Portfolio Applications For VIX-Based Instruments

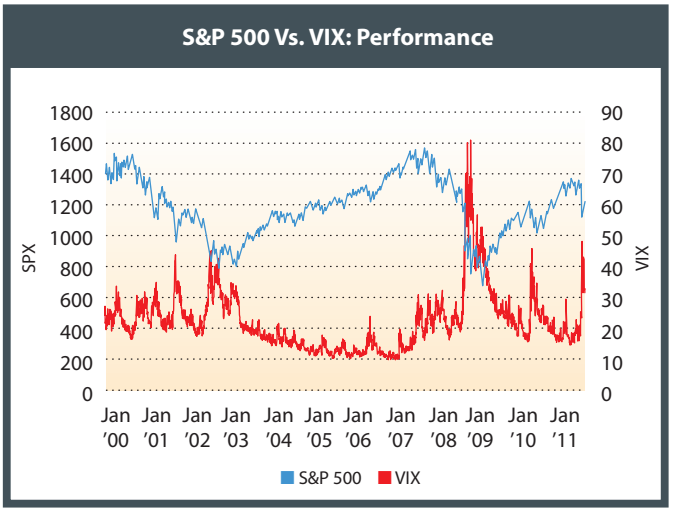
Taking advantage of volatility

By Nick Cherney, William Lloyd and Geremy Kawaller

Diversification proved to be a relatively ineffective hedge against 2008's stock market crash, and since that realization almost three years ago, investors have been searching for an efficient means to insulate equity portfolios from a repeat performance.

One asset class that performed well in the face of the crash was volatility—the stock market plummeted in September 2008 and the CBOE Volatility Index (the VIX) soared (see Figure 1). The S&P 500 fell by 47 percent from its September 2008 peak to its trough in March 2009. During that same period, the VIX rallied 126 percent and at one point was up over 250 percent since the September high on the S&P 500. This negative correlation to the S&P 500 led many investors to investigate the VIX as a potential way to protect their portfolios from another collapse. Perhaps VIX, the so-called fear index,

Figure 1



Sources: VelocityShares, Bloomberg; January 1990–August 2011

would enable managers to develop the portfolio hedge that investors had been seeking.

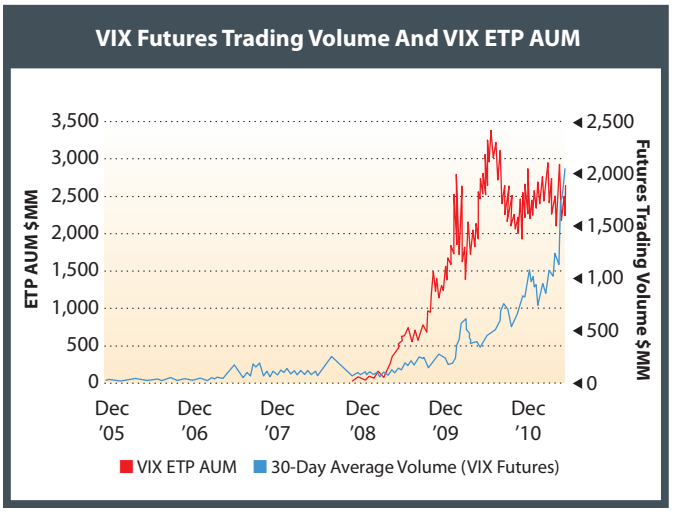
The VIX was introduced in 1993, but it wasn't until 2004, when futures were first listed, that investors could take positions in exchange-traded VIX instruments. Trading in VIX futures accelerated dramatically after the launch of VIX-related exchange-traded products in early 2009. As shown in Figure 2, the 30-day average trading volume in VIX futures has increased almost twentyfold since the advent of VIX ETPs. In that period, investments in VIX-related ETPs have increased from zero to $3 billion.

Before looking at specific strategies or asset allocation concepts, it is important to understand the construction of the underlying volatility benchmarks and indexes. The VIX index and instruments related to the index have performance characteristics that differ from other futures-based instruments.

The Fear Index

The VIX[1] is a measure of the volatility implied by prices of S&P 500 options for the next two expiries. The option expiries are weighted such that the index measures the 30-day expected volatility of the S&P 500. The components

Figure 2



Sources: VelocityShares, Bloomberg; January 1990–August 2011

Figure 3

Performance Of VIX And S&P 500 Index

Index	VIX	S&P 500
Minimum	-29.57	-9.03
Maximum	64.22	11.58
Median	-0.31	0.05
Mean	0.20	0.03

Sources: VelocityShares, Bloomberg
Statistics based on daily returns, January 1990–August 2011

of the VIX are near-term and next-near-term put and call options having at least eight days until expiry, and the square root of the variance of these options is used to calculate the index. As volatility rises and falls, the strike price range of options with nonzero bids tends to expand and contract. As a result, the number of options used in the VIX calculation may vary from month to month, day to day and possibly even minute to minute. It is the use of the square root in the index calculation and the potential for change in the components of the index that make it unrealistic to actually trade the index. The VIX is widely followed by the market and the media, but it is *not* an investable index.

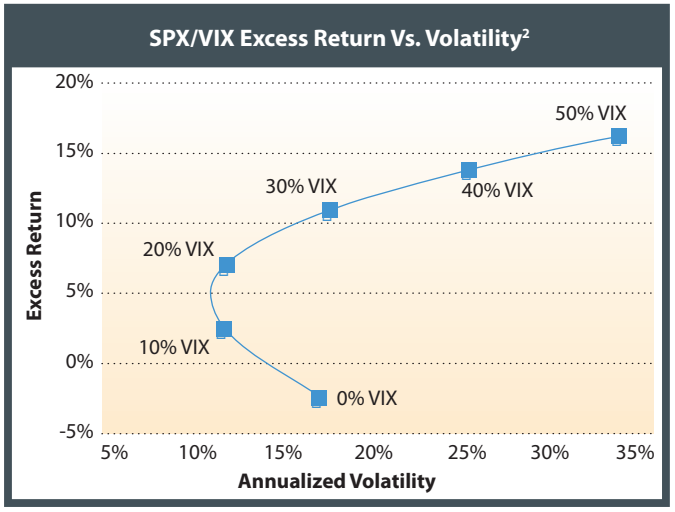
The negative correlation of the VIX to the S&P 500 would make it an attractive addition to a portfolio. Figure 4 demonstrates that adding a holding in the VIX to a holding in SPX improves the risk-adjusted return.

Unfortunately, it is not possible to own the VIX. Investors can gain exposure to equity volatility by investing in futures and options on the VIX as well as ETPs linked to VIX futures indexes, but each of these has specific performance characteristics that should be well understood before investing.

Investable Instruments

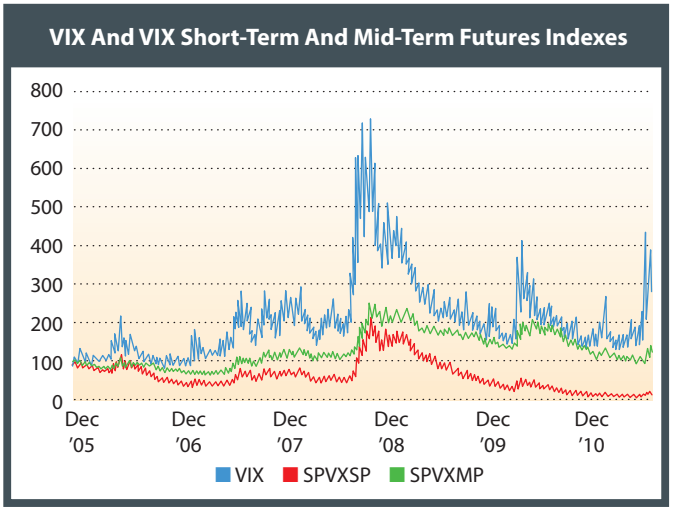
In 2004, CBOE introduced futures on the VIX. This gave market participants the ability to gain exposure to

Figure 4



Sources: VelocityShares, Bloomberg; December 2005–August 2011

Figure 6



Sources: VelocityShares, Bloomberg; December 2005–August 2011

Figure 5

VIX Index And VIX Futures Indexes

	VIX	SPVXSP	SPVXMP
	CVOE SPX Volatility Index	S&P VIX Shrt-Trm Futures Index	S&P VIX Mid-Trm Futures Index
Investable	No	Yes	Yes
Futures Contracts	N/A	1st & 2nd mo.	4th, 5th, 6th, 7th mo.
Average Maturity	N/A	1 mo.	5 mos.
Beta To Spot VIX	1.00	0.44	0.21
Correlation To Spot VIX	1.00	0.88	0.80
Correlation To SPX	-0.86	-0.88	-0.85

Sources: VelocityShares, Bloomberg
Based on daily returns, December 2005–August 2011

equity volatility in exchange-traded markets. One of the challenges with trading VIX futures is that they cannot be arbitraged. It is not possible to own spot VIX, and therefore if a trader believes the futures are mispriced relative to the spot price, it is not possible to buy spot and sell futures (or vice versa) to exploit mispricings. Unlike most futures markets, there is no direct linkage between the VIX and a given futures contract. So while the level of the futures contracts is theoretically an indicator of market expectations about future VIX levels, it is in fact dictated solely by supply and demand; there is no market mechanism to connect the futures and spot price. This means that there is the potential that the level of the futures does not accurately represent the market's expectation for future volatility.

This pricing dynamic leads directly to the single largest concern for investors looking to hedge their exposure to the equity market with VIX futures: the cost of implementing the hedge. The severe contango, or upward-sloping term structure, that generally exists in the VIX futures market makes the cost of buying and holding long positions in VIX futures prohibitively expensive. Since the inception date of VIX futures indexes in 2005, the average contango from the first to second nearby contracts has been 3.8 percent per month. This means that on average, VIX would have to rise by that amount per month for the holder of the contract to break even. VIX futures can be an effective hedge for short holding periods, but the cost of hedging with VIX futures can be very high.

S&P 500 VIX Futures Indexes

While the CBOE has been publishing the VIX since 1993, it wasn't until 2009 that an investable index emerged. Standard & Poor's launched a pair of VIX futures indexes: the S&P 500 VIX Short-Term Futures Index (SPVXSP) and the S&P 500 VIX Mid-Term Futures Index (SPVXMP). The short-term index measures the return from daily rolling weighted long positions in the first- and second-month VIX futures contracts. The midterm index measures the return from daily rolling weighted long positions in the fourth- through seventh-month VIX futures contracts. To maintain a constant average maturity, the weighting of the positions in the futures contracts rolls on each trading day. The specifics of the indexes are presented in Figure 5.

Consequences Of Contango In The VIX Futures Market

Since the launch of the first VIX-related ETPs in January 2009, the futures contracts underlying the VIX futures indexes generally have been in contango. The contango in the futures market results in the index losing value every trading day if future prices do not move higher than discounted in the market—the value of the contracts is falling as they roll down the futures price curve. The 20-day rolling average spread between the first- and second-month futures contracts has averaged 3.8 percent per month since the inception date of the index in 2005, but has averaged a much steeper 6.2 percent per month since the introduction of the VIX ETPs in January 2009. At the same time, the supply/demand dynamic for VIX futures changed dramatically.

Figure 7

Index Performance (%)

Index	August 2011	1st Half 2011	2010	2009
VIX	25.2	-6.9	-18.1	-45.8
Short-Term	66.2	43.8	-72.0	-65.0
Mid-Term	28.8	-23.4	-13.3	-23.7

Sources: VelocityShares, Bloomberg

Many futures markets are in contango from time to time, but the VIX futures market, with the exception of a handful of days, was in contango from mid-2009 through July 2011. A number of theories was put forth as to why: One theory is that the introduction of VIX-related products created continued demand to buy the second month and sell the first month in line with the index. Another posits that after the 2008 stock market crash, investors were willing to pay a higher premium for longer-dated volatility exposure that would provide them "protection" from a sell-off in the equity market. In the fourth quarter of 2008 and again in August 2011, the VIX futures curves tend to go into backwardation when the market undergoes significant spikes in volatility.

The contango in the VIX futures market has had a significant impact on the performance of the S&P VIX Futures indexes. The degree of this impact is most evident when looking at the relative performance of the short- and midterm indexes. Figure 6 depicts the level of the short-term and midterm indexes since inception against the level of VIX. The short-term index has lost 85 percent since inception, and fell 44 percent in the first half of 2011. During those same periods, the midterm index posted returns of 29 percent and -23 percent, respectively. While the two indexes suffered double-digit negative returns during the first half of this year, the VIX was down only 7 percent. This relative performance clearly highlights the cost of a buy-and-hold position in the S&P 500 VIX Futures Index due to the contango in the futures market.

Clearly, the S&P 500 VIX Short-Term Futures Index is *not* the same as the VIX. Since the index's inception through August 2011, the daily return of the short-term VIX futures index has a beta of almost 0.5 with spot VIX, and the beta on the midterm futures index is approximately 0.2.

As many market participants have learned the hard way, it is expensive to buy and hold a long position in VIX futures, options or exchange-traded products. Simply looking at the return of the index makes that painfully clear. The return on the indexes, especially the short-term index, has trended down since inception. The relative performance of the indexes is even clearer when looking at the numbers (see Figure 7).

The S&P 500 VIX futures short-term and midterm indexes are the reference indexes for almost all of the outstanding VIX-related ETPs. Some are leveraged, periodically resetting and/or comprise a combination of indexes. It is important to understand how the index underlying the ETP behaves under different market conditions, and equally important to understand the instrument. One area that has received a great deal of attention is the performance of leveraged and inverse products that reset daily, and that is particularly interesting in the context of VIX futures indexes.

Daily Resetting Leveraged And Inverse Products

Daily resetting leveraged and inverse products have return characteristics that may not be immediately apparent to many investors. These instruments seek to replicate the performance of a leveraged or inverse position in an underlying index for a one-day holding period. In general, these types of instruments are suited for professional traders who are interested in using them to express specific short-term market views or manage portfolio risk. They are not intended for buy-and-hold investors.

In most cases, the performance of a daily rebalancing leveraged or inverse instrument held for more than one day will be different than a similar instrument that is not rebalanced. In fact, for holding periods longer than a day, it is possible for leveraged/inverse products to perform in the opposite direction than would be expected given the performance of the underlying index. For example, the underlying index could have a positive return, while the leveraged instrument could have a negative return. This is especially true in choppy markets. This loss of value resulting from daily resetting is frequently referred to as "decay."

The daily resetting instruments exhibit positive convexity—the returns of the instrument increase more rapidly and decrease less rapidly than an equivalent linear exposure. As an example, in Exhibit A of Figure 8, the exposure increased on day 2, and this is the reason the daily rebalanced position outperformed the nonrebalanced position by 2 percent.

Path Of Underlying Price Changes

In addition to demonstrating the effects of the length of the holding period on returns, the examples above also highlight that the return on the daily rebalanced instrument is dependent on the path of the changes in the price of the underlying asset or index. In Exhibit C in Figure 8, the price of the underlying instrument at the end of the third day is the same as the price at the beginning of the first day. Therefore, one might conclude that there would be no change in the value of the daily rebalanced leveraged instrument over that time period, but, as the analysis shows, that is not the case. As a result of the level rising significantly and then falling significantly, the return on the daily rebalanced 2x leveraged instrument was -2.1 percent. Clearly, a trader who did not understand the effects of daily rebalancing would not have expected that outcome.

In certain scenarios, daily rebalancing could work in favor of the trader. If the underlying index consistently moves in one direction, then, as shown in Exhibit B, the daily rebalancing works in the trader's favor—the daily rebalanced instrument outperforms the nonrebalanced

Figure 8

A 2x Leveraged Product: Comparison Of The Effect Of Daily Rebalancing

	Underlying Price			Daily Rebalanced		Not Rebalanced	
Day	Begin	End	Return	1-Day Return	Cumulative	1-Day Return	Cumulative
Exhibit A							
1	100.0	110.0	10.0%	20.0%	20.0%	20.0%	20.0%
2	110.0	121.0	10.0%	20.0%	44.0%	18.3%	42.0%
3	121.0	108.9	-10.0%	-20.0%	15.2%	-17.0%	17.8%
Exhibit B							
1	100.0	110.0	10.0%	20.0%	20.0%	20.0%	20.0%
2	110.0	99.0	-10.0%	-20.0%	-4.0%	-18.3%	-2.0%
3	99.0	100.0	1.0%	2.0%	-2.1%	2.0%	0.0%
Exhibit C							
1	100.0	105.0	5.0%	10.0%	10.0%	10.0%	10.0%
2	105.0	110.3	5.0%	10.0%	21.0%	9.5%	20.5%
3	110.3	115.8	5.0%	10.0%	33.1%	9.1%	31.5%

Source: VelocityShares

instrument. In a trending market, the daily rebalanced leveraged instrument should outperform the nonrebalanced leveraged position. This relationship holds regardless of the direction of the underlying market. This performance results from the positive convexity of daily rebalanced instruments.

Figure 9 compares the return of a daily resetting inverse position in the index with a nondaily resetting short position in the VIX short-term futures index. The outperformance of the daily resetting index is significant. During the January 2009–August 2011 holding period, the daily resetting position returned 249 percent vs. 90 percent for the nonresetting position. This is due to a combination of factors, such as the convexity of daily resetting products, and that effective exposure of the nonresetting position declines as the level of the index falls—as the trade moves in the desired direction, the effective leverage declines.

A closed-end formula can be used to calculate the expected return on a daily resetting instrument relative to an underlying index based on the return of the underlying index, the volatility of the underlying index and the holding period.[3] The analysis assumes a normal distribution of returns for the underlying index (which, as discussed later, the VIX futures indexes are not). Figure 10 assumes a 60 percent annualized volatility, which is the average volatility of the VIX short-term index since 2005.

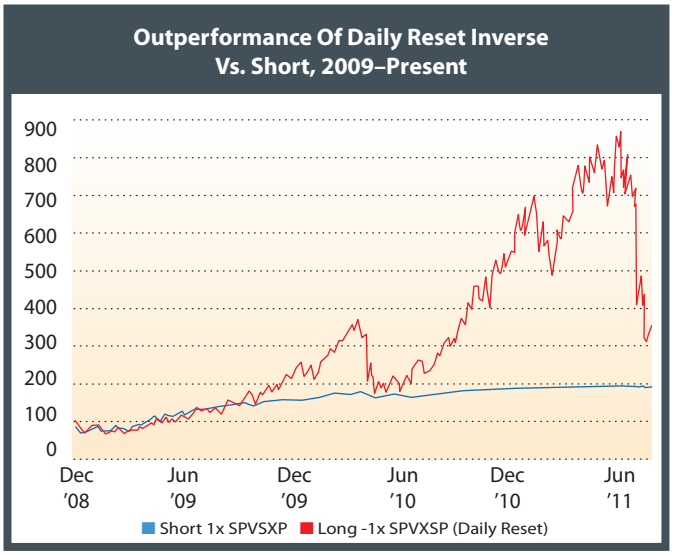
As Figure 10 demonstrates, the longer the holding period, the more likely that the daily resetting product will underperform the underlying index. For a 10-day holding period, the daily resetting product is expected to outperform the underlying index if the underlying index's performance is less than –10 percent or is greater than 10 percent. In effect, it behaves as a long straddle position on excess return: In the event of a large move down or up, the product should outperform the underlying index. However, rather than the cost of the straddle being determined by a fixed option premium, it is determined by the expected decay of a resetting position. The 252-day holding period requires a much larger move to generate a positive expected excess return, approximately a +/-55 percent move in the underlying index.

Daily resetting products exhibit positive convexity (the returns of the instrument increase more rapidly and decrease less rapidly than an equivalent linear exposure); however, the trade-off is that they also exhibit return decay in many return environments. Therefore, a stand-alone position in a daily resetting product should only be initiated in place of a nonresetting position if the trader expects the positive effects of the convexity to outweigh the negative effects of the return decay for the period.

Non-Normal Returns In VIX Futures

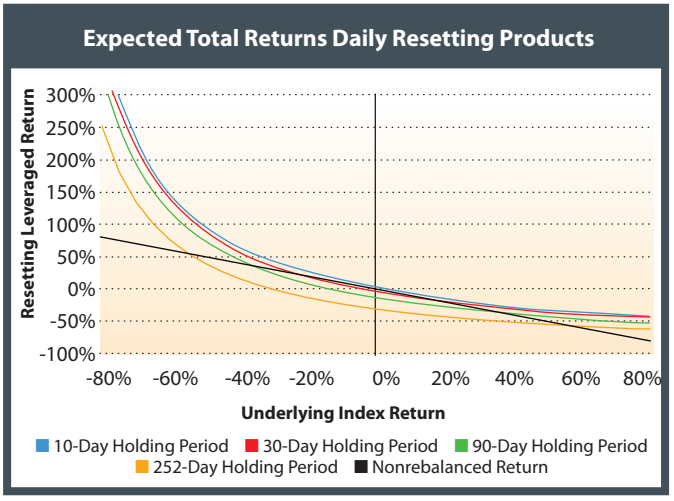
As mentioned earlier, the expected return analysis assumes a normal distribution of returns. This assumption clearly does not hold for VIX futures. The VIX-related ETPs are linked to the VIX futures indexes (not the VIX), and the returns on the indexes exhibit a number of non-normal characteristics: They have a negative mean, exhibit high positive skew and tend to trend. The trending behavior should theoretically improve the performance of the daily resetting products relative to nondaily resetting products. The non-normal distribution of the returns of the S&P 500 VIX Short-Term Futures Index is evident when compared with the returns of the VIX and SPX (see Figures 11 and 12).

Figure 9



Sources: VelocityShares, Bloomberg; December 2008–August 2011

Figure 10



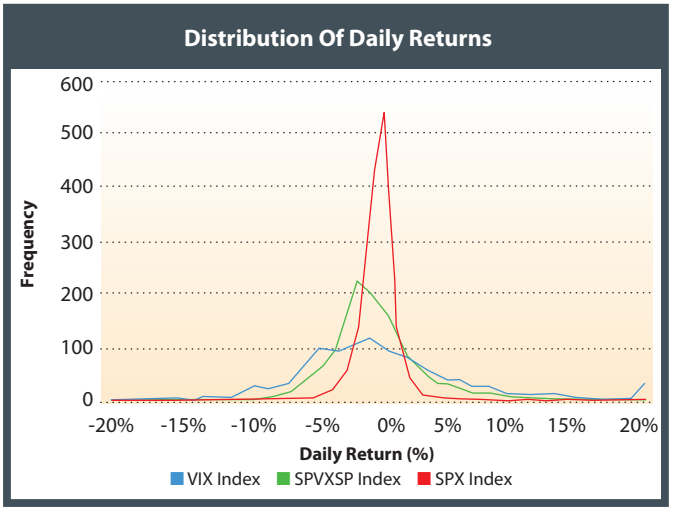
Sources: "The Dynamics of Leveraged and Inverse Exchange-Traded Funds" Cheng and Madhavan, 2009

Developing A Volatility Strategy

The dismal performance of the S&P 500 VIX Short-Term Futures Index since its inception relative to the VIX and the usual shape of the VIX futures curve (contango) make it look attractive to be "short" the short-term index. That said, and as Figure 13 shows, there is a significant risk to being short volatility. While a daily resetting position in the inverse of the short-term index has produced a total return of 249 percent from January 2009 through August 2011, there have been periods when the inverse of the index sustained large losses, i.e., October 2008 and August 2011, when the inverse position would have suffered significant losses. There are a number of strategies a manager can employ to mitigate the exposure to a spike in volatility, such as buying out-of-the-money calls or taking a long exposure to VIX-related instruments.

One technique that can be used to mitigate the risk

Figure 11



Sources: VelocityShares, Bloomberg; December 2005–August 2011

Figure 12

Daily Return Distribution Statistics

	VIX	SPX	SPVXSP
Minimum	-29.57%	-9.03%	-16.35%
Maximum	64.22%	11.58%	24.53%
Mid-Term	-0.58%	0.08%	-0.54%
Mean	0.34%	0.01%	-0.07%

Sources: VelocityShares, Bloomberg; December 2005–August 2011

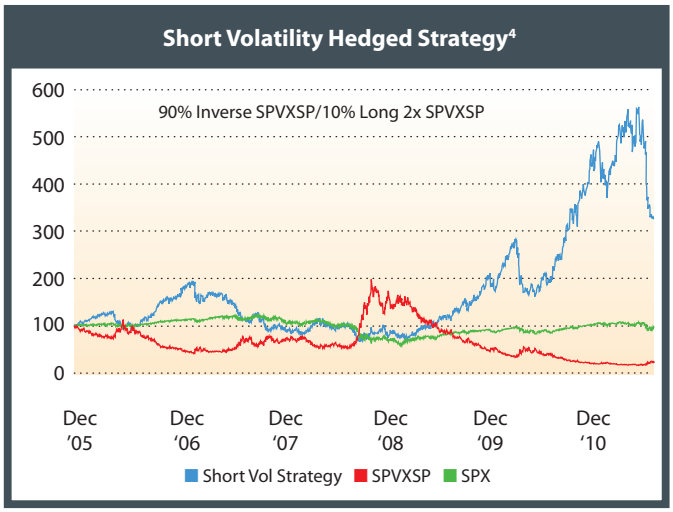
of spikes in VIX to a short volatility strategy is to add a long position in the short-term VIX futures index. At first blush, it may seem odd to combine a long position with an inverse position on the same index, but there are a number of reasons specific to daily resetting instruments and the VIX futures index that make this strategy interesting:

- Daily resetting exposure has positive convexity
- The VIX short-term futures index has a negative mean return
- Index returns are not normally distributed—positive skew

The positive convexity of daily resetting instruments and the non-normal distribution of the index result in performance characteristics that may not be readily apparent. Figure 13 presents a combination of an inverse position (90 percent) and a 2 times long position (10 percent) in the index. The positions are rebalanced to their target weights on a quarterly basis.[4] The performance of the combined positions results in a more balanced return profile than the 100 percent inverse position—the addition of the long volatility position provides a hedge against exposure to a spike in volatility.

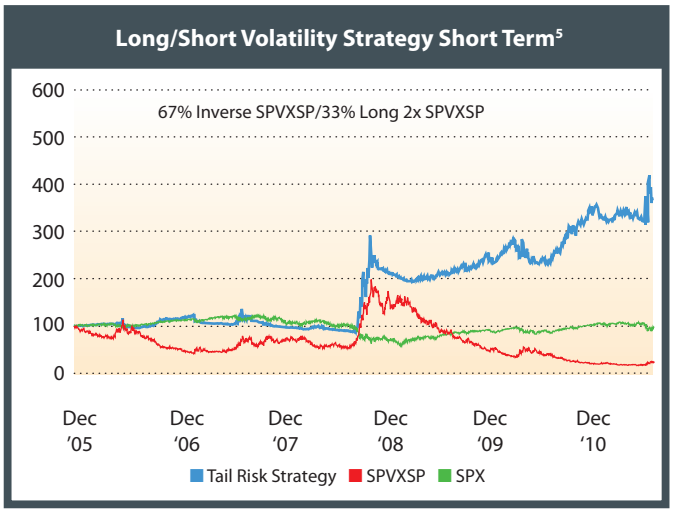
A simple example is useful to more clearly explain why the combination performs as it does it. A portfolio consisting of notionally equally weighted holdings of

Figure 13



Source: VelocityShares, Bloomberg, December 2005–August 2011

Figure 14



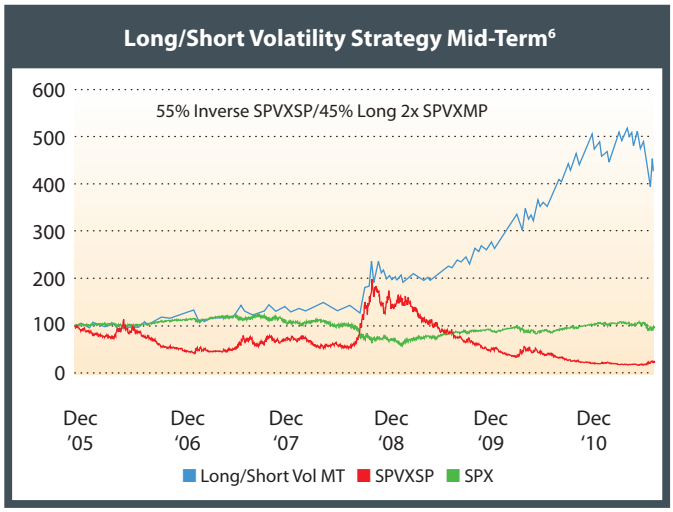
Source: VelocityShares, Bloomberg, December 2005–August 2011

a long position in the index and short position in the index would have a neutral position in the index on day 1—the value of the combined holding should be unchanged at the end of the day. On day 2, because of the resetting of the two positions, the strategy would no longer be neutral to the index. An increase in the index would result in the portfolio having a net long position to the index, and a decrease in the index would result in a net short position.

Rebalancing each of the underlying positions at the end of the day would result in a change in the weighting of the overall portfolio—since the exposure of each position resets, the net exposure responds in a nonlinear fashion, and the net exposure tends to be long as the index increases, and short as the index decreases. To be clear, it is the individual positions in the index that are reset every day, not weightings in the portfolio.

The concept behind the strategy is that the holding in the inverse position enables the investor to benefit from negative roll yield (from contango in the futures market) in most market conditions, while the long position enables the strategy to benefit from a spike in volatility. The cost of the position is the expected decay.

Figure 15



Source: VelocityShares, Bloomberg, December 2005–August 2011

A combination of a long and short position can result in an attractive return profile relative to the S&P 500 (see Figure 14). Determining the desired weighting of these positions and the frequency of rebalancing the portfolio to the target weightings needs to be determined by the manager. It is likely that managers will want to adjust the portfolio weightings over time because of portfolio drift, changes in the shape of the VIX futures curve or because of their view on volatility.

Managing The Strategy

The exposure to the long and short positions can vary significantly due to the performance of the VIX futures index, and therefore it is necessary to manage this strategy. The manager needs to determine how frequently to rebalance the positions to the target weights and what those target weights should be from time to time.

As mentioned earlier, the midterm futures index has a lower beta to VIX than the short-term index, and does not respond to the same degree as the short-term index to temporary spikes in volatility. By the same token, the contango (and therefore the negative roll yield) in the mid-term index is generally not as severe asfor the short-term index.

Given the differences in the characteristics of the indexes, another approach to the hedging strategies is to take a long position the midterm index and an inverse position in the short-term index (see Figure 15). Not surprisingly, substituting the midterm index for the short-term index results in a portfolio that is less responsive to spikes in VIX than those presented earlier, but that performs better when volatility is more restrained. For this reason, the manager will likely adjust target weights to reflect the differences in the expected performance of the short-term and midterm futures indexes.

The analysis assumes the portfolio weights are rebalanced quarterly. While only three portfolios are consid-

Figure 16

Simulated Monthly Returns[7]

Tail Risk Strategy[8]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2006	-2.7%	-1.0%	-0.8%	-0.8%	9.1%	-9.3%	-1.1%	-1.7%	-0.7%	3.8%	-0.1%	-0.8%	-6.9%
2007	-1.3%	-4.5%	-1.5%	-4.5%	-0.9%	2.7%	14.6%	12.3%	-10.2%	-2.9%	0.3%	-4.4%	-2.9%
2008	0.7%	0.0%	-2.1%	-4.4%	-0.8%	-2.4%	-3.8%	-3.1%	10.3%	156.6%	19.5%	-7.8%	165.1%
2009	-3.0%	-0.9%	-2.4%	-7.1%	-1.8%	-1.4%	-1.2%	-0.6%	-1.8%	-1.0%	-2.6%	0.1%	-21.5%
2010	0.0%	-2.6%	2.8%	-0.6%	5.9%	1.5%	-12.9%	-2.0%	2.2%	5.5%	1.2%	2.3%	2.1%
2011	1.0%	-1.6%	-4.5%	-0.6%	-0.4%	-5.0%	-0.4%	33.6%	41.2%				67.9%

Long/Short Vol Strategy Short-Term

2006	1.2%	1.6%	1.2%	0.4%	0.0%	-6.2%	-1.6%	3.2%	1.9%	11.1%	1.6%	0.3%	14.8%
2007	3.2%	-5.3%	-4.4%	-0.7%	-0.5%	-2.2%	3.3%	10.5%	-6.4%	-3.2%	-5.7%	-2.2%	-13.8%
2008	-1.7%	-0.9%	-2.5%	3.7%	1.7%	-5.5%	-2.1%	-0.8%	1.7%	104.1%	16.2%	-1.6%	117.9%
2009	-5.0%	-3.3%	-3.6%	-0.8%	2.7%	3.8%	1.2%	0.7%	3.6%	2.5%	-0.4%	6.5%	7.4%
2010	1.3%	1.9%	9.2%	2.0%	-9.2%	-1.1%	-2.9%	-1.1%	9.9%	11.5%	4.5%	6.4%	35.0%
2011	4.8%	-0.1%	-3.8%	6.5%	1.9%	-4.4%	-3.9%	12.4%	29.6%				46.4%

Short Vol Hedged Strategy

2006	8.9%	6.5%	4.9%	2.8%	-17.1%	0.5%	-2.9%	12.4%	6.6%	24.3%	4.5%	2.5%	61.4%
2007	11.7%	-10.3%	-8.1%	6.7%	1.4%	-10.5%	-12.8%	-11.8%	7.6%	-1.3%	-19.2%	3.4%	-39.1%
2008	-6.5%	-3.5%	-2.8%	17.2%	10.9%	-12.8%	-0.5%	4.0%	-22.4%	1.8%	5.9%	12.9%	-2.8%
2009	-9.5%	-5.8%	-7.0%	12.7%	15.1%	7.7%	6.5%	2.9%	13.1%	0.4%	12.6%	14.6%	77.8%
2010	3.2%	14.1%	18.6%	-2.6%	-26.6%	-7.7%	20.9%	0.7%	18.9%	25.2%	2.4%	23.7%	111.8%
2011	11.5%	2.5%	-2.3%	20.3%	6.1%	-3.1%	-10.4%	-31.2%	-4.4%				-18.6%

Long/Short Vol Strategy Mid-Term

2006	2.0%	1.4%	-2.6%	1.6%	-3.9%	-1.7%	-0.7%	8.6%	6.9%	6.9%	1.1%	3.4%	24.5%
2007	1.4%	-8.3%	-6.0%	4.1%	4.2%	0.2%	16.4%	-6.3%	-2.7%	5.9%	-0.1%	2.0%	8.8%
2008	-1.6%	1.9%	-1.0%	1.6%	8.9%	-6.5%	-3.4%	5.3%	-6.1%	27.6%	17.7%	5.4%	55.0%
2009	-4.6%	2.2%	-1.9%	1.2%	-2.3%	3.2%	4.5%	4.2%	5.7%	-1.6%	9.9%	2.8%	24.7%
2010	-0.3%	5.7%	10.0%	4.4%	3.8%	7.5%	-1.0%	7.4%	7.4%	5.7%	2.5%	8.4%	81.1%
2011	-0.2%	0.1%	-3.1%	9.3%	2.8%	-1.4%	-10.5%	-4.3%	8.0%				-0.8%

Source: VelocityShares

ered here, there are clearly a large number of combinations that could be employed in the development of different strategies. As shown in Figure 16, each strategy has different performance profiles, and it is up to the manager to determine which approach represents the best fit for the portfolio and market view.

Developing cost-effective strategies to hedge sell-offs in the equity markets is challenging. The negative correlation of the VIX to the S&P 500, the performance characteristics of the VIX futures indexes, and the convexity of daily resetting instruments enable sophisticated managers to design strategies to hedge significant equity market sell-offs and more efficiently execute their views on volatility.

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Disclosures

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Endnotes

1. http://www.cboe.com/micro/VIX/vixwhite.pdf
2. Monthly rebalance to target portfolio weights
3. "The Dynamics of Leveraged and Inverse Exchange-Traded Funds," Cheng and Madhavan, 2009
4. Short volatility-hedged strategy represents the returns of a portfolio containing 90 percent -1x SPVXSP and 10 percent 2x SPVXSP for the period December 2005-Agust 2011.The portfolio is rebalanced on a quarterly basis with an equal percentage of the portfolio being rebalanced on each trading day of the quarter.
5. Tail risk strategy represents the returns of a portfolio containing 67 percent -1x SPVXSP and 33 percent 2x SPVXSP for the period December 2005-Agust 2011.The portfolio is rebalanced on a quarterly basis with an equal percentage of the portfolio being rebalanced on each trading day of the quarter.
6. Long-short volatility mid-term represents the returns of a portfolio containing 55 percent -1x SPVXSP and 45 percent 2x SPVXMP for the period December 2005-Agust 2011. The portfolio is rebalanced on a quarterly basis with an equal percentage of the portfolio being rebalanced on each trading day of the quarter.
7. lllustrates the theoretical returns of a portfolio with a long exposure to an inverse index and a long exposure to a leveraged index for the period December 2005-Agust 2011. The percentage exposure to each index depends on the strategy. The portfolio is rebalanced on a quarterly basis with an equal percentage of the portfolio being rebalanced on each trading day of the quarter.
8 Long/short volatility strategy short-term represents the returns of a portfolio containing 55 percent -1x SPVXSP and 45 percent 2x SPVXSP for the period December 2005-August 2011. The portfolio is rebalanced on a quarterly basis with an equal percentage of the portfolio being rebalanced on each trading day of the quarter.