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IMPACT OF SECURITIZED REAL ESTATE ON PORTFOLIO PERFORMANCE UNDER ALTERNATIVE MARKET CONDITIONS

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This study considers the impact of adding real estate investment trust (REIT) stocks to stock portfolios in varying proportions under different economic conditions. To the extent real estate offers diversification benefits to stock market investors, REITs may serve as a practical alternative to the relatively high trading costs of direct equity positions in real estate investments. The results suggest that the inclusion of securitized real estate enhances portfolio performance during positive economic climates, but diminishes portfolio performance during negative economic climates.

INTRODUCTION

The question of how much real estate to include in investment portfolios has been a frequent topic of research in the financial economics literature over the past several decades, but the issue remains surprisingly far from settled. Research agrees that real estate's correlation with other commonly considered portfolio assets certainly warrants its inclusion in mean-variance efficient portfolios, but recommendations about the optimal amount of real estate that should be included in such portfolios range from a low of 3 percent to a high of 75 percent. This wide range of recommended allocations may be partially attributable to differences in the time periods considered in the various published articles on this topic, but much of the disparity in recommendations is likely attributable to the difficulties researchers faced when attempting to accurately measure real estate returns.

Unlike many financial assets, most real estate assets do not typically trade in public markets where prices can be readily and frequently observed, nor are most real estate owners required to report their properties' operating information or financial condition to the public. Thus, researchers who are attempting to consider the issue of how much real estate to include in investment portfolios frequently must rely on real estate return measures derived from other sources.

One measure of real estate returns frequently used by researchers to consider the issue of optimal real estate allocations in investment portfolios comes from the National Council of Real Estate Investment Fiduciaries (NCREIF). Members of this industry group voluntarily share certain information about their real estate assets with other member firms. The shared information is combined into geographic- and property-type-specific indexes (dating back as far as 1978) that are made

available to member firms and the general public (property-specific information in the indexes is treated as confidential). Though certainly useful for benchmarking purposes by NCREIF member firms, the NCREIF indexes are not themselves "tradable" and thus provide little practical means for non-member portfolio managers who wish to use the indexes to determine the appropriate allocation to real estate assets in their portfolios. In addition, the NCREIF indexes reflect only those properties held by member firms (which may not be a representative sample of the real estate universe). Also, NCREIF indexes are based on appraised (estimated) values rather than actual transaction prices for properties that are not involved in transactions during the reporting period. Other privately-traded real estate return series (such as the Evaluation Associates Fund Performance Index) used by researchers to consider this topic are similarly problematic.

Instead of relying on privately-traded/estimated real estate return series in their analysis, researchers might better serve portfolio managers by considering a more practical measure of real estate returns when trying to evaluate the optimal allocation to real estate. One alternative is to derive a real estate return measure from the returns to publicly traded real estate investment trusts (REITs), entities whose primary purpose is to hold ownership positions in real estate assets or real estate mortgages. Although there is some ongoing debate about whether investing in REITs is equivalent to directly investing in real estate assets, buying and selling shares of REITs provide a practical (though still imperfect) means for portfolio managers to adjust their allocations to real estate without incurring the significant transactions costs of direct real estate investments.

The goal of this study is to consider the impact of securitized real estate (REITs) on portfolio performance

in a manner that is practical for managers of relatively small stock portfolios. Although we do not offer a conclusion about the optimal amount of real estate to include in managed portfolios, the evidence we present suggests that real estate should be an important consideration for portfolio managers. Our analysis of a large number of randomly drawn portfolios of stocks with varying proportions of REIT shares suggests that real estate does indeed impact portfolio performance, but that the direction and magnitude of the impact of securitized real estate on portfolio performance varies with general economic conditions. More specifically, our results indicate that real estate enhances portfolio performance in positive economic climates, but diminishes performance in negative economic climates.

The next section of this paper reviews previous published writings relevant to the current study. Subsequent sections describe how we develop the portfolios used in our analysis and the measures used to compare portfolio performance, present the results of our analysis, and summarize our findings.

LITERATURE REVIEW

The issue of how much real estate should be included in investment portfolios has been a frequent topic of research in the financial economics literature for the past several decades, but the question remains unsettled. At the low end of the range, empirical evidence presented by Hartzell (1986) suggests that 3 to 11 percent of a portfolio should be dedicated to real estate assets. Kallberg, Liu, and Greig (1996) conclude that 9 percent is the optimal allocation. Around the middle of the recommended range, numerous other researchers, including, Cooperman, Einhorn, and Melnikoff (1984), Fogler (1984), Firstenberg, Ross, and Zisler (1988), Brinson, Diermeier, and Schlarbaum (1986), Gold (1986), Irwin and Landa (1987), Ennis and Burik (1991), and Giliberto (1992, 1993), present evidence suggesting optimal allocations between 10 and 20 percent.

Even larger optimal allocations are suggested by Ziobrowski and Ziobrowski (1997) who report 20 to 30 percent as the optimal weight, Webb and Rubens (1986, 1987) who suggest 49 to 83 percent and 43 percent as the optimal weight, respectively, and Feldman (2003) who suggests 44.5 percent as the optimal weight. Webb, Curico, and Rubens (1988) suggest 66 percent as the optimal allocation to real estate assets in investment portfolios. Liang, Myer and Webb (1996) report the optimal allocation is somewhere between 13 percent and 75 percent. Mueller and Mueller (2003) present evidence

that mean/variance efficient portfolios could have allocations to real estate from 57.7 percent to 100 percent. Lee (2005) reports that diversification benefits begin to diminish once real estate comprises more than 20 percent of an investment portfolio. Lee and Stevenson (2005) provide results that suggest (without specifying an optimal allocation) that the diversification benefits from adding real estate to investment portfolios tend to increase with longer investment horizons.

The wide range of recommendations for the optimal amount of real estate in investment portfolios from the studies listed above reflects, at least in part, the wide variation in the time periods and the different measures of real estate returns considered by the researchers. For example, the Kallberg, Liu, and Greig (1996) study uses data from 22 properties owned by a large real estate fund between 1982 and 1989 to measure real estate returns. Web, Curico, and Rubens (1988) use data from two commingled real estate funds (owned by life insurance companies) to measure real estate returns during the 1972 to 1983 time period. Ziobrowski and Ziobrowski (1997) use a proprietary real estate return series from Evaluation Associations, Inc. (EAI Fund Performance Index) to measure real estate returns between 1970 and 1995. Mueller and Mueller (2003) use both the NCREIF Index data and the National Association of Real Estate Investment Trust (NAREIT) Equity Index to consider real estate returns over 25- and 30-year time periods. Lee (2005) also makes use of the NCREIF data, while Lee and Stevenson (2005) focus on REIT returns using the NAREIT Index between 1980 and 2002. Much of the variation in the recommended allocations may be a result of the variation in return series and time periods examined in prior studies.

The primary appeal of using REIT returns as a measure of the broad concept of "real estate returns" is the fact that REIT shares are publicly and frequently traded. Although the underlying real estate assets held by REITs are traded infrequently in private market transactions, the readily available returns to shares of REIT stocks may provide a more timely measure of the marketplace's collective evaluation of the firms' assets. In comparison to direct investment in physical real estate, REIT shares are highly liquid and present low transaction costs for portfolio managers.

The substitutability of REIT returns for returns to direct real estate investment is not, however, universally accepted by researchers. Seiler, Webb, and Myer (1999, 2001) suggest that the returns to public and private real estate are dissimilar enough to warrant treatment as separate asset classes. On the other hand, studies by

Gyourko and Kiem (1992), Myer and Webb (1993), and Barkham and Geltner (1995) provide evidence that REIT returns lead unsecuritized real estate returns, implying the REIT returns are a predictor of the returns that will eventually be revealed in privately-traded/estimated real estate return series. Similarly, Glascock, Liu and So (2000) report that REIT returns are co-integrated with the private real estate market and Clayton and MacKinnon (2001) find that REITs are more integrated with private real estate than they are with financial assets. The nature of their underlying assets and the relative ease with which REIT shares can be included in investment portfolios is a compelling argument for their consideration as a reasonable, though possibly imperfect, substitute for direct real estate investment that would otherwise be unattainable for many portfolio managers.

As this brief review suggests, the extant literature on the role of real estate assets in investment portfolios is quite vast and raises numerous critical issues. Even so, the collective evidence generally supports the general notion that adding real estate to an investment portfolio, in some amount, can lead to improved portfolio performance on a risk-adjusted basis. The impact of adding various proportions of real estate assets to investment portfolios is likely to vary over time as the correlation between real estate returns (regardless of the return measure used) varies under changing economic climates. The next section of this paper explores that hypothesis in detail.

RESEARCH DESIGN

To evaluate the impact of including REITs in stock portfolios, we randomly select stock portfolios and stock/REIT portfolios for various holding periods from January 1972 through December 2002. Our stock portfolios are developed with thirty randomly selected stocks (excluding SIC 6798), equally weighted, with monthly returns obtained from the Center for Research in Security Prices (CRSP) monthly returns file during each holding period.

We create stock/REIT portfolios by adding REITs in varying proportions to the stock portfolios. For each stock/REIT portfolio, we include ten randomly selected REIT securities (identified by SIC of 6798) that have monthly returns available in the CRSP database during the designated holding periods. (For 1972, only seven REITs are included on the CRSP database. The REIT portfolios for that year contain all seven of the available REITs. The number of REITs in the CRSP database increased over the years, reaching 154 firms by 2002.).

The proportions of REITs in the stock/REIT portfolios vary from 5 percent to 85 percent, in increments of 5 percentage points.

We evaluate the portfolios with three holding periods: 12 months, 36 months, and 60 months. For each holding period, portfolios are created annually from 1972 through the last year that allow for the full holding period to be analyzed. Forty randomly selected stock and stock/REIT portfolios are created for each holding period, investment year and real estate weight. This produces 18,360 pairs of randomly-matched portfolios with a 60-month holding period, 19,720 randomly-matched pairs of portfolios with a 36-month holding period, and 21,080 randomly-matched pairs of portfolios with a 12-month holding period.

We use two different portfolio performance measures to compare the risk-adjusted returns of our stock and stock/REIT portfolios. The first measure used is the Sharpe ratio (Sharpe (1966)). The Sharpe ratio is the risk premium earned by the portfolio relative to its risk, calculated by dividing the portfolio's average excess return over the sample period by the standard deviation of returns over that period. The risk-free rate is obtained from CRSP monthly U.S. Treasury database risk-free rate file.

$$Sharpe_p = (K_p - K_{rf}) / \sigma_p, \text{ (Eq. 1)}$$

where

$Sharpe_p$ = Sharpe index for portfolio p,

K_p = holding period return for portfolio p,

K_{rf} = risk-free rate of return measure by the return on treasury bills,

σ_p = standard deviation of returns for portfolio p during holding period.

For each random set of portfolios, stock only (stock) and stock/REIT (combined), the difference in the Sharpe ratios (*Sharpediff*) between the combined portfolio and the stock portfolio is calculated as:

$$Sharpediff = Sharpe(stock/REIT) - Sharpe(stock) \text{ (Eq. 2)}$$

If adding real estate provides diversification benefits and improves the risk-adjusted performance of the portfolio, the Sharpe ratio of the portfolio with REITs added will be greater than the stock only portfolio and the difference between the Sharpe ratio for the combined portfolio and the stock portfolio (*Sharpediff*) will be positive.

We also evaluate portfolio performance using a simple risk adjusted return measure (*RAR*) whereby the portfolio return is divided by its standard deviation (the inverse of the coefficient of variation.) $RAR = K_p / \sigma_p$ (Eq. 3)

The difference in mean *RAR* for stock/REIT and stock portfolios is expected to be positive if adding real estate improves the diversification of the investor's portfolio during the periods evaluated. $RARdiff = RAR (stock/REIT) - RAR (stock)$ (Eq. 4)

Results

Table 1 presents the results of hypothesis tests of the

difference in mean portfolio performance for the paired stock and stock/REIT portfolios constructed for this study. We perform *Students-t*, and the non-parametric Fisher sign and Wilcoxin signed rank tests under the null hypothesis that the mean difference (*Sharpediff* and *RARdiff*) in the performance measures for the stock/REIT portfolio and the stock portfolio is zero. The tests statistics are consistently positive and significant, thus, indicating that in repeated sampling over the test period, adding real estate to the investment portfolio significantly improved the risk-adjusted performance of portfolios with holding periods of 12, 36, and 60 months.

Table 1: Difference in Risk-Adjusted Performance of Combined Stock/REIT Versus Stock-Only Portfolios - Overall for all Years and all Weights

Performance Measure	Test	Holding Period:					
		12 Month		36 Month		60 Month	
		Statistic*	p-value	Statistic	p-value	Statistic*	p-value
Sharpediff	Student's t	19.096	0.00	17.142	0.00	11.246	0.00
	Fisher Sign	792	0.00	1152	0.00	1,261	0.00
	Wilcoxin Signed Rank	13,571,996	0.00	14,196,957	0.00	12,139,215	0.00
RARdiff	Student's t	32.195	0.00	35.353	0.00	33.204	0.00
	Fisher Sign	1,638	0.00	2,086	0.00	2,467	0.00
	Wilcoxin Signed Rank	25,391,791	0.00	27,380,995	0.00	26,913,680	0.00

*Test statistic under the null hypothesis that the mean difference of the performance measure for the combined portfolio and the stock portfolio = 0.

To demonstrate how stock-only and REIT-only portfolios performed over the study period, we present the mean 12-month holding period returns, standard deviations, and Sharpe ratios for stock-only and REIT-only portfolios by investment year in table 2 below. The rightmost column of the table shows the mean correlation coefficients between stock-only and REIT-only portfolios. The correlation coefficients range from -0.15 in the 2000 calendar year to +0.90 in 1973, indicating that the diversification benefits from adding real estate to stock portfolios may vary year to year. Similar results are obtained for other holding periods, but are not presented for the sake of brevity.

The range of the correlations between the returns of stock and REIT portfolios as shown in table 2 indicates that the impact of adding real estate to the investment portfolio varies from year to year. Test results of the differences in portfolio performance by investment year are given in table 3. The t-statistic results vary by year. Years in which the performance of the stock/REIT portfolios was superior and significant are indicated by "+," and years in which the combine portfolios performance was inferior and significant are indicated by "-".

There appear to be some periods of years in which real estate enhances portfolio performance and other periods where stock only portfolios dominate. (Tests by year were also conducted using the 36-month and 60-month holding periods with similar results. Nonparametric Fisher sign tests and Wilcoxin ranked sign tests yielded the same results. Only the results for comparisons of stock and stock/ REIT portfolios with 15% weight to REIT stocks are reported).

To gain insight into the impact of real estate in stock portfolios under different market conditions, we also examine the relationship of the performance to market and economic cycles. Financial market bear markets periods are identified using common popular press definitions of a bear market period. Portfolio performance measures of paired portfolios for investment years associated with bull and bear market periods were tested and the results are presented in table 4. Test statistics based on both the *Sharpe* and *RAR* performance measures indicate a relationship between the impact of real estate assets in the portfolio and bull and bear market periods. During defined bear market periods, the mean difference in performance measures is negative and significant, but during the other periods the test statistic is positive and

significant. While real estate appears to enhance portfolio performance efficiency during “up” market periods, these

results showed that real estate diminishes mean-variance performance efficiency during “down” market periods.

Table 2: Mean Return, Standard Deviation, Sharpe Ratio for Stock and REIT Portfolios (12 month holding period)

Year	Stock only			REIT only			Correlation Coefficient
	Return	Std Dev	Sharpe	Return	Std Dev	Sharpe	
1972	0.007	0.044	0.086	-0.003	0.036	-0.168	0.72
1973	-0.033	0.073	-0.533	-0.032	0.070	-0.537	0.90
1974	-0.023	0.077	-0.392	-0.047	0.081	-0.664	0.81
1975	0.044	0.090	0.434	0.037	0.123	0.267	0.81
1976	0.035	0.068	0.461	0.036	0.093	0.352	0.79
1977	0.019	0.036	0.408	0.022	0.051	0.356	0.44
1978	0.022	0.073	0.215	0.014	0.071	0.111	0.84
1979	0.029	0.060	0.342	0.034	0.064	0.408	0.77
1980	0.030	0.077	0.269	0.031	0.078	0.286	0.86
1981	0.000	0.053	-0.235	0.007	0.049	-0.079	0.70
1982	0.018	0.060	0.167	0.032	0.044	0.550	0.78
1983	0.032	0.061	0.409	0.025	0.038	0.469	0.48
1984	-0.008	0.042	-0.367	0.017	0.030	0.321	0.68
1985	0.024	0.051	0.362	0.016	0.032	0.321	0.60
1986	0.011	0.051	0.113	0.015	0.034	0.276	0.52
1987	0.000	0.097	-0.045	-0.008	0.055	-0.224	0.84
1988	0.017	0.045	0.249	0.012	0.036	0.198	0.67
1989	0.006	0.040	-0.001	-0.004	0.033	-0.341	0.38
1990	-0.015	0.057	-0.378	-0.020	0.050	-0.540	0.51
1991	0.041	0.057	0.663	0.021	0.055	0.323	0.60
1992	0.018	0.057	0.265	0.012	0.052	0.177	0.56
1993	0.017	0.036	0.405	0.024	0.042	0.543	0.26
1994	0.000	0.038	-0.122	0.003	0.039	0.000	0.31
1995	0.021	0.039	0.440	0.017	0.026	0.479	0.29
1996	0.017	0.050	0.253	0.028	0.028	0.876	0.16
1997	0.014	0.053	0.181	0.017	0.034	0.394	0.54
1998	-0.004	0.083	-0.102	-0.010	0.045	-0.309	0.64
1999	0.016	0.054	0.230	-0.002	0.041	-0.144	0.42
2000	-0.001	0.078	-0.085	0.012	0.042	0.185	-0.15
2001	0.022	0.091	0.211	0.025	0.044	0.552	0.56
2002	-0.009	0.068	-0.160	0.008	0.042	0.181	0.41

Table 3: Mean Difference in Risk-Adjusted Performance by Year - Combined Stock/REIT Versus Stock-Only Portfolios

Year	t-stat	p-value		Year	t-stat	p-value	
1972	-17.19	0.00	-	1988	0.97	0.34	
1973	-2.82	0.01	-	1989	-8.57	0.00	-
1974	-14.50	0.00	-	1990	-7.69	0.00	-
1975	-6.78	0.00	-	1991	-2.76	0.01	-
1976	-2.50	0.02	-	1992	0.15	0.88	
1977	7.09	0.00	+	1993	6.40	0.00	+
1978	-5.28	0.00	-	1994	2.26	0.03	+
1979	6.02	0.00	+	1995	7.76	0.00	+
1980	3.98	0.00	+	1996	20.22	0.00	+
1981	4.45	0.00	+	1997	10.17	0.00	+
1982	19.93	0.00	+	1998	-10.62	0.00	-
1983	13.07	0.00	+	1999	-8.21	0.00	-
1984	20.00	0.00	+	2000	3.45	0.00	+
1985	2.80	0.01	+	2001	9.80	0.00	+
1986	6.49	0.00	+	2002	9.21	0.00	+
1987	-10.09	0.00	-				

12-month holding period, REIT proportion = .15

+ *Sharpediff* is positive and significant at the .05 level

- *Sharpediff* is negative and significant at the .05 level

Table 4: Difference in Risk-Adjusted Performance - Bear Versus Non-Bear Years Stock/REIT Versus Stock-Only Portfolios

Performance Measure	Test	Bear		Otherwise	
		Statistic	p value	Statistic	p value
Sharpediff	Student's t	-8.823	0.00	10.581	0.00
	Fisher Sign	-61	0.00	140	0.00
	Wilcoxin Signed Rank	-6,604	0.00	100,903	0.00
RARDiff	Student's t	-6.833	0.00	15.112	0.00
	Fisher Sign	-55	0.00	189	0.00
	Wilcoxin Signed Rank	-5,580	0.00	138,299	0.00

*Holding period = 12 months, Proportion REITs in portfolio = .15

*Test statistic under the null hypothesis that the mean difference in the performance measure for the combined and the stock portfolio = 0.

We also address the issue of how real estate impacts stock portfolios differently during different market climates using other "up" and "down" market indicators. Economic business cycle recession periods were obtained from the National Bureau of Economic Research. Also, "up" and "down" real estate market years were defined from the National Association of Real Estate Trusts

(NAREIT) REIT indices. Regression analysis results with dependent variables defined as the difference in performance measures (*Sharpediff* and *RARDiff*) and the various market climates indicators are shown in table 5 below. The independent variable is an indicator variable equal to 1 if the investment year is an "up" year, 0 otherwise.

Table 5: Impact of REITs in Portfolios During Up and Down Periods Indicated by Regressing *Sharpediff* and *RARDiff* on the Indicated Independent Variables

Dependent Variable	Intercept	Bear	Down RE	Down Econ	F	Adj. R ²	N
<i>Sharpediff</i>	0.014 (10.91)	-0.035 (-10.99)					
			-0.041 (-14.96)		120.71	0.088	1,239
	0.018 (13.59)				223.86	0.152	
	0.011 (9.07)			-0.0323 (-7.94)			
					62.98	0.048	
<i>RARDiff</i>	0.021 (15.65)	-0.038 (-11.22)					
			-0.043 (-15.02)		125.84	0.092	1,239
	0.025 (18.23)				225.68	0.154	
	0.018 (13.85)			-0.035 (-8.16)			
					66.61	0.050	

Holding period = 12 months, Proportion REITs in portfolio = .15, *Sharpediff* = Sharpe ratio of combined stock/REIT portfolio minus Sharpe ratio of stock-only portfolio, *RARDiff* = Risk-adjusted return (inverse of coefficient of variation) difference between stock/REIT and stock-only portfolio, Bear = 1 if financial markets defined as a bear period, 0 otherwise, DownRE = 1 if return on NAREIT Equity index is negative, 0 otherwise, Down Econ = 1 if period of economic recession, 0 otherwise, * Significant at the .01 level.

CONCLUSION

The role of real estate assets in investment portfolios is a frequent research question, but the optimal allocation of real estate assets in such portfolios remains an elusive bit of knowledge. Limitations of available real estate return measures such as the NCREIF index makes even retrospective analysis difficult, leaving portfolio managers with little practical guidance on the issue. In addition, transaction costs associated with trading the types of assets reflected in the NCREIF index further inhibit its usefulness to stock portfolio managers.

The purpose of this study was to consider whether and how the inclusion of securitized real estate (REIT stocks) impacts stock portfolios. REIT stocks offer a practical alternative to direct equity positions in real estate assets for portfolio managers. We designed and implemented a simulation analysis using a large number of randomly selected portfolios of 30 non-REIT stocks and measured and compared their risk-adjusted performances when real estate (REIT stocks) was added to the portfolios in varying proportions. We considered 12-month, 36-month, and 60-month holding periods. We also considered how the impact of adding real estate to stock portfolios varies

under different market climates.

The evidence presented here strongly supports the notion that real estate can impact portfolio performance, but that the impact varies in magnitude and direction during different market climates. In particular, we find that real estate enhances portfolio performance in positive economic climates, but diminishes portfolio performance in negative economic climates. Portfolio managers are advised to give careful consideration to the issue of how much securitized real estate to include in stock portfolios as market conditions change.

Whereas this study only considers the combination of domestic (U.S.) common stocks and REIT stocks in investment portfolios, future research could consider a broader spectrum of portfolio assets. Comparisons of risk-adjusted returns to portfolios containing REITs, domestic and international common stocks and fixed-income securities could provide additional valuable insights into impact of securitized real estate on portfolio performance under alternative market conditions.

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