Are REITs a Distinct Asset Class?

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Abstract

Real estate investment trusts (REITs) are often considered to be a distinct asset class. But, do REITs deserve this designation? While exact definitions for asset class vary, a number of statistical methods can provide strong evidence either for or against the suitability of the designation. The authors step back from the established real estate and REITs literature and answer this broader question. Beginning with a set of asset class criteria, the authors then utilize a variety of statistical methods from the literature and factor-based asset pricing to evaluate REITs for their candidacy as a distinct asset class. REITs fail to satisfy almost all of the relevant criteria leading the authors to conclude that REITs, in fact, are not a distinct asset class but do deserve a market capitalization weighted allocation in a diversified investment portfolio.

Please send any comments to jkizer@bamadvisor.com. This analysis is for academic purposes only. The research, opinions and data shared within this paper are those of Mr. Kizer and Mr. Grover and do not directly reflect those of Buckingham Asset Management, LLC.

Many investors think of real estate investment trusts (REITs) as a distinct asset class because, in aggregate, they have historically had relatively low correlation with both stock and bond markets. However, this is a far too simplistic definition for what defines a distinct asset class. Many individual stocks have low correlation with the overall stock and bond markets, yet no one would (hopefully) consider a single stock, or a small handful of stocks, to be an asset class. For individual equities, a better definition would be a well diversified portfolio of securities that has historically demonstrated statistically significant excess return relative to what is explained by a generally accepted factor model like the Carhart [1997] four-factor model. For example, early research on the size and value premiums argued that these two types of equity securities are distinct equity asset classes because their excess returns were not fully accounted for by the CAPM.

On a relative basis, public REIT equities are a young investment vehicle. The REIT Act title law of 1960 allowed the creation of REITs and accordingly, the ability for investors to gain access to diversified real estate portfolios. The first REIT was formed shortly thereafter and the first public REIT debuted in 1965.[1] Early research into public real estate investment, such as Webb and Rubens [1987], tends to use appraisal-based individual property data and suggests that real estate provides diversification benefits for traditional stock and bond portfolios. Following the growth of the industry and accumulation of sufficient returns histories, REIT indexes debuted. Subsequent studies often used REIT indexes, tending to confirm earlier findings concerning diversification benefits and suggesting sizable portfolio allocations.

There is an important distinction to be made here as broad real estate and REITs are not synonymous. REIT indexes are better suited for research purposes as they feature up-to-date pricing and do not exhibit the positive autocorrelation found in appraisal-based series.

[1]reit.com

Gyourko and Keim [1993] demonstrate this and actually find that REITs are highly correlated with the S&P 500 Index. Much of the relevant research makes the distinction that REITs data is used as an imperfect proxy for real estate or in conjunction with other measures. Notable examples from the literature that use REIT data in this manner, with results in support of real estate as a portfolio diversifier, are Goetzmann and Ibbotson [1990] and Hudson-Wilson et al. [2005]. But many pieces implicitly treat REITs as a near-perfect substitute for real estate or explicitly treat REITs as an asset class. For example, using a mean-variance framework, Feldman [2003] suggests a 12 percent allocation to REITs in a balanced portfolio of global developed country equities and US government bonds. With a finding nearer to the market capitalization weight of U.S. REITs, Mull and Soenen [1997], using a nonparametric technique, suggest a REIT allocation of 2.2 percent in a US stock and bond portfolio. Whether implicit or explicit, the sentiment and results of these works has taken root in practical application, especially in the large and growing indexing and evidence-based management spaces; consider for example the Vanguard REIT Index Funds and ETF which, as of early 2017, collectively hold nearly $100 billion in assets representing about 13 percent of the MSCI U.S. REIT Index.[2]

As mentioned, it is not surprising that individual REITs, or a small handful of REITs, would improve a portfolio from a CAPM perspective, as many individual equities would do the same. Further, so long as REITs are not perfectly correlated with a chosen benchmark portfolio and have a similar Sharpe Ratio, the addition of REITs to that portfolio, in some specific amount, will improve the original portfolio's Sharpe Ratio. These are standard results from modern portfolio theory. Works attempting to determine an optimal allocation to REITs and the diversification benefits of REITs are important for both academics and practitioners but we think that the body of literature has skipped an important step. In this study we step back from previous work and evaluate a more general question: should

[2]Bloomberg

public REIT equities be considered a distinct asset class? In this evaluation, we draw on methodologies present in the literature but also utilize some more advanced techniques that, to our knowledge, have not been applied to REITs in a diversified portfolio context. Our results suggest that REITs themselves should not hold the distinct asset class moniker. The main contribution of this article is the result that, on a statistically inferred basis, REITs do not improve the mean-variance frontier of a standard benchmark stock and bond portfolio.

Section 2 of this paper reviews the data used in this evaluation. Section 3 presents a variety of analytical procedures and key findings and Section 4 concludes.

Data

Focusing on a more comprehensive methodology and staying consistent with the body of literature, we use standard benchmarks in our analysis. The Dow Jones U.S. Select REIT Index, henceforth REITs, represents public REITs. The S&P 500 Index (SP500) and 5-year Treasury bond (5YT) returns are the chosen representors of stock and bond markets, respectively. Data for these indexes is obtained from Thomson Reuters Lipper. Returns for 12 other industries, U.S. equity market factor data and U.S. small-cap value (SV) returns are obtained from Ken French's data library. Long-term corporate bond (CORP) returns and the investment grade default premium (IGDEF) are taken from Barclay's Capital Live. All data used is at a monthly frequency and all data, with the exception of IGDEF, begins in January 1978 and ends in July 2017. The IGDEF series begins in August 1988.

Analyses

This research steps back from much of the REITs literature in that the goal is not to analyze the extent to which REITs should be included in a generalized portfolio nor is it to comment on the diversification benefits of REITs. Rather, we seek to provide a measured look at REITs qualifications for consideration as a distinct asset class. To do so, we utilize an array of statistical techniques and relevant comparisons. The analysis begins with more common techniques, such as correlation, to address the current literature and common investor views, but then moves to more advanced techniques to provide deeper insight and add to the body of REITs literature. The first step though, is to define the term asset class, as this definition frames the work that follows. The broad but typical definition for an asset class is a group of similarly characterized securities whose behavior is similar in the marketplace and is distinct from other asset classes. Here, we already run into a circular definition issue as a comparison to other asset classes is required. But if we establish more careful criteria we can build a better definition. The criteria that we use to define an asset class incorporates the broader definition, and common techniques of its measurement, but considers more modern analytical finance techniques. While not perfect, the list below provides a number of key criteria for asset class distinction and the frame of reference for this research.

1. Low correlation with established asset classes such as broad market equities and government bonds.
2. Statistically significant positive alpha with respect to generally accepted factor models.
3. Inability to be replicated, on a comovement basis, by a long-only portfolio holding established asset classes.
4. Improved mean-variance frontier when added to a portfolio holding established asset classes.

Correlation and Factor Analysis

Beginning with criteria one, our analysis first examines the historical correlation between REIT returns and the returns of both the S&P 500 Index and 5-year Treasury bonds. Exhibit 1 presents these figures.

Exhibit 1: Monthly Correlations (January 1978–July 2017)

	REITs	SP500	5YT
REITs	1.00	0.58	0.07
SP500	0.58	1.00	0.07
5YT	0.07	0.07	1.00

We see that REITs have indeed had low correlation with stocks and bonds, particularly with bonds. These simple but important results have led many investors to jump to the conclusion that REITs are indeed a distinct asset class. But in reality, many sectors have had relatively low correlations with stocks and bonds. Exhibit 2 shows an expanded correlation matrix that includes the three series from Exhibit 1 but adds 12 other sectors from Ken French's data library. These sectors are defined based upon SIC codes and span the historical cross-section of the U.S. equity market. A non-abbreviated listing is included in Exhibit 7 in the appendix.

Exhibit 2: Monthly Correlations (January 1978–July 2017)

	REITs	SP500	5YT
REITs	1.00	0.58	0.07
SP500	0.58	1.00	0.07
5YT	0.07	0.08	1.00
BUSEQ	0.40	0.83	-0.04
CHEM	0.54	0.85	0.08
DURB	0.59	0.79	-0.05
ENRG	0.40	0.64	-0.03
HLTH	0.40	0.76	0.17
MANUF	0.61	0.92	0.00
MONEY	0.62	0.87	0.11
NDUR	0.52	0.80	0.20
OTHER	0.64	0.91	0.02
SHOPS	0.53	0.85	0.08
TELCM	0.39	0.77	0.08
UTIL	0.46	0.53	0.29

Focusing on the column of correlations with the S&P 500, observe that a number of other sectors have had relatively low correlation with this index. In particular, ENRG and UTIL have had correlations with the S&P 500 that are roughly similar to that of REITs at 0.64 and 0.53, respectively. Using just correlation, one might argue that all three of these sectors are their own asset classes. But as noted earlier, classification based on correlation alone is too simple.

Small capitalization and value stocks once presented researchers with a classification issue as the one-factor CAPM could not adequately explain their respective excess returns. The seminal Fama and French [1993] study expanded the CAPM to include size (SMB) and value (HML) factors and ushered in the risk factor asset pricing era. Since, much research has built upon and improved factor models, such as the Carhart [1997] four-factor model which adds a momentum (UMD) factor. Researchers and practitioners alike now use factor models extensively as a tool for examining cross-sectional asset returns. Compared to simple correlation analysis, evaluating REITs in a factor model specification provides much more advanced insight into the drivers of their return. Exhibit 3 presents the results of Carhart four-factor regression analyses for REITs as well as each of the 12 sectors from Ken French's data library.

Exhibit 3: Carhart Four-Factor Analysis (January 1978–July 2017)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	R-squared
NDUR	373	2.6	0.78	28.3	-0.19	-4.7	0.13	3.1	0.06	2.2	64%
HLTH	420	2.4	0.80	24.4	-0.23	-4.9	-0.18	-3.6	0.08	2.4	60%
BUSEQ	286	1.8	1.12	36.2	0.22	4.9	-0.69	-14.4	-0.18	-6.1	83%
SHOPS	170	1.2	0.96	33.2	0.05	1.3	0.04	0.9	-0.02	-0.6	73%
TELCM	176	1.0	0.86	25.0	-0.19	-3.8	0.02	0.3	-0.08	-2.5	60%
UTIL	117	0.7	0.56	16.4	-0.24	-4.9	0.35	6.6	0.12	3.6	37%
CHEM	83	0.6	0.92	34.3	-0.16	-4.2	0.16	3.9	0.00	-0.1	73%
REITs	27	0.1	0.76	18.1	0.43	7.3	0.67	10.3	-0.07	-1.7	51%
MANUF	9	0.1	1.13	52.0	0.10	3.2	0.20	5.8	-0.07	-3.5	87%
ENRG	-34	-0.1	0.89	18.6	-0.12	-1.7	0.34	4.6	0.10	2.1	43%
MONEY	-130	-1.1	1.17	49.8	-0.09	-2.8	0.58	15.9	-0.06	-2.6	85%
DURB	-259	-1.3	1.21	31.1	0.20	3.7	0.52	8.6	-0.26	-7.1	72%
OTHER	-265	-2.7	1.10	56.4	0.21	7.5	0.15	5.1	-0.03	-1.6	89%

Exhibit 3 sorts the regression results by the t-statistic, from highest to lowest, of each series' estimated annualized alpha from the Carhart four-factor specification. The intuition is that statistically significant alphas may signify that the factor model is not able to sufficiently explain the excess returns of a given sector and thus, *could* be evidence for considering a given sector to be a distinct asset class. With this consideration, there are three sectors with statistically significant alphas, two of which are positive (NDUR and HLTH) and one negative (OTHER). REITs, however, are not one of the three, with an alpha t-statistic of only 0.1, which is close to a fatal blow in arguing that REITs should be treated as a distinct asset class. Additionally, NDUR, HLTH and OTHER show sizable estimates of annualized alpha compared to the 27 bps estimate for REITs. We do note that the REITs regression shows the third lowest R-squared (51 percent) of the industries considered, UTIL and ENRG being the two lower, which indicates a relative deficiency in the ability for the factor model to explain the variance in REIT returns. But looking further into the regression results, it could be argued that REIT returns are somewhat well explained by the Carhart four-factor model in that they show statistically significant loading estimates for the equity market premium (MKT), SMB and HML, just as most of the 12 industries do.

Expanding on the four-factor model, Exhibit 4 presents a six-factor regression analysis for REITs and each of the 12 sectors from Ken French's data library. The two additional factors are the TERM (5YT less the risk free rate) and IGDEF (investment grade-corporate bonds less 5YT) premiums. The reason to include these two fixed income factors is that some equity sectors may have exposure to fixed income oriented risks, given the underlying nature of the businesses, and so explanatory power may be gained over the equity-only four-factor model. Exhibit 4 shows the results from these regressions, which are again sorted from highest to lowest estimated annualized alpha t-statistic.

Exhibit 4: Six-Factor Analysis (August 1988–July 2017)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	TERM	t-stat	IGDEF	t-stat	R-squared
BUSEQ	363	1.9	1.26	29.5	0.20	4.0	-0.72	-13.3	-0.15	-4.4	-0.30	-2.3	-0.32	-1.9	84%
HLTH	384	1.9	0.77	16.3	-0.23	-4.2	-0.16	-2.7	0.07	1.9	0.16	1.1	-0.03	-0.2	52%
NDUR	290	1.8	0.72	19.0	-0.20	-4.5	0.13	2.8	0.02	0.5	0.34	2.9	-0.12	-0.8	58%
SHOPS	222	1.3	0.93	24.5	0.01	0.3	0.07	1.4	-0.04	-1.4	-0.12	-1.0	-0.42	-2.8	70%
CHEM	166	1.0	0.83	21.9	-0.17	-3.6	0.24	5.0	0.00	-0.1	-0.01	-0.1	0.02	0.2	66%
MANUF	107	0.8	1.08	35.6	0.07	2.0	0.27	7.0	-0.06	-2.5	-0.08	-0.8	0.24	2.0	86%
UTIL	57	0.3	0.42	8.6	-0.20	-3.4	0.32	5.2	0.12	3.1	0.66	4.4	0.78	4.0	35%
ENRG	32	0.1	0.69	11.0	-0.09	-1.2	0.38	4.8	0.09	1.7	0.03	0.2	0.85	3.4	40%
TELCM	-8	0.0	0.98	21.5	-0.21	-3.8	-0.07	-1.2	-0.02	-0.5	0.01	0.1	0.07	0.4	67%
REITs	-133	-0.5	0.60	10.1	0.41	5.8	0.71	9.4	-0.08	-1.7	0.76	4.1	0.96	4.0	51%
MONEY	-124	-0.9	1.20	36.2	-0.11	-2.8	0.64	15.2	-0.06	-2.4	0.00	0.0	-0.22	-1.7	85%
DURB	-260	-1.1	1.11	20.8	0.22	3.5	0.64	9.4	-0.24	-5.6	-0.14	-0.8	0.72	3.4	74%
OTHER	-271	-2.4	1.06	41.5	0.14	4.5	0.22	6.7	-0.06	-3.0	-0.08	-1.1	-0.15	-1.5	88%

Interestingly, now only one industry (OTHER) has statistically significant annualized alpha and the estimate is negative. Similar to the four-factor specification, the annualized alpha estimated t-statistic for REITs is near zero. Also similar to the four-factor specification, the R-squared figures are still relatively low for REITs but also for other industries including ENRG, UTIL and HLTH. But the results in Exhibit 4 show that virtually all industries are well explained by four equity factors and two fixed income factors; most have statistically significant loadings on MKT, SMB and HML and many have statistically significant loadings on the TERM and IGDEF, including REITs which has statistically significant loadings on all five. In consideration of industries with non-statistically significant annualized alpha estimates and statistically significant factor loading estimates, the low R-squared ratios seem to indicate diversifiable risks present in each industry, not uniqueness in underlying return drivers. So, while the relatively low correlation with the S&P 500 Index and 5YT was encouraging, with respect to criterion two, the four- and six-factor regression models indicate that REITs are likely not a distinct asset class, especially when compared to the results of other industries.

Exhibit 4, however, provides us with other clues as to how the returns and systematic risk characteristics of REITs could be replicated with standard long-only positions in stocks and bonds. As mentioned, Exhibit 4 shows that REITs have positive and statistically significant exposure to the SMB, HML, TERM and IGDEF premiums. This indicates that a certain portfolio of small-cap value stocks and long-term investment grade corporate bonds should be able to closely replicate the returns of REITs, from a comovement perspective.

Portfolio Replication

As a term, replication is a bit of a misnomer. The basic idea is to use optimization techniques to identify a combination of assets that has historically behaved like a target portfolio or strategy, with respect to returns comovement. However, rarely (if ever) will the identified portfolio exactly replicate the returns stream of the target portfolio. Nevertheless, replication is typically the term that is used so we use that convention. As noted in the prior section, the six-factor regression analysis tells us that a portfolio of small-cap value stocks and long-term corporate bonds should do a decent job at replicating the returns of REITs. With respect to criterion three, a distinct asset class should not be easily replicated by a long-only portfolio of established asset classes. The ability to replicate a security (or portfolio) with a broader portfolio implies that the security is redundant in the given portfolio. For this reason, we evaluate REITs on their ability to be replicated, as suggested by the six-factor regression results.

We begin with returns for U.S. small-cap value stocks (SV) from Ken French's data library and the Barclay's Capital Long-Term Corporate Bond Index (CORP). To attempt a replication of REITs returns with these two returns series, we specify a constrained least squares regression and utilize linear optimization to minimize the objective function with respect to the portfolio weights. The portfolio weights are designated by the vector w, we define $A = [\iota, SV_t, CORP_t]$ and $B = REIT_t$ where ι is a ones vector and the subscript t designates the month. We define the linear equality constraint matrix as $u = [0, 1, 1]$. The specified objective function is shown below.

$$\hat{w} = \underbrace{argmin}_{w} \left\{ (Aw - B)^2 \right\} \text{subject to: } uw = 1 \quad (1)$$

The $\hat{w}$ that minimizes the objective function produces a portfolio which allocates about 66 percent to SV and consequently 34 percent to CORP. This optimal replicating portfolio has a monthly correlation with REITs of 0.72. Exhibit 5 presents other statistics that compare this optimal replicating portfolio to REITs over this same time period.[3]

Exhibit 5: Monthly Return Summary Statistics (January 1978–July 2017)

	REITs	Portfolio
Average Return	1.11	1.19
Annualized Return	12.2	14.2
Annualized Std. Dev.	18.4	13.2
t-stat	3.0	4.6
Annualized Sharpe Ratio	0.48	0.74
Min. Return	-32.4	-17.2
Max. Return	32.8	12.6
Max DD	-70.5	-46.0
Skewness	-0.7	-0.9
Kurtosis	10.7	5.9
% Neg. Periods	39	32

The statistics in Exhibit 5 are compelling. The replicating portfolio dominates REITs from almost every imaginable angle. It earns higher compound returns, has lower volatility, achieves a higher Sharpe Ratio, has lower kurtosis, and wins on most historical risk characteristics. A skeptic might note that the replicating portfolio has 34 percent allocated to long-term corporate bonds during a period where interest rates have declined significantly. Regression results reported in Exhibit 8 in the appendix, however, show the TERM loading for the replicating portfolio is lower than the TERM loading for REITs, so interest rate risk exposure cannot account for the results in Exhibit 5. Speaking to criterion three, REITs appear to be a complete miss. Using the six-factor regression results, we were able to create a simple long-only two-asset portfolio that not only comoves well with REITs but dominates

[3]Note that compound return, standard deviation and Sharpe Ratio are all annualized.

REITs from a historical return and risk perspective. Note, again, we are not arguing that the allocation to REITs should be zero. We are, arguing, however, that there is scant analytical evidence for overweighting REITs above market-cap weighting (with the possible exception of overweighting *as part of* a more general strategy of tilting a portfolio toward small and value stocks).

Mean-Variance Spanning

As mentioned, the motivation behind the portfolio replication exercise is to determine if REITs are redundant in the sense that a combination of other assets in a portfolio can be weighted to replicate the comovement of REITs. While interesting to our specific research question, this exercise may be narrow in that we explicitly chose the assets for our replicating portfolio and did not evaluate the broader investable universe in our comparison. A more complete technique requires us to step back and evaluate REITs in the context of an overall investment portfolio, specifically with respect to modern portfolio theory. Many studies have evaluated the diversification benefits of REITs by attempting to quantify the optimal portfolio allocation to REITs, generally in the mean-variance sense, such as Goetzmann and Ibbotson [1990] and Feldman [2003]. In order to evaluate criterion four, we also evaluate REITs' role in a portfolio in a mean-variance sense but do so with a more advanced technique that allows us to evaluate diversification benefits and optimal weighting simultaneously and with accompanying statistical inference. The technique used to do so are tests of mean-variance spanning.

At a high level, the idea is to statistically determine if the addition of a test asset (or assets) to a given portfolio (the benchmark asset) improves the efficient frontier. If the efficient frontiers are statistically similar, one would not be able to conclude that the test asset improves portfolio efficiency. Kan and Zhou [2012] review these techniques in extensive detail and we use their findings for guidance in this work. Speaking more formally, consider

K benchmark assets and N test assets. The K benchmark assets span the larger set of $K+N$ assets if the mean-variance frontiers of both portfolios are statistically identical. With the existence of a risk-free rate and unlimited lending and borrowing at that rate, then investors solely seek the tangency portfolio of the mean-variance frontier, or rather, the portfolio with maximum Sharpe ratio. With these assumptions in place and because we are only interested in one test asset (the REITs index), we can move forward with the mean-variance spanning test of Huberman and Kandel [1987] with $N = 1$. Define R_1 as the $T \times K$ matrix of benchmark asset returns and R_2 as the $T \times 1$ matrix of test asset returns. We first specify the regression $R_2 = \alpha + R_1\beta + \epsilon$ where we assume that ϵ is mean-zero and iid. We then define $\delta = 1 - \iota\beta$ where ι is a $1 \times k$ vector of ones. With this specification, we use a Likelihood Ratio test statistic having $\chi^2_{2\times N=2}$ distribution under the following null hypothesis:

$$\mathrm{H}_0 : \alpha = 0 \text{ and } \delta = 0 \tag{2}$$

The calculation of the test statistic is omitted for brevity.[4] The null hypothesis presents a joint test of 1) whether the tangency portfolio has zero weight in the test asset and 2) whether the minimum-variance portfolio has zero weight in the test asset. Together, we test whether every portfolio on the mean-variance frontier of the $K + 1$ assets has zero weight in the test asset i.e. the K asset portfolio spans $K + 1$ asset portfolio. In simpler terms, a failure to reject the null hypothesis suggests that addition of the test asset to the benchmark does not improve portfolio efficiency.

Chen et al. [2005] utilize tests of mean-variance spanning with the FTSE NAREIT All REITs Index as the test asset and find evidence for improved portfolio efficiency. But we find their benchmark assets to be unrealistic in a practical portfolio context. The benchmark used in that study are the 25 portfolios resulting from a 5x5 sort of size and book-to-market, from Ken French's data library. We would assert that an investor seeking to diversify their

[4] Refer to Kan and Zhou [2012] for a detailed derivation.

equity portfolio would first look to fixed income (a very widely used diversifier of equity risk) and thus, a simple benchmark comprised of broad equities and fixed income is much more realistic. In a replication of their results over our sample, we indeed find that while the null hypothesis is rejected using their original benchmark and test assets, when Long-Term Corporates or Five-Year US Treasuries are included in their benchmark, the null hypothesis is not rejected.

We conduct mean-variance spanning tests for three separate benchmarks with REITs as the test asset. The benchmarks are chosen to compliment other analyses from this study that, we would argue, are practical starting points for an investor seeking to diversify their portfolio. Exhibit 6 shows the makeup of each benchmark and the associated p-value from the Likelihood Ratio test of mean-variance spanning from Huberman and Kandel [1987]. For additional perspective, Exhibit 6 also shows the unconstrained mean-variance optimal portfolio weights for a portfolio comprised of the respective benchmark assets and REITs.

Exhibit 6: Mean Variance Spanning Tests (January 1978–July 2017)

Benchmark Assets	Test Asset	p-value
K = [SP500, 5YT, SV]	REITs	0.9464
-8%, 38%, 73%	-3%	
K = [SP500(60%), 5Y(40%)]	REITs	0.1309
83%	17%	
K = [SV(66%), CORP(34%)]	REITs	0.8935
111%	-11%	

The K = [SP500, 5YT, SV] benchmark allows an unconstrained view into a portfolio with holdings in standard asset classes. The K = [SP500(60%), 5YT(40%)] benchmark looks at an industry standard 60/40 stock and bond portfolio. The K = [SV(66%), CORP(34%)] benchmark allows us to dive deeper on our REITs replicating portfolio. The null hypothesis is not rejected in any of the tests meaning that we cannot statistically say that the addition of REITs improves the mean-variance frontier for any of our benchmark portfolios. Because we know that REITs load on SMB and HML, the failure to reject the null in the first benchmark test is expected. The surprising result in the first specification though, is that even in an unconstrained mean-variance optimization, REITs do not receive a positive allocation. The second test is most surprising: the null is not rejected when REITs are added to a standard 60/40 S&P 500 and 5YT portfolio. As mentioned, because REITs load on SMB and HML, ex ante, we expected the addition of REITs to improve the mean-variance frontier of this second benchmark. Of note, the unconstrained mean-variance optimization allocates 17 percent to REITs in this case, a number far above the market capitalization weight of REITs. This is because the stock/bond portfolios Sharpe Ratio is highest at a portfolio allocation of 30/70 (see Exhibit 9 in appendix). As we overweight S&P 500 to arrive at a stock/bond allocation of 60/40 and the correlation between S&P 500 and REITs is low, we would expect the addition of REITs to significantly reduce volatility and improve the Sharpe Ratio. The third test result fell in-line with expectations as we tested REITs against a portfolio specifically designed to resemble REITs, from a comovement perspective. The failure to reject the null in any of these tests, specifically the second, leads us to conclude that REITs fail to meet our fourth asset class criterion.

Pre-2007 Analyses

For robustness, one other question worth exploring is whether REITs' performance during and after the financial crisis drives the long-term results. We repeat our correlation, four- and six-factor analyses for the pre-2007 period, the results of which are in Exhibits 10, 11 and 12 in the appendix, respectively. The correlation of REITs with stocks over the pre-2007 period was lower but roughly similar to the result over the full period. In the four-factor model, REITs had an annualized alpha not distinguishable from zero and roughly similar factor exposures when compared to the full-period analysis. In the six-factor regression results for the pre-2007 period, we again see an annualized alpha estimate that is not statistically significant. We do see, however, that the loading on the IGDEF premium is now negative (but not statistically significant) compared to the full period six-factor regression that showed positive exposure to the IGDEF premium. This means that the post-2006 period is driving the full-period relationship for this particular factor. Overall, we do not find any results which suggest a structural break in the data and conclude that the period during and after the financial crisis does not drive the long-term results.

Post-May 1996 Analyses

Another question worth exploring is whether the earlier portion of our sample — when REITs were a meaningfully smaller portion of investable markets — is driving our findings. The introduction of REIT mutual funds in the 1990s allows us to address this question. We consider the period after the inception of Vanguard REIT Index Fund (VGSIX) to be a point-in-time at which the REIT market was large and diverse enough to allow individual and institutional investors to easily access diversified exposure to REITs. We repeat our correlation, four- and six-factor analyses, the results of which are in Exhibits 13, 14, and 15 in the appendix, respectively. The correlation of REITs with stocks over the post-May 1996 period was lower but roughly similar to the result over the full period. We do see however, correlations with 5YT have now become negative, which is consistent with the changes in the interest rates environment. In both the four-factor and six-factor model, REITs had an annualized alpha that is not statistically significant and roughly similar factor exposures when compared to the full-period analysis. Overall, we do not find any results which suggest a structural break in the data and conclude that post-May 1996 period did not produce significantly different results.

Conclusion

This study steps back from the body of REITs literature and evaluates a broader question: are REITs a distinct asset class? Studies tend to generally accept REITs as an asset class and seek to make comments on their diversification benefits or deserved allocations in a portfolio. We establish a pragmatic list of criteria for consideration as an asset class and then use an array of techniques to evaluate REITs as such. While REITs do indeed exhibit relatively low correlation with traditional equity and fixed income, a deeper dive into their returns reveal shortfalls in their qualifications for asset class distinction. Four- and six-factor regression analyses reveal no statistically reliable alpha generation in REIT returns and coefficient estimates point to REITs being well explained by traditional risk factors. Taking direction from the regression results and attempting a long-only replication of REIT returns with small-value and equities and long-term corporate bonds produces a portfolio that comoves well with REIT returns and exhibits historically superior return and risk characteristics. Utilizing tests of mean-variance spanning, we also examine the diversification properties of REITs on a statistically inferred basis. These tests suggest that REITs do not reliably improve the mean-variance frontier when added to a benchmark portfolio of traditional stocks and bonds. These results, and the associated failure to satisfy our asset class criteria, lead us to conclude that REITs are not a distinct asset class.

We would like to point out that this study used only U.S. based returns data. A large body of evidence suggests that an investor wishing to diversify their portfolio would do well to add developed international and emerging market equities. This study focused on U.S. stocks, bonds, and REITs primarily for increased sample lengths, as international REIT indexes are quite young. A global evaluation of REITs in the spirit of this study would be helpful but we leave this to future work.

In conclusion, we want to make clear that we are not suggesting that REITs deserve no allocation in an investment portfolio. Nor are we suggesting that any results previously brought forth in the literature are spurious or incorrect. The results of this study lead us only to suggest that REITs, as an equity security with only marginal diversification benefits, should not receive a weighting in investor portfolios that significantly deviates from market capitalization based weights. The Dow Jones U.S. Select REIT Index represents a non-trivial approximately 2.5 percent of the Russell 3000 Index, as of early 2017, on a market capitalization basis, which we would argue is a valid starting point for a REITs allocation in a diversified portfolio.[5]

Appendix

Exhibit 7: SIC Industry Classifications

Designation	Industry
NDUR	Consumer NonDurables - Food, Tobacco, Textiles, Apparel, Leather, Toys
DURB	Consumer Durables - Cars, TVs, Furniture, Household Appliances
MANUF	Manufacturing - Machinery, Trucks, Planes, Office Furniture, Paper, Commercial Printing
ENRG	Energy - Oil, Gas, and Coal Extraction and Products
CHEM	Chemicals and Allied Products
BUSEQ	Business Equipment - Computers, Software, and Electronic Equipment
TELCM	Telephone and Television Transmission
UTIL	Utilities
SHOPS	Wholesale, Retail, and some Services (Laundries, Repair Shops)
HLTH	Healthcare Medical Equipment, and Drugs
MONEY	Finance
OTHER	Other - Mines, Construction, Building Material, Business Services, Entertainment

Exhibit 8: Replicating Portfolio Exercise - Six-Factor Analysis (August 1988–July 2017)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	TERM	t-stat	IGDEF	t-stat	R-squared
[SV(66%), CORP(34%)]	63	1.6	0.64	70.7	0.57	52.6	0.48	41.5	-0.01	-1.0	0.57	20.4	0.52	14.4	98%
REITs	-133	-0.5	0.60	10.1	0.41	5.8	0.71	9.4	-0.08	-1.7	0.76	4.1	0.96	4.0	51%

[5] Bloomberg

Exhibit 9: Sharpe Ratio of Stock/Bond Portfolio By Allocation (January 1978–July 2017)

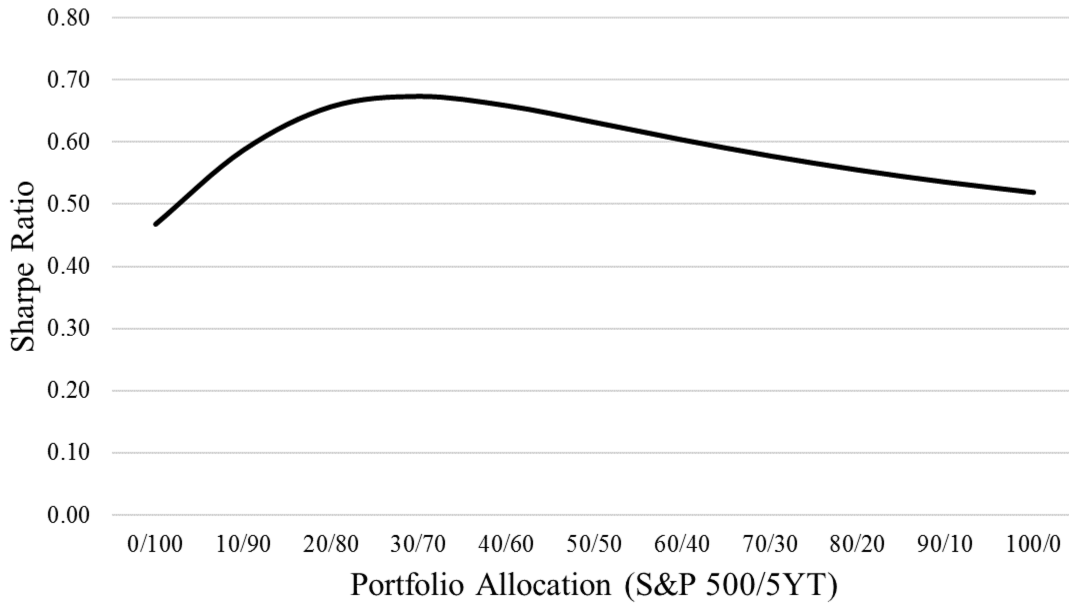

Exhibit 10: Pre-2007 Analysis - Monthly Correlations (January 1978–December 2006)

	REITs	SP500	5YT
REITs	1.00	0.51	0.16
SP500	0.51	1.00	0.17
5YT	0.16	0.17	1.00
BUSEQ	0.35	0.81	0.03
CHEM	0.49	0.83	0.14
DURB	0.47	0.78	0.04
ENRG	0.43	0.60	0.03
HLTH	0.35	0.76	0.24
MANUF	0.55	0.91	0.08
MONEY	0.57	0.86	0.25
NDUR	0.50	0.79	0.27
OTHER	0.60	0.90	0.10
SHOPS	0.50	0.84	0.14
TELCM	0.26	0.73	0.17
UTIL	0.45	0.50	0.37

Exhibit 11: Carhart Four-Factor Analysis (January 1978–December 2006)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	R-squared
BUSEQ	452	2.2	1.10	26.4	0.24	4.5	-0.75	-11.4	-0.23	-6.0	83%
HLTH	440	2.1	0.78	18.4	-0.29	-5.3	-0.22	-3.3	0.09	2.2	59%
NDUR	217	1.2	0.85	23.6	-0.12	-2.6	0.28	4.8	0.04	1.1	63%
TELCM	239	1.0	0.83	18.1	-0.20	-3.3	0.00	0.0	-0.13	-3.0	55%
SHOPS	50	0.3	1.05	27.6	0.08	1.6	0.16	2.6	-0.05	-1.4	73%
ENRG	46	0.2	0.88	14.6	-0.10	-1.4	0.40	4.1	0.08	1.5	39%
REITs	-2	0.0	0.65	15.1	0.46	8.3	0.63	9.3	0.00	-0.1	47%
MONEY	-30	-0.2	1.15	39.3	-0.12	-3.3	0.52	11.1	-0.03	-1.2	82%
CHEM	-55	-0.3	0.95	26.6	-0.13	-2.9	0.25	4.4	0.00	0.0	69%
MANUF	-55	-0.4	1.11	40.4	0.08	2.3	0.22	5.1	-0.06	-2.3	85%
UTIL	-139	-0.7	0.64	15.5	-0.16	-3.0	0.59	9.1	0.08	2.0	42%
DURB	-375	-1.7	1.18	25.8	0.14	2.4	0.57	7.8	-0.22	-5.1	68%
OTHER	-298	-2.3	1.10	43.3	0.23	7.1	0.15	3.8	-0.03	-1.3	88%

Exhibit 12: Six-Factor Analysis (August 1988–December 2006)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	TERM	t-stat	IGDEF	t-stat	R-squared
BUSEQ	517	1.9	1.26	18.4	0.23	3.3	-0.76	-8.7	-0.19	-3.8	-0.13	-0.7	0.12	0.2	83%
HLTH	486	1.7	0.70	9.8	-0.33	-4.5	-0.26	-2.9	0.09	1.7	0.11	0.5	-0.13	-0.3	47%
NDUR	161	0.7	0.79	13.5	-0.10	-1.7	0.30	4.1	-0.03	-0.8	0.28	1.8	-0.83	-2.0	52%
ENRG	231	0.7	0.73	8.3	0.02	0.3	0.50	4.4	-0.03	-0.5	0.07	0.3	-0.28	-0.4	28%
MANUF	61	0.4	1.15	27.0	0.10	2.4	0.39	7.2	-0.08	-2.5	-0.35	-3.0	-0.91	-2.9	82%
SHOPS	75	0.3	1.01	17.0	0.02	0.3	0.21	2.7	-0.05	-1.2	-0.26	-1.6	-0.31	-0.7	66%
CHEM	48	0.2	0.91	15.4	-0.10	-1.6	0.40	5.3	-0.01	-0.2	-0.32	-2.0	-0.92	-2.1	57%
REITs	37	0.1	0.49	7.4	0.46	6.6	0.67	7.7	-0.08	-1.6	0.43	2.3	-0.12	-0.2	36%
TELCM	-34	-0.1	0.96	13.3	-0.25	-3.4	-0.10	-1.1	-0.04	-0.8	0.07	0.3	0.48	0.9	61%
MONEY	-35	-0.2	1.20	24.9	-0.13	-2.6	0.60	9.7	-0.04	-1.0	0.14	1.1	-0.32	-0.9	80%
UTIL	-106	-0.4	0.56	8.1	-0.03	-0.5	0.64	7.3	0.00	0.1	0.53	2.9	-0.32	-0.6	35%
DURB	-527	-1.9	1.17	16.8	0.21	2.9	0.84	9.4	-0.23	-4.4	-0.35	-1.8	0.41	0.8	69%
OTHER	-329	-2.1	1.05	27.2	0.14	3.6	0.23	4.6	-0.06	-2.0	-0.23	-2.2	-0.11	-0.4	84%

Exhibit 13: Post-May 1996 Analysis - Monthly Correlations (June 1996–July 2017)

	REITs	SP500	5YT
REITs	1.00	0.55	-0.08
SP500	0.55	1.00	-0.25
5YT	-0.08	-0.25	1.00
BUSEQ	0.33	0.83	-0.26
CHEM	0.53	0.78	-0.19
DURB	0.60	0.78	-0.31
ENRG	0.35	0.59	-0.19
HLTH	0.39	0.69	-0.10
MANUF	0.58	0.90	-0.29
MONEY	0.59	0.85	-0.25
NDUR	0.50	0.72	-0.07
OTHER	0.61	0.91	-0.28
SHOPS	0.50	0.83	-0.24
TELCM	0.40	0.82	-0.24
UTIL	0.45	0.43	-0.01

Exhibit 14: Carhart Four-Factor Analysis (June 1996–July 2017)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	R-squared
NDUR	354	1.9	0.63	16.7	-0.21	-4.5	0.22	4.3	0.03	0.9	56%
HLTH	377	1.6	0.70	15.0	-0.21	-3.5	-0.03	-0.5	0.08	2.0	49%
BUSEQ	298	1.5	1.29	31.9	0.14	2.8	-0.80	-14.4	-0.12	-3.6	88%
UTIL	364	1.3	0.47	8.5	-0.16	-2.3	0.34	4.5	0.09	1.8	26%
SHOPS	199	1.0	0.85	22.4	-0.04	-0.8	0.14	2.8	-0.01	-0.2	70%
CHEM	168	0.9	0.78	19.9	-0.15	-3.0	0.28	5.1	0.00	-0.1	65%
REITs	287	0.8	0.72	10.6	0.37	4.3	0.76	8.2	-0.10	-1.7	48%
MANUF	135	0.8	1.11	33.7	0.09	2.1	0.30	6.6	-0.07	-2.4	85%
ENRG	99	0.3	0.82	11.7	0.00	0.0	0.40	4.2	0.05	0.8	39%
TELCM	-1	0.0	0.98	20.7	-0.18	-3.0	-0.13	-2.0	-0.06	-1.6	68%
DURB	-278	-1.0	1.20	20.9	0.24	3.3	0.59	7.5	-0.29	-6.0	74%
MONEY	-164	-1.0	1.15	35.0	-0.16	-3.9	0.67	14.8	-0.04	-1.6	86%
OTHER	-325	-2.5	1.04	39.3	0.11	3.2	0.23	6.3	-0.05	-2.4	89%

Exhibit 15: Six-Factor Analysis (June 1996–July 2017)

	Alpha (bps)	t-stat	MKT	t-stat	SMB	t-stat	HML	t-stat	UMD	t-stat	TERM	t-stat	IGDEF	t-stat	R-squared
BUSEQ	384	1.9	1.33	29.2	0.14	2.8	-0.80	-14.6	-0.13	-3.9	-0.29	-1.9	-0.40	-2.4	88%
HLTH	301	1.2	0.70	13.1	-0.20	-3.3	-0.03	-0.4	0.08	1.9	0.24	1.3	0.11	0.6	50%
NDUR	235	1.2	0.64	15.2	-0.19	-4.0	0.23	4.5	0.02	0.6	0.37	2.6	0.03	0.2	57%
SHOPS	213	1.1	0.88	20.5	-0.03	-0.6	0.15	2.8	-0.02	-0.5	-0.06	-0.5	-0.27	-1.8	71%
MANUF	150	0.9	1.07	28.7	0.07	1.7	0.30	6.5	-0.05	-1.8	-0.02	-0.2	0.28	2.1	86%
UTIL	220	0.8	0.39	6.4	-0.17	-2.4	0.34	4.6	0.11	2.3	0.49	2.4	0.77	3.5	30%
CHEM	133	0.7	0.76	17.0	-0.15	-3.0	0.28	5.1	0.00	0.1	0.12	0.8	0.21	1.3	65%
ENRG	110	0.3	0.72	9.1	-0.04	-0.4	0.39	4.1	0.08	1.4	0.02	0.1	0.77	2.7	41%
TELCM	42	0.2	0.97	17.9	-0.19	-3.1	-0.13	-2.0	-0.06	-1.4	-0.13	-0.7	0.02	0.1	68%
REITs	-22	-0.1	0.64	8.6	0.38	4.5	0.77	8.6	-0.08	-1.4	1.02	4.2	1.03	3.9	53%
DURB	-229	-0.8	1.10	17.0	0.20	2.7	0.58	7.4	-0.25	-5.1	-0.09	-0.4	0.75	3.2	75%
MONEY	-140	-0.8	1.17	31.2	-0.16	-3.7	0.67	14.8	-0.05	-1.7	-0.09	-0.7	-0.16	-1.2	87%
OTHER	-323	-2.4	1.05	34.8	0.11	3.3	0.23	6.4	-0.06	-2.5	-0.01	-0.1	-0.10	-0.9	89%

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