Projecting Portfolio Risk and Return

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When investors allocate their money to a specific portfolio, there is an expectation of a certain level of future return over time and of how much volatility there will be along the way. But where do investors get their expectations of future performance? The most common source of expectations is from trailing performance. Trailing performance can provide some guidance, but using trailing performance as the basis for portfolio allocations leads to very poor results. William Bernstein, in his book ***The Intelligent Asset Allocator***, provides some very striking demonstrations of the hazards of portfolio construction using trailing performance as your guide. He shows that a portfolio with allocations to each of six major asset classes that maximize the return relative to risk over the most recent five years and then held for five years consistently results in returns that are half that of a generic portfolio that is equally allocated to each of the six asset classes. This poor performance occurs because of Reversion to The Mean (RTM), as John Bogle likes to call it. Asset classes that have been out-performing relative to their risk levels for some period of time ultimately tend to under-perform in the future so that risk and return balance out across asset classes through time. Because of RTM, a portfolio designed based on trailing return or by maximizing trailing return vs. trailing volatility is highly likely to provide poor returns.

It is, of course, very tempting to get on the bandwagon of the best-performing asset classes and there are always good reasons posited as to why they can provide superior returns. When building a portfolio allocation, however, it is important to have realistic expectations of the risk and return in your portfolio. This is one of the best reasons to use a portfolio planning tool. You can look at historical performance but we know that historical performance must be tempered with more information—and a good portfolio planning tool can provide a balanced view of the future.

Quantext Portfolio Planner (QPP) is a portfolio planning tool that combines some amount of recent historical performance with long-term data on the risk and return provided by capital markets. QPP's projections of portfolio risk and return are used to look at saving, investing, and withdrawal plans via Monte Carlo simulation. These projections depend on QPP generating a reasonable estimate of future risk and return, so we have tested QPP

using a wide range of validations. I will review two of these studies and then show results from a new analysis.

In one previous study, I used QPP to generate a series of outlooks for risk and return for the NASDAQ index:

http://www.quantext.com/PerformancePredictionQQQQ.pdf

The history for the NASDAQ index allowed me to go back as far as the early 1970's. I examined ten three-year periods through 2005. I used each three-year period as input to Quantext Portfolio Planner (QPP) to predict the next three years' average return (and volatility) for the index. I compared QPP's predictions to using the trailing three years' average returns as the expected future return. Using trailing returns as the prediction yielded errors twice as large as using QPP's projections. QPP's projected average returns were a far better basis for planning than trailing performance.

In a related article, I looked at a portfolio of individual stocks from 1973 through 2005---eleven successive three-year periods.

http://www.quantext.com/RiskReturnBalance.pdf

The portfolio was made up of seven stocks and my goal was to exploit diversification effects effectively. I compared the trailing three-year average return and volatility to the outlook for average return and volatility generated by Quantext Portfolio Planner (QPP). The trailing performance and QPP-generated outlook were both compared to what actually happened in the next three-year period. In this case, using trailing performance as the estimate of average portfolio return again resulted in an error twice as large as using the QPP-generated expected return.

The statistic used to measure the difference between the projected performance of a portfolio and what actually happens is the Mean Absolute Error (MAE). The MAE is the

average difference between the ***predicted value*** and ***what actually happened***, regardless of whether the predicted value is too big or too small. If the predicted average return is 12% and the actual average return is 10%, the absolute error is 2%. If the predicted average return 8% and the actual return is 10%, the absolute error is 2%. If we have average these two values, we get the MAE for the two predictions—and the MAE is 2%. It should be clear that this is a much better way to measure the quality of a forecast than simply averaging. In the first case we had an error of -2% and in the second case we had an error of 2%. If we simply averaged the errors, we would have an average error of 0%, but that is not meaningful. A forecast of too high a return does not offset a forecast of too low a return.

The results from the two studies cited above are summarized here in terms of MAE:

	MAE for QPP's Projected Annual Return	MAE for Trailing Performance	Ratio
NASDAQ Index over 30 years	11.5%	21.5%	53%
7-stock portfolio over 33 years	6.7%	12.1%	55%

Summary of two studies

Using QPP's projected annual returns results in about half the prediction error as using trailing performance (53% and 55%). Using trailing performance as the basis for your expectation of future return is far from optimal---it makes a great deal more sense to use a portfolio outlook that takes more information into account.

In the case of the 7-stock portfolio, the testing includes the way that QPP accounts for the persistence of correlation effects between the portfolio components. This is an important feature because low correlation between portfolio assets is what creates effective diversification. We know that correlations between asset classes and individual stocks can drift, but we hope that a reasonable forward-looking analysis will be fairly insensitive to that drift. The results for the 7-stock portfolio suggest that this is the case.

As with any type of computational tool, more testing is better! For another series of tests, I selected a portfolio of twenty stocks from the Dow Jones Industrial Average and assigned equal weight to each of them.

Company	Ticker	Percentage of Funds
Alcoa	AA	5%
American Express	AXP	5%
Boeing	BA	5%
Citigroup	C	5%
Caterpillar	CAT	5%
Dupont	DD	5%
Disney	DIS	5%
General Electric	GE	5%
Honeywell	HON	5%
Hewlett Packard	HPQ	5%
IBM	IBM	5%
Coca-Cola	KO	5%
McDonalds	MCD	5%
3M Co.	MMM	5%
Altria	MO	5%
Pfizer	PFE	5%
Procter and Gamble	PG	5%
United Technologies	UTX	5%
Walmart	WMT	5%
Exxon	XOM	5%

Simple Dow portfolio

I ran the same analysis as in the previous two studies. I used three years of trailing historical data as input to QPP, and QPP was run with all baseline settings. QPP then predicted the average return and standard deviation in average return for the next three years. I compared this projection from QPP to what actually occurred in the next three years, and then ran the analysis again, but with the trailing three years of data stepped forward. The results are shown below.

Start	End	Average Annual Return	Predicted Average Annual Return	Error (Trailing)	Error (Predicted)
6/1/1983	5/31/1986	22.4%			
6/1/1986	5/31/1989	13.6%	14.8%	8.8%	1.1%
6/1/1989	5/31/1992	20.6%	11.2%	6.9%	9.4%
6/1/1992	5/31/1995	16.9%	13.1%	3.7%	3.7%
6/1/1995	5/31/1998	31.3%	16.8%	14.4%	14.4%
6/1/1998	5/31/2001	14.9%	15.0%	16.4%	0.1%
6/1/2001	5/31/2004	6.4%	14.8%	8.5%	8.4%
6/1/2004	5/31/2007	14.7%	13.5%	8.3%	1.2%

Performance results from QPP-predicted and trailing average returns

The historical data from 6/1/1983-5/31/1986 was used as the only input to QPP. QPP's projection is then benchmarked against the observed performance for the period from 6/1/1986-5/31/1989. In the second step, QPP is given historical data from 6/1/1986 – 5/31/1989 as input and then the QPP's projections are compared to observed performance from 6/1/1989-5/31/1992. The Absolute Error (AE) for the QPP-Predicted average returns are shown in the column labeled ***Error(Predicted)***. For the period 6/1/1986-5/31/1989, QPP predicted an average annual return for the portfolio of 14.8% per year (using only data from the previous three years). The trailing three-year average annual return for the portfolio was 22.4%. The AE for the QPP projection is (14.8-13.6) = 1.1% (shown in the table above—but you may not the small rounding error). The AE if we use the trailing average return for our prediction is (22.4%-13.6%) = 8.8% (also shown above).

The average AE (the MAE) between QPP-projected average annual return and actual average annual return in the subsequent three-year period is 5.5%, whereas the difference between trailing three-year average annual return and average annual return over the subsequent three years is 9.6% (see chart below).

	MAE for QPP's Projected Annual Return	MAE for Trailing Performance	Ratio
NASDAQ Index over 30 years	11.5%	21.5%	53%
7-stock portfolio over 33 years	6.7%	12.1%	55%
20-stock Dow portfolio over 21 years	**5.5%**	**9.6%**	**57%**

Updated summary of Quantext Portfolio Planner's (QPP's) projections and accuracy

It is notable that the relative advantage of using forward-looking projection from QPP is, once again, between 50% and 60% of the total error that you have if you use trailing performance as the estimate of future average returns.

As with the earlier studies, the volatilities from QPP are slightly better than using trailing volatility but volatility has a great deal more persistence, so the overall MAE's are lower. The MAE for using QPP's projections for subsequent three year periods is 5.4% (measured in terms of standard deviation in annual return), while the MAE using pure trailing volatility is 5.7%.

Looking forward from 5/31/2007 and using the most recent three years of data as input, QPP projects an average annual return for this portfolio of 15.4% per year, with a standard deviation in annual return of 20.1%. Interestingly, when we use twenty four years of trailing historical data, QPP projects an average return of 14.1% per year, with a standard deviation in annual return of 20.6%. Over the three years through the end of May 2007, this portfolio has averaged 14.7% per year---very close to the projected future return, but the projected standard deviation of 20% is about 2.5 times as high as we have seen for this portfolio over the most recent three years. If we use the trailing three years as our guide, the statistics suggest that this portfolio has only a 5% chance of generating returns less than zero over the next year. Based on the QPP projections, this portfolio has a 23% chance of generating returns less than zero over the next year---and a 5% chance of generating -18% or worse over the next year.

The main reason to use portfolio management tools is to determine a portfolio with risk and return characteristics that best meet your needs. You want to account for diversification among individual positions and have reasonable forward-looking estimates of portfolio risk and return. You are not highly likely to find a portfolio with the right level of risk and return if you do not have a decent way to estimate the future risk and return of a portfolio. Historical data alone does not provide the best basis for such an analysis. The best practice is to use a forward-looking tool like QPP. There is no magic in what QPP is doing, however. QPP simply combines the recent history specified by the user with long-term relationships on the balance between risk and return. Benjamin Graham is widely quoted as saying that in the short term, the market is a voting machine and that in the long-term, it is a weighing machine. Looking at trailing historical performance as the basis of your portfolio planning puts a great deal of weight on the 'voting' action of the market and not enough on the 'weighing' aspect. QPP generates an outlook that creates convergence between the near-term effects and the long-term effects. For investors trying to plan based on reasonable expectations of future performance of a portfolio, my analysis suggests that you can create outlooks that are substantially more realistic when you account for both of these effects.

The author holds long positions in AA and HON

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*