

# **The Benefits of Real Estate Investment**

Georgi Georgiev

Ph.D. Candidate, University of Massachusetts  
CISDM

CISDM Working Paper  
March 1, 2002

Please Address Correspondence to:  
Thomas Schneeweis  
CISDM/School of Management  
University of Massachusetts  
Amherst, Massachusetts 01003

Phone: (413) - 545-5641  
Fax: (413) - 545-3858  
Email: Schneeweis@som.umass.edu

## **The Benefits of Real Estate Investment**

Despite the recent focus on stocks and bonds, real estate remains a significant part of the institutional investment portfolio. This article reviews the existing literature and theory on commercial real estate as an investment vehicle and examines the investment benefits of real estate as a part of a diversified portfolio. The results suggest that direct real estate investment provides diversification benefits, while securitized real estate (REIT) investment does not. The conclusion is twofold: 1) real estate returns are determined by factors different from those driving the returns to other asset classes and hence may produce diversification benefits and 2) REIT investment is an inadequate substitute for direct investment in real estate.

## **I. Introduction**

Real estate investment represents a significant part of many institutional portfolios. Since real estate is not directly traded on a centralized exchange, the physical real estate market is characterized by relative lack of liquidity, large lot size and high transactions costs with properties that are locationally-fixed and heterogeneous. The low transparency of the real estate marketplace also results in potential asymmetric information. The potential existence of asymmetric information also provides a source of relative high risk/adjusted returns to those individuals for who can obtain costless ‘quality’ information. Further, the lack of frequent transaction data for the analysis of return distributions necessitates the use of appraisal-based series.

As for other less liquid investments (e.g., hedge funds, emerging market debt/equity), exchange-traded shares of real-estate investment companies (real estate investment trusts (REITs)) provide investors with a liquid exposure to real estate via standardized financial securities in an organized, efficient and transparent market where frequent transaction-based data is readily available (e.g. Chan et al (1998)). It is important to note, however, that these instruments represent an exchange traded market price for the REITs and not necessarily the actual ‘underlying market value’ of the underlying assets.

The existing literature on and available vehicles for real estate investment are reviewed in Section II. The data, methodology and empirical results are covered in Section III. The results indicate that direct real estate investment offers some diversification benefits, while securitized real estate does not. Investment in shares of real estate investment companies does not substitute for direct real estate investment. Section IV concludes the paper.

## **II. Background**

The focus of the academic research on real estate investment lies in three principal areas: 1) indexing, benchmarking and measurement issues in the real estate market; 2) the risk-return and diversification properties of real estate investment, both internationally and within specific markets and asset allocation issues; and 3) the economic determinants of returns in real estate. Major work in these three areas is reviewed briefly below.

### **Real Estate Benchmarks**

Exposure to the real estate market can be achieved via two principal modes of investment – direct (physical) and indirect (securitized or financial). Direct real estate investment involves the acquisition and management of actual physical properties. Indirect investment involves buying shares of real estate investment companies (e.g. REITs). These shares are then traded on financial exchanges. Ziering and Taylor (1998) provide an overview of major U.S. real estate benchmark indices (see Exhibit 1) with a number of descriptive statistics and analysis of industry trends.

Both direct and indirect investments have significant measurement issues associated with them. The principal benchmark used to measure the performance of direct real estate investment in the U.S. is the National Council of Real Estate Investment Fiduciaries (NCREIF) Index. The NCREIF Index (henceforth NCREIF) is a quarterly benchmark segregated by market sector and geographical region comprised of appraisal-based valuations of a sample of commercial properties owned by large U.S. institutions. Due to the methodology used in constructing the NCREIF, returns calculated solely on percentage changes in the index suffer from a number of deficiencies.

## Exhibit 1

U.S. Real Estate Benchmarks (Ziering and Taylor (1998))

Name	Type	Since	Frequency
S&P Real Estate	REITs	1997	Daily
NAREITs	REITs	1979	Monthly
Morgan Stanley REITs Index	REITs	1996	Real Time
Wilshire Real Estate Securities	REITs and Non-REITs	1978	Monthly
PSI Small-Cap	REITs	1980	Daily
PSI Mid-Cap	REITs	1980	Daily
CBOE REITs Index	REITs	1996	Real Time
NCREIF Property Index	Individual Properties	1978	Quarterly

First, the relative illiquidity of the physical real estate market necessitates that the index is based on appraisals rather than market transaction data. Since many of the properties included in the index are appraised on an annual basis but reported quarterly, there is an artificially induced seasonality in the return series. Second, the appraisal process due its nature is not entirely objective, which produces uncertainty as to the true value of properties. Third, appraisers face a limited information set which they update at every subsequent appraisal. This process is said to induce an autoregressive or exponential smoothing effect, which in turn “dampens” the measured volatility of real estate returns. Volatility may be reduced also by the fact that appraisals may lag and thus understate turning points in the market values of properties (see e.g. Geltner, 1997 and Lizieri and Ward, 2000).

The above problems associated with appraisal-based indices of real estate are well recognized and researchers have come up with a number of approaches designed to remedy them. Isakson (1998) presents a multiple regression technique for testing the quality of real estate appraisals. A number of authors have proposed techniques to recover real returns and volatility from NCREIF data. Geltner and Goetzmann (1999) use repeated-measures regression (RMR) to produce a version of the NCREIF index purged of stale appraisal and seasonality problems. Gatzlaff and Geltner (1998) develop a repeated-sales regression (RSR) index of real estate return based on actual property transaction data from the state of Florida. Somewhat surprisingly, the transaction-based index’s volatility does not differ significantly from the “dampened” volatility of the NCREIF index. In addition, the study finds no major difference between price movements in institutional quality real estate and a broader sample of commercial properties in Florida. Fisher and Geltner (2000) describe a new approach which incorporates both RMR and transaction data but also goes a step further by stipulating a model for appraiser behavior and attempts to reverse engineer the appraisal process in order to recover actual market values. Geltner (2000) and Geltner and Ling (2001) summarize the issues in measuring direct

real estate investment returns and provide criteria which good investment and research benchmarks should meet (see Exhibit 2).

The above-discussed problems with physical real estate benchmarks suggest using data from financial (securitized) real estate for which low frequency and subjectivity are not an issue as market data is readily available. The National Association of Real Estate Investment Trusts (NAREIT) provides indices of exchange-traded real estate securities, which can be used in analyses. There are three subcategories of REITs: equity, mortgage and hybrid<sup>1</sup>. Unfortunately, research has shown that financial real estate is an inadequate representation of the underlying physical market (Moss, 1997). Returns on REITs are nearly uncorrelated with returns in the direct market. REIT returns are more closely related to equity markets than real estate markets. Lizieri and Ward (2000) report typical contemporaneous correlation coefficients in the 0.65-0.80 range. This is evidence of the presence of a significant equity component of financial real estate returns. A number of researcher have used so called “hedged” indices, described in the next section, (e.g. Giliberto (1993), Liang and Webb (1996) and Stevenson (2000)) in an attempt to recover the underlying real estate return distributions by purging REIT returns of their equity component.

### **Real Estate Risk-Return and Diversification Properties**

The properties of real estate return distributions are of importance for the portfolio manager as they provide key inputs into the assets allocation process. Lizieri and Ward (2000) review the literature on return distributions and return generating processes of physical and financial real estate investment in the U.S. and the UK. Much of the existing research has focused on testing for normality in real estate returns. Generally, normality is rejected in terms of skewness and kurtosis both domestically and internationally for both the direct market (e.g. Young and Graff (1995), Miles and McCue (1984), Hartzell (1986)) and the indirect market (Lizieri and Satchell (1997), Sieler, Webb and Myer (1999), Mei and Hu (2000)). Further, the direct market exhibits a high degree of autocorrelation, while the indirect market does not. This can be explained partly by the appraisal-based construction and smoothing of direct market benchmarks and the equity-like nature of much of the indirect market. Lizieri and Ward (2000) argue that much of the non-linearity and autocorrelation of direct market returns remain even after corrective procedures. They suggest that a better explanation can be found in the fact that many return observations are close to zero as a result of the illiquid market and slow arrival of information.

A body of research has focused on non-linearity in real estate returns. Maitland-Smith and Brooks (1999) use a threshold autoregressive (TAR) method to identify two different regimes in direct real estate returns conditioned on real interest rates. Then they perform tests on fitting a mixture of normal distributions to the data. Results indicate that normality is not as easily rejected within each regime. Lizieri et. al. (1998) also employ TAR to conclude that a regime-switching models is superior to a linear model as a representation of indirect market returns in the U.S. and the U.K. The results show that in lower interest environments indirect real estate returns follow a mean reverting process around a positive trend while they oscillate randomly around a falling trend when rates are high. Lizieri and Ward (2000) find that out of a number of alternatives – extreme value, error function, logistic and Student’s t – the logistic distribution provides the best fit to U.K. securitized real estate returns.

---

<sup>1</sup> *Equity REITs* hold portfolios with more than 75% invested in equity positions in real estate, which they manage. Shareholders receive rental income and capitals gains when properties are sold. *Mortgage REITs* hold portfolios with more than 75% invested in mortgages. They lend money to developers and collect on the loans. Investors receive interest income and capital appreciation on the loans. *Hybrid REITs* combine both investment strategies (Francis and Ibbotson, 2001).

## Exhibit 2

### Six Fundamental Criteria for the Ideal Benchmark Index (Geltner and Ling (2001))

Measurability	The benchmark's return can be calculated over the time span of the investment contract
Client Investability	The investor (principal) can invest directly in the benchmark index as an alternative to hiring the investment manager
No Forced Bet by Agent	The investment manager will never be forced to place a bet against the benchmark index
Appropriateness	The benchmark should reflect the investment style or specialization of the manager
Non-Manipulatability	The manager should not be able to influence the performance of the benchmark to any significant degree
Agreement in Advance	The benchmark should be mutually agreed upon by the investor and the manager at the outset of the investment contract

### Four Fundamental Criteria for the Ideal Research Index (Geltner and Ling (2001))

Optimality and Efficiency	Based on data sources and index construction methodologies that reflect the best practice state-of-the-art for academic and industry statistical research
Objectivity	Compiled in an unbiased, neutral manner not susceptible to manipulation by any interested party
Transparency	Compiled in an open manner subject to public and academic scrutiny and criticism
Accessibility	Widely accessible to industry and academic researchers at reasonable cost

The diversification benefits of real estate are considered in Kallberg and Liu (1996). Using a mean-variance efficient framework, the study suggests that a 9% allocation to real estate is optimal in a portfolio including stocks, bonds and cash. Grauer and Hakansson (1995) find strong gains from adding real estate to a dynamically managed portfolio of stock and bonds. Chandrashekar (1999) explores the time-series behavior of U.S. REIT returns and uses conditioning on lagged returns to devise a dynamic asset allocation strategy including REITs, which yields significant diversification benefits.

### Economic Determinant of Real Estate Returns

The evidence in support of interest-rate-based<sup>2</sup> regime-switching models above is a demonstration of how real estate returns are a function of fundamental economic variables. Case, Goetzmann and Rouwenhorst (2000) explore returns in global property markets, their intergration and

<sup>2</sup> Interest rates directly or indirectly affect a multitude of factors associated with the demand and supply for real estate, such as business financing costs, employment levels, savings habits and the demand/supply for mortgage financing.

their relation fundamental economic variables. A substantial amount of the correlation across world real estate markets is attributed to changes in GNP. Thus real estate is a bet on internationally correlated fundamental economic variables.

Like many economic fundamentals, real estate markets follow cycles. Pyhrr, Roulac and Born (1999) review the literature on real estate cycles and emphasize the importance of incorporating cycle forecasting into assets allocation models for real estate. The authors differentiate between two general categories of cycles – macroeconomic and microeconomic. Macroeconomic cycles occur at the regional, national and international levels. These include the general business cycle, inflation and currency cycles, technological cycles and demographic and employment cycles. Microeconomic cycles work on a metropolitan area, location and property levels. Demand and supply cycles can be either macro-or micro-level, depending on the focus. Other microeconomic cycles are urban and neighborhood cycles, physical life cycles, rent rate and occupancy cycles. For any investment horizon, many different cycles interact in complex ways to affect the returns on real estate investment. From an asset allocation point of view, good cycle forecasting should result in improved dynamic strategies that reallocate between different assets depending on the expected stage of their respective cycles. Forecasting models accounting for these complex relationships need to be further developed.

Ling and Naranjo (1997, 1998) analyze economic risk factors priced in real estate markets. They identify growth in consumption, real interest rates, the term structure of interest rates and unexpected inflation as systematic determinants of real estate returns. Since the same state variables are priced in other assets classes, these relationships have important implications for asset allocation. The codependency of equity and real estate markets has been examined in the literature. Quan and Titman (1999) find that the contemporaneous correlation between physical real estate property price changes and stock market returns in all of the 17 countries in their samples, except Japan, is not statistically significant. However, at longer measurement intervals the relationship is apparent. Okunev, Wilson and Zurbruegg (2000) run causality tests on the relationship between U.S. real estate and the S&P 500 index from 1972 to 1998. The results reveal a unidirectional causality from stock market to the real estate market and the presence of structural breaks.

A distinct body of research has focused on the return attribution of REIT investment. As financial securities, REITs follow a different return generating process than the underlying market. Karolyi and Sanders (1998) find that both a stock and a bond returns premium are priced in the return to REITs, whose predictability is similar to that of stocks. Using standard multifactor models, the authors establish that there is a significant idiosyncratic component in REIT returns, which is not captured by the models. Clayton and MacKinnon (2000, 2001) develop a method of decomposing equity REIT returns into stock market, bond market, real estate and idiosyncratic components. The analysis reveals a shift over the period 1978 to 1998 in the major factors associated with REIT returns from large stocks to small stocks and the real estate property market. There is also an increase in the importance of the idiosyncratic component specific only to REIT securities.

The value of physical real estate, similarly to other real assets such as commodities, maybe positively related to the rate of inflation to the degree that the underlying materials used in construction are linked with the rate of inflation. However, it is important to realize that to the degree that inflation has negative impacts on general economic factors then periods of increased inflation may have an overall negative impact on the value of real estate. Similarly, certain financial assets like stocks and bonds are adversely affected by inflationary pressure, particularly when it is unexpected.

The inflation-hedging capabilities of real estate investment have been examined in literature with mixed results. Bond and Seiler (1998) find that U. S. residential real estate can provide a significant inflation hedge using an added variables regression over the period of 1969-1994.

Hoesli et al (1997) find that U.K. real estate provides a better short-term inflation hedge than bonds but worse than stocks. Stevenson and Murray (1999) do not find evidence that Irish real estate provides a significant inflation hedge. However, causality tests indicate that real estate leads inflation.

Liu et al (1997) find that real estate provides a worse hedge than stocks in some countries and comparable in others. Analyzing U.S. REITs specifically, Chatrath and Liang (1998) find some long-run but no short-run inflation hedging ability.

Finally, real estate values are affected by idiosyncratic variables such as location. As mentioned above, real estate cycles operate at the submarket and location levels as well. Eichholtz and Geltner (1997) investigate the location value of properties in the Netherlands over four centuries. They find little evidence that a central location yields excess returns in the long run. Eichholtz et al (1998) and Eichholtz et al (1999) identify strong continental factors in real estate returns in Europe and North America. The implication is that true international real estate diversification can only be achieved by investing intercontinentally. Also, near optimal diversification can be achieved by targeting one country from each continent.

### III. Data, Methodology, and Empirical Results

#### Methodology and Data

Quarterly returns are derived for a series of stock (S&P 500), bond (Lehman Aggregate Bond), commodity (GSCI), hedge fund (EACM 100), and real estate (NCREIF and NAREIT) indices as well as inflation (U.S. CPI) and a risk-free rate (U.S. Treasury 30-Day Bill) for the time period from 1990 through 2001. Stock, bond, commodity, NAREIT and inflation indices are obtained from Ibbotson Associates. The EACM 100 index returns are obtained from Evaluation Associates Capital Markets. NCREIF Index data were provided by the National Council of Real Estate Investment Fiduciaries.

In addition, three data series were constructed from original data – a proxy for unexpected inflation, a “hedged” REIT return series and an “unsmoothed” NCREIF series. To construct the proxy for unexpected inflation, expected inflation estimates were computed for each quarter in the sample. The estimates were derived from repeated regressions of quarterly percentage changes in the U.S. CPI on lagged changes in the CPI over a rolling window of twelve quarters. The estimates were then subtracted from the actual inflation values for every quarter. The resulting residual series was used to proxy for unexpected inflation. The purpose of constructing the “hedged” REIT return series is to purge the actual REIT returns of their equity return component. This is meaningful only for Equity REITs, since Mortgage and Hybrid REITs have different characteristics. However, it was done also on the overall index level, since Equity REITs represent close to 95 percent of the composition of the index. Following Giliberto (1993), REIT returns were regressed on returns to the S&P 500 index.

$$r_t^{REIT} = \alpha + \beta r_t^{S\&P500} + \varepsilon_t$$

The “hedged” series were then constructed as

$$r_t^{HEDGED} = r_t^{REIT} - \beta r_t^{S\&P500}$$

The approach described in Stevenson (2000) was employed in unsmoothing the NCREIF return series. The method assumes that real estate returns follow a first-order autoregressive process of the form:

$$r_t^{NCREIF} = \alpha + \beta r_{t-1}^{NCREIF}$$

The underlying unsmoothed returns can then be extracted from the raw series via the following filter:

$$r_t^U = \frac{r_t^{NCREIF}}{1 - \beta} - \frac{\beta}{1 - \beta} r_{t-1}^{NCREIF}$$

## Empirical Results

The performance of real estate indices was analyzed both when those were considered as a stand-alone investment and as a part of a diversified portfolio of assets. Exhibit 3 contains various performance statistics for the two major real estate indices (NAREIT – raw and “hedged” and NCREIF – raw and unsmoothed) and stock, bond, hedge fund and commodity indices, both individually and in portfolio combinations (the raw NAREIT and the unsmoothed NCREIF only). Real estate indices underperform on a risk-adjusted basis (Sharpe ratio) stock, bonds and hedge funds both before and after the respective corrections for an equity component and smoothing. The raw real estate indices outperform commodities on a risk-adjusted basis but the corrected indices do not.

The performance properties of direct and securitized real estate investment differ significantly. While REITs exhibit a relatively high return (10.1%) and high standard deviation (14.3%), appraisal-based real estate returns are low (6.4%) with low volatility (3.7%). The extremely low standard deviation of NCREIF returns is indicative of the volatility dampening problems associated with smoothing and lagging due to stale valuations. After the correction for smoothing in the NCREIF, its volatility rises, as expected, almost two and a half times to 8.9 percent but is still far from the level of NAREIT volatility. The average return on the other hand drops to 5.8 percent. The correlation between the two indices is a negative 0.08. These large discrepancies support the existing evidence that securitized real estate investment is a poor substitute for direct investment.

The higher return and higher volatility of the NAREIT index can be attributed the existence of an equity component of REITs. The “hedged” index eliminates at least part of that component – the part associated with large-cap equities since NAREIT is “hedged” with respect to the S&P 500. The volatility of the “hedged” index, however, remains high at 13.1 percent. This suggests the presence of a residual equity component which could be related to small-cap stocks or simply unique to REITs or both. Even though the correction is far from perfect, it does results in a much more realistic representation of the underlying real estate market as the correlation between NAREIT and the unsmoothed NCREIF rises to 0.21.

When added (with a weight of 20 percent) to a portfolio of stocks and bonds, REITs do not seem to enhance performance. The Sharpe ratio remains flat at 0.67 between Portfolios I and III. The reason for this is the high volatility of REIT returns coupled with their high correlation with S&P 500 returns (0.39). The high correlation with the S&P 500 is an exhibition of the presence of an equity component in REIT returns. Similar results are observed when addition of REITs to a more diversified portfolio of stocks, bonds, hedge funds, and commodities is considered. The Sharpe ratio falls from 0.84 to 0.70 in this case (Portfolios II and IV). Thus, REITs seem to be an inadequate diversifier for stocks, bonds, hedge funds and commodities.

Direct commodity investment, on the other hand, has some diversification benefits. Adding the unsmoothed NCREIF (20 percent) to a portfolio of stocks and bonds helps raise the Sharpe ratio of the portfolio from 0.67 to 0.70. This is expected, given the small negative correlation of unsmoothed NCREIF returns with the S&P 500 returns (–0.03) and their negative correlation with the Lehman Aggregate Bond returns (–0.24). When added to the portfolio including hedge funds and commodities, direct real estate reduces risk-adjusted performance from 0.84 to 0.79. This may indicate that real estate is an ex-post redundant asset in the presence of hedge funds and commodities.

## Exhibit 3

### Performance 1990 - 2001

	NAREIT	NAREIT Hedged	NCREIF	NCREIF Unsmoothed	EACM 100	S&P 500	Lehman Aggr. Bond	GSCI
Annualized Return	10.1%	4.9%	6.4%	5.8%	13.8%	12.9%	8.1%	3.4%
Annualized StDev	14.3%	13.1%	3.7%	8.9%	5.1%	15.1%	4.8%	23.2%
Sharpe Ratio	0.33	-0.04	0.26	0.05	1.65	0.50	0.56	-0.09
Minimum Quarterly Return	-14.2%	-12.0%	-5.3%	-17.1%	-5.2%	-14.7%	-3.1%	-17.7%
Correlation with NAREIT	1.00	0.92	-0.08	0.18	0.32	0.40	0.22	-0.08
Correlation with NCREIF	-0.08	-0.09	-	0.71	-0.28	-0.01	-0.16	0.06
Correlation with NAREIT - Hedged	0.92	1.00	-0.09	0.21	0.13	0.00	0.23	0.06
Correlation with NCREIF - Unsmoothed	0.18	0.21	0.71	1.00	-0.14	-0.03	-0.24	0.13
	Portfolio I S&P 500 & Lehman Bond	Portfolio II S&P 500, Lehman Bond, EACM100, & GSCI		Portfolio III S&P 500, Lehman Bond & NAREIT	Portfolio IV S&P 500, Lehman Bond, EACM100, GSCI, & NAREIT		Portfolio V S&P 500, Lehman Bond, & NCREIF Unsmoothed	Portfolio VI S&P 500, Lehman Bond, EACM100, GSCI, & NCREIF Unsmoothed
Annualized Return	10.8%	10.6%		10.8%	9.9%		9.9%	10.3%
Annualized StDev	8.0%	6.2%		8.1%	6.4%		6.4%	6.2%
Sharpe Ratio	0.67	0.84		0.67	0.70		0.70	0.79
Minimum Monthly Return	-6.6%	-5.0%		-8.1%	-5.4%		-5.4%	-4.5%
Correlation with NAREIT	0.44	0.45		0.71	0.49		0.49	0.48
Correlation with NCREIF	-0.05	-0.06		-0.07	0.14		0.14	0.05
Correlation with NAREIT - Hedged	0.07	0.11		0.38	0.13		0.13	0.12
Correlation with NCREIF - Unsmoothed	-0.10	-0.07		-0.02	0.18		0.18	0.06

Note:

Portfolio I: 50% S&P 500 and 50% Lehman Aggregate Bond  
 Portfolio II: 40% S&P 500, 40% Lehman Aggregate Bond, 10% EACM 100 and 10% GSCI  
 Portfolio III: 40% S&P 500, 40% Lehman Aggregate Bond and 20% NAREIT  
 Portfolio IV: 40% S&P 500, 40% Lehman Aggregate Bond, 5% EACM 100, 5% GSCI and 10% NAREIT  
 Portfolio V: 40% S&P 500, 40% Lehman Aggregate Bond, and 20% NCREIF Unsmoothed  
 Portfolio VI: 40% S&P 500, 40% Lehman Aggregate Bond, 5% EACM 100, 5% GSCI and 10% NCREIF Unsmoothed

Exhibit 4 shows the performance statistics for the NCREIF and NAREIT indices and their component subindices. Returns on direct real estate investment overall are low, both in absolute (6.4 percent) and in relative terms (Sharpe ratio is 0.26). The five sectors of the business real estate market, however, perform differently. The Office and Retail sectors are the ones driving down the return on the overall index with mean returns and Sharpe ratios of 5.4 percent and 0.00 and 5.2 percent and 0.04, respectively. The Apartment and Hotel sectors, on the other hand, yield mean returns and Sharpe ratios of 9.2 percent and 1.45 and 10.2 percent and 0.75, respectively.

The unsmoothed version of the NCREIF indices yields reduced risk-adjusted performance. The reason is the de-dampening of volatility which decreases the Sharpe ratios as the mean returns remain relatively unaffected. The unsmoothed NCREIF gives similar comparative results across the real estate market sectors with the Apartment (0.50) and Hotel (0.41) sectors still showing risk-adjusted performance far superior to the Office (-0.01), Retail (-0.08) and Industrial (0.09) sectors. This suggests that targeting those particular sectors of the commercial real estate market over the last decade would have yielded better results than simply diversifying across all sectors.

Exhibit 5 shows the correlation matrix of total returns for the four geographical (unsmoothed) NCREIF indices and the combined index. The correlations are high across all pairs of geographical subindices. This suggests that successful geographical diversification should look at finer subdivisions such as metropolitan areas or cities.

## Exhibit 4

### Performance of Real Estate Indices (1990 -2001)

	Return	St. Dev	Sharpe Ratio	Minimum Quarterly Return
NCREIF Index	6.4%	3.7%	0.26	-5.3%
NCREIF Apartment	9.2%	2.6%	1.45	-2.8%
NCREIF Office	5.4%	5.6%	0.00	-8.6%
NCREIF Retail	5.2%	19.5%	-0.01	-20.0%
NCREIF Industrial	7.5%	3.9%	0.55	-3.8%
NCREIF Hotel	10.2%	6.4%	0.75	-4.2%
NCREIF Index - Unsmoothed	5.8%	8.9%	0.05	-17.1%
NCREIF Apartment - Unsmoothed	8.7%	6.7%	0.50	-11.4%
NCREIF Office - Unsmoothed	5.2%	11.6%	-0.01	-20.6%
NCREIF Retail - Unsmoothed	5.0%	4.6%	-0.08	-8.2%
NCREIF Industrial - Unsmoothed	6.5%	12.3%	0.09	-17.3%
NCREIF Hotel - Unsmoothed	9.6%	10.3%	0.41	-10.0%
NAREIT Index	10.1%	14.3%	0.33	-14.2%
NAREIT Equity	10.9%	14.4%	0.38	-14.6%
NAREIT Mortgage	7.4%	23.0%	0.09	-31.9%
NAREIT Hybrid	5.2%	19.5%	-0.01	-20.0%
NAREIT Index - Hedged	4.9%	13.1%	-0.04	-12.0%
NAREIT Equity - Hedged	5.7%	13.3%	0.02	-10.9%

Exhibit 4 also shows that Equity REITs (and hence the NAREIT Index) by far outperform Mortgage and Hybrid REITs. However, this performance is largely attributable to the equity component of returns. This is evident in the fact that the “hedged” version of the indices produces much lower Sharpe ratio (0.02 Equity REIT and -0.04 overall) than the raw version (0.38 Equity REIT and 0.33 overall). On a risk-adjusted basis, Equity REITs underperform direct investment in the Apartment and Hotel sectors, while Mortgage and Hybrid REITs underperform direct investment in all sectors.

Exhibit 6 contains correlation values for real estate indices and a number of other assets classes as well as inflation. It is easy to trace to diversification benefits of direct real estate investment to its low or negative correlation with other asset classes. For example, the unsmoothed version of the index is negatively correlated with the S&P 500 (-0.03), the Lehman Bond (-0.24) and the EACM 100 (-0.14). It is positively (but weakly) correlated only with the GSCI.

As discussed above, it has been pointed out in the literature that real estate and commodities, due to their nature are expected to appreciate in inflationary times and therefore serve as a natural inflation hedge. The last two columns of Exhibit 3 present some evidence in support of this claim. While real estate returns seem to be unrelated to inflation in general (except for the Apartment and Hotel sectors, which are negatively related), they are positively related (except the Apartment and Hotel sectors) to unexpected inflation with correlations up to 32 percent (Retail).

## Exhibit 5

NCREIF Unsmoothed (1990-2001)					
	<i>Index</i>	<i>East</i>	<i>Midwest</i>	<i>South</i>	<i>West</i>
<i>Index</i>	1.00				
<i>East</i>	0.96	1.00			
<i>Midwest</i>	0.92	0.91	1.00		
<i>South</i>	0.92	0.87	0.87	1.00	
<i>West</i>	0.92	0.81	0.76	0.78	1.00

The Apartment and Hotel sectors' superior performance may be partially explained by their apparent lack of correlation to inflation since the sample period was characterized by low inflation rates. In addition, to the degree that inflation results in a decreasing business cycle environment, apartment and hotel sectors would be negatively correlated with inflation. Thus, the Office, Retail and Industrial sectors, whose returns seem to include an inflation component, have been at a relative disadvantage over the 1990's. Overall, direct real estate investment may be able to provide an inflation hedge to some degree, although not as well as commodities (GSCI correlation with unexpected inflation is 0.47).

In contrast, securitized real estate does not. The NAREIT indices are negatively related to both actual and unexpected inflation. This behavior is typical of other financial assets (equities, bonds and hedge funds), with which REITs are positively related. Once the large stock component is removed from Equity REIT returns, the negative relationship with inflation weakens significantly.

## Exhibit 6

Factor Correlations (1990 - 2001)						
	S&P 500	Lehman Bond	EACM 100	GSCI	Inflation	Unexpected Inflation
NCREIF Index	-0.01	-0.16	-0.28	0.06	-0.07	0.29
NCREIF Apartment	-0.08	-0.25	-0.31	0.05	-0.19	0.20
NCREIF Office	0.00	-0.13	-0.24	0.11	-0.05	0.28
NCREIF Retail	0.18	0.22	0.11	-0.18	-0.04	-0.08
NCREIF Industrial	0.03	-0.09	-0.31	0.09	-0.10	0.28
NCREIF Hotel	0.21	0.01	-0.01	0.03	-0.10	0.09
NCREIF Index - Unsmoothed	-0.03	-0.24	-0.14	0.13	0.10	0.24
NCREIF Apartment - Unsmoothed	-0.12	-0.25	-0.16	0.11	-0.22	-0.02
NCREIF Office - Unsmoothed	-0.03	-0.21	-0.14	0.18	0.10	0.25
NCREIF Retail - Unsmoothed	-0.01	-0.22	-0.15	-0.06	0.15	0.32
NCREIF Industrial - Unsmoothed	0.02	-0.22	-0.14	0.16	0.06	0.16
NCREIF Hotel - Unsmoothed	0.11	-0.03	-0.07	0.02	-0.12	0.04
NAREIT Index	0.40	0.22	0.32	-0.08	-0.13	-0.15
NAREIT Equity	0.39	0.22	0.32	-0.08	-0.12	-0.14
NAREIT Mortgage	0.24	0.25	0.19	-0.14	-0.03	-0.08
NAREIT Hybrid	0.18	0.22	0.11	-0.18	-0.04	-0.08
NAREIT Index - Hedged	0.00	0.23	0.13	0.06	0.00	-0.02
NAREIT Equity - Hedged	0.00	0.23	0.13	0.06	0.01	-0.02
S&P 500	1.00	0.02	0.51	-0.35	-0.32	-0.33
Lehman Gov./Corp. Bond	0.02	1.00	-0.02	-0.14	-0.15	-0.22
EACM 100	0.51	-0.02	1.00	0.14	0.13	-0.06
GSCI	-0.35	-0.14	0.14	1.00	0.47	0.47

#### **IV. Conclusion**

This paper has examined the risk-return and diversification properties of real estate investment. The analysis indicates that direct real estate investment may provide some diversification benefits to stocks and bonds. These benefits disappear, however, once other asset classes such as hedge funds and commodities are added to the portfolio. Further, the direct real estate market is not homogeneous. The Apartment and Hotel sectors outperform the rest.

Real estate investment trusts were shown to be poor substitutes to direct investment in real estate. Their returns seem to incorporate a significant equity market component. REITs are not suitable diversifiers for stock and bond portfolios.

## **Bibliography**

- Bond, M. and Michael Seiler, "Real Estate Returns and Inflation: An Added Variables Approach", *Journal Of Real Estate Research*, Vol. 15, No. 3, 1998.
- Case, B., W. Goetzmann and K. G. Rouwenhorst, "Global Real Estate Markets – Cycles and Fundamentals", Working Paper, NBER, 2000.
- Chan, S. H., W. K. Leung and K. Wang, "Institutional Investment in REITs: Evidence and Implications", *Journal of Real Estate Research*, Vol. 16, No.3, 1998.
- Chandrashekar, V., "Time-Series Properties and Diversification Benefits of REIT Returns", *Journal of Real Estate Research*, Vol. 17, 1999.
- Chatrath, A. and Y. Liang, "REITs and Inflation: A Long-Run Perspective", *Journal of Real Estate Research*, Vol. 16, No. 3, 1998.
- Clayton, J. and G. MacKinnon, "What Drives Equity REIT Returns? The Relative Influences of Bond, Stock and Real Estate Factors", Working Paper, 2000.
- Clayton, J. and G. MacKinnon, "The Time-Varying Nature of the Link between REIT, Real Estate and Financial Asset Returns", *Journal of Real Estate Portfolio Management*, 2001.
- Chinloy, P. T., "Real Estate Cycles: Theory and Empirical Evidence", *Journal of Housing Research*, Vol. 7, No. 2, 1996.
- Eichholtz, P. and D. Geltner, "Four Centuries of Location Value: Implication for Real Estate Capital Gain in Central Places", Working Paper, 1997.
- Eichholtz, P., R. Huisman, K. Koedijk and L. Schuin, "Continental Factors in International Real Estate Returns", Working Paper, 1998.
- Eichholtz, P., R. Mahieu and P. Schotman, "Real Estate Diversification: By Country or by Continent?", Working Paper, 1999.
- Fisher, J. F. and D. Geltner, "De-Lagging the NCREIF Index: Transaction Prices and Reverse Engineering", *Real Estate Finance*, Spring 2000.
- Francis, J. and R. Ibbotson, "Empirical Risk-Return Analysis of Real Estate Investments in the U.S., 1972-1999", *Journal of Alternative Investments*, Summer 2001.
- Gatzlaff, D. and David Geltner, "A Transaction-Based Index of Commercial Property and its Comparison to the NCREIF Index", *Real Estate Finance*, Summer 2000.
- Geltner, D. and W. Goetzmann, "Two Decades of Commercial Property Returns: A Repeated-Measures Regression-Based Version of the NCREIF Index", Working Paper, 1999.
- Geltner, D., "How Accurate Is the NCREIF Index as a Benchmark and Who Cares", *Real Estate Finance*, Winter 1997.
- Geltner, D. "Benchmarking Manager Performance Within the Private Real Estate Investment Industry", *Real Estate Finance*, Spring 2000.

- Geltner, D. and D. Ling, "Ideal Research and Benchmark Indexes in Private Real Estate: Some Conclusions from the REPI/PREA Technical Report", *Real Estate Finance*, Winter 2001.
- Giliberto, S. M., "Measuring Real Estate Returns: The Hedged REIT Index", *Journal of Portfolio Management*, Spring 1993.
- Grauer, R. and N. Hakansson (1995), "Gains From Diversifying Into Real Estate: Three Decades of Portfolio Returns Based on the Dynamic Investment Model", *Real Estate Economics*, Vol. 23, No. 1, 1995.
- Hartzell, D., J. Hekman and M. Miles, "Diversification Categories in Investment Real Estate", *Journal of the American Real Estate and Urban Economics Association*, Vol. 14, 1986.
- Hoesli, M., B. MacGregor, G. Matysiak and N. Nanthakumaran, "The Short Term Inflation Hedging Characteristics of U.K. Real Estate", *Journal of Real Estate Finance and Economics*, Vol. 15, No. 1, 1997.
- Isakson, H., "The Review of Real Estate Appraisals Using Multiple Regression Analysis", *Journal Of Real Estate Research*, August 1998.
- Kallberg, J. and C. Liu, "The Role of Real Estate in the Portfolio Allocation Process", *Real Estate Economics*, Vol. 24, No. 3, 1996.
- Karolyi, G. A. and A. B. Sanders, "The Variation of Economic Risk Premiums in Real Estate Returns", *Journal of Real Estate Finance and Economics*, Vol. 17, No. 3, 1998.
- Liang, Y. and J. R. Webb, "The Hedged REIT Index and Mixed-Asset Portfolios", *Journal of Real Estate Portfolio Management*, Vol.2, 1996.
- Ling, D. and A. Naranjo, "Economic Risk Factors and Commercial Real Estate Returns", *Journal of Real Estate Finance and Economics*, Vol. 14, No. 3, 1997.
- Ling, D. and A. Naranjo, "The Fundamental Determinants of Commercial Real Estate Returns", *Real Estate Finance*, Winter 1998.
- Liu, C. H., D. Hartzell and M. Hoesli, "International Evidence on Real Estate Securities as an Inflation Hedge", *Real Estate Economics*, Vol. 25, No. 5, Summer 1997.
- Lizieri, C. and S. Satchell, "Property Company Performance and Real Interest Rates: A Regime Switching Approach", *Journal of Property Research*, Vol. 14, 1997.
- Lizieri, C., S. Satchell, E. Worzala and R. Dacco, "Real Interest Regimes and Real Estate Performance: A Comparison of U.S. and U.K. Markets", *Journal of Real Estate Research*, Vol. 16, 1998.
- Lizieri, C. and C. Ward, "Commercial Real Estate Return Distributions: A Review of Literature and Empirical Evidence", Working Paper, University of Reading, 2000.
- Maitland-Smith, J. and C. Brooks, "Threshold Autoregressive and Markov Switching Models: An Application to Commercial Real Estate", *Journal of Property Research*, Vol. 16, 1999.
- Mei, J. and J. Hu, "Conditional Risk Premiums on Asian Real Estate Stocks", *Journal of Real Estate Finance and Economics*, Vol. 21, No. 3, 2000.
- Miles, M. and T. McCue, "Commercial Real Estate Returns", *Journal of the American Real Estate and Urban Economics Association*, Vol. 12, 1984.

- Moss, S., "A Test of the Construct Validity of Equity Real Estate Investment Trusts' Returns as an Operationalization of the Construct 'Real Estate Returns'", Working Paper, Delta State University, 1997.
- Okunev, J., P. Wilson and R. Zurbrugg, "The Causal Relationship Between Real Estate and Stock Markets", *Journal of Real Estate Finance and Economics*, Vol. 21, No. 3, 2000.
- "Property Index Detailed Quarterly Performance Report: Fourth Quarter 2000", The National Council of Real Estate Investment Fiduciaries, 2000.
- Pyhrr, S., S. Roulac and W. Born, "Real Estate Cycles and Their Strategic Implications for Investors and Portfolio Managers in the Global Economy", *Journal of Real Estate Research*, Vol. 18, No. 1, 1999.
- Quan, D. and S. Titman, "Do Real Estate Prices and Stock Prices Move Together? An International Analysis", *Real Estate Economics*, Vol. 27, No.2, 1999.
- Stevenson, S. and L. Murray, "An Examination of the Inflation Hedging Ability of Irish Real Estate", *Journal of Real Estate Portfolio Management*, Vol. 5, No.1, 1999.
- Stevenson, S., "International Real Estate Diversification: Empirical Tests Using Hedged Indices", *Journal of Real Estate Research*, Vol. 19, 2000.
- Wheaton, W., "Real Estate "Cycles": Some Fundamentals", *Real Estate Economics*, Vol. 27, No. 2, 1999.
- Worzala, E., E. Norman and G. S. Sirmans, "Portfolio Allocations of Insurance Companies: An Exploration of Investment Decision Making Techniques for Both Mixed-Assets and Real Estate Portfolios", Working Paper, *Center for Real Estate and Urban Economic Studies*, University of Connecticut, 1996.
- Young, M. and R. Graff, "Real Estate is Not Normal: A Fresh Look at Real Estate Return Distributions", *Journal Of Real Estate Finance and Economics*, Vol. 10, 1995.
- Ziering, B. and L. Taylor, "Real Estate Benchmarks and the Public Market Real Estate Dynamics Shaping Them", *Real Estate Finance*, Summer 1998.