01	2.84	
a	0.01	0.12	0.06	0.06	0.04	0.02	0.11	-0.13	-0.13	0.05	0.15	0.19	0.32	0.15
b	1.33	1.03	0.97	0.95	0.90	-0.43	(0.58)	1.05	0.98	0.98	0.97	0.95	-0.10	(0.08)
i	-0.51	-0.07	0.01	0.14	0.00	0.51		-0.18	-0.08	0.06	0.16	0.08	0.26	
p	-0.59	-0.21	-0.05	0.25	0.30	0.89		-0.18	-0.09	-0.06	0.09	0.24	0.42	
t_a	0.04	1.00	0.67	0.62	0.23	0.06		-0.95	-1.02	0.55	1.42	1.89	1.61	
t_b	11.89	25.42	45.81	34.32	16.94	-2.71		23.26	41.30	26.77	49.56	31.14	-1.56	
t_i	-1.62	-1.32	0.21	2.56	0.01	1.42		-2.20	-1.38	0.58	2.89	1.44	2.74	
t_p	-3.72	-2.49	-1.22	5.32	3.02	3.67		-2.64	-1.53	-0.90	2.08	6.50	5.44	
	Low	2	3	4	High	H-L	t[H-L]	Low	2	3	4	High	H-L	t[H-L]
INV (%)	27.45	24.70	25.60	26.37	28.35	0.91	0.27	24.44	25.81	22.05	25.27	24.86	0.42	0.19
PROF (%)	1.48	1.98	2.29	2.31	2.53	1.05	4.88	1.05	1.62	2.15	2.46	3.54	2.49	13.47

Table 6: Idiosyncratic Volatility Quintiles and Share Turnover Quintiles (1/1994 to 12/2012, 228 months)

In Panel A, we sort REITs into five value-weighted portfolios at the beginning of each month based on their idiosyncratic volatility. In Panel B, we sort REITs into five value-weighted portfolios at the beginning of each month based on their share turnover. For each set of portfolios, we report the mean monthly returns in excess of one-month T-bill rate, the CAPM regressions ($r - r_f = a_{CAPM} + b * r_{MKT} + e$), the Fama-French three-factor regressions ($r - r_f = a_{\text{FF}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + e$), the Carhart four-factor regressions ($r - r_f = a_{\text{Carh}} + b * r_{MKT} + s * r_{SMB} + h * r_{HML} + w * r_{WML} + e$), and the new three-factor regressions ($r - r_f = a + b * r_{MKT} + i * r_{INV} + p * r_{PROF} + e$). We also report the value-weighted mean investment rates (INV) and profitability (PROF) for each portfolio. m.a.e. is the average magnitude of the pricing errors (i.e., regression intercept a) across a given set of testing portfolios. The numbers in the parentheses are the p-values for the Gibbons, Ross, and Shanken (1989) tests on the null that the pricing errors across the portfolios are jointly zero. The t-statistics are adjusted for autocorrelations and heteroskedasticity.

	Panel A: Idiosyncratic Volatility							***Panel B: Share Turnover***						
	Low	2	3	4	High	H-L	m.a.e.	Low	2	3	4	High	H-L	m.a.e.
$\overline{r - r_f}$	1.00	0.86	0.85	0.76	0.44	-0.55		0.88	0.91	0.75	0.81	0.62	-0.27	
$t_{\overline{r-r_f}}$	3.04	2.31	2.24	1.91	0.71	-1.25		3.00	2.73	2.12	2.07	1.24	-0.94	
a_{CAPM}	0.34	0.13	0.09	-0.11	-0.66	-1.01	0.27	0.32	0.26	0.02	0.04	-0.31	-0.62	0.19
b	0.84	0.92	0.98	1.10	1.41	0.58	(0.01)	0.72	0.83	0.93	0.99	1.18	0.45	(0.06)
$t_{a_{CAPM}}$	3.80	1.47	1.28	-0.78	-2.34	-3.01		2.33	2.58	0.22	0.38	-2.36	-3.40	
a_{FF}	0.36	0.16	0.08	-0.13	-0.75	-1.11	0.30	0.28	0.26	0.04	0.04	-0.33	-0.60	0.19
b	0.85	0.93	0.98	1.10	1.35	0.50	(0.00)	0.75	0.84	0.94	0.99	1.16	0.41	(0.05)
s	-0.17	-0.20	0.02	0.19	0.77	0.94		0.23	-0.02	-0.17	-0.03	0.19	-0.04	
h	-0.09	-0.08	-0.01	0.01	0.42	0.52		-0.23	-0.07	-0.06	-0.04	0.12	0.35	
$t_{a_{FF}}$	3.93	1.77	1.23	-0.98	-2.94	-3.66		2.21	2.61	0.45	0.40	-2.53	-3.41	
a_{Carh}	0.26	0.10	0.06	-0.08	-0.40	-0.67	0.18	0.18	0.18	-0.03	0.01	-0.23	-0.40	0.12
b	0.91	0.97	0.99	1.07	1.15	0.25	(0.02)	0.81	0.89	0.98	1.01	1.10	0.30	(0.29)
s	-0.05	-0.13	0.05	0.12	0.33	0.37		0.35	0.08	-0.08	0.02	0.06	-0.29	
h	-0.06	-0.07	0.00	0.00	0.30	0.36		-0.19	-0.05	-0.04	-0.03	0.08	0.28	
w	0.13	0.07	0.04	-0.07	-0.46	-0.59		0.13	0.11	0.09	0.05	-0.13	-0.27	
$t_{a_{Carh}}$	2.78	1.03	0.78	-0.59	-1.24	-1.79		1.27	1.80	-0.30	0.06	-1.77	-2.13	
a	0.22	0.07	0.07	-0.04	-0.09	-0.31	0.16	0.13	0.12	-0.06	0.01	-0.06	-0.19	0.07
b	0.87	0.94	0.98	1.08	1.27	0.40	(0.03)	0.77	0.87	0.95	0.99	1.11	0.34	(0.84)
i	0.03	0.00	0.09	-0.11	-0.42	-0.45		0.18	0.19	-0.05	0.03	-0.10	-0.29	
p	0.16	0.10	-0.04	-0.04	-0.59	-0.75		0.16	0.09	0.16	0.02	-0.30	-0.46	
t_a	2.11	0.64	1.00	-0.28	-0.22	-0.66		0.95	1.16	-0.67	0.11	-0.50	-1.13	
t_b	32.72	27.11	68.87	31.35	10.23	2.79		27.49	35.87	35.53	39.44	36.25	7.74	
t_i	0.60	0.04	2.59	-1.08	-1.32	-1.32		2.96	3.45	-0.95	0.58	-1.78	-3.00	
t_p	2.30	2.18	-1.34	-0.51	-3.45	-3.53		2.25	1.77	2.59	0.49	-4.58	-4.35	
	Low	2	3	4	High	H-L	t[H-L]	Low	2	3	4	High	H-L	t[H-L]
INV (%)	23.48	26.63	27.70	26.68	33.20	9.72	3.12	26.42	19.33	23.62	26.39	33.82	7.39	1.61
PROF (%)	2.45	2.31	2.13	2.17	1.23	-1.22	-7.24	2.77	2.41	2.30	2.15	1.80	-0.97	-4.03

Table A1: Descriptive Statistics for REIT-based Conventional Factors (1/1994 to 12/2012, 228 months)

The REIT-based market factor (r_{MKT}), is defined as the return on the FTSE NAREIT All Equity REIT Index minus the one-month Treasury bill rate. The constructions of other conventional factors largely follow the standard Fama and French approach. At the beginning of each month, we sort all REITs into two portfolios based on their market equity. We define the size factor (r_{SMB}) as the return spread between the small-cap portfolio and the big-cap portfolio. Independently, we sort REITs into three portfolio based on their B/M. The two-way sort on size and B/M produces six portfolios. The B/M factor (r_{HML}) is defined as the return spread between the simple average of the small-value and big-value portfolios and the simple average of the small-growth and big-growth portfolios. Independently, we also sort REITs into three portfolios based on their return momentum. The two-way sort on size and momentum produces six portfolios. The momentum factor (r_{WML}) is the return spread between the return spread between the simple average of the small-winner and big-winner portfolios and the simple average of the small-loser and big-loser portfolios. Panel A reports the mean factor returns and the factor regressions of the REIT-based factors on the common-stock-based factors (from French's website, denoted by a subscript "cs"). Panel B reports the Pearson correlations between the REIT-based and common-stock-based conventional factors. The t-statistics are shown in parentheses and have been adjusted for autocorrelations and heteroskedasticity.

Panel A: Regressing REIT-based factors on common-stock-based factors

	Mean	a	b_{cs}	s_{cs}	h_{cs}	w_{cs}	R^2
MKT	0.78	0.39	0.75				0.35
	(2.04)	(1.25)	(5.43)				
		0.03	0.81	0.49	0.95		0.61
		(0.12)	(9.25)	(6.21)	(8.40)		
		0.13	0.76	0.51	0.91	-0.13	0.62
		(0.51)	(8.91)	(6.56)	(9.31)	(-2.26)	
SMB	0.14	0.11	0.07				0.02
	(1.00)	(0.80)	(1.60)				
		0.08	0.05	0.14	0.05		0.05
		(0.59)	(1.14)	(2.46)	(0.60)		
		0.18	-0.01	0.17	0.00	-0.14	0.13
		(1.29)	(-0.38)	(2.75)	(0.00)	(-2.19)	
HML	0.06	-0.03	0.17				0.09
	(0.32)	(-0.20)	(3.65)				
		-0.09	0.17	0.10	0.15		0.12
		(-0.55)	(3.60)	(2.02)	(1.78)		
		-0.05	0.15	0.11	0.13	-0.05	0.14
		(-0.31)	(3.08)	(2.01)	(1.61)	(-1.29)	
WML	0.26	0.45	-0.37				0.10
	(0.77)	(1.53)	(-2.45)				
		0.61	-0.42	-0.10	-0.45		0.17
		(2.26)	(-3.00)	(-0.74)	(-2.17)		
		0.27	-0.23	-0.17	-0.30	0.46	0.35
		(0.87)	(-2.32)	(-1.15)	(-2.20)	(2.70)	

Panel B: Correlation matrix (Pearson)

	SMB	HML	WML	MKT_{cs}	SMB_{cs}	HML_{cs}	WML_{cs}
MKT	0.03	0.28	-0.52	0.59	0.26	0.29	-0.35
	(0.68)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SMB		0.23	-0.49	0.12	0.20	-0.03	-0.28
		(0.00)	(0.00)	(0.06)	(0.00)	(0.63)	(0.00)
HML			-0.36	0.30	0.15	0.06	-0.20
			(0.00)	(0.00)	(0.02)	(0.33)	(0.00)
WML				-0.32	-0.06	-0.17	0.54
				(0.00)	(0.38)	(0.01)	(0.00)