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Alternative Benchmarks for Evaluating Mutual Fund Performance

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While real estate investment trusts (REITs) have experienced very high growth rates over the past 15 years, the growth in mutual funds that invest in REITs has been even more dramatic. REIT mutual fund returns are typically presented relative to the return on a simple value-weighted REIT index. We ask whether including additional factors when benchmarking funds' returns can improve the explanatory power of the models and offer more precise estimates of alpha. We investigate three sets of REIT-based benchmarks, plus an index of returns derived from non-REIT real estate firms, namely homebuilders and real estate operating companies. The REIT-based factors are a set of characteristic factors, a set of property-type factors and a set of statistical factors. Using traditional single-index benchmarks, we find that about 6% of the REIT funds exhibit significant positive performance using traditional significance levels, which is more than twice what random chance would predict. However, with the multiple-index benchmarks that we prefer, this falls considerably to only 0.7%. In addition, we find that these sets of factors and the non-REIT indices better explain the month-to-month returns of the REIT mutual funds. This suggests that investors or researchers evaluating REIT mutual fund performance may benefit from a multiple-benchmark approach.

Over the past several years, the total market value of publicly traded real estate investment trusts (REITs) has grown rapidly. In 1990, prior to the Omnibus Budget Reconciliation Act of 1993 that changed REIT ownership rules, there were about 117 REITs with a total market capitalization of about $8.5 billion. In 1994, after the Act, there were 230 REITs with a combined market capitalization of about $46 billion. By 2005, while the number of REITs had declined slightly to 208, the total market capitalization had grown to $355 billion, representing a compound annual growth rate of more than 20%.

Along with this growth in the REIT market has been an even greater growth in mutual funds that specialize in REITs. Over the same period, the number

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of REIT funds has grown from 27 to 235, or, more conservatively, the number of unique funds (considering only one share class per fund) has grown from 16 to 132. Meanwhile, the total market capitalization of all REIT funds has grown at a compound annual growth rate of nearly 40%, from $1.3 billion in 1994 to $50 billion in 2005.[1] This growth outpaced the overall growth in sector funds, suggesting that real estate funds may be special among the set of industry-specific investment vehicles.[2]

Because almost all of these mutual funds are actively managed, there is an interest in evaluating how funds perform relative to more passive benchmarks. Most REIT mutual funds present their performance relative to either the FTSE NAREIT or the Dow Jones Wilshire indexes, which means that their goal is to construct a portfolio that is highly correlated with, yet beats, the index. Hence, at least as a starting point, it makes sense to evaluate how the mutual funds perform relative to these value-weighted benchmarks. Our null hypothesis is that the mutual funds do not perform better than these passive benchmarks, which we test against the alternative that some of the mutual fund managers have superior information or ability that enables them to generate superior returns.

Since Roll (1978), researchers have been concerned about the choice of benchmarks used to evaluate mutual funds. As Roll emphasizes, if inefficient benchmarks are used, passive portfolios will exhibit evidence of abnormal performance, which means that mutual fund managers with no special information or abilities can exhibit what looks like positive performance using these same passive strategies. Our analysis of passive REIT portfolios suggests that the traditional benchmarks were in fact inefficient during our sample period. In particular, REIT funds could have outperformed the FTSE NAREIT or the Dow Jones Wilshire indexes by tilting their portfolios toward smaller capitalization REITs, REITs that had higher previous returns and retail REITs. Indeed, a number of REIT mutual funds did follow one or more of these strategies and, in addition, improved their portfolios by including stocks of homebuilders and real estate operating companies (REOCs). Hence, to evaluate the extent to which REIT mutual fund managers have superior selection skills, one needs to consider alternative benchmarks that correctly account for the return patterns of these passive portfolios.

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[1] Note that this total underestimates the total ownership of REITs by real estate–specific asset managers. For example, mutual fund managers such as Cohen & Steers also manage separate accounts where they purchase REITs for clients, such as pension funds and endowments, but these do not enter the mutual fund database.

[2] Tiwari and Vijh (2004) find 308 unique, non–real estate sector funds as of 1999, with a total market value of $151 billion, and this was largely driven by 66 technology funds that were worth $72 billion at that time.

Along these lines, we consider three multifactor benchmarks that are composed of portfolios of REITs. The first benchmark consists of the returns to size, book-to-market and momentum characteristic-based factor portfolios that are constructed along the lines of the Fama and French (1993) and Carhart (1997) factors, but where the factor returns are portfolios of REITs rather than common stocks. The second benchmark consists of the returns of portfolios sorted by property type. The third benchmark combines these two and consists of the returns of a set of 13 statistical factor portfolios formed from a factor analysis of a large number of REIT portfolios that are formed based on firm size, book-to-market ratio and property type. In addition to these variables, because REIT mutual funds sometimes invest in non-REIT real estate companies, we consider whether an index of homebuilders' stock returns and two different REOC indices add explanatory power.

Our analysis indicates that a value-weighted portfolio of all REIT mutual funds fails to outperform any of our alternative benchmarks net of fees. When we add back fees, we find only weak evidence of abnormal performance, which is generally not robust to our additional benchmarks. Although the R^2 of the single-index model is quite high for this value-weighted mutual fund portfolio, at 0.977, additional factors do add significantly more explanatory power. Notably, the estimated coefficient on the non-REIT indices are statistically significant in nearly all specifications, suggesting that controlling for the performance of real estate firms other than REITs is important.

To evaluate the importance of the benchmark choice for individual mutual funds, we consider two dimensions. We first estimate the R^2 of the regression of the fund returns on the benchmark portfolios to measure the extent to which the benchmarks explain the monthly returns of the funds. The general idea is that benchmark returns that best explain the monthly returns of the mutual funds probably also provide the most reliable indicator of abnormal return. This regression is also useful for portfolio attribution because it determines the extent to which the mutual fund returns can be explained by the different benchmark portfolios. For each set of benchmark portfolios, we then evaluate abnormal return as the intercept from the regression of the mutual funds' excess return (over the risk-free rate) on the excess returns of the benchmark portfolios.

Several interesting facts emerge from this analysis. First, consistent with the results on the value-weighted portfolio of all funds, adding indices for returns to homebuilders and REOCs to any set of benchmark returns increases the explanatory power of the performance regression for a significant number of mutual funds, especially those that exhibit low estimated R^2 with the single REIT index model. The addition of the non-REIT factors generally reduces the mutual funds' estimated abnormal performance, suggesting that some funds generate positive abnormal returns relative to the REIT-index benchmarks by investing in non-REIT stocks.

We also note that the characteristic-based factors and statistical factors appear to perform better than the property-type factors. The property-type factors explain less of the variation in returns of the typical fund, are not quite as good in explaining the left tail of the distribution and produce higher estimated alphas. Our results suggest that the characteristic and statistical factors benefit from the fact that they explain return differences between REITs that are due to a REIT size effect and momentum, which are not accounted for by the single index and the property-type benchmarks.

Although our analysis suggests that the benchmark choice has only a modest effect on the measured performance of the value-weighted portfolio of REIT mutual funds, the performance of individual mutual funds can be much more sensitive to the benchmark choice. Based on the traditional single-index model, we find that 6.16% of the mutual funds have a positive alpha net of fees with p values less than .05 (based on a two-tailed test), versus the 2.5% one would expect by chance. However, using a benchmark that includes characteristic factors reduces this percentage by about half, to 3.42%, while using the non-REIT indices with our characteristic factors, reduces this figure to 0.68%. When we consider returns before fees, we find that 26.43% of the mutual funds have positive alphas with p values less than .05, but this falls to 10.71% using the benchmark that includes characteristic factors plus the non-REIT indices.

To better understand the extent to which different benchmarks generate different alphas we examine pairwise rank correlations of the alphas from the alternative benchmark models. We find that 19 of the 28 correlations are less than 0.80, and the lowest is 0.43. These correlations indicate that the benchmark choice can have an important effect on how one would rank the different mutual funds. Indeed, there are examples of mutual funds that have positive and statistically significant alphas measured relative to the single REIT index benchmark, but which have negative alphas using a multiple index benchmark. For example, the CGM Realty Fund has a single-index monthly alpha of 54 basis points before fees but a monthly alpha based on the index plus characteristic factors and our non-REIT indices of −35 basis points.

The final issue we examine relates to the predictability of mutual fund performance. Specifically, we ask whether there is a relation between fund performance and fund characteristics. Using Fama-MacBeth (1973) regressions of returns on characteristics, we find little evidence that fund characteristics are systematically related to performance. However, we do find some indication that the more actively managed funds experienced better performance and that expense ratios are negatively related to net-of-fees returns. This latter finding is inconsistent with funds earning their fees back via superior stock-picking performance.

Our study is most closely related to the analysis of Kallberg, Liu and Trzcinka (2000), which studies the performance of 44 REIT mutual funds over the 1986–1998 period. In contrast to our results, they find evidence consistent with significant average abnormal performance (net of fees), which they attribute to better performance in down markets.[3] The fact that there was abnormal performance in this earlier period but not in our later time period suggests that the increase in the number of mutual funds and other institutions investing in REITs may have diluted average fund performance.[4] They also evaluate several single-index REIT benchmarks and four-factor benchmarks based on the broader stock market. They find little difference across different REIT indices and little explanatory power from the factors based on the overall stock market. They conclude that, "a real estate index is the appropriate benchmark for evaluating real estate mutual funds" (p. 298). Consistent with our results, they find that more actively managed funds experienced better performance; they also find that larger funds have significantly better performance.

Our study is also related to the large literature on mutual fund performance, which we do not fully review here. The question of whether mutual funds exhibit abnormal performance and the degree to which abnormal performance persists has been studied by many, including Jensen (1968, 1969), Brown and Goetzmann (1995), Gruber (1996) and Carhart (1997). The use of appropriate benchmarking is central to this question. The broader mutual fund study that is most directly relevant to ours is Grinblatt and Titman (1994), who conclude that inference about fund performance can be strongly influenced by the choice of benchmark.

[3] Lin and Yung (2004) also study real estate fund performance, but they conclude that there is no evidence of average abnormal performance over their 1993–2001 sample. Like Kallberg, Liu and Trzcinka (2000) they consider broad stock market factors in addition to a REIT index, and they conclude that the stock market factors do not materially impact inference about real estate fund performance.

[4] We obtain qualitatively similar results to Kallberg, Liu and Trzcinka (2000) when we estimate the alpha on the value-weighted portfolios of all funds over their earlier 1986–1998 time period. Similar to their results, we find some evidence of a significant positive abnormal return using the Dow Jones Wilshire REIT index (at the 0.10 level), but that significance is reduced when we use the FTSE NAREIT All REIT Index. Of note, our characteristic factors are still significant over that time period, beyond the FTSE NAREIT index, suggesting that firm size, book-to-market and/or momentum were important in that period as well and that using the FTSE NAREIT index does not completely control for these effects.

The remainder of the article is organized as follows. The next section describes our data, including estimates of performance of passive portfolios formed on firm characteristics. In the subsequent section, we discuss the ways in which we construct our various alternative benchmarks and present the empirical results for alternative benchmark models. The next section discusses the relations between performance and fund characteristics. The final section concludes.

Data

We construct our dataset using the Center for Research in Security Prices (CRSP) Survivorship-Bias Free U.S. Mutual Fund database. We include all funds that list their detailed objective as Equity USA Real Estate and collect monthly returns and fund information for the 1994 through 2005 period. In several of our tests, we present our results for "unique" funds only. For this subset, we collapse multiple share classes into one fund.[5] We also collect monthly returns for all U.S. REITs, obtained from CRSP, using securities with the second share class digit of eight.

Table 1 presents summary statistics for the mutual funds and REITs over our sample period. The table documents the rapid growth in the REIT mutual fund industry from 27 funds in 1994 (16 of which are unique) to 123 funds in 1999 (103 unique) to 235 in 2005 (132 unique). Over this period, the number of REITs actually declines somewhat, from 230 to 208, but the market capitalization of REITs grows to nearly eight times its starting level, from \$45.9 billion in 1994 to \$129.4 billion in 1999 to \$355 billion in 2005. The market capitalization of the mutual funds grows even more dramatically (almost 38 times), from \$1.3 billion in 1994 to \$7.4 billion in 1999 to almost \$50 billion in 2005. As a result, the fraction of the REIT sector held by REIT-specific mutual funds has grown over the 11-year period, from about 3% to over 14%.

Single-Index Benchmarks

Our starting point for benchmarking fund returns is the Dow Jones Wilshire REIT index, which is a value-weighted index of REIT returns. We considered both the FTSE NAREIT All REIT Index and the Dow Jones Wilshire REIT index, which were the two most commonly cited benchmarks in a hand-checked

[5] The algorithm we use for reducing the set of funds is as follows. We consider funds of the same family to be duplicates if the R^2 of a regression of one return on the other is greater than 0.999. If they are duplicates, we first select the class that is present at a given date if there is only one. Next, we select the retail class based on the CRSP retail indicator if there is one. Then, we select the lowest-fee fund if there is one. If the funds are the same along all these dimensions, we randomly break the tie.

Table 1 ■ Summary of the number and market Capitalization of mutual funds and REITs.

Year	Number of Funds	Number of Unique Funds	Fund Market Cap	Number of REITs	REIT Market Cap
1994	27	16	1,325	230	45,862
1995	37	37	2,019	231	60,175
1996	54	53	5,710	215	91,069
1997	72	64	11,964	226	138,868
1998	101	90	8,807	228	141,646
1999	123	103	7,436	221	129,404
2000	135	108	11,106	204	145,098
2001	144	107	12,072	197	159,644
2002	134	105	14,974	191	168,193
2003	162	125	25,888	187	235,617
2004	216	128	41,275	204	324,879
2005	235	132	49,967	208	355,046

All market capitalization figures are in millions of U.S. dollars.
Note: This table presents the number of mutual funds that specialize in *Equity USA Real Estate* as well as their total market capitalizations at the end of each year of our sample. *Number of Unique Funds* represents the number of mutual funds after we join funds in the same family which seem to hold the same portfolio. As a comparison, we also present for each year the number of publicly traded REITs and their total market capitalizations.

subsample of our funds' annual reports.[6] We present results for the Dow Jones Wilshire REIT index for our analysis because it has the highest explanatory power with respect to the funds' returns. We simply call this the "Index" for expositional ease. To calculate excess returns on either our funds, benchmarks or REITs, we subtract the 30-day Treasury Bill return, as reported by the St. Louis Federal Reserve. We later consider multifactor benchmarks that consist of

[6] As an example, consider the 2006 annual report for the Morgan Stanley Real Estate Fund, available at http://sec.gov/Archives/edgar/data/1074111/000110465907008604/a06-26022_1ncsr.htm. The report notes, "Morgan Stanley Real Estate Fund outperformed both the FTSE NAREIT Equity REIT Index and the Lipper Real Estate Funds Index for the 12 months ended November 30, 2006, assuming no deduction of applicable sales charges. The Fund's outperformance during the period was driven primarily by bottom-up stock selection, and top-down sector allocation was also favorable. The Fund's stock selection was especially strong in the mall and office sectors. Within the mall sector, the Fund benefited from its underweight to two of the weakest malls stocks relative to the FTSE NAREIT Equity REIT Index, which had company-specific issues." As suggested by this quotation, we considered the FTSE NAREIT Equity REIT Index, but we present results using the FTSE NAREIT All REIT Index. Many of the funds we examine were allowed to invest in mortgage REITs as well as equity REITs, so we use the broader benchmark.

portfolios that are formed based on property types, REIT size, book-to-market and momentum characteristics.

The Performance of Passive Portfolios

Before examining REIT mutual funds we examine whether a variety of passive REIT and non-REIT real estate firm portfolios generate abnormal performance relative to the REIT Index.[7] If so, then an active portfolio that has exposure to the passive factors that generate excess returns will also generate alpha with respect to a single-index model.

To assess the performance of these passive strategies, we estimate the performance of REIT portfolios that are formed based on the market capitalization, the book-to-market ratio, momentum and the property types of the REITs. Specifically, we form five size and five book-to-market portfolios by sorting the REITs into the appropriate quintiles. We form three momentum portfolios by sorting REITs based on their prior 12-month return lagged 1 month. We also construct passive property type portfolios based on the five main REIT property types (Hotel, Industrial, Office, Residential and Retail). Finally, we include portfolios of homebuilders and REOCs, where REOCs are split into hotels and all other firms. This is motivated by the observation that the average fund in our sample has almost 20% of its portfolio invested in non-REIT stocks, based on CRSP share-class codes.[8] For the homebuilder portfolio, we calculate the value-weighted monthly returns for all firms on CRSP in SIC code 1531 (Operative Builders). The REOC portfolios consist of the SNL REOC-Hotel and REOC-Other indices.

For each of these portfolios, we calculate the value-weighted monthly returns in excess of the risk-free rate and regress these excess returns on the excess returns on the Index. The results of these 21 regressions are reported in Table 2. As the table shows, we find strong evidence of a size effect in our sample. Relative to the Dow Jones Wilshire benchmark, the smallest quintile portfolio has a significant positive alpha (of 82 basis points) while the largest quintile portfolio has a significant negative alpha (of -13 basis points). This implies that, by overweighting smaller REITs, a fund manager could have generated a positive alpha with respect to a single-index benchmark over our 11-year period. The estimated alphas of the momentum portfolios indicate that a fund manager could also have outperformed the single-index benchmark by investing in the

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[7] The non-REIT real estate firm portfolios consist of homebuilders and REOCs.

[8] The most common non-REIT investments, based on four-digit SIC codes, are operators of nonresidential buildings (SIC code 6512), land subdividers and developers (6552), operative builders (1531) and hotels and motels (7011).

Table 2 ■ R^2, alphas and *t* statistics for passive portfolios formed using individual factors.

	R^2	alpha	*t* statistic	beta
Size.1	0.1692	0.0082	3.3331***	0.3059
Size.2	0.4850	0.0039	1.6155	0.6459
Size.3	0.7160	0.0018	0.9573	0.8168
Size.4	0.8672	0.0015	1.1639	0.8831
Size.5	0.9736	−0.0013	−2.2043*	1.0157
BE.ME.1	0.8862	−0.0002	−0.1255	0.9587
BE.ME.2	0.9252	−0.0007	−0.6836	0.9866
BE.ME.3	0.8810	0.0001	0.0966	0.9024
BE.ME.4	0.6528	−0.0007	−0.2888	0.8851
BE.ME.5	0.4806	0.0039	1.3282	0.7873
Momentum.1	0.7444	−0.0027	−1.4508	0.8903
Momentum.2	0.9404	0.0008	0.9658	0.9041
Momentum.3	0.8706	0.0022	1.6841°	0.9331
Homebuilders	0.2186	0.0145	2.7079**	0.7806
REOC.Hotel	0.2042	−0.0015	−0.2815	0.7600
REOC.Other	0.3705	0.0060	1.8748°	0.6868
Hotel	0.4636	−0.0041	−0.9139	1.1441
Industrial	0.8447	0.0022	1.4554	0.9590
Office	0.8751	0.0006	0.4104	1.0058
Residential	0.8601	0.0008	0.5903	0.8929
Retail	0.8332	0.0026	1.8049°	0.9020

$^{\circ}p < 10\%$; $^{*}p < 5\%$; $^{**}p < 1\%$; $^{***}p < 0.1\%$.

Note: This table presents R^2, alphas, *t* statistics of alphas and betas from a set of univariate regressions of each individual factor on the index. The factors used are size quintile portfolios of REITs (numbered from smallest to largest), book-to-market ratio quintile portfolios of REITs (numbered the same way), momentum tercile portfolios of REITs (numbered analogously), the portfolio of homebuilders, the SNL REOC Hotel index, the SNL REOC Other index and the individual property-type portfolios.

REITs that exhibited the strongest previous performance, although the effect is economically and statistically weaker than the size effect.[9]

In addition, we find positive abnormal returns for three types of real estate firms. Within the REIT sector, retail REITs outperformed the Index, with an alpha of 26 basis points per month but weaker statistical significance. Our index of homebuilders also exhibited strong, significant performance, at 145 basis points per month, while our REOC Other portfolio exhibited monthly outperformance of 60 basis points with a weaker significance level. Both of these portfolios

[9] Overall, the momentum pattern appears consistent with the finding of intra-industry momentum in REITs, documented by Chui, Titman and Wei (2003).

have a low R^2 with respect to the index at 0.22 and 0.37, respectively (the only lower one among this set is the smallest set of REITs, at 0.17).

Evaluating REIT Mutual Fund Benchmarks

The message from Table 2 is that simple passive investment strategies exhibit significant abnormal returns with respect to the single-index benchmark over our sample period. This calls for investigating multidimensional benchmarks, which we do in our subsequent tests.

Characteristic Factors

Our first set of candidate benchmarks consists of REIT-based versions of the size and book-to-market factors of Fama and French (1993) and the momentum factor as in Carhart (1997). To construct these, we sort firms into terciles based on both size (market capitalization) and book-to-market ratio. We then compute *BE/ME* as the value-weighted return to the high book-to-market tercile, less the value-weighted return to the low book-to-market tercile. *Size* and *Momentum* are defined analogously, as the value-weighted returns to the smallest or highest-return firms' tercile, respectively, less the value-weighted returns to the largest- or lowest-return firms' tercile.

We believe that using REITs to construct characteristic-based factors rather than factors from the broader stock market has advantages. To the extent that the returns on passive REIT-specific portfolios do not move with the returns of similar portfolios from the broader market, then our REIT-based characteristic factors will provide better benchmarks that control for returns to such passive strategies. In addition, if the correlation between the REIT market and the broader stock market is time varying, using the broad market portfolios is likely to result in less precise estimates of abnormal performance. Consistent with potentially important industry effects, Chui, Titman and Wei (2003) find empirical evidence that the REIT market exhibits intra-industry momentum. It is worth noting that our approach differs from that used previously in studies examining real estate funds' returns, such as Kallberg, Liu and Trzcinka (2000) and Lin and Yung (2004), which use the standard Fama-French factors for the overall U.S. stock market (which are constructed *excluding* REITs).[10]

[10] We also examined using Fama-French factors (including momentum) from the overall stock market instead of our REIT-based factors, but they do not improve the explanatory power of our tests.

Property-Type Factors

Our next set of candidate benchmark returns consists of returns to property-type portfolios. To construct these, we use the SNL classification of each REIT's type to form portfolios of five different property types: Hotel, Industrial, Office, Residential and Retail. For each property type, we calculate monthly value-weighted returns over the sample period and then subtract the REIT Index return in each month.[11]

Statistical Factor Analysis Portfolios

In order to construct statistical factor analysis portfolios, we need a balanced panel of REIT portfolio returns. To construct such a panel we form portfolios based on REIT property types, their market capitalizations and their book-to-market ratios. Specifically, we assign REITs into one of five property types: Industrial, Office, Residential, Retail and Other (all other types) and split each property type sample into terciles by market capitalization and by book-to-market ratio. We then take the REITs in each of the 45 groups (five property types, each divided into three size groups, then further divided into three book-to-market groups) and form 45 value-weighted portfolios. From the returns of these portfolios we subtract the return on the REIT Index and then estimate via maximum likelihood a set of 13 statistical factors. This is the smallest number of factors for which we cannot reject the null that the number of factors is sufficient to explain the variation in the data. Table 3 presents these results in the form of factor loadings for each of the 45 portfolios for the nine factors. For the remainder of the analysis, we use the returns to these 13 statistical factor portfolios as candidate benchmark returns for REIT funds.

As the table shows, the first factor explains 7% of the variation in the data. The cumulative fraction explained by the first five factors is 30.8%, and this reaches 52% by the 13th factor. Thus, even starting with a set of 45 portfolios rather than individual REITs, a relatively large number of factors is required to explain most of the variation in REIT returns, consistent with differences in returns due to firm size, property types and book-to-market, rather than simply a common U.S. real estate factor. Unfortunately, the loadings themselves do not reveal any obvious patterns.

[11] While we use SNL's classification of each REIT's property focus, one could imagine using data on specific property holdings to generate more precise estimates, as in Geltner and Kluger (1998). We explored using a finer partition of REITs' property types based on 12 categories from the SNL REIT database: Diversified, Health Care, Hotel, Industrial, Manufactured Housing, Multifamily, Office, Regional Mall, Shopping Center, Retail (Other), Self Storage and Specialty. Using these more detailed categories does not noticeably increase the explanatory power in our tests, so we present the more parsimonious grouping.

Table 3 ■ Factor loadings for triple-sort portfolios.

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13
Industrial.big.high	0.1490	−0.4463	0.1084	−0.0547	0.1261	0.0620	−0.0983	0.2635	−0.1287	0.0507	−0.0315	−0.1230	−0.1472
Industrial.big.low	0.1090	−0.0040	−0.2051	−0.1525	−0.0120	−0.0220	0.0464	−0.1829	−0.4066	−0.0127	−0.1352	0.0442	−0.0070
Industrial.big.med	0.0112	0.1413	0.1439	−0.0619	0.0902	0.1202	−0.0063	0.4641	−0.0648	0.0371	−0.0439	0.0725	0.0361
Industrial.mid.high	0.0285	0.1361	−0.0420	−0.0328	0.1138	0.8307	0.0394	0.1563	0.0180	0.0433	0.0139	0.0235	0.0463
Industrial.mid.low	0.0620	0.0224	0.2177	−0.0003	0.0148	0.1754	0.0673	0.2026	−0.0052	0.1277	0.1022	0.6181	−0.0549
Industrial.mid.med	0.1028	0.0894	0.0111	−0.0594	0.1292	0.7820	−0.1145	0.1064	0.0646	0.0897	−0.0943	0.1631	0.0192
Industrial.small.high	0.1509	0.8743	0.0931	0.0842	0.1275	0.0799	0.0157	0.1835	−0.0318	0.0015	0.0046	0.0360	−0.0052
Industrial.small.low	0.0887	0.8202	0.0214	0.0738	−0.1112	0.1546	0.0508	0.2460	−0.0099	0.0644	0.0536	0.0007	−0.2641
Industrial.small.med	0.1484	0.9642	0.0474	0.0683	0.1011	0.0764	−0.0405	−0.0315	0.0111	0.0090	−0.0107	−0.0424	0.0489
Office.big.high	−0.1617	−0.0798	0.1260	0.0200	−0.6653	0.0442	0.3345	0.1392	0.0528	0.0300	0.0359	−0.2080	0.1045
Office.big.low	−0.1029	0.0251	0.0084	−0.0656	−0.0585	0.1162	−0.0195	0.0487	0.0100	0.9759	0.0148	0.0570	0.0622
Office.big.med	−0.0214	−0.0498	0.0297	−0.0087	0.0267	−0.0829	0.0479	0.2541	−0.5590	−0.0928	0.0259	0.0006	−0.1030
Office.mid.high	0.2630	0.0182	−0.0838	0.0675	0.0021	−0.2931	0.0940	0.2929	−0.3139	0.1549	0.0895	−0.4060	0.0344
Office.mid.low	−0.0172	−0.0390	−0.0451	0.0576	−0.0841	0.0375	0.0218	−0.0617	0.0101	0.0626	0.0107	−0.0508	0.5599
Office.mid.med	0.0647	0.0416	0.0241	0.0916	−0.1275	0.0940	−0.0006	0.6437	−0.1077	0.0269	−0.0059	0.0446	−0.0734
Office.small.high	0.0194	−0.0053	0.3094	−0.0013	0.0613	0.0371	−0.0604	0.1148	0.0966	0.0048	0.1110	0.1157	−0.0262
Office.small.low	−0.1061	0.0881	0.1531	−0.0268	0.6480	0.2030	−0.0889	−0.0123	0.0241	0.0136	0.0650	−0.0738	−0.0152
Office.small.med	0.0876	−0.1475	0.0652	0.0310	−0.1311	0.2210	0.2021	−0.0045	−0.2078	−0.0156	0.1503	−0.1141	0.1761
Other.big.high	0.2299	0.0901	0.1494	0.5554	−0.0260	−0.0763	0.0542	0.0057	−0.0440	0.1376	0.0519	−0.0214	−0.0588
Other.big.low	0.0044	0.1397	0.1136	0.0764	−0.0188	−0.0485	0.3336	−0.1011	−0.0268	−0.0988	0.0930	0.2420	−0.1051
Other.big.med	−0.0354	0.1347	−0.2404	0.5998	0.0944	−0.0515	0.1234	−0.0574	−0.0569	−0.1246	0.0833	0.0772	0.0283
Other.mid.high	0.1819	0.0358	0.2241	0.6653	−0.0405	−0.0063	0.0130	0.0703	0.1077	−0.0666	−0.0198	−0.0049	0.0986
Other.mid.low	0.4077	0.0277	0.1918	0.2534	0.0060	0.0150	0.2027	0.2162	0.0544	−0.0581	0.1666	0.0500	0.0200
Other.mid.med	0.3935	−0.0328	0.1511	0.4480	0.0810	0.0582	0.3383	−0.0020	0.1153	−0.0882	0.1861	−0.1387	0.1206
Other.small.high	0.3689	0.0760	0.0660	−0.0700	0.1154	−0.1014	0.2865	0.0068	−0.0117	−0.0277	0.4564	0.0152	0.0991
Other.small.low	0.1573	−0.0245	0.3012	0.2410	0.0136	0.0494	0.3586	0.0599	0.0464	−0.1163	0.1332	−0.0294	0.2092
Other.small.med	0.4349	0.0562	0.4633	0.1793	0.0449	0.0268	0.3704	−0.2197	−0.0791	−0.0684	0.1123	0.1664	−0.0464

Table 3 ■ continued

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13
Residential.big.high	−0.0484	−0.0555	0.1771	−0.0551	0.0766	−0.0162	−0.5937	0.0254	−0.0286	−0.0306	−0.0463	0.0389	0.0256
Residential.big.low	−0.1288	0.0360	0.1834	−0.1788	−0.4637	0.0081	−0.2380	−0.1650	0.0390	−0.0370	−0.0545	−0.0151	0.1222
Residential.big.med	−0.2953	0.1056	0.0351	−0.0620	−0.1862	0.3052	−0.5318	−0.0959	0.0609	−0.0774	0.1779	−0.0749	−0.1182
Residential.mid.high	0.1993	0.0350	0.6330	0.0542	−0.0589	−0.0068	−0.1743	0.1397	−0.0744	−0.0020	−0.0757	0.1524	−0.0383
Residential.mid.low	0.0582	−0.0322	0.3132	−0.0711	−0.0388	0.0904	−0.0468	0.3259	0.0825	−0.0981	0.1760	−0.0693	0.3262
Residential.mid.med	0.2452	0.0257	0.3729	0.0691	−0.1507	−0.1119	−0.1062	0.3087	0.1729	−0.0522	0.0135	0.2191	0.3441
Residential.small.high	0.2448	0.0127	0.2550	0.2813	0.0304	−0.0177	0.0175	−0.0214	0.0817	0.0445	0.7742	0.1348	0.0326
Residential.small.low	0.1227	0.0925	0.4686	0.1100	0.0455	−0.0299	0.1282	0.2714	0.0496	−0.0345	0.0553	0.2680	0.3083
Residential.small.med	0.2318	0.0367	0.5617	0.1138	−0.0227	−0.0652	0.1248	−0.1036	−0.0313	0.0754	0.1864	−0.1414	−0.0521
Retail.big.high	0.4253	0.0199	−0.0198	−0.0634	0.0484	0.0027	0.1420	−0.0323	0.4893	−0.1846	0.0917	0.0695	0.0129
Retail.big.low	0.2868	−0.1328	−0.0406	−0.0386	0.2944	−0.1666	0.2229	−0.1423	0.4228	−0.0410	−0.1271	0.1031	−0.2370
Retail.big.med	0.0827	−0.0600	−0.0487	−0.2729	0.4991	0.1046	0.2077	−0.2471	0.3504	−0.1684	−0.0630	−0.3010	0.0067
Retail.mid.high	0.5077	0.0436	0.2364	0.0787	0.1603	0.0164	0.0433	−0.0008	0.0083	−0.1653	−0.0171	−0.1281	0.0614
Retail.mid.low	0.7085	0.0736	−0.0646	0.1615	−0.0203	0.1220	0.0700	0.0746	0.0053	0.0850	0.0102	−0.0149	−0.2297
Retail.mid.med	0.2976	−0.0781	0.1797	0.1261	0.4320	0.1235	0.2533	0.0548	0.1356	−0.1509	0.0590	−0.0076	−0.0214
Retail.small.high	0.3181	−0.0054	0.1828	0.1636	0.0635	0.1212	−0.0734	0.1648	0.0518	−0.0090	0.0464	0.0129	0.0816
Retail.small.low	0.5188	0.0883	0.1898	0.2221	0.0125	0.0535	0.0377	0.0335	0.1911	0.0417	0.0079	0.0852	0.1611
Retail.small.med	0.5902	0.1129	0.1311	−0.0344	0.0162	−0.0860	0.0490	−0.0072	−0.1359	−0.0266	0.2259	0.0303	0.0064
Cumulative Fraction of Variance	0.070	0.133	0.183	0.226	0.268	0.308	0.349	0.386	0.417	0.445	0.471	0.496	0.520

χ^2 statistic that 13 factors are sufficient: 506.85 on 483 degrees of freedom. The p-value is 0.219. Number of time-series observations: 144.

Note: This table presents factor loadings for statistical factors computed on portfolios of REITs, sorted simultaneously by property type, size and book-to-market ratio. The first part of each portfolio name refers to property type, the second to size and the third to book-to-market. At the bottom of the table, we indicate for each factor N the cumulative proportion of the variance explained by all factors $n \leq N$, as well as the value of a χ^2 test statistic that the 13 factors presented here are sufficient in explaining the systematic variance of the system.

Non-REIT Real Estate Firm Factors

For our final set of candidate benchmark returns, we use a portfolio of homebuilder stocks as well as the SNL REOC-Hotel and REOC-Other indices. For the homebuilder factor, we calculate the value-weighted monthly returns for all firms on CRSP in SIC code 1531 (Operative Builders) and subtract the REIT Index return, which we then label Homebuilders. We similarly construct excess returns on the two SNL REOC indices. We consider multifactor benchmarks that include these non-REIT real estate firm factor portfolios along with the other benchmark portfolios described above.

Using Alternative Benchmarks to Explain Individual REIT Returns

We begin by investigating the degree to which our alternative benchmarks can explain the returns to individual REITs. Table 4 reports regressions of monthly excess returns for individual REITs on the excess returns of the REIT Index, and various factor models. In this table, and in subsequent tables with individual mutual fund returns, we require a minimum of 24 months of returns for a REIT (or fund) to be included. The results are consistent with the factor analysis in the sense that individual REITs exhibit a large degree of idiosyncratic variation. For the mean (median) firm, the Index alone explains only 20% (16%) of the variation. Among the alternative additional benchmarks, the statistical factors appear to add the most explanatory power; the mean and median R^2 for these factors is about 0.31. Even though our focus is not on the alphas of individual REITs, it is interesting to note that the typical alphas generated by the single-index models are larger than those calculated by the other models. As we show further, this difference in estimated alphas also appears at the mutual fund level. It is also worth noting that the addition of the non-REIT factors to any particular model has a very small effect. This implies that any significant correlation between the funds' returns and the non-REIT factors is likely to be due to funds investing beyond the REIT universe, rather than non-REIT factors that are capturing some portion of returns within the REIT universe.

Using Alternative Benchmarks to Explain Returns to the REIT Fund Sector

We now turn to the question of how well our alternative benchmarks explain the returns of REIT mutual funds. To do this, we run regressions of the monthly excess return on a value-weighted portfolio of all funds on our various single-index and multiple-factor benchmarks. In Table 5 we calculate the average return using the actual returns investors in the funds experienced (*i.e.*, net of fees), while in Table 6 we use returns before fees (*i.e.*, we add them back to the net returns).

Table 4 ■ Adjusted R^2, alphas and t statistics of alphas for REITs.

Figure	Mean	10%	25%	Median	75%	90%
			Index Only			
Adj. R^2	0.205286	−0.009296	0.025764	0.163032	0.354748	0.508471
Alpha	0.003892	−0.005596	0.000099	0.003679	0.007853	0.013519
t-stats.	0.605821	−0.630753	0.007579	0.656272	1.226306	1.796753
$\sigma_\alpha = 0.01318$	% of positive (negative) alphas with p-values $\leq$ 0.05: 5.99% (0.63%)					
			Index + Non-REITs			
Adj. R^2	0.219372	−0.007952	0.055655	0.184169	0.380193	0.529596
Alpha	0.003042	−0.008570	−0.001240	0.003587	0.007330	0.018238
t-stats.	0.459048	−0.826161	−0.199398	0.546418	1.114478	1.616308
$\sigma_\alpha = 0.01863$	% of positive (negative) alphas with p-values $\leq$ 0.05: 4.73% (1.89%)					
			Index + Characteristic Factors			
Adj. R^2	0.255519	0.012140	0.088473	0.245762	0.397426	0.525401
Alpha	0.000733	−0.009547	−0.002505	0.001885	0.005466	0.010083
t stats.	0.272260	−1.013447	−0.313914	0.302344	0.935435	1.497886
$\sigma_\alpha = 0.01415$	% of positive (negative) alphas with p-values $\leq$ 0.05: 3.79% (1.26%)					
			Index + Characteristic Factors + Non-REITs			
Adj. R^2	0.264575	0.004568	0.090946	0.259260	0.425224	0.551070
Alpha	0.000428	−0.010889	−0.003340	0.002087	0.006173	0.010353
t-stats.	0.236111	−1.025679	−0.378285	0.318496	0.907758	1.404608
$\sigma_\alpha = 0.03054$	% of positive (negative) alphas with p-values $\leq$ 0.05: 2.52% (2.52%)					
			Index + Property Type Factors			
Adj. R^2	0.247604	−0.030007	0.056630	0.204076	0.417073	0.573246
Alpha	0.003438	−0.008460	−0.001448	0.002158	0.006847	0.014118
t-stats.	0.371435	−0.737833	−0.297614	0.331761	1.001710	1.681147
$\sigma_\alpha = 0.01790$	% of positive (negative) alphas with p-values $\leq$ 0.05: 4.10% (2.21%)					
			Index + Property Type Factors + Non-REITs			
Adj. R^2	0.259766	−0.027602	0.087067	0.227497	0.440277	0.600271
Alpha	0.001300	−0.010275	−0.002881	0.002163	0.007695	0.017625
t-stats.	0.273139	−0.980853	−0.354278	0.282841	0.976070	1.607282
$\sigma_\alpha = 0.02521$	% of positive (negative) alphas with p-values $\leq$ 0.05: 4.42% (2.52%)					
			Index + Statistical Factors			
Adj. R^2	0.308226	−0.006205	0.144116	0.311309	0.495487	0.609606
Alpha	0.002145	−0.007906	−0.001820	0.002226	0.006482	0.013542
t-stats.	0.377583	−0.827453	−0.258906	0.371270	0.991320	1.615394
$\sigma_\alpha = 0.01356$	% of positive (negative) alphas with p-values $\leq$ 0.05: 3.47% (0.63%)					
			Index + Statistical Factors + Non-REITs			
Adj. R^2	0.322178	0.010614	0.152056	0.333381	0.527623	0.644440
Alpha	−0.000294	−0.012021	−0.003354	0.001835	0.006761	0.017270
t-stats.	0.263723	−1.049106	−0.345796	0.312508	0.961192	1.457640
$\sigma_\alpha = 0.07967$	% of positive (negative) alphas with p-values $\leq$ 0.05: 8.83% (6.94%)					

Number of firms: 317.

Note: This table presents means, 10th percentiles, 25th percentiles, medians, 75th percentiles and 90th percentiles of the distributions of adjusted R^2, alphas and t statistics of alphas, for excess returns to individual REITs with respect to a variety of explanatory variables, as well as the standard deviation of the alphas and the percentage of firms that realize alphas that are significant at the 5% level (two-tailed test). The explanatory variables consist of the excess returns to the Dow-Jones Wilshire index, a four-factor model of the index plus three firm-characteristic factors, namely a book-to-market factor, a size factor and a momentum factor, all computed using only REITs, a six-factor model of the index and five property-type portfolios and a 14-factor model of the index augmented by the 13 statistical factors from the triple-sorted portfolios presented in Table 3. Each model in turn is also augmented by the index of homebuilders plus the two SNL REOC Indices. We term these three additional factors Non-REITs.

Table 5 ■ Results from value-weighted portfolio regressions, net of fees.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
(Intercept)	−0.00009	0.00029	−0.00083	−0.00048	−0.00113	0.00007	−0.00071	−0.00011	−0.00111
	(−0.18773)	(0.46882)	(−2.01994)*	(−0.96626)	(−2.76863)**	(0.14290)	(−1.64983)	(−0.22381)	(−2.79102)**
Index	0.92594	0.96374	0.85533	0.95045	0.86626	0.91432	0.84751	0.92787	0.86889
	(77.53735)***	(59.35927)***	(68.22403)***	(64.16109)***	(54.58236)***	(68.06812)***	(54.99726)***	(51.34514)***	(53.68413)***
BE/ME				0.03866	−0.02678				
				(1.78618)°	(−1.38045)				
Size				0.03646	0.04161				
				(1.77314)°	(2.55524)*				
Momentum				0.01266	0.04010				
				(0.73179)	(2.75716)**				
Hotel						0.03777	−0.00314		
						(3.61800)***	(−0.20251)		
Industrial						0.00457	0.02223		
						(0.17268)	(0.92721)		
Office						0.04793	0.02693		
						(1.25929)	(0.75884)		
Residential						−0.03566	−0.06369		
						(−0.86161)	(−1.74794)°		
Retail						−0.03656	−0.04038		
						(−0.80362)	(−1.00665)		
Factor1								0.00056	0.00083
								(1.00941)	(1.72232)°
Factor2								−0.00027	−0.00123
								(−0.56554)	(−1.35668)
Factor3								−0.00024	0.00088
								(−0.33332)	(1.51331)
Factor4								0.00143	−0.00049
								(2.62636)**	(−0.97733)
Factor5								−0.00065	−0.00010
								(−1.26575)	(−0.14899)
Factor6								0.00035	−0.00046
								(0.70340)	(−0.77194)
Factor7								0.00054	0.00078
								(1.01074)	(1.70876)°

Table 5 ■ continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Factor8								0.00083 (1.57909)	0.00179 (3.49804)***
Factor9								−0.00118 (−2.14878)*	−0.00066 (−1.37078)
Factor10								0.00022 (0.46910)	0.00052 (1.36065)
Factor11								0.00012 (0.22063)	0.00046 (0.92652)
Factor12								0.00071 (1.27930)	0.00225 (3.86619)***
Factor13								0.00081 (1.46212)	0.00037 (0.60916)
Homebuilders			0.02809 (4.09104)***		0.02802 (4.14567)***		0.02781 (4.04054)***		0.03010 (4.41363)***
REOC Hotel			0.02785 (4.04277)***		0.03849 (5.02630)***		0.03010 (2.47742)*		0.03487 (4.34051)***
REOC Other			0.04155 (3.72475)***		0.03349 (2.98070)**		0.03585 (3.19457)**		0.03445 (3.11310)**
$\overline{R^2}$	0.9768	0.9610	0.9866	0.9779	0.9876	0.9799	0.9872	0.9786	0.9888
Total Model F	6012	3524	2419	1582	1486	1163	1121	467.3	678.9
F				3.4004*	4.1290**	5.4354***	2.0548°	1.9170*	2.846**

$^{\circ}p < 10\%$; $^{*}p < 5\%$; $^{**}p < 1\%$; $^{***}p < 0.1\%$. Time-series observations: 144.

Note: This table presents results from regressions of excess returns to a value-weighted portfolio of all REIT mutual funds on a variety of factor models. These are the excess returns to the Dow-Jones Wilshire index, a four-factor model of the index plus three firm-characteristic factors (namely a book-to-market factor, a size factor and a momentum factor, all computed using only REITs), a six-factor model of the index and five property-type portfolios and a 14-factor model of the index augmented by the 13 statistical factors from the triple-sorted portfolios presented in Table 3. Each model in turn is also augmented by the three non-REIT indices. For Model 2 only, the index used is the FTSE NAREIT All REIT Index; all other models use the Dow Jones Wilshire REIT Index. All mutual fund returns are net of expenses. The second F-statistic at the bottom of the table is the result of a joint hypothesis test that all coefficients included in a model, outside of the intercept, the index and (if included) the coefficients for the non-REIT indices are equal to 0. (t-statistics in parentheses).

Table 6 ■ Results from value-weighted portfolio regressions, before fees.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
(Intercept)	0.00095	0.00138	0.00005	0.00062	−0.00027	0.00106	0.00022	0.00104	−0.00034
	(1.83216)$^{\circ}$	(1.90960)$^{\circ}$	(0.11148)	(1.12633)	(−0.58318)	(1.96996)$^{\circ}$	(0.46040)	(1.93689)$^{\circ}$	(−0.77310)
Index	0.93894	0.97301	0.86394	0.95903	0.87451	0.93092	0.85793	0.92934	0.87752
	(73.13477)***	(52.03587)***	(61.36798)***	(59.06110)***	(49.22931)***	(62.27385)***	(49.38507)***	(46.16313)***	(49.73009)***
BE/ME				−0.00496	−0.04217				
				(−0.20906)	(−1.94184)$^{\circ}$				
Size				0.04461	0.05013				
				(1.97919)*	(2.75016)**				
Momentum				0.01776	0.04091				
				(0.93664)	(2.51328)*				
Hotel						0.03483	0.00288		
						(2.99852)**	(0.16478)		
Industrial						0.03344	0.02052		
						(1.13640)	(0.75903)		
Office						0.00610	0.02894		
						(0.14397)	(0.72331)		
Residential						−0.01245	−0.06602		
						(−0.27031)	(−1.60736)		
Retail						−0.04065	−0.04504		
						(−0.80292)	(−0.99607)		
Factor1								−0.00002	0.00077
								(−0.03515)	(1.47250)
Factor2								−0.00025	−0.00228
								(−0.47435)	(−2.31088)*
Factor3								−0.00073	0.00111
								(−0.91631)	(1.75333)$^{\circ}$
Factor4								0.00097	−0.00052
								(1.59671)	(−0.95517)
Factor5								0.00047	−0.00016
								(0.82197)	(−0.21123)
Factor6								0.00035	−0.00045
								(0.62405)	(−0.68453)
Factor7								0.00004	0.00087
								(0.06569)	(1.75151)$^{\circ}$

Table 6 ■ continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Factor8								−0.00028	0.00174
								(−0.46824)	(3.11835)**
Factor9								−0.00154	−0.00068
								(−2.52845)*	(−1.28930)
Factor10								−0.00044	0.00042
								(−0.84246)	(1.01143)
Factor11								0.00027	0.00055
								(0.42980)	(1.01211)
Factor12								0.00034	0.00302
								(0.54275)	(4.76725)***
Factor13								0.00093	0.00035
								(1.49732)	(0.52528)
Homebuilders			0.02778		0.02856		0.02784		0.03211
			(3.60307)***		(3.77472)***		(3.58736)***		(4.31889)***
REOC Hotel			0.02128		0.03399		0.01902		0.02816
			(2.75064)**		(3.96607)***		(1.38856)		(3.21559)**
REOC Other			0.03907		0.03045		0.03268		0.03192
			(3.11885)**		(2.42117)*		(2.58338)**		(2.64555)**
$\overline{R^2}$	0.9740	0.9498	0.9832	0.9742	0.9845	0.9759	0.9838	0.9742	0.9867
Total Model F	5349	2708	1922	1353	1189	964.5	883.7	386.7	573.1
F				1.506	4.4229**	3.242**	1.8471	1.1039	3.5528***

°$p < 10\%$; *$p < 5\%$; **$p < 1\%$; ***$p < 0.1\%$. Time-series observations: 144.

Note: This table presents results from regressions of excess returns to a value-weighted portfolio of all REIT mutual funds on a variety of factor models. These are the excess returns to the Dow-Jones Wilshire index, a four-factor model of the index plus three firm-characteristic factors (namely a book-to-market factor, a size factor and a momentum factor, all computed using only REITs), a six-factor model of the index and five property-type portfolios and a 14-factor model of the index augmented by the 13 statistical factors from the triple-sorted portfolios presented in Table 3. Each model in turn is also augmented by the three non-REIT indices. For Model 2 only, the index used is the FTSE NAREIT All REIT Index; all other models use the Dow Jones Wilshire REIT Index. All mutual fund returns are before expenses. The second F-statistic at the bottom of the table is the result of a joint hypothesis test that all coefficients included in a model, outside of the intercept, the index and (if included) the coefficients for the non-REIT indices are equal to 0. (t-statistics in parentheses).

Model 1 in Table 5 presents the results for a regression using only the Dow Jones Wilshire REIT Index. These results indicate that the single-factor REIT Index model explains a great deal of the variation in the value-weighted funds' returns; the R^2 in the regression is 0.977. By way of comparison, Model 2 presents the results for a similar regression using the FTSE NAREIT index as the single index. This model has a slightly lower R^2 of about 0.961, so we focus on the Dow Jones Wilshire REIT Index for the remainder of the analysis. The point estimate of the alpha in this single-index model is very small at −0.9 basis points per month (for the Dow Jones Wilshire Index) and is insignificantly different from zero.[12] This is in contrast to the results of Kallberg, Liu and Trzcinka (2000) who find positive abnormal returns for the average REIT fund in their sample.[13] This appears to be sample specific; if we run this same regression over their sample period (1986–1998), we find some evidence of abnormal performance (at the .10 level using two-tailed tests) consistent with their results.[14] Kallberg, Liu and Trzcinka (2000) argue that the positive abnormal performance may be due to an informational advantage possessed by REIT fund managers. The insignificant results in the recent time period after the explosive growth in funds is consistent with this advantage being reduced over time and with the dilution of the average advantage due to the entry of new managers who may be less skilled in evaluating REITs.

In Model 3, we add our non-REIT factors (Homebuilders, REOC Hotel and REOC Other) to our base model. As the results indicate, returns to non-REIT real estate firms have significant incremental explanatory power. The adjusted

[12] This is inconsistent with the results of Lin and Yung (2004), who find a significant alpha of −46 basis points using a value-weighted average of real estate mutual funds over the 1997–2001 period. They use the FTSE NAREIT index and find a lower R^2 than ours, at 0.90 versus our 0.98. They also find no additional explanatory power beyond the FTSE NAREIT index for broad stock-market based Fama-French and momentum factors. This suggests that their results may be sample- or benchmark-specific.

[13] Our work is also related to previous studies of the performance of institutionally managed real estate investments other than mutual funds, such as commingled real estate funds (CREFs). For recent evidence of positive abnormal performance in a sample of CREFs, see Gallo, Lockwood and Rodriguez (2006). They use a single-index model to explain CREF returns, where the index is based on property-level returns, but they also investigate the addition of regional or property-type indexes and find similar results. For prior evidence on CREF performance, see Myer, Webb and He (1997) and Myer and Webb (1993).

[14] Consistent with Kallberg, Liu and Trzcinka (2000), we find lower, insignificant alphas when we use the FTSE NAREIT index instead of the Dow Jones Wilshire Index. It is worth noting, however, that our characteristic factors are still statistically significant in their time period using FTSE NAREIT as the market index, even though FTSE NAREIT includes smaller REITs than the Dow Jones Wilshire Index.

R^2 in the regression increases to 0.987, and the t statistics on the three non-REIT factors are very significant at 4.09, 4.04 and 3.72, respectively, which is consistent with REIT fund managers investing in some non-REIT real estate stocks. This is a consistent theme throughout the table—no matter what set of REIT-based benchmarks is used, the non-REIT factors are still significant and their inclusion increases the model's adjusted R^2.

In Models 4, 6 and 8 we successively consider adding our characteristic factors, property-type factors and statistical factors to the single index. Models 5, 7 and 9 present identical specifications, respectively, except for the addition of the non-REIT factors. The property-type regressions offer the highest adjusted R^2 (0.980 without the non-REITs), although all of the alternatives improve the explanatory power relative to the single-index model (adjusted R^2 of 0.978 for the characteristic factors and 0.979 for the statistical factors, respectively). F statistics for tests of the joint hypothesis that all of the coefficients except for that on the Index (and those of non-REITs, if included) are zero, are also the highest for the property type factors, although they are also significant in the statistical-factor and characteristic-factor regressions. Across models, there is no evidence of significant positive abnormal performance. The only significant alphas are in Models 3, 5 and 9, and their estimates are -8, -11 and -11 basis points per month, respectively.

In Table 6, we present results from identical specifications, except we use the value-weighted excess return on all of the funds before fees (*i.e.*, we add back fees to the CRSP returns by adding one-twelfth of the annual expense ratio to each month's return). As one would expect, the explanatory power of the various models is virtually unchanged. Of more interest is the estimated abnormal performance across different specifications. We find weakly significantly positive abnormal performance in specifications using the single indexes (Dow Jones Wilshire or FTSE NAREIT), statistical factors and property-type factors. The magnitude of this performance is plausible, at around 10 basis points per month (about 1.2% per year), for all these models. However, the estimated abnormal performance is reduced in every alternative by the addition of the non-REIT factors; the estimated alpha is not signficant in any model where they are included. In addition, the alpha is insignificant in the characteristic-factor model, although the point estimate is not very different from the single-index model (6 basis points versus 10 basis points per month). Taken together, the results suggest that the average REIT fund exhibits some abnormal performance but that the performance is offset by expenses. They are also consistent with the results of Table 2, which suggest that fund managers add alpha in this sample by overweighting smaller REITs, betting on momentum and/or buying non-REIT stocks.

Using Alternative Benchmarks to Explain Individual REIT Fund Returns

While these results suggest that additional factors beyond a single index can more precisely estimate abnormal performance for the group of REIT funds as a whole, our ultimate question is whether these alternative benchmarks provide better assessments of the performance of individual funds. To address this, we run separate time-series regressions of each fund's excess monthly returns on the same alternatives as before (the single index, plus characteristic factors, property-type factors and statistical factors, with and without non-REIT factors). In Table 7, for each of these alternatives, we summarize the distribution of three key statistics across the sample of funds: the adjusted R^2, alpha and the t statistic for the alpha. We also present additional statistics regarding the distribution of alphas: the cross-sectional standard deviation of estimated alphas and the percentage of alphas that are significantly positive and negative. For these significance calculations, we tabulate the fraction of alphas with p values that are less than or equal to .05, separated by whether they are positive or negative. Note that because these p values are based on two-sided tests, random chance would predict that 2.5% of alphas are significantly positive, with another 2.5% significantly negative.

First, as one can see from the table, the benchmarks do a very good job of explaining the variation in returns of the typical fund. The single-index model produces a mean (median) R^2 of 0.903 (0.955). By way of comparison, in their 1986–1998 sample, Kallberg, Liu and Trzcinka (2000) find a mean (median) R^2 of 0.851 (0.91) with respect to the Wilshire REIT index. This suggests that typical REIT funds more closely track this index than they did previously.

Benchmarks that more accurately explain monthly returns produce more precise estimates of fund performance. In addition to considering the improved explanatory power for a typical fund, we also consider whether the additional factors increase the R^2 of the funds for which the single-index model performs most poorly. In the middle of the distribution, the results are consistent with what we found for the value-weighted index of all funds. We find that all of the multiple-factor models improve explanatory power beyond the single index; median and mean R^2 are higher in all of these alternatives. Based solely on this criterion, the statistical factors with non-REITs offer the highest mean and median adjusted R^2 (0.942 and 0.968, respectively). The addition of non-REITs also improves explanatory power for the typical fund. For explaining the left-tail outliers, the statistical factor model with non-REITs again offers the biggest improvement, with a 10th-percentile adjusted R^2 of 0.855 versus 0.745 for the single-index model.

In addition to improvements in R^2, we also care about estimated alphas and their statistical significance. The mean (median) monthly alpha using the

Table 7 ■ Adjusted R^2, alphas and t statistics of alphas for REIT mutual funds, net of fees.

Figure	Mean	10%	25%	Median	75%	90%
			Index Only			
Adj. R^2	0.902632	0.744769	0.900920	0.955183	0.975847	0.986345
alpha	−0.000012	−0.001773	−0.001190	−0.000001	0.000919	0.002078
t-stats.	−0.125239	−1.973508	−1.043690	−0.001036	0.850925	1.522797
$\sigma_\alpha = 0.00182$	% of positive (negative) alphas with p-values ≤ 0.05: 6.16% (10.27%)					
			Index + Non-REITs			
Adj. R^2	0.923187	0.801115	0.911647	0.961110	0.977601	0.988957
alpha	−0.000938	−0.002736	−0.001675	−0.000765	0.000149	0.000992
t-stats.	−0.746104	−2.285342	−1.603998	−0.785300	0.153755	1.053756
$\sigma_\alpha = 0.00186$	% of positive (negative) alphas with p-values ≤ 0.05: 2.05% (17.81%)					
			Index + Characteristic Factors			
Adj. R^2	0.921101	0.812081	0.919287	0.957900	0.978707	0.988341
alpha	−0.000678	−0.002470	−0.001619	−0.000609	0.000361	0.001260
t-stats.	−0.613470	−2.544744	−1.355562	−0.586654	0.391480	1.124304
$\sigma_\alpha = 0.00174$	% of positive (negative) alphas with p-values ≤ 0.05: 3.42% (13.7%)					
			Index + Characteristic Factors + Non-REITs			
Adj. R^2	0.935528	0.840042	0.926273	0.963473	0.981448	0.990525
alpha	−0.001456	−0.003231	−0.002188	−0.001230	−0.000397	0.000770
t-stats.	−1.154601	−3.030093	−1.853099	−1.111217	−0.365155	0.672472
$\sigma_\alpha = 0.00206$	% of positive (negative) alphas with p-values ≤ 0.05: 0.68% (22.6%)					
			Index + Property Type Factors			
Adj. R^2	0.918186	0.774156	0.908595	0.962672	0.978111	0.990082
alpha	−0.000025	−0.002089	−0.001245	0.000025	0.001021	0.001956
t-stats.	−0.141473	−2.211532	−1.167726	0.008985	0.928812	1.787704
$\sigma_\alpha = 0.00199$	% of positive (negative) alphas with p-values ≤ 0.05: 7.53% (10.96%)					
			Index + Property Type Factors + Non-REITs			
Adj. R^2	0.930456	0.817307	0.927798	0.965368	0.981084	0.991128
alpha	−0.001076	−0.003515	−0.002017	−0.000943	0.000132	0.001010
t-stats.	−0.805899	−2.357918	−1.810602	−0.810803	0.133927	0.914468
$\sigma_\alpha = 0.00201$	% of positive (negative) alphas with p-values ≤ 0.05: 2.74% (19.18%)					
			Index + Statistical Factors			
Adj. R^2	0.927135	0.831071	0.935677	0.962484	0.980552	0.989259
alpha	−0.000045	−0.002262	−0.001231	−0.000052	0.000964	0.001960
t-stats.	−0.116190	−1.863425	−1.207681	−0.050681	0.811080	1.641077
$\sigma_\alpha = 0.00201$	% of positive (negative) alphas with p-values ≤ 0.05: 6.85% (8.9%)					
			Index + Statistical Factors + Non-REITs			
Adj. R^2	0.942055	0.855017	0.944427	0.968425	0.981819	0.990078
alpha	−0.001117	−0.003374	−0.001800	−0.000955	0.000136	0.001108
t-stats.	−0.775349	−2.217761	−1.613814	−0.866076	0.134938	1.011632
$\sigma_\alpha = 0.00207$	% of positive (negative) alphas with p-values ≤ 0.05: 3.42% (12.33%)					

Number of funds: 146.

Note: This table presents means, 10th percentiles, 25th percentiles, medians, 75th percentiles and 90th percentiles of the distributions of adjusted R^2, alphas and t-statistics of alphas, for excess returns to individual REIT mutual funds with respect to a variety of explanatory variables, as well as the standard deviation of the alphas and the percentage of funds that realize alphas that are significant at the 5% level. The variables consist of the excess returns to the Dow-Jones Wilshire index, a four-factor model of the index plus three firm-characteristic factors, namely a book-to-market factor, a size factor and a momentum factor, all computed using only REITs, a six-factor model of the index and five property-type portfolios and a 14-factor model of the index augmented by the 13 statistical factors from the triple-sorted portfolios presented in Table 3. Each model in turn is also augmented by the index of homebuilders plus the two SNL REOC Indices. We term these three additional factors Non-REITs. For our sample of funds, we combine funds within the same family which seem to hold the same portfolio. All returns are net of expenses.

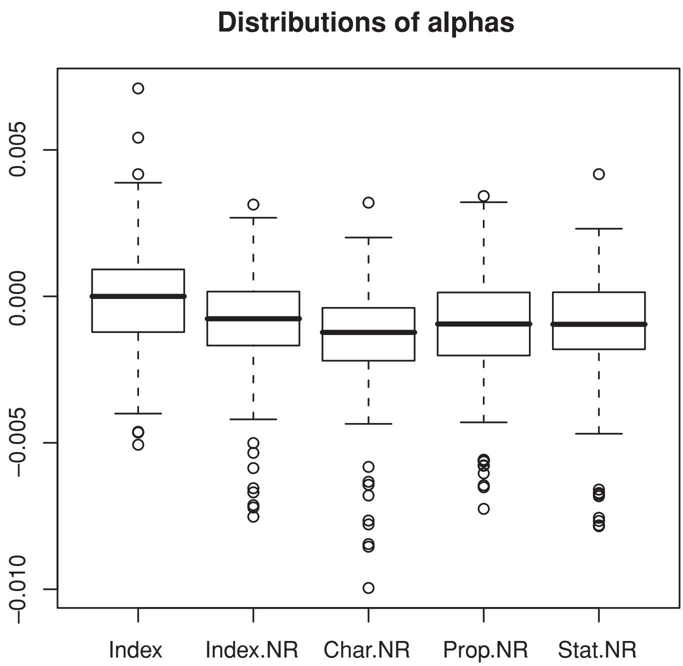
single index is only about −0.1 (−0.01) basis points. In contrast, the mean (median) alpha using the same benchmark reported in Kallberg, Liu and Trzcinka (2000) for their earlier time period is 18 basis points (nine basis points) per month. This difference across samples is not surprising given our results on the alpha of the value-weighted portfolio of all funds.

Based on the standard deviations of alphas across different benchmarks, the multiple-index models do not appear to reduce the variation in alphas across funds. While the characteristic-factors model has the lowest standard deviation (0.00178), the single-index model's standard deviation is the next lowest (0.00182). However, if one looks at reductions in the right tail of estimated alphas and also at the extreme t statistics, the models using statistical factors and characteristic factors with non-REITs appear to work well. The 90th percentile of the alpha distribution is reduced from 21 basis points per month in the single-index model to 11 basis points for the model using statistical factors with non-REITs and to 8 basis points in the model using characteristic factors with non-REITs. The t statistic drops from 1.52 to 1.01 or to 0.67, respectively, at the same point in the distribution. At the middle of the distribution, the estimated alphas from these two alternatives also appear to be more conservative than the single index. Compared to the average and median alphas based on the single-index model that were basically zero, when one adds the statistical factors and non-REITs, the mean (median) alpha is −11 basis points (−10 basis points). Similarly, for the models using the characteristic factors and non-REITs, the mean (median) alpha is −15 basis points (−12 basis points). Typical alphas using the property-type factors are higher than those based on the characteristic or statistical factors when non-REITs are not included, consistent with an important firm size or momentum component of returns over this sample.

These reductions in right-tail (positive) alphas can also be seen by examining the fraction of significant positive alphas across models. For the single-index model, 6.16% of alphas are positive and significant at the .05 level (using two-tailed tests), which is more than twice what would be expected based on random chance. Four alternative models reduce this proportion considerably: the single-index model with non-REITs to 2.05%, the statistical factors with non-REITs to 3.42%, the property factors with non-REITs to 2.74% and the characteristic factors with non-REITs to 0.68%. In the left tail of the alpha distribution, the models using characteristic factors with non-REITs produces the largest fractions with estimated significant negative alphas, at 22.6%, versus 10.27% for the single-index model.

Figure 1 presents box-and-whisker plots of the alphas of the single-index model, as well as each alternative model including non-REITs. In the figure, the solid middle line represents the median alpha, while the upper and lower edges

Figure 1 ■ Box and whisker diagrams of the distrbutions of alphas generated by the single-index model and four different models including non-REITs.



Note: The heavy line in the middle of each box indicates the median, the lower and upper edges indicate the first- and third quartiles, respectively, while the whiskers extend 1.5 times the interquartile range outward from the edge of the box. Any outliers that lie beyond this distance are indicated individually by a circle. *Index* represents the alphas from a model of the Dow Jones Wilshire REIT Index only. *Char*, *Prop* and *Stat* denote models using the single index, plus the chracteristic factors, property factors and statistical factors, respectively. The suffix NR indicates models that include the non-REITs index. All returns are net of fees.

of each box represent the first and third quartiles, respectively. The dashed vertical lines (the whiskers) extend 1.5 times the interquartile range (the length of the box) from the edges, while any remaining outliers beyond this distance are plotted individually as circles. As the figure shows, the Index-only model generates alphas that are noticeably higher than any of the alternative models that include the non-REIT indices, both in terms of the medians and the left tail of the distribution. Among the models that include non-REITs, median alphas are slightly smaller using the characteristic or statistical factors. In addition, these two models result in tighter distributions than the other alternatives. The characteristic-factor model with non-REITs appears the most conservative, displaying the lowest median, the tightest distribution and more low-alpha outliers.

Table 8 presents the same information as Table 7, but using returns to funds before fees (*i.e.*, with $\frac{1}{12}$ of the annual expense ratio added to each fund's monthly return). Because fees do not vary much with the factors, we find little difference in explanatory power. Of more interest are the estimated alphas. Here, again, the combination of the characteristic factors and non-REITs appears to offer the most conservative approach. For example, using the single index, the 75th percentile of the alpha distribution is 20 basis points per month, while the t-statistic at that percentile is 2.03. In contrast, using characteristic factors plus non-REITs, the 75th-percentile alpha and t statistic are 10 basis points and 1.09, respectively. For the statistical factors plus non-REITs, we also see a reduction in estimated abnormal performance, albeit a smaller one in terms of the point estimate. The estimated alpha and t statistic at those same cutoffs are 15 basis points and 1.25, respectively. Looking at the percentage of funds with significantly positive alphas, the characteristic factors (plus non-REITs) is the again the most conservative. While 26.43% of funds have positive alphas with p values of less than or equal to .05, this drops to 10.71% for the characteristic factors model with non-REITs (compared to 13.57% for the statistical factors with non-REITs). The property-type factors plus non-REITs offers the smallest reduction in alphas, with a 75th-percentile estimated alpha and t statistic of 14 basis points and 1.45, respectively.

In summary, the results of Tables 7 and 8 are consistent with a fairly large percentage of REIT fund managers producing significant alpha before fees. The estimates using our most conservative model indicate that 10.7% of funds had positive significant alphas, much more than the 2.5% level one would expect by chance. However, after fees, depending on the benchmark, less than 3% of the funds realize abnormal performance. In contrast, the incidence of negative abnormal performance before fees is in line with random chance (around 3%, depending on the model used), but after fees this becomes as high as 19.18%. One exception to this is specification with characteristic factors and non-REITs; using this model, the incidence of significant negative abnormal performance is 8.57% before fees.

To illustrate how the different benchmarks affect estimated alphas for different funds, Table 9 reports how the top-ten funds in terms of performance using the single-index model faired with our multiple-benchmark models. In all cases, the multiple benchmarks produce lower estimates of performance. For example, for the top fund, the Third Avenue Real Estate Fund, the estimated alpha is 71 basis points per month for the single-index model but is only 20 basis points using the characteristic factors with non-REITs. For half of these 10 funds, including Third Avenue, the benchmark choice does not matter much, but for the other half it matters a lot. For 5 of the 10 funds, the estimated alphas are consistently positive and of similar magnitude. But, for the

Table 8 ■ Adjusted R^2, alphas and t-statistics of alphas for REIT mutual funds, before fees.

Figure	Mean	10%	25%	Median	75%	90%
			Index Only			
Adj. R^2	0.899541	0.702734	0.886946	0.954243	0.975152	0.986280
alpha	0.001354	−0.000631	0.000262	0.001457	0.002043	0.003289
t-stats.	1.186317	−0.685829	0.291970	1.239449	2.031819	3.032670
$\sigma_\alpha = 0.00182$	% of positive (negative) alphas with p-values ≤ 0.05: 26.43% (2.86%)					
			Index + Non-REITs			
Adj. R^2	0.920983	0.783650	0.909314	0.960429	0.977071	0.989465
alpha	0.000414	−0.001079	−0.000333	0.000462	0.001331	0.002329
t-stats.	0.566112	−0.928546	−0.276713	0.457571	1.475181	2.285556
$\sigma_\alpha = 0.00178$	% of positive (negative) alphas with p-values ≤ 0.05: 12.86% (2.86%)					
			Index + Characteristic Factors			
Adj. R^2	0.918770	0.801180	0.898182	0.956152	0.977771	0.988416
alpha	0.000696	−0.000980	−0.000185	0.000749	0.001614	0.002480
t-stats.	0.713656	−1.141403	−0.148031	0.544250	1.752722	2.634092
$\sigma_\alpha = 0.00169$	% of positive (negative) alphas with p-values ≤ 0.05: 17.14% (5%)					
			Index + Characteristic Factors + Non-REITs			
Adj. R^2	0.933854	0.839600	0.922126	0.963290	0.980988	0.990670
alpha	−0.000084	−0.001665	−0.000701	0.000038	0.000964	0.001895
t-stats.	0.175017	−1.493635	−0.573825	0.035649	1.090286	2.072142
$\sigma_\alpha = 0.00197$	% of positive (negative) alphas with p-values ≤ 0.05: 10.71% (8.57%)					
			Index + Property Type Factors			
Adj. R^2	0.915650	0.734656	0.902323	0.961733	0.977490	0.989721
alpha	0.001382	−0.000746	0.000140	0.001292	0.002426	0.003100
t-stats.	1.209916	−0.680398	0.126693	1.243153	2.205727	3.422720
$\sigma_\alpha = 0.00198$	% of positive (negative) alphas with p-values ≤ 0.05: 30% (2.86%)					
			Index + Property Type Factors + Non-REITs			
Adj. R^2	0.928428	0.802065	0.916560	0.963855	0.980935	0.991729
alpha	0.000301	−0.001964	−0.000559	0.000278	0.001465	0.002286
t-stats.	0.435520	−1.222540	−0.564869	0.192494	1.449491	2.399426
$\sigma_\alpha = 0.00191$	% of positive (negative) alphas with p-values ≤ 0.05: 14.29% (2.86%)					
			Index + Statistical Factors			
Adj. R^2	0.924881	0.800631	0.930724	0.958522	0.979722	0.989585
alpha	0.001319	−0.000739	0.000033	0.001366	0.002302	0.003346
t-stats.	1.123287	−0.780240	0.033099	1.074476	2.208032	3.041706
$\sigma_\alpha = 0.00199$	% of positive (negative) alphas with p-values ≤ 0.05: 29.29% (2.86%)					
			Index + Statistical Factors + Non-REITs			
Adj. R^2	0.940538	0.840993	0.943850	0.967666	0.981277	0.992801
alpha	0.000203	−0.002039	−0.000417	0.000408	0.001502	0.002175
t-stats.	0.402994	−1.145986	−0.443582	0.336317	1.258371	2.101046
$\sigma_\alpha = 0.00193$	% of positive (negative) alphas with p-values ≤ 0.05: 13.57% (2.14%)					

Number of funds: 146.

Note: This table presents means, 10th percentiles, 25th percentiles, medians, 75th percentiles and 90th percentiles of the distributions of adjusted R^2, alphas and t statistics of alphas, for excess returns to individual REIT mutual funds with respect to a variety of explanatory variables, as well as the standard deviation of the alphas and the percentage of firms that realize alphas that are significant at the 5% level. The variables consist of the excess returns to the Dow-Jones Wilshire index, a four-factor model of the index plus three firm-characteristic factors, namely a book-to-market factor, a size factor and a momentum factor, all computed using only REITs, a six-factor model of the index and five property-type portfolios and a fourteen-factor model of the index augmented by the 13 statistical factors from the triple-sorted portfolios presented in Table 3. Each model in turn is also augmented by the index of homebuilders plus the two SNL REOC Indices. We term these three additional factors Non-REITs. For our sample of funds, we combine funds within the same family which seem to hold the same portfolio. All returns are before expenses.

Table 9 ■ Comparison of the performance of the top ten funds across factor models.

Fund	Index	Index.*NR*	Characteristics.*NR*	Property.*NR*	Statistical.*NR*
Third Avenue Real Estate Fund	0.00710	0.00250	0.00201	0.00278	0.00417
CGM Realty Fund	0.00542	−0.00137	−0.00351	0.00144	−0.00122
Alpine Realty Income and Growth Fund	0.00388	0.00235	0.00157	0.00258	0.00201
Evergreen US Real Estate Equity Fund	0.00358	−0.00586	−0.00779	−0.00558	−0.00671
Alpine US Real Estate equity Fund	0.00320	−0.00669	−0.00996	−0.00604	−0.00676
Davis Real Estate Fund	0.00251	0.00251	0.00148	0.00230	0.00219
Morgan Stanley Inst: US Real Estate	0.00235	0.00149	0.00139	0.00075	0.00110
Prudential Real Estate Securities/Z	0.00195	−0.00023	−0.00282	−0.00115	0.00213
Prudential Real Estate Securities/A	0.00185	0.00034	−0.00286	0.00003	0.00055
JP Morgan Realty Income Fund	0.00179	0.00130	0.00077	0.00098	0.00151

Note: This table presents a performance comparison across factor models for REIT funds. Specifically, we list, in descending order, the funds for which we have five years of observations, which generated the top ten alphas in the index-only model, net of fees. We then present the alpha for each fund for the model of index + non-REITs (homebuilders + two types of REOCs), index + characteristics + non-REITs, index + property factors + non-REITs and index + statistical factors + non-REITs. The suffix NR behind a label indicates the inclusion of the non-REIT benchmarks.

other five, alphas are actually negative for the characteristic-factor model with non-REITs.

To further investigate changes in alpha ranks across models, we calculate the Spearman rank correlations of the alphas from our eight candidate models (single index, plus characteristic factors, property-type factors or statistical factors, with or without non-REITs). These rank correlations are presented in Table 10. Several facts emerge from the data. First, the addition of the non-REIT returns appears to have important effects beyond the single-index model. The rank correlation between the single-index model and the single-index model with non-REITs is only 0.77, and this falls to between 0.53 and 0.73 for the other factors plus non-REITs. Second, by looking at the correlation of alphas between a set of factors without non-REITs and that same set with non-REITs, it appears that including non-REITs has the biggest impact on the ranks of alphas of the characteristic factors (rank correlation of 0.75) and the single-index model (rank correlation of 0.76).

Managers' Abilities to Time Risk Factors

In this section, we examine whether some fund managers successfully time the risk factors. For example, do some funds tilt towards small REITs in time periods when small REITs outperform the general REIT market. In order to gauge whether this is the case, we construct a characteristic timing measure, similar in nature to that of Daniel *et al.* (1997). We do this by examining the time-variation in the holdings of mutual funds, which we obtain by matching the pre-2003 holdings data from Thomson Financial with data for 2004 and 2005 from the CRSP holdings database. Based on the results we find in previous sections, we classify mutual fund holdings into one of three categories at the beginning of each month t: Small REITs, Large REITs and Non-REIT real-estate firms. Using these three categories and the benchmarks derived from them, we then construct a characteristic timing measure according to the same methodology as Daniel *et al.* (1997).[15]

Using the the 61 unique funds for which we have holdings data and for which we have continuous returns observations for 24 months or more, we only find

[15] Small REITs are defined as REITs that have below-median market capitalization; Large REITs are defined as REITs that have above-median market capitalizations; Non-REIT real-estate firms consist of homebuilders and constituent firms for the two SNL REOC indices (REOC Hotel and REOC Other). We drop any fund holdings in stocks that do not fall into any of these three categories. For each of these categories we compute the return to a respective benchmark portfolio for month t. The Small- and Large-REIT benchmark portfolio returns consist of value-weighted returns to all below-median-market-capitalization and above-median-market-capitalization firms, respectively, and the Non-REIT benchmark returns consist of a value-weighted average of the returns to the three indices which constitute this category.

Table 10 ■ Spearman rank correlations of alphas across factor models.

	Index	Characteristic	PropertyType	Statistical
Index	1.0000			
Char	0.7948	1.0000		
Property Type	0.8091	0.7765	1.0000	
Stat.	0.7976	0.7748	0.9164	1.0000
Index.Non-REITs	0.7658	0.7952	0.5930	0.5761
Characteristic.Non-REITs	0.5336	0.7479	0.4668	0.4336
PropertyType.Non-REITs	0.7306	0.8011	0.9166	0.8343
Statistical.Non-REITs	0.6573	0.7179	0.7397	0.8161
	Index.Non-REITs	**Characteristic.Non-REITs**	**PropertyType.Non-REITs**	**Statistical.Non-REITs**
Characteristic.Non-REITs	0.8222	1.0000		
PropertyType.Non-REITs	0.8029	0.7477	1.0000	
Statistical.Non-REITs	0.7642	0.6937	0.8112	1.0000

Note: This table presents Spearman rank correlations of individual-fund alphas across different factor models. These are the index-only model, the model of index plus firm characteristics, the model of index plus property-type factors and the model of index plus statistical factors. Each model is also augmented by the three non-REIT benchmarks (the index of homebuilders, the SNL REOC Hotel Index and the SNL REOC Other Index).

two funds with characteristic timing measures that are statistically significant: Inland Real Estate Income & Growth Fund and Evergreen Global Real Estate (these results are not tabulated in order to conserve space but are available upon request). However, one must be cautious when interpreting this result, as our tests are likely to have low power due to the short time period of available data (1995–2005).

Performance as a Function of Fund Characteristics

We conclude our analysis by investigating the relations between fund performance and various fund characteristics. While we find no evidence of abnormal performance for a typical fund, it may be that some fund performance is related to characteristics such as fund size, expenses and the degree to which the fund appears to be actively managed. To test for this, we estimate regressions using the Fama-MacBeth (1973) methodology. For each year in the sample, we run a cross-sectional regression of fund returns on fund characteristics (where fund returns have fees added back, although we obtain similar results using returns net of fees). We then present the average coefficient and t statistic for each variable across the time series, where the t statistic is calculated based on the ratio of the average coefficient to the time-series standard deviation of the coefficient. By calculating the t statistics from the time series, this technique avoids problems associated with the cross-sectional correlation between the errors for different mutual funds.

The characteristics we investigate are firm size (the natural logarithm of the fund's net asset value as of the end of the previous year, denoted $\text{Ln}(Size_{t-1})$), the total expense ratio (*Expenses*), the annual fund turnover (as reported on CRSP, denoted *Turnover*), the total number of holdings of the fund (*Holdings*), an indicator variable for funds with loads (*Load*) and the percentile rank of the fund's performance (with fees added back) among our sample funds during the previous year (*Percentile Rank*). Kallberg, Liu and Trzcinka (2000) find evidence consistent with larger funds and more actively managed funds exhibiting greater performance. If this were true in our sample, we would expect a positive coefficient on our fund size variable, a positive coefficient on *Turnover* and a negative coefficient on *Holdings* (as more actively managed funds would hold fewer REITs than the index and would trade more aggressively). We are also interested in the coefficients on the *Expenses* variable. If fees are uncorrelated with stock-picking ability, then we would expect an insignificant coefficient for *Expenses* in the regression with fees added back to returns (and a coefficient of -1.0 on expenses in the unreported regression using returns net of fees). In contrast, if expenses were strictly based on stock-picking ability and passed through to investors accordingly, we would expect a coefficient of 1.0 in the before-expenses regression (and a coefficient of zero in the net-of-expenses

Table 11 ■ Fund performance as a function of fund characteristics.

	Coefficient	t statistic
Intercept	0.1535	2.1297°
Ln($Size_{t-1}$)	0.0001	0.0388
Expenses	−0.4236	−0.5819
Turnover	0.0191	1.4808
Holdings	−0.0001	−0.4020
Load	0.0037	0.5140
Percentile Rank	0.0059	0.3244
Average $\overline{R}^2$	0.1411	
F	0.3917	

$^\circ p < 10\%$; $^* p < 5\%$; $^{**} p < 1\%$; $^{***} p < 0.1\%$. Eight time-series observations.
Note: This table presents results from Fama-Macbeth (1973) regressions of annual fund returns (before fees) on a constant, the natural logarithm of the fund's total NAV lagged by one year, expense ratio, turnover, number of holdings, a load indicator which is equal to one if the fund has a nonzero front or rear load and zero otherwise and a variable that measures the percentile rank of the fund based on the previous year's performance. We also compute the usual F statistic (H_0 : All coefficients except the intercept equal zero), as a joint test of univariate hypotheses on the time-series of the cross-sectional coefficients. All returns are before expenses.

regression). Including the previous year's performance, *Percentile Rank* allows us to test for persistence in fund performance across years; a significant positive coefficient would be consistent with persistent relative performance ("hot hands").

The results of these regressions are presented in Table 11. Unfortunately, we are unable to explain much of the variation in returns across our sample, perhaps due to a lack of power given the small number of years. We find an insignificant coefficient for fees, which is consistent with a lack of correlation between stock picking and expense ratios. There is some marginal evidence of a relation between active management and performance; the point estimate on *Turnover* is positive, the point estimate on *Holdings* is negative and the p value on the former is about .18 in a two-tailed test. We find little evidence of relations between performance and either fund size, the presence of a load or the relative performance of the fund in the prior year.

Conclusion

REIT mutual funds have experienced a tremendous recent growth in popularity. These funds are actively managed and charge substantial fees that reflect the possibility that their active management will generate returns that exceed the returns that can be generated with passive investment strategies. In order to evaluate whether these funds do in fact generate abnormal returns, we need benchmark portfolios that allow us to evaluate the marginal benefits of active portfolio management. By constructing such benchmarks, one can better disentangle positive performance due to passive strategies based on REIT characteristics (such as overweighting small REITs) from managers' skill in picking individual REITs (such as successful bets on which REITs are taken private).

This study examines these indexes and considers some multiple-factor benchmarks that can potentially provide better assessments of the performance of REIT mutual funds. We first document that, over our sample period, simple passive portfolios that concentrated on smaller REITs or non-REIT real estate firms generate significant alphas with respect to the commonly used single-REIT-index benchmarks. This suggests that alternative benchmarks may add explanatory power beyond the index, which should lead to more precise estimates of abnormal performance. We investigate three sets of REIT-based benchmarks, plus an index of homebuilders' returns and two (non-REIT) REOC indices. The REIT-based factors are a set of statistical factors, a set of property-type factors and a set of Fama-French–type characteristic factors including momentum that are zero-cost portfolios of REITs.

Our statistical factors and these REIT-based characteristic factors, when combined with returns of our non-REIT real estate firms and the REIT index, appear to offer the most attractive benchmarks for evaluating fund returns. These benchmarks provide the highest R^2 in the time-series regressions of mutual fund returns on factor returns and generate alphas that tend to be closer to zero.

We expect that these benchmarks will prove to be quite useful in practice. For example, suppose that over the past 5 years a mutual fund outperforms the Dow Wilshire REIT index by 2% per year. By regressing the mutual fund returns on our factor benchmark returns one can estimate the portion of that return that can be attributed to the fund's exposure to factors represented by property types, size, etc., and the portion that can be attributed to the mutual fund's ability to select REITs that outperform others with the same characteristics. Our results suggest that the choice of benchmarks matters and that a multifactor approach should lead to more precise inference about mutual fund managers' skill.

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