Case Study Portfolio for a Sophisticated Individual Investor

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Many people, including myself, are interested in seeing real portfolios put together by real people. In this article, I have the opportunity to present a portfolio developed by one of the users of Quantext Portfolio Planner, our portfolio management software. This person, we will call him Will, has developed a portfolio that generates an attractive risk/return balance. Part of the reason that Will sent me the portfolio was that he was interested in constructive comments. In this article, I want to introduce the topic of portfolio stress testing. ***Stress testing*** is the generic name given to the process of varying input parameters in a financial model and seeing how much your answers change. In a recent article on portfolio planning I showed how assumptions about the future average return for equities as a whole could affect an investors chances of generating a sustainable income stream in retirement. In this article, I will examine the impact of changing the length of the data record used as input to the portfolio planning process.

Ticker	Fund Name	Percentage of Funds
IGNAX	Ivy Global Natural Resources A	3.0%
SGGDX	First Eagle Gold A	5.0%
PRPFX	Permanent Portfolio	2.0%
IYY	iShares Dow Jones US Total Market Ind	29.0%
ICF	iShares Cohen & Steers Realty Majors	3.0%
EFA	iShares MSCI EAFE Index	12.0%
EWC	iShares MSCI Canada Index	0.9%
VEIEX	Vanguard Emerging Mkts Stock Idx	2.1%
VPACX	Vanguard Pacific Stock Index	3.8%
EWJ	iShares MSCI Japan Index	3.8%
IIF	Morgan Stanley India Investment Fund	3.8%
EWM	iShares MSCI Malaysia Index	3.8%
VBMFX	Vanguard Total Bond Market Index	12.5%
PRRIX	PIMCO Real Return Instl	3.5%
COY	Corporate High Yield Fund	2.0%
PFO	Flaherty Preferred Income Opportunities	4.2%
NSL	Nuveen Senior Income Fund	2.8%
PTSHX	PIMCO Short-Term Instl	3.0%

Will's Portfolio

The portfolio that Will has created (above) generates an annual yield of about 2.6% with a Beta over the trailing four years of about 63%. What's more, this is a very well diversified portfolio—and I mean this in the quantitative sense rather than simply noting that this portfolio is spread around into many different asset classes. A key measure of

diversification is to look at how the parts of the portfolio return that are not explained by moves in the broader market interact across asset classes. The return on an asset or portfolio that cannot be captured by the market (i.e. by Beta effects) is called the non-systematic portion of returns. In a well-designed portfolio, these non-market components of return will exhibit relatively low correlation to each other—and this is what QPP's Diversification Metric (DM) measures. Over the trailing four years, this portfolio has DM=53% which is about as high as I have seen in any plausible real portfolios. Over this four year period, this portfolio has generated an average annual return of 13.36% per year (see chart below) with less volatility than the market as a whole. The S&P500 has generated an average return of 7.17% per year over this period.

Portfolio Stats	
Average Annual Return	Standard Deviation(Annual)
9.03%	11.17%
Historical Data	
Start: 6/1/2002	End: 5/31/2006
Average Annual Return	Standard Deviation (Annual)
13.36%	9.78%
Historical Beta: **62.79%**	
Historical Yield: **2.71%**	
Performance of S&P500 over historical period	
Average Annual Return on S&P500	
7.17%	
Annual Standard Deviation on S&P500	
12.60%	

Historical and projected portfolio performance

Quantext Portfolio Planner uses a Monte Carlo engine to generate forward-looking estimates of risk and return and the results are shown in the ***Portfolio Stats*** table above. I have assumed that the S&P500 will generate an average return of 8.3% per year with a standard deviation of 15.07% per year in the future. In this conservative but plausible

scenario (less than recent decades but higher than some smart people like Warren Buffett are predicting), this portfolio is projected to generate 9.03% per year with a standard deviation in return of 11.17% per year. As I have noted previously, a ratio of average return to standard deviation in return for portfolios with the majority of assets in stocks will typically be less than a value of one. This is a useful rule of thumb and shows up over long periods of time—see cases in Bernstein's ***The Intelligent Asset Allocator***, for example. This portfolio would approach a ratio of one if I were to use a less conservative estimate of future market returns. This portfolio has generated a ratio of more than 1.3 over the past four years (see tables above), but the Monte Carlo projection suggests that the future will yield more conservative outcomes.

One of the standard steps in analyzing a portfolio is to see how much the results change as the time horizon chosen to generate the parameters changes. This topic is one of the great bugaboos in the analysis of historical performance: there is almost always a considerable level of sensitivity to the historical period chosen. The instruments in this portfolio have all been in existence at least since the end of August in 2001, so we have started our analysis there. For the period from the end of August of 2001 through May 2004 (2.75 years), QPP yields the following results for this portfolio:

Portfolio Stats	
Average Annual Return	Standard Deviation(Annual)
8.23%	9.86%
Historical Data	
Start: 8/31/2001	End: 5/31/2004
Average Annual Return	Standard Deviation (Annual)
10.18%	11.37%
Historical Beta: **56.57%**	
Historical Yield: **2.60%**	
Performance of S&P500 over historical period	
Average Annual Return on S&P500	
0.95%	
Annual Standard Deviation on S&P500	
16.71%	

Portfolio performance and predicted future performance from 8/31/2001-5/31/2004

Despite the fact that the returns for the S&P500 were dismal, this portfolio performed very well over this period (***Historical Data*** above), with an average annual return of 10.18% and a standard deviation of 11.37%. The projected future performance of this portfolio (i.e. from the end of May 2004 forward) suggests a well-diversified and fairly low-volatility portfolio. This portfolio is predicted to generate an average return of 8.23% per year (***Portfolio Stats*** above)—very close to the 8.3% per year assumed for the S&P500—but with dramatically less volatility (i.e. less risk—lower standard deviation). For the kind of investor who will carry 30% in bonds, this portfolio looks attractive. This portfolio has a diversification metric (DM) of 57% for this period—a high value. QPP indicates that this portfolio is well designed on a going forward basis if this risk level is what you are looking for.

Now let's flash forward and run QPP with the 2.75 year period starting on August 31, 2003 and ending on May 31, 2006 (below).

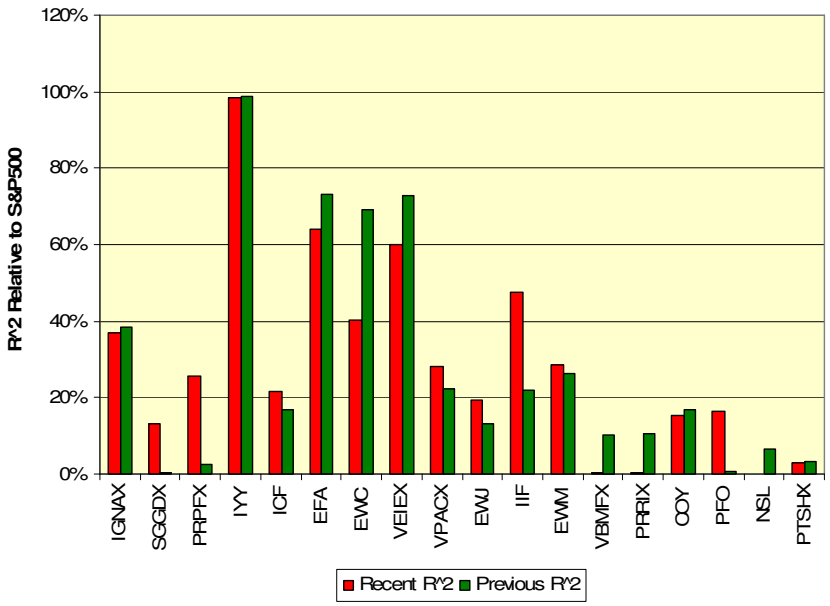
Portfolio Stats	
Average Annual Return	Standard Deviation(Annual)
11.01%	16.25%
Historical Data	
Start: 8/31/2003	End: 5/31/2006
Average Annual Return	Standard Deviation (Annual)
14.89%	9.02%
Historical Beta: **94.01%**	
Historical Yield: **2.70%**	
Performance of S&P500 over historical period	
Average Annual Return on S&P500 9.46%	
Annual Standard Deviation on S&P500 8.04%	

Portfolio performance and predicted future performance from 8/31/2003-5/31/2006

Over this period, this model portfolio performed even better and with an even higher ratio of return to volatility. This high performance is due to the fact that foreign and emerging markets have generated very high returns over the past several years (recent months notwithstanding) and because the market as a whole has performed quite well. This portfolio generates a diversification metric, DM, of 46% for this historical period. This value of DM is lower than we observed for the earlier historical period in which we obtained a value of 57%. That said, even the more recent (lower) value of DM=46% indicates an attractive level of diversification. It is also notable that Beta for this more recent historical period has increased considerably—from 56.6% for the earlier portfolio to 94% in the more recent historical period. The higher Beta and lower value of DM using the more recent history inevitably mean that this portfolio will have a higher total risk (measured by standard deviation in return). The projected future performance based on the more recent history is also for a higher long-term return of 11.01% with a standard deviation in annual return 16.25% per year, higher than the 15.07% per year that we estimate for the overall market.

I see the difference in projected portfolio performance as a reflection of the changing dynamics of foreign markets. As globalization increases, some other economies are more coupled to the U.S. economy and—perhaps more important—are perceived as being more coupled to the U.S. economy. Further, as more domestic investors put an increasingly heavy allocation into foreign stocks, we will naturally see more coupling in returns and there will be a decreased level of diversification effects available from investing in many foreign economies. In the past several years, this portfolio has simply tracked much more closely with the U.S. economy. This effect is also driven by the fact the precious metals have been tracking the broader market much more closely and investors put increasing allocations into these and other commodities.

The portfolio Beta has gone up, as I noted, but you can also get important insight from looking at the R^2 of individual assets. R^2 (or r-squared) measures the fraction of the returns on an asset that can be explained by moves in an index—and we use the S&P500 for all portfolio components. If R^2 is high, then an asset tends to move with the market. If R^2 is low, an asset is not well correlated to the market. It is important to note that, unlike Beta, R^2 does not tell you anything about volatility.



R^2 for portfolio assets over the recent period and earlier period

As we would expect, the R^2 for IYY is almost exactly equal to 100% (above). When we look at changes in R^2 in the more recent 2.75 year period, we can easily see dramatic changes. Remember that as R^2 increases, there is less potential for diversification relative to the S&P500. We see that R^2 has increased dramatically for precious metals though not for natural resources. We also see notable decreases in R^2 for the developed economy components of this portfolio. There is a massive increase in the R^2 of the India-focused component of this portfolio. There is a notable decrease in the bond / fixed income component of the portfolio.

The choice of whether to use longer or more recent market histories is a classic dilemma in quantitative finance. ***Quantext Portfolio Planner*** (QPP) discounts many of the spurious effects of simply using recent market history—recent outperforming classes tend to see their future expected performance discounted, for example. Further, QPP uses its market projections to account for the probability of increasing market volatility in the long-term, as compared to the very low levels that we have seen for the past several years. If the coupling between portfolio components is increasing because of long-term

secular trends (as many people believe is the case for globalization), a case can be made for using more recent histories.

Another important point here than can easily get lost is that the most critical issue regarding the future average return and portfolio volatility (i.e. standard deviation in return) is whether the portfolio will fund a stream of future income. Consider the case in which Will is 55, has $1 Million in his account, is adding $15K per year, and will retire at age 65 with a portfolio draw of $100K per year in 2005 dollars (i.e. he will escalate his draw to preserve purchasing power). Will runs QPP for this portfolio using historical data from 8/31/2001 until 5/31/2006 (long data history) and then he runs with a more recent history going from 8/31/2003 to 5/31/2006 (recent data history).

	Age	
Probability of Running Out of Money	**Recent Data History**	**Long Data History**
10%	81	82
15%	87	84
20%	92	87
25%	98	89

Monte Carlo results for Recent Data and Longer Data History

QPP's Monte Carlo simulation calculates the probability of running out of money by a certain age for Will (above). Using the more recent data history, QPP projects that Will has a 15% chance of running out of funds by age 87, while using the longer data history yields an age of 84. These are fairly similar numbers. For the higher failure probabilities, the portfolio projection history using the more recent data actually improves—the more aggressive portfolio outcomes projected using recent data along with Will's investing horizon suggest that he will be even better off if current trends in the relative risk and return of these assets compared to the broader market hold up. In

other words, more recent history suggests that the higher return that Will receives more than compensates him for bearing the higher short-term volatility.

There are many uncertainties in portfolio planning. You must assume something about future rates of return and volatility, as well as for correlation between asset classes. Monte Carlo simulation can help investors to ***stress test*** their portfolios under various scenarios and varying the amount of history to use to generate the risk, return, and correlation parameters is a good approach. In this test case, Will's probability of funding his future retirement for the balance of his life is very high – regardless of whether he uses more recent data or a longer data history. Certainly there are happier outcomes and less happy outcomes as far as his heirs are concerned, but this portfolio has a lot going for it.

More information on ***Quantext Portfolio Planner*** and a free trial are available at http://www.quantext.com/gpage3.html