Real Estate Performance Attribution: Pure Theory Meets Messy Reality

Authors Michael S. Young and Susan Annis

Abstract

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The popularity of performance attribution in the publicly-traded equities arena may soon spill over to real estate markets. With that in mind, this study analyzes the practical and statistical problems that may arise when real estate managers apply this technique to their portfolios. The study involves three data sets: a portfolio of publicly-traded REITs, a single-client separate account and a multi-client private REIT. The findings indicate that there is no clear distinction between stock selection and sector allocation in any of the data sets (*i.e.*, the portfolio impact of the manager's sector allocation and asset selection decisions are, on average, indistinguishable). Also, for the publicly-traded REIT portfolio (the only data set with sufficient sample size), the monthly returns attributed to stock selection versus sector allocation do not display significant serial persistence (*i.e.*, the manager cannot consistently attribute the portfolio returns to either the stock selection or sector allocation decision).

Introduction

As sure as day follows night, real estate performance attribution follows the development of benchmarks. Although there is considerable disagreement as to the suitability of the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index (NPI) as a performance benchmark for private real estate portfolios, the handwriting is on the wall; the NPI will become a benchmark owing to the demand by investors and their consultants to have one. Publicly-traded real estate investment trusts (REITs) and real estate operating companies (REOCs) have several readily available benchmarks from National Association of Real Estate Investment Trusts (NAREIT), Wilshire Associates and others against which they can be compared. Once there is acceptance of a benchmark, the natural question is: What should be benchmarked? The answers seem to be that managers

should outperform the benchmark and that they should be compared with one another for purposes of selection and retention.

Using the precedent set in the publicly-traded equities arena, the authors expect that performance attribution will be a likely extension of benchmarking. In particular, investors will want to learn the reasons why a manager of real estate assets has outperformed or underperformed the benchmark. Was the difference due to the selection of a particular property type or by making particular locational choices, the only two dimensions that are routinely published in the NPI? In the real estate securities area, property type sectors and individual security selection analysis parallel the approach used elsewhere in equities.

After surveying the literature and discussing the theory behind performance attribution analysis, this study proceeds to the practical aspects of implementing the theory. It begins with the largest data set available to the authors, a large portfolio of publicly-traded REITs held by a single manager for multiple accounts. Being monthly data, this set provides a starting point most similar to the extant literature. Private equity real estate, however, is much more messy in terms of manager mandates, frequency of reporting, and practicality of making timely adjustments to the portfolio. Thus, this study examines two actual portfolios of equity real estate assets, one a single-client separate account and the other a multi-client private REIT.

While the mechanics of computing performance attribution are straightforward, the practical problems surrounding prescriptions that might derive from the calculations are, as indicated by this study, insurmountable, thereby calling into question the wisdom of embarking on this activity for either publicly-traded or privately-held equity real estate.

Previous Research

In the early 1950s, Harry Markowitz introduced the theoretical foundation underlying the portfolio management process, which later became known as modern portfolio theory (MPT). Various theories have evolved over the past several decades that provide securities advisors with strategies to manage their portfolios. In the mid-1980s, real estate investors looked to MPT to understand the risk exposure of real estate portfolios. Many of the techniques and terminology of MPT have been adopted for real estate portfolios, although their application remains problematic (Young and Graff, 1995). Most recently, the applications of portfolio performance measurement techniques, following their application in the securities markets, have received attention in the real estate community as investors and their consultants seek better ways to understand the factors underlying manager performance, whether good or bad.

The goal of performance attribution is to identify the portfolio impact of the portfolio manager's sector allocation and asset selection decisions. The first performance attribution methodologies were exemplified by Brinson and Fachler

(1985) and Brinson, Hood and Beebower (1986). They illustrated accounting decompositions, or performance attribution, that could be applied at the pension plan level (across managers) or at the individual manager level. Their research focused on performance attribution developed to provide pension plan sponsors and investment managers a method of attributing returns to those factors that compose the investment management process––investment policy, market timing and security selection.

In one approach to attribution analysis, the design of a portfolio involved the selection of asset classes within a portfolio, a determination of the normal or long-term weights for each of the asset classes, alteration of the investment weights from the baseline in order to capture excess returns from short-term fluctuations in asset class prices (market timing) and selection of individual securities within an asset class to achieve superior returns relative to that asset class (security selection). Brinson, Singer and Beebower (1991) revisited their investigation and expanded performance attribution to account not only for security selection and active asset allocation, but also for changes in portfolio risk characteristics attributable to risk within individual asset classes.

A second group of attribution methodologies incorporated some measure of risk into performance attribution measures. Fama (1972) was the first to include an explicit analysis of incremental risk relative to the benchmark by separating a component that measures a manager's skill level from a component that accounts for the underlying risk in the portfolio. Ankrim (1992) built upon this analysis and attempted to make adjustments to remove excess returns that would have been expected, given the manager's risk exposure. Singer (1996a) studied component risk analysis by the Sharpe ratio, by the Treynor ratio and by Fama decomposition. Singer (1996b) revisited attribution analysis and provided a framework for attributing portfolio performance to market, currency allocation and security selection decisions.

Following this work, Hamilton and Heinkel (1995) were the first to apply attribution analysis exclusively to a real estate portfolio. They relied on quarterly data for a sample of sixteen managers provided jointly by Frank Russell Canada Ltd. and the Institute of Canadian Real Estate Investment Managers (ICREIM). The Russell Canadian Property Index (RCPI) was the benchmark. The analysis used both property type and property location as asset groupings, and property selection as the analogous security selection factor. Their analysis suggested that diversification by property type or location type offers some potential risk reduction. Additionally, the analysis suggested that real estate managers contribute their largest benefit or losses through property selection.

Finally, more recent variations to the attribution framework include studies by Higgs and Goode (1993), Liang, Hess, Bradford and McIntosh (1999) and Burnie, Knowles and Teder (1998). Higgs and Goode provide a framework for determining the relative contributions of active asset allocation and stock selection based on an allocation process that includes ex ante target active returns for stock selection.

Liang, Hess, Bradford and McIntosh offer another refinement to the previous return attribution approach. Their framework introduces a ''neutral effect'' and ''net value added'' factor, both of which add no new information at the portfolio level, but allow a different interpretation of the decomposition of the sector returns into selection and allocation contributions at the sector level. Their research also suggests a modified presentation format to report both single- and multi-period return attributes. Burnie, Knowles and Teder deviate from previous research and present geometrically formulated (versus arithmetically formulated) attribution, which defines the ''management effect'' as the ratio of fund return factor to benchmark return factor.

Data

The data for this study consists of three real estate portfolios: a large portfolio of publicly-traded REITs held by a single manager for multiple accounts, a single-client separate account and a multi-client private REIT.

The portfolio of publicly-traded REITs includes forty-seven separate accounts and one commingled fund with over $2.5 billion in assets. The investment strategy includes buying and owning thirty to forty stocks that offer investment yield potential, including dividend income and return appreciation; establishing sector allocations among property types; and selling or re-evaluating when the target price is ''hit'' in the market or when earnings growth is revised such that the new target price will not produce attractive returns. The data are available monthly from January 1996 through December 2000.

The benchmark used in the attribution analysis for publicly-traded REITs is the Wilshire Real Estate Securities Index (RESI), a broad, capitalization-weighted measure of the performance of publicly-traded real estate securities, such as REITs and REOCs. As of July 31, 2000, 112 companies with a total market capitalization of $133.753 billion were included in this index. The Wilshire RESI returns are calculated on a buy and hold basis, and additions or removal of securities take place monthly according to the index construction rules established by Wilshire.

The single-client separate account includes nineteen properties with an aggregate market value of over $800 million. The investment strategy is to provide the client superior risk-adjusted returns through a three-pronged strategy including core, value added and development property investments. Holding periods for the investments, typically three to ten years, are market-driven and intended to maximize returns for the client. An attempt is made to spread risk across different real estate investments. A research-driven approach targets investments in those markets anticipated to offer the best prospects for achieving client-established return hurdles.

The multi-client private REIT account includes twenty-six properties with a market value of over $600 million. This fund is diversified by property type and geographic region. The investment strategy features a low-risk, core strategy of

acquiring income-producing, small- to medium-sized apartments, industrial, retail and office properties in major metropolitan areas of the United States. These properties are managed intensively to maximize their income-generating potential and are sold when market conditions and property positioning will maximize their value to the fund.

The data used to develop the benchmark for the private real estate portfolios consists of information on individual properties owned by or on behalf of tax-exempt institutional investors and compiled by NCREIF. Although there is disagreement as to the suitability of the NCREIF Property Index as a benchmark, this study sets aside those discussions (see Geltner and Ling, 2001).

NCREIF quarterly return data were collected by property type (Apartment, Industrial, Office or Retail) and by region (East, West, Midwest or South) beginning in 1990 through 2000. In 1990, there were 1,748 individual properties and by 2000 this number had grown to 2,948 with a market value of more than $90 billion. The actual NCREIF property database contains other properties that were excluded. In particular, hotel properties and land were excluded because they are not included as ''core'' properties in institutional private real estate accounts.

Results

Portfolio of Publicly-Traded REITs

The portfolio of publicly-traded REITs is examined for the 1996 to 1999 period. The monthly return data are distributed across apartments, shopping malls, office, retail, self-storage, industrial, hotels, manufactured homes, factory outlet centers and diversified asset classifications based on the predominant property type owned by a particular REIT or REOC. Attributing returns to the framework outlined for performance attribution requires historical data on portfolio composition (weights), actual investment results and disaggregated returns along one or more dimensions from the appropriate benchmark.

Following Brinson, Hood and Beebower (1986), Exhibit 1 provides an example of the performance attribution computation using one month of data from the portfolio of publicly-traded REITs benchmarked against the Wilshire RESI by property type. The presentation is based on the format included in Lieblich (1995). The portfolio composition weights for both the portfolio of publicly-traded REITs and the benchmark are shown in columns A and B. The returns by property type (sector allocation) for both the portfolio of publicly-traded REITs and the benchmark are provided in columns C and D. Column E, the product of sector weights (column A) and sector returns (column C), represents the actual decomposed returns of the manager's portfolio for the month, referred to as the *active return*. Column H, the product of benchmark sector weights (column B) and benchmark sector returns (column D), represents the decomposed benchmark

Exhibit 1 | Performance Attribution: Sector Allocation and Stock Selection
August 2000, Publicly-Traded REIT Portfolio

	Sector Weights		Stock Returns		Weighted Returns			
Sector or Property Type	Active (A) Col. A	Passive (B) Col. B	Active (C) Col. C	Passive (D) Col. D	(A × C) Col. E	(A × D) Col. F	(B × C) Col. G	(B × D) Col. H
Apartment	23.52	21.18	3.63	3.16	0.85	0.74	0.77	0.67
Malls	11.86	9.39	7.73	2.17	0.92	0.26	0.73	0.20
Office	34.62	29.64	0.26	1.81	0.09	0.63	0.08	0.54
Retail	9.47	8.01	3.73	2.19	0.35	0.21	0.30	0.18
Self Storage	2.49	3.62	−2.50	−1.60	−0.06	−0.04	−0.09	−0.06
Industrial	9.17	10.99	0.10	0.62	0.01	0.06	0.01	0.07
Hotels	6.26	9.56	5.00	6.11	0.31	0.38	0.48	0.58
Diversified	2.60	6.05	1.19	4.14	0.03	0.11	0.07	0.25
Man. Homes	0.00	1.54	0.00	0.22	0.00	0.00	0.00	0.00
Factory Outlets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	100.00	100.00			2.50	2.34	2.34	2.43

Notes:

Active return (Col. E)	2.50
Passive return (Col. H)	−2.43
Effect of active management (Col. E − Col. H)	0.07
Active return at passive weight (Col. G)	2.34
Passive return (Col. H)	−2.43
Effect of stock market selection (Col. G − Col. H)	−0.09
Passive return at active weight (Col. F)	2.34
Passive return (Col. H)	−2.43
Effect of sector allocation (Col. F − Col. H)	−0.09
Interaction effect	0.26

Active Management = Stock Selection + Sector Allocation + Interaction
0.07 = −0.09 + −0.09 + 0.26

returns for the month, often referred to as the *passive return* or policy return. Column F, the product of the active portfolio sector weights (column A) and the passive benchmark sector return (column D), represents the return effects due to timing or the strategic under/over-weighting of an asset class relative to its normal weights. Column G, the product of the passive benchmark sector weights (column B) and the active portfolio sector returns (column C) represents the portfolio's actual property type returns in excess of the passive benchmark returns.

The *effect of stock selection* measures the sum of the differences between the securities actually owned in comparison to the benchmark portfolio. It is calculated by taking the difference between column G and column H. The *effect of sector allocation* measures the difference between the actual portfolio return and the benchmark portfolio return. It is calculated by taking difference between column F and column H. The *interaction effect*, often referred to as the ''cross product,'' consists of multiplying the allocation difference (portfolio vs. benchmark) by the return difference (portfolio vs. benchmark). The interaction effect has characteristics of both the selection contribution and sector allocation contribution and is often associated with either for simplicity of presentation or for some presumed dominant contribution that one or the other makes in support of the strategic intent of the portfolio manager.

Summary statistics for the analyses of the publicly-traded REIT portfolio, including stock selection, sector allocation, interaction effects and effects of active management are shown in Exhibit 2. Panel A shows relevant attribution performance statistics in months and Panel B shows these statistics in quarters.

Because there is disagreement in the literature about how or whether to account for the interaction effect, an assignment of the interaction effect was included with the asset selection contribution (Method II), the sector allocation contribution (Method III) and no assignment of the interaction effect to either (Method I). This taxonomy is reordered from the one suggested in Liang, Hess, Bradford and McIntosh (1999).

Exhibit 3 presents a test of the null hypothesis that the mean of the stock selection effect is equal to the mean of the sector allocation effect. The purpose in performing this statistical test is to determine if the sample data suggest an association between stock selection and sector allocation, *i.e.*, that these effects, on average, are indistinguishable. The results suggest that for each ''method'' (including/excluding interaction effects) there is an association between stock selection and sector allocation. That is, the data suggest that there is no difference (at a .01 confidence interval) between the true average stock selection and true average sector allocation. Another way to look at the result is that there is a 99% probability that the selection and sector samples are actually drawn from the same sample.

To study the persistence in relative investment return attributable to one performance effect, the serial persistence technique of Young and Graff (1996) was employed. The serial persistence was tested for the difference in total monthly returns between stock selection and sector allocation. For each month from 1996 to 1999, the difference in total returns between stock selection and sector allocation was assigned a binomial (in this case positive or negative) ranking. For a detailed discussion of the technique, including the test of persistence and confidence interval estimation, refer to Young and Graff (1996).

Exhibit 2 | Performance Attribution for Publicly-Traded REIT Portfolio

Period	Stock Selection	Sector Allocation	Interaction Effect	Effects of Active Management	Stock Selection + Interaction	Sector Allocation + Interaction
Panel A: Monthly						
Jan 96	−0.62	0.40	0.12	−0.10	−0.50	0.52
Feb 96	0.18	0.23	−0.33	0.08	−0.15	−0.10
Mar 96	0.25	−0.23	0.11	0.13	0.36	−0.12
Apr 96	0.24	0.24	0.29	0.78	0.54	0.54
May 96	0.33	−0.34	−0.76	−0.77	−0.43	−1.10
Jun 96	0.11	−0.32	0.15	−0.06	0.26	−0.17
Jul 96	0.05	0.74	−0.29	0.50	−0.24	0.45
Aug 96	0.56	0.20	−0.22	0.54	0.34	−0.02
Sep 96	0.46	1.38	−0.63	1.21	−0.17	0.75
Oct 96	−0.08	0.24	−0.24	−0.08	−0.32	0.00
Nov 96	−0.19	0.88	0.16	0.85	−0.03	1.04
Dec 96	0.02	1.02	−0.56	0.48	−0.54	0.46
Jan 97	−0.23	−0.18	1.97	1.56	1.74	1.79
Feb 97	−0.12	0.64	−0.49	0.03	−0.61	0.15
Mar 97	0.19	−0.60	0.83	0.42	1.02	0.23
Apr 97	0.86	0.44	−1.52	−0.22	−0.66	−1.08
May 97	0.36	−0.30	−1.07	−1.01	−0.71	−1.37
Jun 97	0.27	0.72	0.56	1.56	0.84	1.29
Jul 97	−0.55	2.83	−1.09	1.19	−1.64	1.74
Aug 97	0.06	−0.31	0.26	0.01	0.32	−0.05
Sep 97	−0.08	0.00	1.26	1.18	1.18	1.26
Oct 97	0.26	−0.59	0.33	0.00	0.59	−0.26
Nov 97	−0.04	−0.22	0.06	−0.20	0.02	−0.16
Dec 97	0.51	−0.10	−0.40	0.00	0.10	−0.51
Jan 98	−0.02	−0.21	0.02	−0.21	0.00	−0.19
Feb 98	−0.07	−0.01	0.49	0.41	0.42	0.48
Mar 98	−0.43	−0.08	0.93	0.42	0.50	0.85
Apr 98	0.78	−0.41	−0.25	0.12	0.53	−0.66
May 98	−1.75	−0.34	2.07	−0.02	0.32	1.73
Jun 98	−0.53	−0.62	0.61	−0.53	0.09	0.00
Jul 98	1.81	0.08	−1.27	0.62	0.54	−1.19
Aug 98	0.68	−0.17	−2.58	−2.07	−1.90	−2.75
Sep 98	2.46	−0.43	−3.35	−1.32	−0.89	−3.78

Exhibit 2 | (continued)

Performance Attribution for Publicly-Traded REIT Portfolio

Period	Stock Selection	Sector Allocation	Interaction Effect	Effects of Active Management	Stock Selection + Interaction	Sector Allocation + Interaction
Panel A: Monthly						
Oct 98	0.24	0.24	−0.68	−0.20	−0.44	−0.44
Nov 98	−0.41	0.06	1.86	1.52	1.46	1.93
Dec 98	0.06	0.38	0.41	0.84	0.46	0.78
Jan 99	0.30	−0.11	−0.14	0.05	0.16	−0.25
Feb 99	2.39	0.01	−1.89	0.52	0.51	−1.87
Mar 99	−1.31	−0.29	1.35	−0.25	0.04	1.06
Apr 99	−0.08	0.05	1.81	1.78	1.73	1.86
May 99	−0.36	0.05	0.05	−0.26	−0.31	0.10
Jun 99	0.39	0.11	−0.09	0.41	0.30	0.02
Jul 99	0.62	0.61	−2.50	−1.27	−1.88	−1.89
Aug 99	−0.40	−0.20	1.89	1.29	1.49	1.69
Sep 99	−0.63	0.03	0.73	0.14	0.11	0.77
Oct 99	−0.35	−0.18	0.90	0.37	0.55	0.72
Nov 99	0.14	0.34	−1.26	−0.78	−1.12	−0.92
Dec 99	0.18	−0.06	1.30	1.42	1.48	1.24
Jan 00	−0.84	−0.02	0.25	−0.61	−0.59	0.23
Feb 00	−0.23	−0.17	−0.14	−0.54	−0.37	−0.31
Mar 00	0.68	0.21	0.09	0.98	0.77	0.30
Apr 00	−0.15	−0.09	0.36	0.12	0.21	0.27
May 00	−0.09	−0.09	0.73	0.55	0.64	0.64
Jun 00	0.87	−0.26	−0.92	−0.30	−0.04	−1.17
Jul 00	−0.84	−0.02	0.27	−0.59	−0.57	0.25
Aug 00	−0.23	−0.17	−0.16	−0.56	−0.39	−0.33
Sep 00	0.68	0.21	−0.09	0.80	0.59	0.12
Oct 00	−0.15	−0.09	−0.01	−0.25	−0.16	−0.10
Nov 00	−0.09	−0.09	0.26	0.07	0.17	0.17
Dec 00	0.87	−0.26	−0.20	0.42	0.68	−0.45
Panel B: Quarterly						
1Q '96	−0.19	0.41	−0.10	0.11	−0.29	0.31
2Q '96	0.68	−0.42	−0.30	−0.04	0.38	−0.72
3Q '96	0.29	−0.10	2.17	2.36	2.46	2.07
4Q '96	0.97	2.40	−1.97	1.40	−1.00	0.42

Exhibit 2 | (continued)
Performance Attribution for Publicly-Traded REIT Portfolio

Period	Stock Selection	Sector Allocation	Interaction Effect	Effects of Active Management	Stock Selection + Interaction	Sector Allocation + Interaction
Panel B: Quarterly						
1Q '97	−0.69	−0.14	2.86	2.03	2.17	2.71
2Q '97	−0.20	0.33	0.14	0.27	−0.06	0.47
3Q '97	0.27	−0.27	2.53	2.53	2.80	2.26
4Q '97	0.04	0.24	−0.48	−0.20	−0.43	−0.24
1Q '98	−0.52	−0.30	1.43	0.61	0.91	1.13
2Q '98	−1.50	−1.36	2.45	−0.41	0.95	1.09
3Q '98	0.23	0.07	−2.85	−2.55	−2.62	−2.78
4Q '98	2.19	0.20	−0.28	2.11	1.91	−0.08
1Q '99	1.04	0.28	−1.01	0.31	0.03	−0.72
2Q '99	−0.51	−0.18	2.67	1.98	2.16	2.49
3Q '99	0.68	−0.01	−0.57	0.10	0.12	−0.58
4Q '99	0.13	−0.26	1.08	0.95	1.21	0.82
1Q '00	−0.39	0.02	0.13	−0.24	−0.26	0.15
2Q '00	0.63	−0.44	0.22	0.41	0.85	−0.22
3Q '00	−0.39	0.02	−0.02	−0.38	−0.40	0.00
4Q '00	0.63	−0.44	−0.05	0.14	0.57	−0.49

The null hypothesis assumes that the binomial ranking for the difference in total returns between stock selection and sector allocation is independent across time. This implies that the probability of return remaining in the same binomial rank from one period to the next is 50%. Statistically significant departures from 50% are considered evidence of serially dependent performance persistence.

Exhibit 4 shows that the persistence for the difference in total returns between stock selection and sector allocation is not statistically significant for all methods. Panel A shows the results for Method I, Panel B the results for Method II and Panel C the results for Method III. The runs for this analysis are limited to one to two months because the test for serial persistence is a function of sample size.

Exhibit 5a and 5b graphically show magnitudes of the monthly and quarterly return effects of stock selection, sector allocation and interactions between the two for the entire sample period. These graphs show the essentially random

Exhibit 3 | Test of Null Hypothesis that Means are Equal
Publicly-Traded REIT Portfolio

	Method I		Method II		Method III	
	Stock Selection	Sector Allocation	Stock Selection	Sector Allocation + Interaction	Stock Selection + Interaction	Sector Allocation
Panel A: Monthly Data (n = 60)						
Mean	0.0012	0.0008	0.0012	0.0007	0.0011	0.0008
Std. Dev.	0.0070	0.0053	0.0070	0.0108	0.0077	0.0053
t-Test	−0.326		−0.294		−0.207	
Null hypothesis	Not Rejected		Not Rejected		Not Rejected	
Panel B: Quarterly Data (n = 20)						
Mean	0.0017	0.0000	0.0017	0.0040	0.0057	0.0000
Std. Dev.	0.0079	0.0069	0.0079	0.0131	0.0132	0.0069
t-Test	−0.721		0.684		−1.716	
Null hypothesis	Not Rejected		Not Rejected		Not Rejected	

relationship between returns attributed to stock selection and sector allocation and the inconsistency to which performance returns can be assigned to either factor. Also, the magnitude of the interaction effect relative to either stock selection or sector allocation should raise concerns about the adequacy of either measure for discerning manager performance over time, much less attributing performance to a specific action or strategy employed by the manager.

Single-Client Separate Accounts

The single-client separate account is examined for the 1991 to 2000 period beginning in the second quarter of 1991 (the first property in the account was purchased in the first quarter of 1991, but return data were not available until the second quarter of 1991). The data are provided on a quarterly basis and distributed across apartment, office, retail and industrial property types and across four locations known as NCREIF regions: East, West, South or Midwest.

The performance attribution analysis for the single-client separate account identifies the portfolio impact of the portfolio manager's asset allocation and property selection decisions. The analysis is considered for both property type asset allocation and property location asset allocation. This is a slight variation to

Exhibit 4 | Performance Persistence for the REIT Portfolio—1996 to 2000

	No. of Samples	No. of Successes	Successes (%)	95% Confidence	
				Lower	Upper
Panel A: Method I					
Length of Positive Run					
1	25	10	40.0	30.8	69.2
2	10	5	50.0	19.0	81.0
Length of Negative Run					
1	31	16	51.6	32.4	67.6
2	16	8	50.0	25.5	74.5
Panel B: Method II					
Length of Positive Run	27	13	48.1	31.2	68.8
1	13	4	30.8	24.9	75.1
2					
Length of Negative Run					
1	33	17	51.5	32.9	67.1
2	17	7	41.2	26.6	73.4
Panel C: Method III					
Length of Positive Run					
1	36	22	61.1	34.1	65.9
2	22	17	77.3*	32.5	67.5
Length of Negative Run					
1	23	15	65.2	50.0	69.5

Note:
*Statistically distinct from 50% with 98% confidence.

the analysis performed on the portfolio of publicly traded REITs, which identified the impact of stock selection versus property selection.

Summary statistics, including property selection, asset allocation, interaction effects and effects of active management are shown in Exhibit 6 by quarter (including the various ‘‘methods’’ for assigning the interaction effect). Panel A shows relevant attribution performance statistics when property type is the asset allocation and Panel B shows these statistics when property location is the asset allocation.

The number of locations and property types included in the portfolio over time is shown in Exhibit 7. This data demonstrates the relatively short period that investments have been made in the properties representing all four property types

Exhibit 5a | Effects of Stock Selection, Sector Allocation and Interaction for Monthly Data on Publicly-Traded REIT Portfolio

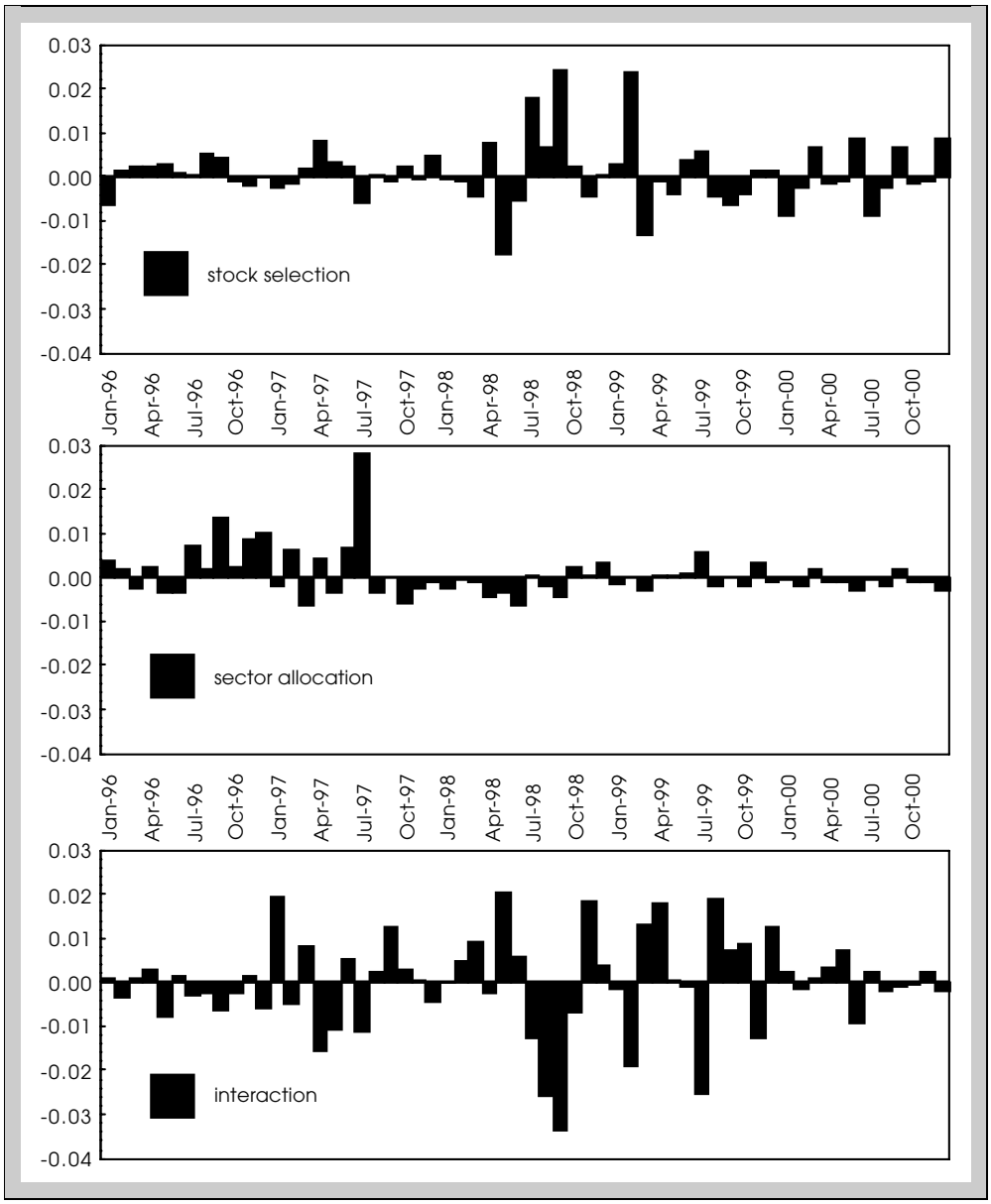

Exhibit 5b | Effects of Stock Selection, Sector Allocation, and Interaction for Quarterly Data on Publicly-Traded REIT Portfolio

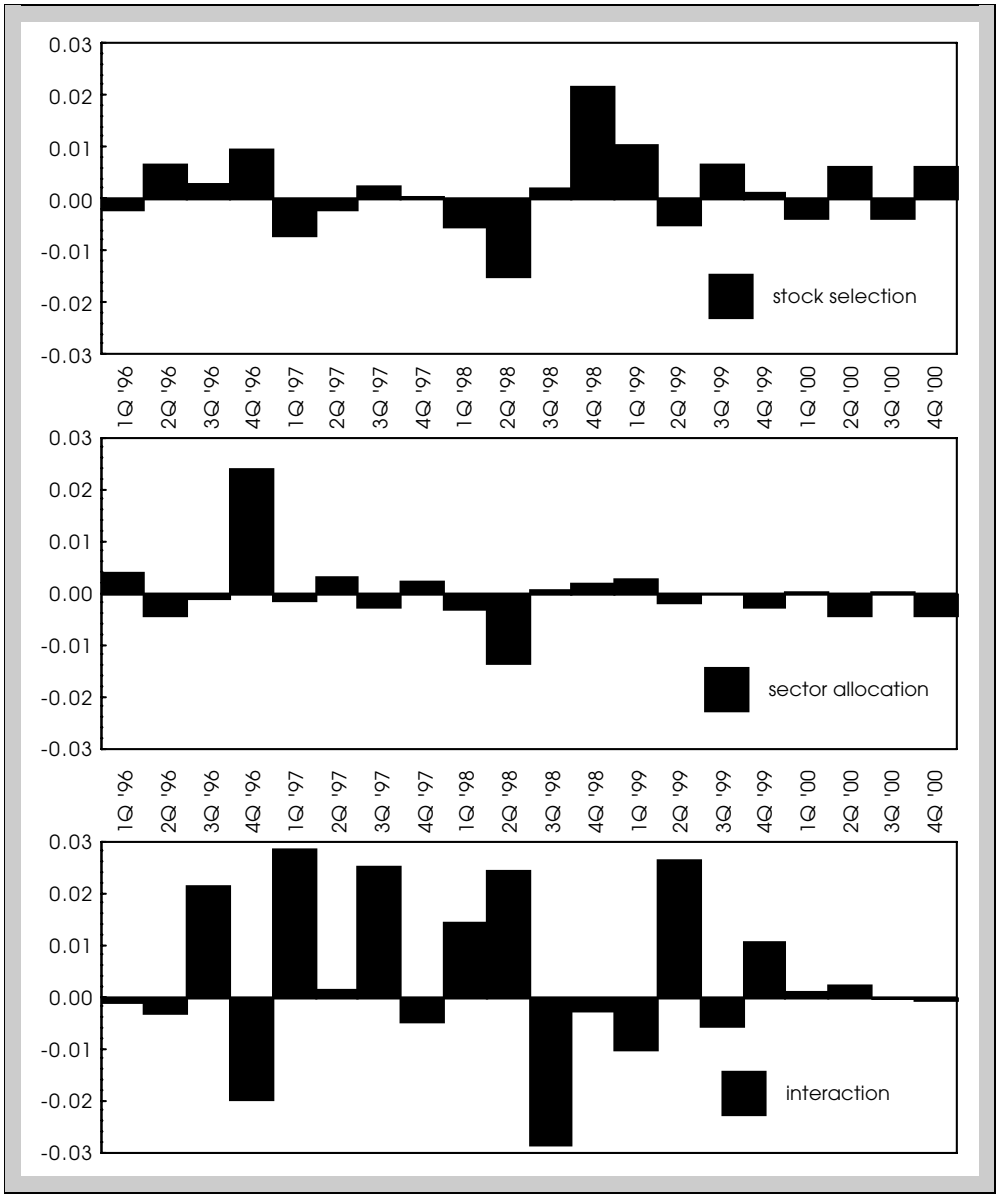

Exhibit 6 | Quarterly Performance Attribution for Single-Client Separate Account

Period	Property Selection	Property Type Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Type Allocation + Interaction
Panel A: Property Selection—Property Type Allocation						
2Q '91	0.84	0.45	0.88	2.17	1.72	1.33
3Q '91	0.89	−0.20	0.69	1.39	1.59	0.50
4Q '91	5.88	1.03	0.27	7.18	6.15	1.31
1Q '92	1.29	−0.37	1.88	2.81	3.17	1.52
2Q '92	2.05	0.18	1.26	3.50	3.31	1.44
3Q '92	1.47	−0.23	1.54	2.78	3.01	1.31
4Q '92	3.68	0.03	1.39	5.10	5.07	1.41
1Q '93	0.09	−0.15	1.56	1.51	1.66	1.42
2Q '93	1.88	−0.12	1.10	2.86	2.98	0.98
3Q '93	0.41	−0.16	1.08	1.34	1.50	0.93
4Q '93	1.81	−0.16	1.16	2.81	2.97	1.00
1Q '94	0.05	−0.04	1.08	1.09	1.12	1.04
2Q '94	−0.03	−0.30	1.29	0.96	1.26	0.99
3Q '94	0.35	0.03	1.04	1.42	1.38	1.07
4Q '95	−0.80	−0.36	0.70	−0.46	−0.09	0.34
1Q '95	−0.20	−0.07	0.55	0.28	0.36	0.48
2Q '95	−0.38	−0.12	0.48	−0.02	0.10	0.36
3Q '95	1.57	−0.16	1.47	2.88	3.04	1.31
4Q '95	0.32	−0.55	0.97	0.74	1.29	0.42
1Q '96	−0.60	−0.04	0.49	−0.15	−0.11	0.45
2Q '96	2.98	−0.21	−0.12	2.64	2.85	−0.34
3Q '96	−0.85	0.08	0.44	−0.33	−0.41	0.52
4Q '96	−0.86	−0.51	1.04	−0.33	0.17	0.53
1Q '97	−1.40	−0.08	0.88	−0.60	−0.52	0.80
2Q '97	−1.69	0.10	0.32	−1.28	−1.38	0.42
3Q '97	−1.72	0.06	0.39	−1.26	−1.33	0.45
4Q '97	−2.47	−0.47	0.89	−2.04	−1.58	0.43
1Q '98	−2.13	−0.33	0.86	−1.59	−1.27	0.54
2Q '98	4.52	0.17	0.75	5.44	5.27	0.92
3Q '98	−1.76	0.02	0.45	−1.29	−1.31	0.47
4Q '98	−1.58	−0.08	0.60	−1.06	−0.99	0.52
1Q '99	−1.00	−0.08	0.55	−0.53	−0.45	0.48

Exhibit 6 | (continued)

Quarterly Performance Attribution for Single-Client Separate Account

Period	Property Selection	Property Type Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Type Allocation + Interaction
Panel A: Property Selection—Property Type Allocation						
2Q '99	1.07	0.02	0.33	1.42	1.40	0.35
3Q '99	−0.69	0.00	0.04	−0.65	−0.65	0.05
4Q '99	−0.76	−0.05	0.08	−0.73	−0.68	0.03
1Q '00	−0.10	0.00	0.04	−0.06	−0.06	0.03
2Q '00	8.38	0.03	0.05	8.46	8.42	0.08
3Q '00	−1.05	−0.09	0.12	−1.02	−0.93	0.03
4Q '00	−1.20	−0.25	0.27	−1.18	−0.93	0.03
Period	Property Selection	Property Location Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Location Allocation + Interaction
Panel B: Property Selection—Property Location Allocation						
2Q '91	0.89	0.11	1.37	2.37	2.26	1.49
3Q '91	0.54	−0.43	0.97	1.09	1.51	0.55
4Q '91	6.13	0.62	0.82	7.57	6.95	1.44
1Q '92	0.97	−0.15	1.81	2.63	2.78	1.66
2Q '92	1.98	−0.14	1.72	3.57	3.71	1.58
3Q '92	1.32	−0.85	2.26	2.73	3.58	1.41
4Q '92	3.68	−1.11	2.64	5.21	6.32	1.54
1Q '93	0.00	−0.18	1.58	1.40	1.58	1.39
2Q '93	1.26	−2.38	3.93	2.81	5.19	1.55
3Q '93	−0.15	−0.77	2.25	1.33	2.10	1.48
4Q '93	1.24	−0.85	2.43	2.81	3.67	1.58
1Q '94	−0.37	−0.30	1.86	1.19	1.50	1.56
2Q '94	−0.57	−0.31	1.90	1.02	1.33	1.59
3Q '94	−0.01	−0.08	1.69	1.60	1.68	1.61
4Q '95	−0.87	0.19	0.50	−0.19	−0.37	0.68
1Q '95	−0.60	0.18	0.86	0.45	0.26	1.04
2Q '95	−0.66	0.01	0.88	0.23	0.22	0.88
3Q '95	1.14	0.07	2.14	3.34	3.27	2.20
4Q '95	0.29	0.35	0.55	1.18	0.83	0.89

Exhibit 6 | (continued)
Quarterly Performance Attribution for Single-Client Separate Account

Period	Property Selection	Property Location Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Location Allocation + Interaction
Panel B: Property Selection—Property Location Allocation						
1Q '96	−0.96	0.18	0.75	−0.03	−0.21	0.93
2Q '96	0.84	0.17	1.67	2.68	2.51	1.84
3Q '96	−1.18	0.15	0.79	−0.24	−0.40	0.94
4Q '96	−1.21	0.67	0.30	−0.24	−0.91	0.97
1Q '97	−1.09	0.39	0.33	−0.38	−0.77	0.72
2Q '97	3.17	0.20	2.84	6.21	6.01	3.04
3Q '97	−1.46	0.27	0.16	−1.03	−1.30	0.43
4Q '97	−2.75	0.41	0.02	−2.32	−2.72	0.43
1Q '98	−1.83	0.17	−0.15	−1.81	−1.98	0.02
2Q '98	0.85	0.75	2.10	3.70	2.95	2.85
3Q '98	−1.24	0.00	0.04	−1.20	−1.20	0.04
4Q '98	−1.19	0.07	−0.01	−1.12	−1.20	0.07
1Q '99	−0.65	0.10	0.11	−0.44	−0.54	0.21
2Q '99	0.91	0.13	0.43	1.47	1.34	0.56
3Q '99	−0.66	0.01	0.06	−0.60	−0.60	0.07
4Q '99	−0.75	0.20	−0.12	−0.67	−0.87	0.08
1Q '00	−0.13	0.18	−0.10	−0.05	−0.22	0.08
2Q '00	7.37	0.34	0.06	7.77	7.43	0.40
3Q '00	−0.80	0.18	−0.19	−0.82	−0.99	−0.01
4Q '00	−0.85	0.38	−0.37	−0.85	−1.22	0.00

or in all four locations, a condition deemed commonplace among private real estate separate accounts.

Exhibit 8 presents a test of the null hypothesis that the mean of the property selection effect is equal to the mean of the asset allocation effect. Panel A shows the results when property type is the allocation criterion and Panel B shows the results when property location is the allocation criterion. The results suggest a mixed result across the various methods and asset classes. When considering property type as the allocation criterion, Method I and Method II suggest that there is an association between property selection and asset allocation, while Method III suggests there is no association between property selection and asset

Exhibit 7 | Duration of Allocations within Single–Client Separate Account by Property Type and Location

	Duration of Allocation		
	From	To	% of Sample Period
Number of Property Types			
1	2Q 1991	1Q 1993	100
2	2Q 1993	2Q 1994	79
3	3Q 1994	1Q 1999	67
4	2Q 1999	4Q 2000	18
Number of Locations			
1	2Q 1991	2Q 1994	100
2	3Q 1994	1Q 1997	67
3	2Q 1997	3Q 1997	38
4	4Q 1997	4Q 2000	33

Exhibit 8 | Test of Null Hypothesis that Means are Equal
Single-Client Separate Account

	Method I		Method II		Method III	
	Property Selection	Property Type	Property Selection	Property Type + Interaction	Property Selection + Interaction	Property Type
Panel A: Property Type Allocation (n = 39)						
Mean	0.0047	−0.0008	0.0047	0.0067	0.0121	−0.0008
Std. Dev.	0.0224	0.0027	0.0224	0.0049	0.0231	0.0027
t-Test	1.503		−0.537		3.443	
Null hypothesis	Not Rejected		Not Rejected		Rejected	
Panel B: Property Location Allocation (n = 39)						
	Property Selection	Property Location	Property Selection	Property Location + Interaction	Property Selection + Interaction	Property Location
Mean	0.0032	−0.0003	0.0032	0.0102	0.0137	−0.0003
Std. Dev.	0.0200	0.0056	0.0200	0.0078	0.0258	0.0056
t-Test	1.055		−2.032		3.314	
Null hypothesis	Not Rejected		Rejected		Rejected	

Exhibit 9 | Quarterly Performance Attribution for Multi-Client Private REIT Account

Period	Property Selection	Property Type Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Type Allocation + Interaction
Panel A: Property Selection—Property Type Allocation						
1Q '95	−1.90	−0.65	2.46	−0.09	0.56	1.80
2Q '95	−1.14	−0.42	1.26	−0.31	0.12	0.84
3Q '95	−0.81	−0.37	1.22	0.03	0.40	0.84
4Q '95	2.90	−0.15	1.44	4.19	4.34	1.29
1Q '96	−0.53	−0.08	−0.07	−0.69	−0.61	−0.16
2Q '96	−0.07	0.12	−0.17	−0.11	−0.24	−0.05
3Q '96	1.02	0.10	0.00	1.11	1.02	0.10
4Q '96	0.73	0.20	−0.40	0.54	0.34	−0.19
1Q '97	1.38	0.03	−0.02	1.39	1.36	0.01
2Q '97	−0.99	0.02	−0.03	−1.00	−1.02	−0.01
3Q '97	0.57	0.00	0.01	0.58	0.59	0.01
4Q '97	−0.46	0.04	−0.11	−0.52	−0.57	−0.07
1Q '98	0.10	0.01	0.03	0.14	0.13	0.04
2Q '98	1.87	−0.06	−0.39	1.42	1.48	−0.45
3Q '98	0.00	0.02	−0.10	−0.08	−0.11	−0.08
4Q '98	−0.91	−0.09	0.06	−0.94	−0.85	−0.03
1Q '99	−0.44	0.02	−0.12	−0.53	−0.55	−0.10
2Q '99	−0.52	−0.01	0.01	−0.52	−0.51	0.00
3Q '99	0.86	−0.02	0.61	1.45	1.46	0.59
4Q '99	0.56	0.02	0.10	0.69	0.66	0.13
1Q '00	−0.92	−0.03	0.30	−0.65	−0.62	0.27
2Q '00	−0.66	−0.04	0.05	−0.66	−0.61	0.01
3Q '00	0.48	−0.03	0.28	0.73	0.76	0.25
4Q '00	0.52	−0.02	0.34	0.84	0.85	0.32

Period	Property Selection	Property Location Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Location + Interaction
Panel B: Property Selection—Property Location Allocation						
1Q '95	−1.34	0.17	1.31	0.15	−0.03	1.48
2Q '95	−0.73	0.17	0.51	−0.05	−0.22	0.68
3Q '95	−0.31	0.05	0.51	0.25	0.20	0.56
4Q '95	2.24	0.02	2.58	4.84	4.82	2.60

Exhibit 9 | (continued)

Quarterly Performance Attribution for Multi-Client Private REIT Account

Period	Property Selection	Property Location Allocation	Interaction Effect	Effects of Active Management	Property Selection + Interaction	Property Location + Interaction
Panel B: Property Selection—Property Location Allocation						
1Q '96	−0.60	0.03	0.14	−0.43	−0.46	0.17
2Q '96	0.00	0.00	0.00	−0.01	0.00	0.00
3Q '96	1.26	0.06	0.01	1.33	1.27	0.07
4Q '96	0.61	0.07	0.13	0.81	0.74	0.20
1Q '97	2.12	0.01	−0.67	1.45	1.44	−0.67
2Q '97	−0.96	−0.02	0.01	−0.96	−0.95	0.00
3Q '97	0.62	0.06	0.08	0.76	0.70	0.14
4Q '97	−0.48	0.08	−0.09	−0.49	−0.57	−0.01
1Q '98	0.39	0.05	−0.37	0.07	0.01	−0.32
2Q '98	1.69	0.11	−0.04	1.76	1.65	0.07
3Q '98	−0.10	0.02	0.09	0.01	−0.01	0.11
4Q '98	−0.95	−0.02	−0.01	−0.97	−0.96	−0.02
1Q '99	−0.21	0.01	−0.16	−0.36	−0.37	−0.15
2Q '99	−0.27	0.03	−0.04	−0.27	−0.30	0.00
3Q '99	0.77	−0.07	0.33	1.03	1.11	0.26
4Q '99	0.48	0.08	0.08	0.63	0.56	0.15
1Q '00	−0.62	0.10	−0.25	−0.77	−0.87	−0.15
2Q '00	−0.63	0.16	−0.10	−0.56	−0.73	0.06
3Q '00	−1.95	0.07	−0.35	−2.23	−2.30	−0.28
4Q '00	−2.18	0.06	−0.19	−2.31	−2.37	−0.13

allocation. When considering property location as the allocation criterion, Method I suggests that there is an association between property selection and asset allocation, while Method II and Method III suggest that there is no association between property selection and asset allocation.

The results from Exhibit 8 should be regarded with some qualification. As shown in Exhibit 7, not all property types or property locations are represented for the entire sample period. In fact, representation across all four property types starts in the second quarter of 1999 and accounts for less then 20% of the sample period. Likewise, representation across all four locations starts in the fourth quarter of 1997 and accounts for only 33% of the sample period. To supplement this analysis adequately would require several more years of data with investments well

Exhibit 10 | Duration of Allocation within Multi-Client Private REIT Account by Property Type and Location

	Duration of Allocation		
	From	To	% of Sample Period
Number of Property Types			
1	1Q 1995	1Q 1995	100
3	2Q 1995	3Q 1995	96
4	4Q 1995	4Q 2000	88
Number of Locations			
1	1Q 1995	1Q 1995	100
3	2Q 1995	4Q 1995	96
4	1Q 1996	4Q 2000	83

Exhibit 11 | Test of Null Hypothesis that Means are Equal Multi-Client Private REIT Account

	Method I		Method II		Method III	
	Property Selection	Property Type	Property Selection	Property Type + Interaction	Property Selection + Interaction	Property Type
Panel A: Property Type Allocation (n = 24)						
Mean	0.0007	−0.0006	0.0007	0.0022	0.0035	−0.0006
Std. Dev.	0.0108	0.0018	0.0108	0.0051	0.0114	0.0018
t-Test	0.560		−0.642		1.731	
Null hypothesis	Not Rejected		Not Rejected		Not Rejected	
Panel B: Property Location Allocation (n = 24)						
	Property Selection	Property Location	Property Selection	Property Location + Interaction	Property Selection + Interaction	Property Location
Mean	−0.0005	0.0005	−0.0005	0.0020	0.0010	0.0005
Std. Dev.	0.0114	0.0006	0.0114	0.0065	0.0143	0.0006
t-Test	−0.438		−0.928		0.152	
Null hypothesis	Not Rejected		Not Rejected		Not Rejected	

represented in each asset class. Again, this pattern of inclusion or exclusion of various property types or locations over time is typical of institutional separate account real estate portfolios and, naturally, complicates conclusions that might be inferred from small sample sizes.

Multi-Client Private REIT

The multi-client private REIT is examined for the 1995 to 2000 period. The data are provided on a quarterly basis and distributed across apartment, office, retail and industrial property types and across four NCREIF regions: East, West, South or Midwest.

The performance attribution analysis for the multi-client private REIT, similar to the single-client separate account, identifies the portfolio impact of the portfolio manager's asset allocation (both property type and property location) and property selection decisions.

Summary statistics, including property selection, asset allocation, interaction effects and effects of active management are shown in Exhibit 9 by quarter (including the various methods for assigning the interaction effect). Panel A shows relevant attribution performance statistics when property type is the allocation criterion and Panel B shows these statistics when property location is the allocation criterion.

The number of locations and property types included in the portfolio over time is shown in Exhibit 10. Panel A shows the duration of the allocation of properties across the four property types and Panel B shows the duration of the allocation of properties across the four location types. Unlike the client separate account, the multi-client private REIT has investments across all four locations and property types for most of the period under investigation (over 80% of the sample period).

Exhibit 11 presents a test of the null hypothesis that the mean of the property selection effect is equal to the mean of the asset allocation effect. Panel A shows the results when property type is the allocation criterion and Panel B shows the results when property location is the allocation criterion. The results suggest that, for each method (including/excluding interaction effects) and each asset allocation, there is an association between property selection and asset allocation. That is, the data suggest that there is no difference (at the 95% confidence level) between the true average property selection and true average asset allocation.

Conclusion

This study finds no statistically significant difference between the mean performance attribution of stock selection versus sector allocation on monthly or quarterly reporting frequencies in a portfolio of publicly-traded REITs managed by a single firm employing a single, unvarying investment strategy. Further, owing

to the large relative magnitude of the interaction effect (the cross product) and the suggestions that have been made that this interaction be added to either the stock selection or sector allocation, the consequences of these modifications to the traditional performance attribution technique were analyzed. Here too no statistical difference between the means of the modified attributions was found.

The monthly real estate securities data were examined to see whether the signals of superior or inferior performance along the selection or allocation dimensions, with and without adding the interaction effect to either dimension, produced serially dependent, *i.e.*, persistent, results. No statistically significant serial persistence was found.

Results for the single-client separate account portfolio were mixed with respect to mean differences, but the outcome is questionable in light of the small sample size and the simple fact that the strategy that the manager was asked to follow varied considerably over time. From the authors' experience, the situation of this separate account is similar to others. Thus, performance attribution on portfolios of this kind is essentially worthless for practical portfolio management or manager peer measurement purposes.

Results for the multi-client private REIT where the manager had considerable discretion in purchasing assets were more similar to those of the publicly-traded REIT portfolio in that none of the mean differences were statistically different from one another.

The notion of performance attribution has several embedded presumptions, not the least of which is that the manager being scrutinized has discretion over the investment acquisition, disposition, and allocation decisions within guidelines and within capital constraints typically imposed by the plan sponsor or investor. In the three subject cases investigated, there were varying forms of discretion. In the publicly-traded REIT portfolio, the manager had full discretion over which securities to buy or sell and among which sectors to allocate capital. Thus, this portfolio meets the discretion presumption of performance attribution.

The separate account managed for a single client, however, represents the opposite pole. As Exhibit 7 suggests and as the reality of the separate account relationship shows, the client changed the manager options over time both in terms of the property types in which the manager could invest and in the locations in which those properties might be located. This situation is not common in the institutional separate account management arena and the practice has been given the name ''discretion in a box,'' a constrained strategy that oftentimes has additional constrains on the freedom of the manager to act such as restrictions on the amount of mortgage debt or the minimum or maximum size of individual investments.

Even when managers have freedom to buy and sell direct equity real estate investments with full discretion, there are practical limitations imposed by the investment process and real estate markets in general that inhibit rapid or timely execution of trades that might be indicated by performance attribution. Investment

programs typically involve a sequential process of setting investment plans, sourcing appropriate investments, time-consuming acquisition, management toward a goal and adjustments to the plan or tactics over time. To impose a measurement against a benchmark for the purpose of understanding the source of investment over- or under-performance adds other time lags in decision-making that beg the question of the efficacy of performance attribution as anything other than an historic artifact.

Investment programs like the separate account and private REIT discussed here typically have a few dozen, lumpy investments. The addition or removal of an asset can have large impacts on reported performance. Benchmarks, on the other hand, comprised of hundreds or thousands of individual investments have a mean return of a broad class of investments that may or may not have relevance to the investment program being analyzed. If performance attribution is an investor requirement, it is not hard to imagine that the manager will begin to game the benchmark, a consequence probably not intended by the investor.

Is it reasonable to expect that managers can consistently produce superior results on any yardstick decomposed from the total return differential versus a benchmark? Can a manager produce superior results on say asset selection while performing less well on sector allocation, or vice versa? From the results of this study, probably not. First, it is highly unlikely that investment strategies or tactics can remain stationary for long given the vagaries of the marketplace, whether public or private. Second, superior results in asset selection might detract from superior results in asset allocation, or the reverse. A manager too focused on the short-term might be inclined to change tactics.

The fact that performance attribution has focused on the asset selection, sector allocation or locational attributes is not the least bit surprising. That there are no other data on which managers might be compared to a benchmark makes it impossible to investigate other variables that might be more informative. Research in both public and private real estate markets suggests that the data are insufficient to determine whether location or property type is economically distinguishable attributes of a portfolio [see Graff and Young (1996) for private markets and Young (2000) for public markets].

The problem with benchmarks is twofold: few dimensions along which investments might be compared and no assurance or suggestion that the dimensions are necessarily appropriate for discriminating among mangers or the assets they manage.

In short, performance attribution in the public and private real estate arenas is so problematic as to render it useless in any practical sense and, at best, a historical curiosity. The knowledge that might be gleaned from performance attribution with current technology is unlikely to persist long enough for meaningful actions to be taken in a portfolio or in the activities of investment managers. From the results of this study, no further inquiry in the subject is warranted at this time.

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Michael S. Young, San Francisco, CA 94111 or MYoung@RREEF.com.

Susan Annis, San Francisco, CA 94111 or SAnnis@RREEF.com.