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RISK AND RETURN ON REAL ESTATE: EVIDENCE FROM EQUITY REITs

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ABSTRACT

We analyze monthly returns on an equally-weighted index of 18 to 23 equity (real property) real estate investment trusts (REITs) that were traded on major stock exchanges over the 1973-87 period. We employ a multifactor Arbitrage Pricing Model using prespecified macroeconomic factors. We also test whether equity REIT returns are related to changes in the discount on closed-end stock funds, which seems plausible given the closed-end nature of REITs.

Three factors, and the percentage change in the discount on closed-end stock funds, consistently drive equity REIT returns: unexpected inflation and changes in the risk and term structures of interest rates. The impacts of these variables on equity REIT returns is around 60 percent of the impacts on corporate stock returns generally. As expected, the impacts are greater for more heavily levered REITs than for less levered REITs. Real estate, at least as measured by the return performance of equity REITs, is less risky than stocks generally, but does not offer a superior risk-adjusted return and is not a hedge against unexpected inflation.

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Early research on real estate returns concluded, somewhat tentatively, that real estate both earned substantial risk-adjusted excess returns and served as a good hedge against inflation [Brueggeman, Chen and Thibodeau (1984), Ibbotson and Siegel (1984) and Hartzell, Heckman and Miles (1987)]. Unfortunately, these studies employed return data based on market appraisals, rather than actual transaction prices. Such data are now widely recognized as being smoothed, which understates the true volatility of real estate returns and overstates the risk-adjusted returns (Firstenberg, Ross and Zisler, 1988, and Geltner, 1989).[1]

Rather than focus on appraisal-based returns, we analyze monthly returns on equity (real property) real estate investment trusts (REITs) that are traded on major stock exchanges. While our series might overstate the volatility of real estate returns owing to the closed-end nature of the REITs (Firstenberg, Ross and Zisler, 1988), these returns are certainly more representative of transaction prices than those based on appraised values. In assessing the relative riskiness of real estate returns, we employ a multifactor Arbitrage Pricing Model as well as the Capital Asset Pricing Model. Because we wish to uncover how various macroeconomic factors, including inflation, affect real estate returns, we use the factors prespecified in Chen, Roll and Ross (1986), rather than the factor analytic approach of Titman and Warga (1987). Because we are interested in the relative riskiness of real estate, we explain equally-weighted market indexes for both equity REITs and NYSE firms.

Our results illustrate the importance of using a multifactor model. When a simple CAPM framework is employed, we find evidence of excess real estate returns, especially in the 1980s. However, when the multifactor model is employed, this evidence evaporates. Three factors consistently drive both real estate and stock market returns: changes in the risk and term structures and unexpected inflation. Because unexpected inflation has a negative impact, real estate is not a hedge against unexpected inflation. The impact of changes in expected inflation is not stable over time, tending to be negative in the 1970s and positive in the 1980s, while the impact of forward changes in industrial production is positive but estimated imprecisely. Except for the latter variable, the impacts of the macro factors on real estate returns are consistently around 60 percent of the impacts on corporate stock returns generally.

We also explore the possibility that the same forces driving discounts on closed-end stock funds affect returns on equity REITs. Because equity REITs are closed-end mutual funds invested in real-estate assets (largely real properties), such a relationship seems plausible and is, in fact, uncovered in the data. When our equally-weighted equity REIT return index is regressed on the closed-end stock-fund discount computed by Lee, Shleifer and Thaler (1989), a coefficient of 0.5 is obtained with a t-ratio of three, further reinforcing the result that real estate is less risky than common stocks.

The paper is divided into three sections and a conclusion. Section I derives the basic estimation equation, Section II discusses the equity REIT data and their determinants, and Section III reports the empirical results.

I. The Estimation Methodology

A useful empirical framework for evaluating REIT risk-adjusted performance in a multifactor world requires regressing REIT excess returns on the excess returns of portfolios whose returns mimic (are perfectly correlated with) the individual prespecified factors. This approach is similar to the performance evaluation technique of Connor and Korajczyk (1986) and Titman and Warga (1988) using factors estimated from stock return data. The mimicking portfolios we use are those derived by Huberman, Kandel and Stambaugh (1986). The model subsection below derives the pricing relation. The second subsection then explains how these mimicking portfolios are formed and their returns calculated.

A. The Model

In the Arbitrage Pricing Model of Ross (1976), returns on N assets in the economy are assumed to be generated by the following factor model:

$$r = E + Bf + \epsilon, \tag{1}$$

where r is a Nx1 vector of returns, E is a Nx1 vector of expected returns, f is a Kx1 matrix of random factors with means equal to zero, B is a NxK matrix of factor sensitivities (loadings), and ϵ is an Nx1 vector of residuals. The covariance matrix of r is given by V, and the covariance matrix of the ϵ is given by Z. If exact pricing condition obtains,[2]

$$E = ir_f + Bu, \tag{2}$$

where r_f is the return on a riskless asset if it exists, i is a vector of ones, and u is a Kx1 vector of risk premiums associated with each of the factors. Thus

$$r - ir_f = Bu + Bf + \epsilon. \tag{1'}$$

The factors f are not identified by the APT. Following Chen, Roll and Ross (CRR, 1986) and Chan, Chen and Hsieh (1985), we prespecify them to be a set of macroeconomic innovations that capture the pervasive forces in the economy. Regressing the time series of returns in excess of the T-bill rate on these macroeconomic innovations and a constant can help us determine the sensitivities, B, but the risk premiums, u, are imbedded in the constant. Thus, the intercept of the time series regression cannot be interpreted as a Jensen performance measure, as in the Capital Asset Pricing Model. We can, however, obtain a Jensen performance measure if we state the pricing relation in terms of a set of mimicking portfolios.

Portfolios are known as mimicking portfolios if their payoffs, rather than the random factors, can be used for pricing the N assets when exact arbitrage pricing holds. Let a_k be a Nx1 vector that represents positions in the N assets that mimic the k-th factor, i.e., the return on this portfolio moves one-for-one with movements in the k-th factor and is unrelated to movements in the other factors. The Kx1 vector of payoffs on the K mimicking positions is given as $R = A'r$, where A is a NxK matrix whose k-th column is a_k. That is, when the expected returns on the N assets can be stated in terms of return sensitivities to these mimicking portfolios:

$$E = ir_f + Cv, \tag{3}$$

where $C = Cov(r,R) = VA$ and v is a vector of constants.

Huberman, Kandel and Stambaugh (1986) show that there are numerous sets of mimicking portfolios for a given set of factors. One particular set of mimicking portfolios that is convenient for our tests is given by

$$A = V^{-1}B(B'V^{-1}B) = Z^{-1}B(B'Z^{-1}B)^{-1}. \tag{4}$$

These portfolios have the minimum residual variance of all the possible mimicking portfolios, subject to the condition that $a'_k B = e_k$ where e_k is a Kx1 vector with the k-th component equal to one and other components equal to zero. Note that the returns to the mimicking portfolios, $R = A'r$, are equivalent to generalized least squares cross sectional regression coefficients of the asset returns on the sensitivity coefficients (Grinblatt and Titman, 1987).

Two properties of these "unit loading" mimicking portfolios are noteworthy (the proofs are given in Huberman, Kandel and Stambaugh). First, the loadings of all assets with respect to these mimicking portfolios are equal to B, which are the loadings with respect to the original factors.

$$r = \alpha + BR + \eta, \tag{5}$$

where α and η are both Nx1 vectors, η containing random residuals with mean zero. Taking the expectation of (5) and substituting this value for E in equation (2),

$$\alpha + B\bar{R} = ir_f + Bu, \tag{2'}$$

where $\bar{R}$ is the mean return vector for the mimicking portfolios. Second, if the mimicking portfolios are financed by zero investment, their expected returns are equal to the risk premiums associated with the factors, i.e., $\bar{R} = u$. Substituting this relation into equation (2'), $\alpha = ir_f$ and thus equation (5) becomes

$$r - ir_f = BR + \eta. \tag{6}$$

Thus, we can estimate REIT risk exposures and evaluate risk-adjusted performance by regressing excess REIT returns on the mimicking portfolio returns and a constant. If the constant is indistinguishable from zero, REIT expected returns are commensurate with their risk. If the intercept is significantly positive, REITs are a superior investment; if the intercept is significantly negative, REITs are poor performers. This yardstick of risk-adjusted performance is analogous to the Jensen alpha in the single index model.

B. Formation of Mimicking Portfolios

Five macroeconomic variables are pre-specified to be the factors that affect returns in interval t. These are identical to the ones used by CRR: (1) industrial production growth from t to t+1; (2) the change in expected inflation from t-1 to t: (3) unexpected inflation in t; (4) the difference between the returns on low grade corporate bonds (below BAA) and long-term Treasury bonds in period t (the change in the risk structure); and (5) the difference between the returns between the long-term Treasury bonds and the one month T-bill rate in period t (the change in the term structure). The bill rate, inflation rate and Treasury bond return data are all from Ibbotson and Sinquefield (1987). The manufacturing industrial production index is from the Citibase Data Base, and the low grade corporate bond return was supplied by Ibbotson. Expected inflation is estimated by an univariate autoregressive procedure with six lags.

The assets from which we form the mimicking portfolios are twenty common stock portfolios ranked by market capitalization. These comprise all stocks on the New York Stock Exchange and are formed in a way identical to that used by CRR. We use portfolios to mitigate the potentially large estimation errors in computing asset return sensitivities to the macroeconomic variables when individual stocks are used. The use of size ranking builds on the existing empirical studies that find that it yields portfolios of diverse risk and return characteristics.

At the end of each year from 1972 to 1986, we rank all common stocks on the New York Stock Exchange that have been listed for at least five years by their capitalization and group them into twenty portfolios. Altogether, there are 180 months (January 1973 to December 1987) of return data. We first run time series regressions like equation (1) to obtain estimates of the factor sensitivities B and the residual covariance matrix Z of the size-ranked portfolios. We regress the excess returns $(r - ir_f)$ of each of the twenty size portfolios on the five macroeconomic variables and intercept in the 1973-1987 period. Then we run the cross-sectional regressions to obtain the returns on the mimicking portfolios. In each month of the 1973-1987 period, we regress the portfolio returns r cross-sectionally on the factor sensitivities B by the generalized least squares method. The resultant monthly regression coefficients on B are the returns on the mimicking portfolios.

II. The Data

Our total REIT sample consists of 30 equity REITs traded on the NYSE, AMEX and NSDAQ for various parts of the 1973-87 period. To be included in our sample, we had to have share data over a variety of economic environments (upswings and downturns, changing inflation) and the REIT had to be invested predominately (over 75 percent) in (unforeclosed) real estate properties during these periods.[3] This effectively requires that the REIT must have existed before 1982 and have lasted over four years. Because we have excluded some short-lived REITs that subsequently declared bankruptcy, some upward bias exists in our sample.

The 30 equity REITs, the period over which they are in our sample (pre-1973 data were not used), the stock exchanges on which they were listed, and whether they are highly (14 REITs) or moderately (16 REITs) levered are shown in Table 1. Highly levered firms are those with at least 60 percent book debt-to-asset ratios and 40 percent book net debt (debt less financial assets) to asset ratios.[4] The sample contains seven "1970s" REITs that are not in our data base after 1982; seven "1980s" REITs that are not in our data base prior to 1978, and sixteen 70s/80s REITs. At least 18 equity REITs are in our sample throughout our estimation period, except the first three months of 1973 when only 15 are in the sample.

Table 2 contains means and standard deviations for both the alternative investments considered. The return series include indexes on our equally-weighted portfolio of equity REITs and of the highly and moderately levered subset portfolios, on both equally and value-weighted New York Stock Exchange firms, and on one month Treasury bills. The return indexes are expressed net of the Treasury bill yield. Excess returns on equity REITs, especially highly levered REITs, were higher in the 1980s than in the 1970s and with lower standard deviations. This was also true, but to a lesser extent, for NYSE stocks generally.

For comparison, Figure 1 plots quarterly values of our equally-weighted REIT series against the value-weighted equity REIT series published by the National Association of Real Estate Investment Trusts (1989, p. 55). While the series are obviously correlated, our series is more volatile in the 1970s.[5] Figure 2 plots quarterly returns on our two REIT subclasses. As can be seen, returns on the more levered REITs are more volatile than those on the less levered REITs, as one would expect.

Means, standard deviations, and correlations for the macroeconomic factors (correlations for the mimicking portfolios are given in parentheses) are listed in Table 3. Unexpected inflation was generally positive in the 1970s, when actual inflation was accelerating, and negative in the 1980s, when actual inflation was decelerating. The mean values of industrial production growth (nearly 3 percent per year), the change in expected inflation (zero), and the risk structure variable are roughly the same in the 1970s and 1980s. In contrast, the term structure variable tends to be negative in the 1970s, when bond rates were generally rising, and positive in the 1980s, when bond rates were generally falling.

The correlation matrix reveals two large correlations, especially in the mimicking portfolios. First, the change in expected inflation and unexpected inflation have a correlation coefficient of 0.53 (0.77 for the mimicking portfolios). The positive correlation arises because unexpected inflation leads to an upward revision in expected inflation. Second, the risk and term structure variables are strongly negatively correlated (-0.65 for the factors and -0.76 for the mimicking portfolios. The negative correlation should not be a surprise given that the expost return on Treasury bonds is subtracted in the change-in-risk structure variable and is added in the change-in-term structure variable.[6]

III. Empirical Results

Our empirical results are divided into three parts. In the first, we relate real estate returns net of the bill rate to the underlying macroeconomic factors and the mimicking portfolios (we estimate equations 1′ and 6). Both a single factor model (returns on equally- or value-weighted NYSE indexes) and the five factor model of CRR are tested. In the second part, we test for leverage effects by explaining component equity REIT indexes where the REITs have been subdivided by degree of leverage. In the third part, we explore the relationship between equity REIT returns and changes in the discount on an index of closed-end stock funds.

A. Factors and Returns

Table 4 contains results for the full 1973-87 sample (180 months) and the 1973-79 and 1980-87 subsamples for some single-factor return regressions. In all cases, the dependent variable is our equally-weighted equity REIT return series less the one-month bill rate. The independent variable (factor) is either the equally- or value-weighted NYSE index. As can be seen, the β estimates for both indexes are about 0.65 (slightly greater in the 1970s and less in the 1980s), and there is some evidence of excess returns. The α estimates are both statistically greater than zero in the 1980s ($t > 1.76$), and that for the regression including the value-weighted NYSE is statistically greater than zero for the entire period.[7] With a monthly α of 0.005, the point estimate of the annual excess return is a startling 6 percent. These regressions also indicate that our equally-weighted equity REIT return series is more closely related (higher $\bar{R}^2$) to an equally-weighted NYSE return index than to a value-weighted index, a not surprising result. In what follows, both our equally-weighted REIT series and the equally-weighted NYSE return series will be explained with the five factors.

Table 5 reports regressions of monthly equally-weighted equity REIT and NYSE indexes, respectively, over the one-month Treasury bill rate on a constant term and the five macroeconomic factors for the 1973-87 period and the 1973-79 and 1980-87 subperiods. Both indexes are significantly positively related to the risk and term structure return variables in a consistent way over both subperiods. The indexes are also systematically, if not always statistically significantly, negatively related to unexpected inflation. The greater precision in the risk and term structure estimates may reflect the precision with which these variables are computed and lined up time wise with the return indexes.

Three events are bad for stocks, including REITs: unexpected inflation, an increase in long-term interest rates, and an increase in low grade rates relative to higher grade rates (an increase in bankruptcy risk). These events occur at various, and variable, points in the business cycle. What is important about our results is that equity REIT returns are significantly less sensitive (only about 60 percent as much) to these bad events as are stock returns generally. This is consistent with the conventional wisdom that real estate is less risky than common stocks.

In all cases, for both the REIT and NYSE indexes, coefficients on the risk and term return variables are within a standard error of each other, which suggests that REIT and general stock market returns responded solely to returns on low-grade bonds (the positive response to the high grade bond return implicit in the term structure variable is cancelled by the negative response implicit in the risk structure variable). NYSE returns move slightly more (30 percent) than one-for-one with low-grade bond returns; REIT returns move somewhat less (20 percent).

The impacts of changes in expected inflation and industrial production are far less clear.[8] Both REIT and NYSE indexes are significantly positively related to changes in expected inflation in the 1980s, but unrelated (with negative coefficients) in the 1970s. Both return series appear to be positively related to industrial production, with most of the impact for equity REITS coming from the 1970s. However, none of the coefficients is statistically different from zero at the 95 percent confidence level. Given the mixed results here, we would be inclined to doubt the importance of these two factors.

The factors explain only half as much of the movement in equity REIT returns as in the NYSE index ($\bar{R}^2$ of 0.17 versus 0.35). The greater unexplained variation in REIT returns probably reflects two factors: the greater unique risk in REITs (on average, there are about 20 REITs in the sample versus over a 1000 NYSE firms) and variation in the implicit discounts of the closed-end REITs.

Table 6 repeats the Table 5 regressions, but with the mimicking portfolios replacing the factors. In this table, the NYSE return results are reported first, and the residuals from these equations are included as a regressor in the REIT equation. This inclusion does not affect the estimated REIT factors loadings, but it does alter the constant term and improve the precision of the estimates.

Unexpected inflation and the risk and term structure returns work as before, although the risk structure coefficients are about a fifth less and the term structure coefficients a third less. Changes in expected inflation and industrial production now have more consistent positive coefficients. Most important are the constant terms, which can now be interpreted as evidence of positive or negative risk-adjusted excess returns. As can be seen, there is no evidence of excess returns on REITs, in contrast to the single factor results reported in Table 4.

B. Returns on REITs with Varying Leverage

As we noted early, most of the equity REITs in our sample are substantially levered (have book debt to asset ratios above 0.6). Why REITs are levered is uncertain. The usual optimal leverage point is that at which the tax advantage of debt equals agency and bankruptcy costs, but equity

REITs are not subject to taxation. For equity REITs, nontax advantages must exist. What these advantages are could well affect how returns on differentially levered firms respond to the macroeconomic factors.

Two possible advantages to long-term debt come to mind. First, if the underlying properties have nonvariable long-term leases, long-term debt will act to balance the risk associated with such leases in a volatile world. Second, if equity REIT investors are largely institutions with legal restrictions against leverage, the REITs can lever for the institutions. The second advantage will simply increase risk for the usual reasons.[9] In this case we would expect returns on highly levered equity REITs to be more sensitive to all macroeconomic factors than returns on less heavily levered equity REITs.

The results where the REITs are partitioned into highly levered (14 REITs) and moderately levered (16 REITs) are given in Table 7. The highly levered REITs are consistently more strongly related to the three factors most important to REIT returns (the risk and term structure variables and unexpected inflation) than are the moderately levered REITs. This suggests that REITs are not using leverage to hedge fixed-rate long-term leases. There is no evidence of excess returns for either REIT category in either the 1970s or the 1980s.[10]

C. REITs and Closed-End Stock Funds

Lee, Shleifer and Thaler (1989) have computed value-weighted discounts on closed-end stock and bond funds and provided evidence that the discounts are high when investors (especially in small stocks) are pessimistic and low when investors are optimistic. It is at least plausible that the same forces causing changes in the LST discounts cause changes in equity REIT discounts and thus in equity REIT returns.

LST computed discounts for 20 stock funds and 30 bond funds. However, discount data for only 7 to 18 stock funds existed in any given month. Separate weighted-average discount series were obtained for all funds, just stock funds, and just domestic stock funds (American South African and Japan Fund were excluded).[11] Results are reported below using each of these three series.

In the absence of a closed-end fund discount, the value of an equity REIT is simply its net asset value (NAV). With a discount, we write

$$REIT = NAV \frac{REIT}{NAV}.$$

The percentage change (%Δ) in REIT value, which is also the REIT return ignoring cash flow, is then

$$\%\Delta REIT = \%\Delta NAV + \%\Delta \frac{REIT}{NAV}.$$

The definition of a REIT's discount is

$$DISC = \frac{REIT - NAV}{NAV} = \frac{REIT}{NAV} - 1.$$

Thus REIT/NAV = 1 + DISC, and its percentage change is simply ΔDISC/(1+DISC). To determine whether the discount in our equally-weighted equity REIT index is related to any of the LST value-weighted discounts, we regress the our equity REIT return on this variable.

Our sample is restricted to the January 1973-December 1985 period because LST did not compute their discounts after 1985. The results based on their three discount measures are

$$\underset{}{REIT} = \underset{(.0042)}{.0075} + \underset{(.183)}{.505}\ \text{All Funds} \qquad \bar{R}^2 = .0410$$

$$= .0075 + .528 \text{ Stock Funds} \qquad \bar{R}^2 = .0535$$
$$(.0042) \quad (.169)$$

$$= .0075 + .518 \text{ Domestic Stock Funds} \qquad \bar{R}^2 = .0557$$
$$(.0041) \quad (.163)$$

As can be seen, the equity REIT discount seems to move by about one-half the movement in any of the LST discounts.

To determine whether the LST discount is an independent force or is simply picking up the impact of macroeconomic factors, we reestimated the first equation in Table 5 over the 1973-85 period with the domestic stock fund discount variable. The latter has a coefficient of 0.404 with a t-ratio of 2.6, while the coefficients on the macro factors are similar to those in Table 5. That is, the discount does have an independent effect.

REIT returns are also regressed on the discount variable and the mimicking portfolios. Here the discount's coefficient is only 0.10 with a t-ratio of 0.8. That is, the discount is dominated by the mimicking portfolios but not by the macrofactors themselves: This is because the mimicking portfolios are size ranked and, as Lee, Shleifer and Thaler have shown, the discount is correlated with returns on size-ranked portfolios.

Last, we regressed our highly-levered and moderately-levered REIT indexes on the percentage change in the LST closed-end stock fund discount. The results are

$$\text{REIT, HL} = .0085 + .777 \text{ Stock Funds} \qquad \bar{R}^2 = .0689$$
$$(.0054) \quad (.220)$$

$$\text{REIT, ML} = .0069 + .370 \text{ Stock Funds} \qquad \bar{R}^2 = .0308$$
$$(.0037) \quad (.150)$$

As expected discounts on more highly levered REITs are more sensitive to the LST closed-end stock fund discount than are discounts on less highly levered REITs.

IV. Conclusion

Early research on real estate returns concluded that real estate both earned substantial risk-adjusted excess returns and served as a good hedge against inflation. This research employed appraisal-based real estate return data. When transactions-based equity REIT returns (an equally-weighted series for 18 to 23 REITs) are utilized in a single factor CAPM model, excess returns still seen to exist, at least in the 1980s. However, when a five factor model is used, the evidence of excess returns disappears. Moreover, real estate is not seen to be a hedge against inflation.

The five factors employed are changes in expected inflation and industrial production, the risk and term structure return variables, and unexpected inflation. The latter three factors consistently affect both real estate and general stock market returns in the 1970s and 1980s. Returns are positively related to the risk and term structure returns and negatively related to unexpected inflation. Moreover, real estate returns are affected only about 60 percent as much as NYSE returns generally. That is, real estate is less risky than common stocks. Changes in expected inflation and industrial production do not have systematic impacts, although that of industrial production does seem to be positive.

We also divide our equity REITs into highly and moderately levered subgroups and compute equally-weighted return series. Regressions of these series on the five macroeconomic factors indicate that the more levered REITs are consistently more strongly related to the factors than are the less levered REITs. Again, no evidence of excess returns appears.

Last, we relate equity REIT returns to the percentage change in the discount on closed-end stock funds. A statistically significant relation is estimated, with the implied closed-end fund discount on equity REITs changing by about half of any change in the closed-end stock fund discount. Regressions of REIT returns on the discount variable and the macroeconomic factors suggest that the discount variable is not simply proxying for the macroeconomic factors but has an independent influence.

We see three useful directions in which to extend this research. First, the effect of leverage should be studied in more depth. Varying leverage of REITs over time and the proportion of assets with long-term fixed rate leases (nonresidential properties versus residential properties) should be accounted for in this extension. Second, the same model can be applied to various classes of mortgage REITs. These REITs vary widely in risk with construction-loan REITs probably being the riskiest and GNMA REITs being the least. Third, the performance of equity REITs could usefully be compared more closely with that of closed-end mutual funds, as was done in the original equity REIT study (Smith and Shulman, 1976).

Footnotes

[1]Geltner (1989) contends that real estate does not provide excess returns when the smoothed nature of appraisal returns is taken into account.

[2]Chamberlain (1983) and others provide conditions under which (2) holds.

[3]Seven of the 16 REITs classified by Titman and Warga (1987) as equity REITs were mortgage REITs that had foreclosed on many loans. An eighth was Pittsburg and West Virginia Railroad. While technically an equity REIT, its single asset is a 99 year fixed-rate lease. Thus we have excluded it from our sample. Because our definition of equity REITs differs so markedly, we do not compare our results with those of Titman and Warga.

[4]The book values refer to data around 1980-82, the middle of our estimation period.

[5]Means (and standard deviations) for their quarterly data are 3.66 (7.88) for 1973-87, 3.04 (9.03) for 1973-79, and 4.21 (6.83) for 1980-87. The same data for our equally-weighted series are 4.45 (9.77) for 1973-87, 3.73 (12.50) for 1973-79, and 5.10 (6.68) for 1980-87.

[6]This reasoning is a bit too mechanistic. If changes in new-issue Treasury coupon rates affected returns on Treasuries and junk bonds equally, the changes in the risk and term structure variables would not be correlated. Junk bond returns would be affected differentially (less) to the extent that they have a shorter duration and are callable.

[7]These results are consistent with Liu, Hartzell, Grissom and Greig (1990) who find that six of their 18 equity REITs earned excess returns in the 1978-86 period.

[8]Note that the expected inflation variable employed is the change in expected inflation, not the level. Because the level is known at the beginning of the month, it is not an economic surprise. The studies referred to in our opening paragraph generally related real estate returns to the level of expected inflation, not the change.

[9]Some of the debt could be below-market mortgages assumed when properties were purchased. It would seem unlikely that most of the debt arises in this way, and if the debt were really onerous except for its low interest rate, then the REIT would likely induce the lender to accept retirement of the debt at below par. In any event, such debt increases the risk of equity returns.

[10]When the moderately leveraged REITs are further subdivided into medium and lightly leveraged (8 each), leaving as few as five REITs in the sample at times, there is some evidence of excess returns for the medium group in the 1980s.

[11]We thank Charles Lee for supplying us with the data.

References

Brueggeman, William, Andrew Chen and Thomas Thibodeau. "Real Estate Investment Funds: Performance and Portfolio Considerations," AREUEA Journal, Fall 1984, 333-354.

Chamberlain, Gary. "Funds, Factors and Diversification in Arbitrage Pricing Models." Econometrica 51, September 1983, 1305-23.

Chan, K.C., Nai-fu Chen and David Hsieh, "An Explanatory Investigation of the Firm Size Effect," Journal of Financial Economics, 14, 1985, 451-471.

Chen, Nai-fu , Richard Roll, and Stephen A. Ross. "Economic Forces and the Stock Market: Testing the APT and Alternative Asset Pricing Theories," Journal of Business 59, July 1986, 383-403.

Connor, Gregory and Robert Korajczyk, "Performance Measurement with the Arbitrage Pricing Theory: A New Framework for Analysis," Journal of Financial Economics, 15, 1986, 373-394.

Firstenberg, Paul M., Stephen A. Ross, and Randell C. Zisler, "Real Estate: The Whole Story," The Journal of Portfolio Management, Spring 1988.

Geltner, David, "Estimating Real Estate's Systematic Risk from Aggregate Level Appraisal Based Returns," AREUEA Journal, Winter 1989.

Grinblatt, Mark, and Sheridan Titman, "The Relationship between Mean-Variance Efficiency and Arbitrage Pricing," Journal of Business, 60, January 1987, 97-112.

Hartzell, David, John Hekman and Mike Miles, "Real Estate Returns and Inflation," AREUEA Journal, Winter 1987, 617-637.

Huberman, Gus, Schmuel Kandel and Robert F. Stambaugh, "Mimicking Portfolios and Exact Arbitrage Pricing," Journal of Finance 42 (1), 1987, 1-9.

Ibbotson, Roger and Laurence Siegel, "Real Estate Returns: A Comparison with Other Investments," AREUEA Journal, Fall 1984, 219-242.

________, and R.A. Sinquefield, Stocks, Bonds, Bills and Inflation: The Past and the Future, Financial Analysts Research Foundation, 1987.

Lee, Charles, Andrei Shleifer and Richard Thaler, "Investor Sentiment and the Closed-End Fund Puzzle," mimeo, September 1989.

Liu, Crocker H., David J. Hartzell, Terry V. Grissom and Wylie Greig, "The Composition of the Market Portfolio and Real Estate Investment Performance," AREUEA Journal, forthcoming 1990.

Ross, Stephen A., "The Arbitrage Theory of Capital Asset Pricing," Journal of Economic Theory, 13, December 1976, 341-360.

Titman, Sheridan and Arthur Warga, "Risk and Performance of Real Estate Investment Trusts: A Multiple Index Approach," AREUEA Journal, Fall 1986, 414-431.

Table 1:
Equity REITs Used to Compute Equally-Weighted Return Indexes

Name	Period	Exchanges	Leverage
American Equity Investment TR.	6/74-8/84	NASDAQ	HL
B.F. Saul	1/78-12/87	NYSE	HL
California Jockey Club	12/72-12/83	AMEX, NASDAQ	ML
Continental Illinois Prop.	10/73-6/79	NYSE	ML
Eastgroup Prop.	2/73-12/87	AMEX	ML
Federal Realty Investment Tr.	7/75-12/87	NYSE, AMEX	HL
First Fidelity Investment Tr.	1/73-10/78	NASDAQ	HL
Florida Gulf Realty Tr.	6/73-11/85	NASDAQ	HL
General Growth Prop.	4/73-12/84	NYSE, NASDAQ	HL
General Real Estate Shares	1/73-12/87	NASDAQ	ML
Gould Investment Trust	5/73-9/82	AMEX	HL
Greater Washington Inv. Corp.	7/69-5/74, 12/80-12/87	NYSE, NASDAQ	HL
HMG/Courtland Prop	1/82-12/87	AMEX	HL
Hollywood Pk. Realty Group	1/73-12/87	NASDAQ	ML
HRE Prop.	6/70-12/87	NYSE	ML
International Inc. Prop. Inc.	1/80-12/87	NASDAQ, AMEX	ML
IRT Prop. Co.	11/71-12/87	AMEX, NYSE	ML
Kenilworth Realty Tr.	1/74-7/81	NYSE	HL
Miller Henry	1/73-11/82	NASDAQ	ML
Property Capital	1/73-12/87	AMEX	ML
Penn. REIT	7/70-12/87	AMEX	ML
Property Trust of America	1/73-12/87	NASDAQ	ML
REIT America	5/71-1/84	AMEX	ML
Santa Anita Realty Center	6/81-12/87	NYSE	ML
Storage Equities, Inc.	10/82-12/87	NASDAQ, NYSE	ML
Summit Properties	1/73-5/79	NASDAQ	HL
USP REIT	5/78-12/87	NASDAQ	HL
United Domain Pty Trust	3/80-12/87	NASDAQ	HL
Virginia REIT	1/73-2/81	NASDAQ	HL
Washington REIT	6/71-12/87	AMEX	ML

Leverage: HL = highly levered (14)
ML = moderately levered (16)

Table 2: Means and Standard Deviations of Return Series

	1973-87	1973-79	1980-87
Equally-Weighted EREIT - TBill			
Mean	.0877	.0748	.0990
Std. Dev.	.627	.782	.454
t-stat for Mean = 0	1.58	0.64	1.99
Highly-Levered REIT-TBill			
Mean	.0978	.0729	.1197
Std. Dev.	.812	1.037	.550
t-stat	1.62	0.64	2.13
Moderately-Levered REIT-TBill			
Mean	.0802	.0732	.0864
Std. Dev.	.569	.679	.454
t-stat	1.89	0.99	1.86
Equally-Weighted NYSE - TBill			
Mean	.0761	.0645	.0863
Std. Dev.	.742	.830	.660
t-stat	1.38	0.71	1.28
Value-Weighted NYSE - TBill			
Mean	.0319	-.0130	.0711
Std. Dev.	.607	.599	.613
t-stat	0.71	-0.20	1.14
Treasury Bills			
Mean	.0789	.0670	.0895
Std. Dev.	.0275	.0186	.0299
t-stat	38.35	33.02	29.21

Table 3: Means, Standard Deviations, and Correlations for Macroeconomic Factors, Annual Rates

	1973-87	1973-79	1980-87	Correlations*				
				IP	EXP	UNE	Risk	Term
Change in Industrial Production (IP)								
Mean	.0281	.0279	.0283	1.0	-.03	.05	.25	-.24
Std. Dev.	.353	.392	.317		(.01)	(.04)	(.00)	(.10)
t-stat (mean = 0)	1.07	0.65	0.87					
Change in Expected Inflation (EXP)								
Mean	-.0001	.0006	-.0007		1.0	.53	.20	-.41
Std. Dev.	.016	.012	.0184			(.77)	(.03)	(.06)
t-stat	-0.05	0.44	-0.35					
Unexpected Inflation (UNE)								
Mean	-.0063	.0092	-.0199			1.0	.18	-.26
Std. Dev.	.036	.032	.034				(.12)	(.12)
t-stat	-2.36	2.63	-5.75					
Low Grade Corporate Less Treasury Bond (Risk)								
Mean	.0078	.0099	.0059				1.0	-.65
Std. Dev.	.363	.326	.394					(-.76)
t-stat	0.29	0.28	0.15					
Treasury Bond less Treasury Bill (Term)								
Mean	.0069	-.0294	.0375					1.0
Std. Dev.	.424	.260	.529					
t-stat	0.22	-1.04	0.72					

*The numbers refer to the macro factors and the mimicking portfolios (in parentheses).

Table 4:
Equity REIT Returns less the Treasury Bill Rate in a Single Factor Model

Period	Constant	Equally-Weighted NYSE	Value-Weighted NYSE	$\bar{R}^2$	t-statistic
1973-87	.0031 (.0025)	.659 (.040)		.606	1.27
1973-87	.0056 (.0031)		.635 (.061)	.373	1.82*
1973-79	.0023 (.0045)	.734 (.065)		.508	0.51
1973-79	.0070 (.0059)		.750 (.118)	.322	1.20
1980-87	.0043 (.0023)	.556 (.042)		.650	1.85*
1980-87	.0050 (.0027)		.541 (.052)	.531	1.89*

Standard errors of regression coefficients are in parentheses.

*Indicates significant t ratio at 5 percent level for one-tailed test.

Table 5: Direct Impacts of the Macro Factors on Real Estate and Stock Market Returns

Period	Dependent Variable	Constant	Change in Industrial Production	Change in Expected Inflation	Unexpected Inflation	Change in Risk Structure	Change in Term Structure	$\bar{R}^2$
1973-87	Equity REITs	.0049 (.0037)	.254 (.128)	4.39 (3.46)	-1.59 (1.42)	.846 (.158)	.758 (.144)	.166
	Equally-Weighted NYSE	.0033 (.0039)	.208 (.135)	6.68 (3.67)	-2.97 (1.51)	1.355 (0.167)	1.282 (0.153)	.348
1973-79	Equity REITs	.0084 (.0069)	.356 (.219)	-3.70 (8.11)	-1.54 (3.11)	.886 (.258)	.947 (.331)	.176
	Equally-Weighted NYSE	.0109 (.0061)	.127 (.196)	-6.69 (7.26)	-3.64 (2.78)	1.369 (0.231)	1.558 (0.296)	.449
1980-87	Equity REITs	.0020 (.0045)	.048 (.142)	9.36 (3.24)	-2.36 (1.65)	.822 (.194)	.736 (.150)	.179
	Equally-Weighted NYSE	-.0029 (.0060)	.234 (.188)	14.17 (4.31)	-3.82 (2.20)	1.378 (0.258)	1.332 (0.200)	.341

Table 6: Impacts of the Mimicking Portfolios on Equity REIT and NYSE Returns

Period	Dependent Variable	Constant	Industrial Production	Expected Inflation	Unexpected Inflation	Risk Structure	Term Structure	NYSE Residuals	$\bar{R}^2$
1973-87	NYSE	-.0016 (.0030)	.105 (.043)	2.22 (1.04)	-2.25 (0.39)	1.035 (.068)	.852 (.059)	...	.594
	REITs	.0014 (.0023)	.225 (.033)	0.62 (0.81)	-1.56 (0.30)	.690 (.053)	.508 (.046)	.589 (.059)	.655
1973-79	NYSE	.0001 (.0025)	.117 (.031)	1.97 (0.94)	-2.53 (0.33)	1.100 (.045)	.948 (.045)	...	.895
	REITs	-.0010 (.0041)	.282 (.051)	-1.73 (1.53)	-0.60 (0.54)	.626 (.074)	.452 (.076)	.885 (.184)	.687
1980-87	NYSE	.0001 (.0054)	.047 (.092)	2.73 (1.75)	-1.68 (0.73)	.804 (.172)	.660 (.132)	...	.196
	REITs	.0028 (.0023)	.079 (.039)	3.15 (0.75)	-2.25 (0.31)	.739 (.074)	.537 (.057)	.522 (.045)	.690

Table 7: Impacts of the Mimicking Portfolios on Returns of REITs with Different Degrees of Leverage

Dependent Variable	Constant	Change in Industrial Production	Change in Expected Inflation	Unexpected Inflation	Change in Risk Structure	Change in Term Structure	$\bar{R}^2$
1973-87							
Highly-Levered REITs	.0001 (.0040)	.236 (.058)	1.50 (1.39)	-2.12 (0.53)	.865 (.091)	.628 (.079)	.391
Moderately-Levered REITs	.0005 (.0027)	.218 (.039)	0.14 (0.94)	-1.24 (0.36)	.581 (.061)	.432 (.054)	.358
1973-79							
Highly-Levered REITs	.0024 (.0068)	.338 (.085)	-1.54 (2.54)	-1.29 (0.90)	.887 (.121)	.690 (.122)	.509
Moderately-Levered REITs	-.0002 (.0042)	.266 (.052)	-2.00 (1.54)	-0.63 (0.55)	.559 (.073)	.438 (.074)	.577
1980-87							
Highly-Levered REITs	.0049 (.0045)	-.017 (.077)	4.93 (1.46)	-2.40 (0.60)	.677 (.143)	.469 (.110)	.197
Moderately-Levered REITs	.0017 (.0037)	.090 (.063)	2.42 (1.21)	-1.67 (0.50)	.580 (.119)	.416 (.091)	.196