Apartment REITs and Apartment Real Estate

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Abstract: **This study employs a "hedged" apartment REIT index to track the performance of apartment real estate and to assess the performance of apartments in efficient mixed-asset portfolios consisting of stocks, bonds and real estate. The hedged apartment index reflects the returns of apartment REITs after the effects of equity REITs and the stock market are removed from the apartment REIT returns. It is demonstrated that the hedged apartment REIT index captures a substantial amount of the volatility unique to apartment real estate. Furthermore, the hedged apartment REIT index does not suffer from the appraisal-smoothing problem and the apparent seasonality of appraisal-based indices, such as the Russell-NCREIF apartment index. Therefore, it would appear that the hedged apartment REIT index can be employed as a proxy for apartment real estate in portfolio allocation decisions. This study provides evidence that apartment real estate should be a candidate for some efficient mixed-asset portfolios.**

Introduction

The purpose of this study is to investigate the performance of apartment real estate and to assess its role in efficient mixed-asset portfolios consisting of stocks, bonds and real estate. The potential role of real estate in portfolio allocations has been widely recognized (e.g., Fogler, 1984; Hartzell, 1986; Firstenberg, Ross and Zisler, 1988; Webb, 1990). However, a closer examination of types of real estate will reveal that there are differences in the characteristics of the various real estate categories which translate into differences in their performance. The examination of apartment real estate in this study is thus motivated by the possibility that apartment real estate investment trusts (henceforth apartment REITs or AREITs) may provide a proxy to the ownership of apartment sticks and bricks.

Recent studies have shown that real estate investment trusts (REITs) capture real estate market factors, and can collectively be employed as a proxy for real estate in mixed-asset portfolio decisions (e.g., Kuhle, 1987; Giliberto, 1990). However, the connection between the equity REIT index and the Russell-NCREIF property index may be clearly established only when the effects of the price movements for financial assets are removed from real estate security returns (e.g., Giliberto, 1993). One reason for the general preference of REIT indices in studies on mixed-asset portfolio decisions is that appraisal-based indices have been shown to suffer from smoothing bias and to contain a seasonal component due to the popularity of fourth-quarter appraisals (e.g., Geltner, 1989a, 1989b, 1991; Giliberto, 1988; Wheaton and Torto, 1989). REITs, on the other hand, are repriced by participants in the market on a daily basis when the stock market is open.

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This study uses securitized apartment real estate (REITs) to assess the performance of apartment real estate. There are two obstacles in developing a proxy for unsecuritized apartment real estate. First, there are only a few REITs that invest exclusively in apartments. Moreover, several studies have demonstrated a strong positive correlation between REITs and stock market indices such as the S&P 500. Therefore, an investigation of the performance of apartment real estate, using apartment REITs as a proxy, must involve the isolation of the "apartment component" in the REITs. Second, there is the problem of establishing the relationship between REITs and unsecuritized real estate.

This study overcomes these two obstacles. First, an apartment performance index is constructed by removing the return components of stocks in general and non-apartment equity REITs from returns of REITs that invest in apartment real estate. The resulting "double hedged" apartment REIT index reflects the return on apartment real estate. Second, a forecasting model involving a seasonal correction is employed to establish the ability of the hedged apartment REIT index to track the performance of appraisal-based apartment real estate. The model, fitted over different sample intervals, explains a substantial amount of the variation in apartment real estate returns. Thus, the hedged apartment REIT index is found to be a viable proxy for apartment real estate.

In the final stage of the analysis of apartment real estate, this study assesses the usefulness of apartment real estate in efficient portfolios. The results indicate that apartment real estate is a potential candidate in efficient mixed-asset portfolios alongside stocks, bonds and real estate in general.

Data and Research Design

This study employs data series that individually proxy for returns on stocks, bonds, real estate, and apartment real estate. The real estate series used include both securitized and unsecuritized indices. The sample of apartment REITs is selected on the basis that each REIT has at least 10% of its total investments (equity and mortgage) in equity-financed apartments for each of the years, 1993 and 1994.[1] The investment information for REITs are from the *REIT Handbook* (NAREIT, 1993, 1994). This apartment REIT sample is presented in Exhibit 1. The equally weighted apartment REIT return index is used later to construct the hedged AREIT returns. Individual apartment REIT returns are from the 1993 CRSP tapes.

The equity REIT return index is from the *REIT Handbook* (NAREIT, 1994). The real estate return index and the apartment return index are the Russell-NCREIF total return index and its apartment subindex,[2] respectively. The S&P 500 return index, the bond return index (long-term government), and the one-month T-bill return index are from Ibbotson Associates (1994). Indices for the S&P 500, bond, real estate, apartment real estate, equity REITs, and apartment REITs represent total returns.

Three hedged REIT indices are constructed from the monthly equity REIT and apartment REIT indices. The hedged equity REIT index (HEREIT) is the equity REIT index hedged against the S&P 500 index. The hedged apartment REIT index (HAREIT) is the apartment REIT index hedged against the S&P 500 index. The double-hedged apartment REIT index (HHAREIT) is the apartment REIT index hedged against both the S&P 500 index and the equity REIT index.

The single-hedged indices (HEREIT and HAREIT) are constructed by first estimating the following regression:

Exhibit 1
The Apartment REIT Sample

REIT Name	Exchange	Total Investments ($ millions) 1992	Total Investments ($ millions) 1993	% Share of Equity-Financed Apartments in Total Investments 1992	% Share of Equity-Financed Apartments in Total Investments 1993
1. Berkshire Realty Corporation	N	344.55	393.08	52.93%	61.67%
2. BRE Properties	N	226.22	284.13	41.39	53.96
3. Central Realty Investors, Inc.	Q	.98	.98	18.37	18.37
4. Continental Mortgage and Equity Trust	Q	155.32	130.92	32.12	40.73
5. Eastgroup Properties	A	90.19	109.84	18.96	29.08
6. First Union Real Estate Equity & Mtg Invt	N	428.13	444.61	10.18	13.47
7. Income Opportunity Realty Trust	A	51.76	47.96	31.96	60.53
8. Manufactured Home Communities	N	151.44	196.61	100.00	100.00
9. Merry Land and Investment Corporation	N	247.95	433.68	48.92	97.48
10. MGI Properties	N	214.43	258.66	31.68	30.53
11. New Plan Realty Trust	N	228.90	228.64	14.74	14.76
12. Pennsylvania Real Estate Investment Trust	A	210.66	260.52	36.02	49.75
13. Presidential Realty Corporation	A	30.88	27.19	19.04	29.83
14. Property Capital Trust	A	202.70	196.63	13.88	12.90
15. Property Trust of America	N	298.71	873.12	78.66	100.00
16. Real Estate Investment Trust of California	N	109.50	155.57	25.57	44.73
17. South West Property Trust	A	92.00	203.89	91.30	96.83
18. Transcontinental Real Estate Investor's Corp.	N	178.98	161.64	37.61	38.26
19. United Dominion Realty	N	391.02	582.21	79.64	86.43
20. Vinland Property Trust	Q	21.99	27.30	53.84	63.55
21. Washington Real Estate Investment Trust	A	155.77	170.46	15.58	14.77
22. Wellsford Residential Property Trust	N	167.81	301.39	100.00	100.00
Mean		181.81	249.50	43.29	52.62
Standard Deviation		112.33	197.94	28.35	31.07
Maximum		428.13	873.12	100.00	100.00
Minimum		.98	.98	10.18	12.90

Notes: N: New York Stock Exchange; A: American Stock Exchange; Q: NASDAQ

$$R_{REIT} = a + h * R_{S\&P500} + error\ , \tag{1}$$

where:

R_{REIT} = *REIT* total return;
a = regression intercept;
$R_{S\&P500}$ = *S&P 500* total return; and
h = hedge ratio associated with the S&P 500 index.

The hedged REIT return index is developed by the following rule: for every dollar invested in REITs, h dollars of the S&P 500 index is sold short, with the proceeds being invested in short-term Treasury bills (*Tbills*). The resulting hedged REIT return index can be calculated as:

$$R_{Hedged\ REIT} = R_{REIT} - h(R_{S\&P500} - R_{Tbill}) , \tag{2}$$

where:

$R_{Hedged\ REIT}$ = *hedged REIT* return;
R_{REIT} = *REIT* total return;
$R_{S\&P500}$ = *S&P 500* total return;
R_{Tbill} = one-month *Treasury bill* return; and
h = estimated hedge ratio associated with S&P 500 from equation (1).

Equations (1) and (2) are employed to calculate both the HEREIT and HAREIT indices.[3]

Since the correlation between the return on REITs and the return on the S&P 500 index is expected to change over time, the hedge ratio must be adjusted periodically. Given that monthly returns are employed in estimating the hedge ratios, the hedge ratio is also adjusted on a monthly basis. A rolling regression with a forty-eight-month window is used to compute one-month-ahead hedge ratios.

The double-hedged apartment REIT (*HHAREIT*) return index is calculated in similar fashion to the HEREIT and HAREIT indices, with an extra term appended to equations (1) and (2). First, the following regression is undertaken to arrive at the two hedge ratios:

$$R_{AREIT} = a + h_1 R_{S\&P500} + h_2 R_{EREIT} + error , \tag{3}$$

where:

R_{AREIT} = *apartment REIT* total return;
a = regression intercept;
$R_{S\&P500}$ = *S&P 500* total return;
R_{EREIT} = *equity REIT* total return; and
h_1, h_2 = hedge ratios associated with S&P 500 and Equity REITs.

The hedge ratios given by h_1 and h_2 are employed in the computation of the double-hedged *AREIT* return index in the following manner:

$$P_{HHAREIT} = R_{AREIT} - h_1(R_{S\&P500} - R_{Tbill}) - h_2(R_{EREIT} - R_{Tbill}) , \tag{4}$$

where:

$R_{HHAREIT}$ = double-hedged *apartment REIT* return;
R_{AREIT} = *apartment REIT* total return;
$R_{S\&P500}$ = *S&P 500* total return;
R_{Tbill} = one-month *T-bill* return; and
h_1, h_2 = estimated hedge ratios associated with the S&P 500 and equity REITs from equation (3).

The double-hedged apartment REIT index is developed as follows. For every dollar invested in apartment REITs, h_1 dollars of the S&P 500 index and h_2 dollars of equity REITs are sold short. The proceeds from the short sales (h_1+h_2) are invested in T-bills.

Following the computation of the hedged EREITs and AREITs, quarterly hedged REIT return indices are derived by compounding the monthly indices. Further analysis is conducted using quarterly return information for stocks, bonds, appraisal-based real estate, securitized real estate, and hedged REITs. Since the Russell-NCREIF real estate index is available only from 1978, the sample period spans the interval 1Q82–4Q93. The loss of four years of data is due to the forty-eight-month window for the rolling regressions.

To verify that the hedged apartment REIT index captures the performance of apartment real estate, HAREIT returns are correlated with those from apartment real estate appraisals. However, as has been indicated by previous research, simple contemporaneous correlations between REIT returns and real estate returns may be weak, due mainly to the fact that appraisals impart smoothing and seasonal effects into real estate prices. To better track the appraisal-based series, the following forecasting model is developed:[4]

$$R_{A,t}=a+b_1R_{S\&P500,t}+b_2R_{bond,t}+b_3R_{H,t-1}+b_4R_{H,t-2}+ b_5R_{H,t-3}+b_6R_{H,t-4}+b_7D_t+error_t\,, \tag{5}$$

where:

$R_{A,t}$ = return on appraisal-based apartment real estate at quarter t;
$R_{S\&P500,t}$ = S&P 500 total return at quarter t;
$R_{bond,t}$ = long-term government bond total return at quarter t;
$R_{H,i-1}$'s ($i=1,2,3,4$) = up to four-quarter lagged returns on the hedged apartment REIT indices (HAREIT or HHAREIT);
D_t = a dummy variable (1 if t is the fourth quarter and 0 otherwise); and
a, b_j = ($j=1, \ldots, 7$) regression intercept and coefficients.

The model is developed based upon the belief that factors affecting the stock and bond markets should also affect the real estate market, and the belief that REIT returns are forward-looking. The seasonal dummy, of course, is to capture the fourth-quarter effect of the appraisal-based apartment index.

Results

Exhibit 2 reports the means, standard deviations and correlations of returns for stocks, bonds, real estate, REITs, and hedged REITs over the interval 1982 through 1993. As expected, the mean returns of real estate in general and apartment real estate in particular are much lower than those of stocks, bonds and REITs.[5] The low standard deviations of the appraisal-based real estate and apartment series are consistent with the notion that the appraisal process is slow to incorporate market changes into the Russell-NCREIF indices. The returns and standard deviations of equity REITs and apartment REITs are

far closer to those of stocks than to those of real estate. However, the hedged equity REIT index has a mean return that is closer to real estate mean return, and a standard deviation that is about 66% of the stocks' volatility. This proportion of volatility is consistent with the results of Hartzell and Webb's (1988) survey which assessed that real estate's true risk be between 50% to 75% of equity risk. As expected, the double-hedged equity REIT index (HHAREIT) has the smallest mean return and the smallest standard deviation of all the REITs investigated. It also appears that most of risk in AREITs arises from their relationship with EREITs rather than stocks. This conclusion follows from a simple comparison of the standard deviations of AREITs, HAREITs and HHAREITs. While the standard deviation for the HAREITs is almost as large as AREITs, it is dramatically lower for the HHAREITs.

The correlation coefficients in Exhibit 2 indicate very little relationship between unsecuritized real estate and stocks and bonds. On the other hand, there appears to be a strong positive relationship between the appraisal-based real estate return series and the apartment series (correlation coefficient is .743). This may be an indication that appraisal-based apartment returns suffer from the smoothing and seasonality characteristics found in other real estate. There is also evidence of a positive relationship among the securitized real estate and stocks and bonds. However, while the EREITs and AREITs are highly correlated with stocks, the AREITs-stocks correlation coefficient is lower (.512) than that of the EREIT-stocks correlation coefficient (.692). Thus, there are preliminary indications that AREITs may provide further diversification opportunities in securitized real estate.

As evidenced by other researches (e.g., Giliberto, 1993), the correlation between the securitized REITs and their appraisal-based counterparts is weak. However, there is evidence that the hedged EREITs and hedged AREITs provide improved proxies for real estate in general and apartments in particular. The correlation coefficients for the HEREITs-real estate and HAREITs-apartments pairings are greater than those for the EREITs-real estate and AREITs-apartment pairings. In turn, the HHAREITs-apartments correlation coefficient is substantially greater than that of the HAREITs-apartments pairing. This provides some indication that the double-hedged AREIT index better captures the performance of apartment real estate.

Exhibit 3 presents the mean returns and standard deviations for the variables over two subperiods: 1Q82–4Q87 and 1Q88–4Q93. The correlations between the variables and hedged REITs indices are also reported. As in Exhibit 2, it is apparent from the statistics for HHAREIT that, upon removing the impact of stocks and EREITs from the AREITs, the mean return is lower than AREITs, EREITs and stocks. On the other hand, the standard deviation of the returns of HHAREITs is lower than that of EREITs and AREITs for either subperiod. In fact, the coefficient of variation (standard deviation/mean return) of the HHAREITs index is lower than that of the AREITs index for either subperiod. This would indicate that, for the period under study, the double-hedged AREITs index dominates the AREIT index in a mean-variance sense.

The correlation results in Exhibit 3 further highlight the potential usefulness of apartment REITs in a portfolio of stocks, bonds and real estate. The HHAREITs index is weakly correlated with returns on stocks and bonds in either subperiod. Further, the correlation coefficients for the HHAREITs-EREITs pairing over the two intervals are modest (.220 and .491, respectively). This evidence, along with the evidence of positive mean returns on the double-hedged index, is consistent with the notion that firms

Exhibit 2
Stocks, Bonds, Real Estate, and REITs: Descriptive Statistics Quarterly Return Data for 1Q82–4Q93

	Stocks	Bonds	Real Estate	Apartments	EREITs	AREITs	HEREITs	HAREITs	HHAREITs
Mean Return	4.101%	3.747	1.259	2.002	3,.704	4.183	2.337	2.619	1.835
Std Deviation	7.828%	5.929	1.740	1.711	7.258	11.955	5.134	10.050	4.691
				Correlations					
Stocks	1.000								
Bonds	.340	1.000							
Real Estate	−.027	−.032	1.000						
Apartments	−.100	−.067	.743	1.000					
EREITs	.692	.379	.055	−0.093	1.000				
AREITs	.512	.225	.005	−.012	.893	1.000			
HEREITs	.264	.218	.145	−.046	.853	.828	1.000		
HAREITs	.181	.081	.043	.033	.724	.926	.861	1.000	
HHAREITs	.060	−.085	.059	.235	.391	.735	.482	.826	1.000

Sources: Stock (S&P 500) and bond (long-term government) returns are from the Ibbotson Associates (1994).
Real estate and apartments returns are the Russell-NCREIF total return index and apartment total return index, respectively.
Equity REIT (EREIT) return is from NAREIT.
Apartment REIT return (AREIT), equity REIT return hedged against the S&P 500 (HEREIT), apartment REIT return hedged against the S&P 500 (HAREIT), and apartment REIT return double-hedged against the S&P 500 and the equity REIT (HHAREIT) are calculated by authors.

Exhibit 3
Stocks, Bonds, Real Estate, and REITs:
Descriptive Statistics on Quarterly Returns by Subperiod

	Stocks	Bonds	Real Estate	Apartments	EREITs	AREITs	HEREITs	HAREITs	HHAREITs
Quarterly Data for 1Q82–4Q87									
Mean Return	4.523%	4.289	2.330	2.732	4.313	4.120	2.831	2.438	1.793
Std Deviation	9.687%	7.436	.985	1.562	6.686	8.360	3.929	4.882	3.587
				Correlations					
HEREITs	.167	.160	.350	−.005	.683	.527	1.000		
HAREITs	.223	−.040	.391	.208	.574	.728	.740	1.000	
HHAREITs	.150	−.176	.285	.336	.220	.577	.219	.816	1.000
Quarterly Data for 1Q88–4Q93									
Mean Return	3.680%	3.204	.187	1.272	3.095	4.247	1.844	2.799	1.876
Std Deviation	5.570%	3.990	1.680	1.559	7.884	14.906	6.158	13.509	5.665
				Correlations					
HEREITs	.433	.339	.018	−.162	.955	.944	1.000		
HAREITs	.249	.214	.002	−·007	.840	.981	.923	1.000	
HHAREITs	−.021	−.003	.008	.230	.491	.792	.593	.853	1.000

Sources: Stock (S&P 500) and bond (long-term government) returns are from the Ibbotson Associates (1994).
Real estate and apartments returns are the Russell-NCREIF total return index and apartment total return index, respectively.
Equity REIT (EREIT) return is from NAREIT.
Apartment REIT return (AREIT), equity REIT return hedged against the S&P 500 (HEREIT), apartment REIT return hedged against the S&P 500 (HAREIT), and apartment REIT return double-hedged against the S&P 500 and the equity REIT (HHAREIT) are calculated by authors.

represented in the AREITs index may display a return generating process that is unique in the broader class of equity REITs. However, while the correlation between HHAREIT and apartment real estate returns is positive for either subperiod, the coefficients are unable to convincingly indicate that the hedged index is a viable proxy for apartment real estate.

Tracking Apartment Real Estate

Given that the correlations fail to provide strong evidence that hedged AREITs are able to satisfactorily track apartment real estate, we investigate this issue further by plotting the actual apartment real estate returns alongside the predicted apartment real estate returns employing equation (5).[6] These plots are presented in Exhibit 4. It is apparent that several of the major peaks and troughs for the actual apartment returns occur in the last quarter of the years in the sample, consistent with the notion that appraisal data contain a fourth-quarter bias. This bias appears to lead to an increase in the divergence in the returns on the hedged indices and the returns on the appraised apartment real estate in the fourth quarters.

Nonetheless, the models using both HAREIT and HHAREIT indices appear to effectively track the Russell-NCREIF apartment index. The model involving the hedged apartment index (HAREIT) explains about 33% of the variation in the Russell-NCREIF apartment index for the 1988–1993 interval, 37% of the variation for the overall 1982–1993 interval, and 44% of the variation for the overall 1982–1993 interval when the "outlier" return for the fourth quarter of 1991 (−4.39%) is excluded from the analysis. The model involving the double-hedged apartment index (HHAREIT) explains about 51% of the variation in the Russell-NCREIF apartment index for the 1988–1993 interval, and 42% of the variation for the overall 1982–1993 interval, and 52% of the variation for the overall 1982–1993 interval when the return for the fourth quarter of 1991 is excluded from the analysis. Based on these results, and given that the effects of appraisal smoothing are not precisely known, there is little reason for us not to accept the hedged AREIT index, especially the double-hedged AREIT index, as the proxy for apartment real estate performance.

Apartment REITs and Portfolio Allocations

Exhibit 5 presents samples of efficient portfolio allocations for stocks, bonds, securitized/unsecuritized real estate, and apartment real estate for the sample period 1Q82–4Q93. For ease of exposition, only four efficient portfolios with quarterly expected returns in the range (3.40%, 4.00%) are shown in the exhibit.[7]

Panel A reports efficient portfolios of stocks, bonds and unsecuritized real estate. There is no portfolio allocation for real estate for the entire risk/return spectrum. However, there are substantial allocations in apartment real estate at the lower end of this spectrum. For instance, the portfolio corresponding to the return of 3.4% involves a 25% allocation in apartments. Efficient portfolios at the high risk/return spectrum involve only stocks and bonds.

The efficient portfolios in Panel B pertain to those of stocks, bonds and unhedged securitized real estate. Unlike the case in Panel A, all the four assets are allocated in at least one efficient portfolio. However, there is substantial asset substitution of AREITs

Exhibit 4
Apartment Total Return Indices
Russell-NCREIF Apartment Index vs. Model Predictions
(1Q82-4Q93)

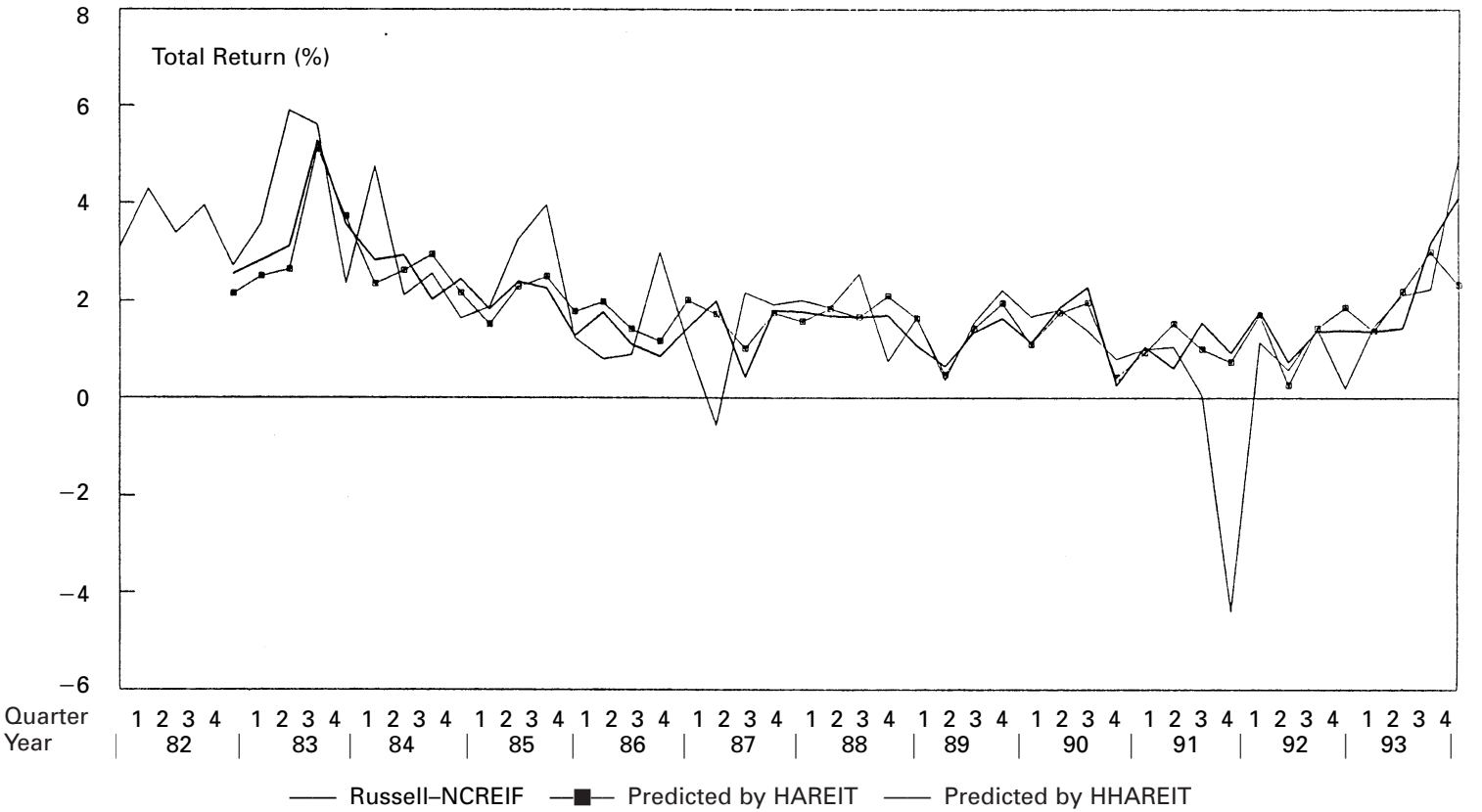

Exhibit 5
Sample Efficient Portfolios
(quarterly data for 1Q82–4Q93)

Return	Std Dev.	Portfolio Weights			
Panel A:		Stocks	Bonds	Real Estate	Apartments
3.4%	4.05%	29%	46%	0%	25%
3.6	4.64	33	52	0	15
3.8	5.23	37	59	0	4
4.0	6.43	73	27	0	0
Panel B:		Stocks	Bonds	EREITs	AREITs
3.4%		n/a	n/a	n/a	n/a
3.6		n/a	n/a	n/a	n/a
3.8	5.29	19	62	19	0
4.0	6.26	56	30	0	14
Panel C:		Stocks	Bonds	HEREITs	HAREITs
3.4%	4.49%	22%	48%	30%	0%
3.6	4.82	29	54	17	0
3.8	5.24	34	60	0	6
4.0	6.43	73	27	0	0
Panel D:		Stocks	Bonds	HEREITs	HAREITs
3.4%	4.29	26%	51%	0%	23%
3.6	4.73	31	55	0	14
3.8	5.25	36	60	0	4
4.0	6.43	73	27	0	0

Notes: No short sales are allowed. n/a: not applicable. EREIT: Equity REIT; AREIT: Apartment REIT; HEREIT: Equity REIT hedged against the S&P 500; HAREIT: Apartment REIT hedged against the S&P 500; and HHAREIT: Apartment REIT double-hedged against the S&P 500 and the Equity REIT.

for EREITs as one moves up from the lower end of the risk/return spectrum. It is notable that the highest risk/return portfolio sampled in this panel dominates, in a mean-variance sense, the corresponding portfolio in Panel A. This portfolio involves a 14% allocation for apartment REITs and no allocation for equity REITs. Stocks continue to dominate the high risk/return portfolios and bonds continue to dominate the low risk/return portfolios.

Panel C reports efficient portfolios of stocks, bonds, hedged EREITs, and hedged AREITs. The portfolios at the lower end of the risk/return spectrum involve substantial allocations for the HEREITs. For the higher end of this spectrum, there is no portfolio allocation for HEREITs, but some for HAREITs. For instance, the portfolio with 3.8% mean return allocates 60% for bonds, 34% for stocks, and only 6% for HAREITs. For

portfolios of higher mean returns, there is a dramatic substitution in the allocations for stocks and bonds, and no allocation for either the HEREITs or the HAREITs.

Panel D reports efficient portfolios of stocks, bonds, hedged EREITs, and double-hedged AREITs. All efficient portfolios allocate no investments for HEREITs. On the other hand, the lower risk/return portfolios involve substantial allocation for the HHAREITs. For instance, the portfolio with the return of 3.4% has an allocation of 51% for bonds, 26% for stocks and 23% for HHAREITs. Interestingly, the portfolio allocations pertaining to the four sampled returns in Panel D are very similar to those in Panel A. Notably, the allocation for HHAREITs (Panel D) and the allocation for apartments (Panel A) are almost identical. This evidence is consistent with the notion that the double-hedged index is an effective proxy for apartment real estate.

The overall evidence in Exhibit 5 indicates that apartment real estate is a potential candidate in efficient mixed-asset portfolios alongside stocks, bonds and real estate in general.

Summary and Conclusions

This study investigates the performance of apartment real estate and assesses its usefulness in efficient mixed-asset portfolios. For this purpose, a hedged apartment REIT index is constructed by removing the return components of stocks in general and non-apartment equity REITs from returns of equity REITs that invest in apartment real estate. The resulting "double-hedged" apartment REIT index is found to satisfactorily track the performance of appraisal-based apartment real estate. Furthermore, the hedged apartment REIT index does not suffer from the appraisal-smoothing problem and the apparent seasonality of appraisal-based indices such as the Russell-NCREIF apartment index. Therefore, the hedged apartment REIT index can be used as a proxy for apartment real estate for mixed-asset portfolio decisions. The asset allocation results indicate that apartment real estate is a potential candidate in efficient mixed-asset portfolios. Therefore, ignoring the role of apartment real estate in efficient mixed-asset portfolios may result in suboptimal asset allocations.

Notes

[1]The 10% minimum is small. However, there are only a few REITs that invest exclusively in apartments. Moreover, the double-hedged apartment REIT returns, which proxy for apartment real estate performance, are calculated by removing the general influences of the stock market and equity REITs. The desire to have a reasonable sample size and the ability to remove non-apartment components from the sample apartment REITs make the 10% minimum acceptable to us.

[2]While the Russell-NCREIF total return index began in 1978, its official apartment subindex did not begin until 1988. The data for the apartment subindex was back-filled for the 1978–1987 period.

[3]Giliberto (1993) provides an alternative to compute the hedged REIT index.

[4]A similar forecasting model was used by Giliberto (1993).

[5]Our sample period of 1Q82–4Q93 also includes the longest bull market for stocks and bonds. Due to the fall in interest rates, stocks and bonds delivered relatively high returns in this period.

[6]A first-order autoregressive process was identified in the regression residuals, and the coefficients were estimated accordingly.

[7]Because of exceptionally strong performance of stocks and bonds relative to real estate in the sample period, many efficient portfolios do not contain any real estate.

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