MEKETA
INVESTMENT GROUP

Rebalancing

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Expectations of risk and return are determined by a portfolio's asset allocation. Over time, market returns can cause one or more assets to drift away from their initial asset allocation targets, leading to portfolios that may not reflect an investor's risk tolerance or investment goals. An investor must decide which rebalancing strategy, if any, is appropriate to maintain the target allocation. This paper presents a comparative analysis of different rebalancing strategies. Meketa Investment Group recommends adopting an explicit rebalancing policy, the precise form of which is dependent on a Board's preferences and governance structure.

Overview

Investors adopt long-term asset allocation targets in an effort to achieve specific investment goals. If, after careful consideration, an investor concludes that approximately 60% of his portfolio should be invested in equity-like assets, then it becomes important to maintain an allocation to equities of about 60% most of the time. Allowing the equity allocation to stabilize below 60% could diminish the investor's return prospects, while allowing the equity allocation to exceed 60% could result in an unacceptable level of volatility.

Markets, however, are not static. First, assets have different expected growth rates—equities are usually expected to return more than investment grade bonds. As such, there will be a natural portfolio drift as equities grow at a faster rate and represent a greater portfolio share over time (see Figure 1). Second, market prices are volatile on both a short term and a long-term basis. As an extreme example, the MSCI ACWI gained or lost at least 3% a week in nineteen of the fifty-two weeks between January 1, 2009 and December 31, 2009. And, in the twelve calendar months ending December 31, 2009, the MSCI ACWI gained or lost an average of 6% per month, with individual monthly returns ranging from –10% to +12%. While average volatility is considerably lower, the general point remains that market volatility will affect a fund's asset allocation over all time periods.

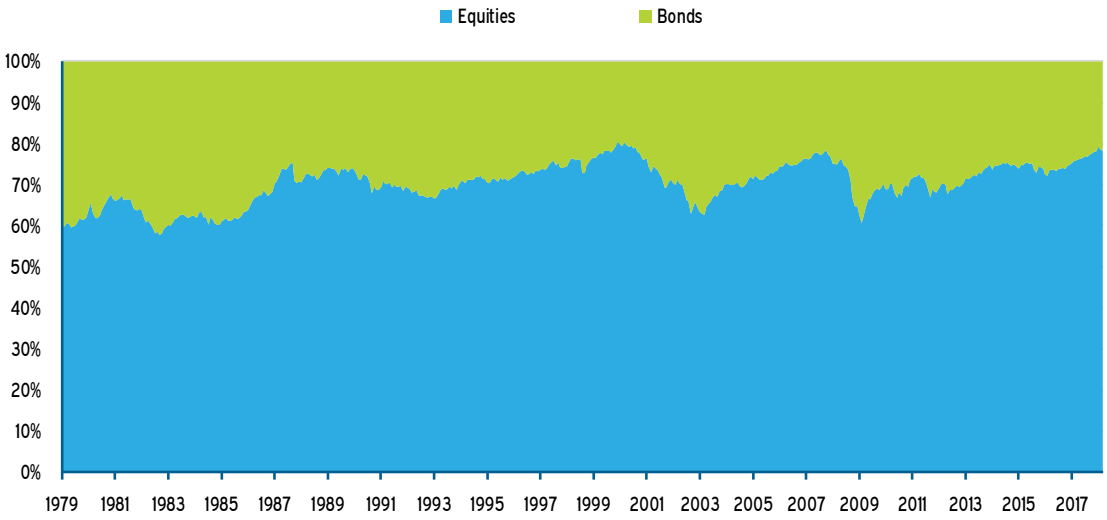

FIGURE 1
Portfolio Drift[1]

[1] Weight drift of a 60% Equities (MSCI ACWI) and 40% (Barclays Aggregate) Bonds portfolio. MSCI ACWI backfilled with MSCI World prior to 1988.

Rebalancing is the process by which an investor maintains a pre-defined asset allocation in response to market movements. This paper provides a conceptual framework for rebalancing as an investment strategy, and it presents a comparative analysis of different rebalancing strategies.

Is rebalancing necessary?

Not all investors rebalance—a strategy in which investments are allowed to drift freely is known as a "buy-and-hold" strategy. A buy and hold strategy generally works best when markets move in a single direction with relatively little volatility (i.e., a "trending" market), as when equities steadily outperform bonds over a number of years. In these cases, the portfolio steadily becomes dominated by the asset class with the highest returns.

In contrast, rebalancing strategies perform best when the markets experience repeated reversals, as when equities sharply outperform—then sharply underperform—bonds. The more frequent the changes in leadership, the greater the advantages for strategies that regularly rebalance allocations. It is for this reason that most investors consider rebalancing necessary for risk control. The act of rebalancing maintains the portfolio's overall risk exposure, whether through limiting the natural portfolio drift towards risky assets or through the potential for higher risk-adjusted performance during volatile market environments.

Rebalancing strategies

There are many customizable rebalancing strategies available to investors that offer different risk tolerances, durations, or liquidity constraints. Most rebalancing strategies fall into one of the following categories:

→ Passive risk-based rebalancing

In passive risk-based rebalancing, the rebalancing decision is systematically determined by the volatility of the portfolio or component asset classes. In the case of portfolio risk-based rebalancing, the proportion of high and low volatility assets is adjusted either periodically or when the overall portfolio volatility changes appreciably. In this manner, the overall portfolio volatility is maintained. In the case of component asset classes, each asset class is assigned a "risk budget" that is maintained either periodically or when the volatility of a component asset class changes. Both of these approaches are complicated and assess risk ex-post, and as a result, they are not particularly common.

→ Passive capital-based rebalancing

In passive capital-based rebalancing, the rebalancing decision is systematically determined by the overall capital share of the component asset classes. In the simplest case, allocations are adjusted periodically to maintain pre-set targets. In a slightly more complicated variant, allocations are adjusted when asset shares fall outside of a "target range." For example, if the equity target is 60% of the portfolio with a target range of +/- 5%, the equity allocation would be adjusted if it represented more than 65% or less than 55% of the portfolio.

There are several variations of this methodology. With target rebalancing, if the equity allocation moved above 65%, stocks would be sold in order to restore the percentage of equity in the portfolio to the target, 60%. However, for an endpoint rebalancing approach, if the asset's proportion grew to over 65% it would be reset to the endpoint of the target range, in this case, 65%; similarly, if it fell below 55% it would be reset to 55%. Finally, for a *midpoint rebalancing* approach, assets would be rebalanced halfway to their target once they move outside the range.

There are many different styles of target range rebalancing but most seek to capitalize on market trends by not overcompensating for outperformance and underperformance by a particular asset class.

→ Active rebalancing

Instead of following a set of simple systematic rules to guide rebalancing, some investors prefer to rebalance tactically or opportunistically. In *tactical rebalancing,* an investor periodically rebalances based on shorter-term expectations for asset class returns. This is essentially tactical asset allocation (TAA). In *opportunistic rebalancing*, an investor periodically *reviews* asset classes for attractive opportunities and only makes shifts when an attractive option is identified. Both of these strategies can be conducted in either the risk or capital space.

For those plan sponsors who wish to implement a passive rebalancing approach, a decision must be made whether to make such rebalances required (as memorialized

in an investment policy statement or through explicit direction to a custodian) or optional. Making the rebalancing action required means that the psychology of the decision (e.g., the potential for irrational behavior) is removed, to the probable benefit of the portfolio. On the other hand, some plan sponsors may wish to systematically rebalance by default, but retain control over the decision in the event of unusual circumstances.

Since passive capital-based rebalancing strategies are the most common and also the simplest to analyze and to understand, we will evaluate these strategies more closely in the next section.

Comparative analysis

To evaluate the merits of different passive capital-based rebalancing techniques, we constructed a policy portfolio of 60% global equities and 40% core bonds using the MSCI ACWI[2] and Barclays Aggregate indices respectively. The data collected were from January 1979 through March 2018, which includes a variety of market and economic conditions. Ten- and fifteen year sub-periods were also examined, but they did not provide added insight into determining the optimal rebalancing technique and so are not reported. For simplicity, we applied a flat fee of two basis points during any month in which rebalancing was required to account for transaction and commission costs.[3]

[2] MSCI ACWI history was backfilled with MSCI World prior to 1988.

[3] Note that these costs can be significantly higher for less liquid asset classes.

For our first analysis, we examined the effects of employing different frequencies in a passive periodic rebalancing strategy. The results of our first analysis are shown in Table 1.

Rebalacing Timeframes	Annualized Return (%)	Cost-Adjusted Annualized Return (%)	Standard Deviation (%)	Cost-Adjusted Sharpe Ratio	Number of Rebalacing Actions
Monthly Rebalancing	9.17	8.91	9.55	0.46	471
Quarterly Rebalancing	9.25	9.16	9.52	0.49	157
Semiannual Rebalancing	9.22	9.18	9.46	0.50	79
Annual Rebalancing[4]	9.31	9.29	9.47	0.51	40
Buy-and-Hold	9.11	9.11	10.89	0.43	0

TABLE 1
Periodic Rebalancing, January 1979-March 2018

[4] Annual rebalancing as reported takes place on January. Annual rebalancing schedules occurring in April, July, and October were examined but led to essentially the same results.

Before taking transaction costs into account, all rebalancing strategies outperformed the buy and-hold strategy on both an absolute and risk-adjusted basis. When adjusted for transaction costs, the monthly rebalancing strategies lags the buy and-hold strategy. While each of the four periodic rebalancing techniques successfully lowered volatility by roughly 1.5%, monthly rebalancing produced relatively lower

returns because of several instances where rebalancing required selling off an outperforming asset class in order to purchase another that was underperforming. In other words, frequent rebalancing did not take advantage of trending markets. The relatively large number of minor rebalancing operations negatively affected cost-adjusted returns for monthly, quarterly, and semiannual rebalancing.

In a situation where rebalancing incurs a flat fee, target and midpoint range rebalancing would be advantageous because it minimizes the number of rebalances. However, if costs are proportional to the amount of funds rebalanced, endpoint rebalancing would be optimal because of the small amount of capital transferred during each rebalance.

Annual rebalancing appears to be the best periodic rebalancing strategy for two reasons. First, it has historically offered a relatively high return for a given level of risk (Highest cost-adjusted Sharpe Ratio). Indeed, it appears to have benefited from trending markets by not selling winners too early. Second, and perhaps more importantly, annual rebalancing may further outperform its monthly, quarterly, and semiannual counterparts on a cost-adjusted basis because it requires far fewer rebalancing actions and hence incurs fewer transaction costs.

Passive range rebalancing is another strategy for maintaining the desired asset allocation. Range rebalancing's main advantage is that instead of reflexively rebalancing assets every period, range rebalancing only rebalances when any asset's portfolio share falls outside a pre determined range.

There is an inherent trade-off between large and small target ranges. Larger ranges require less frequent rebalancing, thus reducing associated transaction costs. Furthermore, larger ranges may enable the portfolio to benefit from broader market trends. However, wide ranges may permit too much deviation from the target allocation, altering the portfolio's risk posture unacceptably. Acknowledging these trade-offs, we recommend ranges of about 5-10% around the target policy for asset classes that comprise 20% or more of the total portfolio.

In our range rebalancing analysis, 5% and 10% bands were established for target, midpoint, and endpoint rebalancing strategies. The target rebalancing simulation resets assets to their target percentages whenever any one of the assets fell outside

the range at the end of a month. Midpoint rebalancing resets assets to the midpoint between the target and the allowed range and Endpoint rebalancing resets assets back to the endpoint of the band. For example in a 10% range, if at the end of the month equities stood at 71%, target would reset to 60%, midpoint to 65%, and endpoint to 70%. The results for all four simulations are displayed in Table 2.

Rebalacing Range	Rebalancing Point[5]	Annualized Return (%)	Cost-Adjusted Annualized Return	Standard Deviation	Cost-Adjusted Sharpe Ratio	Number of Rebalancing Actions
Range +/- 5%	Target	9.22%	9.21%	9.56%	0.50	18
	Midpoint	9.30%	9.28%	9.57%	0.50	26
	Endpoint	9.30%	9.25%	9.64%	0.50	85
Range +/- 10%	Target	9.27%	9.27%	9.75%	0.49	5
	Midpoint	9.33%	9.33%	9.73%	0.50	8
	Endpoint	9.15%	9.14%	9.89%	0.47	25
Buy-and-Hold	N/A	9.11%	9.11%	10.89%	0.43	0

TABLE 2
Range Rebalancing, January 1979-March 2018

[5] Refers to the weights used when a rebalancing event occurs. For example for a Range +/- 10% with Midpoint rebalancing point strategy, a rebalancing event adjusts weights to Target +/- 5% (10%/2) for each asset.

Again, all range rebalancing strategies dominate the buy-and-hold strategy by enhancing cost adjusted returns and meaningfully lowering the portfolio's standard deviation. Generally, there was little difference between target, midpoint, and endpoint rebalancing from a performance standpoint. Instead, the difference lies mostly in the relative number of rebalances. In a situation where rebalancing incurs a flat fee (such as in our own analysis), target and midpoint range rebalancing would be advantageous because it minimizes the number of rebalances. However, if costs are proportional to the amount of funds rebalanced, endpoint rebalancing would be optimal because of the small amount of capital transferred during each rebalance. Also, note that target and midpoint rebalancing involves moving as much as 5-10% of the portfolio at any time, which may occur during periods of market distress. Making a decision to reinvest such a large allocation in a likely underperforming (or more likely, declining) asset class may be difficult for even the most steadfast investor.

Almost any passive rebalancing strategy—whether periodic or range-based—is better than a buy-and-hold strategy.

Note that while a portfolio that includes more than two asset classes will inevitably incur more costs during each rebalancing action, this problem may be offset by the portfolio requiring less rebalancing actions under a range rebalancing schedule because each asset is less likely to trigger a rebalance since it represents a smaller percentage of the entire portfolio. However, it is recommended that investors who adopt range rebalancing focus mainly on whether aggregate asset classes (e.g., all equities, all bonds, all real assets) are outside of their ranges in order to make sure

that the aggregate risk profile does not deviate too meaningfully from the policy target. Finally, investors should be aware that wider ranges will result in an asset allocation that may deviate substantially from a plan's policy allocation, especially if endpoint rebalancing is used.

Overall, there is one primary takeaway from these simple analyses. Almost any passive rebalancing strategy—whether periodic or range-based—is better than a buy-and-hold strategy.

Performance during 2007—2009

During the extreme volatility of 2007 through 2009, many investors reasonably questioned the value of rebalancing. In Table 3 below, we show the results of our two analyses during those difficult years. While there was significant variation between the rebalancing strategies, we note again that all rebalancing strategies with the exception of monthly calendar rebalancing outperformed the buy-and-hold approach—and in this case by a much wider margin. Note also that—in contrast to the full period analysis—the precise month during which the annual rebalancing took place mattered significantly. For example, an annual rebalance in October 2008 led to an investment in stocks before the big crash, while an annual rebalance in April 2009 led to an investment in stocks before an extraordinary rally. Nevertheless, even the October 2008 rebalancing schedule outperformed the buy-and-hold approach. Given the hesitation by many investors to rebalance during such violent market behavior, plan sponsors may wish to make their rebalancing strategy mandatory and systematic (as described above).

TABLE 3
Rebalancing, January 2007-December 2009

Rebalacing Range	Rebalancing Point	Annualized Return (%)	Cost-Adjusted Annualized Return	Standard Deviation	Cost-Adjusted Sharpe Ratio	Number of Rebalancing Actions
	Target	0.39%	0.38%	14.12%	-0.29	2
Range +/- 5%	Midpoint	0.56%	0.54%	13.91%	-0.28	3
	Endpoint	0.89%	0.85%	13.72%	-0.26	6
	Target	0.46%	0.46%	13.60%	-0.30	1
Range +/- 10%	Midpoint	1.20%	1.19%	13.56%	-0.24	2
	Endpoint	0.76%	0.73%	13.22%	-0.28	5
Monthly	N/A	0.13%	-0.11%	14.27%	-0.15	36
Quarterly	N/A	0.37%	0.30%	14.21%	-0.13	12
Semiannually	N/A	0.69%	0.66%	13.84%	-0.10	6
Annually						
January	N/A	1.25%	1.24%	13.64%	-0.06	3
April	N/A	1.52%	1.50%	13.69%	-0.04	3
July	N/A	0.47%	0.45%	13.07%	-0.13	3
October	N/A	0.12%	0.10%	13.42%	-0.15	3
Buy-and-Hold	N/A	-0.05%	-0.05%	12.65%	-0.17	0

Minimizing rebalancing costs

There are numerous means by which a multi-asset investment fund can be rebalanced, and depending upon the mechanism chosen, the effective cost of rebalancing adjustments can range from very little to substantial. As with most portfolio strategies, Meketa Investment Group recommends that investors seek a solution that minimizes the cost.

Rebalancing shifts can be implemented with three generic strategies. In order of increasing transaction cost, these are: directing necessary cash flows, using index funds, and shifting actively managed assets. There is a fourth option: an overlay approach in which a plan directs an overlay provider to purchase and sell futures in order to maintain a target allocation. However, this option can be expensive because it requires an active manager to implement it. In addition, it rebalances imperfectly because it does not move funds and the futures may not be a perfect match with the underlying assets—that is, it carries "basis" risk.

Rebalancing should not be viewed as a separate task, since many ordinary investment activities (e.g., implementing manager changes) provide an opportunity to accomplish a rebalancing objective at the same time.

→ Directing external cash flows

In our judgment, external cash flows (i.e., external contributions or withdrawals from investment assets) should *always* be used as a rebalancing tool. In this way, a necessary event (i.e., the cash flow) is made to serve two purposes at no additional cost. Cash should be used to return assets to an allocation target even if the assets remain within the target range.

The cheapest mechanism for effecting rebalancing moves is to direct external positive cash flows (i.e., new contributions) to underweighted asset classes. New monies purchase additional positions in the most underweighted assets. The operating cost of this type of rebalancing is essentially zero.

External *negative* cash flows (i.e., net withdrawals), on the other hand, pose a slightly more complex problem. If money must be withdrawn, there may be several potential sources of funds, each with a different associated operating cost. For example, if equities are overweighted when a net withdrawal is necessary, it may be possible to make the withdrawal from active equity managers, or to make the withdrawal by liquidating positions in an equity index fund. Selling positions in an index fund, while not free, is generally much cheaper than causing active manager turnover.

If a withdrawal can be spread across several active managers such that the impact on any one manager is small and can potentially be met from the cash they have on hand, then we recommend that approach. If, in contrast, a withdrawal from an active manager would incur meaningful trading costs, then taking the money from an index fund (if one exists) is probably more efficient.

→ Using index funds

Occasionally it is necessary to effect a rebalancing by shifting assets actively from one asset type to another. For example, in a sustained bull market for stocks, a fund's equity allocation may grow to the point where it is no longer consistent with the investment policy. In such a case, it will be necessary to liquidate equities and buy bonds to restore balance.

Index funds offer an excellent, low-cost mechanism for rebalancing. Index fund managers are skilled at buying and selling securities at very low brokerage costs, and often with minimal market effects. Index fund managers sometimes swap securities with other investors, or use crossing networks to affect trades. Commingled index funds may have sufficient cash flow to provide cost-free rebalancing, in many cases.

A series of two to three equity index funds and a bond market index fund are particularly efficient for implementing rebalancing shifts. By shifting assets between one or more of the equity index funds and a bond index fund, an investor can maintain not only the desired overall equity/bond ratio, but also a capitalization structure and value/growth tilt as well.

→ Using active managers

The most expensive mechanism for implementing rebalancing shifts is to instruct active investment managers to buy or sell securities. Without index funds, however, this may be the only vehicle available to an investor. We recommend that when it is necessary to use active managers to rebalance, the managers be permitted to make the changes over a reasonable time period to avoid hasty (and unnecessarily expensive) turnover.

Rebalancing versus market timing

Active rebalancing (i.e., maintaining prudent asset allocation levels) is not the same as market timing. Rebalancing is the adjustment back toward an agreed upon asset allocation *in response to* market induced changes. Market timing is the deliberate adjustment of an asset allocation *in anticipation of* a market shift. For example, a market timing investor who expects the equity market to decline may exchange stocks for bonds or cash in advance of the anticipated equity decline. If the equity market does, in fact, decline, that investor's returns are improved. If, on the other hand, the equity market goes up, the investor's returns are degraded.

Dozens of academic studies of market timing strategies have been conducted over the past thirty years. These studies indicate that successful market timing is very difficult to implement. That is, few investors are able to correctly identify market shifts in advance with sufficient accuracy to recover the costs of the extra turnover and the losses associated with incorrect judgments. The realities of the governance structure for many institutional investors also make it difficult to reach a consensus on the direction of the market in a timely manner. Therefore, Meketa Investment Group recommends that investors carefully consider whether they want to engage in market timing or limit their rebalancing activity to a systematic approach.

Conclusion

Meketa Investment Group believes that there are several appropriate approaches to rebalancing, including periodic rebalancing and employing target ranges. Depending on the cost structure, the strategy may require customized cash flow management or adjustments to the rebalancing point in order to avoid excessive transaction costs. Alternatives do exist, however, and investors should evaluate with the help of their consultant whether a different portfolio rebalancing strategy, including a tactical approach, is warranted. Overall, we believe that any of these rebalancing approaches is superior to a policy of not rebalancing.

Appendix I

Introducution to rebalancing with options[6]

Another approach in which target based rebalancing strategies can be implemented is with the use of options. The introduction of options to a rebalancing strategy will add complexity and risks, but their use can also generate benefits, such as additional income and forced discipline.

While the explicit dynamics of rebalancing with options escape the breadth of this paper, the following stylized example introduces the process:

- **Trade setup** Suppose an investor has a $100 million portfolio with a 60-40 allocation to stocks and bonds and a rebalancing policy based on 5% ranges and back to target rebalancing.[7] In order to enforce her rebalancing policy she initiates an option position overlay by selling one-month 5% out of the money calls and puts on the $60 million stock position (60% of $100 million) and picking up option premium (income) in the process.
- **Trade settlement**[8] At the end of the month we consider the following scenarios and hold all else equal:
  - **Equities up more than 5%** Short puts expire worthless, but short calls expire in the money and are exercised, forcing the investor to sell 5% of her stock position, which can be in turn used to purchase bonds and systematically rebalance the portfolio back to its 60-40 target from a 65 35 end of the month allocation.
  - **Equities down more than 5%** Short calls expire worthless, but short puts expire in the money and are exercised, forcing the investor to buy 5% of stock, which can be financed with the proceeds of selling 5% of bonds. Again, this effectively rebalances the portfolio back to its 60-40 target, but from a 55-45 end of the month allocation.
  - **Equities up less than 5% or down less than 5%** Both options expire worthless, consistent with a scenario that does not trigger a rebalancing action.
- **Periodic renewal** In order to maintain the rebalancing policy, the trade setup and settlement process are periodically renewed to coincide with the option expiration schedules.

[6] For additional perspective, please refer to AQR's: Israelov, Roni and Tummala, Harsha, An Alternative Option to Portfolio Rebalancing (October 30, 2017). Available at SSRN: https://ssrn.com/abstract=3061975.

[7] As a refresher, this means than whenever the stock allocation goes higher than 65% (60% + 5%) or lower than 55% (60% - 5%) the portfolio would be rebalanced back to its original target of 60% stocks and 40% bonds.

[8] Figures shown for illustrative purposes only, may not match exactly due to rounding and compounding effects. bonds.

Even though the process seems straightforward and provides the opportunity of picking up additional yield through option selling, a real world implementation could be more challenging than this example implies. Below we summarize some of the pros and cons that this strategy can present to investors:

- **Pro—income generating strategy** Selling options for rebalancing generates additional income from option premia. While realized income can vary based on multiple variables such as expected and realized volatility, anecdotal evidence suggests investors can pick up anywhere between 2 to 10 bps at the total fund level from these programs.
- **Pro—forced discipline** By selling the options every month (quarter, or any other regular period chosen), rebalancing becomes a systematic process, as the exercise of the option contracts at the end of each period forces investors to rebalance, removing any subjectivity or potentially irrational decision making from the rebalancing process.
- **Con—additional risks** All strategies that involve derivatives, and especially options, introduce risks to portfolios that traditional risk metrics do not easily capture, such as tail risk and convexity.
- **Con—trading infrastructure/active management** While most institutional investors are equipped with the necessary infrastructure to rebalance portfolios of traditional assets, trading options periodically increases complexity and thus generates a need for larger infrastructure and staff. It is likely that only a select few very large institutional investors have the internal staff and infrastructure to manage this process internally, leaving the rest in need of paying an active manager to manage this task.
- **Con—basis risk** Rebalancing with options can be easily done for large equity indices such as the S&P 500, but these instruments may not be available for all the asset classes used by sophisticated institutional investors. This creates basis risk if, for example, investors use S&P 500 options to rebalance a small cap equity or private equity portion of a portfolio.

Appendix II

Adding momentum signals to range-based rebalancing

Without crossing over to the realm of Tactical Asset Allocation (TAA), investors have looked for ways to enhance their rebalancing strategies by incorporating rules based approaches that can produce superior risk adjusted returns to traditional rebalancing methods.

One such case involves the use of momentum signals to complement a range based rebalancing approach. The objective is that if an asset is experiencing positive momentum and it has moved outside its target range, then instead of rebalancing it back to target, an investor would let her "winners run" by either not rebalance the allocation or by just rebalancing back to the endpoint of the target range. The rationale is that the outperforming asset class will continue to do well in the near term.

Below we show the results of adding a momentum tilt[9] to the 5% range based rebalancing strategies reviewed in the paper. Essentially, this rebalancing policy follows the rule that if an asset breaks the range and is experiencing positive momentum, then the investor would only rebalance its weight back to the endpoint of the range. In turn, if at the moment of rebalancing the asset is not experiencing positive momentum, then rebalancing is done back to target.

[9] Momentum is based on 12-month moving average crossovers. If the current price of the asset was higher than the 12-month trailing moving average (excluding the most recent month) then we said the asset had positive momentum. Other definitions of momentum were explored but did not alter the results significantly.

Rebalacing Range	Rebalancing Point[10]	Annualized Return (%)	Cost-Adjusted Annualized Return	Standard Deviation	Cost-Adjusted Sharpe Ratio	Number of Rebalancing Actions
Range +/- 5%	Target	9.22%	9.21%	9.56%	0.50	18
	Midpoint	9.30%	9.28%	9.57%	0.50	26
	Endpoint	9.30%	9.25%	9.64%	0.50	85
Momentum + Range +/- 5%	Varies	9.27%	9.23%	9.65%	0.49	82
Buy-and-Hold	N/A	9.11%	9.11%	10.89%	0.43	0

TABLE 3

Rebalancing, January 2007-December 2009

[10] Refers to the weights used when a rebalancing event occurs. For example for a Range +/- 10% with Midpoint rebalancing point strategy, a rebalancing event adjusts weights to Target +/- 5% (10%/2) for each asset.

Our simple momentum enhancement was not successful. It did not produce higher returns nor reduce risk relative to the traditional range based approached, resulting in a slightly inferior strategy from a risk-adjusted perspective.

This exercise does not mean to imply that rules-based enhancements to rebalancing policies are inefficient. In fact, sophisticated investors may be able to design policies that can reduce risk or slightly augment returns through strategies such as momentum, but we must caution that this would be a difficult task to achieve, after incorporating market frictions such as transaction costs.

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