WHAT DOES THE STOCK MARKET TELL US ABOUT REAL ESTATE RETURNS?

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ABSTRACT

This paper analyzes the risks and returns of different types of real estate-related firms traded on the New York and American stock exchanges (NYSE and AMEX). We investigate the relation of real estate stock portfolio returns with returns on a standard appraisal-based index, and find that lagged values of traded real estate portfolio returns can predict returns on the appraisal-based index. The stock market appears to incorporate information about real estate markets that is later imbedded in property appraisals. Additional analysis suggests that the differences in the return and risk characteristics across different types of traded real estate firms can be explained in part by appealing to real estate market fundamentals relating to the degree of dependence of the real estate firm upon the rental cash flows from existing buildings. These findings highlight the heterogeneity of real estate-related firms and indicate that future work needs to consider other firms in addition to REITs.

1. Introduction

There is increasing interest, both practical and academic, in the characterization of the risks and returns from investing in real estate. However, market-determined real estate prices are not readily available due to infrequent trading of properties and the absence of a centralized exchange. Research into real estate returns typically uses appraisal-based return series such as the Russell-NCREIF Property Index.[1] It is important to realize that the appraisal process is not a continuous one and, therefore, imparts a lag in the incorporation of information into prices. This lag results in stale prices during the intervals between appraisals, and also injects undesirable statistical properties into the series. In addition, there remains the issue of the accuracy of the appraisal process itself: Do the prices generated by the appraisal process reflect rational assessments of the value of real properties?[2]

A second strand of this literature examines the returns of real estate investment trusts (REITs) and their *contemporaneous* correlation with the appraised real estate series. A typical finding is that equity REIT returns are far more correlated with the stock market than with the returns on the appraised real estate series, causing many to conclude that traded real estate equities do not accurately reflect real estate values. Such a conclusion may be unwarranted, though, since it implicitly depends upon the reliability of *both* the REIT and the appraisal series. The lack of contemporaneous correlation between the stock market-based and the appraisal-based real estate series may be due primarily to the fact that the appraisal series do not accurately reflect information about real estate in a *timely* fashion.

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[1]The letters NCREIF stand for the National Council of Real Estate Investment Fiduciaries. Prior to the fourth quarter of 1989, this index was called the Frank Russell Company (FRC) Property Index.

[2]Ross & Zisler (1987a,b) were the first to detail the weaknesses of the appraisal-based series and to suggest ways to cleanse the data of allegedly faulty appraisal information.

In this paper, we test the joint hypothesis that real estate stocks efficiently reflect information about real estate fundamentals and that prices of appraised series reliably reflect this information with a lag. We find a statistically significant relation between *lagged* returns of a portfolio of equity REITs and the *current* returns of the Russell-NCREIF Property Index and conclude that both series accurately incorporate information about real estate fundamentals. This conclusion is bolstered by the fact that the influence of the lagged REIT returns is much greater when they occur immediately preceding the the fourth quarter, which is the period of greatest appraisal activity. This predictive power is independent of the broader stock market's predictive ability. In addition, our real estate-related stock portfolio returns are positively contemporaneously correlated with the National Association of Realtors' (NAR) existing home price appreciation rate, which also is a transactions-based, but nonsecuritized, return measure.

Our conclusions about the usefulness of stock market data to characterize the returns and risks of real estate are reinforced by added analysis of different types of real estate firms. Firms such as equity REITs primarily are owner-operators of existing properties. Others such as the residential general contractors and commercial developers primarily are builders, not owners, of property. With long-term leases on many commercial properties making rents a fixed cost for tenants, we would expect the cash flows of owner-operators to be less variable than those of their tenants over the business cycle. As producers of an extremely durable good, the builders' cash flows should be very cyclical. The different risks these two types of real estate firms face imply that the market betas of the builders should be much higher than those of the owner-operators. We investigate this hypothesis by examining the returns of equity REITs and three additional portfolios of real estate-related stocks (land subdividers and developers of commercial property, general contractors (primarily homebuilders), and other building owner-operators not organized as trusts) traded on the New York and American stock exchanges. The data strongly

confirm our intuition about the rank ordering of real estate firm market betas. These findings highlight the heterogeneity of real estate-related firms and indicate that research in this area should consider other real estate-related stocks in addition to REITs.

The outline of the paper is as follows. Section 2 details data sources, reports summary statistics, and documents a significant relation between lagged real estate stock portfolio returns and the current returns of the Russell-NCREIF Property Index. Section 3 describes how changes in real estate market fundamentals and stock price behavior are likely to be related, reports summary statistics about the real estate stock indexes we create to test this relation, and analyzes the cross sectional heterogeneity in the real estate stock index returns. A brief summary concludes the paper.

2. The Relation Between Market- and Appraisal-Based Real-Estate Indexes

2.1 Data and Summary Statistics

The Russell-NCREIF Property Index is a widely known appraisal-based series. We have total returns for this index that are available only on a *quarterly* basis, beginning in the first quarter of 1978. The index now incorporates over 1100 widely diversified properties owned or managed by a broad cross section of major institutional investors, plan sponsors, and advisors. The net rental income data are based on actual cash flows, but the appraisals are thought to smooth the overall returns and may induce some biases.[3] The *Annual Data Supplement to the NCREIF Real Estate Performance Report* (1989) provides added detail about the index.

[3]See Giliberto (1988), Geltner (1989), and Gau & Wang (1990) for arguments as to why such bias could be positive or negative.

The real estate stocks examined in this section are equity REITs.[4] These stocks are investment trusts composed of firms that own and (often) operate various types of real properties. These firms are a subset of standard industry classification (SIC) 6799 which is used to help identify them on the monthly return files of the Center for Research in Security Prices (CRSP). The CRSP returns incorporate both dividends and capital gains. Our equity REIT portfolio is composed of qualifying firms with stock trading on the NYSE and AMEX. There is no survivorship bias in the sample in the sense that we include firms that were delisted for any reason.

The REITs' trust status allows them to escape the corporate income tax in return for following special provisions dealing with issues such as income pass-throughs to trust investors. The *REIT Fact Book*, an annual publication of the National Association of Real Estate Investment Trusts (NAREIT), details this and other provisions. Standard and Poor's *Handbook of Real Estate Securities* and various issues of the *REIT Fact Book* were employed to guide us in separating the equity REITs from the mortgage and hybrid REITs also in the CRSP files under SIC 6799. The number of stocks in the portfolio ranges from a low of 15 in 1978 to a high of 48 in 1989. For comparison with the Russell-NCREIF series, quarterly returns are created by compounding the monthly returns from CRSP.

Another real estate series examined is the NAR's *monthly* existing home price series obtained from The WEFA Group. These data run from January 1966 to December 1989. This series is based on actual transactions in a large number of metropolitan statistical areas

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[4]There has been a substantial amount of research into REITs. Lee & Kau (1987) study their dividend policies. Allen & Sirmans (1987) investigate REIT performance in takeover settings. More general studies of REIT investment performance date back at least to Smith & Shulman (1976) and Davidson & Palmer (1978). Building upon these efforts have been Patel & Olsen (1984), Kuhle, Walter, & Wurtzebach (1986), Mengden & Hartzell (1986), Titman & Warga (1986), Kuhle (1987), Chen & Tzang (1988), and Sagalyn (1990). Chan, Hendershott, & Sanders (1991) and Liu & Mei (1991) are among the most recent investigations into REIT return behavior.

throughout the United States. This is not a quality-adjusted price series and U.S. Bureau of the Census data (1990) on new homes indicate a secular rise in quality over the past thirty years. As new homes come on the market over time, some of the measured appreciation in the NAR series is due to a better stock of homes. There are quality-adjusted home price series available for a few select cities (e.g., see Case & Shiller (1987)), but we know of no such series for broader regions or for the nation. Note that this series is based upon the home's appreciation rate and does not respresent the total return because the implicit rent on owner-occupied housing is not known. Quarterly appreciation rates are created by compounding the monthly observations.

Because one objective of this paper is to identify the sources of volatility in real estate returns, we also collected data on equity market movements, interest rate and term structure movements, and inflation (both expected and unexpected). Both the S&P 500 index and a small stock index are employed to represent the broader equity market. The small stock index return is based on the returns of the NYSE- and AMEX-listed firms which are among the smallest 20% in market capitalization on the NYSE only. Bond market variables include the returns on a portfolio of long-term Treasury bonds and on one-month and three-month Treasury bills. With the exception of the three-month Treasury bill which is from the CRSP goverment bond file, the stock and bond index variables are from Ibbotson & Sinquefield (1989) for the 1962-1987 period. Updates through 1989 are from Ibbotson & Associates. The monthly observations for these series are compounded to produce quarterly observations.

The inflation variables in this section are derived from consumer price index (CPI) data. To create our expected inflation measure, we estimated an ARMA model with quarterly CPI data. Experimentation showed that the structure of the process is not stable over time. Consequently, we estimated rolling quarterly forecasts with a new ARMA model specified each

quarter. Unexpected inflation is the difference between actual inflation and the ARMA forecast.

Table 1 reports summary statistics for the quarterly excess returns for the asset categories described above. There are several interesting findings. First, and consistent with previous results, excess returns on the Russell-NCREIF index exhibit no significant contemporanous correlation with the REIT portfolio or with other stock returns. The same is true with respect to housing appreciation. The appraisal-based returns are significantly negatively correlated with the excess return on long-term bonds, but are not correlated with inflation shocks.

The equity REIT returns do exhibit a significant correlation with the housing appreciation index ($\rho = .32$), providing evidence of a contemporaneous linkage between our two transactions-based real estate series.[5] Also, equity REITs display a high correlation with stock market returns, especially the small stocks ($\rho = .80$), a finding that may largely reflect the fact that equity REITs generally are small stocks. It is interesting to note, however, that the small stocks are also significantly related to the housing returns ($\rho = .43$). Such strong contemporaneous comovement between the small stocks and residential housing suggests a common factor in their returns.

[5]The mean excess existing home appreciation rate is negative, but the average quarterly *total* appreciation rate over this twelve year period is 1.58%. It is also noteworthy that the NAR's appreciation series is strongly positively correlated with unexpected inflation. This is consistent with with the finding by Fama & Schwert (1977) that residential real estate provides a good hedge against unexpected inflation.

2.2 Time Series Properties of the Russell-NCREIF Index

While the transactions-based (i.e., REITs and homes) and appraisal-based (i.e., Russell-NCREIF) real estate returns appear to have little or no relation to one another (table 1), that appearance is misleading because the appraisal process probably causes the Russell-NCREIF series to lag changes in property values. Appraisals can occur as frequently as every quarter, but often occur only every six or twelve months. Even with accurate appraisals, changes in real estate market conditions will only slowly be incorporated into the index. This implies that *lagged* real estate-related stock returns and housing appreciation may be correlated with current period Russell-NCREIF returns.

To investigate this issue properly, we have to account for the persistence and seasonality of the Russell-NCREIF returns. Subtracting the three-month Treasury bill return from the Russell-NCREIF returns reduces the persistence, but not the seasonality of the appraisal-based index. Consistent with previous research, we find significant first-order autocorrelation in the Russell-NCREIF excess returns (RNC_t) as estimated in equation (1),

$$\text{(1)}\quad \underset{}{RNC_t} = \underset{(.0020)}{0.0035} + \underset{(.1415)}{0.3416}*RNC_{t-1} + \mu_t,\ R^2=.11,$$

where μ_t is the mean zero residual from this regression of current period returns on returns lagged one quarter and standard errors are in parentheses.[6] This result has led many to doubt the validity of appraisal-based returns, with the suspicion being that appraisers are 'smoothing' the data by reporting smoothed capital values in their appraisal reports. Such smoothing induces persistence into the return series and biases variances downward. If the smoothing

[6]The first-order autocorrelation of the total returns is 0.59 and the R^2 is 0.34.

argument is correct, the Russell-NCREIF returns need to be adjusted or purged of any artificially-induced smoothness before investigating whether lagged stock returns can predict the index.[7]

A possible alternative explanation for the significant first-order autocorrelation lies in the well-known fourth quarter seasonal in the Russell-NCREIF return series. This seasonal probably is due to the nonuniform distribution of appraisal activity over time. There typically is an upsurge of appraisal activity at the end of the calendar year, possibly for tax-reporting reasons. Adding a fourth quarter dummy variable (QTR4) to the AR(1) process in (1) yields the following results,

$$\text{(2)}\quad RNC_t = \underset{(.0021)}{0.0003} + \underset{(.1300)}{0.3702}*RNC_{t-1} + \underset{(.0038)}{0.0117}*QTR4 + \tau_t, \quad (R^2=.27),$$

where τ_t is mean zero error term. The Russell-NCREIF returns are significantly higher in the fourth quarter. It is also the case that return variance is at its highest in the fourth quarter. More importantly for our purposes, the coefficient on RNC_{t-1} in equation (2) is statistically significant and as large as the estimate reported in (1). We can conclude, therefore, that the first-order serial correlation in the Russell-NCREIF series is not due to the fourth quarter seasonal.[8]

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[7]Starting from a given specification of the appraisal methodology, reseachers such as Ross & Zisler (1987b) and Geltner (1989) propose procedures to adjust smoothed returns. However, the widely held smoothing contention has come into some doubt with the recent work of Quan & Quigley (1991). They build a model of price formation in markets with imperfect information. Appraisers act as signal extractors. They find that smoothed returns can be the result of a rational filtering process by the appraisers, not the result of flawed asset evaluations.

[8]We also estimated equation (2) with a fourth quarter dummy variable and a time trend (ranging from 1 to 47 for each available quarter). In that specification, the coefficient on the lagged Russell-NCREIF excess return is also positive, but insignificant.

2.3 Market-Determined Variation in the Appraised Real Estate Returns

In this section we investigate the ability of stock and bond returns and the appreciation on the transactions-based housing index to explain the variation in the Russel-NCREIF index. We use the residual (μ_t) from the AR(1) specification reported in equation (1) as the dependent variable in our investigation, since some of the persistence in the index may be the result of appraisal smoothing. We use current and lagged values of the stock, bond and housing indexes as independent variables. Our use of contemporaneous variables reflects the fact that appraisals can occur within any quarter and may reflect information that also is impounded contemporaneously into that quarter's bond and stock market return. We use lagged values of the transaction-based series because those data may incorporate information before it is contained in the appraisal series. Finally, the nonuniform timing of appraisals is such that a disproportionate amount of information about real estate market fundamentals is impounded into the Russell-NCREIF Property Index in the fourth quarter of each year (assuming appraisals are not random guesses by completely uninformed evaluators). This implies that an important test of the reliability of the real estate stock data will be whether their lagged returns that occur just prior to the fourth quarter, as well as their contemporaneous fourth quarter returns, are especially influential in explaining the appraisal series.

We begin by estimating the following equation,

$$(3)\ \mu_t = ß_0 + ß_1 R_{er,t} + ß_2(R_{er,t}*QTR4) + ß_3 R_{er,y(-1)} + ß_4(R_{er,y(-1)}*QTR4) + ß_5(R_{ss,t}*QTR4) + ß_6(R_{ss,y(-1)}*QTR4) + \epsilon_{i,t}.$$

The variable $R_{er,t}$ is the equity REIT portfolio return in quarter t, $R_{er,y(-1)}$ is the compound

annual return on the REIT portfolio over the four quarters constituting the calendar year immediately preceding quarter t,[9] $R_{ss,t}$ and $R_{ss,y(-1)}$ are the analogous current and lagged excess returns on the small stock index, and all other terms are defined as above. Given the strong positive correlation between the returns on the equity REITs and the small stock index, we include the small stock return to help assess whether any ability to explain the appraisal series is due to the influence of real estate versus that of the stock market in general. Lagged compound annual returns are used in lieu of individual quarterly lags to conserve on a limited number of degrees of freedom (n=47). The coefficients $ß_2$, $ß_4$, and $ß_5$ on the interaction terms will show whether there is an increased explanatory power at the end of the year. The results are presented in the first row of Table 2.

Contemporaneous REIT returns on average have no significant explanatory power with respect to the Russell-NCREIF return residual as indicated by the small and insignificant estimate of $ß_1$. The $ß_2$ coefficient on the current period equity REIT interaction term is positive, but not significant at standard confidence levels (t= 1.47 with an associated probability level of 0.15). The interesting finding in Table 2 is that real estate stock returns over the previous calendar year have substantial predictive power with respect to the Russell-NCREIF returns. The significant estimate of $ß_3$ (t=2.17) indicates that prior year returns of equity REITs can predict next quarter's Russell-NCREIF return. The significantly positive $ß_4$ coefficient (t=2.15) implies that the compound return on equity REITs over the prior year is even more influential when the predicted return occurs in the fourth quarter. Given the increased appraisal activity at the end of the year, this is precisely the result one would expect if the stock market was incorporating information about real estate market fundamentals in a more timely manner than possible for the Russell-NCREIF series given the lags in the appraisal

[9]This annual return is transformed into an equivalent quarterly return.

process. The simple correlations in Table 1 indicate a high degree of collinearity between the returns on the equity REITs and the small stock index. In equation (3), the impact of the lagged small stock returns is insignificant after accounting for the influence of equity REIT returns.[10] The predictive ability of the REIT portfolio is likely due to the fact that the firms in the portfolio own commercial properties similar to those tracked in the Russell-NCREIF Property Index.

Other variables are also correlated with the appraisal series' returns. Table 1 reported a negative contemporaneous correlation with excess long bond returns ($R_{lb,t}$). It may be that investors view a more steeply sloped yield curve as indicative of higher real rates. If so, appraisers would capitalize future rental flows at higher discount rates, lowering property values and returns. Table 1 does not report correlations with lagged returns, but it is the case that the previous year's housing appreciation rate ($R_{h,y(-1)}$) is significantly positively correlated with the current period Russell-NCREIF return. It may be that this correlation reflects the same forces that lead the previous year's equity REIT returns to forecast the Russell-NCREIF return. It is also possible that a change in the growth rate of housing prices proxies for different aspects of changes in business cycle conditions than do changes in the returns on commercial property-owning firms.

To investigate the independent influences of these factors, we estimated equation (4) which modifies equation (3) to include the yield curve and housing variables instead of the insignificant

[10]Estimating an equation that includes *only* current and lagged small stock return variables shows lagged small stock returns to be significant predictors of the Russell-NCREIF Property Index. The R^2 from that estimation is approximately two-thirds of that from an equivalent equation including only equity REITs. Finally, it is noteworthy that neither current or lagged S&P500 index returns have any ability to explain the variation in the appraisal series.

small stock return variables,[11]

$$(4)\ \mu_t = \beta_0 + \beta_2(R_{er,t}*QTR4) + \beta_3 R_{er,y(-1)} + \beta_4(R_{er,y(-1)}*QTR4) + \beta_7 R_{h,y(-1)} + \beta_8 R_{lb,t} + \epsilon_{i,t}.$$

The results of this estimation are presented in the second row of Table 2.

The size of the β_2 coefficient on current REIT portfolio returns realized in the fourth quarter is essentially unchanged, but it is now highly significant. The estimated value of 0.0812 implies that a 12 basis point rise in (current) fourth quarter REIT portfolio returns is associated with a single basis point rise in the residual μ_t representing the Russell-NCREIF returns. A 12 basis point change is only 2.48% of the standard deviation of this regressor. Thus, the so-called standardized marginal effect of this variable (i.e., the impact on μ_t of a one standard deviation change in the interaction term, $R_{er,t}$*QTR4) on the appraisal return is 40 basis points.

With the influential lagged home price appreciation rate in the specification, lagged compound annual REIT returns are significant only when occurring just prior to the fourth quarter. The estimated β_4 on that *lagged* interaction term implies that a 15 basis point rise in the return is associated with a 1 basis point rise in the Russell-NCREIF residual. However, one should not conclude that the marginal impact of the current return is greater. The variance of the lagged compound return is relatively greater so that a 15 basis point move is only 1.85% of the variable's standard deviation. Its standardized marginal effect is 54 basis points. This compares to a 40 basis point standardized marginal effect for the lagged housing appreciation variable (based on the β_7=.0749 and the excess appreciation rate's quarterly standard deviation

[11]Equation (4) does not include the current period equity REIT return ($R_{er,t}$) which had a very small and insignificant coefficient in equation (3). Dropping this variable does not alter any other coefficient in a material way. Experimentation also showed there not to be differential fourth quarter effects for the bond market and housing variables. That is why we do not report results on interaction terms for those variables.

of 2.52%.) Increasingly steep yield curves depress Russell-NCREIF returns, but the estimated β_8 is significant only at the 0.11 level. Including these two variables does raise the adjusted R^2 by about one-fifth to 0.46.[12]

Finally, we estimate a modified version of equation (4) that includes only the predetermined independent variables,

$$(5)\ \mu_t = \beta_0 + \beta_3 R_{er,y(-1)} + \beta_4 (R_{er,y(-1)} * QTR4) + \beta_7 R_{h,y(-1)} + \epsilon_{i,t}.$$

where the variables are defined as before. The results of this estimation are presented in the third row of Table 2. All three predetermined variables are significant at the .10 level or better, and the adjusted R^2 indicates that 37 percent of the variation in the Russell-NCREIF returns can be explained by transactions-based information that is available *prior* to the quarter during which the Russell-NCREIF return is measured. To the extent that market participants are making investment decisions based on movements in the Russell-NCREIF index, they are basing

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[12]Giliberto (1990) also reports significant correlations between lagged equity REIT and Russell-NCREIF index returns. Using total REIT returns and an unadjusted Russell-NCREIF series, Giliberto extracted residual components for both that were purged of all correlation with the stock and bond markets (as well as some seasonality). Regressing the Russell-NCREIF residual on the current quarter equity REIT residual and three lags of the residual, he found that current and lagged REIT returns were significant explanators of Russell-NCREIF residual variation. We reran Giliberto's model where the independent variables were purged of stock and bond market influence, but with a Russell-NCREIF (dependent) variable that was based on excess returns and was corrected for first-order serial correlation (i.e., like μ_t in equation (1)). In this specification, only the current period REIT variable is individually significant; the joint F-statistic is such that one cannot reject at standard confidence levels the null that all four REIT variable coefficients are zero. This reversal of results makes two important points. First, the low-order serial correlation in the unadjusted Russell-NCREIF series is so strong that regressing it on any lagged stock and bond variables will likely result in a statistically significant relation. Second, the implications of purging the REIT returns of their correlation with the stock and bond market needs to be carefully considered. In the next section, we argue that some common factors influence both corporate and real estate returns. Thus, purging the real estate stock return of stock market movements removes economically important components of its mean and variance.

those decisions, in large part, on stale information.

3. Beyond REITs: Extracting more information about real estate from the stock market

After accounting for appraisal lags, it should not be surprising that stock market and real estate returns are related. It is likely that common factors help drive returns in both markets. Zeckhauser & Silverman (1983) report that roughly one-quarter of corporate value is real estate-related in nature. This suggests that at least part of the variance in stock returns should be related to changes in the value of corporate-owned land and structures. Some of this real estate-induced variance may be orthogonal to the firms' core business risk, but some almost certainly is correlated with that risk. Long-term expectations of real growth as well as changes in real interest rates likely affect the capital values of both (non-real estate) firms and real properties in qualitatively similar ways. Tenants' willingness to pay a given rent and their demand for space should be influenced by their expectations of future growth as well as their discount rates. As Geltner (1989) argues, the part of general property market risk associated with the health of the economy should result in a positive correlation between real property returns and the returns on the broader market.

For the office and industrial property markets in particular, institutional factors such as multi-year leases are likely to limit the strength of the positive correlation between property and stock market returns. Gyourko & Linneman (1990) argue that rental flows from buildings with good quality tenants should be smoother than their tenants' own cash flows (not necessarily their smoothed earnings or dividends) over the business cycle. The reason is that rents are a fixed cost to tenants and cannot easily be altered in the short run. Even a building with tenants in cyclical industries will have a relatively stable rental income flow as long as the probability of tenant bankruptcy over the cycle is low and the exercise of space options on the upside of the

cycle is somewhat limited.[13] The fixities introduced by long-term leases suggest that the strength of the covariance of a real estate stock with the market should be a decreasing function of the degree of the real estate firm's dependence on the cash flows from tenants in existing real properties.

To better understand this, contrast contractors and developers who only build structures with owner-operators of structures who do no building. One would expect the pure builders to have high stock market betas. Construction activity is a leading indicator and has a high amplitude over the business cycle. Building activity should be strongly positively correlated with corporate cash flows because businesses' demand for *new* space falls when equity prices drop. Purely property owning firms should have materially lower stock market betas in part due to the fact that their cash flows are more closely linked with the rental income flows from existing buildings. Tenants have to pay rents even when the demand for their products drops and they do not have to pay higher rents when the demand for their product increases.

The remainder of this section analyzes the cross sectional heterogeneity in the returns of four portfolios of real estate stocks. Evidence of significant heterogeneity in covariances with the market along the lines just suggested would strengthen the previous section's conclusion that the stock market accurately reflects information about real estate. For comparision purposes with previous research, we also examine the influence of interest rates and inflation on real estate stock returns.

3.1 Data

We construct four portfolios of real estate-related stocks trading on the NYSE and the

[13]Special features of leases on retail properties help to make their rental flows more procyclical. In addition to the base rent tenants pay, retail leases typically contain 'overage' clauses that make total lease payments an increasing function of store sales. Retail sales themselves are procyclical.

AMEX with data from the CRSP monthly return files. We began with a masterlist of real estate-related firms drawn from Standard and Poor's *Handbook of Real Estate Securities* and then searched through the CRSP data, identifying additional real estate stocks via four-digit SIC codes for four different categories of real estate firms.

The first group of firms is general contractors (SIC 1521-1542). This category includes mostly residential builders who build for contract, not on their own account as speculative builders.[14] Our second category contains land subdividers and developers (SIC 6552). If these firms do own properties, they tend to relinquish them soon after development is finished. The equity REITs described in section 2.1 comprise the third category examined. Recall that these stocks are comprised of owner-operators of properties. The last group of firms studied are also owner-operators of their own properties (SIC 6512-6519).[15] However, the firms in this portfolio are not organized in trust form. They are not subject to the special REIT provisions that are thought by some to mask the performance of the underlying properties that would occur if they were managed unhindered by the trust restrictions. The sample includes firms that failed or were delisted for other reasons. A complete list of firms is available upon request.

We certainly do not claim that these four groups span all traded real estate-related firms. Many firms in the restaurant and vacation businesses have quite valuable real property holdings. Real estate industry suppliers such as lumber and wood products firms might also be considered real estate-related firms. It may well be fruitful for future work to consider more peripheral firms that mix real estate with another core business operation. We focus on the four groups

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[14]Major contractors for bridges and other infrastructure (such as the Bechtel Corporation) are not in this group. The government classifies them elsewhere.

[15]Included in these SIC's are a small number of firms labelled as "Lessors of Real Property". Closer examination showed them often to be energy or mining companies often with land holdings in the western U.S. Such firms were dropped from the sample.

noted above for two reasons. First, we can identify them in the CRSP files via their SIC codes as being primarily in the real estate business. More importantly, our strong priors about the relative strength of the relation between these stocks and the stock market provides an appropriate foundation for further examination of whether the stock market accurately reflects information about real estate fundamentals.[16]

Portfolio returns are computed by combining securities within the same SIC groups. We compute equal- and value-weighted portfolio returns for each month over the period from August 1962 to December 1989. The results using both value-weighted and equal-weighted returns are quantitatively and qualitatively similar since there is relatively little cross sectional diversity in market capitalization across firms within a given real estate category. The simple correlation between any pair of the four groups of equal- and value-weighted portfolio returns ranges from 0.83 to 0.95. In addition, market capitalization data are missing for many of our firms over the first 10-15 years of the sample. For these reasons, we report results based only on the equal-weighted portfolio returns.

The number of stocks in a portfolio can be quite small in the early years. However, the numbers grow through time and remain fairly stable after the mid-1970's. Table 3 lists the maximum and minimum number of stocks in any portfolio throughout the sample period. Due to the very limited number of traded real estate firms prior to the mid-1970's, we present results in the text only for the post-1974 time period. Tables providing analogous findings for the full 1962-1989 period and for the 1962-1974 subperiod are available upon request. It should be

[16]Knowledge of the differences in return behavior for different types of real estate firms is scarce. Davidson & Palmer (1978) and Sagalyn (1990) have analyzed the investment performance of different types of real estate firms. Our sample is much larger than that studied by Davidson & Palmer (1978) who focused on homebuilders in addition to equity REITs in the early to mid-1970's. Sagalyn's (1990) sample of non-REIT firms combines homebuilders, developers, and investment companies. However, her sample is composed exclusively of firms that survived over a fifteen year period.

noted that the number of owner-operator firms not organized as trusts remains quite small until the early 1980's. Even though idiosyncratic factors could materially influence such a small portfolio, we report results for this group for comparison purposes with the equity REITs. Recall that because these owner-operators are not trusts, they do not have to meet special payout provisions.

3.2 Summary Statistics

Summary statistics over the January 1975-December 1989 period for the four real estate stock portfolio returns, the existing home appreciation rate, and for various stock and bond indexes are reported in Table 4. The statistics are based upon monthly excess returns defined as total returns less the one-month T-bill return, unless noted.

There is substantial variation in mean excess returns across the four real estate categories, with the contractors' and developers' returns exceeding even the small stock index return. Except for the equity REIT portfolio, the real estate equities have coefficients of variation far higher than those found for the two broader stock indexes. The simple correlations also reported in Table 4 document the substantial comovement of the different real estate-related stock portfolio returns. The owner-operator portfolio appears the most distinct, with correlations ranging from 0.51 to 0.60 with the other real estate equity groups. Note that each real estate equity portfolio's return is also significantly positively correlated with existing home appreciation, albeit less strongly than with securitized real estate.

The returns on each real estate series are also strongly positively correlated with the broader stock market. The real estate stock portfolio return correlations with the small stock index are particularly high, ranging from 0.60 for the owner-operators to 0.90 for the developers. Most of the real estate firms are relatively small in terms of market capitalization as Figures 1-4

illustrate for each real estate stock portfolio. Figure 1, for example, plots the annual capitalization values for the median general contractor firm against the analogous values for the 10%, 20%, and 50% fractiles of the market capitalization distribution for all NYSE and AMEX firms.

Given that our real estate securities are stocks and that many are small capitalization issues, the strong correlation with the S&P500 index and the small stock index is expected and, therefore, need not represent any linkage between real estate market fundamentals and stock market valuation. However, the results from section 2 and the significantly positive correlations of the nonsecuritized real estate return measure, existing home appreciation, with both the S&P500 index return ($\rho = 0.26$) and the small stock index return ($\rho = 0.28$) suggest that common forces influence both real estate and corporate value in qualitatively similar ways.[17] [18]

Table 4 also provides information about the relation of real estate returns with the bond market and inflation. Three of the real estate stock portfolio returns exhibit significantly positively correlations with excess returns on Treasury bonds. Those correlations are lower than the simple correlation between the bond market and S&P500 returns. Unlike the real estate stocks, the housing market series is almost completely uncorrelated with the long bond excess

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[17]See Liu & Mei (1991) for more on the comovement of equity REIT returns with returns on the broader market. They use a latent variable model to investigate the time variation of expected returns across the asset classes.

[18]It also should be noted that the NAR appreciation series contains significant seasonals as has been observed for small stocks. There are peaks in January and in June, with the summer seasonal slightly stronger. We investigated whether the significant positive correlation with the small stock index return is due solely to common seasonality by regressing the small stock excess return on excess housing appreciation, a dichotomous dummy variable for January, and the interaction of the excess appreciation rate with the January dummy. The excess appreciation variable remains significant even when the January dummy is included. The interaction term's coefficient is small and insignificantly different from zero. Thus, existing home appreciation is contemporaneously positively correlated with the small stock index throughout the year. The same holds for the S&P500 index which, of course, does not contain a January seasonal.

returns. Finally, the excess returns on each of the real estate stock portfolios are negatively correlated with unanticipated inflation. The NAR's home price appreciation series is only slightly positively correlated with unexpected inflation in these monthly data.[19]

3.3 Return Variability Patterns Across Different Real Estate Sectors

To investigate the independent influences of these variables on real estate stock returns, we estimated the following equation,

$$(6)\quad R_{i,t} = \beta_0 + \beta_1 R_{sp,t} + \beta_2 R_{sp,t-1} + \beta_3 \epsilon_{lb,t} + \beta_4 \epsilon_{ui,t} + \delta_{i,t},$$

where $R_{i,t}$ is the monthly excess return on real estate portfolio i in period t, $R_{sp,t}$ is the monthly excess return on the S&P500 index in period t, and $\delta_{i,t}$ is the standard error term. The variables $\epsilon_{lb,t}$ and $\epsilon_{ui,t}$ are the residuals for the monthly excess long bond return ($R_{lb,t}$) and unexpected inflation ($V_{ui,t}$), respectively, from the following regression,

$$(7)\quad R_{lb,t} \text{ or } V_{ui,t} = \beta_0 + \beta_1 R_{sp,t} + \beta_2 R_{sp,t-1} + \epsilon_{i,t}.$$

We include lagged market returns since the real estate stocks are small and likely trade infrequently (see, e.g.,Scholes & Williams (1977) and Dimson (1979)).[20] [21]

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[19]Because the Treasury-bill return has been subtracted to compute excess returns, we do not report correlations with expected inflation. The one month Treasury-bill returns should reflect expected inflation.

[20]We also estimated a version of (6) that included a default-risk premium variable measured as the difference in returns between a junk bond portfolio and the long-term Treasury bond index. This variable's impact was uniformly insignificant. Excluding it had no material impact on any other coefficient.

The results of estimating (6) for our real estate portfolios are reported in Table 5. Note that the previous month's market excess return significantly predicts this month's return for each real estate stock portfolio except the equity REITs. Evidence of significant *monthly* cross-autocorrelations is unusual. More important for our purposes, the rank ordering of the strengths of the different firms' covariances with the market is precisely as anticipated. The general contractors and developers who produce very durable real properties have betas significantly in excess of one. We hypothesized above that the cash flows of owner-operators of structures would be smoother on average than the cash flows of their tenants. Both owner portfolios have market betas signficantly less than one. The appropriate F-statistics allow us to conclude with very high confidence that the contractors' and developers' market betas (both for the current period alone and for the sum of the current period and the lagged betas) are larger than those for the owner-operators and equity REITs. We are not able to reject the null that the developers and contractors have identical market betas. The same is true for the comparision of equity REIT betas with owner-operator betas.[22]

With respect to the absolute levels of the portfolio betas, the contractors' and developers' betas are slightly larger than the consumer durables industry ß of 1.29 and the construction industry ß of 1.20 reported in Breeden, Gibbons, & Litzenberger (1989). Those ß's were estimated with respect to the CRSP value-weighted index. The equity REIT and owner-

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[21]Many attribute the ability of this period's large stock returns to predict next period's small stock returns to the relatively slower assimilation of information into the prices of small stocks that trade less frequently. Others have argued that such lead-lag effects cannot be caused by the levels of nontrading observed in the data (Lo & MacKinlay (1989, 1990)).

[22]The rank ordering of market betas is preserved if the small stock index is used as the market proxy in lieu of the S&P500. Conclusions about statistically significant differences in betas also remain unchanged. Given that the real estate firms tend to be small capitalization issues, the small stock index has greater explanatory power. The R^2's rise by 40%-50% depending upon the real estate portfolio. Lagged small stock index returns are significant at the .05 level only for the general contractors and that coefficient is less than half of its lagged S&P500 coefficient of .38 in Table 5.

operator portfolio's ß's are smaller than any other industry ß reported in Breeden, Gibbons, & Litzenberger (1989). They find that that utilities have a ß=0.75 with the food and tobacco industry having ß=0.76. The long-term leases on real properties apparently do substantially reduce the covariance with the market.

Unfortunately, we are unable to determine how much of the explanatory power of the stock market is due to common factors affecting both the real estate and general business markets versus purely stock market trading-related factors (i.e., program trading of broad market baskets of stocks that include real estate-related firms). That some is due to common factors driving both markets again is suggested by the significant stock market beta for the appreciation rate on existing homes, even though the explained variation is much smaller for this nonsecuritized real estate measure (column 5).

With respect to the other variables, there is no evidence of significant independent influence for changes in the term structure. Increases in unexpected inflation depress excess returns in each real estate portfolio, with the impacts being significant at the .10 level for the general contractors and the equity REITs. However, the adjusted R^2's from equation (6) are only marginally higher than when that equation is estimated without the bond market and inflation variables.[23]

Given the large role we find for the stock market, it is useful to compare our findings to those in a recent study of equity REITs by Chan, Hendershott, & Sanders (1991). They examine the relation between equity REIT returns and the five variables documented by Chen, Roll, & Ross (1986) as proxies for the arbitrage pricing theory factors estimated in Roll & Ross (1980). The comparison is interesting because the key difference between their specification

[23]If equation (5) is estimated with raw bond market returns ($R_{lb,t}$) and unexpected inflation ($V_{ui,t}$), the results, including the stock market betas, are almost identical to those reported in Table 5.

and ours is the use of a stock market variable in lieu of industrial production. First, the inclusion of the stock index results in substantially higher R^2's. Consistent with their results, the statistical significance of the term structure and inflation variables increases when we exclude the stock market variable. Both expected and unexpected inflation variables become statistically significant in such a specification. The R^2 for a regression including only term structure and inflation variables typically is about 0.10. However, as noted in footnote 20, our risk structure variable never has a significant impact on any real estate stock porfolio's returns.[24]

4. Conclusions

The stock market provides a ready and useful source of transactions-based data with which to analyze real estate markets. Important information about changing market fundamentals appears to be incorportated into equity REIT returns before appraisers impound the information into the Russell-NCREIF Property Index. This probably is due to lags in the appraisal process. Lagged equity REIT returns are particularly strong predictors of the Russell-NCREIF series when they occur just prior to the end of the calendar year which is the time of greatest appraisal activity. The stock market also appears to accurately reflect information about the risks and returns faced by different types of real estate firms. The market betas of

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[24]The fact that real estate-related stocks tend to be small capitalization issues may be an important part of the story behind the finding in Chan, Hendershott, & Sanders (1991) and Barker (1990) that REIT returns also are related to changes in the discount on closed-end funds. The discount is defined as the difference between the price of the fund and the net asset value of the underlying securities held by the fund. Relying on the investor sentiment hypothesis of Lee, Shleifer, & Thaler (1991), both papers attribute the relation between REIT returns and discounts on closed-end funds to changes in investor sentiment. Lee, Shleifer, & Thaler (1991) also report that changes in the discount on closed-end funds are significantly related to the behavior of small stock returns. One likely reason for this last finding is the fact that closed-end funds themselves can almost always be classified as small stocks. Therefore, it is not surprising that the behavior of closed-end fund prices relative to their net asset values (which are dominated by larger capitalization stocks) should mimic the behavior of the small stock premium. In fact, Brauer & Chang (1990) document a January seasonal in the time series of discounts for closed-end funds.

firms specializing in construction were significantly higher than those of firms that specialized in owning and operating existing properties. This is what one would expect given that long-term leases make rents a fixed cost over the business cycle for many tenants.