

PORTFOLIO REBALANCING: HOW AND HOW OFTEN?

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Unless an investor is invested in just a single holding, portfolio rebalancing is an issue that affects them. Questions to answer include: How often should an investor rebalance? What should trigger a rebalance? And how should the rebalance be implemented?

Investors spend a lot of time determining their asset allocations. That is, what specific investments – and what relative quantities of those investments – they should hold. However, the moment a portfolio is implemented it changes – primarily due to market movements. This makes rebalancing an important part of the ongoing asset allocation process. After all, what is the sense in carefully building our initial asset allocation if we are going to allow all of that hard work to drift from the scope of the original design?

We review and provide insight into the most popular rebalancing methods below. Northern Trust's Global Asset Allocation team tends to favor a risk-based tracking error approach (and tying to tactical asset allocation decisions whenever possible), but it is important to note that there is no universal method. Our results show that over full market cycles it pays to rebalance. Over the period studied, our results validate that the risk-based tracking error method is a compelling rebalancing policy method, as is the absolute threshold method. We also make an argument for the simplicity of annual rebalancing in the case of investors who may not have the systems to implement these other methods. However, each portfolio will have unique objectives/risks that can put it on a different rebalancing path, and the outcome will be dependent on the types of markets experienced.

OUR STUDY

Most studies tend to use a simple portfolio of stocks versus bonds. Some have extended the stock portfolio to add variations of capitalizations and different regions. Our study takes a more robust approach adding an investment style review along with liquid versions of alternative asset classes which include listed real estate, commodities, hedge funds, and listed private equity. We have chosen liquid versions of alternatives, recognizing the rebalancing limitations of illiquid asset classes. The test we have designed is set up to test various policies with asset classes that offer unique drivers of risk and return beyond the traditional portfolio of stocks and bonds. The study runs from September 30, 1995, to

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December 31, 2017, a common period covering two full economic and financial market cycles where data is available for all indices used in our portfolio.

DIFFERENT REBALANCING POLICY METHODS

The three rebalancing policy methods we'll explore are: frequency-based, threshold-based, and risk-based. Within the frequency method, we'll review monthly, quarterly, semi-annual and annual rebalancing policies – wherein, periodically, all asset classes are fully rebalanced to their initial allocations. Within the threshold method, we'll look at set ranges around asset classes and individual product selections (absolute and as a relative percent of current capital weights). We'll also explore whether rebalancing back to target offers any advantages versus methods that rebalance half-way back to target or back to the boundary that triggered the rebalance. Note that, within this threshold method, we keep all of the thresholds consistent across tests, in order to ensure that results are not driven by differences in the thresholds applied. The last category, the risk-based method, will focus on tracking error triggers so that, as a tracking error target versus a benchmark (defined in the Appendix) is violated, a rebalance is triggered. This trigger has also been set to be consistent with the thresholds noted in the second method above. All policies will be reviewed relative to a portfolio that is strictly “buy and hold” (referred to as “BAH” throughout this paper).

Exhibit 1 below demonstrates the three rebalancing methods with simple equity/fixed income portfolios.

EXHIBIT 1: REBALANCING EXAMPLES



SOURCE: Northern Trust Global Asset Allocation, Morningstar. December 31, 2012 to December 31, 2017.

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TEST RESULTS

The methods we explored have differing results over different types of markets, be it up, down or sideways markets. We expand on each of these individually below. Also, it is important to note that the cost of rebalancing is not factored into our quantitative analysis. The transaction costs, bid-ask spreads, and market impact of trading should be considered by any investor when deciding how frequently to rebalance their portfolios and in what magnitude. This consideration will be highly influenced by the asset classes held by the investor.

Up Markets

We define an up market as a period during which the S&P500 increased over a prolonged period to a new peak. During the period of our study we classify Sept-95 to Aug-00, Oct-02 to Nov-07, and Mar-09 to Dec-17 (interrupted by a brief period of sideways movement from Apr-15 to Mar-16) as periods of up markets.

In up markets, results show that it pays not to rebalance. BAH results in the greatest value add over each of the individual up periods measured, but it comes with the highest risk and low efficiency ratios relative to most other methods. Other methods that allow for a degree of additional drift (i.e. threshold and risk-based methods) also do well in up markets. Those that rebalance half-way to target or back to boundary still capitalize on market run-ups and are rewarded more versus those that rebalance back to target. Risk-based tracking error rebalancing is also quite successful, ranking in the top three methods based on returns across all periods, while requiring the fewest rebalances of all methods other than BAH. Frequency based policies are the worst performers as they constantly force investors to take profits, instead of enjoying the gains from asset classes that are showing persistent positive returns.

EXHIBIT 2: UP MARKETS

UP MARKETS	Buy & Hold	FREQUENCY				THRESHOLD				RISK BASED	
		Monthly	Quarterly	Semi	Annually	Absolute Threshold to Target	Half-Back	Boundary	Relative Threshold to Target	Tracking Error	BMK
Sep-95 to Aug-00											
Return (%)	11.6	10.9	11.0	10.9	11.1	11.5	11.5	11.5	11.2	11.5	10.9
Excess over BAH (%)		(0.8)	(0.6)	(0.7)	(0.5)	(0.2)	(0.2)	(0.2)	(0.4)	(0.2)	
# Times Rebalanced		58	19	9	5	4	6	22	8	2	
Standard Deviation	8.1	7.5	7.6	7.5	7.7	7.6	7.7	7.8	7.5	8.0	
Efficiency Ratio	1.4	1.4	1.5	1.4	1.4	1.5	1.5	1.5	1.5	1.4	
Oct-02 to Nov-07											
Return (%)	16.9	14.4	14.5	14.5	14.7	14.8	15.5	15.7	14.7	15.5	14.3
Excess over BAH (%)		(2.5)	(2.4)	(2.4)	(2.2)	(2.0)	(1.4)	(1.2)	(2.2)	(1.4)	
# Times Rebalanced		62	20	10	5	4	8	27	6	2	
Standard Deviation	6.7	5.4	5.5	5.5	5.6	5.6	5.9	6.0	5.5	6.0	
Efficiency Ratio	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.6	
Mar-09 to Dec-17											
Return (%)	11.2	10.0	10.1	10.2	10.3	10.3	10.5	10.7	10.2	10.4	10.0
Excess over BAH (%)		(1.2)	(1.1)	(1.0)	(0.9)	(0.9)	(0.7)	(0.5)	(0.9)	(0.8)	
# Times Rebalanced		106	36	18	8	6	7	37	12	2	
Standard Deviation	9.2	7.7	7.7	7.8	7.8	7.8	8.1	8.3	7.8	8.0	
Efficiency Ratio	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	

SOURCE: Northern Trust Global Asset Allocation, Morningstar. September 30, 1995 to December 31, 2017.
 Absolute: +/-4% Asset Class Weight, +/-5% Fulfillment Weight
 Relative: +/-10% of Asset Class Weight, +/-30% of Fulfillment Weight
 Risk Based: Trigger at Tracking Error of 1%

Down Markets

We define a down market as a period during which the S&P500 experienced a prolonged drawdown. During the period of our study we classify Sept-00 to Sept-02, and Dec-07 to Feb-09 as periods of down markets.

In down markets, the results show that it also pays to BAH similar to up markets. It pays not to rebalance as asset classes that have persistently negative returns become a lesser weight in the portfolio as they continue to underperform. In contrast to the up markets, however, BAH comes off as most efficient (and remains best performing). Results of the other methods vary, but the threshold method to go half-back, and back to boundary, also come out strongly, which is consistent with what was observed in the up markets analysis. The risk-based tracking error method also comes out decently for these scenarios with the fewest number of rebalances relative to other methods.

EXHIBIT 3: DOWN MARKETS

DOWN MARKETS	Buy & Hold	FREQUENCY				Absolute Threshold to Target	THRESHOLD			RISK BASED	
		Monthly	Quarterly	Semi	Annually		Half-Back	Boundary	Relative Threshold to Target	Tracking Error	BMK
Sep-00 to Sep-02											
Return (%)	(3.4)	(5.3)	(4.9)	(5.2)	(4.9)	(4.9)	(4.4)	(4.1)	(4.7)	(4.2)	(5.3)
Excess over BAH (%)		(2.0)	(1.6)	(1.8)	(1.5)	(1.5)	(1.0)	(0.7)	(1.3)	(0.9)	
# Times Rebalanced		25	9	4	2	2	4	8	4	1	
Standard Deviation	7.0	8.4	8.3	8.1	7.9	8.2	7.7	7.6	8.1	7.9	
Efficiency Ratio	(0.5)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.5)	(0.6)	(0.5)	
Dec-07 to Feb-09											
Return (%)	(22.9)	(27.1)	(26.4)	(25.5)	(24.8)	(26.5)	(25.4)	(24.8)	(26.7)	(25.2)	(27.1)
Excess over BAH (%)		(4.3)	(3.6)	(2.6)	(2.0)	(3.7)	(2.5)	(1.9)	(3.9)	(2.3)	
# Times Rebalanced		15	5	3	2	3	6	7	4	1	
Standard Deviation	13.1	14.8	14.6	13.9	13.5	14.3	13.9	13.6	14.6	13.5	
Efficiency Ratio	(1.8)	(1.8)	(1.8)	(1.8)	(1.8)	(1.9)	(1.8)	(1.8)	(1.8)	(1.9)	

SOURCE: Northern Trust Global Asset Allocation, Morningstar. September 30, 1995 to December 31, 2017.
 Absolute: +/-4% Asset Class Weight, +/-5% Fulfillment Weight
 Relative: +/-10% of Asset Class Weight, +/-30% of Fulfillment Weight
 Risk Based: Trigger at Tracking Error of 1%

Sideways Markets

We define a sideways market as one in which the S&P500 oscillates with no clear trend. An example of this within our data period is from Apr-15 to Mar-16.

We have limited sideways market data during our period of study on which to base results. However, the relative threshold method that rebalances back to target appears to do best. This is followed by the frequency methods from most frequent to least frequent. It is hard to draw any conclusions in this case however as there is limited data and four of the methods tested (absolute threshold, half-back, boundary and tracking error) don't result in a rebalance and so give the same result as BAH.

EXHIBIT 4: SIDEWAYS MARKETS

SIDEWAYS MARKETS	Buy & Hold	FREQUENCY				THRESHOLD				RISK BASED	
		Monthly	Quarterly	Semi	Annually	Absolute Threshold to Target	Half-Back	Boundary	Relative Threshold to Target	Tracking Error	BMK
Apr-15 to Mar-16											
Return (%)	(2.6)	(2.4)	(2.4)	(2.5)	(2.6)	(2.6)	(2.6)	(2.6)	(2.3)	(2.6)	(2.3)
Excess over BAH (%)		0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.0	
# Times Rebalanced		12	4	2	1	-	-	-	1	-	
Standard Deviation	8.1	8.3	8.2	8.1	8.2	8.1	8.1	8.1	8.2	8.1	
Efficiency Ratio	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	

SOURCE: Northern Trust Global Asset Allocation, Morningstar. September 30, 1995 to December 31, 2017.
 Absolute: +/-4% Asset Class Weight, +/-5% Fulfillment Weight
 Relative: +/-10% of Asset Class Weight, +/-30% of Fulfillment Weight
 Risk Based: Trigger at Tracking Error of 1%

Full Period (Ups/Downs/Sideways)

When we consider the full period, from September 30, 1995, to December 31, 2017, most rebalancing methods outperform BAH (the one exception being the monthly frequency method) from a return, risk and efficiency perspective. From an annual return perspective, the returns of those methods that beat BAH don't substantially differ, ranging from a 7.3% annual return (quarterly, semi-annual and tracking error methods) to a 7.8% annual return (risk based tracking error method). Tracking error also came out on top for its efficiency ratio over the whole period.

Another major item we need to consider is the number of times rebalancing must occur, as each rebalance requires effort and costs. Traditional threshold methods ranged from 19 rebalances to 34 rebalances throughout the entire period. Half-back was rebalanced 31 times while back to boundary was rebalanced 108 times. The risk-based tracking error policy triggered only 9 rebalances and was the clear winner in this case. As noted earlier, Northern Trust Global Asset Allocation team favors the tracking error approach. The infrequency of rebalances, combined with the quantitative assurance that the portfolio is not straying too far from its intended risk/return profile is a big reason for this stance.

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In addition, another risk dimension to pay attention to is style risk. BAH, half-back and back to boundary methods caused a meaningful style drift to value. This implies that style will have an influence on the return/risk of the portfolio beyond the contribution from the asset mix (and drifted asset class weights). It's clear that in order to manage style risk to the original exposure of the portfolio, rebalancing back to the original target weights is the best method.

EXHIBIT 5: FULL PERIOD

FULL PERIOD	Buy & Hold	FREQUENCY				THRESHOLD				RISK BASED	
		Monthly	Quarterly	Semi	Annually	Absolute Threshold to Target	Half-Back	Boundary	Relative Threshold to Target	Tracking Error	BMK
Return (%)	7.2	7.1	7.3	7.3	7.5	7.5	7.5	7.6	7.4	7.8	7.1
Excess over BAH (%)		(0.1)	0.1	0.1	0.3	0.3	0.3	0.4	0.2	0.6	
# Times Rebalanced		266	89	44	22	19	31	108	34	9	
Standard Deviation	9.4	8.3	8.3	8.2	8.1	8.3	8.5	8.6	8.3	8.4	
Efficiency Ratio	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
EQUITY STYLE DRIFT	6.0	0.8	1.2	1.6	2.0	2.3	6.1	6.3	1.7	4.5	

SOURCE: Northern Trust Global Asset Allocation, Morningstar. September 30, 1995 to December 31, 2017.
 Absolute: +/-4% Asset Class Weight, +/-5% Fulfillment Weight
 Relative: +/-10% of Asset Class Weight, +/-30% of Fulfillment Weight
 Risk Based: Trigger at Tracking Error of 1%

CONCLUSION

We observed that in trending markets (up or down) it pays not to rebalance. In sideways markets with no clear trend, it pays to rebalance, back to target. We also found that going back to target preserves the original investment style so that you don't introduce style risk. However, in order to take advantage of this information, investors would need to time the markets and know when they are trending vs oscillating, or when style is in favor, and then implement the relevant rebalancing method.

When you ignore market timing and observe over the full period a risk-based tracking error method which rebalances back to target is preferred, as it outperforms most other methods and requires fewer rebalances. It is also reactive to large swings in the market. Similarly, the absolute threshold method comes off well over the whole period, though with a slightly lower return and twice as many rebalances. For those who might not have the systems to employ more quantitative measures (threshold or risk-based) – and, therefore, must stick to a frequency (calendar rebalancing) approach – rebalancing annually offers a similar balance of reward versus the theoretical cost and effort of threshold rebalancing. It results in a small premium over the BAH strategy and requires only one rebalance per year.

Given that all of the methods we discussed above are rules based, it is also worth noting that any decision to change an investor's asset allocation, introduce a tactical asset allocation position, or change an implementation vehicle, are also opportunities to rebalance portfolios back to target weights. It may be worthwhile rebalancing during periods where the portfolio is already being "turned over" in order to reduce excess portfolio churn and transaction costs.

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APPENDIX:

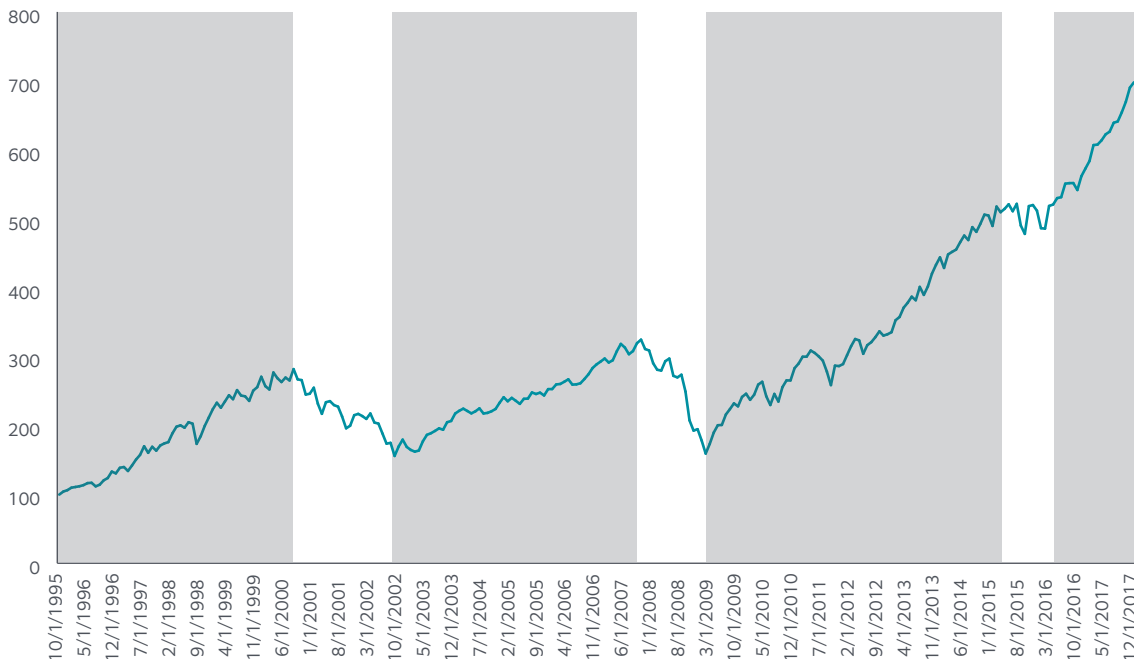
The following is the portfolio used for all of the rebalancing analysis performed in this study. The study runs from September 30, 1995, to December 31, 2017.

We take the approach of resetting the asset allocations to their target weights at the beginning of each of the noted sub-periods to ensure an apples-to-apples comparison for each of the rebalancing methodologies over those sub-periods. For the full period analysis, the weights are only reset following the rules of each of the rebalancing methodologies. The benchmark portfolio used for measuring tracking error is reset to its target weights monthly.

PORTFOLIO FULFILLMENT		WEIGHT (%)	BENCHMARK FULFILLMENT		WEIGHT (%)
Fixed Income	BBgBarc US Aggregate	40.0%	Fixed Income	BBgBarc US Aggregate	40.0%
	BBgBarc US High Yield	6.0%		BBgBarc US High Yield	6.0%
Equity	Russell 200 Growth	5.0%	Equity	Russell 200	10.1%
	Russell 200 Value	5.0%		Russell Mid Cap	2.2%
	Russell Mid Cap Growth	1.1%		Russell 2000	2.2%
	Russell Mid Cap Value	1.1%		MSCI EAFE	14.4%
	Russell 2000 Growth	1.1%		MSCI Emerging Markets	7.2%
	Russell 2000 Value	1.1%	Alternatives	HFR Fund of Funds	6.0%
	MSCI EAFE Growth	7.2%		FTSE/EPRA NAREIT	3.0%
	MSCI EAFE Value	7.2%		Red Rock Listed PE	6.0%
	MSCI Emerging Markets	7.2%		Bloomberg Commodities	3.0%
Alternatives	HFR Fund of Funds	6.0%	TOTAL	100.0%	
	FTSE/EPRA NAREIT	3.0%			
	Red Rock Listed PE	6.0%			
	Bloomberg Commodities	3.0%			
TOTAL	100.0%				

NOTE: For Illustrative Purposes Only.

S&P 500 Growth Over Time, 100 Starting Index



SOURCE: Northern Trust Global Asset Allocation, Morningstar. September 30, 1995 to December 31, 2017.

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