Understanding alternative investing through asymmetric payoffs

By Sonu Varghese

Investing in alternative investment vehicles are typically attractive to investors due to their lower correlation with traditional asset classes like stocks and bonds. The idea is that the ability of alternative vehicles to invest in non-traditional asset classes can help protect investment portfolios against sharp downturns while also participating in positive markets. The purported goal is to change the relation of the portfolio to the equity market from a linear, symmetric profile (up when markets are up, down when markets are down) to a more asymmetric profile.

Given that, it would be valuable to discern the relationship between returns from alternative vehicles, such as hedge funds, and equity markets. Instead of simply looking at traditional performance metrics (returns, volatility, Sharpe ratios, drawdowns, etc) we use a different lens to understand the performance of alternatives and try to answer two questions:

1. Do alternatives in fact provide asymmetric payoffs, and if so

2. Is the relationship convex (up when equity markets are up and flat when equity markets are down) or concave (flat when equity markets are up and down when equity markets are up)?

Background

A GMO whitepaper from 2011 described a different framework for thinking about risk and return while discussing the beta puzzle: low beta stocks have historically matched or beaten broad equity market returns, and with significantly lower volatility. On the other hand, high beta stocks have under-performed while being more volatile. This would be appear to be anomalous to finance theory (and intuition) that long-term returns should be proportionate with the amount of risk taken i.e. more risk = more reward. As the authors note, a number of strategies, including risk parity, attempt to take advantage of this apparent exploitable anomaly.

The paper lays out the important role that asymmetric payoffs play in determining the risk and return characteristics of investment strategies. High beta stocks have convex payoffs but this comes at a substantial cost that hurts returns – think buying call options or adding put options to an equity portfolio. Low beta stocks exhibit concave payoffs and essentially 'get paid' to take downside exposure. Similarly, hedge fund returns (which carry a low beta) can be traced to the downside market exposure they have. Academics have in fact found that hedge fund return series are not significantly different from a mechanical strategy that writes puts on the S&P 500.

In the next section we explore the asymmetric payoffs of hedge fund returns, similar to the GMO study, but with data updated through 2015.

The Asymmetry of Hedge Fund Returns

We consider monthly data between January 1990 and August 2015 for the HFRI Fund Weighted Composite Index, which includes fees. The following figure shows a scatter plot of monthly returns for the HFRI index versus S&P 500 returns.

$$y = -0.96x^2 + 0.33x + 0.01$$
$$R^2 = 0.56$$

A best-fit curve to the above data indicates that monthly hedge fund returns have a concave profile relative to market returns (as seen in the negative coefficient for the quadratic term). The goodness of fit (R-squared) term for the curve is 0.56, and is higher than that obtained when we try a linear fit to the data. What this tells us is that

when the equity market is negative, hedge fund returns are also negative but when equity markets rise, the upside for hedge funds is capped.

To relate the concave payoff structure of hedge fund returns to another strategy with concave payoffs, and one that uses options, we consider a covered call strategy. This is a classic example of a strategy with a concave payoff structure – the upside is capped while the downside is shared with the underlying (though to a slightly less degree since one collects a premium when writing the option).

We chose the CBOE S&P 500 BuyWrite benchmark index instead of constructing a strategy that involves actual options data since the index data goes back to the start of our hedge fund return series. For now, the idea is to simply compare payoff structures stylistically. The BuyWrite Index tracks the performance of a hypothetical covered call strategy on the S&P 500 that involves

1. Buying an S&P 500 index portfolio, and

2. Selling (or "writing") a near-term, slightly out-of-the money call option on the S&P 500 index.

A scatter plot relating monthly returns for the BuyWrite index to S&P 500 returns and a best-fit curve confirms the concavity of returns, and is very similar to what we saw earlier when relating hedge fund returns to the market.


$y = -1.54x^2 + 0.61x + 0.01$
$R^2 = 0.79$

Both strategies exhibit seemingly lower 'risk' characteristics – the beta value over the entire period for the HFRI index and the BuyWrite index are 0.34 and 0.62, respectively. Similarly, the full-period correlation between the HFRI index and the S&P 500 is 0.74, compared to a correlation of 0.88 between the BuyWrite index and the S&P 500. However, it is not the case that either of these strategies are 'safer' since their exposure to the market increases in negative markets relative to their exposure to up markets.

We explore this further by looking at realized betas and correlations for these two strategies in three different market environments – when the S&P 500 falls more than 3% in a month, rises more than 3% in a month and is flat (between -3% and 3% monthly return).
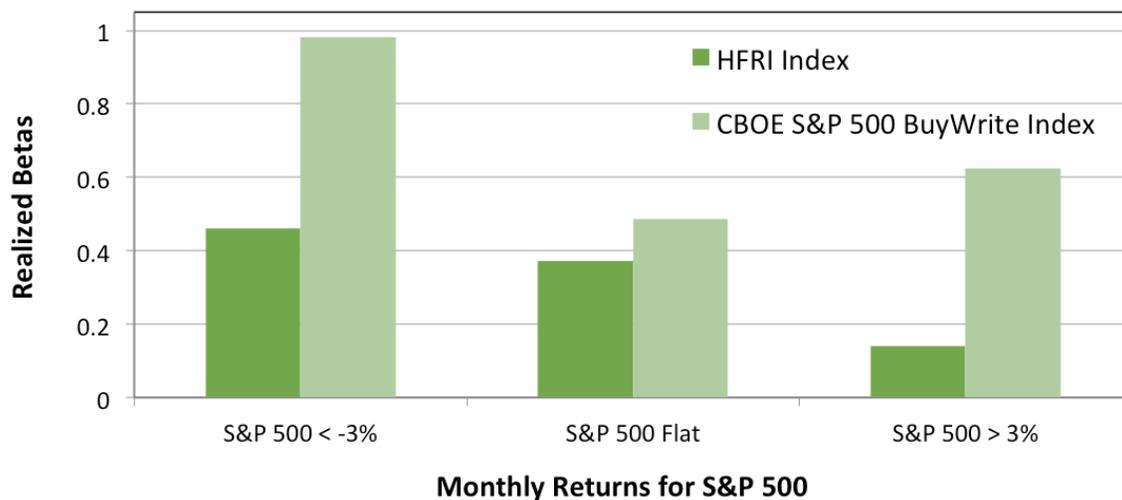
We see that realized beta for both strategies is highest when market returns are the most negative, and fall quite sharply when market returns are flat or high. For the HFRI index, realized beta drops from more than 0.45 during significant down markets to less than 0.15 during significant up markets. Realized beta for the BuyWrite index falls from close to 1 during large negative markets to almost 0.6 during large positive markets. Note that the beta value for this index is higher during the positive months than flat months because the strategy writes options on slightly out-of-the-money options (as opposed to at-the-money options), giving it some exposure to the upside.

A similar story plays out when we look at correlations between the strategies and the S&P 500 in these various regimes. Highest correlations occur during the most negative market regime.
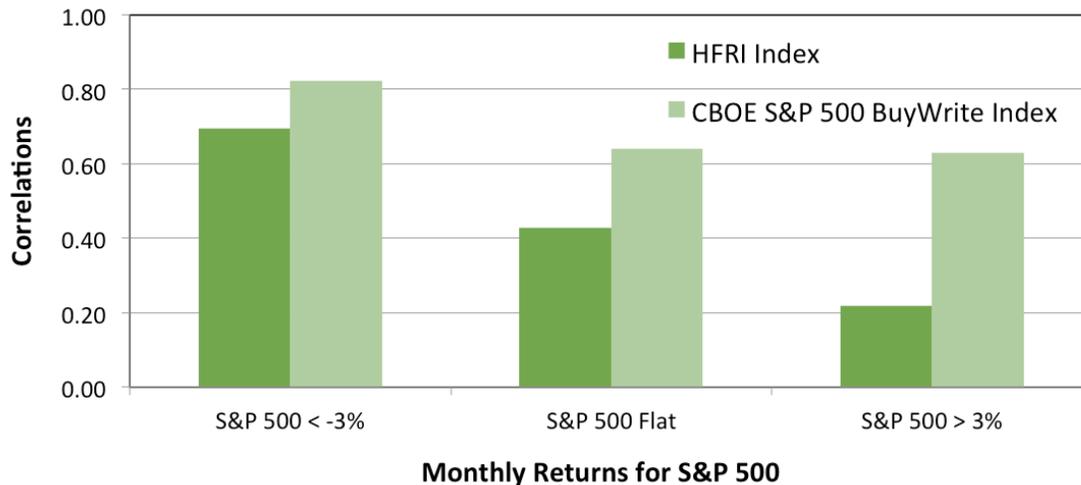
The HFRI index correlation with the S&P 500 is about 0.7 during negative markets, but falls to about 0.2 when markets are positive. The overall correlations for the BuyWrite index with the S&P 500 are higher across all the various market regimes but we do see a similar fall in values when moving from negative to positive markets, albeit to a lesser extent than the corresponding drop for the HFRI index.

What the above results tell us is that investing in hedge funds is akin to a covered call strategy. In large negative markets, one gets to hold on to the option premium (received when selling the call) but remain fully exposed to the downside. However these strategies fail to participate in large up markets since the upside has been exchanged for a premium.

As the authors of the GMO whitepaper note, the asymmetry of payoffs has important implications.

1. Be wary of beta as a measure of risk, since this measure clearly downplays the real risks that are taken.

2. The volatility and diversification benefits that alternative strategies like hedge funds offer comes from altering the payoff structure when markets go up, as opposed to taking on different risks.

An obvious question at this point is, why not simply utilize a strategy that has convex payoffs, say by buying puts in a long equity strategy to protect against large down markets. The short answer is the famous adage "There is no such thing as a free lunch". Tail-risk protection strategies come at a premium cost, which can severely detract from long-term returns.

In the next few posts we will go over the cost of adding convexity to a strategy and explore approaches that can 'tame' black-swans – strategies that provide convex payoffs while also earning reasonable long-term returns.