

# *Testing Forward Looking Asset Allocation*

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## ***Quantitative Asset Allocation***

Many investors seem to be in the process of losing faith in asset allocation. In September and October of 2007, it seems that all asset classes move together—straight down. The positive benefits of asset allocation rely upon certain asset classes having low correlations with one another—when one dives, others don't. While correlations tend to go up during fairly short periods of panic selling in crashes, the value of managing a portfolio using asset allocation has been consistently demonstrated. In this article, we present a useful data point in this regard.

In an article in April 2008, I [Considine] combined Quantext's research with research from a range of institutional sources to suggest that effective diversification (determined by asset allocation) could add 2% to 2.5% per year in return to a generic portfolio made up of a mix of domestic equity indices and a bond index<sup>1</sup>. In this article, we are able to expand upon this theme using out-of-sample testing of Quantext's portfolio planning model over 9+ years. We have also tried to level the playing field by benchmarking against a far more diverse benchmark portfolio. The results suggest that a quantitative approach using forward-looking asset allocation adds considerable value.

## ***Benchmarking Portfolio Performance***

It is well known that most equity mutual funds under-perform the S&P500. In fact, the severity of this effect is somewhat masked by survivorship bias—the fact that shuttered mutual funds simply disappear. For these reasons, the S&P500 is often used as a performance benchmark. This may have been somewhat justified in the decades when U.S. equities dominated all other asset classes, but there are surely better benchmarks now. Even if one were to decide that the S&P500 is a decent benchmark for U.S. equity funds, it is important to establish a benchmark for a well-diversified portfolio: the total portfolio benchmark.

What would a solid benchmark for total portfolio performance look like? A viable benchmark would include domestic and foreign stocks, a variety of durations of bonds, commodities and real estate. The relative allocations would be a bit tricky because you don't want to allocate based on a single historical period. Further, you will want to choose different benchmarks based on some measure of risk—such as the allocation to bonds.

To provide a reasonable benchmark, we started with a group of Vanguard funds that have been around for a while and built a generic portfolio with 40% bonds by having equal allocations to each of the list below:

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<sup>1</sup> <http://seekingalpha.com/article/71946-what-is-diversification-worth>

Name	Ticker
Vanguard Precious Metals	VGPMX
Vanguard S&P500	VFINX
Vanguard European Stock	VEURX
Vanguard REIT's	VGSIX
Vanguard Emerging Markets	VEIEX
Vanguard Pacific Stock Index	VPACX
Dow Jones AIG commodity Index	^DJC
Vanguard Short Term Investment Grade Bonds	VFSTX
Vanguard Long Term U.S. Treasury Bonds	VUSTX
Vanguard Intermediate Term Bond	VBIIX
Vanguard Long Term Tax Exempt Bonds	VWLTX

***Portfolio components—equally weighted***

The one non-Vanguard component is an allocation to the Dow Jones AIG Commodity Index (which is available as an ETF: DJP). Most of this portfolio can be exactly replicated using ETF's. We could substitute IVV for the S&P500, ICF and RWR for VGSIX, EFA for VEURX, and EEM for VEIEX. We used Vanguard funds because they have more historical data (they have been around longer) and are, therefore, better suited to an historical analysis. The funds listed here are not an optimal set--but this portfolio is a considerably harder-to-hit benchmark than the S&P500. The other potential substitutions would not be exact, but the purpose of this analysis is to examine whether quantitative portfolio models add value.

***Strategic Asset Allocation***

One of the most often cited issues in portfolio management is the importance of rebalancing. Rebalancing is perhaps the most basic form of strategic asset allocation (other than buy-and-hold). Let's start by comparing an annual rebalancing strategy to a simple buy-and-hold, starting with the equal weight portfolio among the components listed above. The re-balancing is performed once at the end of each 12-month period, and takes the portfolio back to equal weights. We will be looking at the period from July of 1999 through August of 2008 using end-of-day adjusted closing prices, inclusive of dividends. This was the longest period for which we have all of these funds available, allowing for three years of lead time (prior to July of 1999). We will be using this lead time to drive some forward looking models in a later section.

Strategy	Average Annual Return	Annualized Standard Deviation in Return	Return / SD
Annual rebalancing	9.6%	8.1%	1.19
Buy and hold (never rebalance)	10.6%	9.3%	1.14

***Returns and Volatilities for Buy and Hold vs. Annual Rebalancing***

Several points are immediately apparent. First, the equally-weighted buy-and-hold portfolio diversified among these funds has done quite well over the 9.2 years of this study, with an average annual return of 10.6% and a standard deviation of 9.3%. Annual rebalancing of this portfolio decreases both risk and return—a phenomenon that has been

documented in a range of studies<sup>2</sup>. Simple calendar rebalancing reduces risk, but it also reduces return. Both the buy-and-hold and annually rebalanced portfolios have done well over this period, despite the fact that the cumulative gain in the S&P500 over this entire period is 8%--i.e. less than 1% per year.

### *Going Further*

As many (if not most) readers are aware, the development of portfolio theory is generally regarded as one of the greatest financial innovations on the 20<sup>th</sup> century. The idea behind portfolio theory is that investors should combine available investments so as to maximize return at a given risk level. This process exploits correlations between available asset classes. If you make a chart showing the highest available return at each risk level, you have created what is called the efficient frontier<sup>3</sup>. The funds that we combined in the original portfolio already exploit diversification (simply by virtue of combining asset classes that have historically exhibited fairly low correlation), but there is no reason to assume that this portfolio is optimal.

The challenge of ‘optimizing’ a portfolio by calculating the efficient frontier is that you need to have estimates for the expected returns and standard deviations of all available asset classes, as well as the correlations between them. Where do you get such data? A simple minded approach to this problem is simply to use historical data. This leads to poor results, in general, if you manage a real portfolio simply by looking backwards in this manner. William Bernstein performed an experiment in which he created asset allocations based on trailing data in which he optimized historical returns with a risk constraint over a series of time periods. In other words, he calculated the efficient frontier using historical data and then allocated a model portfolio so that it was on the efficient frontier. He found that a portfolio managed in this way generated a substantially lower return than a simple static allocation with annual rebalancing, in which the portfolio was spread between the major asset classes<sup>4</sup>. The under-performance occurs because asset allocation using historical data simply tends to over-weight the portfolio to the assets that have performed well in that specific period. This tends not to work well going forward (e.g. out-of-sample).

If allocating based on history fails, what do we do? Surely we can do something smarter than just spreading our portfolios across the major asset classes using an arbitrary rule (like equal weights). This is where forward-looking models come in. Forward-looking portfolio models combine historical data with analytical models to produce projections for each asset class that compensate for recent out-performance or under-performance<sup>5</sup>. Forward-looking models are well-established as an analysis framework and, somewhat remarkably, the results from a range of institutional-grade models agree on how much benefit can be derived from a portfolio that is properly designed using forward-looking

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<sup>2</sup> <http://seekingalpha.com/article/63576-rebalancing-can-be-hazardous-to-your-portfolio>

<sup>3</sup> <http://seekingalpha.com/article/78116-choosing-your-portfolio-risk-tolerance>

<sup>4</sup> The Intelligent Asset Allocator, P. 70.

<sup>5</sup> <http://seekingalpha.com/article/24588-portfolio-building-with-forward-looking-asset-allocation>

analysis<sup>6</sup>. In earlier studies, we compared QPP’s projected returns for a range of portfolios over extended out-of-sample periods to estimates from trailing returns and found that QPP’s projections were consistently more accurate than using trailing returns as an estimator of future performance<sup>7</sup>. In this analysis, we are going a step further by optimizing a portfolio based on QPP’s projections and looking at subsequent portfolio performance over 12-month periods.

The original motivation for this analysis using Vanguard funds was to see if Quantext Portfolio Planner (QPP), a forward-looking model, could provide asset allocations that would beat a naive equally weighted allocation (called the 1/N model because 1/Nth of the portfolio goes into each of N funds) on an absolute and risk-adjusted basis on a series of out-of-sample tests. How do we do this? We start with three years of data to initialize QPP, and then run EXCEL’s optimizer to maximize QPP’s projected portfolio return, while constraining projected portfolio risk to be at or below an annualized standard deviation of 10% (this is about the same risk level as a generic 60/40 portfolio). We then look at how this optimized portfolio performs over the next 12 months. At the end of twelve months, we run QPP again to generate portfolio outlooks and optimize again using trailing three years of data, etc. We performed this process over the 9.2 year period—nine portfolio updates.

We have the earlier naïve buy-and-hold and annually rebalanced equal-weight portfolios as benchmarks. To provide an additional point of reference, we performed the portfolio optimization just using the trailing three years of data (similar to Bernstein’s study)—and updated once annually. We expect, based on Bernstein and others, that the historical optimization will yield poor results. The table below summarizes our results:

Strategy	Average Annual Return	Annualized Standard Deviation (SD) in Return	Return / SD
Annual rebalancing / equal weights	9.6%	8.1%	1.19
Buy and hold equal weights (never rebalance)	10.6%	9.3%	1.14
Annual re-allocation by optimizing against 3 years of historical data	9.0%	11.7%	0.77
<b>Annual re-allocation by optimizing against QPP projections</b>	<b>12.4%</b>	<b>9.3%</b>	<b>1.34</b>

***Returns and Volatilities for Four Strategies***

Building a portfolio by optimizing on historical data leads to bad results—as expected. This approach has the lowest returns and the highest risk (measured by volatility) of the four strategies. A simple risk-adjusted return metric, the ratio of annual return to standard deviation (Return/SD) shows this quite clearly. Second place honors in terms of returns go to buy-and-hold with equal weights (10.6% per year in average return). That said, the annual rebalancing back to equal weights provides risk management benefits, so the Return / SD ratio is higher with annual rebalancing.

<sup>6</sup> <http://seekingalpha.com/article/71946-what-is-diversification-worth>

<sup>7</sup> <http://seekingalpha.com/article/38568-projecting-portfolio-risk-and-return>

Building an optimized portfolio using QPP's projections provides the highest returns—adding 1.8% per year over the buy-and-hold strategy, with no additional risk. The reader should understand that this test analysis was entirely automated and shows results that are fully out-of-sample with all default settings in QPP.

There is another point that is well-worth noting. The optimizer used QPP's projections to constrain total portfolio risk (annualized standard deviation in return) to at or below 10%. In the outcome portfolios, the actual observed standard deviation in returns is 9.3%—quite close to the constraint. This means that the model is creating portfolios with volatility levels that are close to the desired level. In other words, QPP's projections of portfolio volatility are pretty good.

### *Discussion*

As with all tests of analytical models, no single test is conclusive. Any analytical test must be considered as part of a validation process. The period in question here is only nine (and a bit) individual years of analysis. We chose this short period because we wanted to use real funds where possible. We see these results as one important validation of Quantext Portfolio Planner's projections. By using the model with all default settings and allowing an optimizer to select the allocations without any human intervention, we are really testing the boundaries of the model in a new way. Further, the benchmark against which we are comparing is high—a considerable amount of the available diversification benefit is captured already.

This out-of-sample analysis of QPP over nine annual re-analyses leads to a performance advantage of 1.8% per year over a naïve diversification (1/N) using a range of funds. What does this mean? Within the context of all of the extensive testing that we have performed on QPP, these results reinforce that forward projections of portfolio risk and return can add considerable value. In a year when the S&P500 is down 30% or so, this may not be a huge consolation. Over time, an increase in average return of this magnitude is enormous. These results demonstrate the value of a quantitative approach to Strategic Asset Allocation (SAA). There are a range of strategies for Tactical Asset Allocation (TAA) that might be layered on top of SAA, of course, that can enhance portfolio performance. I have discussed some of these in the context of QPP<sup>8</sup>. We are not saying that SAA is the whole story—but it is a crucial part of getting portfolio management right.

*Fellow QPP user, Pete Manhardt, collaborated on this study and article. He integrated QPP with commercial back-testing simulation software. Pete can be reached at the QPP Forum, by email: [pete\\_manhardt@hotmail.com](mailto:pete_manhardt@hotmail.com) or via [Linked-In](#).*

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<sup>8</sup> <http://seekingalpha.com/article/98941-tactical-asset-allocation-part-ii>

*Quantext Portfolio Planner* is a portfolio management tool. Extensive case studies, as well as access to a free extended trial, are available at <http://www.quantext.com>

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