Ross, Jeffrey & Antle LLC

A Decision Rule Framework for Asset Allocation

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A Decision Rule Framework for Asset Allocation

Asset reallocation, or moving capital across asset risk classes, is commonly used to modify equity exposure in an investment portfolio. Currently with the rise in the markets the focus of asset allocation has been on de-risking by moving from equities into lower risk assets. However, what comes with the lower risk is lower expected return and by reallocating to low risk asset classes, investors are giving up some of the upside potential of equity investment in exchange for directly proportional downside protection.

An alternative approach to asset allocation in general and to modifying equity exposure in particular is to add an option overlay portfolio to an unchanged equity portfolio. The non-linear nature of the option payoff profile may allow investors to achieve the same level of downside protection without giving up as much upside potential as in the asset reallocation approach. There are no free lunches though and the relevant tradeoff is between the advantages of the risk-return profile provided by options against the cost of the options used to implement the risk profile.

In this paper, we outline a framework to evaluate and compare the two approaches, and to inform a decision.

Metric

The decision framework is designed to allow a comparison of the efficiency of the two approaches. Traditionally risk is measured by the standard deviation but for strategies or asset classes with nonlinear payoff profiles, standard deviation is a poor measure of risk. As an alternative metric we will explore using the expected loss to measure risk. With this metric and in this framework the appropriate measure of efficiency is the Gain/Loss Ratio (GLR) which provides a norm for trading off the expected return against this expected loss. The GLR can be estimated as below:

$$GLR = \frac{E(r|r>0)\times P(r>0)}{ABS[E(r|r<0)\times P(r<0)]} = \frac{Expected\ Gain}{ABS\ [Expected\ Loss]},$$

where r is the return of the strategy.

As can be observed from the construction of the GLR, the efficiency of a strategy is influenced by both the average positive (negative) returns and the probability that the return is positive (negative). Notice, too, that since the expected return is the sum of the expected gain and the expected loss,

$$\begin{aligned} E = E(r) &= E(r|r>0)\times P(r>0) + E(r|r<0)\times P(r<0) \\ &= E(r|r>0)\times P(r>0) - ABS[\,E(r|r<0)\times P(r<0)]\ , \end{aligned}$$

the GLR can be written in terms of the expected return

$$GLR = \frac{Expected\ Gain}{ABS\ [Expected\ Loss]} = \frac{E}{ABS\ [Expected\ Loss]} + 1\ .$$

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A Decision Rule Framework for Asset Allocation

Methodology

To illustrate an implementation of this framework, we'll compare three types of strategies used to modify equity exposure:

1. Equity plus an option overlay
2. An asset reallocation of a portion of equity into short-term Treasury Notes
3. An asset reallocation of a portion of equity into corporate bonds (credit)

To estimate the GLR of each type of strategy, we need to estimate the average positive (negative) returns and the probability that the return is positive (negative). We employ bootstrap simulations to estimate the expected return on the equity portfolio. In each simulation, we generate an S&P 500 index path by sampling independently a series of two-week intervals from the last 14 years of data. The simulated S&P 500 paths allow us to estimate the return on the equity market across different market scenarios.

- For Strategy 1, which utilizes equity index options, we forecast the volatility surface along each simulation path and project the value of the option portfolio at the target horizon. To account for the initiation costs of the option overlay strategies, we take the initiation costs out of the projected value of the option portfolio, and use the after-cost return of the strategy in each market scenario to estimate the expected gain and expected loss.
- For Strategy 2, we project the value of the fixed income portfolio at the target horizon using its yield in the current market environment.
- For Strategy 3, we find the returns on credit for each of the sampled two-week periods to preserve its correlation with the equity market. To account for the current term structure, we subtract the difference between the historical average yield and the current effective yield from the historical return. Lastly we string the adjusted return series together to derive the projected return on the credit portfolio along each simulated path.

Using these simulated returns, we can now estimate the GLR of each strategy.

Examples

Assume an investor is considering the three strategies mentioned above to modify the equity exposure. The investor first chooses a loss-mitigation payoff profile for the equity plus option overlay strategy with a payoff profile that has 80% participation on the upside and 50% protection on the downside until 15% down, i.e., a 85-100 put spread. For the two asset allocation strategies, we assume that the investor is comparing an all equity allocation with an 80/20 asset allocation. Including the two choices for fixed income, this gives us the following four strategies[1] to evaluate:

[1] In this analysis, we assume that the equity investments are all put in an S&P 500 Total Return fund, the short-term Treasury Notes investments are all put in a Barclays US Treasury 1-3 Year Total Return index fund, and the credit investments are all put in a Barclays US Credit Total Return index fund.

A Decision Rule Framework for Asset Allocation

I. 100% equity + 80/50 Option Overlay
II. 80% equity + 20% short-term Treasury Notes
III. 80% equity + 20% credit
IV. 100% equity (do nothing)

The table below summarizes the strategy expected returns and the GLR's that we estimated using bootstrap simulations[2].

	Strategy I	Strategy II	Strategy III	Strategy IV
Expected Return	9.11%	9.36%	9.93%	11.56%
St. Dev	12.60%	13.67%	13.81%	17.09%
Expected Gain	11.50%	12.41%	12.87%	15.41%
Expected Loss	-2.39%	-3.05%	-2.95%	-3.86%
GLR	4.81	4.07	4.37	4.00

While the all equity strategy, Strategy IV has the highest expected return it also has the highest risk and as measured by the GLR, Strategy I, the Option Overlay, is superior to the other strategies. Notice, too, that Strategies II and III, also bring a limited improvement in the GLR over-and-above market exposure.

The choices of the particular number, though, mask the true picture of the dominance. What we really want to know is how the range or frontier of possible choices in each strategy compares with that in the other strategies. There is no reason to compare an 80/50 Option Overlay with an 80%/20% asset allocation and it may be the case that a different proportion of equity and fixed income would be superior to an Option Overlay.

One reasonable question for an investor to ask would be "if I adjust the asset allocation so that the expected loss is the same as the equity plus overlay strategy, can I beat Strategy I?" To answer this question, we modify the asset allocation weights and construct Strategy II-SEL and Strategy III-SEL, which have the **S**ame **E**xpected **L**oss as Strategy I. In other words, holding risk constant which is the better strategy? The table below provides an answer.

	Strategy I	Strategy II-SEL	Strategy III-SEL	Strategy IV
Expected Return	9.11%	7.55%	8.87%	11.56%
St. Dev	12.60%	10.85%	11.73%	17.09%
Expected Gain	11.50%	9.94%	11.26%	15.41%
Expected Loss	-2.39%	-2.39%	-2.39%	-3.86%
GLR	4.81	4.16	4.71	4.00

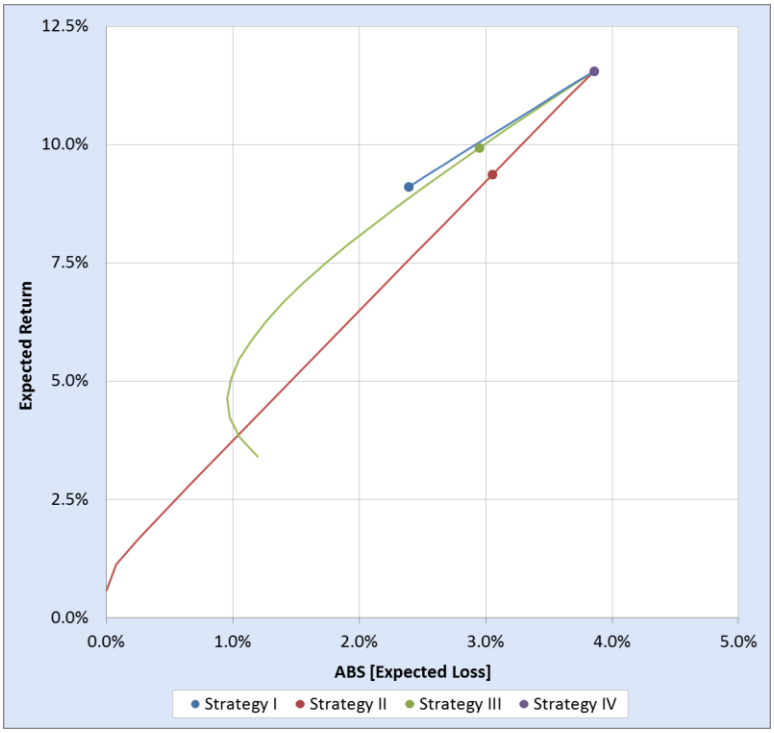
Notice that the all equity strategy, Strategy IV was not adjusted. For the other three strategies we find that, given the same level of expected loss, Strategy I now dominates Strategies II and III in terms of the expected return as well as the GLR.

[2] Dividends and initiation costs of the option portfolio are included in the calculation. Initiation costs of the option portfolio is calculated assuming plain vanilla execution and using closing market inputs from 4/27/2015, a bid/ask spread of 50bps of vol, and an SPX level of 2108.92. RJA fees are not included in these costs. All statistics are annualized.

A Decision Rule Framework for Asset Allocation

More generally, an investor may want to compare variants of Strategy I with different combinations of asset allocation weights. There are many ways to adjust Strategy I, and in this example, we consider the case where the investor varies the amount under protection. For example, the investor may put on an Option Overlay on 60% of his equity portfolio, which enables him to achieve 60% as much downside protection as in Strategy I and give up 60% as much upside potential.

An easy and clear way to visualize this comparison is by plotting the "Return/Loss frontiers" of the strategies, as shown in the figure below. The four dots each correspond to Strategies I-IV, and the three curves each represent the Return/Loss frontiers of Strategies I, II and III. For Strategy I, the Return/Loss frontier comprises those portfolios which invest 100% in equity plus an option overlay on various amounts under protection. For Strategies II and III, the Return/Loss frontier represents portfolios that the investor could achieve by adjusting the asset allocation between equity and fixed income.



Please note that this plot is consistent with our GLR comparison. As we derived in the Metric section, the ratio between the expected return and the absolute value of expected loss is simply equal to (GLR-1). Therefore, if we plot the expected return against the absolute value of expected loss, the closer a strategy lies to the top left corner, the higher its GLR. As can be observed in the graph, the Return/Loss frontier of Strategy I lies above and to the left of the two frontiers for asset allocation strategies, which indicates that at any given level of expected gain or expected loss, the variant of Strategy I dominates the variants of Strategies II and III in terms of long-run efficiency.