Serial Persistence in Equity REIT Returns

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Abstract: Annual and monthly REIT returns display statistically significant serial persistence, although the two types of persistence behavior are qualitatively different. By contrast, quarterly REIT returns do not display serial persistence. This strongly suggests that linear multifactor market models cannot describe REIT investment behavior. Annual REIT returns fail to reflect corresponding persistence behavior in underlying real estate precisely when the REITs are large enough to attract institutional investor interest. Institutional investors move in and out of large-capitalization REITs in ways that negatively impact investment returns.

Introduction

This study examines persistence in relative investment return performance for exchange-listed equity Real Estate Investment Trusts (REITs) during the ten-year interval January 1987 through December 1996. Cross-sectional total return data are compiled for monthly, quarterly, and annual sampling frequencies, and are further divided into large-capitalization and small-capitalization subgroups. Because some market observers suggest that the recent crop of equity REITs has different investment characteristics than earlier REIT securities, we also divide the sample interval into two subintervals at the end of 1992 to test whether there are statistically different results for each subinterval.

This work extends to liquid markets the results of earlier research by the authors, Young and Graff [1996, 1997], which found statistically significant serial persistence in annual returns from privately held real estate in the NCREIF database. Some researchers have suggested that the surprising persistence reported in those studies is the result of spuriously low observed volatility in appraisal-based returns from privately held real estate due to appraisal smoothing.[1] The discovery in the present study of similar persistence behavior in returns from NYSE and Amex securities should exorcise that criticism.

Tests in this study are nonparametric. *Serial independence* is used to describe asset returns for which return performance in each sample period relative to the REIT investment universe is unrelated to relative return performance in the subsequent sample period. *Positive (negative)*

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[1] Although never verified directly, appraisal smoothing remains popular among investment theorists because of its purported ability to explain the relatively high Sharpe ratio observed for real estate in the mid-1980s by implying that sample real estate volatility is biased downward from true real estate volatility. However, two recent developments, one purely theoretical and one empirically based, undermine the rationale for this concept: (1) Lai and Wang [1998] shows that, under modeling assumptions employed in all widely cited appraisal smoothing studies, appraisal smoothing cannot reduce observed volatility; and (2) Graff and Webb [1997] shows that appraisal smoothing would produce cross-sectional return distributions that are normal or platykurtic (i.e., zero or negative kurtosis), whereas it is known from previous empirical studies (e.g. Young and Graff [1995]) that cross-sectional returns are leptokurtic (i.e., positive kurtosis).

performance persistence is used to describe asset returns for which return performance in each sample period is more (less) likely to be observed in the subsequent sample period than would be expected if consecutive asset returns were serially independent.

The methodology in this study is as follows: for each monthly, quarterly, or annual sample period, we group individual REIT returns into quartiles and record the quartile rank for each period in which a return is also available for that REIT in the subsequent sample period. *Successful persistence* is then defined as the same quartile rank in the subsequent period, and *unsuccessful persistence* as a different quartile rank in the subsequent period. Since the returns are grouped into quartiles, the theoretical probability of repetitive quartile rankings is 25% if consecutive quartile rankings for each REIT are serially independent, the typical assumption made by researchers. Thus, statistically significant departures from 25% are deemed evidence of performance persistence.

Additional objectives of the study are to examine whether persistence behavior differs between returns of extreme-percentile rank and returns of moderate-percentile rank, and to examine whether persistence behavior is uniform within the respective subclasses of extreme and moderate returns. Accordingly, we choose quartiles over other quantiles in order to enhance the sensitivity of performance persistence tests by maximizing the number of samples within each quantile, subject to the constraint that there must be at least two quantiles within each subclass in order to test for persistence uniformity in the subclass.

We extend the methodology to longer runs by applying the same criteria for performance persistence in the period subsequent to a sequence of same-quartile rankings. Successful (unsuccessful) persistence is defined by analogy with the above case as the same (different) quartile rank in the sampling period immediately subsequent to the initial sequence of sampling periods. This enables us to examine whether the incidence of persistence depends solely on quartile rank for the immediately preceding sampling period, or whether the incidence of persistence is a function of quartile ranks over several preceding sampling periods.[2]

Although the tests in this study are based on nonparametric statistics, the tests themselves are not totally independent of specification of a class of statistical models for REIT returns. As will be discussed, the statistical test methodology is closely tied to the assumption that there is no linear factor model for REIT returns. While the validity of this assumption cannot be addressed directly, it can be examined indirectly by testing performance persistence over the test interval for several different sampling frequencies. It will be shown that there are qualitative differences in persistence results from the three sampling frequency tests, that this provides empirical support for the validity of the assumption, and that the assumption in turn supports the validity of the statistical test methodology.

Related Research

Questions about investment performance are inextricably tied to the issue of market efficiency. Consequently, bursts of attention are directed at performance evaluation whenever concerns arise

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[2] Sample numbers decline significantly as initial run length increases, weakening the sensitivity of tests based on multiperiod initial runs. Consequently, at this time these tests yield indications of results rather than definitive conclusions. However, due to the recent proliferation of REITs, these tests will be much more decisive towards the end of the next decade when ten to thirteen years of additional data are available.

about the existence of inefficiencies in securities markets. These bursts usually focus on performance evaluation within the mutual fund sector.

Prior to Jensen [1968], performance evaluation for mutual fund portfolios was limited to straight comparisons of fund returns with performance benchmarks. Such comparisons are clearly dependent on systematic return during the test interval. Accordingly, performance measures at that time were joint measures of market and management performance rather than pure management performance measures, although this limitation was not recognized by the investment industry.[3]

The Jensen study represents a conceptual leap forward in performance evaluation technology. The study uses the Capital Asset Pricing Model (CAPM) as a starting point for introduction of market-neutralized performance measures. More precisely, the study suggests that the constant terms that result from regressing individual mutual fund portfolio risk premia against a proxy for the market risk premium should be consistent estimators for true portfolio alphas, conditioned upon the assumption that a one-parameter linear market model is correct. In this case, the constants can be regarded as sample alphas, and are market-neutralized (i.e., risk-adjusted) estimates of the true extent to which portfolio managers outperform or underperform CAPM-efficient portfolios.[4]

Jensen [1968] also applies the methodology to an examination of sample alphas for individual mutual funds derived from fund returns in the test interval 1945-1964, with the S&P 500 Index as a proxy for the market index. The study determines the mean sample alpha for mutual funds to be negative but statistically indistinguishable from zero, and concludes this result to be consistent with the Efficient Market Hypothesis (EMH). In addition, the study shows the cross-sectional distribution of individual sample alphas during the test interval to be consistent with the distribution that would result from sample noise if all true mutual fund alphas are less than or equal to zero.[5] For nearly twenty years after publication of the study, the conclusions were regarded as definitive about investment behavior and the study was cited frequently as evidence supporting the EMH.

Questions about mutual fund alphas revived in the 1980s with the discovery of pockets of stock market inefficiency (i.e., “anomalies” in stock returns). Mutual fund returns have been subjected to several reexaminations since that time, usually with techniques based on the Jensen market-neutral methodology but over different test intervals. As multifactor market models emerged as potential alternatives to the CAPM, it was recognized generally that the market-neutral Jensen performance measures extend automatically to general linear market models. Not as widely acknowledged were practical shortcomings in the Jensen performance concept: Jensen

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[3] Jensen [1968] was not quite the first study to recognize the desirability of using the then-novel technology of Modern Portfolio Theory to develop mutual fund performance measures that are immunized with respect to market performance. Treynor [1965] had already suggested statistical measures that possess the market-neutral features of the Jensen model, and that have the additional desirable feature that they are normalized with respect to systematic risk exposure. However, Treynor [1965] explains its performance measures in terms of geometry of an efficient frontier, rather than in more intuitive algebraic terms such as employed in Jensen [1968]. This may have contributed to a general preference for the Jensen approach, although the two measurement models are closely related; see the discussion by Treynor accompanying Jensen [1968].

[4] Sample alphas are also frequently called *Jensen measures* in the finance literature.

[5] Jensen observes negative individual mutual fund alphas to be consistent with EMH, since unproductive investment research expenditures can result in negative true alphas in efficient markets.

measures are joint tests of investment performance and the market model rather than pure measures of investment performance, applicability of the Jensen model is limited to mutual funds that have constant investment styles over the test interval (i.e., stationary returns), and performance measures depend on the choice of proxies for systematic risk parameters as well as market model selection.

Ippolito [1989] examines mutual fund returns over the two-decade interval 1965-1984 with the Jensen methodology, the one-parameter market model, and the same market index proxy used in the Jensen study. The Ippolito study determines mean sample alpha during the test interval to be positive and statistically significant after trading costs and management fees. However, the study concludes the results to be consistent with EMH because sample alphas are not large enough on average to cover mutual fund load charges.

Lehman and Modest [1987] shows that individual sample alphas can be extremely sensitive to the selection of a market index proxy for either one-parameter or multifactor market models. Elton et al. [1993] extends these results and applies the conclusions to reconcile differences between the results of Jensen [1968] and Ippolito [1989]. More precisely, Elton et al. [1993] shows that use of the S&P 500 Index as a market proxy by both Jensen [1968] and Ippolito [1989] together with inclusion of non-S&P stocks in mutual fund portfolios produces typically negative mutual fund alphas during the test interval examined by Jensen but produces typically positive fund alphas during the test interval examined by Ippolito.

Other directions for research suggested by the existence of stock return anomalies include a reexamination of whether it is possible for mutual fund management to outperform market benchmarks or other mutual funds on a consistent basis after allowance for investor expenses (market efficiency in the context of mutual funds), and whether it is possible for investors to identify high-performance funds on an ex ante basis. The latter research direction raises the question of whether persistence exists in mutual fund performance measures, and leads to nonparametric test methodologies related directly to the methodology in the present study.

Grinblatt and Titman [1992] examines the ability of risk-adjusted mutual fund returns from the first half of the test interval 1975-1984 to predict risk-adjusted returns from the second half of the test interval. The study determines that relative performance has significant predictive ability for up to two years in the future, with strongest results for a one-year predictive time frame. The study also shows that the persistence is not due to survivor bias or to any known stock return anomaly. The study also cites work in progress for Jegadeesh and Titman [1993] showing the existence of significant persistence in individual risk-adjusted stock returns over the test interval 1965-1989 as potential evidence that persistence in stock returns may contribute to the appearance of portfolio management talent in mutual fund managers. This possibility is examined more thoroughly in Grinblatt, Titman, and Wermers [1995], where it is determined that a majority of mutual funds pursue momentum-based stock selection strategies. This follow-on study concludes that performance persistence in mutual fund returns observed by Grinblatt and Titman [1992] is a reflection of performance momentum observed in individual stock returns by Jegadeesh and Titman [1993], and is likely to continue only as long as individual stock returns continue to display performance momentum.

Hendricks et al. [1993] investigates relative performance for returns from no-load mutual funds over the test interval 1974-1988. The study assigns octile ranks to mutual funds every quarter on the basis of excessive risk-adjusted returns from the preceding quarters, and forms octile portfolios designed to neutralize survivorship bias. The study determines that average risk-adjusted return is a strictly increasing function of octile rank for this portfolio strategy, and that the top-octile portfolio return averages approximately 6% per year more than the lowest-octile portfolio. The study also determines that the spread between top- and bottom-octile portfolios is not a proxy for any known stock market return anomaly.

Goetzmann and Ibbotson [1994] examines return performance within the mutual fund universe over the test interval 1976-1987. The study considers the two cases of unadjusted returns and risk-adjusted returns (i.e., alphas). The primary persistence test methodology is nonparametric. More precisely, the methodology is based on the classification of sample values for both unadjusted and risk-adjusted cases into winners and losers, or into quartiles. The study examines the incidence of performance persistence for biannual, annual, monthly, and triennial sampling frequencies. Finally, the study employs a secondary persistence test methodology in the case of risk-adjusted returns, regressing alphas from each sample period on alphas from the preceding sample period for three of the four sampling frequencies. The study determines these regression coefficients to be significant in all cases. The study concludes that there is useful evidence of predictability in persistence test results for both unadjusted and risk-adjusted returns, for all sampling frequencies, and for both test methodologies.

Finally, Brown et al. [1992] investigates the contribution of survivorship bias to performance persistence in parametric and nonparametric tests. The study shows that survivorship can give rise to spurious evidence of performance persistence, but concludes that the question of whether this spurious persistence is enough to account for the results in Goetzmann and Ibbotson [1994] is unanswered. The study also suggests that underperforming funds appear to account for most of the performance persistence observed in Hendricks et al. [1993].

Data

Investment returns for this study are compiled from daily stock price, dividend, and market capitalization data between 1987 and 1996 on NYSE-listed and Amex-listed equity REITs supplied by IDC, a major vendor of securities data.[6] We compute monthly, quarterly, and annual returns for each REIT from the daily IDC data.

The IDC REIT universe includes two examples of a group of equity REITs sponsored by a single manager, such that each manager employs essentially the same investment strategy for all REITs in its respective group. Within each group, prices march in lockstep with one another, and returns are virtually identical. Accordingly, we combine returns for the three issues of Meridian Point Realty Trust with the ticker symbols MPF, MPG, and MPH into a single data series, excluding the issues with symbols MPF.PR, MPG.PR, and MPH.PR from consideration since preferred stock issues were not relevant to the present study. Similarly, we combine returns for fifteen Public Storage issues having ticker symbols PSB, PSF, PSH, PSJ, PSK, PSL, PSM, PSN, PSP, PSQ, PSU, PSV, PSW, PSY, and PSZ into a single return series. Exhibit 1 shows the number of NYSE and Amex-listed equity REITs with daily reported transaction prices and dividends for the complete month of January of each year, adjusted for these consolidations.

Institutional investors have paid increasingly close attention to REITs since the flurry of IPOs began in earnest in 1993. From January 1993 to January 1994 the equity REIT universe expanded from 68 to 100 securities, as shown in Exhibit 1. For this reason, and because some

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[6] There were 136 NYSE and Amex-listed equity REITs as of December 31, 1996.

market analysts have suggested that the recent crop of equity REITs is different from the earlier generation of REITs, we also divide the data set by 1987-through-1992 and 1993-through-1996 subintervals.

The $100 million capitalization level is a critical hurdle from the perspective of institutional investors: most institutions consider REITs with smaller capitalizations as inappropriate for their investment portfolios, whereas REITs with capitalizations of $100 million and above are usually included in the universe of potential investment opportunities. Implicitly acknowledging this criterion, several prominent published indices of REIT performance use $100 million as the minimum market capitalization for inclusion in the index.

Accordingly, we also divide the data set into two categories: “large capitalization” REITs having a market capitalization of $100 million or greater, and “small capitalization” REITs having less than $100 million in market capitalization. In the case of annual data, we do not further subdivide these categories into two temporal subsets because the resulting sample sizes are too small. Although we subdivide these categories temporally in the case of quarterly and monthly data, only the large-capitalization cases are presented in the exhibits since they are the only cases to generate noteworthy results.

Persistence Test

For each sample period in the interval 1987 through 1996, the total returns for each REIT are assigned quartile rankings. As previously discussed, within each quartile group we examine the incidence of serial runs of uniform quartile rank. Our test statistic is the sample incidence of successful persistence, i.e., the observed rate at which a repetitive quartile rank occurs in the period immediately subsequent to a run of identical quartile rankings over one, two, or three sample periods. Thus the shortest time interval covered by the ex ante run for the test statistic is for monthly sampling frequencies and equals one month; the longest time interval covered by the ex ante run is for annual sampling frequencies and equals three years. Accordingly, although calculated for different sampling frequencies, the time interval covered by successful ex post runs range from two months to four years.

Our null hypothesis is that the quartiles ranks of the REIT returns are serially independent.[7] This implies that the probability of a return quartile rank remaining the same from one sample period to the next is 25%. Thus, statistically significant departures from 25% are considered statistical justification for rejection of the null hypothesis, i.e., evidence of performance persistence.

We aggregate the quartiles into two larger subclasses by designating returns in the two extremes quartiles as our proxy for extreme returns, and returns in the two middle quartiles as our proxy for moderate returns. Within each subclass, the sample incidence of successful persistence is then defined to be the combined number of occurrences of successful quartile persistence in the two component quartiles divided by the combined number of samples in the two quartiles.[8]

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[7] This statement is less restrictive than the assertion that the returns are independent across time.

[8] An alternative approach to performance persistence in extreme and moderate returns would be to define the test statistic directly in terms of the incidence of repetitive performance within the two subclasses. However, this definition has the unacceptable drawback that a REIT return that falls within one extreme quartile during any sample period (e.g., first quartile) and in the other extreme quartile during the following period (e.g., fourth quartile) would be included erroneously among the persistent extreme returns, since it falls within the subclass of extreme returns during both periods.

If returns within each component quartile are serially independent, then it follows that the expected value of sample persistence within the subclass is 25%. Thus, the test for performance persistence in the component quartiles extends immediately to a test for performance persistence in the larger subclasses of extreme and moderate returns.

For each sample period we let statistical software determine the 25th, 50th (median), and 75th percentile breakpoints, and then defined the quartile groupings as follows: returns greater than the 75th percentile breakpoint constitute the 1st Quartile, returns greater than or equal to the 50th percentile breakpoint and less than or equal to the 75th percentile breakpoint constitute the 2nd Quartile, returns greater than or equal to the 25th percentile breakpoint and less than the 50th percentile breakpoint constitute the 3rd Quartile, and returns less than the 25th percentile breakpoint constitute the 4th Quartile.

Since the number of REIT returns is usually not divisible by four, the numbers of sample returns in the quartiles are not always quite equal. When this is the case, it follows from the definition of the quartiles that there is a slight bias against the extreme quartiles and toward the moderate quartiles. More precisely, the priority for enlarging quartile groups as the number of return samples increases is as follows: first, the 2nd Quartile; then the 3rd Quartile; next, the 1st Quartile; and finally, the 4th Quartile.

In addition, the monthly return data exhibit a considerable number of return values that are precisely "zero." Since zero percent often coincides with the median cross-sectional REIT return as well, our quartile grouping scheme results in more bias toward the size of every 2nd Quartile group shown in Exhibit 4 (and accordingly, against the sizes of the three remaining quartile groups) than would otherwise be expected solely on the basis of the quartile group definitions.

Even assuming the validity of the null hypothesis, size bias in the monthly sample quartile groups perturbs the ex ante probability of serial persistence for each quartile rank slightly from its theoretical value of 25%, increasing the probability of serial persistence in the case of the 2nd Quartile and decreasing the probabilities of persistence slightly in the case of the other three quartiles. Accordingly, we examine the effect of perturbing the probability of serial persistence for each monthly quartile group to allow for empirically determined size bias. We find that the perturbation adjustment has virtually no effect on results for the extreme quartiles and only marginal effect on results for the moderate quartiles, as will be discussed below with the test results.

Confidence Interval Estimation

To ascertain whether quartile performance is serially dependent, we calculate confidence intervals for the binomial distribution under the assumption that the probability of repeating quartile performance is 25%. In this case, the sample statistic is the percent of sample returns for which the quartile rank during each initial specified sequence of sampling periods equals the quartile rank in the immediately subsequent sample period. The critical question is whether or not the sample statistic is statistically distinct from 25%.

For a $q\%$ confidence interval and n samples, the upper end point of the confidence interval is m/n, where the cumulative probability of m or fewer successes is at least $(1+.01*q)/2$ and the cumulative probability of $m-1$ or fewer successes is less than $(1+.01*q)/2$. Similarly, the lower end point of the confidence interval is k/n, where the cumulative probability of k successes is at least $(1-.01*q)/2$ and the cumulative probability of $k-1$ or fewer successes is less than $(1-.01*q)/2$.

Since the binomial distribution is discrete, the sample statistic can only assume a finite number of potential values between 0 and 1. Thus, in contrast to smooth probability distributions, there is a positive probability that a sample value for the statistic can equal one of the end points of a *q%* confidence interval. In order to avoid confusion in such a case about whether or not the sample value is within the confidence interval, the left end point of the *q%* confidence interval is reported in the exhibits as $(m+1/2)/n$, and the right end point of the confidence interval is reported as $(k-1/2)/n$.[9] Since $(m+1/2)/n$ and $(k-1/2)/n$ cannot occur as sample values (each is midway between two possible sample values for the binomial distribution), each sample value reported in the exhibits is either unambiguously inside or outside each confidence interval.

The standard determination of confidence intervals for the binomial distribution is based on the assumption that samples from the distribution are independent. Since pairs of successive REIT return rankings for different REITs in the same years are treated as distinct samples in this study, it follows that there is an implicit assumption under the null hypothesis that each persistence test sample is independent of samples for other REITs in the same year. This assumption would be questionable were a linear factor model to exist that could describe the variance of REIT returns in terms of a small number of parameters. Since some linear factor models would reduce the number of degrees of freedom in large test samples, in turn reducing the sensitivity of tests of the null hypothesis by expanding the widths of confidence intervals around the true probability of 25% for serial persistence.[10]

Concern about this potential complication is lessened by recent evidence that linear factor models cannot describe a significant percentage of the variance of returns on privately held institutional-grade real estate.[11] Consequently, it is reasonable a priori to expect that linear factor models do not describe REIT returns, at least to the extent that REIT returns are believed to track the returns on underlying REIT real estate portfolios.

Resolution of the factor model question in the case of REIT returns provides an additional rationale for the decision to report results of performance persistence tests for several different sampling frequencies. Although it is not possible to address directly the extent to which REIT returns reflect investment returns on their underlying real estate portfolios, it is apparent that qualitatively distinct persistence behavior for different sampling frequencies would provide strong evidence against the existence of a linear factor model for REIT returns.[12] Accordingly, the three

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[9] Since the range of the binomial distribution is the closed unit interval [0,1], in order to avoid confusion the end points of the confidence interval are not expanded by $1/(2*n)$ in the extreme cases $m=n$ or $k=0$.

[10] It is well known that factor models exist that describe substantial portions of asset return variance in major stock and bond classes such as the S&P 500 and the constituent issues of the Lehman Brothers Government/Corporate Bond Index. It follows that the null hypothesis in the performance persistence test cannot be rejected for these asset classes solely on the basis of confidence intervals computed from the binomial distribution, although such confidence intervals do provide sufficient criteria for acceptance of the null hypothesis. This suggests that applicability of the statistical methodology in this study is limited in scope. However, it is reasonable to expect that the methodology can be applied to test performance persistence in narrowly defined stock and bond subclasses such as REITs.

[11] See Graff and Young [1996], Young and Graff [1996], and Graff and Webb [1997].

[12] Direct examination of the extent to which REIT returns reflect returns on underlying REIT real estate portfolios would only be possible if REITs were to allow periodic independent appraisals of the properties in their portfolios. However, this is contrary to industrywide REIT reporting policy that has not wavered since industry inception.

persistence tests together can be viewed as a qualitative test for the nonexistence of a linear factor model for REIT returns.[13]

As will be seen in the following sections, empirical evidence of qualitative differences in persistence results from the three separate sampling frequency tests is compelling, providing strong support for the assumption of sample independence that underlies the persistence test analysis.

Empirical Results

Data analysis reveals the surprising result that the key determinant of serial persistence in REIT returns throughout the test interval is sample frequency: annual returns, quarterly returns, and monthly returns display qualitatively distinct forms of persistence behavior during the test interval that differ too much for attribution to sampling error. Furthermore, for each sample frequency, persistence behavior remains consistent as the data set is decomposed by subinterval or market capitalization. For these reasons, test results are grouped into three exhibits according to sample frequency: Exhibit 2 for annual returns, Exhibit 3 for quarterly returns, and Exhibit 4 for monthly returns.

Exhibit 2 shows that annual returns display statistically significant sample persistence in the extreme (i.e., combined first and fourth) quartiles in four out of five tests, whereas sample persistence statistics are indistinguishable from 25% for the moderate (i.e., combined second and third) quartiles in each of the five tests. This is the same qualitative serial persistence behavior observed by Young and Graff [1996, 1997] for annual appraisal-based returns from the NCREIF data base, suggesting that annual REIT returns contain a component that tracks the qualitative performance of underlying real estate assets relative to the universe of privately-held institutional real estate.

Panels B and C show that serial persistence within extreme quartiles appears to be greater during the interval 1987-1992 than during the more recent interval 1993-1996, although sample persistence is statistically distinguishable from 25% during both subintervals. As shown by panels D and E, evidence of serial persistence vanishes when data are divided into returns from large-capitalization and small-capitalization REITs; an explanation for this is not apparent at this time.

Sample persistence for annual returns is statistically indistinguishable across extreme quartiles in each of the five panels. Similarly, sample persistence is statistically indistinguishable across moderate quartiles in each of the five panels, although the statistical equivalence of test values is borderline in the case of the (ex ante) run of length one in panel B. This is consistent with the assumption that serial persistence is homogeneous within both extreme and moderate annual returns. In addition, in every case sample persistence for runs of length two and three is statistically indistinguishable from sample persistence for runs of length one. This is consistent with the assumption that serial persistence in annual returns is independent of quartile return ranks for sample periods prior to the most recent period.

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[13] This could be extended by Monte Carlo simulation to a quantitative test for any specified candidate factor model for REIT returns and specified multivariate stochastic process for generating sample values for the model input parameters. However, since a separate simulation would be necessary for each specified factor model and stochastic process for model input, quantitative verification for all factor models is beyond the practical limitations of any Monte Carlo technique.

It is important to note that the relatively small number of annual REIT returns available for this study—732 annual returns in Exhibit 2, versus 3,249 quarterly REIT returns in Exhibit 3, and 10,156 monthly returns in Exhibit 4—implies that confidence intervals are larger in the case of annual REIT returns than in the other two cases examined in this study. It follows that serial persistence tests on annual returns are less sensitive than in the other cases. Thus signal weakness in annual returns should not be viewed as evidence that persistence is weaker in this case than persistence in monthly returns, but rather as a limitation imposed by the paucity of annual return data.

By contrast with results for annual returns, Exhibit 3 shows that sample persistence for quarterly REIT returns is statistically indistinguishable from 25% in all quartiles for runs of length one. However, a few scattered persistence statistics for the moderate quartiles are statistically significant in the case of runs of length two and three. While any set of multiple tests can produce a small percentage of statistically significant test values by chance (Type I test errors), there are more of these statistically significant test values than should occur by chance. This suggests that the statistically significant test values signal the existence of some underlying economic effect, albeit one that affects no more than one-fourth of the returns in each quartile.

Sample persistence for quarterly returns is statistically indistinguishable across extreme quartiles in each of the five panels and for each run length. Similarly, sample persistence is statistically indistinguishable across moderate quartiles in each of the five panels and for each run length. This is consistent with the assumption that serial persistence is homogeneous within both extreme and moderate quarterly returns.

It follows from the statistically significant test values in panel A that sample persistence within both the fourth quartile and the combined extreme quartiles varies statistically across runs of length one and two. Similarly, it follows from the statistically significant test values in panel C that sample persistence within the combined moderate quartiles varies statistically across runs of length one and three. This suggests that serial persistence in quarterly returns is dependent upon quartile ranks for at least three preceding sample periods.

Exhibit 4 shows that serial persistence for monthly returns represents a third distinct type of behavior, qualitatively different from persistence behavior for the other two sampling frequencies. To begin with, in the case of extreme-quartile returns, every panel in the exhibit except the one for small-capitalization REITs displays negative serial persistence, i.e., a statistically significant test statistic *below* 25%. This can be traced to the fact that every first-quartile persistence statistic except for small-capitalization REITs displays similar negative persistence. Corresponding fourth-quartile returns change from positive serial persistence in the subinterval 1987-1992 to negative persistence in the subinterval 1993-1996.

Interestingly, panels B through E of the exhibit show that first-quartile negative persistence is more pronounced in large-capitalization monthly returns than in small-capitalization monthly returns, and that negative persistence is more pronounced in the recent test subinterval than in the earlier subinterval. Panels F and G confirm that corresponding fourth-quartile negative persistence is a large-capitalization effect, due entirely to negative persistence in the recent subinterval (1993-1996) data.

By contrast, second-quartile and corresponding moderate-quartile (i.e., combined second and third) persistence test statistics hover around or slightly above the edge of statistical significance in all panels except the small-capitalization issues, where the test statistic is highly significant; and third-quartile persistence test statistics are insignificant in all seven panels.

The borderline significance of the second-quartile test statistics in panels A and B is explained completely by the contribution from small-capitalization REITs. The exceptionally significant second-quartile test statistic for small-capitalization REITs can be explained in turn by noticing that, in the case of inactively traded small-capitalization stocks, stock prices are determined by a small number of designated institutional market makers from a potential trading range within which investor supply and demand pressure remains essentially constant. Market makers for such stocks have an economic incentive to maintain constant buy and sell prices in the absence of significant incremental investment information that might alter the trading range, because their stock inventories are financed by callable short-term loans collateralized primarily by inventory market value. Since at least two-thirds of monthly stock returns consist entirely of capital gains (dividends virtually never are declared more than once per quarter), this translates into a significant number of 0.00% monthly returns.

It is a virtual certainty that a 0.00% monthly return will fall within either the second or third quartile, and usually within the same quartile in successive months in the absence of a shift in market sector behavior. Thus, the probability of repetitious quartile rankings for such monthly returns is closer to 67% than to 25%. This creates upward pressure on monthly persistence test statistics in the middle quartiles, primarily in the least actively traded smaller capitalization issues as observed in Exhibit 4.

In short, the borderline aggregate significance of serial persistence for moderate monthly returns can be understood as the average effect of a high probability of serial persistence for a small number of small-capitalization REIT issues and serial independence for most moderate monthly REIT returns.

Empirically, the 0.00% small-capitalization returns usually turn out to be contained in the second quartile. This implies that serial persistence should be greater for the second quartile than for the third quartile in the case of small-capitalization REITs, and it is reasonable to expect the difference between moderate-quartile test values to be large enough for the test values to be statistically distinct. As expected, for runs of length one in panel E, second quartile sample persistence is larger than fourth-quartile sample persistence, and the two test values are statistically distinct.

Similarly, sample persistence in monthly returns varies statistically across the two extreme quartiles in both panels A and C for runs of length one, although the difference between test values for the two extreme quartiles in panel C is entirely responsible for the difference between test values for the two extreme quartiles in panel A. Thus, serial persistence is inhomogeneous within both extreme and moderate monthly returns.

By contrast, sample persistence in runs of length two and three is statistically indistinguishable in every case from persistence in runs of length one. This is consistent with the assumption that serial persistence in monthly returns is independent of quartile return ranks from sample periods prior to the most recent period.

In the analysis for each exhibit, a potential source of distortion in the significance of persistence test statistics is the uneven weighting of the sample quartiles due to the assignment of extra samples to the middle quartiles when sample sizes were not evenly divisible by four, and (in the case of monthly data only) due to the existence of multiple returns exactly equal to 0.00% at the boundary of one of the middle quartiles. To test the magnitude of this distortion on the data analysis, we perturbed the 25% probability of persistence in the case of serial independence to allow for differing sample sizes and examined the effect on test value significance. With the exception of the just-discussed case of borderline serial persistence in moderate monthly returns, in no case did this substitution transform a sample test statistic that was significantly different from the theoretical value for serial independence to a statistic that was insignificantly different from the theoretical value; and in every instance the number of asterisks following the test statistic was either unchanged or reduced by at most one.

Persistence in Efficient Markets

Intuition suggests that positive performance persistence can be generated in an informationally efficient market if the variation in expected asset returns across the market is sufficiently large relative to the average magnitude of asset-specific risk. Accordingly, it is necessary to investigate whether this scenario can arise in the case of annual REIT returns before making alternative inferences about REIT market behavior from empirical results about REIT returns derived in the previous section.

In order to simplify the presentation of these results, it is assumed in this section that stock returns are described by the Capital Asset Pricing Model (CAPM). However, the results can be verified in general with only slight modifications if asset returns are assumed to be described by an arbitrary linear market model.

The CAPM assumes that probability distributions for equity risk premia can be regarded as stationary over a not-too-lengthy multiyear interval and that annual equity returns for each asset p in each year n of the interval can be expressed in terms of the annual market (index) return $r_M(n)$ and the risk-free annual rate $r_F(n)$ by the equation

$$r_p(n) - r_F(n) = \beta(r_M(n) - r_F(n)) + \varepsilon_p(n) \quad , \qquad (1)$$

where the true beta β_p and the true standard deviation of $\varepsilon_p(n)$ are assumed constant across the interval for each asset p.[14]

Since this section is concerned with examination of the maximum possible performance persistence that can be generated in the REIT universe under conditions of market efficiency, the remainder of this section is restricted to the examination of returns over two consecutive sampling periods. To simplify the exposition, it is also assumed that the risk-free rate, $r_F(n)$, can be regarded as constant over the two sampling periods.

It is straightforward to verify that, once the average market return across the two sampling periods is specified, ex ante performance persistence is maximized as a function of market return precisely when the market return function is held constant. Thus, in any investigation of the maximum effect market return can exert on performance persistence, it suffices to examine the effect of average market return on persistence under the constraint that market return is held constant.

Monte Carlo simulation is the natural tool to test whether persistence is possible in an efficient market when assets are assumed to have the investment characteristics of REITs. Since the purpose of the test is to determine the maximum serial persistence that can arise under various market conditions, it is sufficient to define REIT returns for purposes of Monte Carlo simulation as follows:

$$r_p(n) = \mu_p + \varepsilon_p(n) \quad , \qquad (2)$$

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[14] The assumptions and implications of the CAPM are described in great detail in virtually any reference on investment theory published in the 1970s or 1980s. For example, see Fama [1976] or Fama and Miller [1972].

where $r_p(n)$ is the actual market return for REIT p in year n, μ_p is the expected return for REIT p ex post systematic risk, and $\varepsilon_p(n)$ is the asset-specific risk for REIT p in sample period n for $n=1,2$. Since $\varepsilon_p(n)$ is asset-specific risk, $\varepsilon_p(n)$ is assumed to be a normally distributed random variable with zero mean and 14% standard deviation such that $\varepsilon_p(n)$ and $\varepsilon_q(n)$ are independent for $p\neq q$.[15] In addition, asset-specific risk is assumed to be informationally efficient, which implies that $\varepsilon_p(n)$ and $\varepsilon_q(m)$ are independent for $n\neq m$. Finally, the distribution of expected REIT returns is assumed to be normal.

Exhibit 5 presents the results of fifteen Monte Carlo simulations, each of which estimates sample persistence for extreme and moderate returns from 10,000 pairs of consecutive Monte Carlo returns.[16] In each simulation, the expected return μ_p for each REIT p is a Monte Carlo sample from a normal distribution with the standard deviation specified in the first column of the exhibit and an arbitrarily specified mean.[17] The simulations together demonstrate the effect that the standard deviation of expected REIT returns has on performance persistence for sufficiently large values of the standard deviation under the joint assumption that expected REIT returns are normally distributed and the true standard deviation of asset-specific risk is constant across the REIT universe.

The second and third columns of Exhibit 5 display the expected incidence of persistence in extreme and moderate annual REIT returns respectively. The last two columns in Exhibit 5 illustrate the difference between the spread in expected returns and the expected spread in observed returns and show that it is not practical to infer the spread in expected REIT returns from observed spreads in sample REIT returns.[18]

Exhibit 5 shows that the standard deviation of expected returns must be at least seven percent to generate the minimum statistically significant performance persistence of 33% observed for

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[15] The average sample standard deviation for REIT annual returns during the test interval across the set of REITs in this study is 15.3%, compared with a standard deviation of 13.3% over the same interval for annual returns from the S&P 500 Index. Based on annual returns, the value-weighted average of individual NAREIT sample betas during the test interval is approximately one-half. Assuming the S&P 500 Index to be an acceptable proxy for the market index, this suggests a representative value for standard deviation of asset-specific risk of

$$\sigma(\varepsilon_p(n)) = ((15.3\%)^2 - ((1/2)^2(13.3\%)^2)^{0.5} \approx 14\%.$$

[16] The quartile data used for Exhibit 5 enables the standard deviation of sample persistence to be estimated by computing sample persistence separately for the four quartiles. The simulation model has the attribute that persistence for the extreme and moderate return subclasses is uniform across the component quartiles of each subclass. It follows that persistence variance in each return subclass can be estimated from sample persistence in the two component quartiles. The Central Limit Theorem implies that the distribution for sample persistence is asymptotically normal, which implies that division of each sample variance by two is sufficient to adjust for the fact that each quartile contains only half as many samples as the entire return subclass. A set of 30 sample variances results from fifteen values for the standard deviation of expected returns and two sample variances for each value (for extreme and moderate returns respectively). The distribution of sample variances is consistent with the hypothesis that variance is constant across the two return subclasses and the standard deviations of expected returns, suggesting that the true variance can be estimated more accurately for all cases by averaging the sample variances. This variance estimate yields a sample standard deviation for performance persistence of 0.48%. Based on this value, sample persistence in Exhibit 5 is reported to two significant figures.

[17] Although specification of a mean value is necessary in order to define the distribution of cross-sectional expected returns, serial persistence in model returns is independent of the particular value selected.

[18] The two parameters are related analytically by the equation $\sigma^2(r_{(0)}(n)) = \sigma^2(\mu_{(0)}) + \sigma^2(\varepsilon)$. It follows that $\sigma(r_{(0)}(n)) \approx \sigma(\varepsilon) = 14\%$ for sufficiently small values of the spread in expected REIT returns (e.g., for $\sigma(\mu_{(0)}) \langle 8\%$). After allowance for sample noise, this suggests that all sufficiently small values for $\sigma(\mu_{(0)})$ imply the same range for the sample standard deviation of cross-sectional REIT returns.

extreme annual returns in panels A, B, C, and E of Exhibit 2. In a REIT universe with more than 40 assets, it follows that the spread in normally distributed expected returns (i.e., the difference between highest and lowest expected returns) is more than four times the standard deviation. Consequently, the spread in expected REIT returns must be more than 28% in order to generate the performance persistence observed for extreme annual returns in Exhibit 2.

Equations (1) and (2) imply that $\mu_p = r_F + \beta(r_M - r_F)$, where r_M is regarded as constant across the two sampling periods in order to maximize implied performance persistence. It follows that the standard deviation of expected REIT returns is given by the following equation:

$$\sigma(\mu_{(0)}) = \sigma(\beta_{(0)}) * | r_M - r_F | \ . \tag{3}$$

Accordingly, the spread of expected REIT returns across the REIT universe equals the spread of true REIT betas multiplied by a scale factor equal to the magnitude of the difference between the ex post market return and the risk-free return.

REIT investment characteristics imply that REITs are basically low-risk income vehicles. This strongly suggests that true REIT betas are contained in the interval between zero and one.[19] In particular, it strongly suggests that the spread of true REIT betas is less than or equal to one.[20] Thus, it follows from equation (3) that the spread in expected REIT returns is less than or equal to $| r_M - r_F |$. Since the spread in expected returns must be more than 28% in order to generate the performance persistence reported in Exhibit 2, it follows that $| r_M - r_F | \rangle 28\%$ if variation in REIT systematic risk is to generate the performance persistence reported in Exhibit 2.

This inequality allows the two possibilities that r_M is either a positive or negative percentage of large magnitude. However, the solutions are to be applied to explain sample persistence in annual returns during the interval 1987-1996. This particular interval was a period of generally rising market prices. More precisely, it was a period in which there were no highly negative market index returns for any calendar year, and no consecutive calendar years in which annual market index returns were negative for both years. Thus, negative solutions to the inequality for r_M cannot contribute to an explanation for sample persistence in annual REIT returns during the years considered in this study.

The only remaining possibility for generating the four statistically significant persistence samples in Exhibit 2 is if the inequality $r_M - r_F \rangle 28\%$ is true, i.e., if $r_M \rangle 28\% + r_F$. The standard proxy for r_F is the one-year Treasury bill rate. As Exhibit 6 shows, this rate is at least 3.6% at the beginning of every year in the test interval 1987-1996, and usually higher. This implies that the market ex post return must average more than 32% over any two-year subinterval of the interval

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[19] High-beta stocks represent companies whose future operating earnings are more dependent on future levels of macroeconomic activity than typical businesses, e.g., companies in growth industries or extremely leveraged high-risk enterprises. Negative-beta stocks represent companies whose future operating earnings are negatively correlated with future macroeconomic activity; standard examples cited in the investment literature are gold mining companies. By contrast, economic characteristics of future REIT operating earnings are both more predictable than most companies and relatively unaffected by changes in macroeconomic activity levels.

[20] A regression of annual returns for the NAREIT Index on annual returns for the S&P 500 Index over the interval 1987-1996 yields the value of 0.56 for the sample beta of the NAREIT Index over that interval (cf. note 15). Since systematic risk is an additive function, it follows that the value-weighted average of individual REIT sample betas across the NAREIT universe is also approximately 0.56 (the average beta would be exactly 0.56 if all NAREIT return series were defined over the entire interval). This suggests that true NAREIT betas are symmetrically distributed about a mean value that is approximately equal to one-half, thus providing additional support for the collateral assumption that all true NAREIT betas are contained within the unit interval.

1987-1996 in order to account for persistence in extreme REIT returns of 33% during that two-year subinterval alone.

Exhibit 6 shows that the two-year running average of annual S&P 500 Index returns is never as high as 32% during the test interval, that the two-year average exceeds 30% only once during the interval, and that annual returns for the S&P 500 Index average only 17.16% over the ten-year interval 1987-1996. Thus, it is apparent from Exhibit 5 that, while cross-sectional variation in REIT systematic risk can account for some of the excess performance persistence observed in this study (i.e., sample persistence in excess of 25%) for annual REIT returns, more than two-thirds of the observed excess persistence cannot be explained in this fashion.

It is important to note that cross-sectional variation of expected asset returns in informationally efficient markets can only provide a source for positive performance persistence. In the case of statistically significant negative performance persistence such as that observed in this study for monthly REIT returns, there is no explanation apparent to the authors that is consistent with the assumption of an informationally efficient market.

Graff [1998] reports the average sample standard deviation of return series for individual properties in the National Council of Real Estate Investment Fiduciaries (NCREIF) data base to be 13.6%, based on return series of at least seven calendar years in length. In addition, Graff and Young [1995] implies that nearly all variance in privately-held real estate can be regarded as asset-specific (in the vocabulary of linear market models, β_p is close to zero for every commercial property p). Thus, the magnitude of asset-specific risk in appraisal-based returns for privately-held real estate is nearly identical to the magnitude of asset-specific risk for REIT returns. This implies that Exhibit 5 can be applied without modification to appraisal-based returns for individual commercial properties.

Young and Graff [1996, Exhibit 3] implies that performance persistence in disaggregated extreme annual NCREIF returns is at least 45%.[21] The second column in Exhibit 5 of this study implies that such high performance persistence can only occur in efficient markets if the spread in expected asset returns due to systematic risk is more than 48%. Such a large spread would be so inconsistent with the widely-held view of institutional-grade property as a low-risk, income-generating investment that no further consideration of this possibility is warranted.

Finally, we point out that the conclusions of this section depend strongly on the assumption that true REIT betas are contained within the unit interval. The methodology of this section yields dramatically different conclusions when applied to market sectors that satisfy different assumptions about the variation of systematic risk across the sector (e.g., see Graff and Young [1998]).

Conclusions

It is assumed typically in the professional and academic investment literatures that returns on liquid market assets such as stocks and bonds can be described by (linear) multifactor market models, at least for monthly to annual sampling frequencies. However, the existence of three

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[21] Serial persistence statistics reproted in Young and Graff [1996] are for MSA-level aggregated returns, since NCREIF is currently unwilling to allow researchers access to return series for individual commercial properties. However, there is no statistically defensible reason why partially aggregated returns should display more performance persistence than individual property returns would display if they were available for analysis.

qualitatively distinct types of performance persistence in extreme REIT returns for different sampling frequencies argues strongly against the existence of multifactor market models in the case of REIT returns. This raises questions about the scope of applicability of multifactor models to general liquid markets. The evidence in this study against such models is virtually conclusive in the case of REITs, unless researchers can demonstrate the existence of a class of multifactor models based on financial and real economic input variables that generate negative persistence in extreme monthly returns, serial independence in extreme quarterly returns, positive persistence in extreme annual returns, and serial independence in moderate returns for all three sampling frequencies.

The serial persistence observed during the test interval in extreme annual REIT returns but not in moderate annual REIT returns is the same serial persistence behavior observed in annual returns in the case of privately-held real estate by Young and Graff [1996, 1997]. These results together suggest that annual REIT returns contain a component that tracked the qualitative performance of underlying real estate assets during the test interval.

Test results for the subintervals 1987-1992 and 1993-1996 also suggest that tracking noise increased during the more recent subinterval, as institutions began looking to REITs as an alternative vehicle to privately-held real estate. In other words, heightened institutional investment activity is causing REIT return behavior to diverge increasingly from the behavior of returns on underlying REIT real estate portfolios.

This conclusion is reinforced by the pattern of persistence observed in monthly REIT returns. Extreme-quartile monthly returns display negative persistence shown to be due entirely to the contribution of large-capitalization REITs during the subinterval 1993-1996, whereas moderate-quartile monthly returns display marginal positive persistence attributable primarily to the contribution of small-capitalization REIT returns clumped at the lower edge of the second quartile. Keeping in mind the institutional investor preference for large-capitalization REITs, extreme-quartile monthly persistence results can be explained as the effect of institutional investors moving into and out of the same large-capitalization REITs en masse. While positions acquired or liquidated by any single institutional investor might be small enough to produce a noticeable effect on transaction prices, the combined effects of several institutional investors attempting similar simultaneous transactions can be sufficient to produce a temporary imbalance in the market supply-and-demand equilibrium.

More precisely, the combined efforts of institutional investors tend to drive prices of REIT shares temporarily up (or down) when they acquire (or liquidate) positions in large-capitalization REITs during the same short interval. This creates temporary upward (or downward) bias in monthly return series that can easily drive the observed returns on the targeted REITs into the extreme quartiles. In the subsequent month, returns from these REITs will be subjected to corresponding bias in the opposite direction as supply and demand for the targeted REIT shares are restored to more normal levels and prices adjust accordingly.

The existence of an ex ante self-correcting return component implies that the probability of repetition in quartile return performance is less than 25% whenever REITs are subject to potential transaction pressure from institutional investors. Large-capitalization REITs are the primary focus of attention for institutional investors, so negative persistence in extreme-quartile returns is both expected and observed for large-capitalization REITs but not for small-capitalization REITs. Since the current burst of institutional investor interest in large-capitalization REITs dates from around 1993, negative persistence in extreme-quartile returns is observed for large-capitalization REITs during the recent sample subinterval 1993-1996 but not during the earlier subinterval 1987-1992.

When institutional investors decide roughly simultaneously to acquire positions in a REIT issue, the resulting demand-driven imbalance in the market for REIT shares temporarily drives up the price of the issue. This creates and incremental acquisition cost for the investors that can be viewed as an acquisition penalty deducted from the initial monthly investment return for failure to develop a diversity of REIT investment strategies. Similarly, when institutional investors decide roughly simultaneously to cut back their positions in a REIT issue, a supply-driven imbalance in the supply-and-demand equilibrium leads to an analogous liquidation penalty deducted from the final monthly investment return.

In short, the evidence of this study is that annual REIT returns ceased to reflect the qualitative behavior of returns on underlying REIT real estate portfolios precisely when the REITs began to attract significant institutional investor interest. Furthermore, the results for monthly returns suggest that, during the more recent test subinterval 1993-1996, institutional investors moved in and out of large-capitalization REITs in ways that negatively impacted investment returns. This suggests that REIT liquidity is not proving to be the panacea for institutional real estate investments promised by consultants in response to investment debacles of the previous decade.

The problem with large-capitalization REIT investing suggested by this analysis is that institutional investors tend to act in concert. This behavior can be attributed to industry-wide restrictions on availability of investment information about underlying REIT real estate portfolios on which institutional investment decisions must be based.

Investor behavior in the absence of complete information about market assets is investigated in Grossman and Stiglitz [1976]. The study concludes that investors find it difficult to develop divergent opinions in the absence of information and that investors tend to behave more and more alike as investment information becomes more restricted.[22] This suggests that negative persistence in large-capitalization REITs can be regarded as a market signal that institutional investors are receiving insufficient information for the development of diverse REIT investment strategies. It follows that the institutional investor acquisition and liquidation penalties signaled by negative persistence can be attributed to an absence of adequate investment information about REIT real estate portfolios.

The absence of adequate investment information on the part of institutional investors also implies that large-capitalization REIT managers are not subject to any practical controls on investment management activities. This implies that there is nothing to prevent the imposition of excessive agency costs on REIT investors, as examined in Graff and Webb [1997] in the case of privately-held real estate.

Serial persistence in asset return series should be statistically insignificant whenever sufficient investment information is available to enable investors to price individual assets according to diverse individual investment agendas. In the case of securities markets, adequate investment information leads to efficient price discovery and enhanced asset liquidity. However, the persistence results in this study imply that such price discovery is deficient in the REIT market.

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[22] Political scientists have long recognized that the same problem can confound the democratic form of government in the absence of a free press that provides relevant information needed for the development of informed individual judgments based on individual citizen agendas.

The straightforward remedy for this problem is for institutional investors to demand a sea change in the quantity and quality of investment information about REIT real estate portfolios available to institutional investors from REIT management as the price for continued institutional participation in the REIT market. Although this could necessitate a change in the relationship between institutional investors and REIT managers, some increase in the flow of investment information is almost certainly a necessary prerequisite to any improvement in market price discovery and liquidity for institutional REIT investors. It is also reasonable to expect that, depending upon the extent to which information flow increases, this reform would also be sufficient to bring efficiency to both the public and private markets for institutional-grade real estate.

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Exhibit 1

Number of REITs
with Monthly Data as of January

Year	No. of REITs
1996	145
1995	149
1994	100
1993	68
1992	64
1991	58
1990	58
1989	58
1988	55
1987	48

Exhibit 2
Annual Equity REIT Return Persistence

Panel A: For the Years 1987 to 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	181	64	35.4 * *	(18.5,31.8)	1	189	61	32.3 *	(18.8,31.5)
2	47	17	36.2	(11.7,39.4)	2	46	18	39.1 *	(12.0,38.0)
3	14	4	28.6	(3.6,53.6)	3	13	3	23.1	(3.8,50.0)
4th Quartile:					3rd Quartile:				
1	180	63	35.0 *	(18.6,31.9)	1	182	42	23.1	(18.4,31.6)
2	48	18	37.5	(11.5,38.5)	2	34	10	29.4	(10.3,42.6)
3	15	6	40.0	(3.3,50.0)	3	9	2	22.2	[0.0,61.1)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	361	127	35.2 * * * *	(20.4,29.8)	1	371	103	27.8	(20.6,29.5)
2	95	35	36.8	(16.3,34.2)	2	80	28	35.0	(15.6,35.6)
3	29	10	34.5	(8.6,43.1)	3	22	5	22.7	(6.8,47.7)

Panel B: For the Years 1993 to 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	94	33	35.1 *	(16.5,34.6)	1	99	34	34.3 *	(16.7,33.8)
2	16	5	31.3	(3.1,53.1)	2	19	10	52.6 *	(2.6,50.0)
3	2	0	0.0	[0.0,100.0]	3	5	3	60.0	[0.0,70.0)
4th Quartile:					3rd Quartile:				
1	94	30	31.9	(16.5,34.6)	1	96	19	19.8	(16.1,34.9)
2	16	5	31.3	(3.1,53.1)	2	11	3	27.3	[0.0,59.1)
3	2	0	0.0	[0.0,100.0]	3	2	0	0.0	[0.0,100.0]
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	188	63	33.5 *	(18.9,31.6)	1	195	53	27.2	(18.7,31.5)
2	32	10	31.3	(7.8,42.2)	2	30	13	43.3	(8.3,41.7)
3	4	0	0.0	[0.0,87.5)	3	7	3	42.9	[0.0,64.3)

Panel C: For the Years 1987 to 1992

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	71	28	39.4 *	(14.8,35.9)	1	74	24	32.4	(14.2,35.8)
2	24	10	41.7	(6.3,43.8	2	19	8	42.1	(2.6,50.0)
3	7	3	42.9	[0.0,64.3)	3	7	0	0.0	[0.0,64.3)
4th Quartile:					3rd Quartile:				
1	70	32	45.7 * * *	(15.0,36.4)	1	71	19	26.8	(14.8,35.9)
2	25	11	44.0	(6.0,46.0)	2	15	4	26.7	(3.3,50.0)
3	9	5	55.6	[0.0,61.1)	3	3	1	33.3	[0.0,83.3)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	141	60	42.6 * * * * *	(17.4,33.0)	1	145	43	29.7	(17.6,32.8)
2	49	21	42.9 * *	(13.3,37.8)	2	34	12	35.3	(10.3,42.6)
3	16	8	50.0	(3.1,53.1)	3	10	1	10.0	[0.0,55.0)

Exhibit 2 (continued)
Annual Equity REIT Return Persistence

Panel D: Large Capitalization REITs for the Years 1987 to 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	85	25	29.4	(15.9,34.7)	1	88	26	29.5	(15.3,34.7)
2	14	4	28.6	(3.6,53.6)	2	16	8	50.0	(3.1,53.1)
3	3	0	0.0	[0.0,83.3)	3	7	4	57.1	[0.0,64.3)
4th Quartile:					3rd Quartile:				
1	69	19	27.5	(13.8,37.0)	1	78	18	23.1	(14.7,35.3)
2	9	2	22.2	[0.0,61.1)	2	10	1	10.0	[0.0,55.0)
3	1	0	0.0	[0.0,100.0]	3	1	0	0.0	[0.0,100.0]
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	154	44	28.6	(17.9,32.1)	1	166	44	26.5	(18.4,32.2)
2	23	6	26.1	(6.5,45.7)	2	26	9	34.6	(5.8,44.2)
3	4	0	0.0	[0.0,87.5)	3	8	4	50.0	[0.0,68.8)

Panel E: Small Capitalization REITs for the Years 1987 to 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	71	23	32.4	(14.8,35.9)	1	80	25	31.3	(15.6,35.6)
2	17	4	23.5	(2.9,50.0)	2	19	7	36.8	(2.6,50.0)
3	2	0	0.0	[0.0,100.0]	3	6	3	50.0	[0.0,75.0)
4th Quartile:					3rd Quartile:				
1	80	29	36.3 *	(15.6,35.6)	1	76	22	28.9	(15.1,36.2)
2	25	9	36.0	(9.7,40.3)	2	19	5	26.3	(2.6,50.0)
3	8	2	25.0	[0.0,68.8)	3	5	0	0.0	[0.0,70.0)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	151	52	34.4 *	(18.2,32.1)	1	156	47	30.1	(18.3,32.4)
2	42	13	31.0	(10.7,39.3)	2	38	12	31.6	(11.8,40.8)
3	10	2	20.0	[0.0,55.0)	3	11	3	27.3	[0.0,59.1)

*	statistically distinct from 25% with 95% confidence
* *	statistically distinct from 25% with 99% confidence
* * *	statistically distinct from 25% with 99.9% confidence
* * * *	statistically distinct from 25% with 99.99% confidence
* * * * *	statistically distinct from 25% with 99.999% confidence

Exhibit 3
Quarterly Equity REIT Return Persistence

Panel A: For the Quarters 1987.1 to 1996.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	805	183	22.7	(21.9,28.1)	1	824	226	27.4	(22.0,28.1)
2	171	46	26.9	(18.4,31.9)	2	215	76	35.3 * * *	(19.3,30.9)
3	40	10	25.0	(11.3,41.3)	3	69	25	36.2	(13.8,37.0)
4th Quartile:					3rd Quartile:				
1	806	205	25.4	(22.0,28.1)	1	814	216	26.5	(22.1,28.1)
2	195	70	35.9 * * *	(18.7,31.5)	2	207	58	28.0	(19.1,31.2)
3	67	25	37.3 *	(14.2,36.6)	3	53	19	35.8	(12.3,38.7)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	1611	388	24.1	(22.9,27.2)	1	1638	442	27.0	(22.9,27.1)
2	366	116	31.7 * *	(20.6,29.6)	2	422	134	31.8 * *	(20.7,29.3)
3	107	35	32.7	(16.4,34.1)	3	122	44	36.1 * *	(16.8,33.2)

Panel B: For the Quarters 1993.1 to 1996.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	460	104	22.6	(21.0,29.0)	1	468	124	26.5	(21.0,29.2)
2	92	27	29.3	(15.8,34.2)	2	113	36	31.9	(16.4,33.2)
3	21	7	33.3	(7.1,45.2)	3	29	9	31.0	(8.6,43.1)
4th Quartile:					3rd Quartile:				
1	461	102	22.1	(20.9,29.2)	1	466	123	26.4	(20.9,29.1)
2	92	29	31.5	(15.8,34.2)	2	114	29	25.4	(17.1,33.8)
3	26	10	38.5	(5.8,44.2)	3	24	6	25.0	(6.3,43.8)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	921	206	22.4	(22.2,27.9)	1	934	247	26.4	(22.2,27.9)
2	184	56	30.4	(18.8,31.8)	2	227	65	28.6	(19.2,31.1)
3	47	17	36.2	(11.7,39.4)	3	53	15	28.3	(12.3,38.7)

Panel C: For the Quarters 1987.1 to 1992.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	329	76	23.1	(20.2,29.9)	1	340	99	29.1	(20.4,29.9)
2	73	16	21.9	(14.4,36.3)	2	94	37	39.4 * *	(16.5,34.6)
3	15	3	20.0	(3.3,50.0)	3	35	16	45.7 *	(10.0,41.4)
4th Quartile:					3rd Quartile:				
1	329	98	29.8	(20.2,29.9)	1	332	90	27.1	(20.3,30.0)
2	93	39	41.9 * * *	(15.6,34.9)	2	84	29	34.5	(14.9,35.1)
3	38	15	39.5	(11.8,40.8)	3	27	13	48.1 *	(9.3,42.6)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	658	174	26.4	(21.7,28.3)	1	672	189	28.1	(21.7,28.3)
2	166	55	33.1 *	(18.4,32.2)	2	178	66	37.1 * * *	(18.3,31.7)
3	53	18	34.0	(12.3,38.7)	3	62	29	46.8 * * *	(13.7,36.3)

Exhibit 3 (continued)
Quarterly Equity REIT Return Persistence

Panel D: Large Capitalization REITs for the Quarters 1987.1 to 1996.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	453	98	21.6	(20.9,29.2)	1	472	125	26.5	(21.1,29.1)
2	88	22	25.0	(15.3,34.7)	2	114	30	26.3	(17.1,33.8)
3	18	7	38.9	(2.8,47.2)	3	25	4	16.0	(6.0,46.0)
4th Quartile:					3rd Quartile:				
1	421	106	25.2	(20.8,29.3)	1	450	120	26.7	(21.0,29.2)
2	90	27	30.0	(16.1,35.0)	2	112	32	28.6	(16.5,33.5)
3	24	8	33.3	(6.3,43.8)	3	29	6	20.7	(8.6,43.1)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	874	204	23.3	(22.1,28.0)	1	922	245	26.6	(22.2,27.8)
2	178	49	27.5	(18.3,31.7)	2	226	62	27.4	(19.2,30.8)
3	42	15	35.7	(10.7,39.3)	3	54	10	18.5	(13.9,38.0)

Panel E: Small Capitalization REITs for the Quarters 1987.1 to 1996.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	325	76	23.4	(20.2,30.0)	1	348	95	27.3	(20.3,29.7)
2	69	22	31.9	(13.8,37.0)	2	89	24	27.0	(16.3,34.3)
3	20	6	30.0	(7.5,47.5)	3	22	5	22.7	(6.8,47.7)
4th Quartile:					3rd Quartile:				
1	343	85	24.8	(20.3,29.9)	1	341	95	27.9	(20.4,29.8)
2	82	26	31.7	(15.2,34.8)	2	89	20	22.5	(16.3,34.3)
3	25	8	32.0	(6.0,46.0)	3	19	2	10.5	(2.6,50.0)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	668	161	24.1	(21.6,28.4)	1	689	190	27.6	(21.7,28.4)
2	151	48	31.8	(18.2,32.1)	2	178	44	24.7	(18.3,31.7)
3	45	14	31.1	(12.2,38.9)	3	41	7	17.1	(11.0,40.2)

Panel F: Large Capitalization REITs for the Quarters 1993.1 to 1996.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	309	64	20.7	(20.2,29.9)	1	316	85	26.9	(20.1,29.9)
2	54	15	27.8	(13.9,38.0)	2	75	21	28.0	(15.3,35.3)
3	11	4	36.4	[0.0,59.1)	3	16	4	25.0	(3.1,53.1)
4th Quartile:					3rd Quartile:				
1	295	74	25.1	(19.8,30.3)	1	308	84	27.3	(20.0,30.0)
2	62	18	29.0	(13.7,36.3)	2	77	20	26.0	(14.9,35.7)
3	15	6	40.0	(3.3,50.0)	3	18	2	11.1	(2.8,47.2)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	604	138	22.8	(21.4,28.6)	1	624	169	27.1	(21.6,28.4)
2	116	33	28.4	(16.8,33.2)	2	152	41	27.0	(18.1,32.6)
3	26	10	38.5	(5.8,44.2)	3	34	6	17.6	(10.3,42.6)

Exhibit 3 (continued)
Quarterly Equity REIT Return Persistence

Panel G: Large Capitalization REITs for the Quarters 1987.1 to 1992.4

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	138	33	23.9	(17.8,33.0)	1	149	38	25.5	(17.8,32.6)
2	32	7	21.9	(7.8,42.2)	2	35	8	22.9	(10.0,41.4)
3	7	3	42.9	[0.0,64.3)	3	8	0	0.0	[0.0,68.8)
4th Quartile:					3rd Quartile:				
1	120	31	25.8	(17.1,33.8)	1	135	36	26.7	(17.4,33.0)
2	25	9	36.0	(6.0,46.0)	2	34	12	35.3	(10.3,42.6)
3	9	2	22.2	[0.0,61.1)	3	11	4	36.4	[0.0,59.1)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	258	64	24.8	(19.6,30.4)	1	284	74	26.1	(19.9,30.5)
2	57	16	28.1	(13.2,37.7)	2	69	20	29.0	(13.8,37.0)
3	16	5	31.3	(3.1,53.1)	3	19	4	21.1	(2.6,50.0)

*	statistically distinct from 25% with 95% confidence
* *	statistically distinct from 25% with 99% confidence
* * *	statistically distinct from 25% with 99.9% confidence
* * * *	statistically distinct from 25% with 99.99% confidence
* * * * *	statistically distinct from 25% with 99.999% confidence

Exhibit 4
Monthly Equity REIT Return Persistence†

Panel A: For the Months January 1987 to December 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
_1_	_2497_	_516_	_20.7_ * * * * *	_(23.3,26.7)_	1	2679	743	27.7 * *	(23.3,26.7)
_2_	_508_	_95_	_18.7_ * * *	_(21.2,28.8)_	2	734	214	29.2 *	(21.9,28.3)
3	92	16	17.4	(15.8,34.2)	3	210	69	32.9 *	(18.8,31.2)
4th Quartile:					3rd Quartile:				
1	2480	607	24.5	(23.3,26.7)	1	2500	652	26.1	(23.3,26.7)
2	596	171	28.7 *	(21.6,28.6)	2	644	167	25.9	(21.7,28.5)
3	167	58	34.7 * *	(18.3,32.0)	3	164	43	26.2	(18.0,32.0)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
_1_	_4977_	_1123_	_22.6_ * * * *	_(23.8,26.2)_	1	5179	1395	26.9 * *	(23.8,26.2)
2	1104	266	24.1	(22.4,27.6)	2	1378	381	27.6 *	(22.7,27.3)
3	259	74	28.6	(19.5,30.7)	3	374	112	29.9 *	(20.5,29.5)

Panel B: For the Months January 1993 to December 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
_1_	_1465_	_311_	_21.2_ * * *	_(22.8,27.3)_	1	1553	434	27.9 * *	(22.8,27.2)
_2_	_303_	_56_	_18.5_ * *	_(20.0,30.2)_	2	425	129	30.4 *	(20.8,29.3)
3	53	9	17.0	(12.3,38.7)	3	125	41	32.8	(17.2,33.2)
4th Quartile:					3rd Quartile:				
_1_	_1456_	_310_	_21.3_ * *	_(22.8,27.3)_	1	1488	402	27.0	(22.8,27.3)
2	299	73	24.4	(19.9,30.3)	2	394	113	28.7	(20.7,29.6)
3	69	18	26.1	(13.8,37.0)	3	110	30	27.3	(16.8,34.1)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
_1_	_2921_	_621_	_21.3_ * * * * *	_(23.4,26.6)_	1	3041	836	27.5 * *	(23.5,26.6)
_2_	_602_	_129_	_21.4_ *	_(21.5,28.7)_	2	819	242	29.5 * *	(22.0,28.0)
3	122	27	22.1	(16.8,33.2)	3	235	71	30.2	(19.4,30.9)

Panel C: For the Months January 1987 to December 1992

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
_1_	_1015_	_202_	_19.9_ * * *	_(22.3,27.7)_	1	1109	302	27.2	(22.4,27.6)
2	199	38	19.1	(18.8,31.4)	2	294	80	27.2	(19.9,30.1)
3	38	7	18.4	(11.8,40.8)	3	78	24	30.8	(14.7,35.3)
4th Quartile:					3rd Quartile:				
1	1007	293	29.1 * *	(22.3,27.8)	1	995	248	24.9	(22.3,27.8)
2	287	95	33.1 * *	(20.0,30.1)	2	244	53	21.7	(19.5,30.5)
3	93	38	40.9 * *	(15.6,34.9)	3	53	13	24.5	(12.3,38.7)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	2022	495	24.5	(23.1,26.9)	1	2104	550	26.1	(23.1,26.9)
2	486	133	27.4	(21.1,28.9)	2	538	133	24.7	(21.3,28.7)
3	131	45	34.4 *	(17.2,33.2)	3	131	37	28.2	(17.2,33.2)

Exhibit 4 (continued)
Monthly Equity REIT Return Persistence[†]

Panel D: Large Capitalization REITs for the Months January 1987 to December 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	1507	299	19.8 * * * * *	(22.8,27.2)	1	1639	456	27.8 * *	(22.9,27.1)
2	293	52	17.7 * *	(20.0,30.2)	2	449	125	27.8	(21.0,29.1)
3	49	8	16.3	(13.3,37.8)	3	123	39	31.7	(17.5,32.9)
4th Quartile:					3rd Quartile:				
1	1457	329	22.6 *	(22.8,27.3)	1	1505	398	26.4	(22.8,27.2)
2	311	81	26.0	(20.1,30.1)	2	392	101	25.8	(20.5,29.5)
3	75	24	32.0	(15.3,35.3)	3	99	20	20.2	(16.7,33.8)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	2964	628	21.2 * * * * *	(23.4,26.6)	1	3144	854	27.2 *	(23.5,26.5)
2	604	133	22.0	(21.4,28.6)	2	841	226	26.9	(22.1,28.0)
3	124	32	25.8	(17.3,33.5)	3	222	59	26.6	(19.1,30.9)

Panel E: Small Capitalization REITs for the Months January 1987 to December 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	947	211	22.3	(22.2,27.8)	1	1165	383	32.9 * * * * *	(22.5,27.5)
2	207	46	22.2	(19.1,31.2)	2	378	125	33.1 * * *	(20.5,29.5)
3	46	8	17.4	(12.0,38.0)	3	123	41	33.3 *	(17.5,32.9)
4th Quartile:					3rd Quartile:				
1	957	246	25.7	(22.2,27.8)	1	904	217	24.0	(22.2,27.9)
2	242	67	27.7	(19.6,30.8)	2	214	55	25.7	(18.9,31.1)
3	67	22	32.8	(14.2,36.6)	3	54	21	38.9 *	(13.9,38.0)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	1904	457	24.0	(23.0,27.0)	1	2069	600	29.0 * * * *	(23.1,26.9)
2	449	113	25.2	(21.0,29.1)	2	592	180	30.4 * *	(21.5,28.6)
3	113	30	26.5	(16.4,33.2)	3	177	62	35.0 * *	(18.4,31.9)

Panel F: Large Capitalization REITs for the Months January 1993 to December 1996

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	1035	202	19.5 * * * *	(22.4,27.7)	1	1085	295	27.2	(22.4,27.6)
2	196	31	15.8 * *	(18.6,31.4)	2	288	79	27.4	(20.0,30.4)
3	28	3	10.7	(8.9,44.6)	3	77	21	27.3	(14.9,35.7)
4th Quartile:					3rd Quartile:				
1	1016	214	21.1 * *	(22.3,27.7)	1	1035	274	26.5	(22.4,27.7)
2	203	46	22.7	(19.0,31.3)	2	268	73	27.2	(19.6,30.4)
3	43	13	30.2	(10.5,40.7)	3	71	14	19.7	(14.8,35.9)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	2051	416	20.3 * * * * *	(23.1,26.9)	1	2120	569	26.8	(23.1,26.9)
2	399	77	19.3 * *	(20.7,29.4)	2	556	152	27.3	(21.3,28.7)
3	71	16	22.5	(14.8,35.9)	3	148	35	23.6	(17.9,32.8)

Exhibit 4 (continued)
Monthly Equity REIT Return Persistence[†]

Panel G: Large Capitalization REITs for the Months January 1987 to December 1992

Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval	Length of Run	No. of Samples	No. of Successes	% of Successes	95% Conf. Interval
1st Quartile:					2nd Quartile:				
1	*464*	*97*	*20.9* *	*(21.0,29.2)*	1	546	158	28.9 *	(21.3,28.8)
2	95	21	22.1	(16.3,34.2)	2	153	44	28.8	(18.0,32.4)
3	21	5	23.8	(7.1,45.2)	3	42	15	35.7	(10.7,39.3)
4th Quartile:					3rd Quartile:				
1	433	114	26.3	(20.9,29.2)	1	462	122	26.4	(21.1,29.1)
2	104	35	33.7	(16.8,34.1)	2	122	27	22.1	(16.8,33.2)
3	32	11	34.4	(7.8,42.2)	3	27	6	22.2	(9.3,42.6)
1st & 4th Combined Quartiles:					2nd & 3rd Combined Quartiles:				
1	897	211	23.5	(22.1,27.9)	1	1008	280	27.8 *	(22.3,27.7)
2	199	56	28.1	(18.8,31.4)	2	275	71	25.8	(19.8,30.4)
3	53	16	30.2	(12.3,38.7)	3	69	21	30.4	(13.8,37.0)

[†] Figures in *italics* indicate negative persistence, i.e. sample persistence significantly less than 25%

*	statistically distinct from 25% with 95% confidence
* *	statistically distinct from 25% with 99% confidence
* * *	statistically distinct from 25% with 99.9% confidence
* * * *	statistically distinct from 25% with 99.99% confidence
* * * * *	statistically distinct from 25% with 99.999% confidence

Exhibit 5

Return Persistence Induced in Efficient Markets by Variation in Expected Returns

Standard Deviation of Expected Returns (percent)	Expected Persistence in Extreme Returns (percent)*	Expected Persistence in Moderate Returns (percent)*	Spread (4σ) in Expected Returns (percent)	Expected Spread (4σ) in Cross-Sectional Returns (percent)
1	25	25	4	56
2	26	25	8	57
3	27	25	12	57
4	28	25	16	58
5	30	25	20	59
6	31	26	24	61
7	33	26	28	63
8	35	26	32	64
9	37	27	36	67
10	40	27	40	69
11	42	28	44	71
12	44	29	48	74
13	47	29	52	76
14	48	30	56	79
15	50	31	60	82

* Sample standard error equals 0.48% (see note 16).

Exhibit 6

Arithmetic Averages of Consecutive Pairs of S&P 500 Index Annual Returns, and Risk-Free Annual Rates

Year	Annual Return for Indicated Year (percent)	Average Return for Indicated Year and Following Year (percent)	Beginning-of-Year 12-month T-bill Yield (percent)
1987	5.23	11.02	6.01
1988	16.81	24.15	7.15
1989	31.49	14.16	9.17
1990	-3.17	13.69	7.87
1991	30.55	19.11	6.79
1992	7.67	8.83	4.08
1993	9.99	5.65	3.57
1994	1.31	19.37	3.58
1995	37.43	30.25	7.15
1996	23.07	28.22	5.15
1997	33.36		5.49
Averages	17.16		6.00