A Fundamental Examination of Securitized and Unsecuritized Real Estate

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***un-Abstract*. Most studies (including this one) have found a weak statistical relationship between total returns for securitized and unsecuritized real estate equities. Some studies argue that REIT shares behave more like the stock market, than real estate. In an attempt to focus this discussion, this study examines the fundamental underlying return-generating components: dividends, investment values and dividend yields using NAREIT and NCREIF data from 1978 through 1994. While dividends have been part of the REIT pricing calculus for some time, relatively few studies have focused upon the "dividends" paid by the NCREIF properties. The short-run relationships between these fundamental components are weak and many of their distributions display significant non-normal tendencies. Even when quarterly lags of up to two years are examined, these distributions also tend to be weakly correlated with one another. Of the three fundamental components, the long-run path of prices exhibited the strongest relationship. Interestingly, the volatility of the NCREIF dividend series is approximately 150% of the NAREIT volatility, while the volatility of the NCREIF asset values is roughly 25% of the NAREIT volatility. This is contradictory: in a simplified setting, greater dividend volatility should be accompanied by greater price volatility, not less, as observed here. Nevertheless, such comparisons suffer due to the incompatibility of the data sources and, accordingly, this study should be viewed as a preliminary examination of securitized and unsecuritized real estate returns.**

Introduction

Since most studies (including this one) have found a weak statistical relationship between total returns for securitized and unsecuritized real estate equities, the purpose of this study is to extend the comparison to an examination of their underlying fundamental components: dividends, investment values and dividend yields. While dividends and dividend yields have been explicitly part of the REIT pricing calculus for some time, relatively few studies have focused upon the "dividends" paid by NCREIF properties. In addition, this study emphasizes the long-term behavior of the fundamental components as a crucial initial step in understanding the relationship between securitized and unsecuritized real estate equities. Unfortunately, the relationship between these fundamental components, as they relate to securitized and unsecuritized returns, is generally weak from a statistical standpoint and many of the distributions presented in this study display significant non-normal tendencies. Even when quarterly lags of up to two years are examined, these securitized and unsecuritized series also tend to be weakly

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correlated with one another. Of the three fundamental components, the path of prices for securitized and unsecuritized real estate equities exhibited the strongest long-term relationship. In turn, this might suggest the weak relationships for explaining total returns may be more attributable to the volatility of dividends and/or changes in dividend yields. Interestingly, the volatility of the (unleveraged) NCREIF dividend series is approximately 150% of the NAREIT volatility, whereas the volatility of the NCREIF asset values is but roughly 25% of the NAREIT volatility. These results are contradictory: in a simplified setting, the greater dividend volatility should be accompanied by greater asset/price volatility, not less, as observed. These results also raise issues about whether REIT dividends are "managed" while NCREIF dividends are unmanaged. These results might also suggest some adaptation of the appraisal smoothing issues raised in other research. However, such comparisons suffer due to the incompatibility of the data sources. Consequently, this study should be viewed as a preliminary analysis of the similarities and differences between securitized and unsecuritized real estate investments.

The balance of this study is organized as follows. The next section reviews previous research applicable to the comparison of securitized and unsecuritized real estate. The third section describes the data sources to be used in this study, as well as the similarities and differences between them. The fourth section describes the methodology and theoretical underpinnings by which the two data sources are compared and analyzed. The fifth section presents the results of the comparisons and the analyses. The sixth section concludes with a summary of the findings and suggestions for future research.

Literature Review

Much of the previous literature has focused upon the relationship(s) between publicly traded equity REITs and the larger stock market forces for publicly traded equities. For example, Chan et al. (1990), using a multifactor arbitrage pricing model over the 1973–87 time period, found that four factors (unexpected inflation, changes in the risk and term structure of interest rates, and the percentage change in the discount on closed-end stock funds) consistently drive equity REIT returns. The impact of these variables is approximately 60% of that for common stocks. Equity REITs offered neither a superior risk-adjusted return nor a hedge against unexpected inflation. Earlier, Titman and Warga (1986) had also applied CAPM and APT models to equity and mortgage REITs over the 1973–1983 time period. Because REIT returns were so volatile, they found that large amounts of abnormal performance were not statistically different from zero.

Other studies have analyzed interest-rate sensitivity, capital structure and other stock-market like effects. For example, Chen and Tzang (1988) examined the interest-rate sensitivity of REITs finding different results over two subperiods and different sensitivities between mortgage and equity REITs. The issue of capital structure is an interesting one. Because REITs are exempt from corporate taxation (subject to compliance with the U.S. Tax Code), they begin to approximate the frictionless capital markets utilized by Modigliani and Miller (1958) who assert that there is no advantage to debt financing. Howe and Shilling (1988) examined the market's reaction to announcements between 1970 and 1985 of new security offerings by REITs. They found a positive stock price reaction to debt offerings by REITs and a negative reaction to equity offerings. These findings support "signalling" as an explanation for this behavior.

Maris and Elayan (1990) examined capital structure for debt and equity REITs, finding that despite the lack of tax incentives many REITs are highly leveraged. Two non-tax factors might encourage the use of indebtedness: agency theory (i.e., an optimum capital structure which is the same for otherwise similar firms) and leverage clientele effects (i.e., investors in high tax brackets prefer unleveraged firms while those in low (or zero) tax brackets prefer leveraged firms). Colwell and Park (1990) found that the "January effect" also exists for REITs (as well as common stocks) and that the effect declines with increasing market capitalization.

Liu et al. (1990), using the NCREIF data, found that the commercial real estate market is segmented from the stock market. Indirect barriers such as the cost, quality and amount of information seem to be the major sources of this segmentation, since they found that equity REITs and the stock market are integrated (i.e., not segmented). However, these conclusions were unclear when another proxy, American Council of Life Insurance Companies' data, for unsecuritized real estate was used. Liu and Mei (1992) examined the predictability of equity REIT returns and their co-movement with other assets. They found, using a multi-factor model with time-varying risk premiums, that expected excess returns are more predictable for equity REITs than for bonds and small-cap and value-weighted stocks. They also found that equity REIT returns move more closely with small-cap stocks than with large-cap stocks.

Myer and Webb (1993) examined the return properties of equity REITs, common stocks and commercial real estate. They found that, in a distributional and time-series sense, equity REITs appear to be more like common stocks. Intertemporally, REIT returns are, however, much more strongly related to unsecuritized real estate. It is this latter finding (i.e., the long-run relationship between securitized and unsecuritized real estate) which this study explores in a more fundamental way. Interestingly, Corgel et al. (1995), in their near encyclopedic review of the REIT literature, do not cite any paper expressly dealing with the detailed analysis of REIT fundamentals.

Given that returns from equity REITs seemingly represent some part general stock market effect and some part unsecuritized real estate, some researchers have suggested hedging a REIT index with either the S&P 500 (see Giliberto, 1993) or a small-cap index (see Kerson, 1994) as a means of capturing the "pure" real estate play within a publicly traded framework. Obviously, the success of such a strategy rests in part on the fundamental relationship between securitized and unsecuritized real estate equities.

The Data

This study uses the NAREIT Equity Index (without the healthcare sector) as a proxy for securitized real estate. The equity index comprises those real estate investment trusts (REITs) that predominantly invest in the equity position of real property – as distinguished from mortgage REITs (which invest predominantly in commercial mortgages) or hybrid REITs (which invest in both equities and mortgages). In theory, these equity REITs are directly comparable to unsecuritized real estate. However, as noted subsequently, there are many practical limitations in this comparison. This study uses the combined NCREIF Property Index as a proxy for unsecuritized real estate. The combined index represents the sum of the (widely quoted) unleveraged NCREIF Property Index and the (less widely quoted) index of leveraged properties reported to NCREIF stripped of their mortgage indebtedness. Gyourko (1992) indicated that the

leveraged properties tend to be larger, more heavily weighted toward retail, and more heavily weighted in the East than its unleveraged counterpart. For purposes of this study, both series begin at the start of 1978 and conclude with the end of 1994. The NAREIT series, however, extends back through 1972. Glascock and Hughes (1995), in a review of NAREIT-identified trusts over the 1972–1991 time period, found only twelve firms that have data over the entire period.

The 1993 volume of new equity REIT issues (both initial and secondary) exceeded the volume of the previous ten years combined. The 1994 volume equalled approximately 75% of 1993's volume. See Frank (1994). The increased volume of REIT activity has benefitted the more recent research activities due to wider market coverage, a greater array of REIT operating philosophies, more stringent financial reporting, narrowing of bid/ask spreads, etc. However, it should also be noted that it will take several years before the impact of this increased volume will significantly manifest itself in the return series. Accordingly, researchers, analysts and investors would be well served to cautiously view empirical studies, including this one, utilizing this evolving database.

At the end of 1994, the NAREIT equity index had a market valuation of $35.6 billion while the NCREIF index stood at $41.0 billion. Exhibit 1 shows the changing market mix of these indices over the 1978–1994 time period. As can be seen, the NCREIF index has consistently comprised a greater share of the real estate investment market, averaging more than three times the size of the NAREIT index. However, this dominance has dramatically narrowed since 1992.

The two indices also vary in other important ways. First, the mix of property types comprising the indices is different. Exhibits 2 and 3 compare the mix of property types by index as of the fourth quarter of 1994. The NAREIT index is overweighted, relative to the NCREIF index, in healthcare and apartment properties and underweighted in office properties (note that NAREIT includes the R&D/office sector in the office sector while NCREIF reports it separately). Because the healthcare sector is not present in the NCREIF index, this study uses the NAREIT equity index without healthcare as a more representative comparison to unsecuritized real estate – as proxied by the NCREIF index. Due to recent stock issuances, the NAREIT index has recently added considerably more apartment and retail properties. Second, the indices also vary considerably by their geographic weightings. In a comparison of the twenty-five largest equity REITs to an estimate of the national stock of real estate investments, Holden and Redding (1993) found that REITs were substantially overweighted in the smaller markets (e.g., Richmond, El Paso, Charleston, etc.) and substantially underweighted in the larger markets (e.g., Los Angeles, New York, Chicago, etc.). Third, the equity interests of the properties in the NAREIT series are leveraged with mortgage indebtedness while those in the NCREIF series are unleveraged. Fourth, the NAREIT series is reported after investment advisory/reporting fees and costs while the NCREIF series is reported before such fees.

Any rigorous comparison between securitized and unsecuritized real estate equities must make adjustment for the differences in the NAREIT and NCREIF indices. Several investment banks have begun to report equity REIT performance by property type and geographic weightings, thereby mitigating or eliminating (depending on how far back in time the data series is available and the interests of the analyst) the first two problems noted above. Should the historical data be available, the second problem (different geographic weightings), in conjunction with the first (different property weightings),

Exhibit 1
***NAREIT* Equity (without Healthcare) Index v. *NCREIF* Index Values**
Relative Market Mix and Combined Asset Values for the Period 1978:1 through 1994:4

Exhibit 2
Mix of Property Types for *NAREIT* Equity Index as of December 31, 1994

Exhibit 3
Mix of Property Types for *NCREIF* Index as of December 1994

might be resolved by sorting the NAREIT database according to a geographic and property-type scheme identical to that used to sort the NCREIF database.[1] This still leaves the third and fourth problems unresolved.

The third problem (leveraged v. unleveraged returns) may prove to be the most problematic. Initial adjustments must not only consider the degree of leverage, but must also distinguish between fixed- and floating-rate debt. These two types of indebtedness will exhibit opposite behavior on returns, which can be summarized as:

	A Changing Interest-Rate Environment and Its Impact on Equity REIT's Return Components	
Type of Interest Rate	Income	Appreciation
Fixed	Neutral	Volatile
Floating	Volatile	Neutral

In a changing interest-rate environment, the value of fixed-rate indebtedness should move inversely with the direction of the interest-rate change. Consequently, the value of the leveraged equity position (i.e., the appreciation return) should reflect the volatility of the interest-rate market, ceteris paribus.[2] Conversely, the income component of return should be unaffected by the changing interest-rate environment as the debt service remains constant (over the life of the loans(s)). The effects of floating-rate debt are opposite those of fixed-rate debt. In a changing interest-rate environment, the market value of the indebtedness should remain unchanged. Consequently, the value of the leveraged equity position should be unaffected by the volatility of the interest-rate market. Conversely, the income component of the return should be effected by the changing interest-rate environment, as the interest expense periodically rolls over to the new floating rate. Moreover, some evidence suggests that the marketplace values REITs utilizing floating-rate debt at a discount from otherwise similar REITs. See Litt et al. (1994) and Vinocur (1992).

In addition to the distinction between floating- and fixed-rate debt, other characteristics of the indebtedness should be captured. For example, as the term to maturity shortens for the fixed-rate debt, the pricing characteristics begin to roughly emulate the characteristics of the floating-rate debt. Conversely, as the time between "rollover" periods lengthens for the floating-rate debt, its pricing characteristics begin to roughly emulate the characteristics of the fixed-rate debt. Other examples would include adjustment for "collars" on floating-rate debt, contingent (or participating) interest, etc. Since all of these terms, rates and other considerations are changing over time, it is unlikely that a complete "deleveraging" of the NAREIT equity series is amenable to some simple adjustment – as in Fisher et al. (1994).

If the investment advisory fees/reporting and costs related to the NAREIT series were constant over time, the fourth problem (fees v. no fees) could be easily rectified – simply add back a constant percentage and/or amount to the NAREIT series so as to make it directly comparable to the NCREIF series. However, these fees and costs (as measured by amounts and/or percentages) change over time and are complicated as the industry moves from externally advised REITs to those that are internally advised. Additionally,

the existence of so-called "Up REITs" (see Frank, 1993) and the multiplicity of agency problems/conflicts of interest (see Sagalyn, 1994) might also contribute to the intractability of identifying fees and costs.

If all these problems were resolved, then securitized and unsecuritized real estate equity could be compared directly. Some of these comparisons would include: auction- v. appraisal-based valuations, the impact of fractional v. controlling interests, market efficiency, the "correct" pricing of leveraged investments, the "management" premium, etc. However, the primary role of this study is to examine the long-term convergence/divergence of securitized and unsecuritized real estate equities with regard to dividends, investment values and dividend yields.

Methodology

In order to make the securitized/unsecuritized comparison, it is assumed that $100 is invested in each data series at the beginning of 1978. In addition to examining quarterly returns, quarterly dividends and investment values as of the end of each quarter through the end of 1994 are reconstructed.

This reconstruction is fairly simple for the NAREIT series, as dividends, investment values (or prices) and dividend yields are separately reported in the *REIT Sourcebook* since the beginning of 1972 on a monthly and quarterly basis. It is relatively straightforward to convert these data series to a 1978 start date. Assuming a $100 investment at the beginning of 1978, the quarterly dividend yield can be used to calculate the dividend amount paid at the end of the first quarter and the quarterly appreciation return can be used to compute the investment value as of the end of the first quarter. This procedure is repeated through all subsequent quarters in order to determine the dollar amounts for dividend and investment values.

For the NCREIF series, the procedure is a bit more complex. The generally reported *NCREIF Property Index* discloses income and appreciation returns. The income return, however, is based upon net operating income and, therefore, is not a measure of dividends. As a special data request, NCREIF provides a more detailed report that lists net operating income, capital improvements, partial sales and beginning and ending asset values. From this information, a "dividend" series can be approximated by subtracting capital improvements from net operating income.[3] Because properties are constantly added to and subtracted from the database, it is necessary to create a quarterly dividend and appreciation return series that conforms to that used by NAREIT.[4] These conforming returns utilizing the NCREIF data series are computed as follows:

$$R_{Div,t} = \frac{NOI_t - CI_t}{MV_{t-1}}, \tag{1}$$

$$R_{App,t} = \frac{(MV_t - MV_{t-1}) + PS_t}{MV_{t-1}}, \tag{2}$$

$$R_{Total,t} = \frac{(MV_t - MV_{t-1}) + PS_t + NOI_t - CI_t}{MV_{t-1}}, \tag{3}$$

where:

$R_{Div,t}$ = dividend return during period t,
$R_{App,t}$ = appreciation return during period t,
$R_{Total,t}$ = total return during period t,
NOI_t = net operating income in period t,
CI_t = capital improvements in period t,
MV_{t-1} = market value at beginning of period t,
MV_t = market value at end of period t, and
PS_t = partial sales during period t.

These quarterly returns are then used to create a return series stated in dollar amounts for an initial investment of $100 that more closely conforms to that utilized for the NAREIT series. In turn, the relationship between market values and dividend amounts can be identified through the dividend yield (y_t):

$$y_t = \frac{Div_t}{MV_t}. \tag{4}$$

Assuming partial sales (PS_t) equal to zero,[5] equation (4) can be used to restate equation (3) as follows:

$$R_{Total,t} = \frac{y_{t-1}}{y_t} \cdot \frac{Div_t}{Div_{t-1}} \cdot (1 - y_t) - 1. \tag{5}$$

Consequently, total return in the t^{th} quarter ($R_{Total,t}$) is extremely sensitive and inversely related to changes in the dividend yield. This can be determined by taking the partial derivative of equation (5) with regard to the current dividend yield:

$$\frac{\partial R_{Total,t}}{\partial y_t} = -\frac{y_{t-1}}{y_t^2} \cdot \frac{Div_t}{Div_{t-1}}. \tag{6}$$

As shown in equation (6), quarterly total returns are inversely effected by changes in the dividend yield. Furthermore, the impact of "squaring" the denominator (y_t), where $0 < y_t < 1$, has the impact of substantially impacting quarterly total returns. However, when shifts in the dividend yields occur over longer periods of time, the impact of such shifts on total returns declines markedly. For ease of discussion, shifts in dividend yields can be defined as:

$$\nabla = \frac{y_{t+n}}{y_t}. \tag{7}$$

The impact of shifting dividend yields on total returns declines as the holding period (n) lengthens as shown in Exhibit 4.

To better convey the concept of the impact of shifting dividend yields, Exhibit 4 has been calibrated in years rather than quarters. The shorter time period (i.e., quarters) would have caused the scaling of the vertical axis to widen dramatically. In any event,

Exhibit 4
Total Annual Return Based upon Various Dividend Yield Shifts and Holding Periods

Exhibit 4 clearly demonstrates that in the short run total returns are highly dependent upon shifts in the dividend yield. While in the long run, total returns converge to the "fundamentals" of return as shown in equation (8).

$$k = \frac{Div_0}{MV_0}(1+g)+g\,, \tag{8}$$

where

k = total return over the holding period, and
g = the (constant) growth in dividends over the holding period.

Equation (8) is a simple reformulation of the Dividend Discount Model (see Gordon and Shapiro, 1956) given as:

$$MV_0 = \sum_{t=1}^{\infty} \frac{Div_t}{(1+k)^t} = \frac{Div_0(1+g)}{k-g}\,, \tag{9}$$

where, for purposes of tractability, it is assumed that dividends grow in perpetuity at some constant rate. As Exhibit 4 shows, if the asset is bought and sold at the same dividend yield (i.e., $\nabla = 1.00$) then the holding period is irrelevant: total return equals the initial dividend yield plus growth (i.e., equation (8)). If however, the beginning and ending dividend yield differ (i.e., $\nabla \neq 1.00$) then the holding period is relevant: total return is increasingly impacted by shifts in the dividend yield as the holding period shortens.

The following two issues illustrate the importance of examining the fundamental return components individually. First, the nature of the traditionally reported income and appreciation (quarterly) returns can lull the unwitting analyst into a false sense of stability with regard to that series' income stream. Consider the following hypothetical (and purposefully extreme) example: Assume that a $50 million building is valued at the end of each quarter by capitalizing next quarter's (annualized) net operating income at 8%, that net operating income declines at the rate of 5% per annum or 1.25% per quarter, and that (for purposes of simplicity) partial sales and capital improvements are zero. Then the NCREIF methodology[6] would generate the returns shown in Exhibit 5.

Notice that the NCREIF reported quarterly income return is approximately 2.0% every quarter, even though net income is declining at the rate of 1.25% per quarter! This results because the NCREIF methodology constantly revises the denominator to reflect drifting asset values. Because of the constant capitalization rate used in this example, the fundamental approach asserted in this study would view (on an annualized basis) this as simply a restatement of equation (8):

$$k = \frac{Div_1}{MV_0} + g\,, \tag{8a}$$

$$3.0\% = 8.0\% - 5.0\%\,. \tag{8b}$$

Notice that both approaches result in annual returns of 3.0% (or a quarterly return of .75%). It is simply that the fundamental approach leads to a much clearer view of the individual return components.

Exhibit 5
Illustration of Potential Disparity between Actual Net Income Growth and Reported Income and Appreciation Returns Using *NCREIF* Methodology*

Quarter	Ending Value $	Net Operating Income $	*NCREIF* Returns		
			Appreciation (%)	Income (%)	Total (%)
0	50,000				
1	49,375	1,000.00	−1.24	1.99	.75
2	48,758	987.50	−1.24	1.99	.75
3	48,148	975.16	−1.24	1.99	.75
4	47,546	962.97	−1.24	1.99	.75
5	46,952	950.93	−1.24	1.99	.75
6	46,365	939.04	−1.24	1.99	.75
7	45,786	927.31	−1.24	1.99	.75
8	45,213	915.71	−1.24	1.99	.75
9	44,648	904.27	−1.24	1.99	.75
10	44,090	892.96	−1.24	1.99	.75
11	43,539	881.80	−1.24	1.99	.75
12	42,995	870.78	−1.24	1.99	.75
13	42,457	859.89	−1.24	1.99	.75
14	41,927	849.15	−1.24	1.99	.75
15	41,403	838.53	−1.24	1.99	.75
16	40,885	828.05	−1.24	1.99	.75
17	40,374	817.70	−1.24	1.99	.75
18	39,869	807.48	−1.24	1.99	.75
19	39,371	797.38	−1.24	1.99	.75
20	38,879	787.42	−1.24	1.99	.75
21	38,393	777.57	−1.24	1.99	.75
22	37,913	767.85	−1.24	1.99	.75
23	37,439	758.26	−1.24	1.99	.75
24	36,971	748.78	−1.24	1.99	.75

*assumes capital improvements and partial sales equal to zero

Second, as shown in Exhibit 4, the effect of fluctuating capitalization rates (or, alternatively, dividend yields) is substantial when the holding period is relatively short. However, in the long run all returns converge towards their fundamental components. Additionally, while shifts in dividend yields can be substantial in the short run, in the long run the percentage change in dividend yields for both securitized and unsecuritized real estate is mean-reverting, as evidenced by their near-zero means – as discussed subsequently.

Consequently, any analysis of short-run returns that ignores the path of the underlying fundamental components encounters substantial "noise," due to short-run deviations from fundamental returns (as dividend yields can shift dramatically), and ignores the fact that this noise is eliminated in the long run by the mean-reverting nature of the shifts in dividend yields.

The Results

The relationship of securitized to unsecuritized real estate equity is examined from four vantage points: (1) total returns, (2) dividend amounts, (3) investment values, and (4)

dividend yields. Additionally, the discussion of dividend amounts also involves an extension to NCREIF's net operating income series.

Total Returns

Exhibit 6 presents a comparison of total quarterly returns for the respective databases. The greater volatility of the NAREIT series is readily apparent. A scatterplot comparison of total securitized (NAREIT) and unsecuritized (NCREIF) real estate quarterly returns is shown in Exhibit 7.

In addition to the graphing of concurrent returns, Exhibit 7 also shows a fitted linear regression line (the straight, dashed line) along with confidence intervals bounded at 95% (the two curved, dashed lines). From visual inspection, the relationship between the two data series appears weak. This appearance is supported by a review of the statistics involving the following univariate regression equation used to fit the straight line in Exhibit 7:

$$y_t = a + b\, x_t + \epsilon\,, \tag{10}$$

where:

y_t = quarterly return on NCREIF index in quarter t,
a = constant (intercept) value,
b = parameter modifying x_t,
x_t = quarterly return on NAREIT index in quarter$_t$, and
ϵ = error term.

The significant statistical values of this equation are summarized in Exhibit 8.

This weak statistical relationship between concurrent returns essentially reaffirms the research discussed in the *Literature Review*. Before exploring more fundamental ways in which the data series might be more similar, two other analyses should be explored. First, the shape of the underlying distributions should be examined. And second, various lagged relationships should be explored. Each might illuminate the weak statistical relationship between concurrent securitized and unsecuritized returns. That the same group (more or less) of underlying assets (i.e., real property) should have such widely dissimilar return patterns begs the question: does "packaging" (i.e., same group of assets, one in a securitized format and the other in an unsecuritized format) make such a substantive difference that the two return series are, statistically speaking, independent (or, nearly so) of one another?

If the shapes of the underlying distributions are non-normal, then this may impact the efficacy of the regression-based analysis discussed above. Summary statistics[7] for the respective returns series over the period beginning with the first quarter of 1978 and ending with the fourth quarter of 1994 are as shown in Exhibit 9. As compared to the NCREIF series, the NAREIT series has historically exhibited greater returns (see means and medians) and greater risk (see standard deviations and ranges). With regard to the question of the normality of the graphs, the measures of skewness and kurtosis indicate that the distributions are not normal. Moreover, given the leveraged nature of the NAREIT series, it would be expected that this return series is non-normal. See Pagliari and Sanders (1995). While these results are also consistent with earlier research (see Myer

Exhibit 6
Total Quarterly Returns for the Period from 1978:1 through 1994:4
***NAREIT* Equity Index (without Healthcare) v. *NCREIF* Property Index**

Exhibit 7
Scatterplot of Quarterly Total Returns
***NAREIT* v. *NCREIF* for the Period 1978:1 through 1994:4 with a Fitted Linear Regression and 95% Confidence Interval**

Exhibit 8
Statistical Summary of Univariate Linear Regression Concurrent *NAREIT* and *NCREIF* Quarterly Total Returns for the Period 1978 through 1994

R^2	.002	
F-Statistic	.161	
	Value	*t*-Statistic
a (Intercept)	.0209	7.90*
b (*Beta* Coefficient)	.0132	.40

*significant at the 99% confidence level

Exhibit 9
Statistical Summary of Distributions of Quarterly Total Returns Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	NAREIT	*NCREIF*
Mean	3.26%	2.13%
Median	2.66%	2.08%
Standard Deviation	7.37%	1.98%
Maximum	23.99%	6.19%
Minimum	−18.38%	−5.37%
Range	42.36%	11.56%
Skewness	.82	−.775
Kurtosis	1.000	2.472

and Webb, 1993 and Young and Graff, 1995), they seem an insufficient explanation as to the statistically weak relationship between the returns of securitized and unsecuritized real estate. This insufficiency leads to the second examination: a lagged relationship between returns.

The lagged relationship between securitized and unsecuritized returns has been previously examined by Gyourko and Keim (1992, 1993). Generally, their 1993 study found a mildly significant relationship[8] between the residual of the unsecuritized real estate returns (after having removed the autocorrelation found in the data series – see below) and the lagged one-year returns of a real estate stock index. Not only was their time period (1978–1991) slightly different from that utilized here, their definition of securitized real estate was also broader (e.g., included non-REIT stocks such as owner/operators, subdividers, developers and general contractors which comprised approximately 45% of their real estate stock index) and, therefore, runs counter to our argument of aligning the databases for homogeneity of product type. Consequently, it is important to examine this lag/lead relationship using the databases as discussed herein.

The correlation of the databases, lagged up to eight quarters, is examined in Exhibit 10. The number of observations (N) declines as the length of the lags increases. The ρ-values represent the probability associated with accepting the null hypothesis (i.e., the correlation coefficients are statistically indistinguishable from zero). Alternatively, one minus the ρ-values represents the confidence level associated with rejecting the null hypothesis.

The upper left quadrant of Exhibit 10 examines the autocorrelation of the NAREIT series by identifying the correlation between current NAREIT returns (t) and those lagged one through eight quarters (noted as $t-1$ and $t-8$, respectively). The autocorrelation of quarterly NAREIT total returns can be observed by inspecting the first column of the upper left quadrant. Interestingly, the most significant autocorrelation appears with the previous two year's returns (i.e., $t-8$) – significant at the 90% confidence level. However, all other lagged relationships for the NAREIT series are weak. None of the lagged returns are significant at the 95% confidence level.[9]

Quite the opposite pattern occurs when examining the NCREIF series. See the lower right quadrant of Exhibit 10. As Geltner (1989, 1993) and Ross and Zisler (1991) have noted previously, there is substantial autocorrelation in this return series. See the first column of the lower right quadrant. All of these lagged returns are significant at the 99% confidence level.[10]

The lower left quadrant examines the lagged relationships between the NAREIT and NCREIF series. The columns indicate the relationship between the current NAREIT (quarterly total) return and the leading, current and lagging NCREIF returns. Examining the first column of the lower left quadrant indicates a very weak relationship between the current NAREIT return and the current (t) and lagged ($t-n$) NCREIF returns. None of these relationships are significant even at a 70% confidence level. Meanwhile, the rows indicate the relationship between the current NCREIF return and the leading, current and lagging NAREIT returns. Examining the top row of the lower left quadrant indicates a persistent negative relationship between current NCREIF returns and the current (t) and lagged ($t-n$) NAREIT returns. Interestingly, this relationship is statistically strongest when the NAREIT returns are also lagged two years ($t-8$) and is statistically significant at a 90% confidence level. However, statistically significant (at a 90% confidence level) lags can also be found at the fourth and fifth quarters.

The relationship between current NCREIF (t) quarterly returns and current/lagged NAREIT returns ($t-n$) can be further examined by using step-wise regression (where missing data are pairwise deleted). For the time period studied, the results of such an approach are shown in Exhibit 11.

The ordering of the independent variables noted above also represents their incremental contribution (from highest to lowest) to the equation's explanatory power. As suggested earlier, NAREIT returns lagged two years (i.e., *NAREIT* $t-8$) is the most significant independent variable – both with regard to the size of its coefficient and t-statistic – in explaining the variability of current NCREIF returns. The intercept is positive and all of the independent variables have positive *beta* coefficients, which suggests a positive relationship between securitized and unsecuritized returns. Over the 1978–1990 time period, Gyourko and Keim (1992) found a significant relationship between current NCREIF returns and lagged one-year (i.e., the preceding annual) NAREIT returns with a dummy-variable adjustment for fourth-quarter "seasonality"

Exhibit 10
Correlation Matrix of Quarterly Total Returns Using *NAREIT* and *NCREIF* Data for the Period 1978:1 through 1994:4

	$NAREIT_t$	$NAREIT_{t-1}$	$NAREIT_{t-2}$	$NAREIT_{t-3}$	$NAREIT_{t-4}$	$NAREIT_{t-5}$	$NAREIT_{t-6}$	$NAREIT_{t-7}$	$NAREIT_{t-8}$
$NAREIT_t$	1 N=68 p=–								
$NAREIT_{t-1}$	.0623 N=67 p=·617	1 N=67 p=–							
$NAREIT_{t-2}$	−.0159 N=66 p=·899	.0341 N=66 p=·786	1 N=66 p=–						
$NAREIT_{t-3}$	−.1903 N=65 p=·129	−.0277 N=65 p=·826	.0731 N=65 p=·563	1 N=65 p=–					
$NAREIT_{t-4}$	.0794 N=64 p=·533	−.189 N=64 p=·135	−.0335 N=64 p=·793	.0892 N=64 p=·483	1 N=64 p=–				
$NAREIT_{t-5}$	−.0393 N=63 p=·760	.0831 N=63 p=·517	−.1765 N=63 p=·166	−.0806 N=63 p=·530	.1522 N=63 p=·234	1 N=63 p=–			
$NAREIT_{t-6}$	.0368 N=62 p=·776	−.054 N=62 p=·677	.097 N=62 p=·453	−.1741 N=62 p=·176	−.0638 N=62 p=·622	.1222 N=62 p=·344	1 N=62 p=–		
$NAREIT_{t-7}$	−.0532 N=61 p=·684	.0315 N=61 p=·810	−.0315 N=61 p=·810	.0896 N=61 p=·492	−.1601 N=61 p=·218	−.1155 N=61 p=·375	.1173 N=61 p=·368	1 N=61 p=–	
$NAREIT_{t-8}$	.2709 N=60 p=·036	−.0458 N=60 p=·728	.0281 N=60 p=·831	−.0267 N=60 p=·840	.0736 N=60 p=·576	−.1322 N=60 p=·314	−.1026 N=60 p=·435	.1284 N=60 p=·328	1 N=60 p=–
$NCREIF_t$	.0493 N=68 p=·690	.0392 N=67 p=·753	.1692 N=66 p=·174	.0359 N=65 p=·776	.2139 N=64 p=·090	.2295 N=63 p=·070	.2018 N=62 p=·116	.1413 N=61 p=·277	.2472 N=60 p=·057
$NCREIF_{t-1}$	−.1251 N=67 p=·313	.0422 N=67 p=·735	.0404 N=66 p=·747	.1788 N=65 p=·154	.0347 N=64 p=·786	.2364 N=63 p=·062	.2337 N=62 p=·068	.2083 N=61 p=·107	.141 N=60 p=·282
$NCREIF_{t-2}$	.0518 N=66 p=·679	−.1444 N=66 p=·247	.0464 N=66 p=·711	.0693 N=65 p=·583	.1757 N=64 p=·165	.0592 N=63 p=·645	.2467 N=62 p=·053	.2524 N=61 p=·050	.2075 N=60 p=·112
$NCREIF_{t-3}$	−.0759 N=65 p=·548	.0402 N=65 p=·751	−.1418 N=65 p=·260	.0612 N=65 p=·628	.0696 N=64 p=·585	.1951 N=63 p=·126	.0619 N=62 p=·633	.2562 N=61 p=·046	.2553 N=60 p=·049
$NCREIF_{t-4}$	.0665 N=64 p=·602	−.0963 N=64 p=·449	.0439 N=64 p=·731	−.1131 N=64 p=·374	.0584 N=64 p=·647	.0933 N=63 p=·467	.2033 N=62 p=·113	.0788 N=61 p=·546	.258 N=60 p=·047
$NCREIF_{t-5}$	−.0148 N=63 p=·908	.0463 N=63 p=·719	−.0987 N=63 p=·441	.0602 N=63 p=·639	−.0104 N=63 p=·417	.0464 N=63 p=·718	.0853 N=62 p=·510	.2115 N=61 p=·102	.0944 N=60 p=·473
$NCREIF_{t-6}$	.0321 N=62 p=·804	−.0575 N=62 p=·657	.0558 N=62 p=·667	−.0367 N=62 p=·777	.0499 N=62 p=·700	−.0646 N=62 p=·617	.0653 N=62 p=·614	.1229 N=61 p=·345	.2102 N=60 p=·107
$NCREIF_{t-7}$	−.0743 N=61 p=·569	.0019 N=61 p=·988	−.0563 N=61 p=·667	.0888 N=61 p=·496	−.0307 N=61 p=·814	.0533 N=61 p=·684	−.0648 N=61 p=·601	.0815 N=61 p=·533	.1367 N=60 p=·298
$NCREIF_{t-8}$	.0893 N=60 p=·497	−.1059 N=60 p=·421	.0073 N=60 p=·956	−.0143 N=60 p=·914	.0874 N=60 p=·507	−.0109 N=60 p=·934	.0614 N=60 p=·641	−.0462 N=60 p=·726	.085 N=60 p=·518

*N equals number of observations using pairwise deletion; p-values represent probability associated with accepting null hypothesis.

$NCREIF_t$	$NCREIF_{t-1}$	$NCREIF_{t-2}$	$NCREIF_{t-3}$	$NCREIF_{t-4}$	$NCREIF_{t-5}$	$NCREIF_{t-6}$	$NCREIF_{t-7}$	$NCREIF_{t-8}$
1 N=68 p=–								
.673 N=67 p=·000	1 N=67 p=–							
.6834 N=66 p=·000	.673 N=66 p=·000	1 N=66 p=–						
.6156 N=65 p=·000	.6835 N=65 p=·000	.6725 N=65 p=·000	1 N=65 p=–					
.7748 N=64 p=·000	.6159 N=64 p=·000	.6829 N=64 p=·000	.6719 N=64 p=·000	1 N=64 p=–				
.5156 N=63 p=·000	.7824 N=63 p=·000	.6178 N=63 p=·000	.6856 N=63 p=·000	.6727 N=63 p=·000	1 N=63 p=–			
.4756 N=62 p=·000	.5167 N=62 p=·000	.7827 N=62 p=·000	.6173 N=62 p=·000	.6845 N=62 p=·000	.6702 N=62 p=·000	1 N=62 p=–		
.4518 N=61 p=·000	.4806 N=61 p=·000	.5183 N=61 p=·000	.7874 N=61 p=·000	.6178 N=61 p=·000	.677 N=61 p=·000	.6679 N=61 p=·000	1 N=61 p=–	
.5527 N=60 p=·000	.4536 N=60 p=·000	.4802 N=60 p=·000	.5178 N=60 p=·000	.7874 N=60 p=·000	.6131 N=60 p=·000	.6746 N=60 p=·000	.6641 N=60 p=·000	1 N=60 p=–

Exhibit 11
Statistical Summary of Stepwise Multivariate Linear Regression of Current *NCREIF* Quarterly Total Returns v. Lagged *NAREIT* Retuns for the Period 1978 through 1994

Adjusted R^2	.175	
F-Statistic	3.08**	
	Value	*t*-Statistic
a (Intercept)	.0105	2.99***
$b_{NAREIT\ t-8}$	.0713	2.14**
$b_{NAREIT\ t-5}$	.0738	2.14*
$b_{NAREIT\ t-2}$	.0534	1.68*
$b_{NAREIT\ t-6}$	.0469	1.39
$b_{NAREIT\ t-4}$	.0513	1.61
$b_{NAREIT\ t-7}$	.0431	1.28

*significant at the 90% confidence level
**significant at the 95% confidence level
***significant at the 99% confidence level

(see Panel 2 of their Exhibit 2 on p. 464). This preceding annual NAREIT return would correspond to the following periods in this study: *NAREIT* $t-1$, *NAREIT* $t-2$, *NAREIT* $t-3$ and *NAREIT* $t-4$. Notably, only two of these periods (*NAREIT* $t-2$ and *NAREIT* $t-4$) are found to be significant in the stepwise regression approach.

Nevertheless, these results are troubling to those who generally believe in market efficiency. How can the two real estate return series exhibit such substantially different risk/return measures (see Exhibit 9) when the covariance is often statistically indistinguishable from zero (see Exhibit 10)? Even lagged NAREIT returns (see Exhibit 11) explain little more than 25% of the variation in NCREIF returns. This pattern has led Giliberto (1990) to examine the residuals from regressions of both data series on financial assets (i.e., stock and bonds). He found these residuals are significantly correlated (ρ=.44, significant at the 99% confidence level). The alternative approach, utilized in various forms by Geltner (1989, 1993), Gyourko and Keim (1992, 1993) and Ross and Zisler (1991), is to remove the autocorrelation in the NCREIF series. Using the "reconstituted" return series, the NCREIF series is more volatile and considered a better estimate of real estate's "true" systematic risk. This study proposes a third alternative: examine the fundamental components of return (dividends, investment values and dividend yields).

Quarterly Dividends

An investment of $100 at the beginning of 1978 in each of the real estate series would result in the dividend patterns (without reinvestment) shown in Exhibit 12.

Some of the volatility in the NAREIT dividend series may be attributable to imperfect adjustments for capital gains, return of capital and special dividends. See Culley and Shilling (1990).

Neither index represents a normal distribution. This appearance is supported by the statistical measures shown in Exhibit 13.

Exhibit 12
Quarterly Dividends for the Period from 1978:1 through 1994:4
***NAREIT* Equity Index (without Healthcare) v. *NCREIF* Property Index**

Exhibit 13
Statistical Summary of the Distributions of the Percentage Change in Quarterly Dividend Amounts Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	NAREIT	*NCREIF*
Mean	3.54%	4.96%
Median	.84%	−.04%
Standard Deviation	21.59%	35.24%
Maximum	83.17%	189.86%
Minimum	−14.97%	−64.54%
Range	125.14%	254.40%
Skewness	1.005	2.464
Kurtosis	2.456	11.299

Clearly, both series are non-normal. Interestingly, the NCREIF series has a higher average percentage change in quarterly dividends, a wider standard deviation and range, and greater skewness and kurtosis than its NAREIT counterpart. All of which is curious, given the unleveraged nature of the NCREIF series. Perhaps, quarterly dividend figures are too volatile and preclude drawing any meaningful conclusions. Certainly most investors forecast more than one quarter's worth of dividends when making an investment decision. Accordingly, the following section examines four-quarter rolling dividends in an attempt to overcome the volatile quarterly growth in dividends.

Rolling Four-Quarter Dividends

The rolling four-quarter dividends represent the simple summation of quarterly dividend payments over a given one-year interval. Quite naturally, the four-quarter summation of dividends has a smoothing effect as shown in Exhibit 14.

The summary statistics of the percentage change in rolling four-quarter dividends is shown in Exhibit 15. In the case of annual dividends, the leveraged NAREIT series experienced a higher average growth rate than did the NCREIF series – the opposite result from the case of quarterly dividends. (However, the substantially higher volatility and non-normality of the quarterly NCREIF returns makes the mean of its distribution misleading.) Notwithstanding the fact that this time period had large influxes of new construction and large declines in rental rates and property values, it is discouraging that the mean growth (or percentage change) in annual NCREIF dividends is virtually indistinguishable from zero. This is all the more troubling given that these dividend series are expressed in nominal (v. real) terms.

Exhibit 16 presents a correlation matrix of the lagged percentage changes in annual dividends. Given that three of the four observations in any four-quarter interval are also common to the observations in adjoining periods, these numbers should be viewed cautiously. Nevertheless, examining the upper left quadrant of Exhibit 16 indicates statistically significant (using a 90% confidence interval) relationships with the two-, four- and five-quarter lags. However, these correlation coefficients have opposite signs: the four-quarter lag is negative while the two- and five-quarter lags are positive. The lower

Exhibit 14
Annual Dividends for the Period from 1978:1 through 1994:4
***NAREIT* Equity Index (without Healthcare) v. *NCREIF* Property Index**

Exhibit 15
Statistical Summary of the Distributions of the Percentage Change in Rolling Four-Quarter Dividends Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	NAREIT	*NCREIF*
Mean	1.08%	.07%
Median	3.23%	−.14%
Standard Deviation	4.73%	7.17%
Maximum	22.02%	22.35%
Minimum	−8.33%	−16.66%
Range	30.35%	39.01%
Skewness	1.599	.633
Kurtosis	5.547	2.019

right quadrant also indicates a statistically significant and negative relationship with lagged annual dividends from four quarters past (i.e., $t-4$) for the NCREIF series. Like the NAREIT series, the lagged NCREIF series is also significant at five quarters; however, unlike the NAREIT series, the correlation coefficient retains a negative sign. Examining the interplay of the NAREIT and NCREIF series (the lower left quadrant) indicates that the only statistically significant coefficient is the NCREIF series lagged seven quarters with the current NAREIT series, which is positively correlated.

Like before, a stepwise regression analysis using the current percentage change in annual NCREIF dividends as the dependent variable and the concurrent and leading NAREIT series (i.e., *NAREIT* t through *NAREIT* $t-8$) as potentially includable independent variables was generated. The results are shown in Exhibit 17.

With the exception of the percentage change in annual NAREIT dividends lagged one quarter, neither the *F*- nor the *t*-statistics were significant at the 90% confidence level. As the time period lengthens (e.g., using a rolling eight-quarter dividend), the summary statistics begin to "settle down" as evidenced by their lowered standard deviations and ranges. However, the ability of NAREIT dividends to explain future variability in NCREIF returns remains statistically insignificant.

Alternatively, performing the analysis with the percentage change in annual NAREIT dividends and the lagged NCREIF series as the independent variables only marginally changes the statistical significance (as measured, for example, by the adjusted R^2 value). Pragmatically, the variability of neither series explains much of the current and/or future variability of the other series.

NAREIT Dividends v. NCREIF Income

In addition, the relationship of the rolling four-quarter NAREIT dividend series to the rolling four-quarter NCREIF net income series was also examined. See Exhibit 18.

The two data series exhibit a generally tight fit over the 1978–1984 and 1987–1990 time periods. As noted previously, the use of a four-quarter rolling total smooths each series. However, it does not explain the remarkable similarity – at least in comparison to the dissimilarity of dividends – in the path of NAREIT dividends and NCREIF net

operating income. In some sense, senior REIT executives "manage" dividends. That is, they declare dividends based on a variety of factors, which include: compliance with U.S. Tax Code provisions, acquisitions/dispositions, capital improvements, debt restructuring, "signalling" effects to investors, etc. The NAREIT Index reports dividends, but not net income (earnings or funds from operations). If dividends are the primary focus of investors and analysts, senior REIT executives might smooth dividends in an effort to stabilize the pricing of REIT shares. However, the recent commotion about a NAREIT-proposed change in the way FFO (funds from operations) is to be reported (see Litt and Harris, 1994; Martin, 1995), suggests that reported earnings are also a substantial concern to senior management.

Conversely, NCREIF reports income and not dividends. Moreover, the NCREIF dividend series created in this study is relatively unmanaged in the sense that advisory-firm executives make decisions about the timing of capital improvements and (generally) not about Tax Code compliance, new acquisitions, debt restructuring, etc. Consequently, if the dividend series is unmanaged, a volatile dividend pay-out ratio might be observed for the NCREIF series. Exhibit 19 tracks the dividend pay-out ratio (i.e., the ratio of dividends to net operating income) on the right vertical axis and net operating income and dividend amounts on the left vertical axis. As this exhibit illustrates, the NCREIF series shows substantially more volatility (and less growth) in its dividend series than does its income series. In turn, this suggests the possibility that NCREIF advisors (and the plan sponsors to the extent they retain discretion over capital improvement expenditures) are less concerned about "managing" the dividend series.

Investment Values

An investment of $100 at the beginning of 1978 in each real estate series would result in the pattern of investment values (without reinvestment) shown in Exhibit 20.

For the NAREIT series, investment values represent the path of aggregate equity REIT stock prices (i.e., real estate asset values less mortgage indebtedness and plus/minus any "management premium") as traded on an exchange. For the NCREIF series, investment values represent the path of appraised asset values. The former represents a fractional/minority interest in a securitized portfolio of leveraged real estate, while the latter represents a controlling interest in an unsecuritized, unleveraged fixed asset. Consequently, it is entirely possible that there is considerable short-run divergence between the two series. In the long run, convergence between the two would be expected however. Exhibit 20 seems to strongly support this view.

Nevertheless, conventional statistical analysis indicates a weak relationship between concurrent investment values. Again, whether the underlying distributions are normally shaped and whether certain lagged relationships are more effective in explaining the relationship between the two "packages" is analyzed. Exhibit 21 examines the distributions of the percentage change in quarterly investment values for the securitized and unsecuritized real estate data series. Interestingly, the NAREIT series exhibits greater normality (as measured by kurtosis) than does the NCREIF series. This is somewhat surprising given the leveraged nature of the NAREIT series.

As compared to dividends where the NCREIF series was considerably more volatile than the NAREIT series, the situation is reversed when investment values are considered. With regard to the percentage change in investment values, the NAREIT series is

Exhibit 16
Correlation Matrix of the Percentage Change in Annual Dividends Using *NAREIT* and *NCREIF* Data for the Period 1978:1 through 1994:4*

	$NAREIT_t$	$NAREIT_{t-1}$	$NAREIT_{t-2}$	$NAREIT_{t-3}$	$NAREIT_{t-4}$	$NAREIT_{t-5}$	$NAREIT_{t-6}$	$NAREIT_{t-7}$	$NAREIT_{t-8}$
$NAREIT_t$	1 N=64 p=–								
$NAREIT_{t-1}$	.1546 N=63 p=·226	1 N=63 p=–							
$NAREIT_{t-2}$	.3066 N=62 p=·015	.1432 N=62 p=·267	1 N=62 p=–						
$NAREIT_{t-3}$	.131 N=61 p=·314	.2911 N=61 p=·023	.1365 N=61 p=·294	1 N=61 p=–					
$NAREIT_{t-4}$	.306 N=60 p=·017	.1531 N=60 p=·243	.2974 N=60 p=·021	.1451 N=60 p=·269	1 N=60 p=–				
$NAREIT_{t-5}$	.2425 N=59 p=·064	−.2924 N=59 p=·025	.1625 N=59 p=·219	.3128 N=59 p=·016	.1403 N=59 p=·289	1 N=59 p=–			
$NAREIT_{t-6}$	−.0722 N=58 p=·590	.2647 N=58 p=·045	−.2899 N=58 p=·027	.1699 N=58 p=·202	.311 N=58 p=·017	.1367 N=58 p=·306	1 N=58 p=–		
$NAREIT_{t-7}$	−.1894 N=57 p=·158	−.0522 N=57 p=·700	.2739 N=57 p=·039	−.2825 N=57 p=·033	.1661 N=57 p=·217	.3057 N=57 p=·021	.1339 N=57 p=·321	1 N=57 p=–	
$NAREIT_{t-8}$	.1705 N=56 p=·209	.2069 N=56 p=·126	−.0494 N=56 p=·718	.2812 N=56 p=·036	−.2849 N=56 p=·033	.1637 N=56 p=·228	.3047 N=56 p=·022	.1316 N=56 p=·334	1 N=56 p=–
$NCREIF_t$	.02 N=64 p=·875	.1897 N=63 p=·136	.0114 N=62 p=·930	.0996 N=61 p=·445	.0248 N=60 p=·851	−.0312 N=59 p=·814	−.0961 N=58 p=·473	−.0469 N=57 p=·729	−.0547 N=56 p=·689
$NCREIF_{t-1}$	−.0222 N=63 p=·863	.0117 N=63 p=·927	.1878 N=62 p=·144	.0073 N=61 p=·955	.1023 N=60 p=·437	.0286 N=59 p=·829	−.0295 N=58 p=·826	−.0933 N=57 p=·490	−.0456 N=56 p=·738
$NCREIF_{t-2}$	.0822 N=62 p=·525	−.0529 N=62 p=·683	.0044 N=62 p=·973	.1781 N=61 p=·170	.0147 N=60 p=·911	.1148 N=59 p=·387	.0342 N=58 p=·799	−.02 N=57 p=·882	−.0899 N=56 p=·510
$NCREIF_{t-3}$	−.1995 N=61 p=·123	.0774 N=61 p=·553	−.0553 N=61 p=·672	.0013 N=61 p=·992	.1802 N=60 p=·168	.0177 N=59 p=·894	.1163 N=58 p=·385	.0368 N=57 p=·786	−.0189 N=56 p=·890
$NCREIF_{t-4}$	−.0234 N=60 p=·859	−.167 N=60 p=·202	.0906 N=60 p=·491	−.0381 N=60 p=·773	−.0081 N=60 p=·951	.1684 N=59 p=·202	.0111 N=58 p=·934	.1054 N=57 p=·435	.0318 N=56 p=·816
$NCREIF_{t-5}$	.0297 N=59 p=·823	−.0183 N=59 p=·891	−.1658 N=59 p=·209	.094 N=59 p=·479	−.0394 N=59 p=·767	−.0103 N=59 p=·939	.1676 N=58 p=·209	.0094 N=57 p=·944	.1048 N=56 p=·442
$NCREIF_{t-6}$	−.1011 N=58 p=·450	.0578 N=58 p=·666	−.0101 N=58 p=·940	−.1555 N=58 p=·244	.0891 N=58 p=·506	−.049 N=58 p=·715	−.0146 N=58 p=·913	.161 N=57 p=·232	.0061 N=56 p=·964
$NCREIF_{t-7}$	.3281 N=57 p=·0123	−.0815 N=57 p=·547	.0658 N=57 p=·627	.0011 N=57 p=·993	−.1611 N=57 p=·231	.0817 N=57 p=·546	−.0528 N=57 p=·697	−.0218 N=57 p=·872	.1587 N=56 p=·243
$NCREIF_{t-8}$	.1023 N=56 p=·453	.3097 N=56 p=·020	.0928 N=56 p=·496	.0509 N=56 p=·710	.0075 N=56 p=·956	−.1518 N=56 p=·264	.087 N=56 p=·524	.0436 N=56 p=·750	−.0177 N=56 p=·897

*N equals number of observations using pairwise deletion; *p*-values represent probability associated with accepting null hypothesis.

$NCREIF_t$	$NCREIF_{t-1}$	$NCREIF_{t-2}$	$NCREIF_{t-3}$	$NCREIF_{t-4}$	$NCREIF_{t-5}$	$NCREIF_{t-6}$	$NCREIF_{t-7}$	$NCREIF_{t-8}$
1 N=64 p=–								
.1742 N=63 p=·172	1 N=63 p=–							
.129 N=62 p=·318	.1713 N=62 p=·183	1 N=62 p=–						
.1087 N=61 p=·404	.128 N=61 p=·326	.1691 N=61 p=·193	1 N=61 p=–					
−.5106 N=60 p=·000	.116 N=60 p=·377	.1486 N=60 p=·257	.1756 N=60 p=·180	1 N=60 p=–				
−.2369 N=59 p=·071	−.5103 N=59 p=·000	.1194 N=59 p=·368	.1494 N=59 p=·259	.1743 N=59 p=·187	1 N=59 p=–			
−.122 N=58 p=·362	−.2344 N=58 p=·077	−.5049 N=58 p=·000	.123 N=59 p=·358	.1371 N=58 p=·305	.173 N=58 p=·194	1 N=58 p=–		
−.066 N=57 p=·626	−.1193 N=57 p=·377	−.2268 N=57 p=·090	−.5044 N=57 p=·000	.1118 N=57 p=·408	.1359 N=57 p=·313	.1662 N=57 p=·217	1 N=57 p=–	
.063 N=56 p=·644	−.071 N=56 p=·603	−.1349 N=56 p=·321	−.2322 N=56 p=·085	−.4956 N=56 p=·000	.115 N=56 p=·399	.1488 N=56 p=·274	.1783 N=56 p=·189	1 N=56 p=–

Exhibit 17
Statistical Summary of Stepwise Multivariate Linear Regression Using the Current Percentage Change in Rolling Four-Quarter Dividends with the *NCREIF* Index as the Dependent Variable and the Lagged *NAREIT* Index for the Independent Variables for the Period 1978 through 1994

Adjusted R^2	.0235	
F-Statistic	1.661	
	Value	*t*-Statistic
a (Intercept)	.006	.616
$b_{NAREIT\ t-1}$	.358	1.674*
$b_{NAREIT\ t-6}$	−.237	−1.138

*significant at the 90% confidence level

approximately four times as volatile as the NCREIF series when standard deviations and ranges are compared. Additionally, the NCREIF series is fat tailed.

Exhibit 22 examines the statistical relationship between the lagged percentage changes in quarterly investment values. Examining the upper left quadrant of Exhibit 22 indicates a generally low level of autocorrelation for the percentage change in NAREIT investment values. Only NAREIT investment values lagged at eight quarters (i.e., *REIT* $t-8$) are significant at a 90% confidence level. All others are, statistically speaking, indistinguishable from zero. Examining the lower right quadrant indicates high levels of autocorrelation for the percentage change in NCREIF investment values. These high levels of autocorrelation are the concerns voiced by Geltner (1989, 1993), Gyourko and Keim (1992, 1993) and Ross and Fisher (1991) with regard to appraisal smoothing. Examining the lower left quadrant (which represents the leading, current and lagged relationships for the NAREIT and NCREIF series) indicates that the strongest correlations again seem to be NAREIT values leading NCREIF values. Statistically significant, positive correlations are observed when NAREIT values lead NCREIF values by four and eight quarters.

When these lagged relationships are further investigated via stepwise regression analysis, with *NCREIF t* as the dependent variable and *NCREIF t* through *NAREIT* $t-8$ as potentially includable independent variables, the results are as shown in Exhibit 23. While all of the *beta* (slope) coefficients are positive and the first four are statistically significant (at the 90% confidence level), the low adjusted R^2 suggests substantial uncertainty in the estimates of the current percentage change in NCREIF asset values as forecasted by earlier changes in NAREIT investment values.

Dividend Yields

As noted earlier, short-run returns are very sensitive to changes in the dividend yield.[12] As Exhibit 4 suggests, it is not changing prices, per se, which distort fundamental returns. In fact, constant dividend yields (or, capitalization rates) imply that prices change at the same rate as dividends (or, net operating income). When the growth rates for prices and dividends (or, net operating income) differ is when dividend yields (or, capitalization

Exhibit 18
Annual Dividends for the *NAREIT* Equity Index (without Healthcare) v. Income for the *NCREIF* Property Index for the Period from 1978:1 through 1994:4

Exhibit 19
***NCREIF* Property Index Annual Net Operating Income, Dividend Amounts and Pay-Out Ratios, Based upon Initial $100 Investment for the Period from 1978:1 through 1994:4**

Exhibit 20
Annual Quarterly Investment Values for the Period from 1978:1 through 1994:4
***NAREIT* Equity Index (without Healthcare) v. *NCREIF* Property Index**

Exhibit 21
Statistical Summary of the Distributions of Percentage Change in Quarterly Investment Values Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	NAREIT	*NCREIF*
Mean	1.28%	.89%
Median	.57%	.96%
Standard Deviation	7.31%	1.91%
Maximum	21.69%	4.77%
Minimum	−20.27%	−6.35%
Range	41.97%	11.12%
Skewness	.758	−.833
Kurtosis	1.152	2.493

rates) change. In the aggregate,[13] changing dividend yields represent the manifestation of changing investor sentiment with regard to risk premiums, expected inflation, lease rates, etc. It is the short-run changes in investor sentiment (more commonly referred to as time-varying risk premiums and cash flow expectations) which can lead to substantial volatility in the quarterly total returns. Consequently, it is extremely important to assess the relationship of changing dividend yields between securitized and unsecuritized real estate equities.

In an attempt to gauge the correlation between NAREIT and NCREIF dividend yields, this study examines rolling four-quarter dividend yields – computed on a trailing-dividends basis.[14] In this study's earlier analysis of quarterly dividends, they were found to be quite volatile and only loosely correlated. The use of the longer period (i.e., four quarters) here is an attempt to dampen this volatility. Not only is there a substantial quarter-to-quarter volatility in the underlying dividend streams, investors are undoubtedly using periods longer than one quarter to value the asset's future dividend stream. Consequently, Exhibit 24 illustrates the rolling four-quarter dividend yields for both indices.

As before, the use of rolling four quarters dampens the volatility of the observations. Nevertheless, the divergence and convergence between the two series is obvious and remarkable. It is apparent that the relationship of dividend yields between securitized and unsecuritized real estate is weak. Again, the securitized/unsecuritized relationship is counterintuitive. Notwithstanding the significant number of caveats mentioned earlier, why should dividend yields for the same group of real estate assets (coarsely defined) move inversely with one another? A statistical summary of these two distributions is provided in Exhibit 25.

The disparity in average dividend yields (roughly 270 basis points) is remarkable, given that the standard deviations of the respective distributions are nearly identical and that asset appreciation, over the long run, has been quite consistent for the respective indices (see the means and medians of Exhibit 21). Also interesting is the mean-reverting nature of dividend yields which is suggested by the near-zero mean for each distribution accompanied by a substantial deviation and range. For the NAREIT series, the mean percentage change in annual dividend yields was .20% with a standard deviation of

7.68%; for the NCREIF series, the mean percentage change was −.06% with a standard deviation of 7.67%. Their mean-reverting nature reinforces the importance of examining the fundamental sources of returns when examining/projecting long-run returns.

Exhibit 26 examines the spectrum of leading/concurrent/lagged relationships for the quarterly dividend yields. The upper left quadrant of Exhibit 26 indicates that the current NAREIT dividend yields are significantly (at least at a 95% confidence level) and positively correlated with lagged NAREIT dividend yields of the past four quarters (i.e., *NAREIT* $t-1$ through *NAREIT* $t-4$). The lower right quadrant indicates that current NCREIF dividend yields are significantly (at the 95% confidence level) correlated with lagged NCREIF dividend yields of the past six quarters. The lower left quadrant indicates (via its first row) that the current NCREIF dividend yields are significantly (at a 95% confidence level) and inversely correlated with current NAREIT dividend yields, as well as those for the past two quarters. Conversely, current NAREIT dividend yields are significantly and inversely correlated with lagged NCREIF dividend yields of the past three quarters.

This univariate approach presented in Exhibit 26 was expanded to a multivariate approach via a stepwise regression with the current NCREIF dividend yields as the dependent variable and the range of current lagged NAREIT dividend yields as includable independent variables. A summary of this multivariate regression is presented in Exhibit 27. Concurrent changes in NAREIT dividends are negatively related, with statistical significance, to current percentage changes in NCREIF dividend yields and the lone significant lagged relationship is found to be positively related. However, the overall explanatory power of the equation is relatively low – as measured by the adjusted R^2 value. Additionally, similar results are obtained if the percentage change in dividend yields is analyzed.

Conclusions and Recommendations

As with previous research, a weak statistical relationship between total returns for securitized and unsecuritized real estate has been found. In an attempt to resolve this enigma, total returns have been unbundled into their fundamental components: dividends, investment values and changes in dividend yields. The short-run relationships between these fundamental components of the securitized and unsecuritized returns are generally weak from a statistical standpoint. Many of the distributions presented in this study display significant non-normal tendencies. Even when lags of up to two years are examined, these distributions also tend to be weakly correlated with one another. Of the three fundamental components, the long-run path of prices for securitized and unsecuritized real estate exhibited the strongest relationship (see Exhibit 20). In turn, this suggests that the weak relationships for explaining total returns may be more attributable to the volatility of dividends (see Exhibit 14) and/or changes in dividend yields. Exhibit 28 highlights the relative volatility of dividends and prices for the securitized and unsecuritized series.

The third and sixth rows of Exhibit 28 compute the ratio of the NCREIF statistic to that of the NAREIT statistic. In comparing the standard deviation of the percentage change in quarterly investment values, NCREIF volatility is roughly one-fourth of the NAREIT volatility. Yet, in comparing the standard deviation of the percentage change in annual dividends, NCREIF volatility is roughly 150% of the NAREIT volatility.[15] This

Exhibit 22
Correlation Matrix of the Percentage Change in Quarterly Investment Values Using *NAREIT* and *NCREIF* Data for the Period 1978:1 through 1994:4*

	$NAREIT_t$	$NAREIT_{t-1}$	$NAREIT_{t-2}$	$NAREIT_{t-3}$	$NAREIT_{t-4}$	$NAREIT_{t-5}$	$NAREIT_{t-6}$	$NAREIT_{t-7}$	$NAREIT_{t-8}$
$NAREIT_t$	1 N=67 p=–								
$NAREIT_{t-1}$	.0714 N=66 p=·569	1 N=66 p=–							
$NAREIT_{t-2}$	−.0101 N=65 p=·936	.0673 N=65 p=·594	1 N=65 p=–						
$NAREIT_{t-3}$	−.1792 N=64 p=·157	−.0111 N=64 p=·931	.0658 N=64 p=·605	1 N=64 p=–					
$NAREIT_{t-4}$	.0622 N=63 p=·628	−.1792 N=63 p=·160	−.0108 N=63 p=·933	.0659 N=63 p=·608	1 N=63 p=–				
$NAREIT_{t-5}$	−.0498 N=62 p=·701	.0549 N=62 p=·672	−.1985 N=62 p=·122	−.0145 N=62 p=·911	.0675 N=62 p=·602	1 N=62 p=–			
$NAREIT_{t-6}$	.0161 N=61 p=·902	−.0453 N=61 p=·729	.0648 N=61 p=·620	−.1974 N=61 p=·127	−.015 N=61 p=·909	.0874 N=61 p=·503	1 N=61 p=–		
$NAREIT_{t-7}$	−.0645 N=60 p=·624	.0117 N=60 p=·929	−.0549 N=60 p=·677	.0632 N=60 p=·631	−.1981 N=60 p=·129	−.0336 N=60 p=·799	.0993 N=60 p=·450	1 N=60 p=–	
$NAREIT_{t-8}$	.2495 N=59 p=·057	−.0527 N=59 p=·692	.0415 N=59 p=·755	−.0521 N=59 p=·695	.0647 N=59 p=·627	−.1528 N=59 p=·248	−.0713 N=59 p=·592	.1409 N=59 p=·287	1 N=59 p=–
$NCREIF_t$	−.0116 N=67 p=·926	−.0108 N=66 p=·932	.1704 N=65 p=·175	.0108 N=64 p=·933	.2091 N=63 p=·100	.1878 N=62 p=·144	.1764 N=61 p=·174	.1343 N=60 p=·306	.2376 N=59 p=·070
$NCREIF_{t-1}$	−.1519 N=66 p=·223	−.0125 N=66 p=·921	−.0124 N=65 p=·922	.1701 N=64 p=·179	.0109 N=63 p=·933	.2101 N=62 p=·101	.1901 N=61 p=·142	.1765 N=60 p=·177	.1433 N=59 p=·279
$NCREIF_{t-2}$	.0337 N=65 p=·790	−.1549 N=65 p=·218	−.0173 N=65 p=·891	−.0135 N=64 p=·916	.1705 N=63 p=·181	.0024 N=62 p=·985	.2165 N=61 p=·094	.1864 N=60 p=·154	.2015 N=59 p=·126
$NCREIF_{t-3}$	−.099 N=64 p=·436	.0308 N=64 p=·809	−.1613 N=64 p=·203	−.0185 N=64 p=·885	−.0132 N=63 p=·918	.1631 N=62 p=·205	.0085 N=61 p=·948	.2122 N=60 p=·104	.2154 N=59 p=·101
$NCREIF_{t-4}$	.041 N=63 p=·750	−.1022 N=63 p=·426	.0258 N=63 p=·841	−.1628 N=63 p=·202	−.0183 N=63 p=·887	−.0235 N=62 p=·856	.1703 N=61 p=·190	.0028 N=60 p=·983	.2423 N=59 p=·064
$NCREIF_{t-5}$	−.0074 N=62 p=·955	.0343 N=62 p=·791	−.1175 N=62 p=·363	.023 N=62 p=·859	−.1642 N=62 p=·202	−.0451 N=62 p=·728	−.0081 N=61 p=·951	.1574 N=60 p=·230	.0534 N=59 p=·688
$NCREIF_{t-6}$	.0466 N=61 p=·721	−.0108 N=61 p=·934	.028 N=61 p=·830	−.1194 N=61 p=·360	.0234 N=61 p=·858	−.18 N=61 p=·165	−.0378 N=61 p=·773	−.0157 N=60 p=·905	.1909 N=59 p=·148
$NCREIF_{t-7}$	−.0896 N=60 p=·496	.0398 N=60 p=·763	−.0263 N=60 p=·842	.0251 N=60 p=·849	−.1206 N=60 p=·359	−.0063 N=60 p=·962	−.1656 N=60 p=·206	−.0567 N=60 p=·667	.0414 N=59 p=·755
$NCREIF_{t-8}$	.0624 N=59 p=·639	−.0963 N=59 p=·468	.0292 N=59 p=·826	−.0287 N=59 p=·829	.0261 N=59 p=·844	−.1461 N=59 p=·269	.0072 N=59 p=·957	−.1814 N=59 p=·169	−.0172 N=59 p=·897

*N equals number of observations using pairwise deletion; p-values represent probability associated with accepting null hypothesis.

$NCREIF_t$	$NCREIF_{t-1}$	$NCREIF_{t-2}$	$NCREIF_{t-3}$	$NCREIF_{t-4}$	$NCREIF_{t-5}$	$NCREIF_{t-6}$	$NCREIF_{t-7}$	$NCREIF_{t-8}$
1 N=67 p=–								
.6358 N=66 p=·000	1 N=66 p=–							
.6409 N=65 p=·000	.6359 N=65 p=·000	1 N=65 p=–						
.5811 N=64 p=·000	.6412 N=64 p=·000	.6348 N=64 p=·000	1 N=64 p=–					
.7518 N=63 p=·000	.5814 N=63 p=·000	.6401 N=63 p=·000	.6335 N=63 p=·000	1 N=63 p=–				
.4564 N=62 p=·000	.7585 N=62 p=·000	.5812 N=62 p=·000	.6395 N=62 p=·000	.633 N=62 p=·000	1 N=62 p=–			
.4289 N=61 p=·001	.4568 N=61 p=·000	.7578 N=61 p=·000	.5795 N=61 p=·000	.6381 N=61 p=·000	.6308 N=61 p=·000	1 N=61 p=–		
.4315 N=60 p=·001	.4338 N=60 p=·001	.456 N=60 p=·000	.7607 N=60 p=·000	.5796 N=60 p=·000	.6288 N=60 p=·000	.6293 N=60 p=·000	1 N=60 p=–	
.5281 N=59 p=·000	.4344 N=59 p=·001	.432 N=59 p=·001	.4534 N=59 p=·000	.7611 N=59 p=·000	.5726 N=59 p=·000	.6264 N=59 p=·000	.6217 N=59 p=·000	1 N=59 p=–

Exhibit 23
Statistical Summary of Stepwise Multivariate Linear Regression Using the Percentage Change in Quarterly Investment Values with the *NCREIF* Index as the Dependent Variable and the Lagged *NAREIT* Index for the Independent Variables for the Period 1978 through 1994

Adjusted R^2	.140	
F-Statistic	2.574**	
	Value	*t*-Statistic
a (Intercept)	.0044	1.713*
$b_{NAREIT\ t-8}$	.0649	1.932*
$b_{NAREIT\ t-5}$	.0628	1.930*
$b_{NAREIT\ t-2}$	.0543	1.676*
$b_{NAREIT\ t-4}$	.0537	1.682*
$b_{NAREIT\ t-6}$	.0378	1.190
$b_{NAREIT\ t-7}$	.0376	1.157

*significant at the 90% confidence level
**significant at the 95% confidence level

disparity is remarkable. In a simplified setting, greater dividend volatility should be accompanied by greater price volatility, not less, as observed here. These results might suggest some adaptation of the appraisal smoothing issues raised by Geltner (1989, 1993), Gyourko and Keim (1992, 1993), Ross and Zisler (1991) and others.

While the unbundling of securitized and unsecuritized real estate into their fundamental return components has substantially improved the ability to understand the differences between these two series, at least three areas warrant future investigation.

Alignment of Real Estate Issues

As pointed out earlier in the third section (*The Data*), the considerable differences (i.e., property type, geography, leverage and fees) in the datasets must be resolved before a definitive comparison of the two data series can be made. Myer and Webb (1994) and Liang et al. (1995) have made initial attempts at doing so, but much work still needs to be done. Additionally, issues related to managed v. unmanaged dividend series demands further research.

Stock Market Inefficiencies

The last several years have witnessed a substantive assault on the market efficiency hypothesis regarding the underlying path of stock prices. These assaults include: (1) the excess volatility of stock prices when using a constant risk premium (see Shiller, 1981); (2) the tendency for past losers to become future winners – and past winners to become future losers, though with less magnitude (see De Bondt and Thaler, 1985); (3) the

Exhibit 24
Annual Dividend Yields for the Period from 1978:1 through 1994:4
***NAREIT* Equity Index (without Healthcare) v. *NCREIF* Property Index**

Exhibit 25
Statistical Summary of the Distributions of Rolling Four-Quarter Dividend Yields Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	NAREIT	*NCREIF*
Mean	7.47%	4.74%
Median	7.40%	4.60%
Standard Deviation	1.00%	.91%
Maximum	10.69%	6.94%
Minimum	5.30%	3.02%
Range	5.39%	3.92%
Skewness	.580	.484
Kurtosis	2.308	−.083

tendency for returns to exhibit a mean-reverting behavior – with positive autocorrelation in the short run and negative autocorrelation in the long run (see Poterba and Summers, 1988); (4) stocks with good fundamentals (e.g., low price-to-book ratios, high dividend yields) tend to outperform those with bad fundamentals (see Fama and French, 1992; Haugen, 1995; Lakonishok et al., 1994); (5) the "January effect", where most of the stocks excess return is generated in the month of January – particularly true for small cap stocks (see Haugen and Lakonishok, 1988); and (6) questions of separating ownership and operating control (see Fama and Jensen, 1983).

Some of the stock market inefficiencies have already been applied to REITs. See Colwell and Park (1990) with regard to the January/small-firm effect, Gyourko and Keim (1992) with regard to the small-cap effect, and McIntosh et al. (1994) with regard to control/pricing questions. If, by extension, some or all of these stock market "anomalies" apply to the REIT market as well (but not to the unsecuritized real estate market), then further adjustments must yet be made before securitized and unsecuritized real estate can be directly compared.

Type I v. Type II Errors

Poterba and Summers (1988) point out that when too much emphasis is placed on avoiding Type I errors (i.e., rejecting the null hypothesis when it is true) the risk of accepting Type II errors (i.e., accepting the null hypothesis when it is false) is increased. Thus, traditional tests of random-walk prices/returns may obscure long-run, mean-reverting behavior in prices/returns. They suggest that transitory price components (i.e., time-varying risk premiums and/or investor "fads") may account for a substantial part of the variance in common stock returns. Perhaps, this is true here as well. Consider the path of asset prices shown in Exhibit 20. The conventional statistical tests reveal little significant correlation. Yet there appears to be a significant long-term relationship.

As this study demonstrates, the comparison between securitized and unsecuritized real estate is far from over. The authors hope this study will stimulate additional research in this evolving and important topic.

Notes

[1]We are not advocating that the NCREIF scheme for geographic and property-type disclosure be used necessarily; rather, we suggest that analysts use the most illuminating geographic and property-type scheme common to both databases.

[2]While it is possible for properties encumbered with short-term leases (e.g., apartments and hotels) to have asset values unaffected by changes in the level of interest rates, this is unlikely for properties encumbered with long-term leases. Consequently, the ceteris paribus condition is more likely to apply to properties leased on a short-term basis and/or to portfolios of properties leased on a long-term basis where the lease rollover is equal each year.

[3]This is an imperfect solution as NCREIF utilizes an accrual-based approach to reporting net operating income. At times, there may be significant timing differences between accrual- and cash-based net operating income (see NCREIF, 1988). The earnings of the NAREIT series were not available to us.

[4]These quarterly return calculations differ substantially from those shown below which are used by NCREIF:

$$R_{Inc,t} = \frac{NOI_t}{MV_{t-1} + .5(CI_t - PS_t) - .33NOI_t}, \tag{11}$$

$$R_{Apt,t} = \frac{(MV_t - MV_{t-1}) + PS_t - CI_t}{MV_{t-1} + .5(CI_t - PS_t) - .33NOI_t}, \tag{12}$$

$$R_{Total,t} = \frac{NOI_t + (MV_t - MV_{t-1}) + PS_t - CI_t}{MV_{t-1} + .5(CI_t - PS_t) - .33NOI_t}, \tag{13}$$

where:

$R_{Inc,t}$ = income return during period t, and
all other notation is as used previously.

For further discussion of shortcomings in the NCREIF-based measures of return, see Young et al. (1995, 1996).

[5]If appraised values are accurate, then a partial sale of property should not impact total return. Consider an example where appraised values (of the total property) are constant over the holding period; the sale of a partial property interest should then satisfy:

$$MV_t + PS_t = MV_{t-1}\,. \tag{14}$$

Moreover, the absolute amount of partial sale in the NCREIF database is quite small in comparison to NOI, capital improvements and/or market values.

[6]See Note 4 for a review of the NCREIF methodology. However, note that similar illustrations can be created with other indices (e.g., NAREIT, S&P 500, etc.).

[7]In a visual examination of the distributions via histogram, the selection of the number of "bins" (or, the width of the ranges utilized in the histogram) can substantially influence the visual appearance of the underlying distribution.

[8]The *beta* coefficient for the lagged indication was statistically significant at the 95% confidence level and the adjusted R^2 was 14%.

[9]This weak relationship is also observed when the lag is extended to sixteen quarters.

[10]This strong relationship is also observed, with declining strength, when the lag is extended to sixteen quarters.

Exhibit 26
Correlation Matrix of Annual Dividend Yields (Computed on a Trailing-Dividends Basis) Using *NAREIT* and *NCREIF* Data for the Period 1978:1 through 1994:4*

	$NAREIT_t$	$NAREIT_{t-1}$	$NAREIT_{t-2}$	$NAREIT_{t-3}$	$NAREIT_{t-4}$	$NAREIT_{t-5}$	$NAREIT_{t-6}$	$NAREIT_{t-7}$	$NAREIT_{t-8}$
$NAREIT_t$	1 N=65 p=–								
$NAREIT_{t-1}$	.8125 N=64 p=·000	1 N=64 p=–							
$NAREIT_{t-2}$	.5822 N=63 p=·000	.8134 N=63 p=·000	1 N=63 p=–						
$NAREIT_{t-3}$	.4056 N=62 p=·001	−.5816 N=62 p=·000	.8076 N=62 p=·000	1 N=62 p=–					
$NAREIT_{t-4}$	.2781 N=61 p=·030	.4008 N=61 p=·001	.565 N=61 p=·000	.7958 N=61 p=·000	1 N=61 p=–				
$NAREIT_{t-5}$	.1512 N=60 p=·249	.2678 N=60 p=·039	.3751 N=60 p=·003	.5378 N=60 p=·000	.7803 N=60 p=·000	1 N=60 p=–			
$NAREIT_{t-6}$	.0418 N=59 p=·754	.1337 N=59 p=·313	.2283 N=59 p=·082	.3266 N=59 p=·012	−.494 N=59 p=·000	.7617 N=59 p=·000	1 N=59 p=–		
$NAREIT_{t-7}$	−.0643 N=58 p=·632	.0212 N=58 p=·875	.0908 N=58 p=·498	.1747 N=58 p=·190	.2706 N=58 p=·040	.4534 N=58 p=·000	.7382 N=58 p=·000	1 N=58 p=–	
$NAREIT_{t-8}$	−.1499 N=57 p=·266	−.0936 N=57 p=·489	−.0356 N=57 p=·792	.0179 N=57 p=·895	.0949 N=57 p=·483	.203 N=57 p=·130	.3886 N=57 p=·003	.7122 N=57 p=·000	1 N=57 p=–
$NCREIF_t$	−.3874 N=65 p=·001	−.3366 N=64 p=·007	−.2455 N=63 p=·052	−.1403 N=62 p=·277	−.015 N=61 p=·908	.0382 N=60 p=·772	.0761 N=59 p=·567	.1389 N=58 p=·298	.2122 N=57 p=·113
$NCREIF_{t-1}$	−.3799 N=64 p=·002	−.383 N=64 p=·002	−.3256 N=63 p=·009	−.2275 N=62 p=·075	−.1118 N=61 p=·391	.0218 N=60 p=·869	.0926 N=59 p=·485	.1288 N=58 p=·335	.2093 N=57 p=·118
$NCREIF_{t-2}$	−.3196 N=63 p=·011	−.376 N=63 p=·002	−.376 N=63 p=·002	−.3149 N=62 p=·013	−.2102 N=61 p=·104	−.0869 N=60 p=·509	.0653 N=59 p=·623	.1369 N=58 p=·305	.1877 N=57 p=·162
$NCREIF_{t-3}$	−.2378 N=62 p=·063	−.3181 N=62 p=·012	−.3759 N=62 p=·003	−.3784 N=62 p=·001	−.316 N=61 p=·013	−.2055 N=60 p=·115	−.073 N=59 p=·583	.0874 N=58 p=·514	.1703 N=57 p=·205
$NCREIF_{t-4}$	−.1229 N=61 p=·345	−.2371 N=61 p=·066	−.3194 N=61 p=·012	−.3816 N=61 p=·002	−.3876 N=61 p=·002	−.3207 N=60 p=·012	−.2069 N=59 p=·116	−.0647 N=58 p=·629	.1088 N=57 p=·420
$NCREIF_{t-5}$	−.0463 N=60 p=·726	−.1175 N=60 p=·371	−.2278 N=60 p=·080	−.3107 N=60 p=·016	−.3755 N=60 p=·003	−.3815 N=60 p=·003	−.3105 N=59 p=·017	−.1885 N=58 p=·156	−.0317 N=57 p=·815
$NCREIF_{t-6}$	.0045 N=59 p=·973	−.0408 N=59 p=·759	−.1068 N=59 p=·421	−.2173 N=59 p=·098	−.3028 N=59 p=·020	−.37 N=59 p=·004	−.3791 N=59 p=·003	−.3005 N=58 p=·022	−.169 N=57 p=·209
$NCREIF_{t-7}$	.036 N=58 p=·789	.0129 N=58 p=·923	−.0228 N=58 p=·865	−.0844 N=58 p=·529	−.196 N=58 p=·140	−.2857 N=58 p=·030	−.3558 N=58 p=·006	−.3651 N=58 p=·005	−.2787 N=57 p=·036
$NCREIF_{t-8}$	.1106 N=57 p=·413	.0462 N=57 p=·733	.0356 N=57 p=·792	.0074 N=57 p=·956	−.0512 N=57 p=·705	−.169 N=57 p=·209	−.2594 N=57 p=·051	−.3353 N=57 p=·011	−.3442 N=57 p=·009

*N equals number of observations using pairwise deletion; *p*-values represent probability associated with accepting null hypothesis.

$NCREIF_t$	$NCREIF_{t-1}$	$NCREIF_{t-2}$	$NCREIF_{t-3}$	$NCREIF_{t-4}$	$NCREIF_{t-5}$	$NCREIF_{t-6}$	$NCREIF_{t-7}$	$NCREIF_{t-8}$
1 N=65 p=–								
.9354 N=64 p=·000	1 N=64 p=–							
.8312 N=63 p=·000	.9351 N=63 p=·000	1 N=63 p=–						
.6911 N=62 p=·000	.8331 N=62 p=·000	.9364 N=62 p=·000	1 N=62 p=–					
.5177 N=61 p=·000	.6942 N=61 p=·000	.8353 N=61 p=·000	.9365 N=61 p=·000	1 N=61 p=–				
.3836 N=60 p=·002	.5134 N=60 p=·000	.6919 N=60 p=·000	.8352 N=60 p=·000	.9378 N=60 p=·000	1 N=60 p=–			
.2678 N=59 p=·040	.3778 N=59 p=·003	.5095 N=59 p=·000	.6908 N=59 p=·000	.8356 N=59 p=·000	.9374 N=59 p=·000	1 N=59 p=–		
.1565 N=58 p=·241	.255 N=58 p=·053	.3688 N=58 p=·004	.5066 N=58 p=·000	.6912 N=58 p=·000	.834 N=58 p=·000	.9372 N=58 p=·000	1 N=58 p=–	
.0491 N=57 p=·717	.1371 N=57 p=·309	.2407 N=57 p=·000	.3633 N=57 p=·005	.5052 N=57 p=·000	.687 N=57 p=·000	.8327 N=57 p=·000	.9363 N=57 p=·000	1 N=57 p=–

Exhibit 27
Statistical Summary of Stepwise Multivariate Linear Regression Using the Percentage Change in Rolling Four-Quarter Dividend Yield with the *NCREIF* Index as the Dependent Variable and the Lagged *NAREIT* Index for the Independent Variables for the Period 1978 through 1994

Adjusted R^2	.144	
F-Statistic	5.704**	
	Value	*t*-Statistic
a (Intercept)	.059	3.96**
$b_{NAREIT\ t}$	−.333	−2.91*
$b_{NAREIT\ t-8}$	.177	1.26

*significant at the 90% confidence level
**significant at the 99% confidence level

Exhibit 28
Summary of the Percentage Change in Annual Dividends and Quarterly Investment Values Using the *NAREIT* and *NCREIF* Data Series for the Period 1978 through 1994

	Mean	Median	Standard Deviation
Rolling Four-Quarter Dividends:			
NAREIT	1.08%	3.23%	4.73%
NCREIF	.07%	.14%	7.17%
Ratio of NCREIF to NAREIT	.065	−.043	1.516
Quarterly Investment Values:			
NAREIT	1.28%	.57%	7.31%
NCREIF	.89%	.96%	1.91%
Ratio of NCREIF to NAREIT	.695	1.684	.261

[11]These analyses and others not shown by summary statistics and/or exhibit are available from the authors upon request.
[12]This also applies to capitalization rates or price-earnings ratios where the dividend pay-out ratio is constant.
[13]For an individual building, changing dividend yields or capitalization rates may solely reflect existing fixed-rate leases (that are above or below market) rolling towards their expiration dates. On a portfolio basis where lease maturities are evenly staggered, dividend yields or capitalization rates will, however, remain constant, ceteris paribus.
[14]On an ex ante basis, only trailing dividends are observable. Accordingly, all dividend yields are computed on a "trailing" (v. leading) basis. Additionally, where appropriate these measures have been annualized to facilitate comparability.
[15]The authors thank Anthony B. Sanders (The Ohio State University) for suggesting this perspective following Shiller (1981).

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LINES FOR PATCHING IN

Total Annual Return

Holding Period (Years)

.90 Shift
.95 Shift
1.00 Shift
1.05 Shift
1.10 Shift

NCREIF Property Index

Quarterly Dividends Based upon Initial $100 Investment

Annual Dividends Based upon Initial $100 Investment

Quarterly Investment Values Based upon Initial $100 Investment

Annual Dividend Yields Computed on Trailing-Dividends Basis