PORTFOLIO ALLOCATIONS TO REAL ESTATE: ANOTHER STORY

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PORTFOLIO ALLOCATIONS TO REAL ESTATE: ANOTHER STORY

Almost 25 years ago Friedman (1970) demonstrated that unsecuritized real estate, because of its relatively high risk-adjusted return and low correlations with stocks and bonds, receives substantial allocations in efficient, mixed-asset portfolios. Fisher and Sirmans (1994) argue that these attractive features of real estate still exist today. In recent empirical work by Mei and Lee (1994), the presence of a unique real estate factor is detected in securitized and unsecuritized real estate returns that cannot be captured by investing in other assets.

Support for portfolio allocations to real estate of 15 to 20 percent is widespread in the literature from the 1980s (Brueggeman, Chen, and Thibodeau 1984; Folger 1984; Zerbst and Cambon 1984; Webb and Ruebens 1987; Irwin and Landa 1987; and Firstenberg, Ross, and Zisler 1988; and Goetzmann and Ibbotson 1990). Skepticism about the similarity between the 'true' return to real estate and the published real estate return series fed to portfolio models remains a serious issue, however. The current attention given to improving real estate return measures is driven by the desire to explain the inconsistencies between reported portfolio weights to real estate (i.e., less than five percent) and normative portfolio outcomes; and to find the best possible proxy of the 'true' return on unsecuritized real estate.

The literature of recent years has followed three paths; work on recovering the true return on real estate from appraisal-based return series (Giliberto 1988; Geltner 1989a; Geltner 1989b; Geltner 1990; Gau and Wang 1990; Geltner 1991a; Giaccotto and Clapp 1992; Geltner 1993a; Geltner 1993b; and DeWit 1993), efforts to construct real estate return series from unsecuritized property transactions (Hoag 1980; Miles, Hartzell, Guilkey, and Sears 1991; Geltner 1991b; Corgel and deRoos 1992; and Fisher, Geltner, and Webb 1994), and attempts to learn about the true returns on unsecuritized real estate from the securitized real estate markets.[1] The desired destination of each path is a return series that, when introduced into portfolio models, yields the correct allocation to real estate. This paper broadens the path of recovering the true return series from appraisal-based return series by examining its portfolio allocation implications.

RELEVANCE OF UNSMOOTHING

Recovery of the true return series from appraisal-based returns involves overcoming the well-known problem of 'smoothing' in the second moment of appraisal-based series by imposing a model that produces a unsmoothed-return series from the reported-return series. In principle, an unsmoothing model inflates the standard deviation of real estate returns, but does not change the mean return because the mean of an appraisal-based return series is an unbiased estimate of the true mean (Geltner 1989a; and Gau and Wang 1990). Because unsmoothing increases the variability of the return series, holding all other parameters constant, the allocation to real estate declines in mixed-asset portfolios. This relationship has been demonstrated when *ad hoc* adjustments are made to the standard deviation of real estate returns (Hartzell 1986; and Webb and Ruebens 1987) and when an appraisal-based return series from the UK is unsmoothed by Newell and Brown (1994) who

[1] See Corgel, McIntosh, and Ott (1995) for a review of this literature.

show sharp declines when the unsmoothed series is substituted for the reported series.

Geltner (1993) unsmooths two appraisal-based return series from the U.S. using a comprehensive unsmoothing technology. A comparison of the parameters from the distribution of reported values and unsmoothed values shows the mean values decline by 5.0% and 56.1% and the standard deviations increase by 68.1% and 84.0%. No direct implications for mixed-asset portfolio construction are provided.

We are motivated to investigate the consequences of using an unsmoothed appraisal-based return series in mixed-asset portfolio formation by our interest in finding answers to the following practical questions:

1. If the mean of the reported series is an unbiased estimate of the true mean, then what is the correct interpretation of the mean from an unsmoothed series?

2. Are allocations to real estate in the market portfolio statistically different when a smoothed series is introduced in place of a reported series for all asset correlation regimes and risk-free rate levels?

Generally, this paper brings into question the relevance of smoothing in a portfolio context. We test the null hypothesis that there is no significant difference in the allocations to real estate in mixed-asset portfolios when the value component of the return series is smoothed and unsmoothed.

The remainder of this paper is organized into four sections. In the next section, the relationships between the standard deviation of an asset, its weight in the portfolio, and the correlations among assets are analytically derived. The section to follow reports on our empirical work to develop an unsmoothed return series. Then, we compare asset allocations using this series to the allocations achieved using a reported, appraisal-based series. The concluding section offers guidance to those who would use unsmoothed real estate return series in portfolio formation models.

THE PORTFOLIO MODEL[2]

Assume a portfolio model that is comprised of two risky assets and a risk-free asset. The mean return of the portfolio and the variance are:

$$r_p = w_1 \; r_1 + (1-w_1) \; r_2 \quad (1)$$

where:

r_p = Portfolio return
w_1 = Percentage of the portfolio invested in Asset 1
r_1 = Return to Asset 1 (real estate)
r_2 = Return to Asset 2

$$Var_p = w_1^2 \sigma_1^2 + (1-w_1)^2 \sigma_2^2 + 2w_1 (1-w_1) \rho_{12} \sigma_1 \sigma_2 \quad (2)$$

where:

Var_p = Variance of the portfolio
σ_1 = Standard deviation of the returns to Asset 1
σ_2 = Standard deviation of the returns to Asset 2
ρ_{12} = Correlation between the returns to Asset 1 and Asset 2

If the portfolio objective is to maximize the Sharpe Ratio (S_p);

$$S_p = \frac{(r_p - r_f)}{Var_p} \quad (3)$$

where r_f is the Risk-free rate, then solving for the w_1 that maximizes S_p gives

[2] This section is based on the development in Bodie, et. al. (1993) pp. 208-211. Waterloo Maple Software (1994) is used as a computational aid for solving the equations in this paper.

$$w_1 = \frac{\sigma_2(r_f \rho_{12} \sigma_1 + r_1 \sigma_2 - r_f \sigma_2 - r_2 \rho_{12} \sigma_1)}{\sigma_1^2(r_1 - r_f) + \sigma_2^2(r_2 - r_f) + \rho_{12} \sigma_1 \sigma_2(2r_f - r_1 - r_2)} \tag{4}$$

The weight in Equation (4) is the optimal weight to one of the risky assets. Numerically, the optimal weight is derived from the data that underlie its calculation.

Conventional wisdom holds that the standard deviation of appraisal-based real estate returns is understated, which suggests that the optimal weight is misspecified, and incorrect asset allocation decisions result. Thus, the change in the optimal weight to real estate; given a change in the standard deviation is an important relationship.

Generally, this relationship is found by taking the partial derivative of w_1 with respect to σ_1.

$$\frac{\partial w_1}{\partial \sigma_1} = \sigma_2 [\rho_{12} \sigma_1^2(r_f^2 + r_2^2 - 2 r_f r_2) + 2 (r_f \sigma_2 (r_2 - r_f + r_1) - r_1 r_2 \sigma_1) + \sigma_2 \rho_{12} (r_f^2 + r_1^2 - 2 r_1 r_f)] / [\rho_{12} \sigma_1 \sigma_2 (2r_f - r_1 - r_2) + \sigma_2^2 (r_1 - r_f) + \sigma_1^2 (r_2 - r_f)]^2 \tag{5}$$

A plot of this function is shown as Exhibit 1, allowing ρ_{12} to vary from -0.6 to 0.6 and the following values for the remaining parameters.

r_1	=	5.9%	(NCREIF annual return)
r_2	=	13.2%	(S&P 500 annual return)
σ_1	=	6.4%	(NCREIF annual volatility)
σ_2	=	12.1%	(S&P 500 annual volatility)
r_f	=	5.0%	(Risk Free annual return)

The values of the parameters are calculated from the reported quarterly NCREIF Series and the S & P 500 over the period from 1981 through the second quarter of 1994.

Note that the partial derivative is *not* negative over the entire range, becoming positive at correlations above 0.4. Verification that the partial derivative switches signs in the way shown in Exhibit 1 is achieved for a wide range of parameter values.

Exhibit 2 shows the optimal value of w_1, allowing σ_1 to vary from 0.01 to 0.12 and allowing ρ_{12} to vary from -0.6 to 0.6. Note that the weight is very sensitive to both parameters. Exhibit 2 reveals the tendency for the weight to real estate (w_1) to fall as the standard deviation increases, holding the correlation constant. We *cannot* however, state that the effect of unsmoothing is to reduce the portfolio weight to real estate because the direction and magnitude in the change in ρ_{12} are unknown as the result of unsmoothing the real estate return series.

Some conclusions, however may be drawn from Exhibit 2. In general, the portfolio weight to real estate declines as the result of unsmoothing, unless the correlation between real estate and stocks declines significantly. In addition, the weight may go to zero, as shown by the 'flat' area in Exhibit 2.

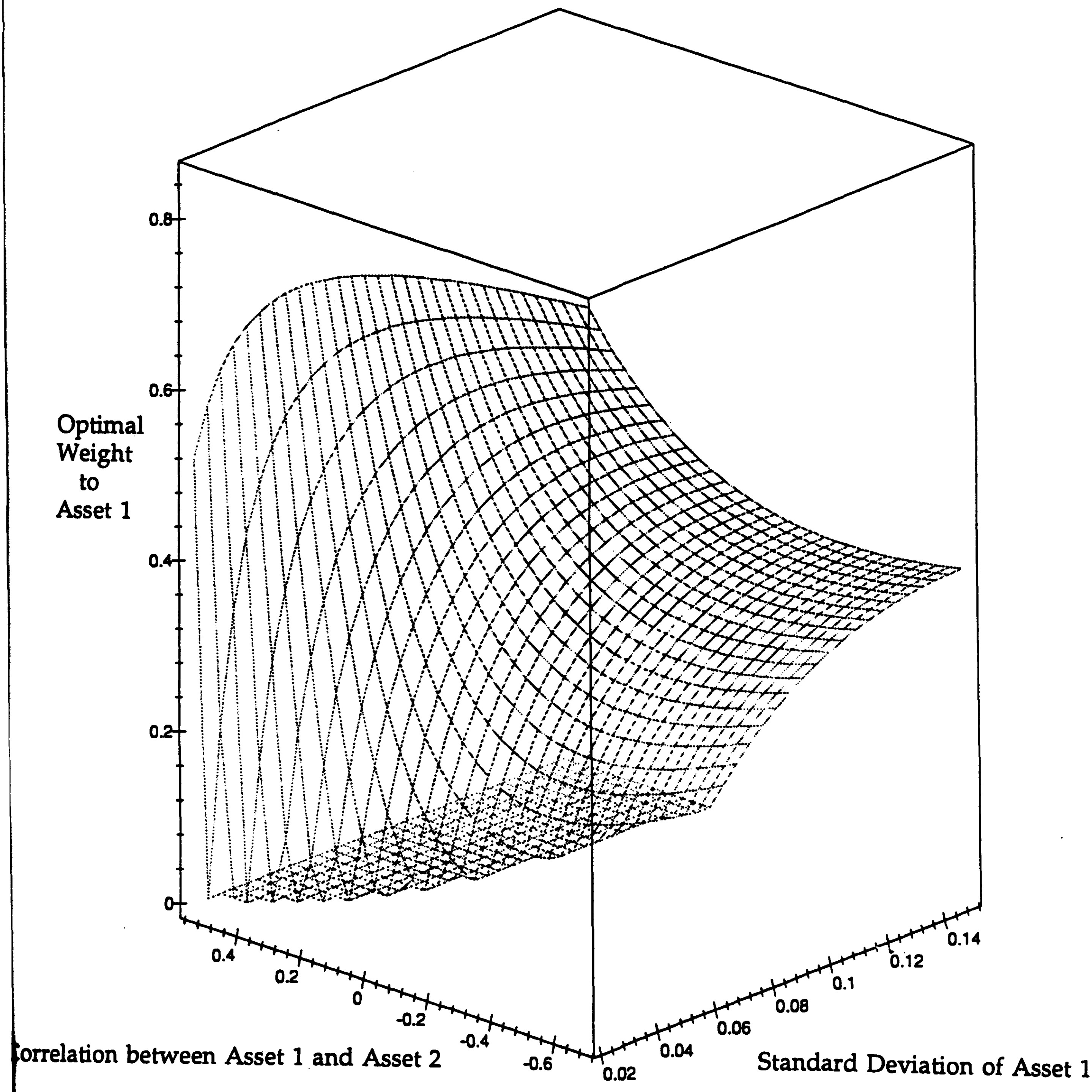
RECOVERY OF THE UNDERLYING RETURNS

Smoothing of the second moment of the appraisal-based return series occurs at the individual property level. Quan and Quigley (1991) show that the extent of smoothing is proportional to the weights professional appraisers place on estimates of value from past appraisals relative to the weights they place on current period transactions of comparable properties. Let V_{t-1}^* be the appraised value in the previous period and V_t^e represent an estimate of value in the current period derived from transaction prices. Then, the current-period appraised value, V_t^*, is given by

$$V_t^* = \alpha V_t^e + (1-\alpha) V_{t-1}^* \qquad (6)$$

EXHIBIT 2

PLOT OF THE OPTIMAL WEIGHT OF ASSET 1, ALLOWING THE STANDARD DEVIATION OF ASSET 1 AND THE CORRELATION BETWEEN ASSET 1 AND ASSET 2 TO VARY



where α is the appraiser confidence factor (i.e., reliance on past appraisals) which may take values between 0 to 1.[3] If $\alpha = 0$, the value component of the return series exhibits perfect, positive, first-order autocorrelation and volatility is induced entirely by appraisers updating estimates of market values.

The problems of understated volatility and positive autocorrelation are exacerbated when multi-period aggregate indexes are created from individual property values and not every property is appraised during every period. This problem is known as *temporal aggregation*. Also, appraisals may be bunched in some periods, which further increases autocorrelation but counteracts the understatement of volatility. This problem is known as *seasonality*.

In Geltner (1993) the underlying return on real estate is modelled as

$$r_t^{**} = a\, r_t^{u} + (1-a)\, r_{t-1}^{**} \tag{7}$$

$$= a\, r_t^{u} + (1-a)\, r_{t-1}^{**} + a(a-1)\, r_{t-2}^{**} + \ldots$$

which can be inverted to recover the underlying return as

$$r^{u}_t = (r_t^{**} - (1-a)\, r_{t-1}^{**}) \,/ a \tag{8}$$

where:

r_t^{**} = reported index return for period t;
r_t^{u} = underlying return for period t;
$r^{**}_{(t-1,2,\ldots)}$ = reported return for periods prior to period t.

The parameter 'a' collects the effect of appraisal smoothing at the disaggregate level,

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[3] This equation is slightly different from the original Quan and Quigley (1991) equation. The interpretations of α and $(1-\alpha)$ are reversed to coincide with the notation in Geltner (1993).

represented as the parameter 'α' in Equation 6, and the combined effect of temporal aggregation and seasonality, which are represented by the parameter 'f' in Geltner (1993), *the fraction of properties reappraised in each period that is not a regularly* scheduled reappraisal period (e.g., the first three quarters of an annual cycle). Values for 'a' are derived from suitable values for 'α' and 'f'.[4]

Using Equation (8), Geltner (1993) recovers an *annual* capital appreciation return series using a = 0.4, which is based on α = 0.5 and f = 0.15. He calls this series a "value level index." In addition, an upper and lower bound for the "value level index" is produced using a = 0.5 and a = 0.33. Our objective in unsmoothing the Russell-NCREIF data is the same as Geltner (1993), but we approach recovery in two different ways. First, our methodology recovers total returns to real estate (i.e., income returns plus appreciation returns). Second, *quarterly* instead of annual returns are recovered. This involves full utilization of the data and conforms to how many practitioners use the published Russell-NCREIF data (i.e., portfolio models are run with quarterly returns). Recovery involves the following steps:

1. Equation (8) is restated as Equation (9) substituting the appreciation index values instead of appreciation returns to recover the underlying value.

$$V_t^u = (V_t^{**} - (1-a)\, V_{t-1}^{**}) \,/\, a \qquad (9)$$

where:

V_t^{**} = reported appreciation index value in year t
V_{t-1}^{**} = reported appreciation index value in year t-1
V_t^u = underlying appreciation index value in year t

[4] See Appendix A in Geltner (1993).

Equation (9) is calculated for each quarter from using data from the first quarter of 1980 through the second quarter of 1994. The use of this model results in the loss of the recovered index values for 1980.

2. The quarterly difference in the recovered appreciation index values are taken to produce a recovered percentage appreciation return.

3. The recovered appreciation return and reported income return are added to produce a recovered total return series. No 'recovery' operation is performed on the reported income return as there is no evidence to suggest that incomes are either biased or smoothed.[5]

STATISTICS AND PORTFOLIO ALLOCATIONS

Exhibit 3 and Exhibit 4 present statistics for the reported Russell-NCREIF Property Index (RNI), the Standard and Poors 500 Index, the Lehman Brothers Government and Corporate Bond Index, the T-Bill Index, and the return index recovered from the RNI. The results in Exhibit 3 are identical to those in Exhibit 4 except that the recovered series are derived by assuming that $a = 0.40$ and $a = 0.24$, respectively.

The value of $a = 0.4$ is used to be consistent with Geltner (1993). The value of $a = 0.24$ is derived using $\alpha = 0.25$ and $f = 0.15$.[6] In both cases, the volatility of the annualized recovered series is well above that of the reported series, and the magnitude of the increase is greater for $a = 0.24$, as expected. The volatility of the recovered series when $a = 0.24$ exceeds the volatility of stocks. Also note that the mean returns for the reported and recovered series are slightly different.

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[5] The reported data and recovered data are presented in Appendix A.

[6] deRoos (1994) finds that appraisers form current value opinions by placing 75% of the weight on previous appraisals and 25% of the weight on current transaction prices in an empirical test of equation (6).

EXHIBIT 3

ANNUAL AND QUARTERLY STATISTICS FOR REPORTED AND RECOVERED REAL ESTATE SERIES AND STOCKS, BONDS, AND T-BILLS ASSUMING a = .40

Annualized Results from 1981 - 1994

Returns and Standard Deviations	Mean Return	Standard Deviation
Real Estate	5.898	6.386
S & P 500	13.186	12.140
Bonds	10.693	8.558
Treasury Bills	7.260	3.132
Recovered R. E.	5.405	10.943

Correlations	Real Estate	S&P 500	Bonds	Recovered Real Estate
Real Estate	1	-0.1108	0.06568	0.79495
S & P 500	-0.1108	1	0.66975	-0.38529
Bonds	0.06568	0.66975	1	-0.36238

Quarterly Results from 1981 - 1994	Real Estate		S & P 500		Bonds		91 Day Treasury		Recov. Real Estate	
	Return	Std. Dev	Return	Std. Dev	Return	Std. Dev	Return	Std. Dev	Return	Sdt. Dev
All Quarters	1.440	1.853	3.523	7.840	2.894	3.596	1.82	0.7371542	1.172	3.295
10 Years,1980 - 1989	2.342	1.086	4.183	8.611	3.318	3.926	2.13	0.6504513	2.088	2.217
10 Years,1984 - 1994	0.764	1.645	3.752	7.901	2.520	3.005	1.47	0.4533247	0.416	3.190
5 Years, 1980 - 1984	3.150	1.109	2.941	7.925	3.842	4.779	2.68	0.5919757	3.086	2.822
5 Years, 1990 - 1994	-0.316	1.789	2.239	6.091	2.070	2.767	1.71	0.2741355	-0.609	4.278
10 Quarters; 92, 93, 1&2 of 94	-0.105	1.577	1.389	2.833	1.382	2.915	1.21	0.4681714	1.530	2.963

Correlations	R. E. and S&P	R. E. and Bonds	S&P and Bonds	Rec. R. E. and S&P	Rec. R. E. and Bonds
All Quarters	-0.081	0.042	0.389	-0.180	-0.255
10 Years,1980 - 1989	-0.145	0.057	0.329	-0.234	-0.285
10 Years,1984 - 1994	-0.021	-0.029	0.244	-0.093	-0.282
5 Years, 1980 - 1984	-0.248	-0.187	0.691	-0.423	-0.504
5 Years, 1990 - 1994	-0.415	-0.393	0.566	-0.345	-0.561
10 Quarters; 92, 93, 1&2 of 94	-0.538	-0.158	0.658	-0.147	-0.410

a= 0.40

Data Source: NCREIF

EXHIBIT 4

ANNUAL AND QUARTERLY STATISTICS FOR REPORTED AND RECOVERED REAL ESTATE SERIES AND STOCKS, BONDS, AND T-BILLS ASSUMING a = .24

Annualized Results from 1981 - 1994

Returns and Standard Deviations	Mean Return	Standard Deviation
Real Estate	5.898	6.386
S & P 500	13.186	12.140
Bonds	10.693	8.558
Treasury Bills	7.260	3.132
Recovered R. E.	5.245	19.823

Correlations	Real Estate	S&P 500	Bonds	Recovered Real Estate
Real Estate	1	-0.1108	0.06568	0.57613
S & P 500	-0.1108	1	0.66975	-0.44953
Bonds	0.06568	0.66975	1	-0.47195

Quarterly Results from 1981 - 1994	Real Estate		S & P 500		Bonds		91 Day Treasury		Recov. Real Estate	
	Return	Std. Dev	Return	Std. Dev	Return	Std. Dev	Return	Std. Dev	Return	Sdt. Dev
All Quarters	1.440	1.853	3.523	7.840	2.894	3.596	1.82	0.7371542	0.975	6.141
10 Years,1980 - 1989	2.342	1.086	4.183	8.611	3.318	3.926	2.13	0.6504513	1.850	3.665
10 Years,1984 - 1994	0.764	1.645	3.752	7.901	2.520	3.005	1.47	0.4533247	0.151	6.479
5 Years, 1980 - 1984	3.150	1.109	2.941	7.925	3.842	4.779	2.68	0.5919757	3.064	4.758
5 Years, 1990 - 1994	-0.316	1.789	2.239	6.091	2.070	2.767	1.71	0.2741355	-0.725	9.157
10 Quarters; 92, 93, 1&2 of 94	-0.105	1.577	1.389	2.833	1.382	2.915	1.21	0.4681714	4.350	6.843

Correlations	R. E. and S&P	R. E. and Bonds	S&P and Bonds	Rec. R. E. and S&P	Rec. R. E. and Bonds
All Quarters	-0.081	0.042	0.389	-0.182	-0.325
10 Years,1980 - 1989	-0.145	0.057	0.329	-0.238	-0.358
10 Years,1984 - 1994	-0.021	-0.029	0.244	-0.104	-0.335
5 Years, 1980 - 1984	-0.248	-0.187	0.691	-0.442	-0.546
5 Years, 1990 - 1994	-0.415	-0.393	0.566	-0.274	-0.549
10 Quarters; 92, 93, 1&2 of 94	-0.538	-0.158	0.658	0.095	-0.401

a= 0.24

Data Source: NCREIF

The reported and recovered real estate series are highly correlated, but not nearly perfectly correlated, especially in the case when a = 0.24. In both cases however the correlation between stock and bond returns and real estate returns is substantially more negative for the recovered series than the reported series.

Overall, the relationships among the return series are similar when the statistics are calculated using quarterly data and annual data. However, the increases in volatility in the recovered series relative to the reported series are far more dramatic with quarterly data as are the shifts in the mean returns.[7] In addition, the statistics vary greatly between reported and recovered real estate series for the most recent periods of the 1990s.

Exhibit 5 reports portfolio allocations to real estate using Equation (4) for the period 1981 through the second quarter of 1994 and for the last ten quarters ending in the second quarter of 1994. Allocations are shown for the reported and the two recovered series (i.e., a = 0.24, 0.40). In addition, two sets of results are presented. In the first the mean return generated by the recovery process is used, while in the second the mean of the reported series return is used.

As others have found, the allocation to real estate that we calculate using reported Russell-NCREIF data is excessive by real-world standards. The allocations decline to more reasonable levels of 3.49 to 19.20 percent using the recovered series. If, however, we accept that the reported mean is unbiased and use the reported mean with the recovered standard deviation and correlation, then the allocations remain

[7] The shift in the mean return is consistent with the evidence presented in Geltner (1993). See Exhibit 8 of that paper.

EXHIBIT 5

OPTIMAL ALLOCATIONS TO REAL ESTATE USING REPORTED AND RECOVERED RUSSELL-NCREIF QUARTERLY RETURNS, 1981-1994(2Q's)

	Mean Return (%)		Standard Deviation (%)			
	Real Estate	Stocks	Real Estate	Stocks	ρ	Allocation to Real Estate (%)
ALL QUARTERS						
Recovered Mean						
Reported	1.44	3.52	1.85	7.84	-0.08	64.13
Recovered, a = .24	0.98		6.14		-0.18	3.49
Recovered, a = .40	1.17		3.30		-0.18	19.20
Reported Mean						
Reported	1.44	3.52	1.85	7.84	-0.08	64.13
Recovered, a = .24			6.14		-0.18	26.56
Recovered, a = .40			3.30		-0.18	46.53
LAST TEN QUARTERS						
Recovered Mean						
Reported	-0.11	1.39	1.58	2.83	-0.54	78.85
Recovered, a = .24	4.35		6.84		0.10	90.54
Recovered, a = .40	1.53		2.96		-0.15	58.65
Reported Mean						
Reported	-0.11	1.39	1.57	2.83	-0.54	78.85
Recovered, a = .24			6.84		0.10	0.00
Recovered, a = .40			2.96		-0.15	99.50

high. Also, the recovery process and allocations are unreliable and unreasonable using data from the last ten quarters.

CONCLUSION

Because appraisal-based indexes of real estate return are widely accepted and the characteristics these indexes are not reflective of the characteristics of the true return on real estate due to temporal aggregation, seasonality, and appraisal smoothing, models have been proposed to recover the underlying return series from the reported series. The recovered series should have a mean equal to the mean of the reported series and a larger standard deviation. Conventional wisdom dictates that the true portfolio allocation to real estate in a mixed asset portfolio is lower than the allocation estimated using the reported series.

We derive $\partial w/\partial \sigma$ from a two-asset model and examine its behavior over the range of possible asset return correlations. As expected, $\partial w/\partial \sigma$ is negative at most values of ρ, but turns positive and ill-behaved for $\rho > 0.4$. This result implies that recovery of the underlying return to real estate is relevant if the correlations between real estate and the other assets in the portfolio are less than 0.40. We provide no evidence to suggest that these correlations are increasing.

Our empirical findings are as follows:

1. The technology used to produce the recovered series creates a bias in the mean return. The mean of the recovered return series is biased in the opposite direction of the path of asset prices.

2. Using the biased mean, the allocations to real estate fall from unreasonably high levels (e.g., greater than 60%) with reported returns to reasonable levels (e.g., 3% to 19%) with the recovered series.

3. Using the unbiased reported mean and the standard deviation from the recovered series, the allocations to real estate remain high relative to the allocations with the reported series.

4. Recovery is successful in producing allocations to real estate that match observed allocations when long-term data series are used in the models, but unsuccessful for shorter periods.

The Geltner (1993) methodology does not allow recovery of a total return series useful in portfolio allocation models. We demonstrate that it is possible to extend his methodology to recover a quarterly total return series. This recovered series is highly dependent on a single parameter, 'a', which is a function of the amount of appraisal smoothing, seasonality, and temporal aggregation in the reported Russell-NCREIF data.

Future research should focus on methods to eliminate the mean return bias introduced by the recovery technology. The work should be extended (1) to a mixed asset portfolio containing a standard set of financial investments (e.g. stocks bonds, treasuries, and real estate) and (2) to asset type and geographic subdivisions within real estate to determine if there are any differential effects.

APPENDIX A

REPORTED AND RECOVERED RUSSELL-NCREIF DATA

A	B	C	D	E	F	G
	Russell	Russell	Russell	Recovered	Recovered	Recovered
	NCREIF	NCREIF	NCREIF	Appreciation	Appreciation	Total
	Reported	Reported	Reported	Value	Return	Return
	Total	Income	Appreciation			G=C+F
YYQ	Return	Return	Value	Produced using a=0.24		
801	5.53	2.07	122.73			
802	2.36	2.07	123.08			
803	3.79	2.02	125.25			
804	5.32	1.99	129.43			
811	2.96	1.94	130.74	156.11		
812	4.23	2.07	133.57	166.79	6.84	8.91
813	3.42	1.91	135.59	168.33	0.93	2.84
814	5.29	1.91	140.17	174.18	3.47	5.38
821	2.49	1.87	141.05	173.70	-0.28	1.59
822	2.07	1.94	141.24	165.53	-4.70	-2.76
823	1.52	1.88	140.73	157.01	-5.15	-3.27
824	3.04	1.98	142.21	148.67	-5.31	-3.33
831	1.72	2.00	141.82	144.26	-2.97	-0.97
832	2.73	1.95	142.92	148.24	2.76	4.71
833	3.11	1.82	144.77	157.56	6.29	8.11
834	5.18	1.80	149.65	173.21	9.93	11.73
841	3.02	1.72	151.58	182.49	5.36	7.08
842	3.50	1.88	154.05	189.30	3.73	5.61
843	2.43	1.77	155.08	187.73	-0.83	0.94
844	3.50	1.80	157.70	183.19	-2.42	-0.62
851	1.94	1.75	157.99	178.29	-2.68	-0.93
852	2.39	1.91	158.75	173.63	-2.61	-0.70
853	2.46	1.86	159.69	174.29	0.38	2.24
854	2.96	1.79	161.56	173.78	-0.29	1.50
861	1.61	1.80	161.26	171.62	-1.25	0.55
862	1.75	1.85	161.11	168.58	-1.77	0.08
863	1.35	1.73	160.49	163.02	-3.30	-1.57
864	1.77	1.71	160.59	157.52	-3.38	-1.67
871	1.41	1.75	160.04	156.18	-0.85	0.90
872	0.25	1.71	157.72	146.99	-5.89	-4.18
873	2.25	1.72	158.56	152.45	3.72	5.44
874	1.65	1.68	158.51	151.92	-0.34	1.34
881	1.42	1.71	158.05	151.75	-0.12	1.59
882	1.71	1.77	157.96	158.72	4.59	6.36
883	2.01	1.69	158.47	158.19	-0.34	1.35
884	1.72	1.71	158.49	158.43	0.15	1.86
891	1.41	1.68	158.06	158.09	-0.21	1.47
892	1.56	1.66	157.89	157.67	-0.27	1.39
893	1.84	1.58	158.30	157.76	0.06	1.64
894	1.27	1.63	157.74	155.37	-1.52	0.11
901	1.19	1.60	157.09	154.02	-0.87	0.73
902	1.34	1.64	156.62	152.60	-0.92	0.72
903	0.55	1.59	155.00	144.55	-5.27	-3.68
904	-1.60	1.71	149.87	124.95	-13.56	-11.85
911	-0.14	1.64	147.21	115.92	-7.22	-5.58
912	-0.03	1.73	144.61	106.58	-8.06	-6.33
913	-0.75	1.66	141.12	97.17	-8.83	-7.17
914	-5.20	1.71	131.37	72.79	-25.09	-23.38
921	-0.15	1.79	128.83	70.63	-2.97	-1.18
922	-0.83	1.94	125.26	63.99	-9.40	-7.46
923	-0.52	1.85	122.29	62.66	-2.07	-0.22
924	-3.74	1.93	115.36	64.66	3.19	5.12
931	0.68	2.07	113.76	66.04	2.13	4.20
932	-0.52	2.03	110.85	65.22	-1.24	0.79
933	1.08	2.08	109.74	70.00	7.33	9.41
934	-0.36	2.20	106.93	80.24	14.62	16.82
941	1.67	2.14	106.43	83.22	3.72	5.86
942	1.65	2.24	105.80	89.81	7.92	10.16

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