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Disciplined Rebalancing:

Friend or Foe?

August 2000

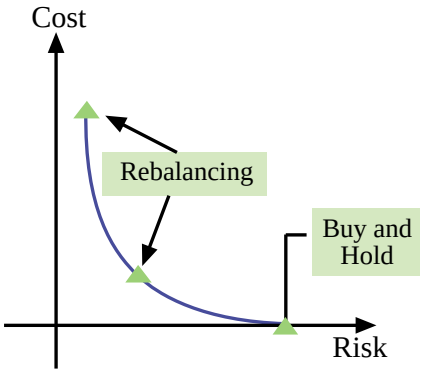
Disciplined Rebalancing: Friend or Foe?

Fund sponsors devote significant time and effort to developing a strategic investment policy. A prudent process begins with the asset allocation decision that focuses on determining a target asset mix relative to return goals and tolerance for risk. The next step in the process is the development of an investment manager structure around the asset mix targets and their benchmarks. An essential, and often overlooked, component of these two steps is the formulation of a rebalancing policy.

Rebalancing is a process to realign an investment portfolio back to its target asset allocation or manager structure as the allocations change over time due to performance (i.e., as one asset class or manager outperforms another).[1] In theory, a disciplined rebalancing strategy is meant to add return at lower risk by taking advantage of the cyclical behavior of capital markets and by eliminating any market timing calls. This theory was supported by long-term research undertaken in the 1980s and early 1990s.[2] The potential cost of rebalancing is that transaction costs, including market impact, incurred from realigning the portfolio may offset any added return.

The alternative is to let the portfolio drift from its initial asset mix and structure to the whims of the capital markets and the managers' performance. This is often referred to as a "buy-and-hold" or "do nothing" strategy, which focuses on "letting the winners ride." Any future decision to realign the portfolio back to the target mix or initial manager allocations is made on an ad-hoc basis. Intuitively, a buy-and-hold strategy will favor non-cyclical or trending markets that are exhibiting a major move in any one direction, at the potential cost of increasing risk exposure.[3]

As shown below, there is a trade-off between maintaining a desired level of risk exposure as compared to the target asset allocation (Risk) and the transaction cost of rebalancing a portfolio (Cost).



The recent trending of U.S. equity markets, particularly in the large cap growth arena, has proven fatal to strict rebalancing advocates. This recent market experience has resulted in more fund sponsors questioning the wisdom of a disciplined rebalancing strategy or postponing implementation of their current policy. From a return perspective, who would have wanted to take assets away from U.S. equity and reallocate them in favor of U.S. fixed income in the last four years? More significantly, who would have wanted to take assets away from a large cap growth manager in favor of a large cap value manager? Are there sound reasons not to rebalance?

[1] A rebalancing policy sets forth the rebalancing procedures and guidelines, including how to monitor and implement the process. A typical rebalancing policy has two components. The first involves rebalancing the asset classes back to the target asset mix, which is referred to as asset class rebalancing. The second deals with rebalancing the manager allocations within the investment structure back to their initial allocations, which is referred to as manager structure rebalancing.

[2] See bibliography.

[3] A tactical asset allocation (TAA) strategy is a special case combining a rebalancing strategy with a buy-and-hold strategy. TAA is similar to rebalancing, as it tends to buy on weakness and sell on strength. However, once a portfolio is positioned it is left to drift until the TAA manager strategically decides to reposition it. Fund sponsors are also willing to assume the additional risk exposures that a TAA strategy encompasses.

Based on Callan's empirical studies over the last three decades, we will show that fund sponsors should prefer a disciplined strategy to a buy-and-hold strategy whose shifting weights can create uncertain outcomes and higher risk exposures. As the stock market is quite capable of reversing itself, with even greater volatility (as evident in 2nd quarter 2000), we believe that there are sound reasons to adopt a disciplined rebalancing strategy. We will also discuss how sponsors can address their cost concerns in implementing their rebalancing policy.

Reward versus Risk

The success of any investment strategy is measured as a blend of returns and risk. Asset allocation studies focus on determining a target asset mix relative to a sponsor's return objectives and risk tolerances over a particular time horizon. These studies focus on well-diversified portfolios, which increase a portfolio's expected return through the diversification process for a given level of risk. The purpose of rebalancing is to complement the asset allocation decision.[4] Rebalancing is a buy-and-sell discipline with which to control the inevitable drift away from the target asset allocation and to maintain the original risk tolerances consistent with return objectives.

Rebalancing is a buy low/sell high philosophy that attempts to take advantage of the cyclical behavior of capital markets. Historically, capital markets have been characterized by cycles of growth and contractions, as a result of the cyclical nature of business and economic growth.[5] A rebalancing policy is meant to add incremental return at lower risk by capturing gains in the portfolio before the occurrence of contraction or down-cycles. A quick review of Callan's Periodic Table of Investment Returns emphasizes the dramatic shifts in market performance:

The Callan Periodic Table of Investment Returns

Annual Returns for Key Indices (1980-1999)

Ranked in order of performance (Best to Worst)

1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Russell 2000 Growth	Russell 2000 Value	LB Agg	Russell 2000 Value	LB Agg	MSCI EAFE	MSCI EAFE	MSCI EAFE	Russell 2000 Value	S&P/ BARRA 500 Growth	LB Agg	Russell 2000 Growth	Russell 2000 Value	MSCI EAFE	MSCI EAFE	S&P/ BARRA 500 Growth	S&P/ BARRA 500 Growth	S&P/ BARRA 500 Growth	S&P/ BARRA 500 Growth	Russell 2000 Growth
52.26%	14.85%	32.65%	38.63%	15.15%	56.14%	69.46%	24.64%	29.47%	36.40%	8.96%	51.18%	29.15%	32.57%	7.78%	38.13%	23.97%	36.52%	42.16%	43.09%
S&P/ BARRA 500 Growth	LB Agg	Russell 2000 Value	Russell 2000	S&P/ BARRA 500 Value	S&P/ BARRA 500 Growth	S&P/ BARRA 500 Value	S&P/ BARRA 500 Growth	MSCI EAFE	S&P 500 Index	S&P/ BARRA 500 Growth	Russell 2000	Russell 2000	Russell 2000 Value	S&P/ BARRA 500 Growth	S&P 500 Index	S&P 500 Index	S&P 500 Index	S&P 500 Index	S&P/ BARRA 500 Growth
39.40%	6.26%	28.52%	29.13%	10.52%	33.31%	21.67%	6.50%	28.26%	31.69%	0.20%	46.05%	18.42%	23.86%	3.14%	37.58%	22.96%	33.36%	28.58%	28.25%
Russell 2000	Russell 2000	Russell 2000	S&P/ BARRA 500 Value	MSCI EAFE	S&P 500 Index	S&P 500 Index	S&P 500 Index	Russell 2000	S&P/ BARRA 500 Value	S&P 500 Index	Russell 2000 Value	S&P/ BARRA 500 Value	Russell 2000	S&P500 Index	S&P/ BARRA 500 Value	S&P/ BARRA 500 Value	Russell 2000 Value	MSCI EAFE	MSCI EAFE
38.58%	2.03%	24.95%	28.89%	7.41%	31.73%	18.67%	5.25%	24.89%	26.13%	-3.11%	41.70%	10.52%	18.89%	1.32%	36.99%	22.00%	31.78%	20.00%	26.96%
S&P 500 Index	S&P/ BARRA 500 Value	S&P/ BARRA 500 Growth	MSCI EAFE	S&P 500 Index	Russell 2000	LB Agg	S&P/ BARRA 500 Value	S&P/ BARRA 500 Value	Russell 2000 Growth	S&P/ BARRA 500 Value	S&P/ BARRA 500 Growth	Russell 2000 Growth	S&P/ BARRA 500 Value	S&P/ BARRA 500 Value	Russell 2000 Growth	Russell 2000 Value	S&P/ BARRA 500 Value	S&P/ BARRA 500 Value	Russell 2000
32.50%	0.02%	22.03%	23.69%	6.27%	31.04%	15.30%	3.68%	21.67%	20.16%	-6.85%	38.37%	7.77%	18.61%	-0.64%	31.04%	21.37%	29.98%	14.69%	21.26%
Russell 2000 Value	MSCI EAFE	S&P 500 Index	S&P 500 Index	S&P/ BARRA 500 Growth	Russell 2000 Value	S&P/ BARRA 500 Growth	LB Agg	Russell 2000 Growth	Russell 2000	Russell 2000 Growth	S&P 500 Index	S&P 500 Index	Russell 2000 Growth	Russell 2000 Value	Russell 2000	Russell 2000	Russell 2000	LB Agg	S&P 500 Index
25.39%	-2.27%	21.55%	22.56%	2.33%	31.01%	14.50%	2.75%	20.38%	16.25%	-17.42%	30.47%	7.62%	13.37%	-1.55%	28.44%	16.53%	22.36%	8.70%	21.04%
S&P/ BARRA 500 Value	S&P 500 Index	S&P/ BARRA 500 Value	Russell 2000 Growth	Russell 2000 Value	Russell 2000 Growth	Russell 2000 Value	Russell 2000 Value	S&P 500 Index	LB Agg	Russell 2000	S&P/ BARRA 500 Value	LB Agg	S&P 500 Index	Russell 2000	Russell 2000 Value	Russell 2000 Growth	Russell 2000 Growth	Russell 2000 Growth	S&P/ BARRA 500 Value
23.59%	-4.92%	21.04%	20.14%	2.27%	30.97%	7.41%	-7.12%	16.61%	14.53%	-19.50%	22.56%	7.40%	10.08%	-1.81%	25.75%	11.32%	12.93%	1.23%	12.72%
MSCI EAFE	Russell 2000 Growth	Russell 2000 Growth	S&P/ BARRA 500 Growth	Russell 2000	S&P/ BARRA 500 Value	Russell 2000	Russell 2000	S&P/ BARRA 500 Growth	Russell 2000 Value	Russell 2000 Value	LB Agg	S&P/ BARRA 500 Growth	LB Agg	Russell 2000 Growth	LB Agg	MSCI EAFE	LB Agg	Russell 2000	LB Agg
22.60%	-9.23%	20.99%	16.24%	-7.13%	29.68%	5.69%	-8.76%	11.95%	12.43%	-21.77%	16.00%	5.06%	9.75%	-2.44%	18.46%	6.05%	9.64%	-2.55%	-0.82%
LB Agg	S&P/ BARRA 500 Growth	MSCI EAFE	LB Agg	Russell 2000 Growth	LB Agg	Russell 2000 Growth	Russell 2000 Growth	LB Agg	MSCI EAFE	MSCI EAFE	MSCI EAFE	MSCI EAFE	S&P/ BARRA 500 Growth	LB Agg	MSCI EAFE	LB Agg	MSCI EAFE	Russell 2000 Value	Russell 2000 Value
2.71%	-9.81%	-1.86%	8.19%	-15.84%	22.13%	3.59%	-10.48%	7.89%	10.53%	-23.45%	12.14%	-12.18%	1.68%	-2.92%	11.21%	3.64%	1.78%	-6.46%	-1.48%

The table shows that, prior to 1995, markets tended to be choppy where no one asset class or style dominated for any extended period.[6] It also shows that different asset classes and styles outperformed at different periods and that the best performing segment of the market in any one year alternated. For example, in 1992 non-U.S. equity had extremely poor returns (-12.18% for MSCI EAFE) only to recover significantly in 1993 (+32.57%). This variable and unpredictable pattern of the capital markets implies that a disciplined

[4] Asset allocation studies typically assume annual rebalancing of the investment portfolio. This assumes that there is an intrinsic rebalancing potential from different returns, standard deviations and correlations among asset classes, with the largest potential excess returns available from rebalancing between asset classes that have high risk and low correlation (e.g., small cap and international equity classes).

[5] A similar argument could be made for the cyclical performance of investment managers as their investment styles move in and out of favor.

[6] With the exception of EAFE, which trended up from 1985 to 1988 and trended down (relatively) from 1989 to 1992.

rebalancing strategy also eliminates the need to second guess or time the markets, as the portfolio is automatically rebalanced without subjective judgement.

The alternative to rebalancing the portfolio is to let the initial asset mix and manager structure drift to what the markets dictate. Inherent in this strategy is a belief that a particular segment of the market will continue to dominate over other underperforming segments. The resulting portfolio may be superior in return performance but may be inconsistent with the sponsor's risk levels. As shown in the next section, a buy-and-hold strategy with an initial 60% equity and 40% fixed income asset mix at the beginning of 1990 would have outperformed a disciplined rebalancing strategy, but the ending portfolio would have been significantly overweight (75%) in equity relative to its original target (60%). Consequently, if there is a sudden correction in the market, then a larger portion of the portfolio is exposed than may have been intended.

Different rebalancing strategies perform best in different market environments and over different time periods. Buy-and-hold strategies will perform better in trending markets without reversals (i.e., strong bull or bear markets), but tend to develop significantly higher risk. On the other hand, choppy markets that exhibit greater volatility in performance, with frequent and large contractions in any one asset class, will favor a disciplined rebalancing strategy over a buy-and-hold one. A rebalanced portfolio will tend to perform in a manner consistent with the return objectives and risk levels set in the original asset allocation decision.

What is important is what fund sponsors expect for the next five to ten years. Do we prepare for choppy markets or trending markets? Is there a strong conviction that a trending market will continue and are sponsors prepared to assume additional risk exposures away from their targets? At the expense of extra return, we believe a systematic rebalancing process eliminates the need to make these difficult decisions and maintains the original risk exposures consistent with return objectives. That is, a systematic process is a prudent default position to unpredictable market cycles.

Empirical Results: Updating History

Focusing on the experience of the last three decades, Callan has examined the impact that alternative rebalancing strategies had on the risk-adjusted returns of a diversified portfolio.

The alternative rebalancing strategies that we analyzed can be categorized into two common groups:

1. ***Periodic Rebalancing:***
   The portfolio is rebalanced at the end of a period (e.g., every quarter or annually).

2. ***Threshold Rebalancing:***
   The portfolio is rebalanced back to its target mix once a tolerance range is reached.[7] While a common tolerance range (e.g., +/-5%) may be used across all asset classes, we have specified that the tolerance ranges for each asset class be based on its expected volatility and percentage of total assets. For example, domestic equity may have a range of +/-5%, but domestic fixed income (with lower volatility) may have a range of +/-2% (given the same allocation). In general, wider ranges for more volatile and heavily weighted asset classes will avoid frequent rebalancing.

Within threshold rebalancing, our analysis considers incremental rebalancing ranges calculated between 25% and 150% of an asset's standard deviation, and adjusted for that asset class' percentage allocation of the total assets to be rebalanced. For example, a rebalancing strategy using a 125% standard deviation guideline implies a rebalancing range of 7% around the 35% target allocation for U.S. large cap equity based on a 16.2% expected volatility [125% x 35% x 16.2% = 7%].[8]

[7] An alternative is to rebalance back to limits of the tolerance range, versus back to the target. This method was not analyzed in our study.
[8] The expected volatility assumptions for each asset class are based on the Callan Capital Market Projections.

For purposes of our analysis, we have used a conservative target asset mix with allocations and benchmarks as shown in the table below. The analysis also incorporates the impact of transaction costs in the rebalancing process, with the following underlying base transaction costs:

Asset Class	% Allocation	Benchmark	Base Transaction Costs[9]
U.S. Large Cap Equity	35%	S&P 500	40 bp
U.S. Small Cap Equity	5%	Ibbotson Small Company Stocks	60 bp
Non-U.S. Equity	20%	MSCI EAFE	80 bp
U.S. Fixed Income	40%	LB Aggregate[10]	10 bp

In assessing the success of alternative rebalancing strategies, we will consider several factors:

1. ***Frequency of Rebalancing and Impact of Transaction Costs*** – the number of times the portfolio required rebalancing over the time period and the impact that transaction costs had on the portfolio.
2. ***Return and Risk*** – the annualized return and standard deviation of the return is shown for each alternative strategy.
3. ***Sharpe Ratio*** – a risk-adjusted measure of performance, the ratio will be used to measure portfolio efficiency under each strategy.
4. ***Minimum, Maximum and Average Equity Exposures*** – equity exposures are compared to the target asset mix to show the impact of portfolio risk.
5. ***Time Period Sensitivity*** – disciplined rebalancing is meant to be a long-term strategy. However, we will show the impact of different time periods on alternative strategies. The longest time period used for this study is 30 years, from 1970 to 1999, based on quarterly data.

Asset Class Rebalancing

We will first consider the impact of alternative strategies on asset class rebalancing, ignoring for the moment the impact of manager structure rebalancing.[11] Table 1 and Chart 1 show the results of alternative rebalancing strategies over the longest time period of our study. We have the highlighted the optimal portfolio as that with high efficiency as measured by the Sharpe Ratio.

[9] These transaction costs assume that trading is somewhere between fully passive and fully active. In general, transaction costs to realign the portfolio would not consider bundled costs, such as soft dollars.

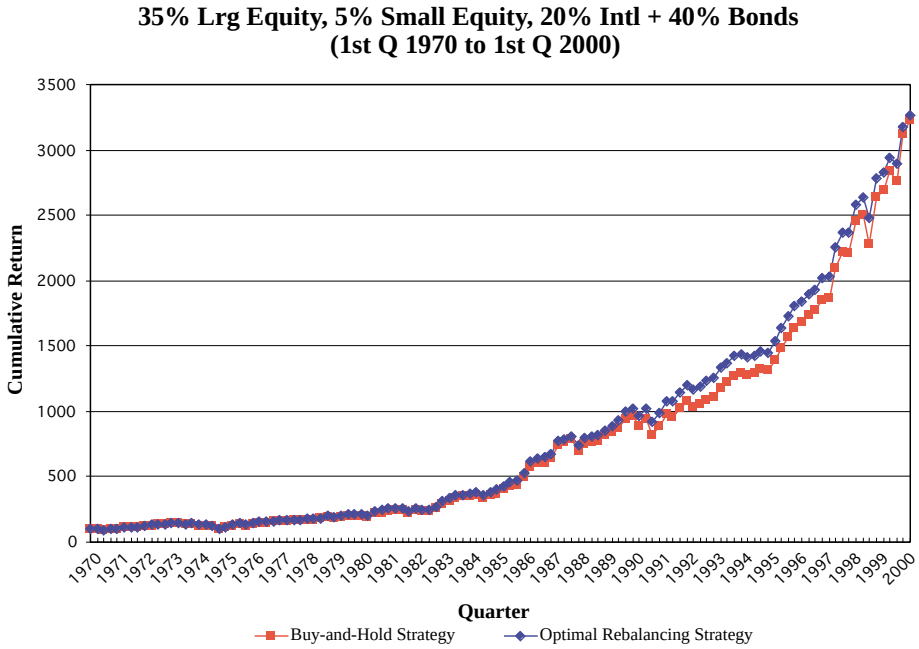
[10] LB Aggregate Index has an inception date of 1st Quarter 1976. The LB Corporate/Government index (inception 1st Quarter 1973) was used for the period 1973-1975. For the period 1970-1972, a proxy of 57%/43% weighting of the Ibbotson's Intermediate Government and Long-Term Corporate Bond indices was used. These weights were derived from regression analysis performed on the various indices.

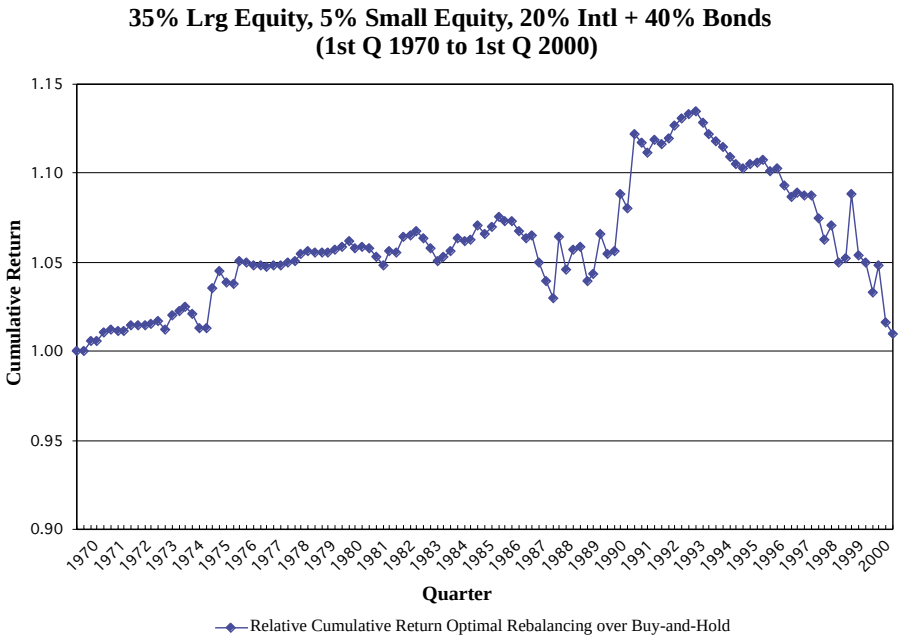
[11] Asset class rebalancing considers the broad equity markets, while manager structure rebalancing will consider investment styles, such as growth and value, within the broad market.

Table 1: Asset Class Rebalancing over the Long Term

First Quarter 1970 to First Quarter 2000											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg	US Small	Non-US Eq	U.S. Fixed
Buy And Hold	0	12.14%	11.84%	0.457	49%	83%	66%	n/a	n/a	n/a	n/a
Annually	30	12.00%	11.10%	0.475	53%	68%	61%	n/a	n/a	n/a	n/a
Quarterly	121	11.98%	11.04%	0.475	53%	65%	60%	n/a	n/a	n/a	n/a
25% Std Dev	100	11.99%	11.04%	0.476	53%	65%	60%	1%	0%	0%	1%
50% Std Dev	60	12.02%	11.03%	0.479	53%	65%	60%	3%	1%	1%	2%
75% Std Dev	39	12.11%	11.03%	0.488	53%	65%	61%	4%	1%	1%	3%
100% Std Dev	32	12.14%	11.03%	0.490	53%	65%	60%	6%	1%	1%	4%
125% Std Dev	22	12.18%	11.04%	0.493	53%	66%	61%	7%	1%	1%	5%
150% Std Dev	15	12.07%	11.04%	0.483	50%	66%	61%	9%	2%	2%	6%

Chart 1: Cumulative and Relative Cumulative Return Performance over the Long Term



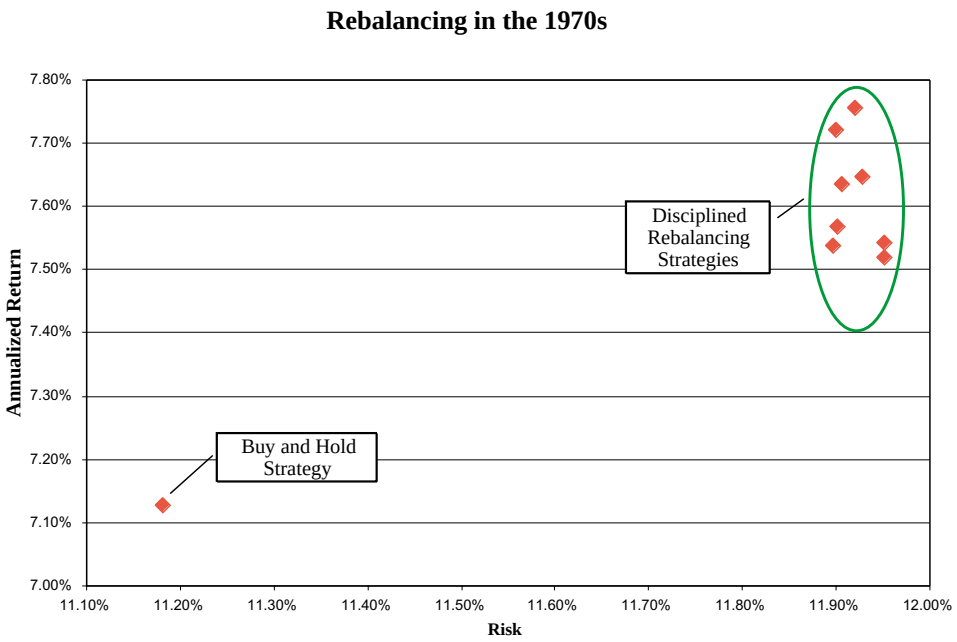


The charts show that a disciplined rebalancing strategy outperformed (from a purely return perspective) a buy-and-hold strategy over the full 30-year period. However, the charts also show that outperformance changed over time. In order to show time period sensitivity, the following sets of tables and charts (2 to 4) show the results of alternative rebalancing strategies over each of the last three decades.

Table 2: Asset Class Rebalancing in the 1970s

First Quarter 1970 to Fourth Quarter 1979											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg	US Small	Non-US Eq	U.S. Fixed
Buy And Hold	0	7.13%	11.18%	0.073	49%	61%	57%	n/a	n/a	n/a	n/a
Annually	10	7.57%	11.90%	0.106	53%	66%	60%	n/a	n/a	n/a	n/a
Quarterly	40	7.52%	11.95%	0.101	54%	65%	60%	n/a	n/a	n/a	n/a
25% Std Dev	33	7.54%	11.95%	0.103	54%	65%	60%	1%	0%	0%	1%
50% Std Dev	20	7.54%	11.90%	0.103	53%	65%	60%	3%	1%	1%	2%
75% Std Dev	14	7.65%	11.93%	0.112	53%	65%	60%	4%	1%	1%	3%
100% Std Dev	10	7.72%	11.90%	0.119	53%	65%	60%	6%	1%	1%	4%
125% Std Dev	9	7.64%	11.91%	0.111	53%	65%	61%	7%	1%	1%	5%
150% Std Dev	8	7.76%	11.92%	0.121	53%	65%	60%	9%	2%	2%	6%

Chart 2: Risk/Return of Rebalancing Strategies in the 1970s



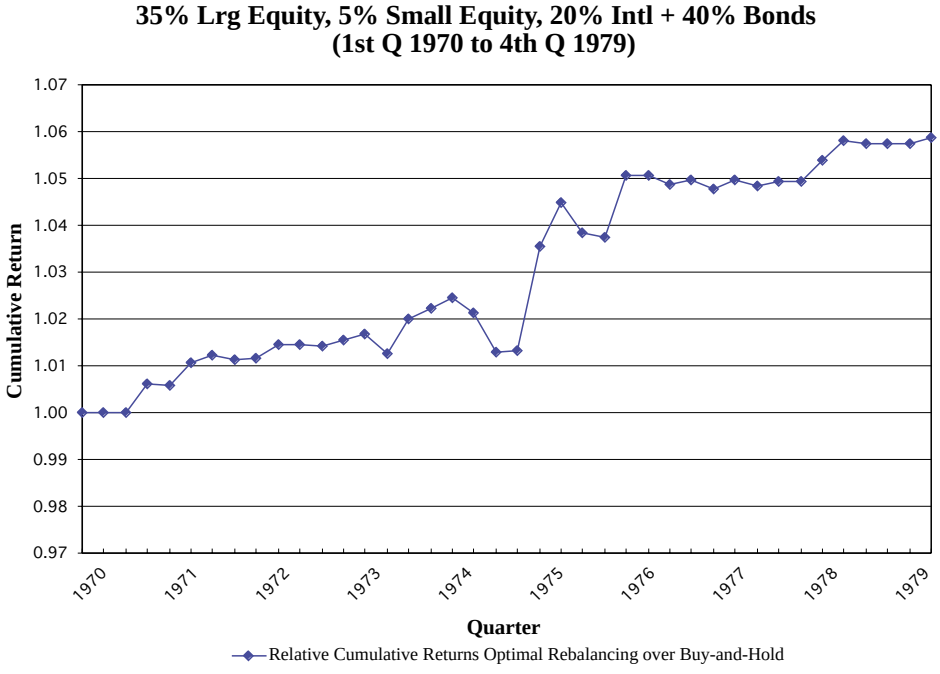
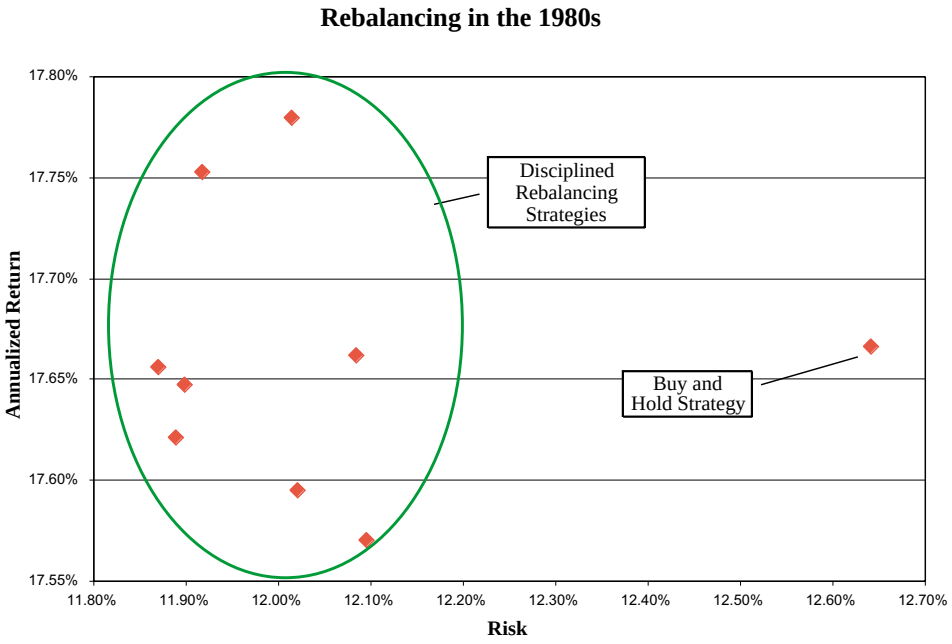


Table 3: Asset Class Rebalancing in the 1980s

First Quarter 1980 to Fourth Quarter 1989											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg	US Small	Non-US Eq	U.S. Fixed
Buy And Hold	0	17.67%	12.64%	0.695	58%	74%	66%	n/a	n/a	n/a	n/a
Annually	10	17.57%	12.10%	0.718	54%	68%	61%	n/a	n/a	n/a	n/a
Quarterly	40	17.62%	11.89%	0.735	53%	64%	60%	n/a	n/a	n/a	n/a
25% Std Dev	32	17.65%	11.90%	0.736	53%	65%	60%	1%	0%	0%	1%
50% Std Dev	20	17.75%	11.92%	0.744	53%	65%	60%	3%	1%	1%	2%
75% Std Dev	11	17.66%	11.87%	0.739	53%	65%	60%	4%	1%	1%	3%
100% Std Dev	7	17.60%	12.02%	0.725	54%	65%	60%	6%	1%	1%	4%
125% Std Dev	5	17.66%	12.08%	0.726	55%	65%	60%	7%	1%	1%	5%
150% Std Dev	5	17.78%	12.01%	0.740	53%	67%	60%	9%	2%	2%	6%

Chart 3: Risk/Return of Rebalancing Strategies in the 1980s



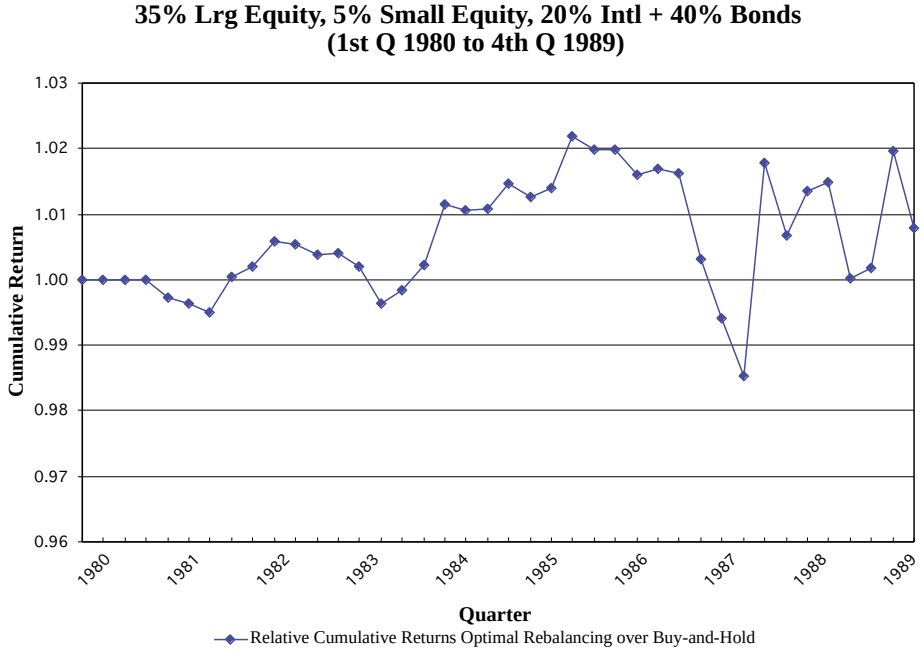
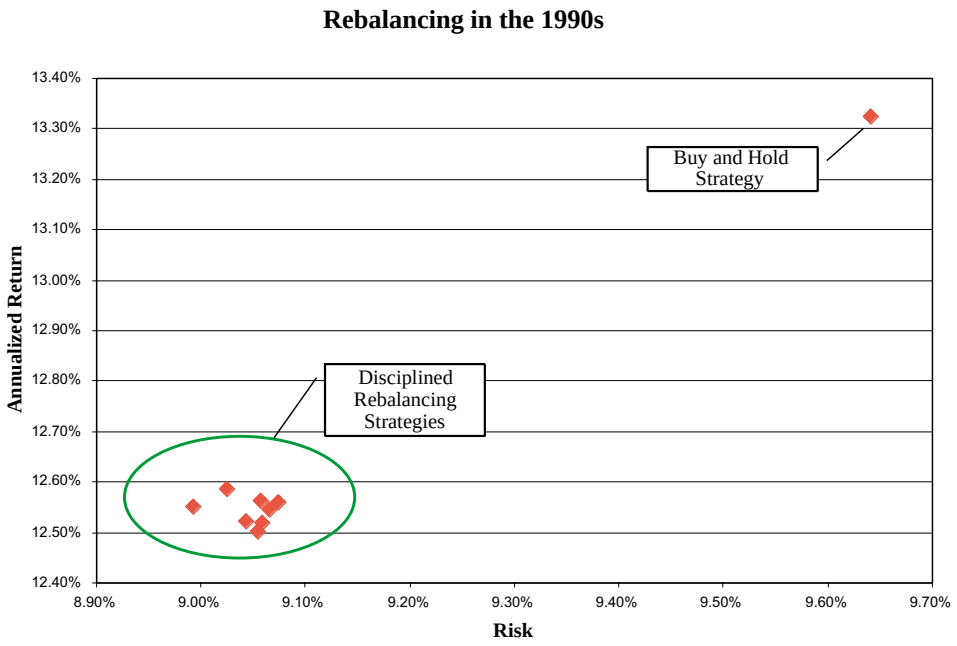
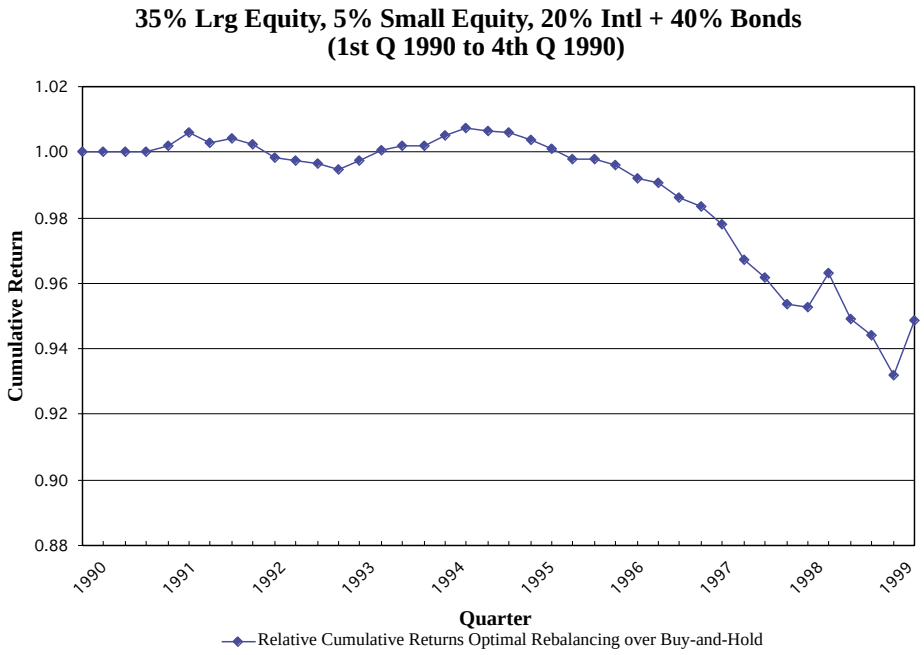


Table 4: Asset Class Rebalancing in the 1990s

First Quarter 1990 to Fourth Quarter 1999											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg	US Small	Non-US Eq	U.S. Fixed
Buy And Hold	0	13.33%	9.64%	0.857	54%	75%	62%	n/a	n/a	n/a	n/a
Annually	10	12.56%	9.06%	0.828	54%	65%	61%	n/a	n/a	n/a	n/a
Quarterly	40	12.50%	9.05%	0.821	55%	64%	60%	n/a	n/a	n/a	n/a
25% Std Dev	32	12.52%	9.06%	0.823	55%	64%	60%	1%	0%	0%	1%
50% Std Dev	21	12.55%	9.07%	0.825	56%	64%	60%	3%	1%	1%	2%
75% Std Dev	15	12.52%	9.04%	0.825	56%	64%	61%	4%	1%	1%	3%
100% Std Dev	13	12.56%	9.07%	0.826	56%	64%	61%	6%	1%	1%	4%
125% Std Dev	10	12.55%	8.99%	0.832	54%	63%	61%	7%	1%	1%	5%
150% Std Dev	7	12.59%	9.02%	0.833	54%	65%	61%	9%	2%	2%	6%

Chart 4: Risk/Return of Rebalancing Strategies in the 1990s





Evaluation of Asset Class Rebalancing:

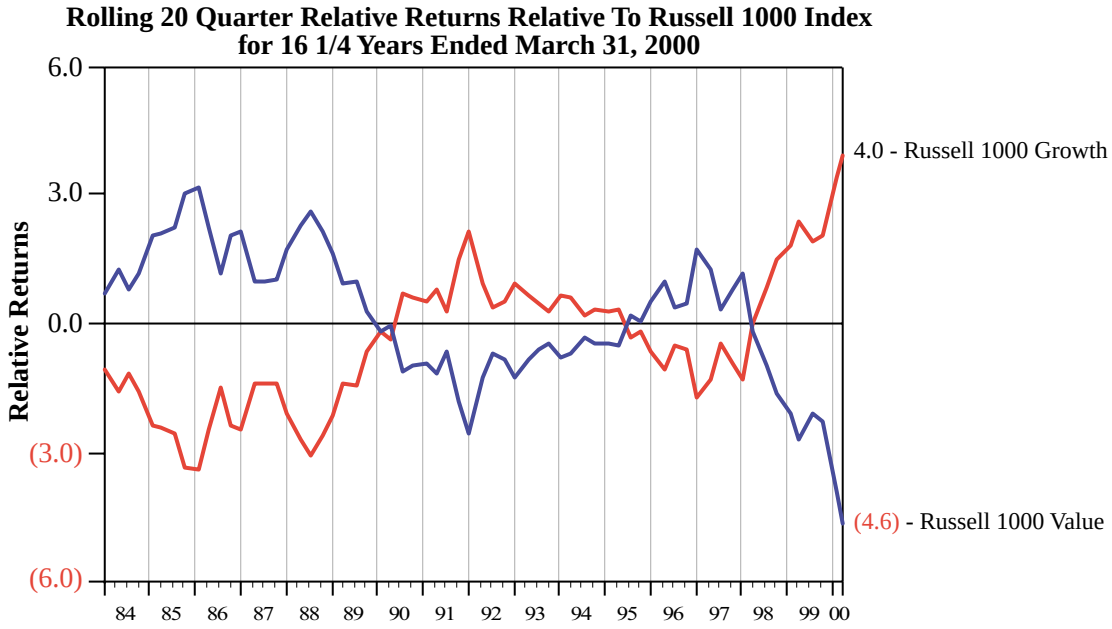
1. Over the long term (Table 1), a disciplined rebalancing strategy (125% Standard Deviation) outperformed a buy-and-hold strategy by 4 basis points per year (12.18% compared to 12.14%).[12] If we compound 4 bp over 30 years, then the fund would have gained approximately 1.2%, which translates into an additional $12 million for a $1 billion fund.
2. Most levels of disciplined rebalancing outperformed the buy-and-hold strategy in both the 1970s and 1980s, but not in the 1990s.
3. In general, disciplined rebalancing lowers risk. With the exception of the 1970s, the standard deviation of returns was lower for all rebalancing strategies.
4. In general, disciplined rebalancing was more efficient than a buy-and-hold strategy, as measured by the Sharpe Ratio. With the exception of the 1990s, the Sharpe Ratio was higher for all rebalancing strategies.
5. Disciplined rebalancing maintained tighter equity exposures around the target allocation than did a buy-and-hold strategy. In all time periods, a buy-and-hold strategy had a significantly wider range of exposure (difference between maximum and minimum equity) and was on average farther away from its target.
6. The results for the 1970s and 1990s suggest that wider rebalancing ranges were more appropriate (at least 125% Standard Deviation), as shown by the highlighted optimal rebalancing strategy. The 1980s suggest tighter rebalancing ranges (50% Standard Deviation). Thus, the full-period perspective suggests rebalancing ranges somewhere between these two.

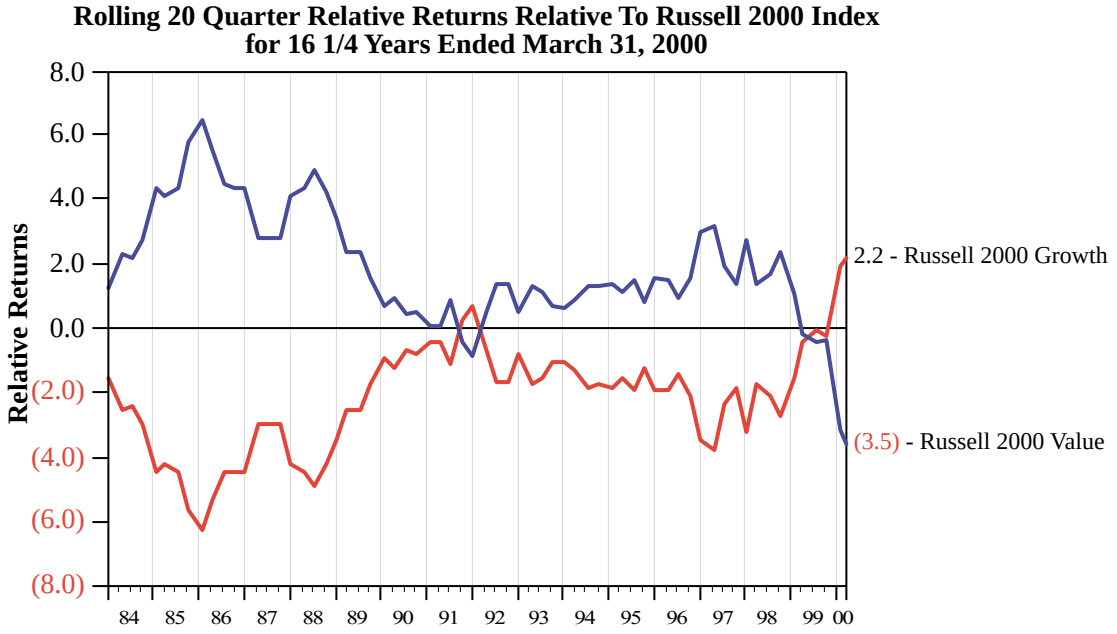
[12] This added return was net of transaction costs incurred from rebalancing the portfolio 22 times during the 30-year period, or on average once every 16 months.

Manager Structure Rebalancing

We will next consider the impact that alternative rebalancing strategies had on the risk-adjusted returns within a manager structure. That is, the following analysis evaluates the impact that manager structure rebalancing had historically on a diversified portfolio, assuming a simplistic world of an equal allocation to growth and value within U.S. large and small cap equity. Chart 5 shows that returns from investment styles in U.S. large and small cap equity have tended to move in cycles, which should favor disciplined rebalancing strategies. The purpose of our analysis therefore will be to test different rebalancing strategies within the manager structure and whether the most efficient strategy differed sufficiently from the optimal asset class rebalancing strategy.

Chart 5: Rolling 5-Year Returns for Large and Small Cap Equity



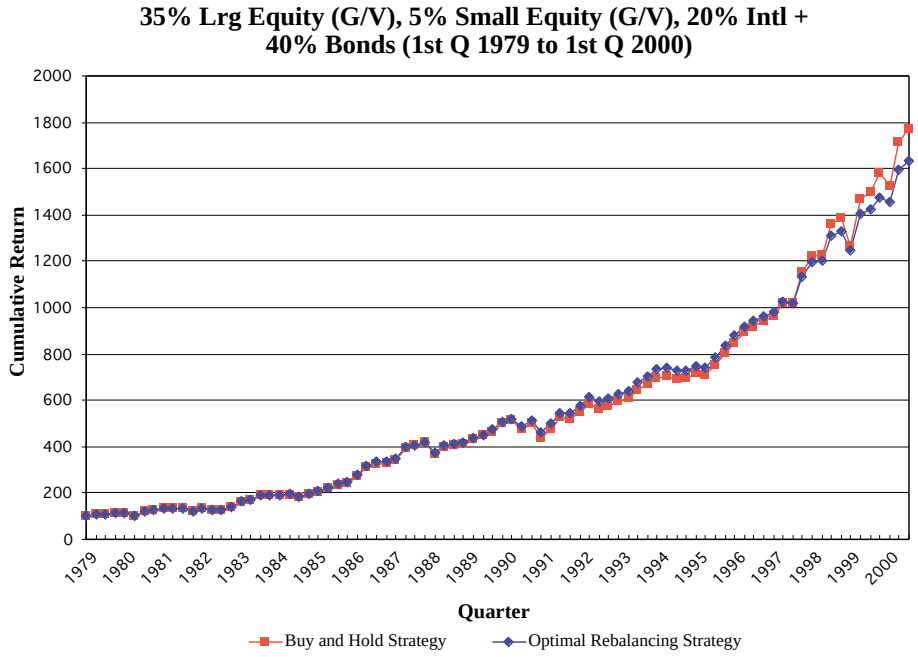


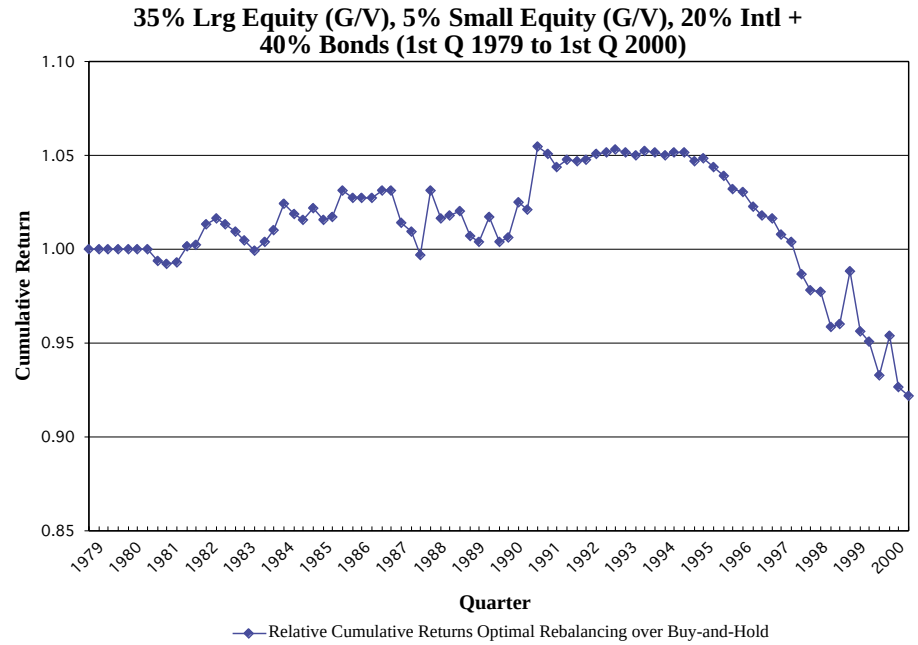
For the purpose of our analysis, we have used the Russell style indices to evaluate various manager structure rebalancing strategies.[13] Table 6 and Chart 6 below show the results that alternative rebalancing strategies had over the longest time period of our study, or 21.25 years. We have again highlighted the optimal portfolio as that with highest risk-adjusted return as measured by the Sharpe Ratio.

Table 6: Manager Structure Rebalancing over the Long Term

First Quarter 1979 to First Quarter 2000											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg G	US Lrg V	US Small G	US Small V
Buy And Hold	0	14.22%	12.00%	0.566	60%	84%	71%	n/a	n/a	n/a	n/a
Annually	21	13.64%	10.67%	0.582	54%	68%	61%	n/a	n/a	n/a	n/a
Quarterly	85	13.61%	10.57%	0.589	53%	65%	61%	n/a	n/a	n/a	n/a
25% Std Dev	72	13.62%	10.58%	0.589	53%	65%	61%	1%	1%	0%	0%
50% Std Dev	45	13.68%	10.57%	0.589	53%	65%	61%	1%	1%	0%	0%
75% Std Dev	30	13.68%	10.61%	0.589	53%	65%	61%	2%	2%	0%	0%
100% Std Dev	19	13.73%	10.58%	0.595	53%	65%	61%	3%	3%	1%	1%
125% Std Dev	13	13.64%	10.71%	0.580	55%	66%	61%	4%	4%	1%	1%
150% Std Dev	11	13.79%	10.58%	0.601	54%	68%	61%	4%	4%	1%	1%

Chart 6: Cumulative and Relative Cumulative Performance over the Long Term





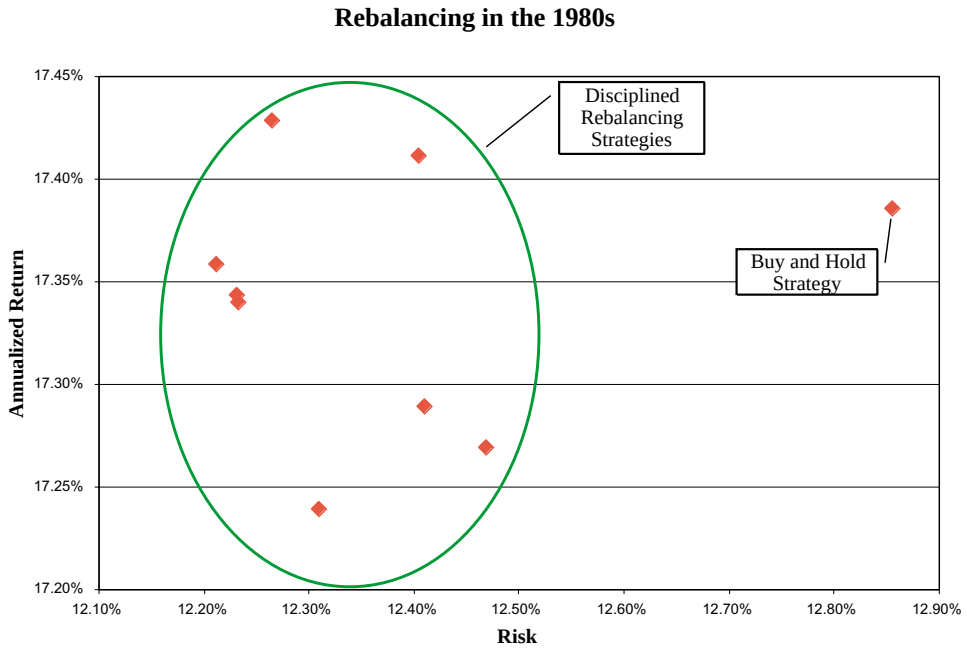
[13] Inception date for Russell indices is 1st Quarter 1979; thus the longest period of our study is 21.25 years.

Similar to the results for asset class rebalancing, Chart 6 shows that outperformance changed over time and was time period sensitive. The following tables and charts (7 and 8) show the impact that alternative rebalancing strategies had on the risk-adjusted returns over the last two decades.

Table 7: Manager Structure Rebalancing in the 1980s

First Quarter 1980 to Fourth Quarter 1989											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg G	US Lrg V	US Small G	US Small V
Buy And Hold	0	17.39%	12.86%	0.612	57%	73%	65%	n/a	n/a	n/a	n/a
Annually	10	17.29%	12.41%	0.626	54%	68%	61%	n/a	n/a	n/a	n/a
Quarterly	40	17.34%	12.23%	0.639	53%	64%	60%	n/a	n/a	n/a	n/a
25% Std Dev	35	17.34%	12.23%	0.639	53%	64%	60%	1%	1%	0%	0%
50% Std Dev	20	17.43%	12.26%	0.645	53%	64%	60%	1%	1%	0%	0%
75% Std Dev	11	17.36%	12.21%	0.642	53%	64%	60%	2%	2%	0%	0%
100% Std Dev	6	17.24%	12.31%	0.627	56%	64%	60%	3%	3%	1%	1%
125% Std Dev	6	17.41%	12.40%	0.636	54%	66%	60%	4%	4%	1%	1%
150% Std Dev	3	17.27%	12.47%	0.621	56%	67%	61%	4%	4%	1%	1%

Chart 7: Risk/Return of Rebalancing Strategies in the 1980s



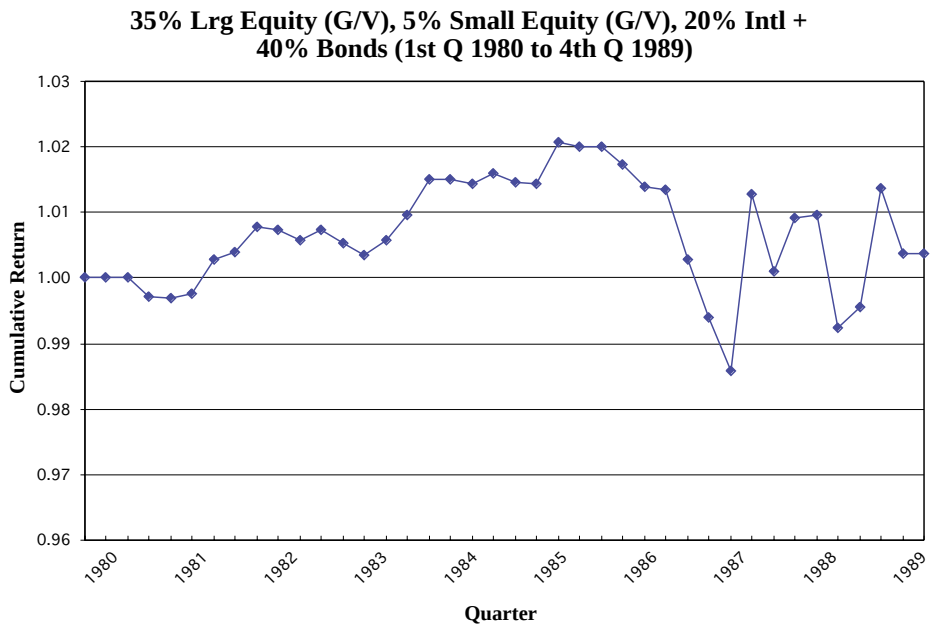
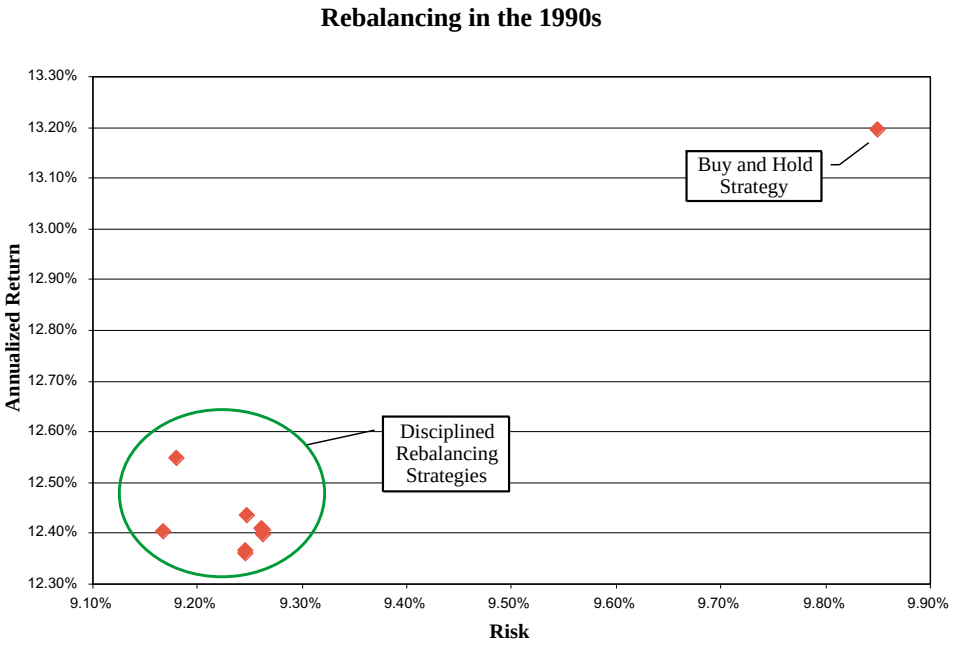
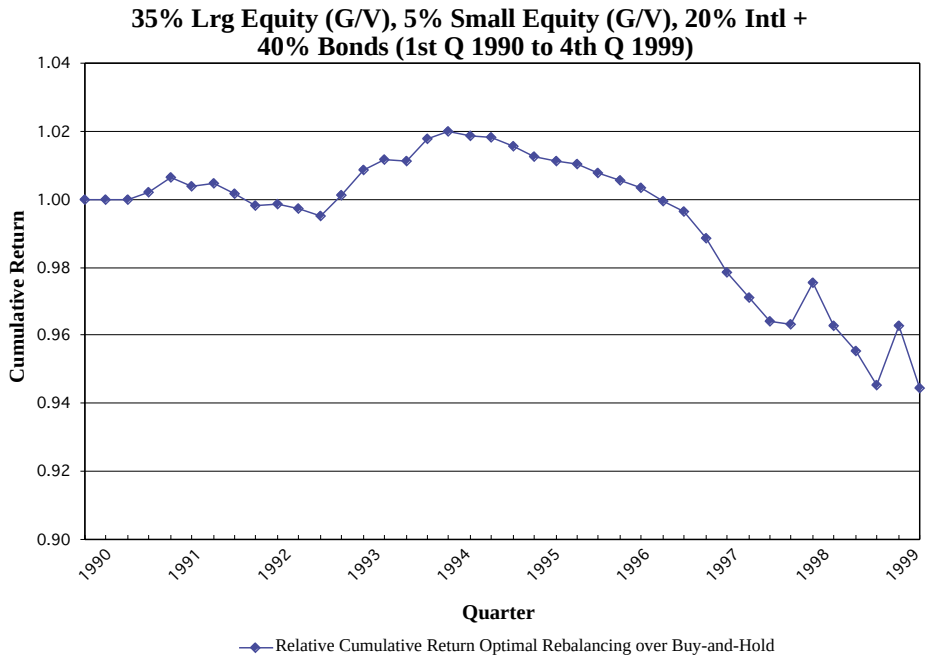


Table 8: Manager Structure Rebalancing in the 1990s

First Quarter 1990 to Fourth Quarter 1999											
	# Times	Return	Risk	Sharpe	Minimum	Maximum	Average	Rebalancing Ranges			
Strategy	Rebalanced	Base T-Cost	(Std. Dev.)	Ratio	Equity	Equity	Equity	US Lrg G	US Lrg V	US Small G	US Small V
Buy And Hold	0	13.20%	9.85%	0.820	54%	74%	62%	n/a	n/a	n/a	n/a
Annually	10	12.44%	9.25%	0.792	54%	65%	61%	n/a	n/a	n/a	n/a
Quarterly	40	12.36%	9.25%	0.784	55%	64%	60%	n/a	n/a	n/a	n/a
25% Std Dev	34	12.37%	9.25%	0.784	55%	64%	60%	1%	1%	0%	0%
50% Std Dev	24	12.40%	9.26%	0.786	56%	64%	60%	1%	1%	0%	0%
75% Std Dev	16	12.41%	9.26%	0.788	56%	64%	60%	2%	2%	0%	0%
100% Std Dev	13	12.41%	9.26%	0.787	56%	64%	61%	3%	3%	1%	1%
125% Std Dev	12	12.55%	9.18%	0.810	54%	64%	61%	4%	4%	1%	1%
150% Std Dev	8	12.40%	9.17%	0.795	54%	64%	61%	4%	4%	1%	1%

Chart 8: Risk/Return of Rebalancing Strategies in the 1990s





Evaluation of Manager Structure Rebalancing:

1. Over the 21-year study period, a buy-and-hold strategy outperformed a disciplined rebalancing strategy (see Table 7). We are unable to draw a concrete conclusion from this result (as compared to the 30-year study for asset class rebalancing), since the returns for the 1970s are not available on a style basis.[14] Nevertheless, the results for each decade (the 1980s and the 1990s) are the same for manager structure rebalancing as for asset class rebalancing.
2. Disciplined rebalancing at the manager structure level lowered risk, was more efficient as evident by higher Sharpe Ratios (with the exception of the 1990s), and maintained tighter equity exposures around the target allocation than did a buy-and-hold strategy. Once again, these results are similar to the ones observed for asset class rebalancing.
3. The results show that the optimal rebalancing method is the same at both the asset class and manager structure level.

Impact of Transaction Costs on Asset Class and Manager Structure Rebalancing

While our analysis incorporates transaction costs in the rebalancing process, we evaluated the impact that changing transaction costs has on the returns for different rebalancing strategies. The tables below show the historical annualized returns over the long term assuming no transaction costs ("Zero Cost"), our base assumptions ("Base T-Cost") and double the transaction costs ("2xBase T-Cost").

Asset Class Rebalancing

First Quarter 1970 to First Quarter 2000			
Strategy	Zero T-Costs	Base T-Costs	2xBase T-Costs
Buy And Hold	12.14%	12.14%	12.14%
Annually	12.04%	12.00%	11.96%
Quarterly	12.05%	11.98%	11.92%
25% Std Dev	12.06%	11.99%	11.93%
50% Std Dev	12.07%	12.02%	11.97%
75% Std Dev	12.16%	12.11%	12.07%
100% Std Dev	12.18%	12.14%	12.09%
125% Std Dev	12.21%	12.18%	12.14%
150% Std Dev	12.09%	12.07%	12.04%

Manager Structure Rebalancing

First Quarter 1979 to First Quarter 2000			
Strategy	Zero T-Costs	Base T-Costs	2xBase T-Costs
Buy And Hold	14.22%	14.22%	14.22%
Annually	13.68%	13.64%	13.60%
Quarterly	13.68%	13.61%	13.55%
25% Std Dev	13.68%	13.62%	13.56%
50% Std Dev	13.73%	13.68%	13.62%
75% Std Dev	13.73%	13.68%	13.64%
100% Std Dev	13.77%	13.73%	13.70%
125% Std Dev	13.67%	13.64%	13.61%
150% Std Dev	13.82%	13.79%	13.76%

Our analysis of changing transaction costs results in two significant observations:

1. In general, returns are symmetric for different rebalancing strategies. That is, the gain in return when we eliminate transaction costs equals the loss in return when transaction costs are doubled. This implies that as transaction costs increase, we would not expect a higher impact on returns than if transaction costs decrease.
2. The impact on returns is less with higher standard deviation rebalancing strategies (i.e., wider ranges). For example, with asset class rebalancing, a 25% Standard Deviation strategy results in a 6 bp return spread for different transaction cost assumptions. At 100% Standard Deviation, the return spread is only 4 bp. This result is intuitive, since the portfolio is rebalanced less often under a high standard deviation strategy.

More Equity Exposure

Over the long term, Table 1 shows that a buy-and-hold strategy leads to higher risk portfolios by increasing the average equity exposure. A buy-and-hold strategy that began in 1970 with 60% equity target would have ended-up at 83% equity at the end of 30 years, or on average at 66% equity over the study period. As

[14] Our analysis assumed that Large Cap Growth and Value had the same expected volatility (15.0%), which in combination with its allocation is used to derive the rebalancing range. The same expected volatility was also used for Small Cap Growth and Value (25.0%). While growth and value may have different expected volatility levels, our analysis did not show a material difference in the results as compared to an equal volatility assumption.

indicated by the Sharpe Ratio, the risk-adjusted return of the buy-and-hold strategy (Ratio = 0.457) was lower than that of the disciplined rebalancing strategy (Ratio = 0.493). This result leads to an interesting question: Under which strategy, buy-and-hold or disciplined rebalancing, are fund sponsors willing to adopt higher risk portfolios?

In the tables below, we analyze the impact on risk-adjusted returns in three different portfolios in which we increase the target equity exposure in 5% intervals. As equity is increased, both the returns and risk increase, but the Sharpe Ratios are equalized. However, in all cases, the ratios for a disciplined rebalancing strategy are superior to a buy-and-hold strategy. These results show that a fund sponsor who is willing to adopt a higher risk portfolio is better-off increasing the exposure directly while adhering to a disciplined rebalancing strategy.

Buy-and-Hold Strategy

Target Equity	Return	Risk	Sharpe Ratio	Average Equity
55% Equity	11.92%	11.36%	0.456	62%
60% Equity	12.14%	11.84%	0.457	66%
65% Equity	12.35%	12.32%	0.456	71%

Optimal Rebalancing Strategy

Target Equity	Return	Risk	Sharpe Ratio	Average Equity
55% Equity	11.95%	10.50%	0.496	56%
60% Equity	12.18%	11.04%	0.493	61%
65% Equity	12.43%	11.60%	0.491	66%

What is the Optimal Rebalancing Method?

The most important conclusion of our rebalancing analysis is that a disciplined rebalancing strategy resulted in superior portfolios on a risk-adjusted basis. This conclusion is evident in the results for both asset class and manager structure rebalancing, in which a disciplined strategy reduced volatility, gave higher Sharpe ratios and had tighter equity exposures around their target allocations. A disciplined rebalancing strategy outperformed a buy-and-hold strategy for all periods until more recently. While our research shows that a buy-and-hold strategy has outperformed over the short term (i.e., the 1990s), the resulting portfolios were generally more risky.

Another important conclusion of our analysis is that a disciplined rebalancing strategy is superior when fund sponsors give thought to higher risk portfolios by increasing equity exposure. Higher equity exposure obtained under a buy-and-hold strategy results in less efficient portfolios as measured by the Sharpe Ratio than under a disciplined rebalancing strategy. Accordingly, fund sponsors should be more willing to adopt higher equity exposures if disciplined rebalancing is in place than if disciplined rebalancing is not in place.

Consequently, fund sponsors should evaluate these results in light of their own investment strategies, capital market expectations, return objectives, and the desired level of risk they want to assume in their portfolios. If fund sponsors desire higher levels of return and believe strongly that trending equity markets will continue, then our research supports a buy-and-hold strategy. However, a fund sponsor must also be prepared to assume higher levels of risk than were originally anticipated. Following a trending market, a portfolio with a buy-and-hold strategy may need to be rebalanced at some point in the future (on an ad-hoc basis), implying that sponsors must also believe they have the skill to correctly time market reversals in the future. In the absence of such strong convictions, our research supports a disciplined rebalancing strategy.

Given that our analysis favors a disciplined rebalancing strategy, our research suggests that the optimal rebalancing strategy is the 100% Standard Deviation scenario. A fund sponsor can calculate the rebalancing range for an asset class or manager allocation using the following formula:

Rebalancing Range = 100% x % Allocation x Expected Volatility

Based on Callan's expected volatility assumptions[15] and a target mix of 60% equities and 40% fixed income, this translates into the following rebalancing ranges for asset classes:

Asset Class	Target Allocation	Rebalancing Range
U.S. Large Cap and Broad Equity	35%	+/- 6%
U.S. Small Cap Equity	5%	+/- 1%
Non-U.S. Equity	20%	+/- 1%
U.S. Fixed Income	40%	+/- 3%

Investment Styles	Target Allocation	Range
Large Cap Growth	17.5%	+/-3.0%
Large Cap Value	17.5%	+/-3.0%
Small Cap Growth	2.5%	+/- 0.5%
Small Cap Value	2.5%	+/- 0.5%

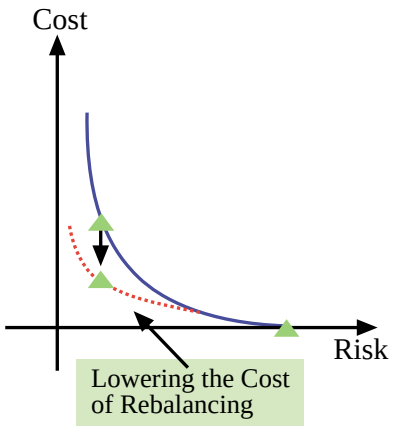
Implementation Issues: How Can We Lower Transaction Costs?

In order to complete the formulation of a rebalancing policy, fund sponsors will need to address implementation issues of their policy. Implementation of a rebalancing policy requires a monitoring process and careful management of the transition of assets to be rebalanced.

The monitoring process adopted in the rebalancing policy will be a function of the time and resources available to fund sponsors. Our empirical analysis assumed that monitoring would occur at the end of each quarter, or once sufficient portfolio market values and return information becomes available from the custodian.[16] More frequent monitoring may be warranted under the following circumstances:

- The custodian provides more frequent portfolio information;
- Fund sponsors have the time and resources[17] to devote to more frequent monitoring; or
- Return volatility is higher over shorter time periods.

Managing the transition of assets once a rebalancing trigger is reached is also critical to an effective rebalancing policy. The reason is that transaction costs can quickly eliminate any benefits from rebalancing the portfolio. As shown below, the objective of a transition process is to lower the transaction costs that will inevitably be incurred from realigning the portfolio.



Fund sponsors have a number of options available:

- Positive cash flow (i.e., contributions exceeding benefit payments and expenses);
- Cash sweep of all manager accounts (i.e., uninvested assets at a manager's discretion);
- Withhold future allocations to overweight groups while deploying all new cash to underweight groups;
- Use index futures, which enable quick rebalancing at significantly lower transaction costs;

[15] In Callan's current five-year assumptions (2000-2004), the expected volatility for U.S. large cap is 15%, U.S. small cap is 25%, U.S. broad domestic equity is 16.2%, Non-U.S. equity is 21.5%, U.S. fixed-income is 5.5%, Non-U.S. fixed income is 10%, real estate is 16.5%.

[16] Our analysis does not consider that an asset class or style may have breached its range during the period. Quarterly monitoring implies that the portfolio is evaluated at the end of the period, regardless of what happened during the period. More frequent monitoring may be effective when markets become more volatile in which swings in performance are dramatic over a relatively short time period.

[17] Some fund sponsors hire "rebalancing managers" whose responsibility is to monitor and implement rebalancing using a futures-based approach.

- Buy and sell commingled fund units in which transaction costs may be shared by all unitholders; or
- Buy and sell securities through a transition manager.

Readily available cash is the least expensive, as it eliminates the need to sell securities in order to raise funds for rebalancing purposes. However, a few months of cash flow and a one-time cash sweep will generally not be sufficient to fully rebalance the portfolio over the short term. More often, securities sales will need to complement any readily available cash. Any time there is a need to buy or sell securities, transition managers can be used as an effective means of addressing transaction cost concerns. These managers have special trading skills and identify opportunities for swapping, and buying and selling securities to lower transaction costs, including the potentially large cost of market impact.

Finally, in evaluating the impact of disciplined rebalancing strategies on a manager structure, our analysis assumed a simplistic manager structure for U.S. equity with a neutral bias to growth and value relative to the large/small cap market benchmark. For funds in which the manager structure is more complex or in which the structure has an inherent bias versus its benchmark, a rebalancing trigger may also signal a time to review the structure. The purpose of such a review would be to confirm the allocations to managers and their strategies under current market conditions and future outlook for the capital markets. A review may be important as the composition of benchmarks and their relative style exposures change over time.

Karen Harris
August 2000

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