



The Benefits of Systematically Selling Volatility

July 2014

By Jeremy Berman

Justin Frankel

Co-Portfolio Managers of the RiverPark Structural Alpha Fund

***Abstract:** A strategy of systematically selling volatility through the use of options allows investors to harness the difference between implied and realized volatility that is often observed in equity markets. This investment strategy is uncorrelated to most other investment strategies and therefore provides diversification to an investment portfolio. Volatility is a form of risk and theoretically should have a degree of return associated with its exposure. While higher levels of implied volatility enhance the potential returns of such a strategy, our research indicates that the spread exists in a variety of market conditions, including during periods of lower volatility. The purpose of this paper is to provide a framework to explain the benefits and risks associated with a strategy of systematically selling volatility, and to highlight some approaches to implementing such a strategy. We will discuss the structural elements of the volatility market that support a strategy of systematically selling volatility, as well as present a case study that shows the type of adjusted returns that we believe could have been achieved by implementing this strategy.*

Volatility: A Brief Overview

Volatility is the measure of how an asset price moves and the dispersion of those moves. In traditional statistical terms, it can be quantified by the standard deviation of an asset's return stream. Investors in the volatility market are generally long volatility because they desire insurance on their broader portfolio or short volatility because they prefer to sell that insurance. Those sellers collect premiums in exchange for the risk of suffering occasional, and potentially sizeable, losses. Practitioners of options selling strategies often believe that volatility is mean reverting, but understand that the path around that mean is asymmetrical – long periods of relative calm often punctuated by shorter and sharper spikes. Derivatives, and volatility-linked trades, have a zero-sum payoff profile. For every winning side of a trade there is an equal and opposite losing side.

The Positive Expected Return Associated With Selling Volatility

As with purchasing insurance, the cost of protection is usually greater than the expected loss. The probability of a house fire, car accident, or some other impairment to a hard asset is lower than the number of hard assets owned on which insurance is purchased. Yet owners are compelled by either regulatory reasons or their own fear to buy this protection. Purchasers of



insurance generally expect to lose money on their purchase, but are comforted by the protection against a catastrophic loss. The insurance industry is characterized by many small buyers, being served by a fewer number of underwriters.

Financial markets are no different when it comes to providing investment insurance, where an asymmetry exists between the numerous buyers of portfolio protection and the small number of institutions with the capability of selling it. Selling volatility thus provides several structural benefits: capital has a cost, hedging is risky and expensive, and downside exposure is hard to quantify. In addition, the constant demand for insurance, when combined with these structural elements, results in option prices that are often greater than their expected value.

The pioneering work in the field of behavioral psychology and economics by Amos Tversky and Daniel Kahneman demonstrated that loss aversion is a more powerful motivating factor than gain satisfaction. Investors are regularly driven by their fear of loss, often making decisions that are far less rational than would otherwise be expected. For example, in derivative markets, investor demand for protection usually increases in the wake of crisis. Not surprisingly, it is during these periods that the option premiums associated with this protection also generally increase.

In addition, demand for protection can be counterintuitive. When things look calm, investor complacency leads to a drop in demand for insurance. It is during these periods of relatively low volatility that such insurance is both plentiful and cheap. Conversely, after a crisis occurs, investor demand tends to spike causing the cost of insurance to skyrocket in response to this higher demand. Thus, we believe that the market systematically overreacts to recent events when pricing insurance in the aftermath of a crisis. After all, how likely is it that a house will burn down two days in a row? This paradox exists despite the fact that most options expire worthless, thus giving a statistical edge to the option sellers. Option buyers are not naïve, however. They are willing to lose the premium that they pay in order to have insurance against a potential negative outcome, or to lever their exposure to potential future moves. As perceived risk increases, so too does the premium a seller can expect to collect.

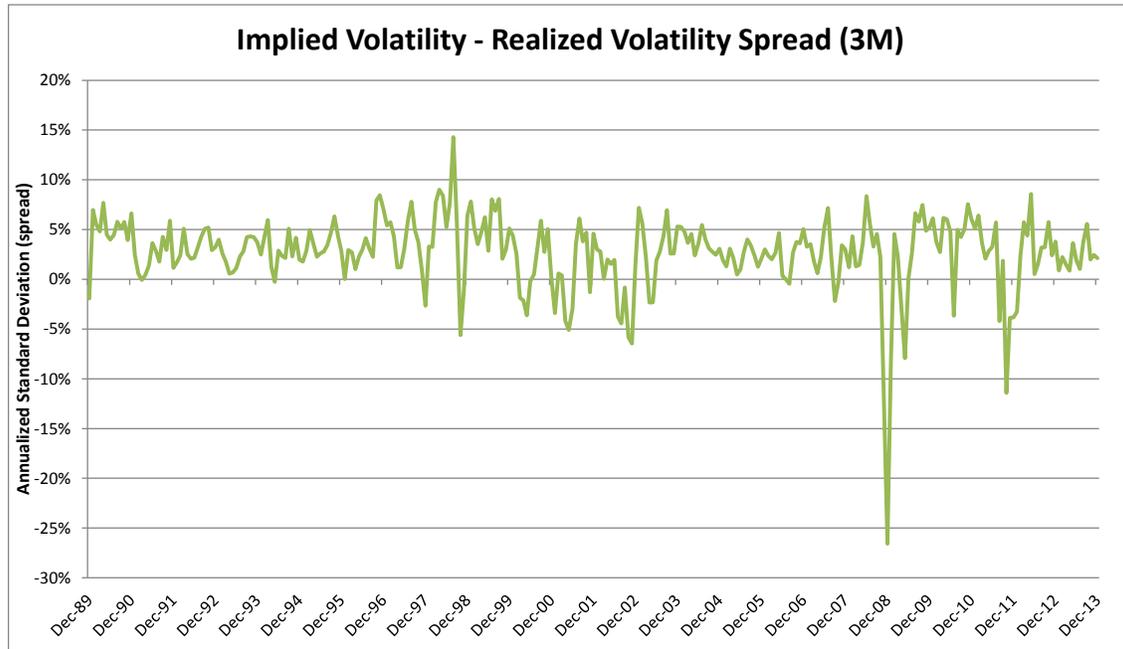
Implied vs. Realized Volatility

Implied volatility reflects the market's expectations of what the future volatility of an asset will be, while realized volatility is what the actual volatility of the asset turned out to be. Historically, there has been a persistent spread between implied and realized volatility, where the anticipated level of what volatility will be is higher than where actual volatility ultimately is priced. This is largely due to the imbalances between supply and demand for hedging solutions and the previously discussed structural forces that guide the marketplace for options.

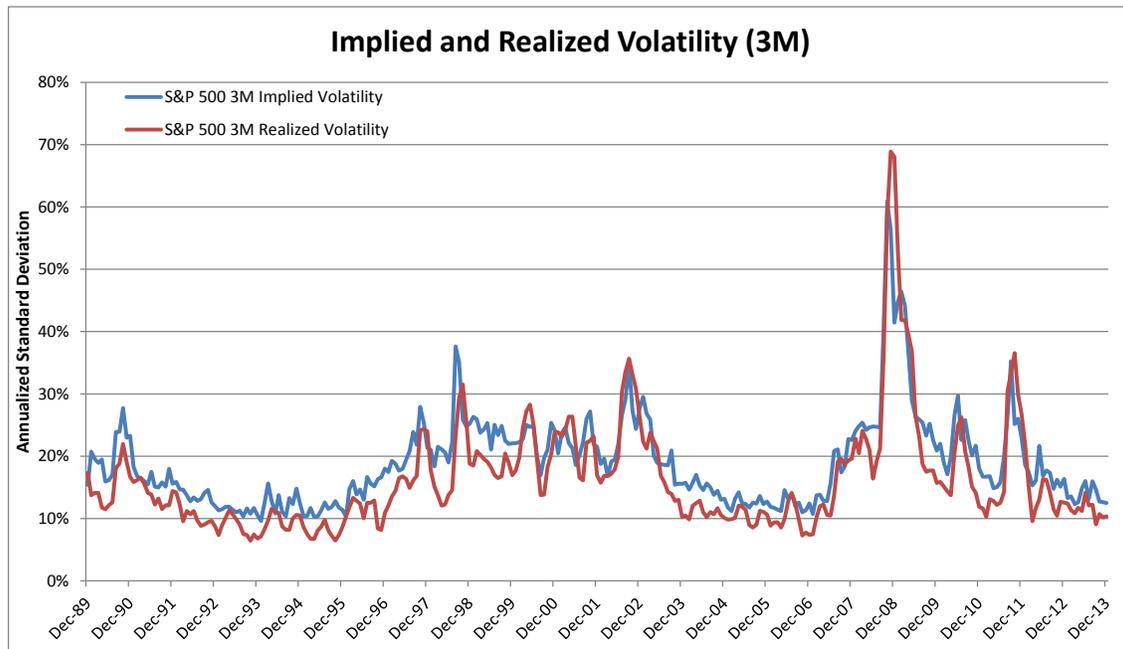
It is noteworthy that this spread, in contrast to most market inefficiencies, cannot be arbitrated away. As much as academicians and practitioners have tried to devise strategies to take



advantage of this arbitrage, they can't, and therefore it persists, and we believe will continue to persist.



Source: RiverPark Advisors, based on data from Bloomberg, Yahoo! Finance, and iVolatility.com



Source: RiverPark Advisors, based on data from Bloomberg, Yahoo! Finance, and iVolatility.com

*Volatility is commonly expressed as the annualized standard deviation of returns, shown as a percentage.



Implementing a Short Volatility Strategy

There are several methods for implementing a short volatility strategy. Variance swaps, volatility swaps, and volatility futures and options are all vehicles that can be used to implement and trade a volatility view. In particular, a strategy that takes a systematic approach to selling index options may generate stable returns through a variety of market conditions.

Typically, there are six variables that affect option pricing: security price, strike price, time to maturity, interest rate, dividend yield, and implied volatility. If all other variables are held constant, as implied volatility increases, so too does the value of an option. In layman's terms, rising expected volatility reflects a higher likelihood of a larger market move. Therefore, there is greater desire for insurance, resulting in higher option prices.

Using direct options transactions to sell volatility involves being short both puts and calls on the same underlying security or instrument. A short straddle, which combines a short put and a short call of equal strike price, maturity, and size, is one of the most basic approaches an investor can use. Another example is a short strangle, or simultaneously selling both out of the money puts and calls with the same maturity and size. These strategies are employed by sophisticated investors and fund managers.

As published in a March 2011 research report from Cambridge Associates, since 1990 implied volatility has been higher than realized volatility in 86.9% of monthly observations, with a mean difference of 4.5%. Our own research suggests similar results. Using monthly observations, and time periods of 1, 3, 6, and 12 months, we found that implied volatility remains higher than realized volatility approximately 85% of the time with a mean spread of 2.7% and a median spread of 3.0%. Furthermore, the spread between implied and realized volatility exists, regardless of the duration of maturity or time of measurement.

As illustrated in the following hypothetical case study, a process of systematically selling both puts and calls on the S&P 500 would have resulted in better returns than owning the total return of the index outright over the same period of time. In addition, this approach would have exhibited lower volatility while offering comparable transparency and liquidity. We suspect that such findings are not specific to the U.S. equity markets, as long as the markets in which these options are sold have sufficient liquidity and depth.

Since these strategies result in being a net-seller of options, the trade itself is net cash-flow positive. Capital is only needed as collateral and may be invested, earning a basic rate of return (i.e. 1 month LIBOR) during the hold periods. This interest income may be used to enhance the overall return of the strategy and further reduce volatility. Although the higher the rate, the more attractive this becomes, this interest income is merely an adjunct to the main strategy and is less significant in an environment where the risk free rate approaches 0% (as is the case today).



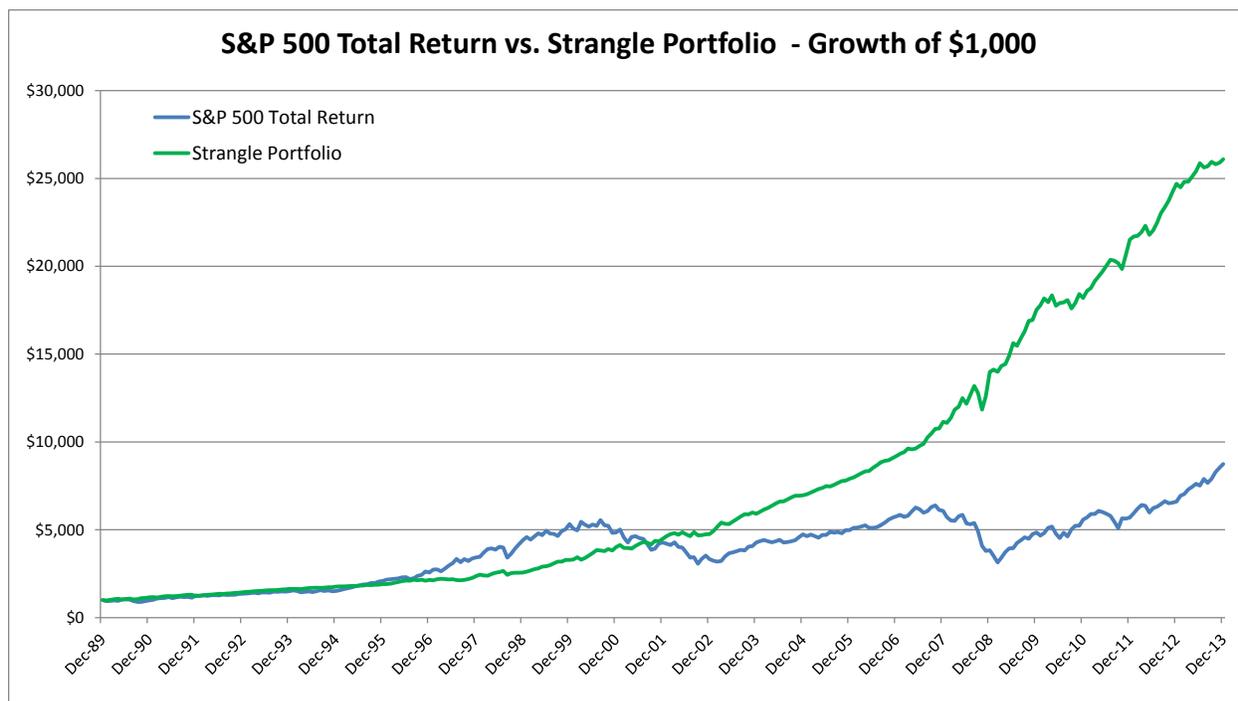
Investors with higher risk tolerances can also choose to move out in duration or move down in credit quality with respect to the collateral positions, but doing so introduces new sources of risk to the overall portfolio.

Selling Volatility: A Hypothetical Case Study

The value of a systematic options selling strategy is illustrated in the following case study, which looks at the 24-year time period between 12/31/1989 and 12/31/2013. Using the S&P 500 Total Return index as the benchmark, we calculated the investment returns of a hypothetical portfolio that sold a 1-month, 2% out-of-the-money strangle linked to S&P 500 index each month, and fully collateralized the options with 100% of capital (excluding the premium received), constantly invested at 1-month Libor.

For the purposes of this analysis, we assume that each month, transaction costs equal 2.5 basis points. Transaction costs included commissions as well as an assumption on the pricing spread of the options. Current S&P 500 options pricing suggests that 2.5 basis points is an accurate reflection of those transactions costs. The returns for the benchmark are total return, inclusive of all dividends, and have no fees or expenses associated with that return stream.

As you can see in the graph and table below, this strategy would have delivered returns that are higher, more stable, less volatile, and uncorrelated to the benchmark index. Over the 24 years, the compounded return of the S&P 500 total return was 9.9%, vs. a compounded return of 15.2% for the strangle portfolio. That return is 54% greater, or 5.3% per year of what we define as structural alpha: the outperformance created by the use of options to generate excess risk-adjusted returns and limit downside exposure. The volatility of the S&P 500 over the 23 years was 14.9%. The volatility of the strangle portfolio was 7.3%, or less than half of the market's. Using 4% as an interest rate*, the Sharpe ratio for the strangle portfolio was about 4 times greater than the S&P 500 (1.54 vs. 0.40). The correlation between monthly returns was only 0.10, clearly illustrating its diverse source of returns.



*For the period studied, the 1M Libor range was 0.19%-8.75%, with a mean of 3.74% and a median of 4.19%.

Annual Returns

| | S&P 500 | Strangle | | S&P 500 | Strangle |
|------|--------------|-----------|------|--------------|-----------|
| | Total Return | Portfolio | | Total Return | Portfolio |
| 1990 | -3.1% | 14.9% | 2002 | -22.1% | 5.8% |
| 1991 | 30.5% | 5.4% | 2003 | 28.7% | 24.3% |
| 1992 | 7.6% | 19.0% | 2004 | 10.9% | 17.8% |
| 1993 | 10.1% | 13.5% | 2005 | 4.9% | 13.6% |
| 1994 | 1.3% | 7.5% | 2006 | 15.8% | 16.3% |
| 1995 | 37.6% | 8.2% | 2007 | 5.5% | 21.2% |
| 1996 | 23.0% | 13.0% | 2008 | -37.0% | 25.5% |
| 1997 | 33.4% | 9.5% | 2009 | 26.5% | 25.3% |
| 1998 | 28.6% | 8.8% | 2010 | 15.1% | 3.8% |
| 1999 | 21.0% | 28.2% | 2011 | 2.1% | 18.2% |
| 2000 | -9.1% | 21.9% | 2012 | 16.0% | 14.8% |
| 2001 | -11.9% | 12.2% | 2013 | 32.4% | 5.6% |

Source: RiverPark Advisors Hypothetical Case Study, based on data from Bloomberg, Yahoo! Finance, and iVolatility.com



Risks to Short Volatility Strategies

One of the most famous options trading scandals in recent times occurred when a trader for Barings PLC, Nick Leeson, sustained huge losses stemming from a short volatility position linked to futures on the Nikkei 225 index. The index plunged in 1995, leading to a sharp spike in volatility. The sharpness of this move, combined with the outsized short position established by Mr. Leeson, all but wiped out Barings. Extreme stories such as this one have led to the perception that strategies which engage in the net selling of volatility carry tremendous risk. Instructively, it was not the short position alone that led to such a catastrophic result. Rather, it was the use of leverage and the size of that position relative to the capital that the bank had available as collateral that determined Barings fate. Leverage and position sizing are basic tenets of risk management, and worthy of a separate analysis. However, the focus here is on the risk associated with the short volatility position itself. Short volatility strategies are typically exposed to declines when markets fall or rise sharply and volatility spikes. Inappropriate leverage will increase this risk.

While the returns generated by systematically selling options may be consistent through various market environments, this strategy also generally results in smaller expected returns, as they will be limited to the amount of option premiums generated by the sales. Selling straddles or strangles also leaves the investor exposed to significant losses in the event that market movement is both dramatic and sustained. This strategy, over long periods of time, provides a cushion against a certain percentage of market movement. However, that cushion goes away once the market moves past the total of the strike prices and premium received. It is for this reason that short volatility strategies are often best combined with other hedging strategies that reduce risk.

Conclusion

Optimizing portfolios for maximum risk-adjusted returns has become more difficult as investment choices have become more closely correlated during tail-risk events. Unfortunately for most investors, the need for such non-correlated, risk-adjusted returns has also never been more critical. The pervasive gap between implied and realized volatility may be used by properly implemented volatility-selling strategies to provide such returns.

Selling volatility can deliver positive risk-adjusted returns that compare favorably with broad equity index returns, while having low correlation to those indices. Systematically selling volatility is not without risk, and may not be appropriate for all investors. The key factors influencing the success of such a strategy are that it be both rules-based and systematic. Further, managers employing such a strategy must be disciplined, especially with respect to the use of leverage, and need to employ the proper systems to monitor risk in real time. Given the inherent structural underpinnings of the volatility market, we believe it is possible to implement a rules-based and systematic strategy to achieve the type of results that our research suggests, regardless of market environment. We believe the short volatility strategy described in this white-paper will



generate returns by capturing the spread between implied and realized volatility, with low volatility, and limited correlation to most other investments and deserves consideration as a portfolio allocation.

Options involve risk and are not suitable for all investors. The information in this document is provided solely for general education and information purposes and therefore should not be considered complete, precise, or current. Many of the matters discussed are subject to detailed rules, regulations, and statutory provisions that should be referred to for additional detail and are subject to changes that may not be reflected in this document. The information in this document is not intended and should not be construed to constitute investment advice or recommendations to purchase or sell securities.