The Predictability of Equity REIT Returns

Edward Nelling*

Abstract. **This study examines the predictability of monthly returns on equity real estate investment trusts (EREITs) over the period 1975–95 and compares it with that for small- and mid-cap firms. Using the time series approach of Jegadeesh (1990), evidence is found that monthly EREIT returns are predictable based on past performance. However, the predictability is not substantial enough to cover typical transactions costs, so that there is no evidence of unexploited arbitrage opportunities.**

The magnitude of EREIT predictability also is examined over different time periods, with the greatest amount found in the most recent data since 1992, which marks the emergence of the new wave of EREITs. Finally, persistence in individual REIT return performance is examined using a nonparametric technique. Limited evidence of persistence in performance is found, with retail-oriented REITs tending to exhibit the most persistence.

Introduction

This study examines the predictability of returns for equity real estate investment trusts (EREITs). Researchers have documented the predictability of stock returns in general, but the nature of real estate markets may be such that the extent to which EREIT returns are predictable differs from that of other stocks. For example, if a REIT's primary source of income is from long-term leases to credit quality tenants in an existing portfolio of properties, then its cash flows almost certainly are more stable and predictable than those of (say) a software producer. In the absence of shocks to the determinants of discount rates, the total return series for such REITs should resemble a random walk, as significant deviations from the returns implied by the net rents could easily be exploited.

The large number of REIT initial public offerings (IPOs) in recent years and the repeal of the five-or-fewer rule have resulted in increased institutional interest in securitized real estate. Furthermore, a number of mutual funds specializing in real estate have emerged in recent years. These funds provide individual investors with additional alternatives for real estate investment. The increased ability to use REITs as part of an asset allocation process calls for additional understanding of their return behavior.

Existing empirical research has followed two main approaches in examining stock return predictability. The cross-sectional approach involves characterizing return

*DuPree School of Management, Georgia Institute of Technology, Atlanta, GA 30332-0520 or edward.nelling@mgt.gatech.edu.
**The Wharton School, University of Pennsylvania, Philadelphia, PA 19104–6330 or gyourko@wharton.upenn.edu.

behavior as a function of other variables. The explanatory variables can be macroeconomic, such as those used by Chen, Roll and Ross (1986) in their study of stock returns and by Chan, Hendershott and Sanders (1990) in their REIT return analysis. Other researchers such as Fama and French (1992) have employed firm-specific variables including firm size, the price-earnings ratio and the book-to-market ratio to explain stock return behavior. The most recent work of this type reports evidence of predictability. However, the findings are mixed as to whether REITs differ from stocks in this regard. Liu and Mei (1992) conclude that expected excess returns on EREITs are more predictable than stocks in general. However, Li and Wang's (1995) analysis using a multi-factor asset pricing model finds that the extent of predictability in REIT returns is about the same as for stocks. Peterson and Hsieh (1997) report that the risk premium on EREITs is related to the market risk premium, and to size and book-to-market factors.

The analysis of predictability in this study uses the time-series approach proposed by Jegadeesh (1990). This approach relies only on past returns and does not require the specification of an asset-pricing model for the return generating process. Moreover, the approach is intuitive and straightforward, in the sense that it addresses whether an investor can analyze the past behavior of returns and construct a portfolio of REITs that will earn abnormal profits in the future. For example, if REIT returns exhibit positive serial correlation, then it may be profitable to buy past winners and sell past losers. On the other hand, a pattern of negative correlation would suggest a contrarian approach involving buying past losers and selling past winners.

EREIT return predictability is investigated here using monthly return data for portfolios of EREITs over the 1975–95 period and for three subperiods, including the 1992–95 period marking the emergence of the new wave of REITs. Monthly data are utilized because of the significant thin-trading biases that make analyses of shorter return horizons difficult.[1] Our analysis finds that monthly EREIT returns are significantly negatively autocorrelated at the first (and only the first) lag. This pattern leads us to investigate whether buying the previous month's underperformers and selling the previous month's overperformers is a profitable strategy. The return to such a contrarian strategy is about 1.1% per month. While this is statistically significant, it is not large enough to cover all transactions costs including those associated with the bid-ask spread, commissions and possible price impact effects.

In addition, REIT return predictability is compared to that of small- and mid-cap stocks. This represents the first effort of which we are aware that directly examines whether EREIT predictability is different from that for size portfolios. Until very recently, EREITs generally were among the smallest capitalization issues. The autocorrelation structures of monthly small stock and EREIT returns are similar, with both having significantly negative correlation coefficients at the first lag. Estimated total returns from following the contrarian strategy noted above are somewhat greater for small cap stocks in general than they are for EREITs.[2] This finding is consistent with the hypothesis noted earlier that relatively stable cash flows associated with

longer-term leases on most real properties should make it easier to identify arbitrage opportunities among EREITs, and thereby render their returns less predictable.

There is no statistically or economically significant evidence that mid-cap stock returns are predictable. It appears that once firms become fairly large and trading in their stock becomes more liquid, no profitable contrarian trading strategy is feasible. This leads us to suspect that, as consolidation in the REIT industry continues and firms become increasingly large, the statistically significant negative autocorrelation pattern exhibited by EREITs will disappear. Given that EREIT return predictability certainly has been no stronger than for the average small capitalization firm, there is no reason to suspect that, in a future time when EREITs are larger firms, their returns will be more predictable than for similarly-sized firms not in the real estate industry.

Finally, predictability at the individual REIT level is examined by conducting nonparametric tests for persistence in REIT returns. Some evidence of persistence is found, with a small sample of retail REITs found to have a higher than average persistence. In general, the pattern of persistence is consistent with the negative autocorrelation structure discussed.

Empirical Tests of REIT Return Predictability

Monthly returns on all EREITs in the CRSP NYSE/AMEX and NASDAQ Data Files were obtained over the period 1975–95. While EREITs existed prior to 1975, the number of firms then is too small to conduct a meaningful analysis of their return predictability.[3] The total number of EREITs throughout the sample period is 148.

Autocorrelation in REIT Returns

The assessment of REIT return predictability begins with an examination of the autocorrelation in REIT returns because the presence of significant correlations between current and lagged returns raises the possibility of profitable trading strategies. The difference in the i^{th} firm's monthly return (R_{it}) from its average return ($\overline{R}_{it}$), where the average is defined as the average monthly return on the i^{th} REIT over the period $t + 1$ to $t + 6$, is regressed on an intercept and twelve lags of the firm's monthly returns as illustrated below.[4]

$$\tilde{R}_{it} - \overline{R}_{it} = a_{0t} + \sum_{j=1}^{12} a_{jt} R_{it-j} + u_{it}$$

Results from these autocorrelation regressions are presented in Exhibit 1. The only statistically significant result is for the first lag. The coefficient at the one-month lag is -0.135, with an associated p-value of 0.000. Because REITs until very recently tended to have small equity market capitalizations and a strong January effect in their returns, the return correlation patterns during January and for the eleven months excluding January were also examined.[5] Those results are presented in the middle and

Exhibit 1
Cross-Sectional Regression Estimates of Autocorrelation in EREIT Returns

	All Months (Jan.–Dec.)	January only	Excluding January (Feb.–Dec)
a_0	0.002	0.007	0.002
	(0.621)	(0.737)	(0.701)
a_1	−0.135	−0.010	−0.138
	(0.000)	(0.354)	(0.000)
a_2	−0.044	−0.001	−0.048
	(0.093)	(0.967)	(0.082)
a_3	−0.037	0.084	−0.048
	(0.211)	(0.584)	(0.097)
a_4	−0.039	0.035	−0.046
	(0.147)	(0.755)	(0.095)
a_5	−0.004	−0.138	0.009
	(0.884)	(0.090)	(0.718)
a_6	−0.001	−0.225	0.020
	(0.956)	(0.070)	(0.435)
a_7	0.002	−0.028	0.005
	(0.946)	(0.825)	(0.860)
a_8	−0.029	−0.018	−0.030
	(0.235)	(0.854)	(0.233)
a_9	−0.021	−0.036	−0.019
	(0.384)	(0.659)	(0.440)
a_{10}	−0.021	−0.079	−0.016
	(0.371)	(0.497)	(0.504)
a_{11}	−0.007	0.002	−0.008
	(0.771)	(0.982)	(0.755)
a_{12}	0.035	0.179	0.022
	(0.114)	(0.011)	(0.352)

This exhibit reports the results of cross-sectional regressions of monthly REIT excess returns on past returns. The model is of the form:

$$\tilde{R}_{it} - \overline{R}_{it} = a_{0t} + \sum_{j=1}^{12} a_{jt} R_{it-j} + u_{it},$$

where R_{it} is the return on REIT i in month t and R_{it} is the average monthly return on REIT i over the period $t + 1$ to $t + 6$. The regression is performed each month over the period of 1975–95. The reported parameters are the average of the time series of coefficients. The p-value (in parentheses) is the probability that average of the time series of coefficients is equal to zero.

right-most columns of Exhibit 1, and indicate that the autocorrelation pattern is not being driven by a January effect.

Formation of Predictive Portfolios

Similar to the procedure in Jegadeesh (1990), predictive portfolios are formed by sorting REITs into groups based on their prior returns. Researchers using large samples to study overall stock return predictability typically divide their firms into ten decile portfolios. Since the total number of EREITs in the 1970s and 1980s is relatively small, only two portfolios are created here. The prior month's returns serve as the basis for forming the portfolios, since the autocorrelations reported in Exhibit 1 were strongest at the first lag. For each month, the half of the sample of REITs with the highest returns in that month is assigned to the portfolio labeled HI, with the other half of the sample placed into the portfolio called LO. Returns on these two portfolios for the following month are then computed. The portfolios are then rebalanced, based on the individual REIT returns for the following month. Average returns on these two portfolios are compared to examine the profitability of a contrarian trading strategy that exploits the negative autocorrelation structure.

The portfolio analysis discussed above also is performed for a subset of firms specializing in the ownership and operation of retail properties. It was not feasible to study other property types individually because of the small number of such firms throughout much of the sample period covered.

Results of Predictability Tests: EREITs vs. Small- and Mid-Cap Stocks

Exhibit 2 reports the results of the predictability analysis for the entire 1975–95 sample period. The findings in the first column of the top panel, based on all months including January, document the total returns to following a strategy of buying past underperformers and selling past overperformers. The mean (median) return for the LO portfolio is 2.1% (1.3%), while the mean (median) for the HI portfolio is only 1.0% (0.8%). This pattern is consistent with the autocorrelation results in Exhibit 1, and suggests some overreaction in EREIT returns with relatively low returns in month t being followed in month $t + 1$ by relatively high returns.[6] The third row reports that the difference in the mean returns on these two portfolios, which represents the total return on a portfolio created by buying past losers and selling past winners, is approximately 1.1% per month. This difference is highly statistically significant (the p-value is 0.0001), but the economic significance is limited once transactions costs such as commissions, the bid-ask spread and the market price impact of a trade are considered. While institutional investors may be able trade at negligible commission costs, Nelling, Mahoney, Hildebrand and Goldstein (1995) document that the average bid-ask spread on EREITs was greater than 5% of the share price between 1985 and 1990. The small market capitalizations of EREITs prior to 1985 virtually guarantees similarly high spreads over the 1975–84 period. Average firm size among REITs has increased in recent years, but the typical EREIT still was small in terms of all traded firms in the early 1990s. Hence, bid-ask spreads and other transactions costs appear

Exhibit 2
Average Monthly Returns on Predictive Portfolios for EREITs

	All months (Jan.–Dec.)	January only	Excluding January (Feb.–Dec.)
Panel A: EREITs			
P(LO)	0.021	0.079	0.016
	(0.013)	(0.043)	(0.010)
P(HI)	0.010	0.056	0.006
	(0.008)	(0.051)	(0.006)
P(LO) − P(HI)	0.011	0.023	0.010
	(0.010)	(0.017)	(0.009)
p-values for test that P(LO) − P(HI) > 0	0.0001	0.0283	0.0001
Panel B: Small-cap stocks			
P(LO)	0.039	0.207	0.024
	(0.027)	(0.170)	(0.020)
P(HI)	0.011	0.115	0.001
	(0.002)	(0.112)	(−0.003)
P(LO) − P(HI)	0.028	0.092	0.023
	(0.049)	(0.058)	(0.023)
p-values for test that P(LO) − P(HI) > 0	0.0001	0.0001	0.0001
Panel C: Mid-cap stocks			
P(LO)	0.018	0.068	0.013
	(0.017)	(0.053)	(0.016)
P(HI)	0.013	0.057	0.009
	(0.012)	(0.040)	(0.008)
P(LO) − P(HI)	0.005	0.011	0.004
	(0.003)	(0.012)	(0.002)
p-values for test that P(LO) − P(HI) > 0	0.0001	0.0001	0.0001

This exhibit reports the mean (median) returns for predictive portfolios of EREITs, and also for small- and mid-cap stocks. Two equally-weighted portfolios, P(HI) and P(LO), are formed each month by sorting EREITs based on the prior month's returns. P(HI) is the portfolio of REITs that had the largest returns in the prior month, and P(LO) is the portfolio of REITs that had the smallest returns. Small-cap stocks are those in the lowest decile of market capitalization, and mid-cap stocks are those in the sixth decile. *p*-values test whether the difference in mean returns across the two portfolios is equal to zero. The sample period is 1975–95.

to have been more than large enough to eliminate any arbitrage profits associated with the limited predictability that exists in REIT returns.[7]

The extent to which the HI and LO portfolios must be rebalanced each month is also related to the transactions cost issue. In other words, if many of the REITs in each portfolio tend to remain within the same portfolio from one month to the next, the typical cost of buying or selling an individual security would tend to overstate the cost of rebalancing the entire portfolio. An examination of the amount of rebalancing required each month found that, on average, 47% of the REITs in a portfolio in month t were also in the same portfolio in month $t - 1$. The remaining 53% either moved from the other portfolio or entered the sample for the first time. This suggests that the rebalancing cost for the above strategy is approximately one-half of the typical round-trip transaction cost for an individual REIT. The difference in returns of 1.1% suggests that the strategy would only be profitable when round-trip transaction costs are about 2% or lower. As noted, the relevant transactions costs include commissions, the bid-ask spread and the market price impact of a trade, and are highly likely to exceed 2% for the typical REIT during our sample period.

The other two columns of Exhibit 2 report the predictive portfolio returns separately for January and the rest of the year. Note that for EREITs, the difference in returns for the HI and LO portfolios is much larger in January: 2.3% and 1.7% at the mean and median, respectively. However, this is still not large enough to cover transactions costs, on average. The differences in returns across the two portfolios when January is excluded are virtually indistinguishable from the results when January is included, as seen by comparing the third rows of columns 1 and 3 in Exhibit 2.[8]

A Comparison of REIT Return Predictability with that of Small- and Mid-Cap Stocks

In order to compare the predictability of REIT returns with that of other stocks, the autocorrelation structures of the returns on portfolios of small and mid-cap stocks were examined. These small and mid-cap portfolios were created using stocks in the tenth and sixth firm size deciles, respectively, for all NYSE and AMEX firms. Small stocks were used for comparison because REITs have until recently tended to be small in market capitalization. The results for the small stock portfolio were very similar to those reported in Exhibit 1 for the EREITs (*i.e.*, the only statistically significant correlation coefficient is at the first lag). Its sign and magnitude of -0.127 are very similar to that for EREITs, which was -0.135 at the first lag. The autocorrelation structure of the mid-cap stocks from the sixth decile of the size distribution exhibited no statistically significant lagged correlation. These correlation coefficients were insignificantly different from zero and small in magnitude.[9]

Of course, the economic significance of the autocorrelation structure is based upon whether meaningfully positive returns can be generated from a trading strategy based on the return history. Panels B and C of Exhibit 2 report results for predictive portfolios of small- and mid-cap stocks analogous to those created for the EREITs.

Panel B of Exhibit 2 shows that using the contrarian strategy of buying last month's underperformers and selling last month's overperformers yields a difference in returns of 2.8% per month on the LO and HI portfolios for the firms in the tenth decile. This is 2.6 times the 1.1% monthly return on the EREIT portfolios. As is the case for the EREITs, the difference is substantially higher in January (9.2%) than for the rest of the year.[10] The lower total return from trying to exploit EREIT return predictability in this manner could be due, at least partially, to the nature of long-term leases and the relative stability of operating expenses. These factors make the net cash flows of a REIT relatively predictable—at least when compared to other industries such as computer software and biotech in which small firms often bring rapid and unpredictable technological change.[11] If net cash flows for REITs can be predicted relatively more easily and accurately, then persistent returns inconsistent with the expected cash flows can be more readily exploited by investors, especially if discount rates are not varying substantially.[12] In such a case, one would expect less return predictability for REITs, which is consistent with the findings reported in Exhibit 2.

Given that there is no significant autocorrelation in mid-cap stock returns, it is not surprising that Panel C of Exhibit 2 shows that there is very little gain to a contrarian investment strategy in these firms. The estimated total monthly return of 0.5% is not statistically significantly different from zero. The difference in January is only 1.1%. The relevant implication of this is not that REITs and other small firms have more predictable returns than do larger firms, but that as consolidation in the EREIT industry continues and the average firm size grows, the negative autocorrelation pattern reported above may disappear. Given that EREIT returns have not exhibited more predictability than is the case for small non-real estate firms (at least in the sense that a contrarian investment strategy generates higher total returns), it seems unlikely that the returns on EREITs that have grown over time into mid-cap stocks would be more predictable than other similarly-sized firms not in the real estate business.[13]

Results of Predictability Tests for Different Time Periods

Exhibit 3 reports the results regarding predictability over three time periods: 1975–84, 1985–92 and 1993–95.[14] These periods were chosen due to the changing nature of the EREIT market. The mid-1980s was characterized by the emergence of health care REITs, and the 1993–95 period was examined separately due to the very large number of IPOs by EREITs in those years.

Panels B and C show that return predictability is highest in the 1975–85 and 1993–95 periods. For those two periods, the mean differences in returns between the HI and LO portfolios are highly statistically significant, but once again, the difference of about 1.5% per month is not large enough to cover transactions costs necessary to exploit the predictability. It is not clear why the economic and statistical significance of predictability is so low between 1985 and 1992. Increasing coverage by analysts and interest by the institutional investment community almost certainly cannot explain this finding, since such coverage and interest was much greater in the 1993–95 period.

Exhibit 3
Average Monthly Returns on Predictive Portfolios for EREITs (By Subperiod)

	All months (Jan.–Dec.)	January only	Excluding January (Feb.–Dec.)
Panel A: 1975–84			
P(LO)	0.031 (0.025)	0.106 (0.062)	0.025 (0.022)
P(HI)	0.016 (0.018)	0.083 (0.077)	0.010 (0.016)
P(LO) − P(HI)	0.015 (0.013)	0.023 (0.014)	0.014 (0.013)
p-values for test that P(LO) − P(HI) > 0	0.0002	0.2382	0.0004
Panel B: 1985–92			
P(LO)	0.008 (0.007)	0.055 (0.045)	0.004 (0.005)
P(HI)	0.003 (0.003)	0.037 (0.050)	<0.001 (0.002)
P(LO) − P(HI)	0.005 (0.005)	0.018 (0.011)	0.003 (0.005)
p-values for test that P(LO) − P(HI) > 0	0.0722	0.2125	0.1757
Panel C: 1993–95			
P(LO)	0.020 (0.010)	0.051 (0.043)	0.017 (0.009)
P(HI)	0.005 (0.007)	0.014 (0.017)	0.004 (0.006)
P(LO) − P(HI)	0.015 (0.017)	0.038 (0.035)	0.013 (0.015)
p-values for test that P(LO) − P(HI) > 0	0.0008	0.0380	0.0046

This exhibit reports the mean (median) returns for predictive portfolios of EREITs. Two equally-weighted portfolios, P(HI) and P(LO), are formed each month by sorting EREITs based on the prior month's returns. P(HI) is the portfolio of REITs that had the largest returns in the prior month, and P(LO) is the portfolio of REITs that had the smallest returns. *p*-values test whether the difference in mean returns across the two portfolios is equal to zero. The sample period is 1975–95.

The mid-1980s did see a fairly large number of EREIT IPOs, a large fraction of which were specialty health care firms.[15] To determine whether the emergence of health care REITs affects the results, the portfolio strategy was repeated after excluding health care REITs, of which there were eight in the 1985–92 period. The results were nearly identical to those using all REITs.

Differences in risk between the HI and LO portfolios were examined for the overall period and for the subperiods by estimating the beta coefficient of each portfolio using market model regression. For all time periods, the betas of the HI and LO portfolios were nearly identical. As a result, the beta of the arbitrage portfolio would be very close to zero, suggesting that the return on the contrarian strategy is not due to differences in risk.

Other studies of stock return predictability such as Conrad, Hameed and Niden (1994) use additional variables such as the number of transactions or trading volume in their analysis. These were not used in this study of REIT predictability since for most of the sample period, trading volume on REITs has tended to be relatively low, and differences in volume are not likely to have a substantial effect on the results.

Results of Predictability Tests: A Retail REIT Sample

Exhibit 4 reports the findings when the analogous predictive portfolios are formed for a sample of retail-oriented EREITs. There has been a substantial increase in the number of retail REITs in the post-1992 period, and there were thirty-five firms (primarily shopping center owners) from 1988–1995, which permitted the analysis of return predictability for this group of firms.[16] Panel A of Exhibit 4 shows that there is no significant evidence of return predictability among retail-oriented EREITs. A comparison with other EREITs in Panel B indicates that return predictability for other property types is statistically but not economically significant. A more detailed analysis of other property types, especially multifamily residential, awaits a longer time series of returns.

Exhibit 4
Average Monthly Returns on Predictive Portfolios for Retail REITs

	All Months (Jan.–Dec.)	January only	Excluding January (Feb.–Dec.)
P(LO)	0.013	0.060	0.008
	(0.015)	(0.038)	(0.013)
P(HI)	0.008	0.020	0.006
	(0.009)	(0.027)	(0.007)
P(LO) − P(HI)	0.005	0.040	0.002
	(0.003)	(0.018)	(<0.001)
p-values for P(LO) − P(HI) > 0	0.3328	0.1889	0.7193

This exhibit reports the mean (median) returns for predictive portfolios of retail REITs. Two equally-weighted portfolios, P(HI) and P(LO), are formed each month by sorting retail REITs based on the prior month's returns. P(HI) is the portfolio of REITs that had the largest returns in the prior month, and P(LO) is the portfolio of REITs that had the smallest returns. *p*-values test whether the difference in mean returns across the two portfolios is equal to zero. The sample period is 1988–95.

Exhibit 5
Nonparametric Tests of Persistence in Monthly Returns of EREITs

OBS	CUSIP	NMISS	NRUNS	UCNT	DCNT	W975	WO25	DRANDOM
1	02649410	147	34	46	35	32.15	49.35	1
2	05528610	184	28	19	25	16.29	28.89	1
3	05564E10	69	95	83	76	68.05	92.64	0
4	09690310	150	40	37	41	31.32	48.47	1
5	10458310	126	60	45	57	41.58	61.01	1
6	12232C10	146	56	41	41	33.18	50.82	0
7	15043810	145	49	39	44	33.51	51.19	1
8	15505210	23	100	89	116	87.97	115.48	1
9	16733910	143	47	40	45	34.40	52.30	1
10	18678010	1	115	104	123	99.08	128.33	1
11	20323720	70	82	70	88	66.86	91.09	1
12	21148C10	195	17	18	15	11.87	22.86	1
13	21745410	128	50	48	52	41.19	60.66	1
14	25247810	145	49	39	44	33.51	51.19	1
15	26441120	200	18	13	15	9.87	19.99	1
16	26882010	124	46	38	66	40.01	58.45	1
17	27727010	1	118	106	121	99.34	128.67	1
18	31374720	7	131	120	101	96.26	125.11	0
19	33740010	2	116	114	112	99.29	128.69	1
20	37001910	101	70	55	72	52.56	74.16	1
21	40009710	144	58	42	42	34.07	51.93	0
22	40423210	1	109	88	139	94.79	122.76	1
23	40426510	1	145	104	123	99.08	128.33	0
24	42191510	126	46	63	39	39.88	58.47	1
25	42192110	138	49	42	48	36.60	55.00	1
26	42216910	145	48	47	36	33.06	50.49	1
27	44143820	1	127	108	119	99.54	128.93	1
28	45005810	1	134	111	116	99.72	129.17	0
29	50022810	165	32	28	35	24.49	39.73	1
30	51509610	169	31	23	36	21.97	36.16	1
31	55288510	1	126	112	115	99.75	129.21	1
32	55349510	119	59	51	58	45.13	65.42	1
33	58461M10	153	32	35	40	29.94	46.73	1
34	58501T10	131	32	58	39	38.41	56.87	0
35	58995110	167	32	27	34	23.61	38.59	1
36	58995210	150	34	28	50	28.99	44.80	1
37	58995310	165	24	25	38	23.78	38.54	1
38	63862010	133	48	59	36	36.78	54.65	1
39	64805910	52	93	90	86	76.00	101.91	1
40	65537910	131	44	49	53	39.56	58.60	1
41	68240610	102	69	62	64	53.03	74.94	1
42	69478510	131	54	46	51	39.80	58.95	1
43	70910210	2	119	111	115	99.27	128.66	1
44	72481910	2	117	110	116	99.23	128.61	1
45	74100410	2	115	99	127	97.79	126.74	1
46	74344510	1	112	115	112	99.75	129.21	1
47	75589310	123	56	48	57	43.19	63.03	1
48	75589510	117	49	61	50	45.78	66.13	1
49	80120920	78	93	70	80	63.76	87.58	0
50	80439610	65	86	74	89	69.44	94.18	1

Exhibit 5 (continued)
Nonparametric Tests of Persistence in Monthly Returns of EREITs

OBS	CUSIP	NMISS	NRUNS	UCNT	DCNT	W975	WO25	DRANDOM
51	83013710	146	44	38	44	33.01	50.55	1
52	86211010	95	69	64	69	56.16	78.65	1
53	89390210	87	82	63	78	59.24	82.17	1
54	90028310	188	20	11	29	12.10	21.80	1
55	90337010	41	108	85	102	80.47	106.98	0
56	91019710	63	80	94	71	69.59	94.20	1
57	91359E10	146	35	52	30	30.87	47.23	1
58	93965310	2	122	119	107	99.02	128.34	1
59	94874110	129	63	54	45	40.47	59.71	0
60	95846810	115	65	59	54	47.04	67.74	1
61	96200410	150	38	41	37	31.32	48.47	1

This exhibit reports the results of nonparametric runs tests for returns of EREITs over the period 1975–93. The tests are based on the number of runs, *i.e.,* clustering of superior or inferior performance in consecutive months, where performance is measured relative to the mean return of all EREITs in a given month. Explanation of column headings:

OBS = An index identifying the firm.
CUSIP = The REIT's CUSIP.
NMISS = The number of missing returns out of a total of 228 monthly observations. Note that the REITs identified as OBS #12. and #15 are ignored because of too many missing returns. The persistence tests required at least thirty-six monthly returns.
NRUNS = The number of observed runs in either good or bad performance.
UCNT = The number of months of superior performance.
DCNT = The number of months of inferior performance.
W025 = The lower bound of the 95% confidence interval for the expected number of runs.
W975 = The upper bound of the 95% confidence interval for the expected number of runs.
DRANDOM = A dummy variable that summarizes the results of the runs test. A value of 1 indicates that the null hypothesis of randomness (no persistence) in returns cannot be rejected; a value of 0 indicates a rejection of the null hypothesis.

Persistence in REIT Performance

The analysis presented addresses whether REIT returns are predictable in general. In other words, it is an analysis of predictability at the market-wide level. In this section, persistence tests are conducted to examine whether *individual* REITs can outperform their peers. Grinblatt and Titman (1992) and Hendricks, Patel and Zeckhauser (1993) find evidence of persistence in equity mutual fund returns. If it is easier to copy successful investment strategies in real estate, or more difficult for a REIT to exhibit differential performance relative to other REITs, we would expect to find less evidence of persistence for REITs than stocks in general.

In order to ascertain whether REITs exhibit any positive or negative performance persistence, nonparametric runs tests are conducted. A run is defined as an uninterrupted sequence of superior performance months or inferior performance months. Nonparametric tests are used to avoid making any assumptions about the distribution of returns in the sample.

By examining how runs behave in a strictly random sequence of observations versus the actual number of runs observed, a test of persistence can be derived. Under the null hypothesis that successive outcomes are independent, the number of runs, n, is distributed asymptotically normally with:

$$E(n) = \frac{2N_1N_2}{N_1 + N_2} + 1$$

and

$$\sigma_n = \sqrt{\frac{2N_1N_2(2N_1N_2 - N_1 - N_2)}{(N_1 + N_2)^2(N_1 + N_2 - 1)}}$$

where N_1 is the number of instances of superior performance and N_2 is the number of instances of inferior performance.[17]

As an example, suppose that over the entire sample period of 252 months, a REIT exhibited 126 months of superior performance and 126 months of months of inferior performance. Under the null hypothesis of randomness, there would be no clustering of superior or inferior performance months. The expected number of runs would be:

$$E(n) = \frac{2 \times 126 \times 126}{126 + 126} + 1 = 127$$

and

$$\sigma_n = \sqrt{\frac{2 \times 126 \times 126(2 \times 126 \times 126 - 126 - 126)}{(126 + 126)^2(126 + 126 - 1)}} = 7.9$$

Further suppose that this REIT exhibited 126 *consecutive* months of superior performance, followed by 126 consecutive months of inferior performance. The observed number of runs for this REIT would be 2, which is far below the lower bound of the 95% confidence interval and thus the null hypothesis of no persistence (randomness) would be rejected. On the other hand, suppose that a month of superior performance was always followed by a month of inferior performance. Such oscillation would result in 251 observed runs, which is far above the upper bound of the 95% confidence interval, and the null hypothesis of randomness would again be rejected. Note that a rejection of the null does not imply superior performance. It simply means that the sequence does not appear to be random. Also note that the tests do not consider the magnitude of superior or inferior performance in any given month.

In the persistence tests, performance is measured for each month over the 1975–95 period relative to the mean performance of all REITs in that month. As a result, a REIT is considered to have exhibited positive performance in month t if its return in

that month is larger than the average return of all REITs in that month. Similarly, a return that is lower than the average return of all REITs in that month would indicate negative performance. A REIT is not included in the analysis if it does not have at least two years of monthly return data available.

Exhibit 5 reports the results of the persistence tests. Of the sixty-one REITs examined, ten exhibit performance persistence.[18] For nine of these ten firms the observed number of runs was significantly higher than the expected value, which is consistent with the autocorrelation results presented in Exhibit 1. These REITs display a tendency to exhibit superior performance in one month and inferior performance in the following month. Interestingly, though, an examination of the types of properties held by these REITs indicates that six of the ten firms invest primarily in retail properties. Retail REITs comprise only 27% of the firms examined for persistent runs. While this particular sample size is small and thereby limits statistical inference, it suggests researchers and investors may wish to see if the large number of new retail REIT firms formed after 1992 also are characterized by this seemingly overreactive behavior.

Conclusion

This study has examined the predictability of returns on EREITs. Results indicate statistically significant evidence of predictability of monthly returns, which is largely associated with return behavior between 1975–84 and 1993–95. However, the average monthly return from the implied trading strategy is about 1.1% and is not large enough to cover the transactions costs that would be necessary to exploit the finding. There is no evidence this result is specific to a single property type, but the small sample sizes available by property type make such a conclusion tentative at this time.

It may be that the low level of predictability of EREIT returns compared to that of general stock returns reported by Jegadeesh (1990) is a statistical artifact of the smaller sample size of firms available for real estate-focused analysis. However, the findings also are consistent with what might be expected for firms in a market characterized by long-term leases to credit tenants and little unexpected technological progress affecting operating expenses.

In addition to the analysis of predictability for the general REIT market, the persistence in return behavior at the individual firm level also was examined using nonparametric tests. The results of these tests indicate that several REITs do exhibit persistence, which appears to be overreactive in nature. In addition, retail REITs are overrepresented among the firms exhibiting persistence.

Appendix
Autocorrelations in Small- and Mid-Cap Stock Returns

	Small-Cap Stocks	Mid-Cap Stocks
a_0	0.009 (0.299)	−0.003 (0.446)
a_1	−0.127 (0.000)	−0.014 (0.534)
a_2	−0.055 (0.047)	−0.049 (0.107)
a_3	−0.049 (0.042)	0.044 (0.143)
a_4	−0.045 (0.129)	−0.022 (0.433)
a_5	−0.006 (0.829)	0.023 (0.468)
a_6	−0.042 (0.030)	0.020 (0.460)
a_7	−0.020 (0.432)	−0.006 (0.806)
a_8	(−0.058) (0.026)	−0.055 (0.038)
a_9	−0.022 (0.352)	−0.028 (0.193)
a_{10}	−0.038 (0.068)	0.016 (0.522)
a_{11}	−0.020 (0.352)	−0.004 (0.853)
a_{12}	−0.001 (0.967)	0.013 (0.546)

This Appendix reports the results of cross-sectional regressions of monthly excess stock returns on past returns. The model is of the form:

$$\tilde{R}_{it} - \overline{R}_{it} = a_{0t} + \sum_{j=1}^{12} a_{jt} R_{it-j} + u_{it},$$

where R_{it} is the return on stock i in month t and R_{it} is the average monthly return on stock i over the period $t + 1$ to $t + 6$. The regression is performed each month over the period of 1975–95. The reported parameters are the average of the time series of coefficients. The p-value (in parentheses) is the probability that average of the time series of coefficients is equal to zero.

Notes

[1] Mei and Gao (1995) and Cooper, Downs and Patterson (1995) investigate REIT return predictability using weekly data and find statistically significant evidence of predictability.

[2] Transactions costs may be higher for small stocks in general, so returns net of transactions costs may not be higher.

[3] See Gyourko and Keim (1992) for the details on the number of firms since 1962.

[4] This relatively short future horizon is used to proxy for expected returns in order to use as many of the wave of new REITs as possible in our analysis. Twelve and twenty-four month horizons were also investigated, but no meaningful result was sensitive to the horizon used to estimate expected returns.

[5] See, for example, Giliberto (1990) and Colwell and Park (1990).

[6] This overreaction pattern is consistent with the findings using weekly data. See, for example, Mei and Gao (1995) and Cooper, Downs and Patterson (1995).

[7] Bhasin, Cole and Kiely (1997) report that spreads on EREITs have fallen in recent years, raising the possibility that contrarian profits have increased. However, these narrower spreads are for larger firms on average, reflecting growth in the EREIT market. As is documented, the predictability of mid-cap stocks in general is very low. Thus, the reduction in transactions costs may be accompanied by a reduction in predictability.

[8] Some REIT industry observers have suggested that a December effect may be emerging in recent years. The level of predictability was investigated separately for December and was found to be no different than the months of February through November. If a December effect does exist, it may be too recent to affect our results.

[9] A complete set of estimated lagged correlations for small- and mid-cap stocks is reported in the Appendix. Results for January and for the eleven months excluding January are available upon request.

[10] Although the returns on the smallest publicly traded firms are more predictable in the sense that the total return from this trading strategy is greater, it should be emphasized that transactions costs may be higher for these firms. In particular, the bid-ask spread and the price impact of a trade can be quite large for the smallest firms. In 1995, the average market capitalization for firms in the tenth decile portfolio was only $14 million, so price impacts alone could be meaningful. In any event, whether an arbitrage opportunity exists for small capitalization firms in general is an issue outside the scope of this article.

[11] Most non real-estate-related small-cap firms create value by bringing new products or technologies to market or by introducing a material change in a production process. Gyourko and Siegel (1994) document that whether they are successful ends up being reflected in share price appreciation, as a key difference between EREITs and other small capitalization firms is the importance of dividends versus capital gains in their total returns. For the typical small firm not in the real estate industry, capital gains are the dominant component of total return, while for similarly sized EREITs, dividends drive total returns.

[12] The same conclusion would apply to apartment REITs, even though they do not sign long-term leases. In the multifamily sector, rental household formation is fairly easily predicted because it is so dependent upon the age distribution of households. That distribution is well known, with changes in it easily anticipated, except in rare markets subject to substantial immigration. For example, see Rosen's (1996) analysis of apartment market fundamentals.

[13] A test of this hypothesis can be performed in the near future. The mean market capitalization of the mid-cap stocks from the sixth decile of the firm size distribution was $220 million in 1995—the final year of our data series. In early 1997, 79% of the firms in the Paine Webber Equity REIT Index have equity market capitalizations above $220 million. Given the extraordinarily strong performance of the stock market in 1996 in particular, there is no doubt that the mean market capitalization of firms in the sixth decile of the size distribution has also risen. Nevertheless, there also is no doubt that average EREIT size has risen relative to the

stock market as a whole. Hence, future work in this area should disaggregate REITs by size and examine their autocorrelation structures to see if there are any material differences.

[14] Results for the EREITs only are reported in this subsection. The small- and mid-cap portfolios were also analyzed. However, the results yielded rankings and conclusions similar to those reported in Exhibit 2. They are available upon request.

[15] To determine if IPO activity affected the results, the number of new firms that entered our sample each month was examined. Fewer than three firms entered the sample in any month until late 1993 when REIT IPOs increased significantly. Consequently, the findings for the first two subperiods are not likely to be related to new REIT offerings.

[16] It was not feasible to disaggregate the retail REITs, as there were no regional mall or outlet mall REITs prior to 1992.

[17] For a more detailed discussion of the theory of runs tests, see Conover (1971).

[18] The smaller sample size here is due to the necessity of having a long time period over which to identify runs. Thus, none of the new wave of post-1992 REITs are examined in this section.

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