

Dynamically Hedging Equity Market Tail Risk Using VEQTOR

MAY 2014

CONTRIBUTOR

Berlinda Liu

Director, Index Research and Design

berlinda.liu@spdj.com

Introduction

After the strong economic rally of 2013, volatility seemed to become less of a concern, and some investors have put risk management on the back burner. However, financial history has taught us that volatility can spike suddenly, usually accompanied by rising correlation across asset classes and the breakdown of traditional diversification techniques. A tail risk event can be a powerful enemy to long-term portfolio performance. It could create a massive drawdown, the so-called “volatility drag,” from which it may take years, if not decades, to recover.

With a high negative correlation to the equity market, VIX[®] has earned the nickname of “investor fear gauge.” In the distressed markets of 2008 and 2011, VIX derivatives including futures, options, exchange-traded products (ETPs) and OTC products, demonstrated robust hedging properties for the equity market and other asset classes. However, this tail-hedging benefit is usually accompanied by expensive holding costs. Based on our studies, it appears that adjusting an allocation to VIX derivatives can help in building a cost-efficient tail-hedging framework.

In this article, we investigate the S&P 500[®] Dynamic VEQTOR Index, which simulates the return of a portfolio that dynamically adjusts its allocation among equity, volatility and cash. According to our review, the index has not posted a negative annual return since 2006, and has demonstrated strong risk statistics in terms of volatility, maximum drawdown and recovery time. We also compare VEQTOR with some other popular volatility-managed equity strategies.

VIX Hedging Properties and Concerns

VIX is the ticker of the CBOE Volatility Index, a popular measure of the implied volatility of S&P 500 options. It represents the market’s expectation of stock market volatility over the next 30 days. Volatility research shows that VIX hits its highest levels during periods of market turbulence, which is why VIX is often referred to as the investor fear gauge.

It is not possible to trade spot VIX, but investors can take a position on the VIX using VIX derivatives. In March 2004 and February 2006, respectively, the CBOE introduced futures and options based on the VIX. In January 2009, S&P Dow Jones Indices launched the S&P 500 VIX Futures Index Series. A variety of popular ETPs linked to these indices offer broad market access to volatility trading, and have been seen as potential diversification tools in a broad equity portfolio, especially in bear markets.

The S&P 500 VIX Short-Term Futures Index measures the return from a rolling long position in the first- and second-month VIX futures contracts. It maintains a constant one-month maturity by rolling continuously throughout each month from the first-month VIX futures into the second-month VIX futures contract. Linked to this index are some of the most popular trading vehicles based on VIX.

Similar to other spot and futures markets, the VIX futures and spot indices are closely related but have important differences. Since Dec. 20, 2005, the S&P 500 VIX Short-Term Futures Index has been highly correlated with the VIX (88.31%). However, it does not track the VIX perfectly due to the distinct characteristics of the futures market (see Exhibit 2).

Historical data shows that both VIX spot and futures tend to have a negative correlation with the equity market that is generally strengthened during market crisis, when traditional geographical hedging and cross-asset-class hedging breaks down. Since Dec. 20, 2005, the S&P VIX Short-Term Futures Index has a correlation of -76.35% with the S&P 500.

In particular, when the equity market drops significantly, VIX tends to move up in both the spot and futures markets. In 2008, the S&P VIX Short-Term Futures Index showed a strong negative correlation of -84.17% with the S&P 500, which is higher than its overall long-term correlation. Commodities and fixed income demonstrated weak correlations to the equity market over the same period (see Exhibit 1).

Exhibit 1: Percentage Correlation Between Selected Asset Classes in 2008							
Index	S&P 500	CBOE VIX	S&P 500 VIX Short-Term Futures Index	S&P GSCI®	DJ-UBS Commodity Index	Barclays U.S. Aggregate Bond Index	Euro Stoxx 50®
S&P 500	100	-84.69	-84.17	31.02	26.29	-25.06	57.48
CBOE VIX	-	100	87.93	-25.58	-23.15	25.38	-54.58
S&P 500 VIX Short-Term Futures Index	-	-	100	-22.09	-17.92	19.49	-51.08
S&P GSCI	-	-	-	100	93.91	-13.92	46.84
DJ-UBS Commodity Index	-	-	-	-	100	-12.04	47.97
Barclays U.S. Aggregate Bond Index	-	-	-	-	-	100	-14.38
Euro Stoxx 50	-	-	-	-	-	-	100

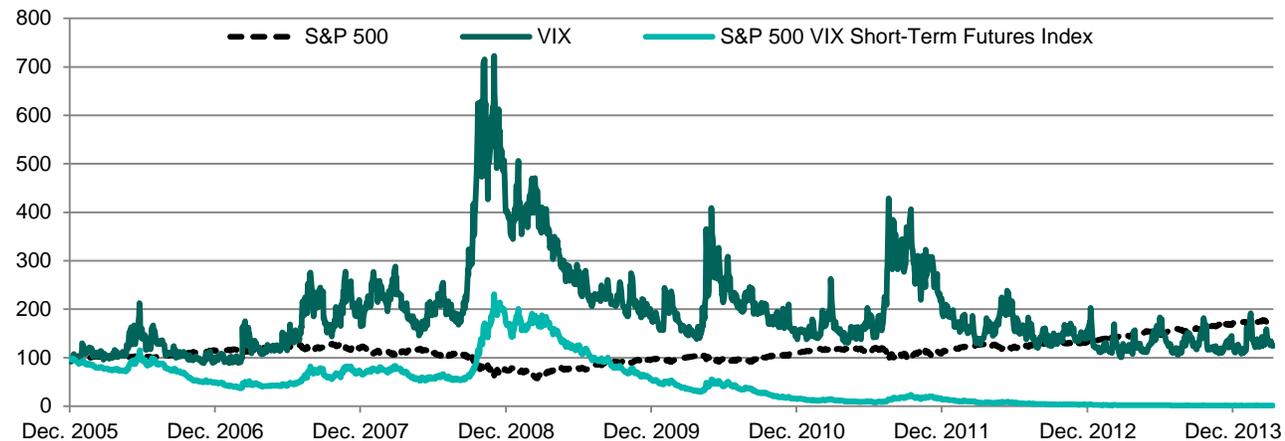
Source: S&P Dow Jones Indices, Bloomberg. Based on data from Jan. 1, 2008, to Dec. 31, 2008. Correlations are calculated on daily returns. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Furthermore, the negative correlation between VIX spot and futures and the equity market is convex. This means that when the S&P 500 drops, VIX spot and futures tend to rise even further; when the S&P 500 rises, VIX spot and futures typically drops less, with the spot index displaying a mean reversion of around 14-17.

Needless to say, this desirable convex negative correlation does not come for free. All futures have fixed expiration dates; hence, the S&P 500 VIX Short-Term Futures Index has to roll from the first-month futures contract to the second-month futures contract prior to the expiration of the first-month contract. This continuous roll process contributes to the daily performance of the futures index. When the futures market is sloping upward (in contango), longer-term futures are more expensive than shorter-term futures, and a roll cost is incurred. Conversely, when the market is in backwardation, longer-term futures are cheaper than shorter-term futures, and the roll would generate profits.

Between December 2005 and March 2014, the VIX futures market was in contango and generated a negative roll yield in 82 of 99 months (82.83%). Despite its small magnitude when compared with the spot yield on a monthly basis, the accumulated roll yield has created a significant performance drag for the S&P 500 VIX Short-Term Futures Index, as shown in Exhibit 5. Unlike the VIX spot, which exhibits a mean-reverting return pattern, the S&P 500 Short-Term Futures Index tends to trend down in the long term.

Exhibit 2: Cumulative Historical Return



Source: S&P Dow Jones Indices, Bloomberg. Based on data from Dec. 20, 2005, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Volatility Equity Allocator

VEQTOR (as referenced in the S&P 500 Dynamic VEQTOR Index) stands for Volatility Equity Allocator, and is designed to provide a cost-efficient tail-risk hedge with VIX futures in an equity portfolio. It simulates a hypothetical long-only portfolio that allocates dynamically to equity (represented by S&P 500), volatility (represented by the S&P 500 VIX Short-Term Futures Index), and cash by monitoring two volatility signals. Exhibit 3 shows how the equity and volatility allocations are determined by the two volatility signals. For example, if realized volatility (measured by the 22-day standard deviation of the S&P 500) is between 10% and 20% and if there is no clear trend in implied volatility (as measured by the 5- and 20-day moving averages for the VIX spot index), VEQTOR would allocate 90% to equity and 10% to volatility.

Exhibit 3: VEQTOR Allocation Matrix			
Realized Volatility	Target Volatility Allocation (Equity %/Volatility %)		
	Implied Volatility Downtrend	No Implied Volatility Trend	Implied Volatility Uptrend
Less Than 10%	97.5 / 2.5	97.5 / 2.5	90.0 / 10.0
10% ≤ RV _{t-1} < 20%	97.5 / 2.5	90.0 / 10.0	85.0 / 15.0
20% ≤ RV _{t-1} < 35%	90.0 / 10.0	85.0 / 15.0	75.0 / 25.0
35% ≤ RV _{t-1} ≤ 45%	85.0 / 15.0	75.0 / 25.0	60.0 / 40.0
More Than 45%	75.0 / 25.0	60.0 / 40.0	60.0 / 40.0

Source: S&P Dow Jones Indices. Charts are provided for illustrative purposes.

Monthly Realized Volatility

VEQTOR monitors the monthly realized volatility of the equity market, defined as the daily standard deviation of log returns of the S&P 500 over the past 22 trading days. With an assumed mean of zero, zero degrees of freedom and a constant 252-day annualization factor, realized volatility is computed as:

$$RV_{t-1} = \sqrt{\frac{252 * \sum_{n=1}^{22} \left(\ln \left(\frac{SPX_{t-n}}{SPX_{t-n-1}} \right) \right)^2}{22}}$$

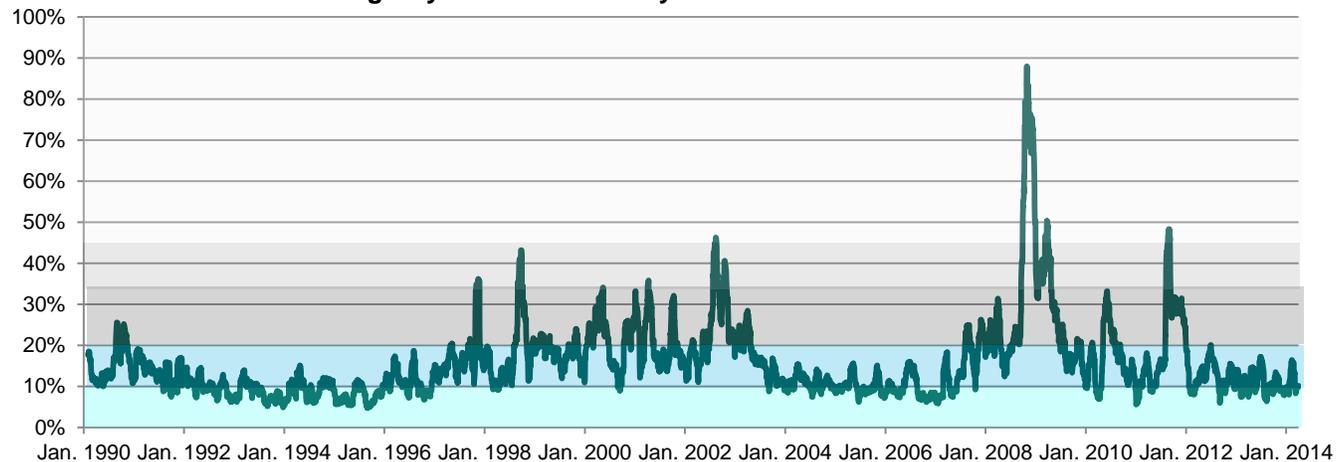
where:

SPX_t refer to the S&P 500 price return index on day t.

Realized volatility is an important indicator of current market stability. High realized volatility is usually associated with significant market swings and may signal a potential market downturn. Therefore, VEQTOR tilts its allocation toward volatility in a market with high realized volatility. The distribution of the S&P 500 monthly realized volatility is of particular importance in the right tail, since VEQTOR is designed as a tail risk hedging tool.

Long-term history of the S&P 500 (Exhibits 4 and 5) shows that for the majority (80%) of the time, annualized monthly realized volatility in the equity market is 20% or lower. VEQTOR deems a market with a realized volatility of 10% or less as the “low volatility region,” and one with a realized volatility between 10% and 20% as the “normal market.” In these regions (the first two rows in Exhibit 3), VEQTOR allocates only 2.5%-15% to volatility. The majority of the index is invested in the S&P 500 in an effort to participate in potential market growth. As the realized volatility rises above 20%, VEQTOR gradually shifts its allocation to volatility. When the realized volatility has advanced into the 35% (approximately 95th percentile) or 45% (approximately 98th percentile) region, VEQTOR prepares for a potential downturn and quickly increases allocation to volatility. Although these high-volatility regions account for less than 5% of the history of the S&P 500, they are usually associated with the riskiest liquidity events that may cause the most sizable losses in a long-only equity portfolio.

Exhibit 4: S&P 500 22-Trading-Day Realized Volatility



Note: Shading corresponds to Realized Volatility categories from Exhibit 3.

Source: S&P Dow Jones Indices, Bloomberg. Based on data from Jan. 1, 1990, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 5: Distribution of the S&P 500 22-Trading-Day Realized Volatility

Percentile	S&P 500 Realized Volatility (%)
20 th	9
80 th	20
95 th	32
98 th	43

Source: S&P Dow Jones Indices, Bloomberg. Based on data from Jan. 1, 1990, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Implied Volatility Trend

While realized volatility tells us what *has* happened in the market, implied volatility indicates investor expectation of what *could* happen in the future. In particular, the VIX spot measures the collective market expectation of potential market movement in the next 30 days. VIX typically increases when markets are turbulent or the economy is faltering. However, if stock prices are rising and no dramatic changes seem probable, VIX tends to fall or remain at the lower end of its scale. The trend of the VIX spot, rather than its level, is generally considered a better indicator of the change of the wind and the shift of investor anxiety level.

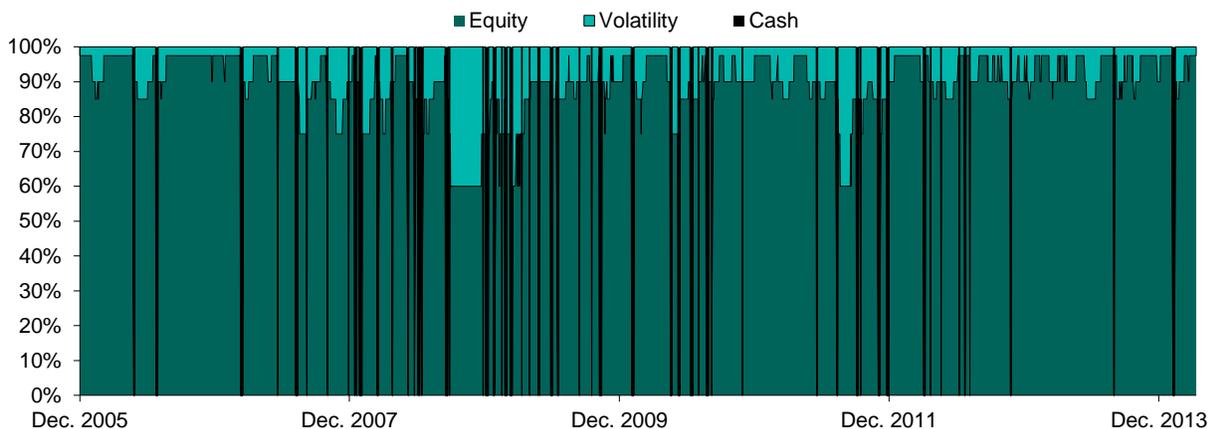
At the end of every trading day, VEQTOR compares the average VIX value over the past five trading days with the average over the past 20 trading days. If the five-day average has been consistently higher than the 20-day average over the past 10 trading days, VEQTOR sees it as a clear uptrend in implied volatility; conversely, if the five-day average has been consistently lower than the 20-day average over the past 10 trading days, VEQTOR sees it as a clear downtrend in implied volatility. If neither of these situations occur, VEQTOR deems that there is no clear trend in implied volatility. At a given level of monthly realized volatility, VEQTOR tends to allocate more to volatility when implied volatility trends up and more to equity when implied volatility trends down. As a result of the mean reverting property of VIX, we usually see no clear trend in implied volatility, and numbers in the middle column of the allocation matrix tend to be the actual allocation.

Stop-Loss Feature

While VEQTOR allocates to equity and volatility for most periods, it may go to a full cash position if the stop-loss feature is triggered. This is to prevent a prolonged losing streak that may dampen long-term performance. At the end of every trading day, VEQTOR evaluates its own excess return over the previous five trading days. If the five-day performance is less than or equal to -2%, the index will move 100% of its notional value to cash. Once the five-day performance rises above a -2% excess return or “watermark,” the index will allocate back to equity and volatility components using the aforementioned allocation matrix.

Exhibit 6 shows the actual allocation of the VEQTOR index since its inception date. The 90%/10% equity/volatility mix is the most common historical allocation. This is because most of the time, monthly realized volatility was between 10% and 20%, and there was no clear trend in implied volatility. The average allocation to equity, however, is slightly lower at 83%. VEQTOR allocated 40% to equity when the market experienced significant turbulence in September-December 2008 and August 2011. In the exhibit, black lines represent days when the stop-loss feature triggered and VEQTOR moved to the all-cash allocation. This tended to happen more often in stressed markets than in optimistic ones. Historically, the average duration of the all-cash allocation period is 2.4 days. An all-cash allocation can never last longer than five days, as the cash position will stop the losing streak and bring the five-day excess return above the -2% threshold.

Exhibit 6: VEQTOR Historical Allocation



Source: S&P Dow Jones Indices, Bloomberg. Based on data from Dec. 20, 2005, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Performance of the S&P 500 Dynamic VEQTOR Index

By allocating between two assets with a strong negative correlation, the S&P 500 Dynamic VEQTOR Index has generally proven to be less volatile than the S&P 500. It has typically beat the equity market in terms of risk-adjusted return, maximum drawdown and recovery time. It has posted a positive return every year since its inception.

Exhibit 7 shows the year-by-year performance of the S&P 500 and its VEQTOR counterpart.

Exhibit 7: S&P 500 Dynamic VEQTOR Index Year-by-Year Performance		
Year	S&P 500	S&P 500 Dynamic VEQTOR Index
Annual Total Return (%)		
2006	15.79	14.15
2007	5.49	17.20
2008	-37.00	21.29
2009	26.46	23.39
2010	15.06	1.65
2011	2.11	17.41
2012	16.00	3.54
2013	32.39	14.31
Q1 2014	1.81	1.20
Annualized Volatility (%)		
2006	10.03	7.50
2007	16.03	9.55
2008	41.01	16.16
2009	27.25	14.32
2010	18.07	10.28
2011	23.37	10.78
2012	12.74	8.15
2013	11.07	7.68
Q1 2014	12.03	8.10
Maximum Drawdown (%)	-55.25	-17.90

Source: S&P Dow Jones Indices, Bloomberg. Based on data from Dec. 20, 2005, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Positive Return

Since its inception date, the S&P 500 Dynamic VEQTOR Index has tended to post a positive return in all calendar years. Even when the S&P 500 returned -37.00% in 2008, the S&P 500 Dynamic VEQTOR Index returned 21.29%.

Lower Volatility

The S&P 500 Dynamic VEQTOR Index has also tended to consistently show a lower volatility than S&P 500. In the stressed markets of 2008 and 2011, VEQTOR tended to have less than one-half the volatility of the equity market.

Lower Maximum Drawdown and Faster Recovery

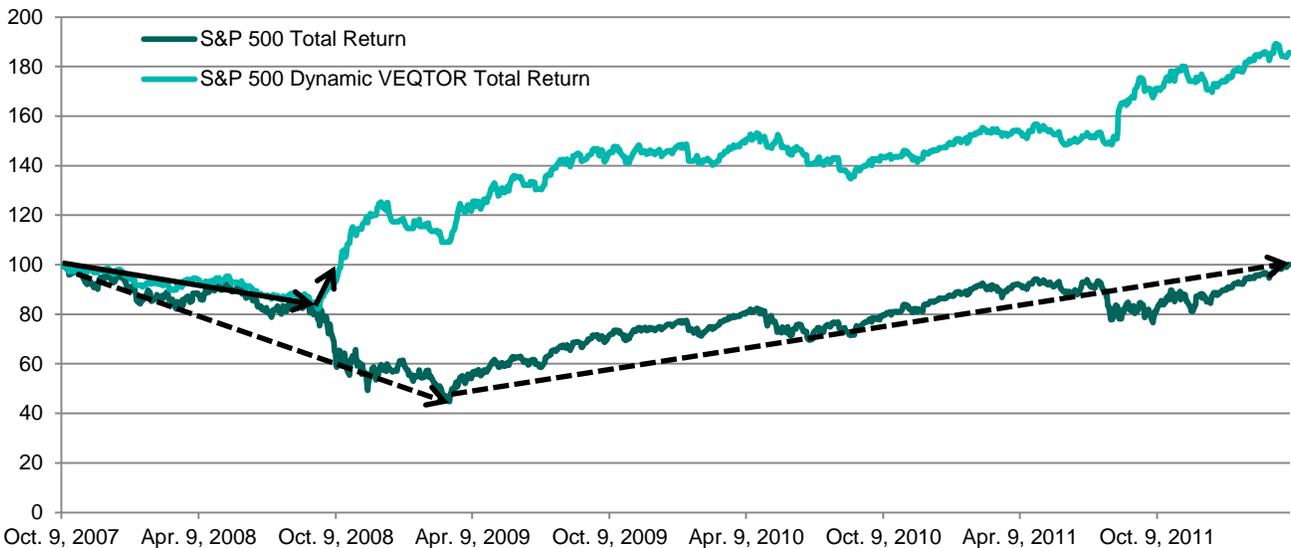
In the period since Dec. 20, 2005, the S&P 500 hit its peak value of 2,447.03 on Oct. 9, 2007, and began its long losing streak, losing more than one-half of its peak value on March 9, 2009. It did not recover until 1,120 calendar days later. The S&P 500 Dynamic VEQTOR Index also hit its peak value of 137,005.24 on Oct. 9, 2007, but hit bottom on Sept. 15, 2008, about six months earlier than the broad equity market. It restored to its previous peak value only 31 days later. On Oct. 16, 2008, the S&P 500 Dynamic VEQTOR Index closed at 140,308.26.

Exhibit 8: Maximum Drawdown and Recovery Analysis

	S&P 500	S&P 500 Dynamic VEQTOR Index
Previous Peak		
Index Value	2,447.03	137,005.24
Date	Oct. 9, 2007	Oct. 9, 2007
Maximum Drawdown		
Index Value	1,095.04	112,477.80
Date	March 9, 2009	Sept. 15, 2008
Recovery		
Index Value	2,449.08	140,308.26
Date	April 2, 2012	Oct. 16, 2008
Number of Calendar Days to Recover		
Total	1,120	31

Source: S&P Dow Jones Indices, Bloomberg. Indices are normalized to 100 as of Oct. 9, 2007. Based on data from Oct. 9, 2007, to April 4, 2012. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 9: Maximum Drawdown and Recovery Analysis



Source: S&P Dow Jones Indices, Bloomberg. Indices are normalized to 100 as of October 9, 2007. Based on data from Oct. 9, 2007, to April 4, 2012. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Behavior in Different Stages of the Business Cycle

As with other investment products, VEQTOR is not an all-season winner. Its performance is contingent on market conditions.

Exhibit 10 illustrates the S&P 500 Dynamic VEQTOR Index’s performance in the choppy market from December 2009 to September 2011. In the first seven months, uncertainty still hovered over the market after the credit crisis, and the S&P 500 lost 4.85% by mid-year 2010. In this period, the S&P 500 Dynamic VEQTOR Index helped to reduce its loss by almost 40%. The market then went on a strong bullish streak for a one-year period and returned 28.03%, while the S&P 500 Dynamic VEQTOR Index lagged significantly. This period was marked with high returns and relatively high realized volatility, which is the environment where the S&P 500 Dynamic VEQTOR Index generally shows the biggest performance drag, by design, as it tends to overhedge. However, equity markets experienced a significant drop in early August of 2011 when the U.S. Treasury was downgraded and lost

12.08% within two months. The S&P 500 Dynamic VEQTOR Index responded to the resulting stress quickly, and gained 13.34% in the same period.

In summary, the S&P 500 Dynamic VEQTOR Index is a tail risk hedging tool. It tends to work best relative to the market when liquidity events occur. It generally underperforms in a strong bull market, especially when the equity market rises with high realized volatility.

Exhibit 10: Historical Performance in Different Stages of Business Cycles

Stage of Business Cycle	Period	S&P 500 Return (%)	S&P 500 Dynamic VEQTOR Index Return (%)
Uncertainty After Credit Risk	Dec. 1, 2009 to June 30, 2010	-4.85	-3.09
Bull Market	July 1, 2010 to July 31, 2011	28.03	6.50
Euro Crisis, U.S. Treasury Downgrade	Aug. 1, 2011 to Sept. 30, 2011	-12.08	13.34

Source: S&P Dow Jones Indices, Bloomberg. Based on data from Dec. 1, 2009, to Sept. 30, 2011. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The S&P 500 Dynamic VEQTOR Index vs. Other Volatility Reduction Strategies

Since the 2008 financial crisis, managed volatility equity strategies have gained popularity and greater acceptance among investors. The common feature among the various types of risk management strategies is that they are designed to provide a degree of upside participation in the market while also limiting downside exposure. However, different volatility reduction indices have different risk/return profiles, and VEQTOR is no exception.

Low/Minimum Volatility Investment Strategies

The past five years have seen a proliferation of low volatility or minimum volatility strategies. Often called alternate beta, these strategies aim to increase risk-adjusted return, either by constructing a portfolio of stocks that exhibit low volatility or low beta, or based on mean variance. Regardless of how the portfolio is constructed, these strategies deliver lower total portfolio volatility than a market-cap-weighted benchmark. One example is the S&P 500 Low Volatility Index, which consists of the 100 least volatile stocks in the S&P 500, with each stock weighted relative to the inverse of its realized volatility.

Risk-Controlled or Target Volatility Strategies

Risk-controlled or target volatility strategies set an explicit risk level for the portfolio. Most risk-controlled strategies dynamically allocate between a risky asset and a relatively risk-free asset. During periods of relatively low volatility, allocation to the risky asset increases, sometimes over 100% if leverage is used. Conversely, when volatility rises, the strategy reduces the allocation to the risky asset and increases allocation to the relatively risk-free asset. One example is the S&P 500 Daily Risk Control Index Series, which dynamically allocates between the S&P 500 and cash according to current measures of realized volatility in the equity market. The index increases its allocation to cash when the risk level is too high, and uses leverage when the risk level is too low. The daily risk control subindices do not use leverage and cap equity allocation at 100%. The target risk levels available for this index series are 5%, 10%, 12% and 15%. Exposure to the underlying index and cash is adjusted on a daily or monthly basis, depending on the subindex.

VIX Options Overlay Strategies

Besides its futures market, VIX also has a very active options market. For example, Investors may long VIX calls in an effort to avoid the impact of a potential market downturn. Since VIX options have to roll from month to month, this strategy is also subject to the roll cost issue associated with using VIX futures as a hedging tool. Instead of paying the roll cost on a daily basis, as the S&P 500 VIX Short-Term Futures Index does, VIX options buyers pay the roll cost up front in the form of an option premium. Also, as options have no downside risk and only upside potential, options buyers have to pay for their right, not obligation, to execute the contract as they desire, and this cost is also included in the option premium. In other words, VIX options are nearly always more expensive than VIX futures as a hedging tool, and investors have to be even more cost-conscious if they choose

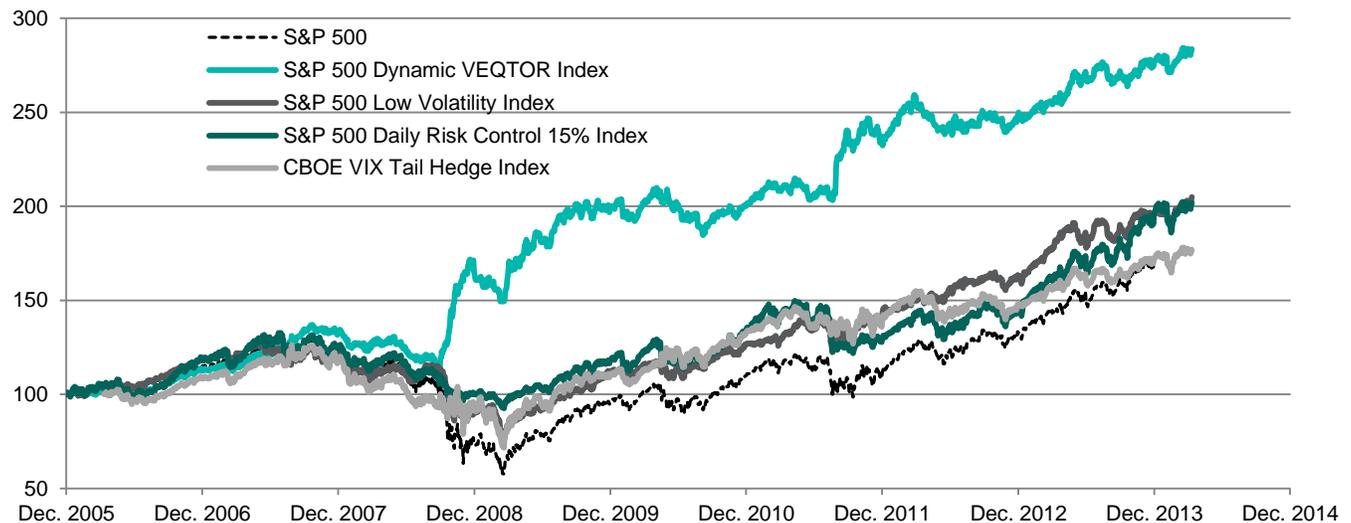
to hedge with VIX options. One example of a strategy based on VIX options is the CBOE VIX Tail Hedge IndexSM, which allocates between the S&P 500 and a 30-delta VIX call option that is rolled monthly. When the VIX forward level is between 15% and 50%, the index allocates up to 1% to VIX calls. Otherwise, all allocation is in the S&P 500, even in a turbulent market when the VIX forward level is above 50%.

Exhibits 11 and 12 show the performance of the aforementioned strategies as compared to VEQTOR. When compared with the other three volatility-controlled indices, the S&P 500 Dynamic VEQTOR Index has generally shown:

- Better risk statistics in terms of volatility, maximum drawdown and recovery time.
- Lower correlation to the S&P 500, especially in stressed markets such as in 2008.
- Outperformance in black swan events.
- Underperformance in strong bull markets.

Overall, VEQTOR is the only index that has posted positive returns in all calendar years since its inception date (based on backtested calculations). Although it may have a significant performance drag when the market has a sustainable rally or swings sideways, it is the only index that successfully hedged the tail risk during the extreme market conditions in 2008 and the second half of 2011.

Exhibit 11: Historical Cumulative Return



Note: The inception date of the CBOE VIX Tail Hedge Index is March 31, 2006; data in this chart for this index starts on that date.

Source: S&P Dow Jones Indices, Bloomberg. Indices are normalized to 100 as of Dec. 20, 2005. Based on data from Dec. 20, 2005, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 12: Year-by-Year Performance Statistics					
Year	S&P 500 Dynamic VEQTOR Index	S&P 500 Low Volatility Index	S&P 500 Daily Risk Control 15% Index	CBOE VIX Tail Hedge Index	
Annual Total Return (%)					
2006*	14.15	19.69	20.26	8.91	
2007	17.20	0.58	5.02	8.31	
2008	21.29	-21.41	-18.98	-19.34	
2009	23.39	19.22	17.20	16.02	
2010	1.65	13.36	14.50	21.10	
2011	17.41	14.78	-3.43	5.92	
2012	3.54	10.30	10.52	3.61	
2013	14.31	23.59	39.31	19.43	
Q1 2014	1.20	3.28	0.22	0.83	
Annualized Volatility (%)					
2006	7.50	7.77	13.61	9.88	
2007	9.55	14.29	15.82	14.94	
2008	16.16	29.96	16.47	34.07	
2009	14.32	17.13	12.04	25.58	
2010	10.28	12.75	14.59	16.26	
2011	10.78	16.50	17.06	17.53	
2012	8.15	8.40	13.50	10.78	
2013	7.68	10.20	14.55	9.29	
Q1 2014	8.10	10.12	15.68	11.81	
Correlation with the S&P 500 Using Daily Returns (%)	62.97	93.32	84.55	88.00	
Maximum Drawdown (%)	-17.90	-40.40	-30.15	-43.30	
Number of Calendar Days to Recover	31	665	641	582	
Tickers	SPVQDTR	SP5LVIT	SPXT15UT	VXTH	

*2006 statistics for the CBOE VIX Tail Hedge Index are calculated based on data from March 31, 2006, to Dec. 31, 2006.

Source: S&P Dow Jones Indices, Bloomberg. Indices are normalized to 100 as of Dec. 20, 2005. Based on data from Dec. 20, 2005, to March 31, 2014. Charts are provided for illustrative purposes. Past performance is no guarantee of future results. This chart may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

VEQTOR Within a Portfolio Context

Although VEQTOR has underperformed in market rallies, its low correlation with the equity market has led to its use as an alternative investment allocation. As its correlation is typically even lower in a bear market, a portfolio containing VEQTOR may help in providing a reduction in overall portfolio volatility.

Some investors include VEQTOR in their fixed income allocation as a high-yield replacement, owing to its generally high negative correlation to equities and consistent positive returns. This is especially interesting in a low interest rate environment, when exposure to the equity upside with a fixed-income-like downside may provide an important noncorrelated source of return.

Conclusions

When a tail risk event occurs in the equity market, volatility usually spikes suddenly and is often accompanied by a spike in correlation. Often, traditional diversification techniques may break down. This phenomenon was seen in the 2008 financial crisis and 2011 U.S. Treasury downgrade. These events can create massive drawdowns and significant lags in long-term performance.

VIX derivatives may be able to hedge against tail risk due to their generally robust negative correlation to the equity markets, which could rise in a sustained bear market driven by investor sentiment. However, this tail risk hedging benefit comes with expensive holding costs. It appears that dynamically adjusting an allocation to VIX derivatives could help build a cost-efficient tail risk hedging framework.

Volatility-managed equity strategies have gained popularity over the past five years. Compared to low/minimum volatility and risk-controlled strategies, VIX derivative-based overlay strategies such as the S&P 500 Dynamic VEQTOR Index have generally been more effective at lowering the potential damage of a tail risk event at a reduced holding cost. This index increases its allocation to VIX futures in a bear market and tilts towards equity in a bull market. It also has a stop-loss feature designed to try to prevent a prolonged losing streak.

Historical performance shows that the VEQTOR strategy has consistently delivered positive returns at reduced volatility since its inception date. In a stressed market, it has typically shown much lower maximum drawdown and much shorter recovery time than long-only portfolios. Although VEQTOR has underperformed in market rallies, it has generally been an efficient hedging tool for equity market tail risk.

References

Liu, Berlinda, "[Identifying the Differences Between VIX Spot and Futures](#)," S&P Dow Jones Indices

Liu, Berlinda, "[Limiting Risk Without Limiting Equity Exposure](#)," S&P Dow Jones Indices

[S&P 500 Low Volatility Index](#), S&P Dow Jones Indices

[CBOE VIX Tail Hedge Index](#), CBOE

ABOUT S&P DOW JONES INDICES

S&P Dow Jones Indices LLC, a part of McGraw Hill Financial, Inc., is the world's largest, global resource for index-based concepts, data and research. Home to iconic financial market indicators, such as the S&P 500® and the Dow Jones Industrial Average™, S&P Dow Jones Indices LLC has over 115 years of experience constructing innovative and transparent solutions that fulfill the needs of institutional and retail investors. More assets are invested in products based upon our indices than any other provider in the world. With over 830,000 indices covering a wide range of assets classes across the globe, S&P Dow Jones Indices LLC defines the way investors measure and trade the markets. To learn more about our company, please visit www.spdji.com.

Like What You Read? Sign up to receive complimentary updates on a broad range of index-related topics and events brought to you by S&P Dow Jones Indices.



PERFORMANCE DISCLOSURES

The S&P 500 Short-Term VIX Futures Index (the “Index”) was launched on Jan. 22, 2009. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect when the index was officially launched. Complete index methodology details are available at www.spdji.com. It is not possible to invest directly in an index.

The S&P 500 Dynamic VEQTOR Index (the “Index”) was launched on Nov. 18, 2009. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect when the index was officially launched. Complete index methodology details are available at www.spdji.com. It is not possible to invest directly in an index.

The S&P 500 Low Volatility Index (the “Index”) was launched on April 4, 2011. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect when the index was officially launched. Complete index methodology details are available at www.spdji.com. It is not possible to invest directly in an index.

The S&P 500 Dynamic Rebalancing Risk Control 15% Index (the “Index”) was launched on Jan. 3, 2012. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect when the index was officially launched. Complete index methodology details are available at www.spdji.com. It is not possible to invest directly in an index.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency on their products. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index’s Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company’s public website or its datafeed to external parties. For Dow Jones-branded indicators introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed “Date of introduction”) is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index’s public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

The Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices LLC maintains the Index and calculates the Index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US \$100,000 investment for a 12-month period (or US \$10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US \$1,650), the net return would be 8.35% (or US \$8,350) for the year. Over a three year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US \$5,375, and a cumulative net return of 27.2% (or US \$27,200).

DISCLAIMER

© S&P Dow Jones Indices LLC, a part of McGraw Hill Financial 2014. All rights reserved. Standard & Poor's and S&P are registered trademarks of Standard & Poor's Financial Services LLC ("S&P"), a part of McGraw Hill Financial. Dow Jones is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones"). Trademarks have been licensed to S&P Dow Jones Indices LLC. Redistribution, reproduction and/or photocopying in whole or in part are prohibited without written permission. This document does not constitute an offer of services in jurisdictions where S&P Dow Jones Indices LLC, Dow Jones, S&P or their respective affiliates (collectively "S&P Dow Jones Indices") do not have the necessary licenses. All information provided by S&P Dow Jones Indices is impersonal and not tailored to the needs of any person, entity or group of persons. S&P Dow Jones Indices receives compensation in connection with licensing its indices to third parties. Past performance of an index is not a guarantee of future results.

It is not possible to invest directly in an index. Exposure to an asset class represented by an index is available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other vehicle. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice. Closing prices for S&P US benchmark indices and Dow Jones US benchmark indices are calculated by S&P Dow Jones Indices based on the closing price of the individual constituents of the index as set by their primary exchange. Closing prices are received by S&P Dow Jones Indices from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof (Content) may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

Credit-related and other analyses, including ratings, research and valuations are generally provided by affiliates of S&P Dow Jones Indices, including but not limited to Standard & Poor's Financial Services LLC and Capital IQ, Inc. Such analyses and statements in the Content are statements of opinion as of the date they are expressed and not statements of fact. Any opinion, analyses and rating acknowledgement decisions are not recommendations to purchase, hold, or sell any securities or to make any investment decisions, and do not address the suitability of any security. S&P Dow Jones Indices does not assume any obligation to update the Content following publication in any form or format. The Content should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. S&P Dow Jones Indices LLC does not act as a fiduciary or an investment advisor. While S&P Dow Jones Indices has obtained information from sources they believe to be reliable, S&P Dow Jones Indices does not perform an audit or undertake any duty of due diligence or independent verification of any information it receives.

S&P Dow Jones Indices keeps certain activities of its business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain business units of S&P Dow Jones Indices may have information that is not available to other business units. S&P Dow Jones Indices has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process.

In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.

VIX[®] is a registered trademark of Chicago Board Options Exchange, Incorporated. The VIX methodology is the property of the Chicago Board Options Exchange ("CBOE"). CBOE has granted Standard & Poor's Financial Services LLC ("S&P"), a license to use the VIX methodology to create the S&P 500 VIX Futures Index Series.