

C A M B R I D G E A S S O C I A T E S L L C

REBALANCING

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ABSTRACT

1. Rebalancing reduces portfolio risk relative to the policy asset allocation. While rebalancing may provide a slight enhancement in returns, the primary benefit is in risk control. Rebalancing provides a discipline for selling assets that have appreciated and may be overvalued, and for buying assets that have declined and may be undervalued. It works best when there are many assets to rebalance among, when the assets have high volatility and when the assets have a low correlation to each other, but rebalancing may not add value in trending markets, and can be difficult to implement in asset classes with limited liquidity.
2. While there are numerous methods to determine when or under what circumstances to rebalance, there is little difference in the effectiveness of each of these rules. The decision to rebalance is more important than the decision of which method to use.
3. Rebalancing should only occur to the extent that the marginal benefits of doing so are greater than or equal to the marginal costs. Transaction costs will create a natural range around the target allocation where rebalancing fails to add value. The greater the costs, the greater the range, and the greater the range, the fewer opportunities there will be to rebalance.
4. To the extent that cash flows, such as gifts or redemptions to support spending, are used to move portfolios closer to target allocations, the marginal costs of rebalancing can be virtually eliminated. Careful use of cash flows can achieve a significant portion of rebalancing with relatively low transaction costs.
5. An effective rebalancing policy should document simple and logical rules with regard to rebalancing triggers, the frequency and degree of rebalancing, the methodology for allocating interim cash flows, and the procedure for raising or holding cash before spending distributions. The responsibility for monitoring and implementing these rules should be clearly designated.

SUMMARY

Introduction

The goal of rebalancing is to keep asset class weights at or near target allocations in order to control risk. The policy portfolio target asset allocation weights are designed to provide the optimal portfolio given investors' financial objectives, risk and return assumptions, and risk tolerances. Choosing not to rebalance is an active decision that lets portfolio weights drift, increasing portfolio tracking error and volatility, and diminishing the benefits of diversification.

This paper outlines the theoretical rationale for rebalancing, characteristics of the most common rebalancing strategies, and practical issues in setting a rebalancing policy. This discussion focuses on the asset class level, and does not consider issues of individual managers or manager structure within an asset class.

Our analysis leads to the following three conclusions: First, rebalancing adds value by lowering portfolio volatility. Second, the method that is used to rebalance has less of an effect than the decision of whether or not to rebalance. Third, allocating cash inflows and outflows according to the specified rebalancing method achieves a large amount of the benefit of rebalancing with relatively low transaction costs.

Rebalancing Considerations

Rebalancing serves to instill discipline over the hesitation to sell recent winners (that may be overvalued) and invest in recent losers (that may be undervalued), essentially fostering a “buy low, sell high” strategy. Given market volatility, rebalancing might also be characterized as “buy on dips, sell on rallies,” in which investors seek to take advantage of market and business cycles. When a portfolio is not rebalanced, the investment becomes a momentum strategy in which the asset classes that have done well have a larger weight in the portfolio, while those that have performed poorly have a lower weight. As with any momentum-driven strategy, success is contingent upon the ability to get out and back in at the right time, which is difficult to achieve as investors tend to extrapolate the past into the future, missing one or both inflection points and harming performance. Furthermore, allowing winners and losers to run their course undermines the optimization of risk-return that is the whole objective of diversification. However, since the act of rebalancing is counterintuitive, investment committees often balk at implementing in practice what they know in theory they should do.

By definition, rebalancing lowers portfolio tracking error, keeping the expected risk and return characteristics of the portfolio in line with investment objectives inherent in the policy or target allocation. The effect of rebalancing is to reduce the probability of extreme negative and extreme positive outcomes by keeping a tighter distribution of returns around the target allocation. Rebalancing nearly always reduces volatility, since failing (or choosing not) to do so increases the allocation to the best performers, which typically are higher risk assets. While the degree of risk reduction obtained through rebalancing varies by portfolio, in general it is greater in more diversified portfolios with higher volatility among individual asset

classes. Similarly, the benefits of rebalancing a specific asset will be greater the lower its correlation with the rest of the portfolio.

Rebalancing will result in lower returns when one asset class is consistently dominant. During the last century, for example, an investor in U.S. stocks and bonds would have experienced higher returns, albeit with higher volatility and larger drawdowns, by not rebalancing. Of course, there were some periods in which bonds outperformed and rebalancing would have improved performance, but over the entire 100 years rebalancing would have reduced returns.

Investors willing to accept higher volatility may be able to justify not rebalancing, or rebalancing infrequently, among asset classes for which they have conviction that one will be dominant over the time horizon they consider meaningful. However, the interim volatility is important, as a reduction in market values over a three-year period (the period over which most spending rules are based) can significantly impair an institution's ability to spend as planned. Institutions that suffer dramatic drawdowns often find it difficult to maintain underwater, albeit attractively priced investments, selling at the bottom of the cycle and missing the subsequent recovery.

Practical Constraints to Rebalancing

Rebalancing can be challenging to implement because of practical constraints dealing primarily with differences in the liquidity among asset classes held by most institutional investors.

Non-marketable alternative investments (e.g., private equity, venture capital, direct real estate) are highly illiquid, making transaction costs high and complicating the determination of fair market values. Transaction costs are high, as interests traded in the secondary market may differ substantially from their intrinsic value. However, distributions from these investments can be large relative to other assets and can be a significant contribution to the rebalancing effort. Careful modeling of the timing and amount of fund contributions and distributions is essential for rebalancing portfolios with significant allocations to these investments.

Even most marketable alternative investments (e.g., long/short hedge funds, absolute return strategies) are only semi-liquid, requiring some degree of advance notice for monthly, quarterly, or annual redemptions, often allowable after an initial lock-up period. It is obviously easier to rebalance among liquid assets and across a large number of asset classes.

Cost of Rebalancing

Rebalancing should only occur when the benefits of doing so exceed the costs. Costs of rebalancing may include commissions and fees (i.e., administrative, custody, purchase, or redemption), bid/ask spreads, market impact, time and resources expended, and taxes. In addition, rebalancing can result in opportunity costs associated with selling winners and buying losers too early. Some of these costs are direct and some are

less transparent. For example, market impact costs are difficult to measure, as they relate to the change in market pricing associated with large sales and purchases of securities. However, these costs are typically relatively insignificant when rebalancing is performed on a regular basis. In addition, transaction costs from a purchase or redemption are spread across all investors in commingled accounts and costs are not directly disclosed. In separately managed accounts, however, all transactions costs are borne by the account holder and can be specifically identified.

A distinction should be made between fixed and variable costs. For example, in selling a stock, commission costs are determined on a per share basis (fixed rate), so selling twice as much stock will cost twice as much in commissions. However, liquidity of the stock affects the market impact cost of the trade, and so the total costs will not be linear (variable rate). In all cases, it pays to rebalance toward the target for only as long as the benefits exceed the costs, and more specifically, as long as the marginal benefits exceed the marginal costs.

Transaction costs will create a natural range around the target allocation where rebalancing fails to add value because the costs exceed the benefits. The greater the costs, the greater the range, and the greater the range, the fewer opportunities there will be to rebalance. While transaction costs associated with rebalancing should be carefully evaluated in setting policy, these costs should not be used as justification to avoid rebalancing altogether.

Types of Rebalancing

The first major decision in setting a rebalancing strategy is when to rebalance. We define four main rebalancing methods that are distinguished by the event that triggers the rebalancing. Within each method, parameters must be set with regard to the frequency and amount of rebalancing performed. In practice, these rules are often combined to some degree, but are discussed below in their pure forms.

Time or Calendar Rebalancing

Rebalancing is performed at specified intervals (e.g., monthly, quarterly, annually). A pure calendar rebalancing rule would require rebalancing to occur at the defined time interval regardless of the deviation of the portfolio from target allocations.

There is a natural tradeoff between the frequency of rebalancing and transaction costs. Investors should consider rebalancing costs when setting the periodicity of rebalancing, as excessive rebalancing can result in costs that outweigh the benefits. Alternatively, rebalancing too infrequently increases portfolio risk and may also allow assets to rise in value and fall back to (or below) targets before rebalancing is performed.

Cash-Flow Rebalancing

Cash-flow rebalancing uses portfolio inflows and outflows to continually rebalance as cash flows are realized. Inflows can be directed to the underweighted asset classes and withdrawals can be taken from the

overweighted asset classes. Inflows come from investments (e.g., interest income, dividends, private equity, or venture capital distributions) or from non-investment sources (e.g., gifts). Redemptions are made to support spending. The portion of rebalancing achieved through cash flows is sometimes referred to as *passive*, and the remaining rebalancing required to move the portfolio back to target weights is referred to as *active*. The greater these cash flows, the less *active* rebalancing is required.

The primary benefit of this rebalancing strategy is that transaction costs are only marginally higher than those that would need to occur if there were no rebalancing policy in place. The cost associated with the *passive* portion of rebalancing is limited to any cost differential that might exist between selling overweight assets (or buying underweight assets) instead of selling (or buying) another asset that may otherwise have been chosen to support spending needs not covered by cash inflows (or to invest cash inflows in excess of spending needs). In addition, the thoughtful use of cash flows to rebalance the portfolio can significantly decrease the amount of *active* rebalancing required. While the timing and frequency of distributions to support spending varies across institutions, it should be noted that some carefully plan for spending by accumulating cash prior to the distribution date.

There are practical issues to cash flow rebalancing. In particular, specific actions must be made to direct funds to or from specific asset classes and managers. If staff has been designated by the investment committee to monitor assets and take appropriate actions, the task can be relatively straightforward. If not, challenges associated with gathering the investment committee to approve rebalancing requirements and direct funds might be prohibitive.

Range or Deviation Rebalancing

Range rebalancing is triggered if any allocation is outside of a specified tolerance range. Tolerance ranges describe the level to which an asset's allocation may drift. A pure range rebalancing strategy would require daily rebalancing whenever an asset class weight exceeded the specified tolerance range.¹

Rebalancing ranges should reflect careful consideration of transaction costs and volatility specific to each asset class. For example, ranges should be wide enough to avoid unnecessary transactions due to normal market volatility (perhaps plus some room for trending), but narrow enough to prevent large over- or underweights.

Tactical Rebalancing

Tactical rebalancing policies allow asset classes to drift, based on either fundamental or technical rules according to specified constraints, and as a result are often associated with market timing strategies.

¹ A study by Wellington Management Company suggests using asymmetric ranges with a higher upside than downside, noting this better reflects the characteristics of capital market returns than does the commonly used symmetric ranges. We do not find a significant difference between symmetric and asymmetric ranges except when extreme differences between the upper and lower ranges are considered; however, this has the effect of increasing tracking error relative to the policy benchmark, diminishing the risk-reduction benefits of rebalancing.

However, a disciplined rebalancing strategy prevents market timing by bringing the actual allocation closer to (and never farther away from) the policy allocation.

Tactical rebalancing does have some appeal, as asset classes will be more or less attractive at different points in time. If an underweighted asset class is overvalued, or vice versa, the asset class might be allowed to drift while the remaining asset classes are rebalanced. Rebalancing occurs to the extent that overweight asset classes are overvalued and underweight asset classes are undervalued.

Another tactical decision would be to let winners ride in trending markets and rebalance frequently in volatile markets, but this requires investors to be right on two fronts: determining when the markets cease to be trending and when they begin trending again.

No Rebalancing

A decision to forgo rebalancing should not be made without careful study and deliberation, as it has important investment implications. Not rebalancing is akin to a buy and hold approach. The strategy allows allocations to drift, and in particular, drift into higher risk/higher return strategies, increasing tracking error and volatility and reducing portfolio diversification.

How Far to Rebalance

The second major decision in setting a rebalancing strategy is how far to rebalance. Given the costs associated with rebalancing, it may not always be optimal to rebalance all the way back to policy target allocations. Risk tolerances and costs associated with rebalancing are specific to each investor and these tradeoffs should be evaluated on a case-by-case basis. The following are the most common practices:

- **Rebalance to policy targets.** Rebalancing back to the policy weight minimizes tracking error relative to policy and keeps the portfolio in line with optimal risk controls, but may result in the costs of rebalancing exceeding the benefits for some investors.
- **Rebalance to range threshold.** Rebalancing back to the threshold reduces transaction costs and is less disruptive to the underlying managers, but may result in less optimal portfolio risk-return characteristics, particularly when wide ranges around the targets are utilized.
- **Rebalance halfway to target.** Research by the investment management firm, AllianceBernstein, suggests rebalancing halfway between policy and threshold weights is optimal.² Based on their algorithm for measuring the costs and benefits of rebalancing, this is the point at which the marginal cost equals the marginal benefit of rebalancing. As one might expect intuitively, this strategy results in rebalancing smaller amounts, but doing so more frequently.

² *Is There a Better Way to Rebalance?*, Seth Masters, AllianceBernstein.

Practical Issues in Establishing a Rebalancing Policy

Any rebalancing policy must factor in practical considerations in order to be applied consistently and effectively. A rebalancing policy should at minimum include:

- the frequency with which the portfolio will be rebalanced and/or reviewed to determine if rebalancing is necessary;
- the amount of deviation tolerated from policy target weights;
- the degree of rebalancing (i.e., to policy weights, to threshold weights, or somewhere in between);
- a methodology for allocating interim cash flows;
- a procedure for raising or holding cash before spending distributions; and
- delineation of who (i.e., staff or committee) will be responsible for monitoring allocations and implementing rebalancing policies.

Evaluation of Strategies

Exhibits 1 and 2 compare the historical performance characteristics of a portfolio using the following rebalancing rules:

1. Range rebalancing with a +/-10% threshold for U.S. equity and a +/-5% threshold for global ex U.S. equity and U.S. fixed income. Only those asset classes whose bounds are violated are rebalanced back to target weights.
2. Calendar rebalancing with an annual frequency.
3. No rebalancing.

The first two rules also are evaluated with spending utilized to move asset allocations closer to portfolio targets. Spending is assumed to be 5% of a trailing 12-quarter average market value; the most common spending rule used by institutions. As cash flows vary significantly across institutions, we evaluate the extreme case where no inflows exist.³

The benchmark for this analysis is a constantly (i.e., quarterly in this case) rebalanced portfolio, since this generally equates to the policy, or target portfolio. We use 28 years of quarterly returns data and a target portfolio of U.S. equity (50%), global ex U.S. equity (20%), and U.S. fixed income (30%). We did not include marketable and non-marketable alternative assets, as they would complicate the analysis for liquidity reasons. Other asset classes, such as emerging markets or TIPS, lack sufficient history. As with any historical analysis of this sort, it is beginning- and end-point sensitive and results can change significantly over different measurement periods.

³ This assumption excludes the impact of using cash inflows to rebalance underweight asset classes. For example, to the extent that cash inflows are not first invested in the endowment, but used directly to support spending, our analysis would overstate the cost savings associated with using cash outflows to rebalance.

The returns and standard deviations for all of the rebalancing rules were virtually identical except for the no-rebalancing rule, which had a comparable return, but higher volatility over the 28-year period (Exhibit 1). In general, over rolling five-year periods, returns for the various portfolios were also similar. However, in more volatile environments, the dispersion of returns among the strategies has been greater. As one would expect, not rebalancing would have helped relative to the other rules in the late 1990s' momentum-driven market and hurt when the market declined in the following period.

The portfolio with no rebalancing incurred a significant amount of drift relative to target allocations, while the drift among the rebalanced portfolios was relatively low and comparable. The average portfolio distance from target, defined as one-half the sum of the absolute differences between actual asset allocation and target allocation for all asset classes prior to any rebalancing, was allowed to rise as high as 23% in 1999 and 2000, compared to a high among rebalanced portfolios of 7% for the range rebalanced portfolio in 1997. (See the Appendix for the formula for calculating the average distance from target.)

While the risk and return characteristics of all rebalanced portfolios were similar over the 28-year period evaluated, the cost of rebalancing differed, with portfolios incorporating cash flows, specifically spending, in the rebalancing rule incurring lower *active* turnover without taking on higher tracking error (Exhibit 2). Active turnover relates to rebalancing required after spending redemptions are used to passively rebalance. Since roughly half of rebalancing needs were met through spending cash flows over the period analyzed, active turnover was meaningfully lower for these portfolios. We use turnover as a proxy for rebalancing costs, as transaction costs are unique to each investor.

Conclusion

A rebalancing policy is an important part of managing an institution's assets, as it imposes discipline to decisions that are otherwise tied to the emotions that often accompany periods of high volatility. Rebalancing keeps the portfolio close to the policy targets, which were set as part of a disciplined process. The primary role of rebalancing is to maintain these policy allocations and thereby maximize the probability of meeting financial objectives given risk tolerances.

While historical analysis suggests the differences among rebalancing strategies are relatively minor, rebalancing clearly dominates not rebalancing and should be a part of a thoughtful investment plan. Furthermore, utilizing cash flows to move assets toward their target allocations can help reduce rebalancing costs.

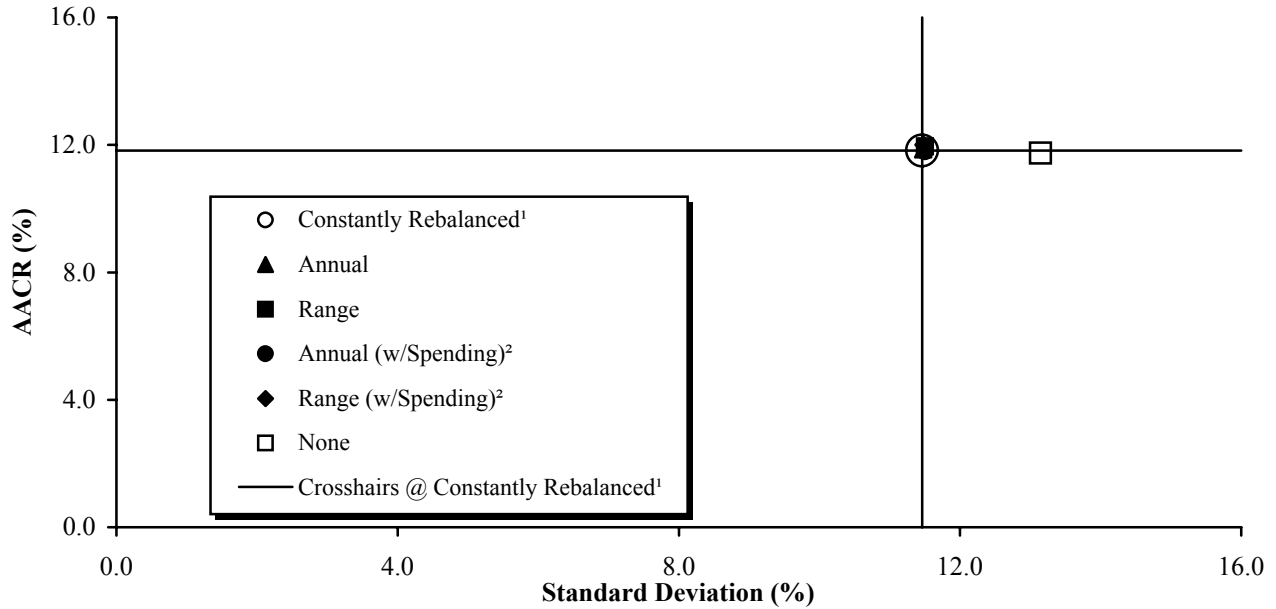
EXHIBITS

Exhibit 1

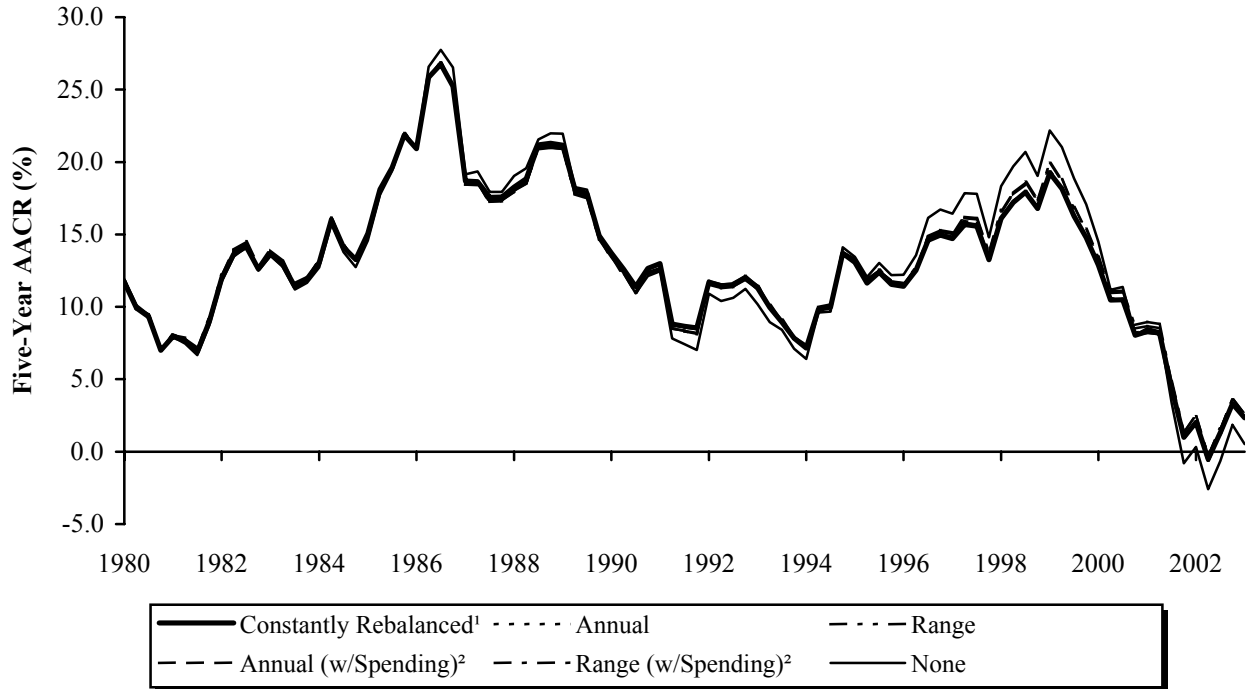
COMPARISON OF REBALANCING POLICIES

January 1, 1976 - December 31, 2003

Full Period Return vs Standard Deviation



Rolling Five-Year AACR

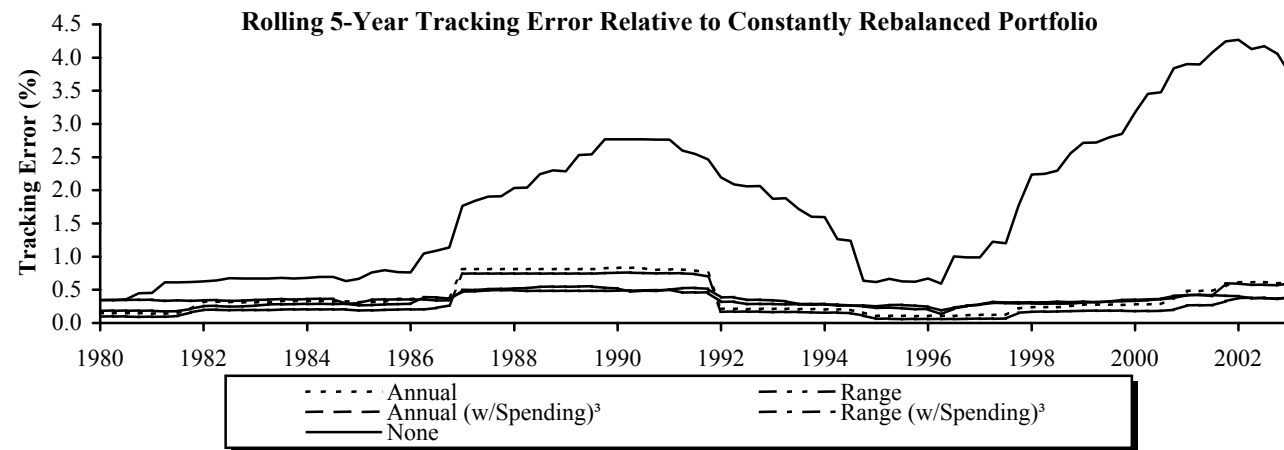
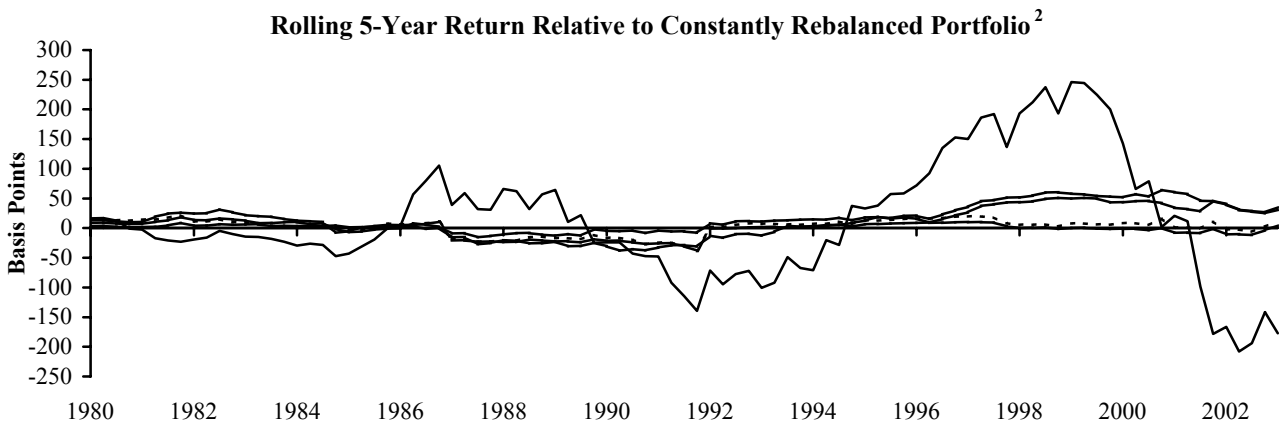
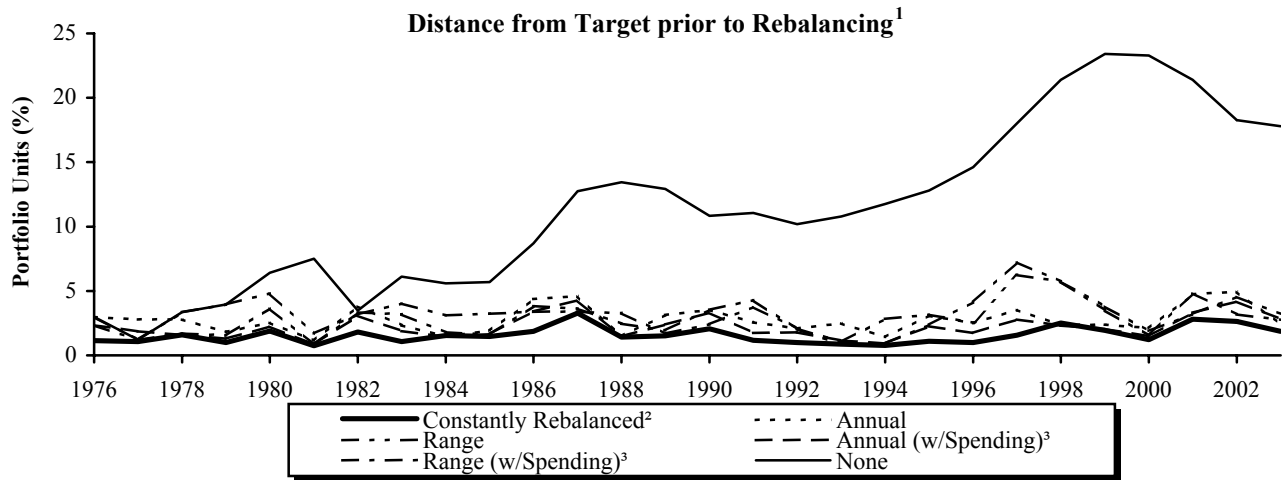


¹ Constant defined as quarterly rebalancing.

² Redemptions for spending needs are used to move asset allocations closer to target weights. We assume no cash inflows are used to support spending as inflows vary significantly relative to spending needs across institutions and over time. Spending rule: 5% of trailing 12 quarters average market value.

Exhibit 1 (continued)
COMPARISON OF REBALANCING POLICIES

January 1, 1976 - December 31, 2003



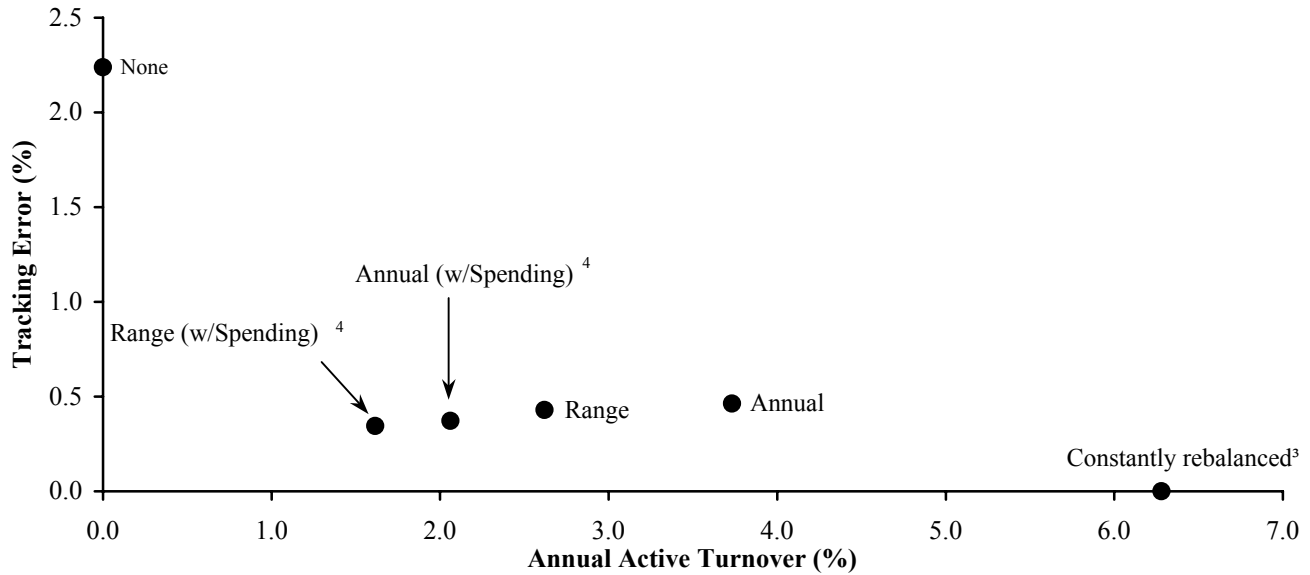
¹ Distance from target is defined as half the sum of the absolute value of the difference between actual and target weights for each asset class.

² Constant defined as quarterly rebalancing.

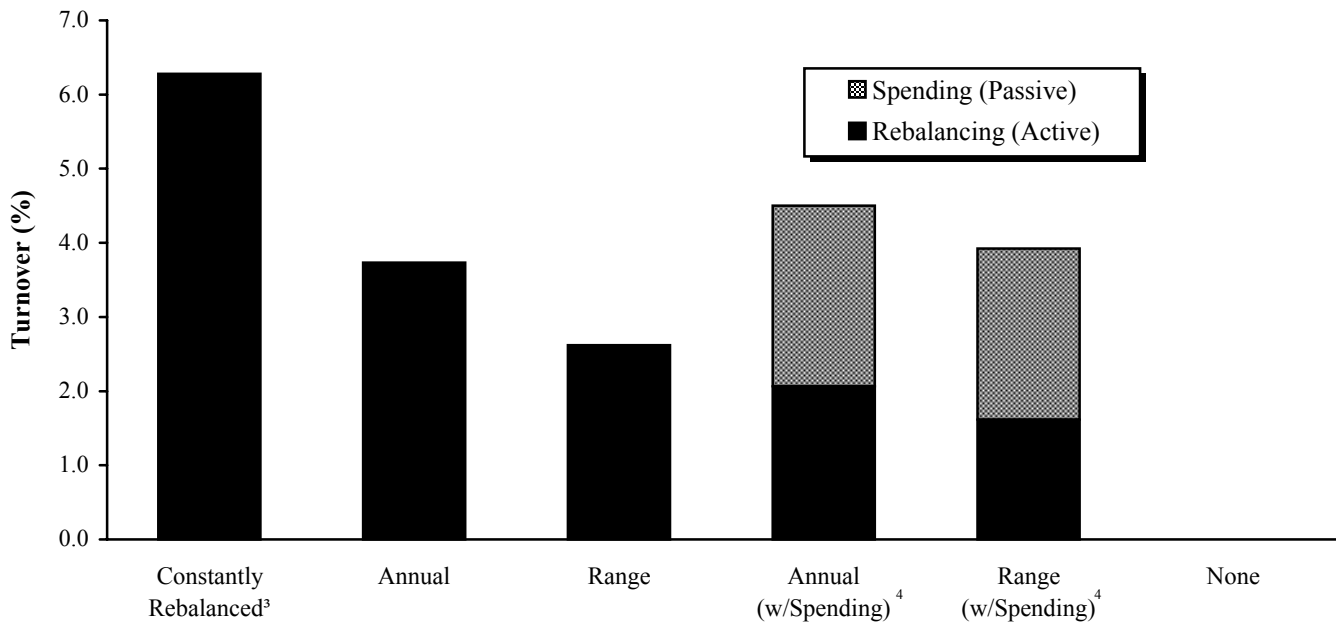
³ Redemptions for spending needs are used to move asset allocations closer to target weights. We assume no cash inflows are used to support spending as inflows vary significantly relative to spending needs across institutions and over time. Spending rule: 5% of trailing 12 quarters average market value.

Exhibit 2
EFFECT OF SPENDING AND TURNOVER
January 1, 1976 - December 31, 2003

Tracking Error to Constant¹ vs Active² Turnover



Turnover as Active and Passive



¹ Tracking error relative to constantly (quarterly) rebalanced portfolio.

² Active turnover excludes turnover that is covered by cash flows (spending, etc.).

³ Constant defined as quarterly rebalancing.

⁴ Redemptions for spending needs are used to move asset allocations closer to target weights. We assume no cash inflows are used to support spending as inflows vary significantly relative to spending needs across institutions and over time. Spending rule: 5% of trailing 12 quarters average market value.

APPENDIX

Appendix

FORMULAS FOR ESTIMATING REBALANCING COSTS

Average Portfolio Distance from Targets

The average amount of turnover necessary to return to target weights, is:

$$Distance = 0.5 * \sum_{i=1}^n |W_{P,i} - W_{T,i}|$$

where $W_{P,i}$ = weight in the actual portfolio P of asset i , and
 $W_{T,i}$ = weight in the target portfolio T of asset i .

Estimated Rebalancing Costs

Multiplying the turnover amount by a transaction cost estimate can give an approximation of the total rebalancing costs.

$$Rebalancing\ costs = \sum_{i=1}^n |W_{P,i} - W_{T,i}| \times TC_i$$

where $W_{P,i}$ = weight in the actual portfolio P of asset i ,
 $W_{T,i}$ = weight in the target portfolio T of asset i , and
 TC_i = cost to rebalance asset i measured in percent.