ABR Dynamic Funds' Portfolio Construction Series: Part 19

Maximizing reward for every dollar put at risk

Modern Portfolio Theory (MPT) has come under criticism in some circles for not providing the expected diversification, especially in crises. However, installment 18 demonstrated that the problem is largely the addition of cash and equity behavior to portfolio components that were meant to be different from equity behavior. **In other words, it was largely a problem of implementation, not theory.** This installment will explain the basic concepts and implement the theory properly using just equity behavior and interest rate behavior and compare it to the 60/40 (give or take) portfolio used by many investors.

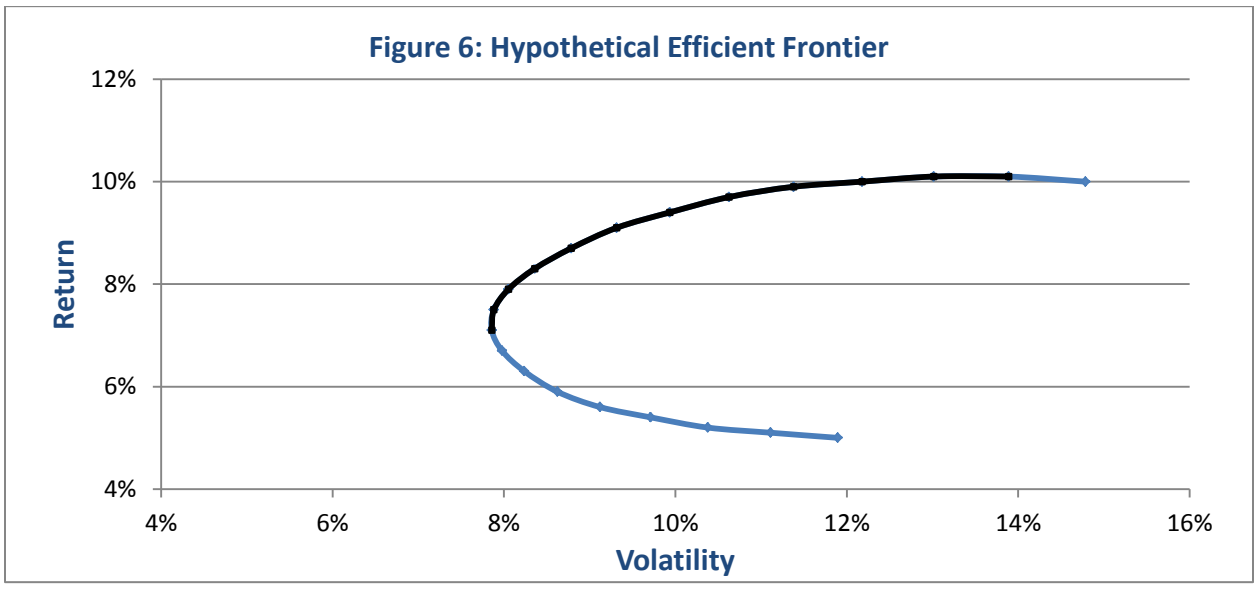
Principle of Optimal Portfolio Construction

The principle of portfolio construction we will use is simply to require the maximum amount of reward possible from every dollar being put at risk in a portfolio. That is the entire methodology, in principle, and the rest of this installment will introduce how to do that and then do it with a simple example. Using return for reward and volatility for risk, we are, of course, looking to maximize the Sharpe ratio (assuming a risk-free rate of 0% throughout this installment for simplicity).

Efficient Frontier

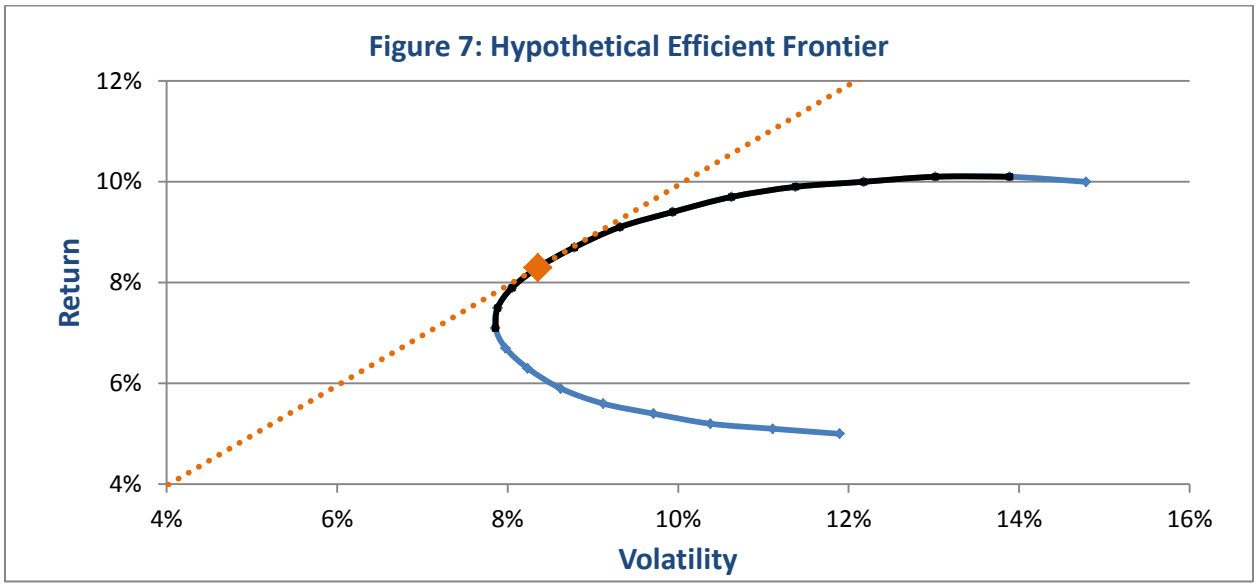
A consequence of MPT is that there is an "efficient frontier." It is the best (lowest) level of volatility required to achieve each possible return from a set of investment choices. Upon a closer read, that is just another way of stating the principle of optimal portfolio construction in the previous paragraph. Maximizing the return for a given amount of volatility is minimizing the volatility for a given amount of return.

The following graph is a hypothetical illustration of the possible combinations of return and volatility from a given set of investments. Portfolios with risks and returns inside the curve are also possible. **The top part of the graph, shaded black, is the efficient frontier.** It represents the lowest possible volatility for a given return and, equivalently, the highest possible return for a given volatility. It is exactly the concept of efficient frontier and the principle of portfolio construction.



Source: ABR white paper (data from Bloomberg)

From the above graph, we can determine the portfolio which maximizes the Sharpe ratio (i.e. maximizes the reward for each dollar put at risk). Conveniently, the axes on the graph are return and volatility, the very components of Sharpe ratio. The portfolio with the highest possible Sharpe ratio is, therefore, the portfolio that intersects the steepest possible line which begins from the point of idle capital (0% return and 0% volatility). The next graph adds this steepest possible line (best possible Sharpe ratio) and highlights the portfolio on the Efficient Frontier which achieves it (orange diamond).



Source: ABR white paper (data from Bloomberg)

The orange diamond represents the best possible portfolio, measured by Sharpe ratio, and it achieved an annualized return of 8.30% with an annualized volatility of 8.36% (again, these are hypothetical results for the sake of the illustration).

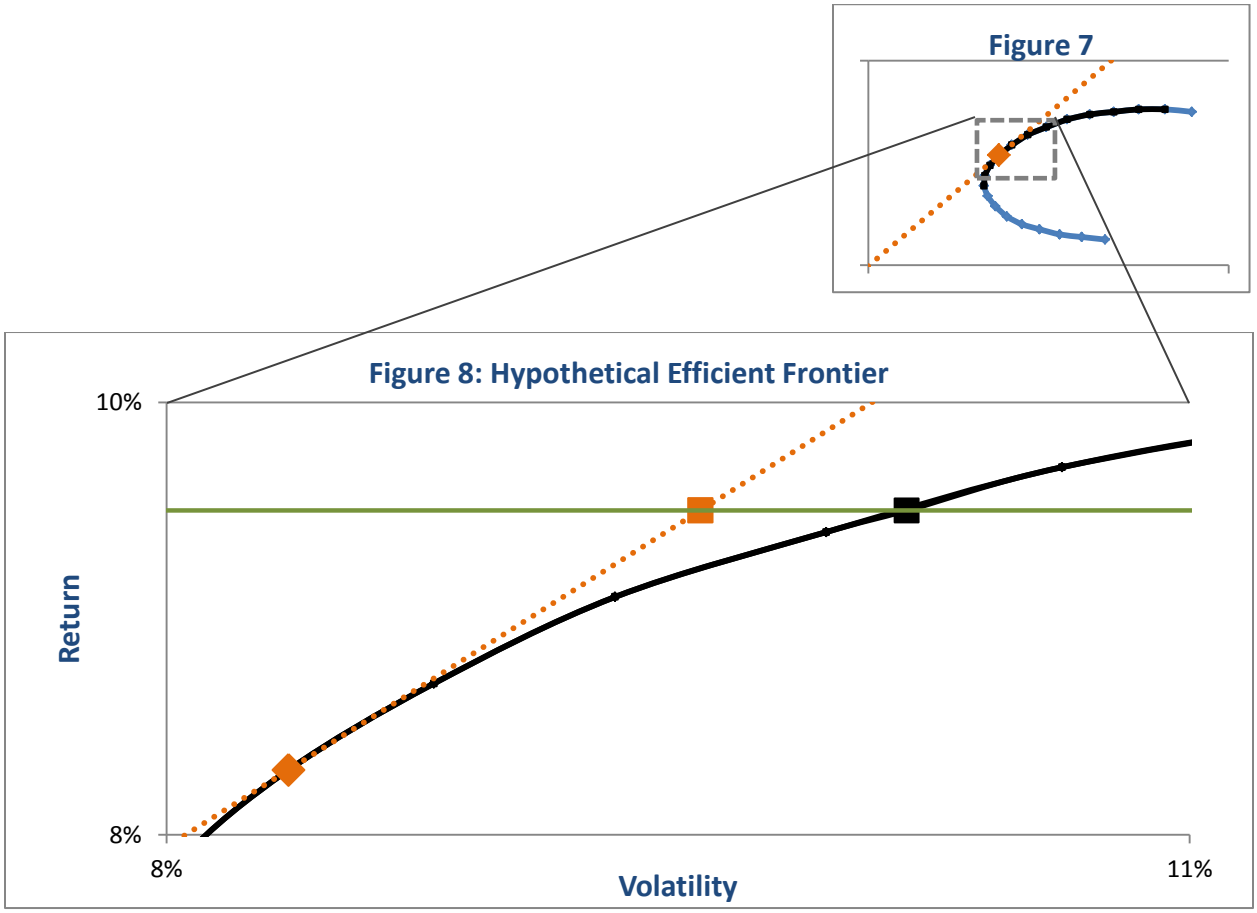
Higher Return

Some investors wish to target a higher return while accepting the necessarily higher volatility. The same principle of portfolio construction can help. For example, consider an investor wishing to target an annualized return of 9.50%, instead of the 8.30% from the previous section. What portfolio should this investor have chosen?

There are actually 2 answers, depending on whether or not this investor can use leverage. The following graph (Figure 8) magnifies a portion of Figure 7, while also adding a green line corresponding to a 9.50% annualized return.

1. If this investor is able to use leverage, s/he would choose the portfolio corresponding to the orange square on Figure 8. It is simply the portfolio from the previous section leveraged to 114% notional exposure (= 9.50% / 8.30%), or 14% leverage. The actual leverage required would be slightly greater than 14% to account for the cost of the leverage, a topic we will cover in more depth in a future installment, but 14% works for the purpose of this illustration.

2. If this investor cannot use leverage for whatever reason, then s/he would choose the portfolio corresponding to the black square on Figure 8. It is the lowest volatility portfolio on the efficient frontier with an annualized return equal to the 9.50% target.



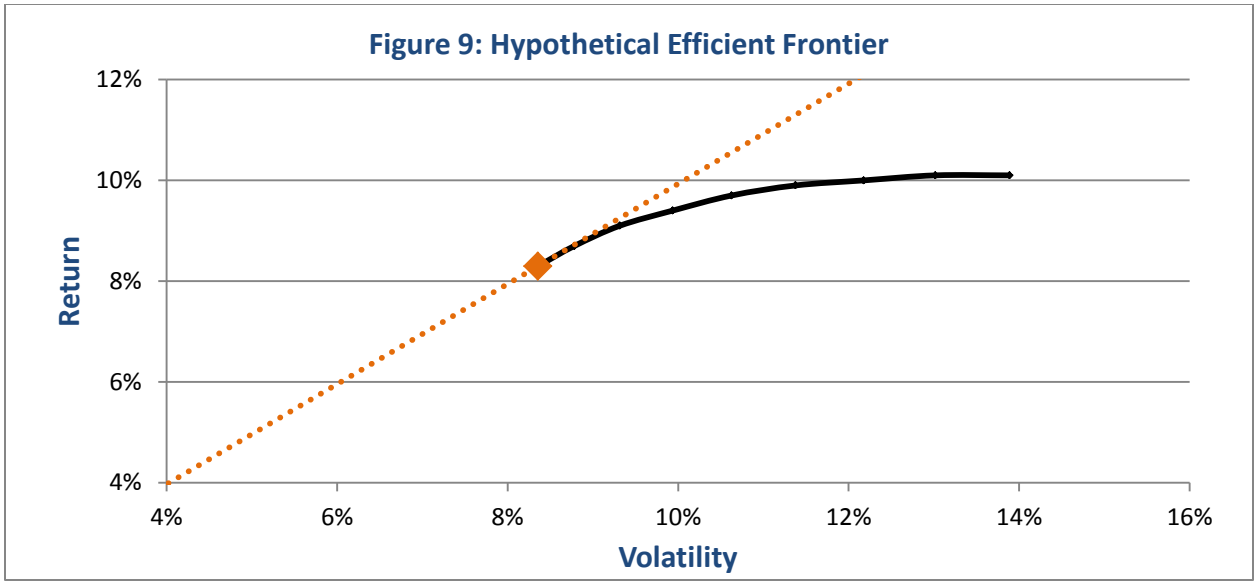
Source: ABR white paper (data from Bloomberg)

Lower Volatility

Some investors wish to target a lower volatility while accepting the necessarily lower return. These investors would simply scale down the allocations in the Sharpe-maximizing portfolio. For example, an investor wishing to target volatility no higher than 7.00% would simply use 84% (= 7.00% / 8.36%) of each allocation in the original Sharpe-maximizing portfolio that had a return of 8.30% with volatility of 8.36%. This portfolio would be found on the orange line in Figure 7, at a point corresponding to 7.00% volatility on the horizontal axis.

Putting it all together

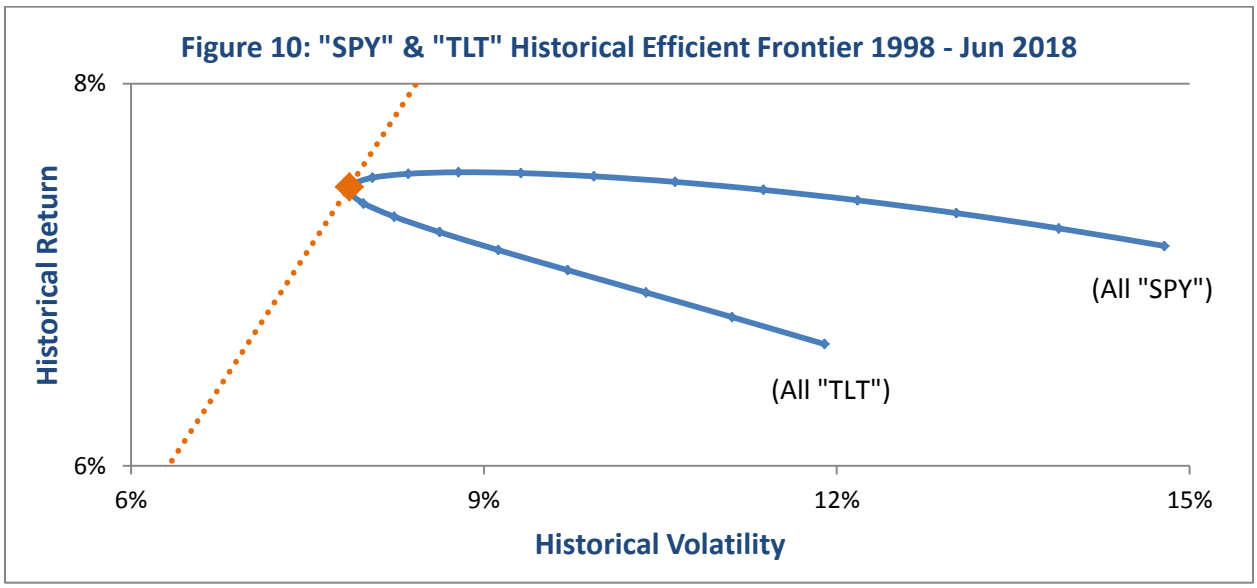
In the following graph (Figure 9), the optimal portfolios for ANY volatility or return targets lie on the dotted orange line for investors who can use leverage. For investors who cannot use leverage, the optimal portfolios lie on the same dotted orange line below the Sharpe-maximizing portfolio (orange diamond), and they lie on the black efficient frontier above the Sharpe-maximizing portfolio. MPT has then boiled down all possible portfolios to the following two lines of optimal choices.



Source: ABR white paper (data from Bloomberg)

MPT in Practice

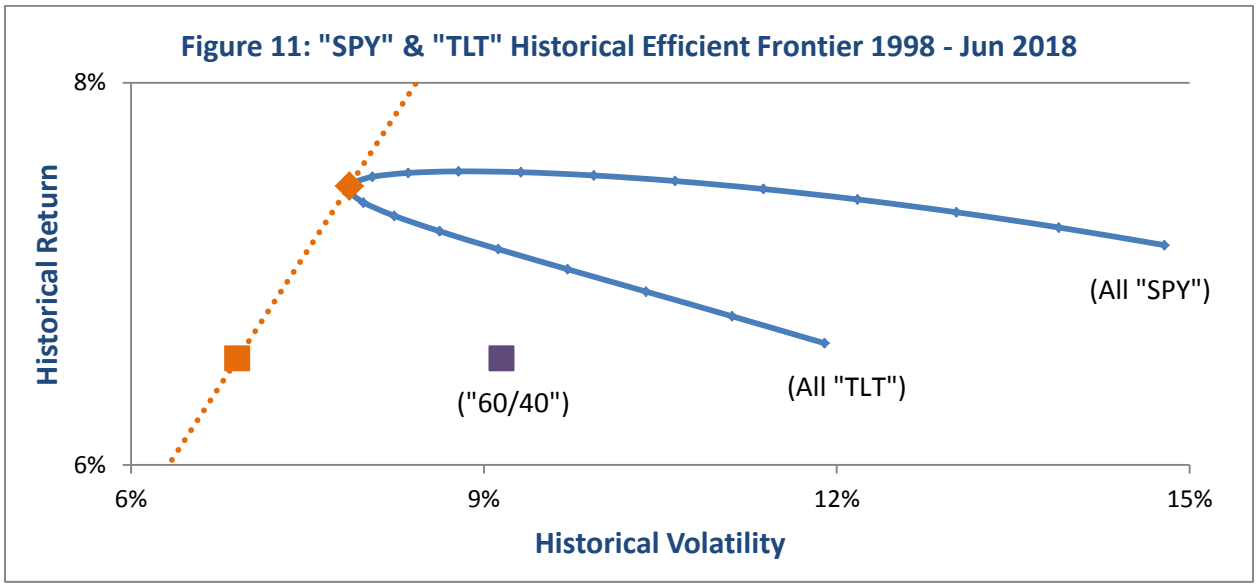
We now have the tools in place to construct a very simple portfolio that was significantly better than the 60/40 portfolio from installment 18. We will assume sufficient diversification already exists within asset classes, and we will apply the principles of MPT across asset classes, instead of within them. For now, we will use only equity behavior, represented by the S&P 500 and called "SPY," and interest rate behavior, represented by 20+ Year U.S. treasuries and called "TLT." The following graph shows the historical efficient frontier based on the returns from 1998 through June 2018.



Source: ABR white paper (data from Bloomberg)

Over this time frame from 1998 through June 2018, the Sharpe-maximizing portfolio, corresponding to the orange diamond, was achieved with 43% "SPY" and 57% "TLT."

The next graph adds "60/40" from installment 18 (purple square), which was 60% S&P 500 and 40% COREPLUS bonds. In line with the "Lower Volatility" section above, it also marks the point investors should have selected along the dotted orange line (orange square) if those investors wanted only the 6.56% return of "60/40" over this time period. This portfolio used 50% "TLT," 38% "SPY," and 12% idle cash. It achieved the same return as "60/40" with meaningfully reduced volatility (6.91% vs. 9.15%).



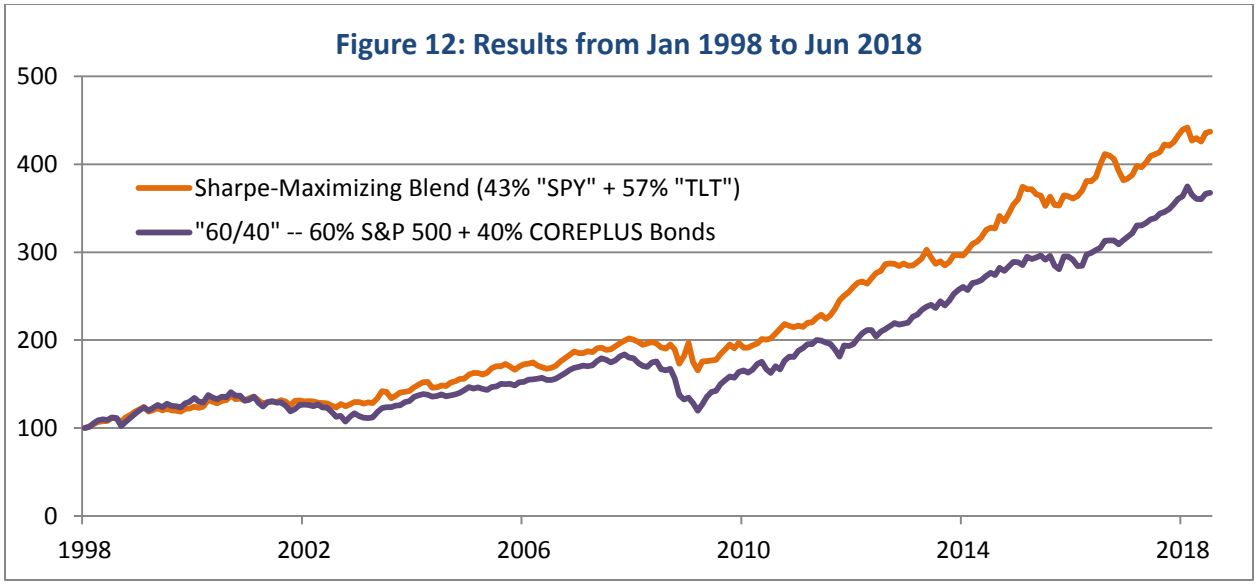
Source: ABR white paper (data from Bloomberg)

Some readers may be wondering why the "60/40" portfolio lies below (or anywhere outside of) the efficient frontier curve. The answer can be found in installment 18. In an effort to smooth the returns of many bond allocations, investors have polluted what we are calling interest rate behavior, or "TLT," with cash and idle capital.

Others may be wondering why "60/40" was so much worse than the optimal blend of "SPY" and "TLT." The answer again lies in the pollution of the bond allocations with cash, idle capital, and also equity behavior. As we noted on page 3 of installment 18, smoothing and increasing returns are appealing goals, but pursuing those goals within the equity-diversifying components of a portfolio can be quite counterproductive to the overall portfolio.

The following graphs and stats show the Sharpe-maximizing portfolio from the above orange diamond vs. the "60/40" portfolio from the above purple square.

The efficient frontier as a principle for optimal portfolio construction worked quite well, increasing the return while also reducing the volatility and halving the maximum drawdown. This optimized portfolio not only produced clearly better results, but was also likely to have been easier to stick with throughout downturns and crises.



Source: ABR white paper (data from Bloomberg)

1998 - Jun 2018	Max Sharpe Blend	"60/40"
Annualized Return	7.5%	6.6%
Annualized Volatility	7.9%	9.2%
Sharpe Ratio*	0.95	0.72
Maximum Drawdown	18%	35%

*risk free rate = 0

Source: ABR white paper (data from Bloomberg)

Calculations

Calculating the efficient frontier and corresponding portfolio allocations can be done with nothing more than the "Solver" tool in Excel. Please contact us at info@abrfunds.com for more information or with any questions.

1. "Set Objective" to maximize the cell with the Sharpe ratio calculation
2. "By Changing Variable Cells" which contain the component allocation percentages
3. "Subject to the Constraint":
    a. that the return is equal to a return target OR the volatility is equal to a volatility target
    b. AND that the sum of the component allocations is equal to 100% for the black portion of Figure 9 above

Looking Ahead: Over the next several installments, we will address the following questions:

- *What other behaviors might be worth including, in addition to equity behavior ("SPY") and interest rate behavior ("TLT")?*
- *How can investors achieve the leverage necessary to remain on (or near) the orange line in Figure 9 above, and what might that leverage cost?*
- *What adjustments can be made for the fact that these results are based on historical data but investors cannot invest in the past?*
- *Once investors have selected the behaviors they want in their portfolios, how might they go about selecting specific investments to gain exposure to those behaviors?*