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What Does the Stock Market Tell Us About Real Estate Returns?

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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 examine the relation between real estate stock portfolio returns and 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 after controlling for persistence in the appraisal series. The stock market reflects information about real estate markets that is later imbedded in infrequent 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 rental cash flows from existing buildings. These findings highlight the heterogeneity of securitized real estate-related firms.

Due to infrequent trading of properties and the absence of a centralized exchange for transactions, market-determined prices of commercial real estate are not readily available. This has led researchers to estimate real estate returns and risks. A number of methods have been used. Some of the earliest work employed hedonic techniques to estimate transactions prices for broader sets of properties that are not actually changing hands (e.g., see Hoag 1980; Miles, Cole and Guilkey 1990). In addition to normal misspecification concerns, the samples of transactions often are so small that trait price coefficients generally cannot be allowed to vary through time. There may be added worries about the representativeness of the sales prices. The issue is not whether the prices are accurately recorded, but whether they are typical arms-length transactions. With small samples, even a few extraordinary transactions (e.g., distressed sales) can affect estimated trait prices and the resulting property return index.

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Beginning in the late 1980s, efforts were made to construct synthetic return series by applying cap rate data to rental income series (e.g., see Firstenberg, Ross and Zisler 1988; Wheaton and Torto 1989; Liu, et al. 1990). The property-level income data appear to be reliable so that the quality of these indexes rests on the quality of the cap rate series. Small errors in cap rates, either in the level of or in the timing of a change in the cap rate, can substantially alter return behavior.

Appraisal-based return series such as the Russell-NCREIF Property Index have also been widely studied.[1] These returns are suspect because of their low volatility relative to their significantly positive means. Ross and Zisler (1987a,b) and Geltner (1989b) were the first to detail the weaknesses of these data and to suggest ways to cleanse the returns of alleged appraisal-induced smoothing.

An alternative data source is equity real estate investment trust (REIT) returns.[2] Widely used by financial economists, stock market-based data often are viewed with suspicion in the real estate field. This is because REIT return volatility is materially higher than that for appraisal-based property series and REIT returns tend to be far more correlated with the stock market than with appraisal-based property return series (e.g., see Hartzell and Mengden 1986; Ross and Zisler 1987a,b).

This paper reexamines the returns of real estate stocks because we believe the stock market-based data provide more useful information on the nature of real estate returns than the existing literature suggests. Trading in the stocks of real estate-owning firms represents transactions-based data on the firms' values. Absent a huge upsurge in commercial property sales that would make hedonic indexes more reliable, the stock market is

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

the only other source of such transactions-driven data. Ross and Zisler (1987b, 1991) note that, for a variety of reasons, not all stock price information bears directly on the value of the underlying properties owned by the firms. Nevertheless, our empirical findings provide convincing evidence that real estate stock returns contain much economically important and timely information about changing real estate market fundamentals.

Our first key finding deals with the ability of lagged equity REIT returns to predict current Russell-NCREIF returns. Because appraisals occur infrequently, appraisal-based series incorporate new information about market fundamentals with a lag. We document that the predictive impact of the lagged stock returns is particularly strong when they occur prior to the fourth quarter, which is the period of greatest appraisal activity. Our lagged REIT returns are constructed as compound annual returns so that a lagged end-of-the-year REIT return includes property market information that was known earlier in the year. The strong explanatory power of this particular lagged return almost certainly arises because the relatively high level of fourth quarter appraisal activity also is incorporating into the Russell-NCREIF Property Index much information that was public prior to the fourth quarter. This implies that the stock market signals changes in real estate values prior to the end of the year when large amounts of information are impounded into appraisal-based series such as the Russell-NCREIF Property Index.

The predictive power of the lagged REIT returns remains even after controlling for the well-known serial correlation in the Russell-NCREIF Property Index. We provide evidence that serial correlation at the fourth quarterly lag (i.e., one year out) is intimately related to an appraisal-induced fourth quarter effect. Research attempting to adjust appraisal returns for smoothing needs to control for this influence more precisely in order to obtain a better estimate of the 'true' variance in real property returns.

Our conclusions about the timeliness of the stock data are strengthened by the finding that equity REIT returns are *contemporaneously* correlated with the National Association of Realtors' (NAR) existing home price appreciation rate. The NAR series also is a transactions-based series. If performance in the housing and commercial property markets is partially

driven by common factors, one might expect transactions-based returns from the two sectors to be contemporaneously correlated.[3]

The reliability of stock market-based data is reinforced by analysis of the risk and return characteristics of different types of traded real estate firms. While the equity REITs are owner-operators, others such as residential home builders 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. The data strongly confirm this intuition.

The outline of the paper is as follows. Section two details data sources, reports summary statistics, and documents a significant relation between lagged real estate stock portfolio returns and current returns on the Russell-NCREIF Property Index. The third section 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.

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

Data Description and Summary Statistics

The Russell-NCREIF Property Index is a widely known appraisal-based series. Quarterly total returns are available beginning in the first quarter of 1978 [78(1)]. We use these data through 90(4), which corresponds to the final quarter for which we have stock return information. The *Annual*

[3] We say 'might' here because, even with common factors, one could justify a lack of contemporaneous correlation with an imperfect information story. Sellers of homes and/or office buildings rationally may not adjust prices equivalently in response to exogenous shocks to the economy. The optimal solution to many signal processing problems is to wait until more knowledge is available. If optimal waiting periods are different across markets, no contemporaneous correlation need exist even with high quality transactions data.

Data Supplement to the NCREIF Real Estate Performance Report (1989) provides details about this appraisal index.

The real estate stocks examined in this section are equity REITs. These stocks are investment trusts run by firms that own and operate real properties. Trust status allows escape from the corporate income tax in return for following rules dealing with issues such as income pass-throughs to investors. The National Association of Real Estate Investment Trusts' (NAREIT) *REIT Fact Book* details these provisions. Equity REITs are a subset of standard industry classification (SIC) 6799 which is used to identify them on the monthly return files of the Center for Research in Security Prices (CRSP). Standard and Poor's *Handbook of Real Estate Securities* and various issues of the *REIT Fact Book* and *REIT Source Book* also were employed to guide us in separating the equity REITs from the mortgage and hybrid REITs. Our equity REIT portfolio is composed of all qualifying firms with stock trading on the NYSE and AMEX, including those that were delisted for any reason. The number of stocks in the portfolio ranges from a low of fifteen in 1978 to a high of forty-seven in 1989 and 1990. For comparison with the Russell-NCREIF series, quarterly returns are created by compounding the monthly returns from the CRSP files. All stock returns employed in the paper incorporate both dividends and capital gains.

Another real estate series that we examine is the NAR's monthly existing home price series obtained from The WEFA Group. These data run from January 1966 to December 1990. Prices are based on transactions in a large number of metropolitan statistical areas throughout the United States. This is not a quality-adjusted price series. Note also that this series is based solely on the appreciation rate and does not represent the total return because the implicit rent on owner-occupied housing is not observed. Quarterly appreciation rates are created by compounding the monthly observations.

Data were also collected on equity market movements, interest rate and term structure movements, and inflation. The S&P 500 index and a small stock index capture the broader equity market. The small stock series is based on the returns of the NYSE- and AMEX-listed firms that are among the smallest 20% in market capitlization 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

Table 1

Summary Statistics
(Quarterly Data: 1978(1) 1990(4), n = 52)

Asset Category	Quarterly Percentage Excess Returns (Std. Dev.)	Correlations (Probability of observing larger ρ under null of $\rho = 0$)					
		Russell-NCREIF	S&P500	Small Stocks	Long Bonds	Home Apprec.	Unexpected Inflation
Equity REITs	1.36	.10	.65	.82	.43	.41	−.20
	(8.46)	(.49)	(.00)	(.00)	(.00)	(.00)	(.18)
Russell-NCREIF	.39		−.04	.07	−.35	.16	.07
	(1.40)		(.76)	(.63)	(.01)	(.27)	(.65)
S&P500 Index	1.64			.83	.39	.28	−.08
	(8.26)			(.00)	(.00)	(.04)	(.60)
Small Stock Index	1.94				.23	.48	−.00
	(11.82)				(.10)	(.00)	(.98)
Long Bond Index	0.41					−.02	−.44
	(7.52)					(.88)	(.00)
NAR Home Appreciation	−.85[a]						.36
	(2.80)						(.01)
Inflation	1.49[b]						
	(1.03)						
90-day Treasury Bills	2.24[b]						
	(0.70)						

Notes: [a]While the mean excess existing home appreciation rate is negative, the average quarter total appreciation rate over the 13-year period is 1.39%.
[b]Raw return or inflation rate

Source: refer to text

government bond file, the stock and bond index variables are from Ibbotson and Sinquefield (1989) for the 1962–1987 period. Updates through 1990 are from Ibbotson & Associates. Monthly observations are compounded to produce quarterly returns.

The inflation variables in this section are derived from consumer price index (CPI) data. Expected inflation is based on an ARMA model estimated 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. Consistent with previous research, excess returns on the Russell-NCREIF index exhibit no significant contemporaneous 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 not with inflation shocks.

Equity REIT returns are significantly positively correlated with the housing appreciation index ($\rho = .41$), providing evidence of a contemporaneous linkage between our two transactions-based real estate series. Also, equity REITs display a high correlation with stock market returns, especially the small stocks ($\rho = .82$), a finding that may reflect the fact that equity REITs themselves are small stocks. It is interesting to note, however, that the small stocks are also significantly related to the housing returns ($\rho = .48$). Such strong contemporaneous comovement between the small stocks and residential housing suggests a common factor in their returns. It is also noteworthy that the NAR's appreciation series is significantly positively correlated with unexpected inflation. This is consistent with the early finding by Fama and Schwert (1977) that residential real estate provides a relatively good hedge against unexpected inflation.

Market-Determined Variation in the Russell-NCREIF Property Index

The transactions-based (i.e., REITs and homes) and appraisal-based (i.e., Russell-NCREIF) real estate returns appear to have no relation to each other, but that appearance is misleading. A key reason is that the appraisal process 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 if appraisals are infrequent and do not occur at the same time for all properties tracked in 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, current period Russell-NCREIF index returns (RNC_t) are regressed on current and lagged stock index returns while controlling for the well-known persistence and seasonality of the appraisal index. All regressions in the section use excess returns—total returns from

Table 2

Regression of Russell-NCREIF Returns on Current and Lagged Transactions-Based Return Series (1979(1)–1990(4); n = 48)

Panel 1

(1) $RNC_t = \alpha_0 + \alpha_1 I_{er,t} + \alpha_2 I_{er,t(-1)} + \alpha_3 I_{ss,t} + \alpha_4 I_{ss,t(-1)} + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t$.

Intercept	Equity REIT Return ($I_{er,t}$)	Lagged Equity REIT Return ($I_{er,t(-1)}$)	Small Stock Return ($I_{ss,t}$)	Lagged Small Stock Return ($I_{ss,t(-1)}$)	Adjusted R^2	D–W Statistic	ρ_1
−.0034**	−.0076	.0474**	.0096	−.0057			
(.0016)	(.0304)	(.0180)	(.0238)	(.0137)	.48	1.96	.01

Panel 2

(2) $RNC_t = \alpha_0 + \alpha_1 I_{er,t} + \alpha_2 (I_{er,t} * QTR4) + \alpha_3 I_{er,t(-1)} + \alpha_4 (I_{er,t(-1)} * QTR4) + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t$.

Intercept	Equity REIT Return ($I_{er,t}$)	Equity REIT Return, 4th Qtr. Impact ($I_{er,t} * QTR4$)	Lagged Equity REIT Return ($I_{er,t(-1)}$)	Lagged Equity REIT Return, 4th Qtr. Impact ($I_{er,t(-1)} * QTR4$)	Adjusted R^2	D–W Statistic	ρ_1
−.0025	−.0016	.0293	.0300**	.0385**			
(.0016)	(.0191)	(.0366)	(.0094)	(.0177)	.54	2.06	−.04

Panel 3

(3) $RNC_t = \alpha_0 + \alpha_1(I_{er,t}{*}QTR4) + \alpha_2 I_{er,t(-1)} + \alpha_3(I_{er,t(-1)}{*}QTR4) + \alpha_4 I_{h,t(-1)} + \beta_5 I_{lb,t} + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t$.

Intercept	Equity REIT Return, 4th Qtr. Impact ($I_{er,t}$*$QTR4$)	Lagged Equity REIT Return ($I_{er,t(-1)}$)	Lagged Equity REIT Return, 4th Qtr. Impact ($I_{er,t(-1)}$*$QTR4$)	Lagged Housing App. Index ($I_{h,t(-1)}$)	Long Bond Return ($I_{lb,t}$)	Adjusted R^2	D-W Statistic	ρ_1
.0017 (.0021)	.0623** (.0300)	.0249** (.0092)	.0383** (.0162)	.0836** (.0336)	−.0227 (.0174)	.61	2.11	−.06

Notes: Standard errors in parentheses; **denotes significance at the .05 level or better.
Source: refer to text

which the three-month Treasury bill return has been subtracted. This reduces the persistence, but not the seasonality of the appraisal-based index.

It is important to control for appraisal-induced persistence in the Russell-NCREIF returns because regressing a series with strong persistence on lagged variables may spuriously indicate economically significant explanatory power for the right-hand side variables. Using the work of Ross and Zisler (1987a, 1991) and Geltner (1989b) as guides, experimentation with our longer time series determined the lags of the appraisal data controlled for below in equation (1). The impact of the fourth lag (RNC_{t-4}) always is strong and significant. Controlling for RNC_{t-4} weakens the otherwise strong first-order serial correlation. Longer lags were not found to be important.

With the Russell-NCREIF quarterly series available only since 1978, we use compounded lagged stock returns to preserve valuable degrees of freedom. A lagged return for stock index i ($I_{i,Y(-1)}$) is defined to be the return over the four quarters constituting the calendar year immediately preceding current quarter t. Given Table 1's finding of a strong contemporaneous positive correlation between the returns on the equity REITs (I_{er}) and the small stock index (I_{ss}), we include current and lagged values of both these indexes in order 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.

The top panel of Table 2 reports estimated coefficients from equation (1),

$$RNC_t = \alpha_0 + \alpha_1 I_{er,t} + \alpha_2 I_{er,Y(-1)} + \alpha_3 I_{ss,t} + \alpha_4 I_{ss,Y(-1)} + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t, \quad (1)$$

where α_j and γ_j are coefficients and ε_t is the standard error term.

The findings indicate no independent influence for either the current or lagged small stock index after controlling for equity REIT returns.[4] Contemporaneous REIT returns ($I_{er,t}$) are not significantly correlated with the Russell-NCREIF returns, but the prior calendar year's equity REIT

[4] The results are virtually identical if the excess return on the S&P500 index is used in place of the small stock excess return.

return ($I_{cr,y(-1)}$) is a significant predictor of the current period appraisal return even after controlling for serial correlation in the appraisal series. No additional lags were found to be influential. We believe that the differential predictive ability of the REIT portfolio is due to the fact that those firms own commercial properties similar to those tracked in the Russell-NCREIF Property Index.[5] This predictive relation is evident even though data limitations prevent us from controlling for REIT leverage.

While informative, the specification in (1) does not fully illuminate the timeliness with which the stock market impounds information about real property markets. Seasonality in the Russell-NCREIF returns, apparently induced by the nonuniform distribution of appraisal activity over the calendar year, can be exploited to increase the REITs' predictive power. There typically is increased fourth quarter appraisal activity, possibly for financial-reporting reasons. This implies that a relatively large amount of information available to market participants prior to the fourth quarter is being impounded into the Russell-NCREIF series via end-of-the-year appraisals. It also means that lagged compound returns occurring just prior to the fourth quarter should be especially influential predictors of

[5] It is noteworthy that Geltner (1989b, 1991b) finds no significant correlation with lagged stock returns. Not only do we find a significant influence for lagged equity REIT returns, but if $I_{cr,t}$ and $I_{cr,y(-1)}$ are dropped from (1), both the lagged small stock ($I_{ss,y(-1)}$) and S&P500 ($I_{sp,y(-1)}$) index returns are statistically significant predictors of the Russell-NCREIF returns. There are a number of potential reasons for the different findings. (We appreciate Geltner's help via private correspondence in identifying the differences.) Foremost among the differences is time series length. Our relatively small number of 48 usable observations represents a one-third increase over Geltner's (1989b) sample size and a doubling of his 1991b sample. We also use excess returns while Geltner created real returns deflated by the consumer price index. The specifications are also different in that Geltner used six individual quarterly lags of the stock index returns on the right-hand side of (1) in lieu of our single lagged compound return. (His 1989b work also investigated the correlation with a consumption series, but not with the small stock index.) When we estimated Geltner's lag structure with our longer series, we could not reject the null that the sum of the *beta*s on the current and lagged S&P500 returns was zero. However, we could reject at high confidence levels the same null with respect to current and lagged small stock returns. The sum of the *beta*s for the current and lagged small stock returns was .20. The analogous sum when only current and six lagged equity REIT returns are used on the right-hand side is .21. Giliberto (1990) does report significant correlations between lagged equity REIT residuals and current Russell-NCREIF returns. However, he does not control for any persistence in the appraisal series and he also purged the real estate indexes of all correlation with the stock and bond markets. In the next section, we argue that common factors are likely to influence both corporate and real estate returns. Thus, we are wary of purging the real estate returns of all stock and bond market influences.

the appraisal index. To test this hypothesis, we estimate equation (2) with the equity REIT returns retained from (1), and include interaction terms to control for differential fourth quarter effects (QTR4 is a 0–1 dummy variable for the fourth quarter),

$$RNC_t = \alpha_0 + \alpha_1 I_{cr,t} + \alpha_2 (I_{cr,t} * QTR4) + \alpha_3 I_{cr,y(-1)} + \alpha_4 (I_{cr,y(-1)} * QTR4) + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t. \quad (2)$$

The results are presented in the second panel of Table 2. There still is no significant contemporaneous correlation between REIT stock and appraisal returns. The α_2 coefficient on the current period interaction term ($I_{cr,t}$*$QTR4$) is positive, but is not significantly different from zero. The significantly positive α_3 ($t = 3.20$) indicates that, on average, equity REIT returns over the previous calendar year ($I_{cr,y(-1)}$) do help explain current period Russell-NCREIF returns. Particularly interesting is the α_4 coefficient ($t = 2.17$) on the lagged interaction term that implies lagged returns are even more influential when the predicted return occurs in the fourth quarter. 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 and seasonality in the appraisal process.

These returns do not appear to be the result of spurious correlations with other market-determined variables whose own returns also are correlated with the appraisal returns. Table 1 reported that Russell-NCREIF excess returns have a significantly negative contemporaneous correlation with excess long bond returns ($I_{lb,t}$). Investors may 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. Table 1 does not report correlations with lagged returns, but it is the case that the previous year's housing appreciation rate ($I_{h,y(-1)}$) is significantly positively correlated with the current period Russell-NCREIF return. This correlation may reflect the same forces that lead the previous year's equity REIT returns to forecast the Russell-NCREIF return. Alternatively, the housing appreciation index may proxy for different aspects of 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 (3) which modifies equation (2) by dropping the always insignificant $I_{cr,t}$ term and adding the yield curve (I_{lb}) and lagged housing

($I_{h,y(-1)}$) variables that had significant simple correlations with the appraisal-based return,

$$RNC_t = \alpha_0 + \alpha_1(I_{er,t}{*}QTR4) + \alpha_2 I_{er,y(-1)} + \alpha_3(I_{er,y(-1)}{*}QTR4) + \alpha_4 I_{h,y(-1)} + \alpha_5 I_{lb,t} + \gamma_1 RNC_{t-1} + \gamma_2 RNC_{t-4} + \varepsilon_t. \quad (3)$$

The results are presented in the third panel of Table 2.[6] The size of the coefficient on current REIT portfolio returns realized in the fourth quarter ($I_{er,t}{*}QTR4$) more than doubles from that in the second panel and is now highly significant. The estimated value of .0623 implies that a 10% increase in the contemporaneous fourth quarter equity REIT return about its mean of 1.36% is associated with six-tenths of a basis point increase in the excess Russell-NCREIF index return. The mean excess return in the Russell-NCREIF index over all quarters is .39%. For the thirteen fourth quarters in our sample, the mean Russell-NCREIF excess return is .98%. (The standard deviation is also higher in the fourth quarter.)

Coefficients on the lagged REIT portfolio returns are little changed and remain significant at standard confidence levels. The estimated $\alpha_2 = .0249$ implies that a 10% increase about the mean lagged compounded annual REIT return of 8.58% is associated with a 2-basis-point rise in the Russell-NCREIF index return. Based on the significant estimate of $\alpha_3 = .0383$ on $I_{er,y(-1)}{*}QTR4$, a 10% increase in lagged returns occurring prior to the fourth quarter is associated with an additional 2.5-basis-point rise in the Russell-NCREIF index return. The results in panel 3 of Table 2 also show a significant independent influence for lagged compounded housing appreciation ($I_{h,y(-1)}$). Its relative marginal impact is similar to that for lagged REIT returns. The estimated $\alpha_4 = .0836$ implies that a 10% increase in existing home sales price appreciation is associated with a 2-basis-point rise in the appraisal-based return. Increasingly steep yield curves depress Russell-NCREIF returns, but the estimated coefficient on $I_{lb,t}$ is significant only at the .20 level. Including the housing and bond market variables raises the adjusted R^2 by about 13% to .61. Finally, if a modified version of (3) is estimated that includes only predetermined variables (that is, only lagged and lagged interaction terms on the right-hand side), the adjusted $R^2 = .58$. Controlling for the serial correlation of the Russell-NCREIF index, much of its variation can be

[6] Dropping the $I_{er,t}$ variable does not alter any other coefficient in a material way. Experimentation also showed there not to be differential fourth quarter impacts for the bond market and housing variables.

explained by transactions-based information that is available *prior* to the quarter during which the Russell-NCREIF return is measured.

Beyond REITs: Extracting More Information about Real Estate from the Stock Market

It should not be surprising that stock market and real estate returns are related since common factors probably influence returns in both markets. Zeckhauser and 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. In general, that part of property market risk associated with the health of the economy should result in a positive correlation between property returns and returns on the broader market.

For 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 and 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 limited.[7] 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 properties.

Contrast contractors and developers who only build structures with owner-operators of structures who do no building. One would expect the

[7] 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.

pure builders to have higher stock market betas. Building activity should be strongly positively correlated with corporate cash flows because businesses' demand for added space falls when equity prices drop. Construction activity is a leading indicator with a high amplitude. Purely property owning firms should have lower stock market betas because 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 three portfolios of real estate stocks. Evidence of significant heterogeneity in covariances with the market along the lines just suggested would strengthen our conclusion that the stock market accurately reflects information and about real estate. For comparison purposes with previous research, we also briefly discuss interest rate and inflation impacts on real estate stock returns.

Data

Portfolios of real estate-related stocks trading on the NYSE and the AMEX are constructed 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 three 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.[8] 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

[8] Major contractors for bridges and other infrastructure are not in this group. The government classifies them elsewhere.

examined.[9] Each portfolio includes firms that failed or were delisted for other reasons. A complete list of firms is available upon request.

These three groups do not include all traded real estate-related firms. Many 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. We focus on the three groups 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 provide an appropriate foundation for further examination of whether the stock market accurately reflects information about real estate fundamentals.[10]

Portfolio returns are constructed by combining securities within the same SIC groups. We compute equal- and value-weighted monthly portfolio returns from August 1962 to December 1990. 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 three groups of equal- and value-weighted portfolio returns ranges from .8 to over .9. Unfortunately, market capitalization data are missing for many of our firms over the first

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[9] There are other firms who primarily are owner-operators of properties but are not organized in trust form. They have SIC codes ranging from 6512 6519. Unfortunately, very few traded owner-operators choose to organize without trust status. From 1975 1979, there is only one firm in the sample. Until 1987, the number always is less than ten. While we do not report results for this portfolio because of the very small sample size, it turns out that the returns on this small sample of non-REIT owner-operators behave very much like those on the equity REITs. This gives us added confidence that the special REIT provisions with regard to pass-throughs of accounting income are not masking the true performance of the underlying properties that would occur if they were managed unhindered by trust restrictions.

[10] Knowledge of the differences in return behavior for different types of real estate firms is scarce. Davidson and 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 and Palmer (1978), whose early to mid-1970s sample focused on homebuilders in addition to equity REITs. 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.

Table 3

Minimum and Maximum Number of Stocks in Real Estate Portfolios

Real Estate Stock Portfolio (SIC Codes)	Aug. 1962–Dec. 1974 Minimum (Date)	Aug. 1962–Dec. 1974 Maximum (Date)	Jan. 1975–Dec. 1990 Minimum (Date)	Jan. 1975–Dec. 1990 Maximum (Date)
General Contractors (1521–1542)	2 (12 62)[a]	14 (1 73)	11 (1 76)	26 (5 88)
Subdividers Developers (6552)	16 (2 68)	45 (11 72)	22 (11 90)	38 (1 75)
Equity REITs	3 (8 62)	16 (8 73)	15 (1 76)	47 (8 90)

Notes: [a]Numbers in parentheses are the dates with the month listed first and then the year. This is the first date at which the relevant minimum or maximum occurs.

Source: refer to text

ten to fifteen years of the sample. Consequently, we report results based only on the equal-weighted portfolio returns.

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-1970s, we present results in the text only for the post-1974 time period. Tables providing analogous findings for the full 1962–1990 period and for the 1962–1974 subperiod are available upon request.

Summary Statistics

Summary statistics for the three 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 real estate stock portfolios, with the contractors' returns exceeding even the small stock index return. The general contractor and commercial developer portfolios have coefficients of variation higher than those found for the two broad stock indexes. The simple correlations also reported in Table 4

Table 4
Summary Statistics: Various Asset Categories (January 1975 December 1990; 192 observations)

Asset Category (SIC Code)	Monthly Percentage Excess Return (Std. Dev.)	6552	Equity REITs	Existing Home Appreciation	LTGOV	S&P500	Small Stocks	Unexpected Inflation
General Contractors	1.48	.85	.77	.26	.27	.66	.82	−.23
(1521–1542)	(11.88)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Subdividers/	.85		.85	.27	.20	.63	.89	−.17
Developers (6552)	(9.64)		(.00)	(.00)	(.00)	(.00)	(.00)	(.02)
Equity	.80			.26	0.23	.59	.83	−.24
REITs	(5.17)			(.00)	(.00)	(.00)	(.00)	(.00)
Existing Home	−.12				.01	.26	.30	.03
Appreciation	(1.51)				(.89)	(.00)	(.00)	(.72)
Long-term								
Treasury Bond	.17					.37	.21	−.26
Index (LTGOV)	(3.50)					(.00)	(.00)	(.00)
S&P500 Index	.64						.78	−.19
	(4.64)						(.00)	(.01)
Small Stock	1.10							−.19
Index	(6.65)							(.01)
30-day	.66[a]							
Treasury Bills	(.22)							
Inflation (π)	.50[a]							
	(.34)							

Notes: [a]Raw return or inflation rate
[b]Numbers in parentheses convey probability of observing stronger correlation under H_0: $\rho = 0$.
Source: refer to text

document the substantial comovement of the different real estate-related stock portfolio returns. Note that each real estate stock portfolio's return is also significantly positively correlated with existing home appreciation, albeit less strongly than with securitized real estate.

The returns on the 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 as high as .89 for the developers. Most of the real estate firms are relatively small in terms of market capitalization as Figures 1–3 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

Figure 1

Market Capitalization Values
General Contractors and Builders (1521 1542)

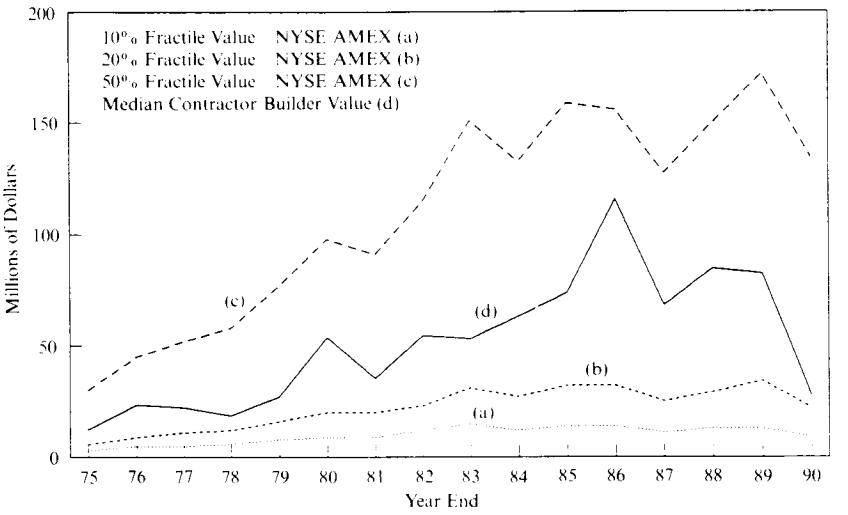


Figure 2

Market Capitalization Values
Developers and Subdividers (6552)

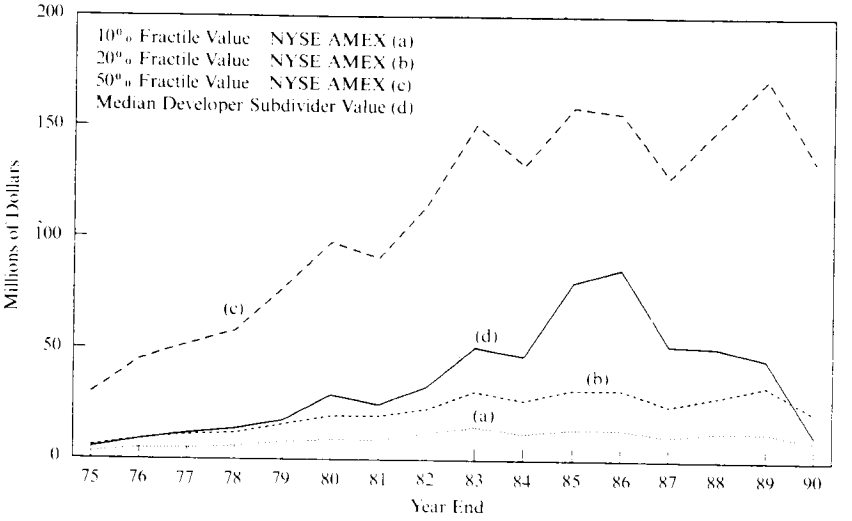
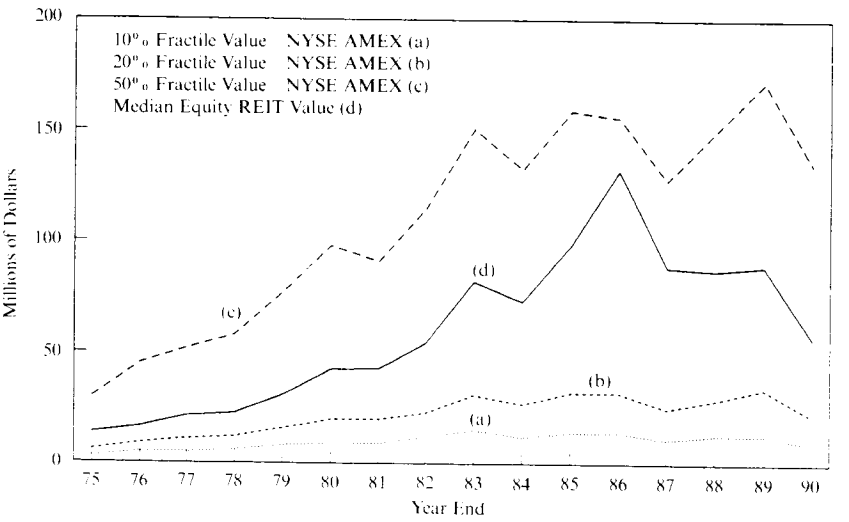


Figure 3

Market Capitalization Values
Equity Reits (6799)



valuation. However, the significantly positive correlation of the other transactions-based (but nonsecuritized) real estate return measure, existing home appreciation, with both the S&P500 index return ($\rho = .26$) and the small stock index return ($\rho = .30$) suggest that common forces influence both real estate and corporate value in qualitatively similar ways.[11]

Table 4 also provides information about the relation of real estate returns with the bond market and inflation. The three real estate stock portfolio returns exhibit significantly positive 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 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.[12]

Return Variability Patterns across Different Real Estate Sectors

To analyze the heterogeneity in real estate return covariances with the market, we estimated the following market equation for each real estate portfolio,

$$I_{i,t} = \beta_0 + \beta_1 I_{sp,t} + \beta_2 I_{sp,t-1} + \delta_{i,t}, \tag{4}$$

where $I_{i,t}$ is the monthly excess return on real estate portfolio i in period t, $I_{sp,t}$ is the monthly excess return on the S&P500 index in period t and $\delta_{i,t}$ is

[11] 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.

[12] 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.

Table 5

Market Model Regressions:

(4) $I_{i,t} = \beta_0 + \beta_1 I_{sp,t} + \beta_2 I_{sp,t-1} + \delta_{i,t}$

	General Contractors			Subdividers/Developers			Equity REITs			Housing Appreciation		
	1975–1990	1975–1982	1983–1990	1975–1990	1975–1982	1983–1990	1975–1990	1975–1982	1983–1990	1975–1990	1975–1982	1983–1990
Intercept (%)	.16	2.08**	−1.75	−.13	1.61**	−1.87**	.33	1.10**	−.45*	−.19	.03	−.43**
	(.65)	(1.02)	(.68)	(.55)	(.90)	(.51)	(.31)	(.51)	(.26)	(.11)	(.15)	(.15)
S&P500 Excess Return ($I_{sp,t}$)	1.68**	2.14**	1.28**	1.29**	1.71**	.94**	.66**	.93**	.43**	.08**	.07**	.09**
	(.14)	(.22)	(.14)	(.12)	(.20)	(.10)	(.07)	(.11)	(.05)	(.02)	(.03)	(.03)
Lagged S&P500 Excess Return ($I_{sp,t-1}$)	.39**	.29	.50**	.24**	.25	.26**	.08	.06	.11**	.03	−.00	.06**
	(.14)	(.22)	(.14)	(.12)	(.20)	(.10)	(.07)	(.11)	(.05)	(.02)	(.03)	(.03)
No. of obs.	192	96	96	192	96	96	192	96	96	192	96	96
Adj. R^2	.45	.49	.50	.40	.44	.48	.35	.41	.41	.07	.03	.11
DW	1.66	1.76	1.81	1.66	2.04	1.20	1.90	2.20	1.67	1.82	1.72	1.97
ρ_1	.05	.03	.09	.07	−.12	.38	.02	−.22	.13	.09	.14	.01

Notes: [a]Standard errors in parentheses

**denotes significance at the .05 level or better; *denotes significance at the .01 level or better

Source: refer to text

the standard error term. Lagged market returns ($I_{sp,t-1}$) are included because the real estate stocks are small and likely trade infrequently (see, e.g., Scholes and Williams 1977; Dimson 1979).[13] The results are presented in Table 5. Note that the specification was estimated over the complete 1975–1990 sample period as well as for two eight-year long subperiods, 1975–1982 and 1983–1990. This was done to determine whether the pattern of decreasing betas over time, reported for equity REITs in Hartzell and Mengden (1987), persists in our longer sample period. We find a similar pattern for both REITs and other real estate stocks. Changing the breakpoint in the data as much as a few years does not alter the pattern of results.

Before examining the heterogeneity in market betas, it is interesting to note that the previous month's market excess return tends to help predict this month's return for the real estate portfolios. The significant influence of the lag arises primarily in the second subperiod. Evidence of significant *monthly* cross-autocorrelations is unusual. We are not precisely sure why this pattern holds for most real estate or why it gained strength in the mid-1980s. One possibility is the addition of more relatively small capitalization stocks in our sample in the 1980s. Such firms are most likely to exhibit non-trading. The mid-1980s did see a marked increase in REIT initial public offerings, many of which were relatively small capitalization issues (see Figure 1 on p. 22 of Nelling, et al. 1992).

More important for the purposes of this paper, the rank ordering of the strengths of the different firms' covariance with the market is precisely as anticipated. For the full sample period, the general contractors and developers who produce very durable real properties have betas significantly in excess of one. The REIT portfolio's market *beta* is significantly less than one. The appropriate *F*-statistics allow us to conclude with very high confidence that the contractors' and developers' market *beta*s (both for the current period alone and for the sum of the current period plus lagged *beta*s) are larger than that for the equity REITs. While the estimated *beta*s for all three portfolios fall over time, the rank ordering of

[13] Many attribute the ability of this period's large stock returns to predict next period's 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 and MacKinlay 1990).

the covariances and conclusions about statistically significant differences between the builder and REIT *beta*s hold for each subperiod.[14]

With respect to the absolute levels of the portfolio *beta*s, the contractors' and developers' *beta*s are at least equal to the consumer durables industry β of 1.29 and the construction industry β of 1.20 estimated with respect to the value-weighted CRSP index in Breeden, Gibbons and Litzenberger (1989). This is true even in the 1983–1990 period if the developers' current and lagged *beta*s are summed. The equity REIT portfolio's β is quite small relative to the other industry β's reported in Breeden, Gibbons and Litzenberger (1989). They find that that utilities have a $\beta = .75$ with the food and tobacco industry having $\beta = .76$. The long-term leases on real properties apparently do substantially reduce the covariance with the market.

The subperiod analysis indicates that Hartzell's and Mengden's (1987) conclusion about the fall in equity REIT covariance with the broader market still holds. The REIT portfolio *beta* in the 1975–1982 period is insignificantly different from 1. The null of $\beta = 1$ can be confidently rejected for the 1983–1990 period (even if current and lagged *beta*s are summed). The number of equity REITs increases substantially over time so that greater diversification is being achieved. Accumulated investor experience with equity REITs and the relative stability of their underlying rental flows also may have played a role in the declining covariance with the market. Moreover, the 1975–82 period immediately follows an interest rate-related downturn in the mortgage REIT market that was so dramatic that it negatively impacted equity REITs, too. Note that covariance with the market has also fallen substantially for the two builder portfolios. Part of the reason may be that the 1983–1990 period does not contain any recession years, which always are times of substantial drops in construction activity. It also may be the case that both the listed homebuilders and commercial developers took deliberate actions to reduce their return variance over the business cycle. There may be increasing ownership of real properties and the rental flows associated with ownership than is

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[14] 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 *beta*s 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 .39 in Table 5.

indicated by the contractor and developer classifications. Other factors not closely related to real estate also may be at work. This possibility is indicated by the fact that the covariance with the S&P500 of our small stock index also falls through time. The sums of the current and lagged market *beta*s if the small stock index is the dependent variable in (4) are 1.42 and 1.14 for the 1975–82 and 1983–90 subperiods, respectively.

We are unable to determine precisely 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 (see the far right-hand side columns of Table 5).

Another interesting pattern in the results of estimating (4) is the significance of the intercept terms, often interpreted as measuring abnormal performance relative to the market. After controlling for covariance with the market, all the real estate stock portfolios earned significantly positive "abnormal" returns in the 1975–82 period, with the general contractors earning an added 2.08% per month. This pattern reverses itself in the 1983–1990 period. Both stock and housing portfolios earn relatively low returns in the 1980s given their comovement with the broader market. Over the entire 1975–1990 period, these patterns counterbalance each other so that there are no statistically significant intercept terms.[15]

Inefficiency explanations aside, the large and significant estimated intercepts over periods as long as eight years intimate that other factors may play a role in determining real estate stock returns. The empirical literature cited in footnote 2 has investigated the influence of various other factors (primarily with respect to REITs). For comparison purposes with the existing literature, we estimated a multifactor model that expanded (4) to include term

[15] This pattern does not hold if current and lagged values of the small stock index are used on the right-hand side of (4) in lieu of the S&P500 index. In that case, there are no significantly positive intercept terms in the 1975–82 period. In the 1983–90 period, only the subdivider-developer and housing appreciation intercept terms still are significantly negative. Even they are smaller in absolute value (i.e., subdivider/developer intercept is −1.11% per month; housing appreciation is −.33% per month).

structure, inflation, and risk premium variables similar to those used in Chan, Hendershott and Sanders (1991) recent study of equity REITs.[16]

The regression results are not presented for space reasons, but we close with a brief discussion of the pattern of findings. First, there is no evidence of any significant influence, independent of the stock market, for changes in the term structure. The same holds for a default-risk premium variable defined as the return difference between a junk bond portfolio and the long-term Treasury index. 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 R^2's from the multifactor model are only marginally higher than those reported in Table 5 for equation (4).

It is noteworthy that some of these findings are at variance with those reported in Chan, Hendershott and Sanders (1991). The key difference between the specifications is our use of a stock market variable in lieu of industrial production. 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. However, the risk structure variable never has a significant impact on any real estate stock portfolio's returns. The R^2 for a regression including only term structure and inflation variables typically is about .10.[17]

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[16] Multifactor specifications were estimated in which the bond market, risk premium, and inflation variables were constructed to be orthogonal to the stock market variables. Others were estimated without being orthogonalized. The findings do not vary across specifications. It is also the case that adding variables not constructed to be othogonal to the stock market still leaves virtually unchanged the estimated stock *beta*s and their standard errors.

[17] Chan, Hendershott and Sanders (1991) and Barker (1990) also find that REIT returns are related to changes in the discount on closed-end funds. Equity REITs being small stocks may be a key part of story behind the result. The discount is defined as the difference between the price of the fund and the net asset value of the fund's underlying securities. Relying on the investor sentiment hypothesis of Lee, Shleifer and Thaler (1991), the papers attribute the relation between REIT returns and discounts on closed-end funds to changes in investor sentiment. Lee, Shleifer and Thaler (1991) report that changes in the discount on closed-end funds are significantly related to small stock returns movements. One likely reason for this 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 and Chag (1990) document a January seasonal in the time series of discounts for closed-end funds.

Conclusions

The stock market provides a ready and useful source of transactions-based data with which to analyze real estate market risk and returns. Important information about changing market fundamentals appears to be incorporated into equity REIT returns before appraisers impound the information into the Russell-NCREIF Property Index. This probably is due to lags and seasonality in the appraisal process. Lagged equity REIT returns are particularly strong predictors of the Russell-NCREIF series' fourth quarter returns. The stock market also appears to accurately reflect information about the risks and returns faced by different types of real estate firms. The market *beta*s of 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.

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