

July 31, 2012

Surrounded by Curvature

“It’s a brilliant surface in that sunlight. The horizon seems quite close to you because the curvature is so much more pronounced than here on earth. It’s an interesting place to be. I recommend it.”

— Neil Armstrong

Investors are always on the hunt for convex payoffs, wanting optionality for little or no cost. Payoffs with greater convexity, however, typically have greater cost. Convex payoffs exist in many markets and many asset classes. The bond market provides the classic example. The higher the rate of change of a bond’s duration, the more convex its payoff is relative to changes in interest rates. Buying a more convex bond and shorting a less convex bond can be a good trade provided the relative cost is right.

The analogous trade in equity derivatives involves buying an option with high convexity and delta hedging the option using the underlying security. Provided the option trader can purchase the option cheaply relative to the volatility of the underlying asset, the trader can achieve a profitable convex payoff.

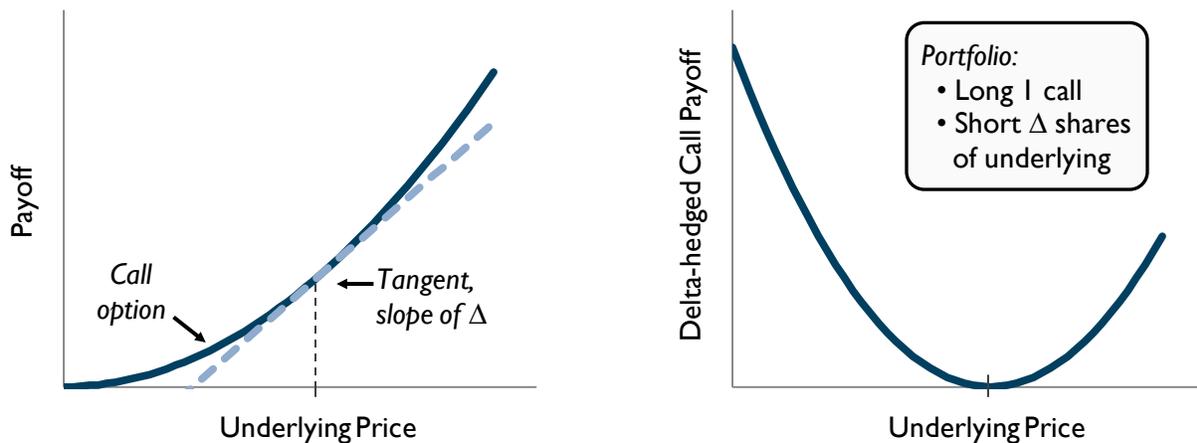


Figure 1: (Left) Price of a call option prior to expiration as a function of the underlying price. The slope Δ of the tangent line is the *delta* of the option and measures the sensitivity of the option price to changes in the underlying price. (Right) Payoff of being long one call option and short *delta* shares of the underlying.

The price of convexity is centrally important to investors who have portfolios with non-zero convexity. Investors with long convexity portfolios can consistently lose money despite the positive convexity by paying too much for it. On the other hand, investors with short

convexity portfolios need to make sure they are being compensated adequately for the risk they assume. A disconcerting element of convexity is that it may exist where investors least expect or want it. Consider, for instance, long equity portfolios. Both high and low beta stock portfolios have convex payoffs relative to the market, albeit in different directions. How can this be?

As the overall equity market goes to zero, so does every other long equity portfolio by definition. For a low beta portfolio to get to zero, its beta (the rate of change relative to the market) must *increase* on the way down. Conversely, for a high beta portfolio to get to zero, its beta must *decrease*. As a result, low beta portfolios tend to have a negative convex payoff and high beta portfolios tend to have a positive convex payoff. To draw a parallel with equity derivatives, the high beta portfolio resembles a long call option whereas the low beta portfolio more closely resembles a short put.

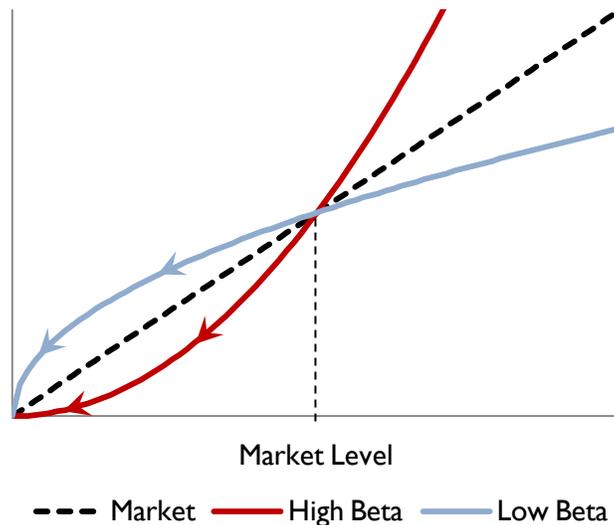


Figure 2: Changes to beta for both high and low beta stocks as the market declines to zero.

Investors must be aware of the impact of convexity on their returns. What is the price for having long convexity in an equity portfolio? What is the cost of owning high beta stocks? How is one compensated for the short convexity in a low beta portfolio? The following figures 3 and 4 show the annual returns of high and low beta portfolios versus the market, overlaid with quadratic fits. These figures also show the expected annual returns of holding beta-hedged long portfolios of high and low beta stocks.

High Beta Stocks

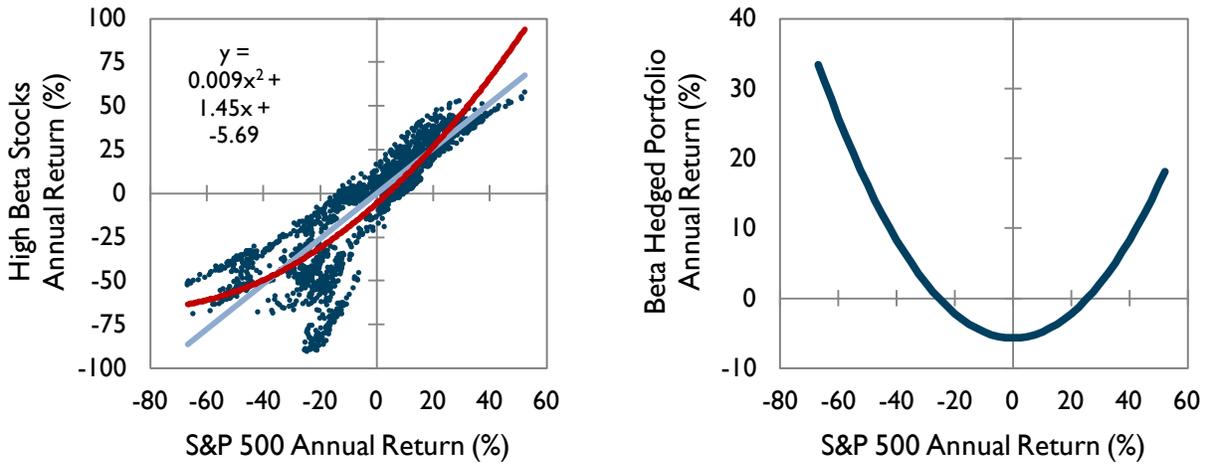


Figure 3: (Left) Annual returns of high beta stocks against the S&P 500. (Right) Expected annual return of a portfolio of long high beta stocks and short beta of the S&P 500.

Low Beta Stocks

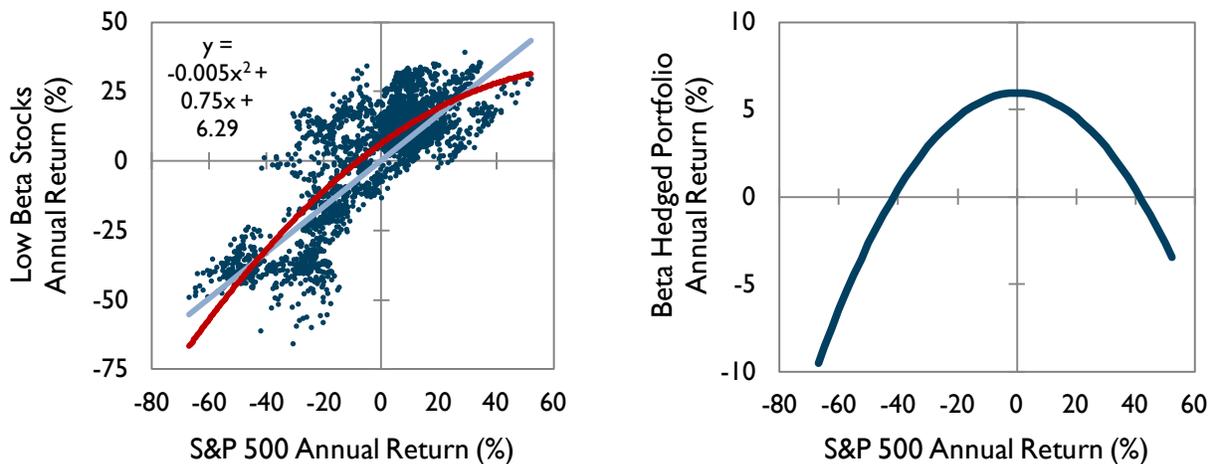


Figure 4: (Left) Annual returns of low beta stocks against the S&P 500. (Right) Expected annual return of a portfolio of long low beta stocks and short beta of the S&P 500.

As expected, the high beta portfolio has positive convexity and a slope of greater than one while the low beta portfolio has negative convexity and a slope of less than one. What may be surprising, however, is the sign of the alpha coefficient in each case. The high beta portfolio has negative alpha while the low beta portfolio has positive alpha. These alpha values reflect the price of convexity that the high beta portfolio pays and the low beta portfolio receives.

The convexity found in long equity portfolios may be surprising, but what is expected from hedge fund investments? Should hedge fund investors expect returns to be convex, and is the convexity fairly priced? Possibly, but the answer depends on the underlying strategy. If we consider the hedge fund universe to be measured by the Dow Jones Credit Suisse (DJ/CS) Hedge Fund Index, we see negative convexity.

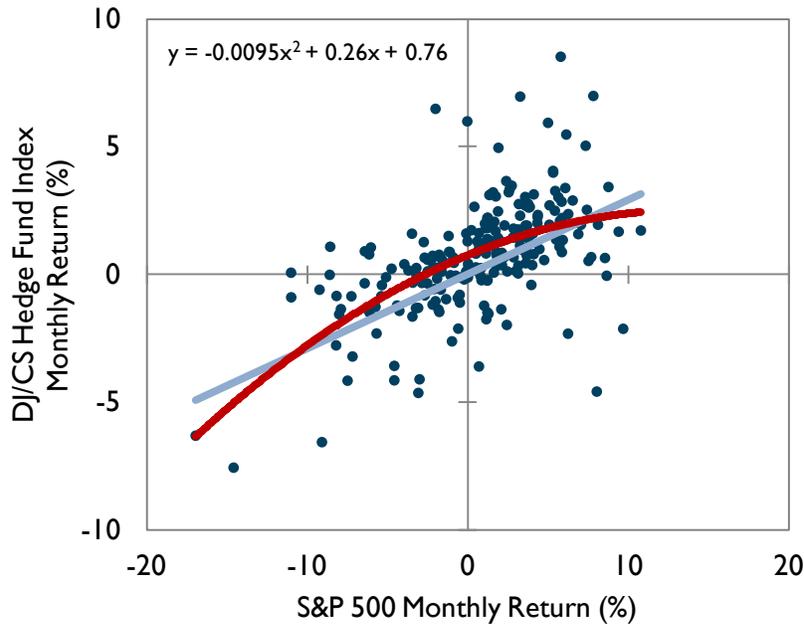


Figure 5: Monthly returns of the DJ/CS Hedge Fund Index against the S&P 500.

This is not completely unexpected given the underlying nature of many hedge fund strategies. However, popular hedge fund strategies that claim to neutralize exposure to the broader market should have payoffs with little to no beta and hopefully no convexity, positive or negative. For example, if we examine the DJ/CS Long-Short Equity and Equity Market Neutral strategies, what do we find?

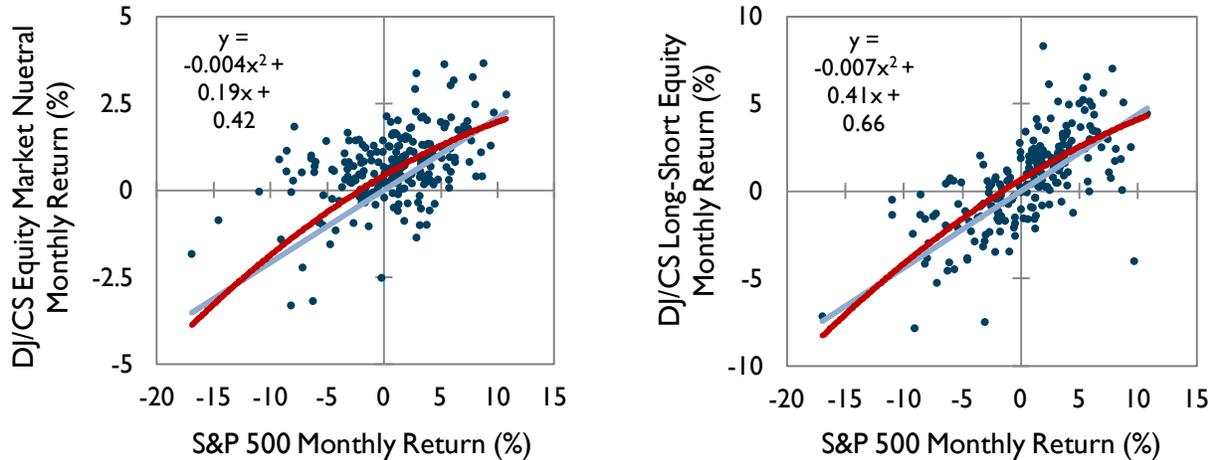


Figure 6: (Left) Monthly returns of the DJ/CS Equity Market Neutral Sub-Index against the S&P 500. (Right) Monthly returns of the DJ/CS Long-Short Equity Sub-Index against the S&P 500.

The results in figure 6 are more revealing. Should hedge fund investors expect negative convexity and a positive beta from their equity managers? Results from both the DJ/CS Long-Short Equity and Equity Market Neutral strategies show both negative convexity and positive beta. Long-short hedge funds can be long low beta and short high beta stocks, and this could explain most of the convexity found in their returns. However, the equity market neutral hedge funds in the DJ/CS index display positive beta and negative convexity relative to the S&P 500, despite how most investors understand the objective of such a strategy.

It is important to mention that the issue is not whether the payoffs have positive or negative convexity. The real issue is how much investors are paying for positive convexity and how much they are receiving for negative convexity. In our March 2012 investor letter, we examined the alpha generation by hedge fund strategies overall and described how these strategies are not compensating investors adequately.¹

As a hedge fund investor, one must have a high degree of confidence that the manager has a clear and definable edge and will continue to generate the alpha necessary to justify the risk inherent in the strategy. This requires each hedge fund to provide greater transparency of its strategies and to clearly articulate its edge and why the edge should continue. Ultimately, hedge fund investors should expect nothing less.

¹ http://www.lakehillgroup.com/files/Lake_Hill_Capital_Management_March_2012_Investor_Letter.pdf

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