

Differentiating and Benchmarking Volatility-Based Investment Strategies Utilizing the CBOE EurekaHedge Volatility Indexes

Christopher DeMeo, CFA, FSA, Founding Partner

Highlights:

Market volatility manifested through financial instrument pricing (and mispricing) offers unique and potentially attractive investment opportunities.

Volatility-based strategies can enhance investment portfolios by providing diversified return and risk management techniques.

Efficient implementation requires a total portfolio perspective, appropriate benchmarks and ongoing monitoring.

Volatility strategies are distinct and non-homogeneous, making it critical to segregate into separate categories to effectively analyze and properly benchmark performance.

The CBOE EurekaHedge Volatility Indexes were specifically created to address this challenge and, based on our analysis, we strongly believe they provide a robust and innovative solution to volatility-based strategy benchmarking and due diligence.

Introduction

Volatility has always been part of the portfolio construction dialogue, although more often as a byproduct of investing in risky assets rather than as an explicit opportunity for a diversified return source. Over the past decade, there has been a growing focus on volatility-based strategies by investors, advisors, asset managers and academia. Investors began the new millennium with the tech bubble and ended the decade recovering from the 2008 financial crisis, creating a surge in demand for more diversified, risk-managed investment solutions to mitigate volatility and improve overall portfolio efficiency.

The word “volatility” often conjures negative reactions, with many investors associating the word with risk, loss, and unpredictability. In fact, unexpected and “uncompensated” (i.e. insufficient return relative to risk) volatility can wreak havoc on investors, especially institutions with portfolios linked to benefit distributions, predicted liabilities or forecasted payouts, such as pension plans, insurance pools, and endowments. This has increased investor focus on strategies that can enhance portfolio returns and provide improved diversification during periods of extreme market volatility, particularly via hedge funds. With this increase in popularity of hedge fund strategies, it has become increasingly important for investors to create and maintain an effective means to monitor and evaluate performance.

In general, performance measurement for hedge fund investors is challenging, especially with the ongoing rise in the number of hedge funds and the wide range of strategies employed. As such, institutional investors continue to examine the validity and representation of available hedge fund benchmarks. However, the lack of consistent methodology and construction has complicated the due diligence process by making it difficult for investors to gauge how a manager has performed relative to a truly representative index. The surge in volatility-based hedge funds has further brought the benchmarking issue to light, particularly given that, until recently, suitable benchmarks were difficult to find.

More specifically, volatility-based hedge fund indexes that do not reflect the fundamental differences in the various volatility strategies are inadequate for investors seeking to effectively assess and implement these types of strategies. Each strategy has different return characteristics depending on the market environment. For example, comparing a tail risk volatility manager’s performance to the amalgamated returns of disparate strategies would not help an investor evaluate the efficacy of including a tail risk strategy in their overall portfolio. Each volatility-based strategy offers unique characteristics and distinctive potential advantages within a portfolio and therefore demand separate, representative benchmarks.

As actual and anticipated allocations to volatility-based strategies continued to grow, an analytical framework was needed to solve this problem and harmonize the types of volatility trading strategies with the philosophies of the different approaches. We believe that the CBOE EurekaHedge Volatility Indexes provide a solution to this benchmarking challenge by effectively delineating the return source for volatility-based investments. By categorizing volatility strategies into four distinct categories, this unique and innovative approach allows for more precise benchmarks that further enhance the due diligence process.

The CBOE EurekaHedge Volatility Indexes are offered in four distinct buckets that include:

- CBOE EurekaHedge Long Volatility Index

- CBOE EurekaHedge Short Volatility Index
- CBOE EurekaHedge Relative Value Volatility Index
- CBOE EurekaHedge Tail Risk Index

The categorization of the indexes in these unique classes allows investors to properly measure and evaluate volatility-based hedge funds within the bands of their respective approaches. The indexes provide a method for investors to benchmark these strategies in a way that marries the volatility trading and investment approach with its specific expected performance. This distinction creates a more meaningful comparison and allows for pragmatic expectations and evaluations, essential elements in effective benchmarking.

Importance of Benchmarks

Performance benchmarking at the fund, asset class, and manager level is critical for overall investment fund due diligence. The hedge fund industry has historically been somewhat reticent to embrace the demand, especially from institutional investors, for robust benchmarking and improved consistency in performance reporting. Prior approaches to hedge fund benchmarking have succumbed to biases such as survivorship, selection, liquidity, and a bias that is often overlooked, return-source. In addition, most benchmarks specific to volatility-based hedge funds lumped strategies together, rendering many of these broad based benchmarks insufficient. As such, investors were constrained to benchmark against indexes that failed to properly categorize distinct return sources, diminishing their relevancy (and accuracy) for investors seeking to allocate to volatility-based strategies.

Many hedge funds are opportunistic in nature, allowing ample room for freedom in terms of how and in what instruments they invest, as well as how best to achieve their return goals. This adaptability is often referred to as strategy drift. Fortunately, volatility-based hedge funds suffer less from this type of drift given they are more focused within the bands of volatility-based investing (Long, Short, Relative Value, Tail Risk). These type of strategies tend to stay within their intended approaches, making it easier to categorize volatility-based strategies into the aforementioned groups.

Before the launch of the CBOE EurekaHedge Volatility Indexes, which were officially introduced to the market in August of 2015, investors seeking to analyze volatility-based strategies faced great difficulty given the lack of transparency and the absence of appropriate benchmarks. It was apparent that investors lacked benchmarks that allowed for more specificity and granularity to meet their due diligence demands.

As the volatility-based strategy asset class continued to grow, the need for effective benchmark instruments became vital for due diligence purposes.

However, before addressing the effectiveness of the CBOE EurekaHedge Volatility Indexes, it is important to note what constitutes an effective benchmark to assess if the benchmarks meet these standards. In order for a benchmark to be both applicable and advantageous for the due diligence process, the methodology must be in line with industry standards. The acronym SAMURAI¹ provides the seven tenets of a good benchmark:

<u>S</u>pecified In Advance	The benchmark is specified prior to the evaluation period.
<u>A</u>ppropriate	It is consistent with the manager’s investment style or area of expertise.
<u>M</u>easurable	The return is readily calculable on a reasonably frequent basis.
<u>U</u>nambiguous	Identities and weights of securities are clearly defined.
<u>R</u>eflective of Current Investment Opinions	The manager has current knowledge of the securities in the benchmark.
<u>A</u>ccountable/Owned	The manager should be aware and accept accountability for the constituents and performance of the benchmark.
<u>I</u>nvestable	It is possible to simply hold the benchmark.

Evaluating the CBOE EurekaHedge Volatility Indexes against the SAMURAI criteria demonstrates that the indexes meet all the requirements, except that the indexes are currently not directly investable (“I”). Most importantly though, the CBOE EurekaHedge Volatility Indexes have been carefully crafted to capture the source return of each type of volatility-based manager, something that has not been previously offered.

The rationale behind, and importance of, the CBOE EurekaHedge Volatility Indexes is relative benchmarking. In terms of methodology, the indexes have been structured in such a way as to eliminate survivorship bias by including the returns for closed/dead

¹ Managing Investment Portfolios: A Dynamic Process (CFA Institute), Third Edition, Maginn, Tuttle, Pinto, McLeavey, 2007

funds to better capture the performance of each underlying strategy. Given that the indexes date back as far as 2005, the historical returns for funds that liquidate have been maintained and reflected in the index values, up to and including their last reporting month. Furthermore, funds that are closed for further capital inflows are also included in the index.

In addition, the indexes are equally weighted in an attempt to maintain fairness in size to all underlying managers, whereas asset weighted indexes typically are biased towards the largest, most successful funds. In keeping with the fairness methodology, there are no assets under management (AUM) restrictions maintained, allowing for an inclusive and more fair representation of managers from the very small to the very large. As the asset class as a whole continues to grow and hopefully becomes more transparent, we anticipate that the number of constituents and AUM in each benchmark will increase, which will serve to better represent each type of strategy.

The indexes currently track 77 unique strategies with combined assets under management of over \$50 billion as of 6/30/15.

CBOE EurekaHedge Index	Details
Long Volatility	The index is designed to provide a broad measure of the performance of underlying hedge fund managers who take a net long view on implied volatility with a goal of positive absolute return. 12 Constituents.
Short Volatility	The index is designed to provide a broad measure of the performance of underlying hedge fund managers who take a net short view on implied volatility with a goal of positive absolute return. 16 Constituents.
Relative Value	The index is designed to provide a broad measure of the performance of underlying hedge fund managers that trade relative value or opportunistic volatility strategies. 40 Constituents.
Tail Risk	The index is designed to provide a broad measure of the performance of underlying hedge fund managers that specifically seek to achieve capital appreciation during periods of extreme market stress. 9 Constituents.

As previously mentioned, benchmarking volatility-based strategies to a broad based index would be insufficient to assess their efficacy and effectiveness. To highlight this, Figure 1 below compares statistical relevance of common broad based hedge fund indexes to the CBOE EurekaHedge Volatility Indexes using R-Squared. We found that using a broad index would provide little insight into how we might expect a volatility-based manager to perform.

Figure 1: R-Squared of CBOE EurekaHedge Indexes to Hedge Fund Indexes

	HFN Hedge Fund Aggregate Index	Barclay Hedge Index	HFN Options Strategies Index	HFN Relative Value Aggregate Index
CBOE EurekaHedge Long Volatility Index	0.10	0.16	0.09	0.08
CBOE EurekaHedge Short Volatility Index	0.44	0.36	0.58	0.37
CBOE EurekaHedge Relative Value Index	0.54	0.53	0.30	0.47
CBOE EurekaHedge Tail Risk Index	0.13	0.15	0.03	0.12

Data Source: CBOE, eVestment Alliance

As the above table further demonstrates, none of the four broad based hedge fund indexes accurately represent the four types of volatility-based strategies. An R-Squared of at least .70 would generally be the threshold for a benchmark to accurately explain the performance of a relevant manager, rendering these benchmarks inappropriate for assessing the underlying managers in the CBOE EurekaHedge Volatility Indexes. This clearly demonstrates the need for valid and applicable benchmarks, which can provide better measures of volatility strategies and performance. While other benchmarks exist, most are too broad in nature and lack proper classification of managers to be meaningful.

The foundation of volatility-based hedge funds strategies is that volatility should be viewed not only as a source of risk, but also as a reliable source of diversified return. Trading volatility can mean different things to different people and as such, it has become increasingly important to clearly define various approaches to trading volatility and implementing specific strategies.

Trading Volatility

True volatility-based strategies target a reliable source of return with lower correlation to “traditional” asset classes over full market cycles. Allocations to lower correlated return sources continue to be in strong demand by investors, although finding non-correlated assets has become increasingly difficult. If we analyze how volatility is correlated to other asset classes using the CBOE® VIX® Index as a proxy for volatility, the potential benefit of volatility’s negative correlation is evident. The CBOE Volatility Index®, the VIX Index, a constant 30 day measure of expected volatility derived from a weighted blend of volatilities for a range of options tied to the Standard & Poor’s 500® Index, is frequently used as a measure of implied equity volatility. The VIX Index is the barometer for implied volatility (SPX) and is often referred to as “the fear index.” As demonstrated in Figure 2, the correlation of the VIX Index to major asset classes is very low or negative.

Figure 2: The Correlation of Volatility to Other Major Asset Classes

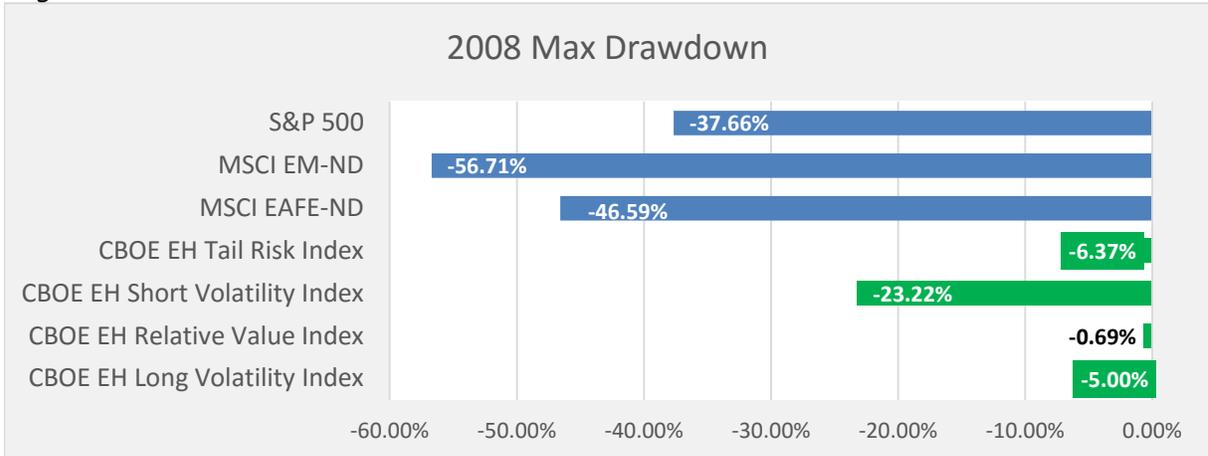
	Correlation 10 Years as of 12/31/15 using VIX Index
CBOE VIX	1.00
Barclays US Aggregate	0.15
MSCI EAFE	-0.43
MSCI EM	-0.31
S&P500	-0.48

Data Source: CBOE, eVestment Alliance

As a result, volatility-based investment strategies have flourished as investors seek to take advantage of this and thereby improve portfolio efficiency.

Investors have also increased their desire for improved downside protection, especially as a result of the damage to most portfolios during the 2008 financial crisis. Figure 3 depicts maximum drawdowns in 2008 for major asset classes, as well as the CBOE EurekaHedge Volatility Indexes. This highlights the potential value of including volatility-based strategies in a portfolio given much lower drawdowns when compared to broader asset classes, such as U.S. equities (S&P500), international developed equities (MSCI EAFE) and emerging markets (MSCI EM). Most importantly, volatility-based strategies not only can protect the portfolio from potentially devastating losses in extreme market downturns, but can also capture upside in more “normal” markets.

Figure 3: Maximum Drawdown



Data Source: CBOE, eVestment Alliance

It is useful to group the four volatility-based strategies buckets correspondingly:

- **Return-Oriented:** *Goal is to capture a systematic, repeatable return premium from investing in volatility*
- **Risk Management focused:** *Goal is to use systematic inefficiencies/pricing discrepancies to provide cost-effective downside equity protection*

Return-Oriented	Objective	Benchmark
Long Volatility	Alpha producer on a continual basis, favors crisis alpha, can perform in a variety of markets, although tends to perform best in volatile markets.	CBOE EurekaHedge Long Volatility Index
Short Volatility	Net short view on implied volatility, higher correlation to equities, performs best in low volatility markets.	CBOE EurekaHedge Short Volatility Index
Relative Value	Highly dependent on mean reversion, often using spread trades to discern where the value is and what to exploit. Evaluate current volatility against expected volatility.	CBOE EurekaHedge Relative Value Volatility Index
Risk-Management Focused		
Tail Risk	Asymmetric Beta to provide upside return to offset losses in extreme market conditions. Also implemented to enable more Delta One/Equity like exposure.	CBOE EurekaHedge Tail Risk Index

Using this framework helps an investor better understand potential sources of return and diversification. The managers of these various strategies utilize distinctly different approaches, so grouping them by type (Long, Short, Relative Value and Tail Risk) is critical to successful performance evaluation and benchmarking. However, it is equally important and beneficial for an investor to understand that there are volatility-based managers who can provide alpha in all markets, and managers who may only intend to provide alpha in more turbulent markets (e.g. Tail Risk).

With the attention volatility has received and continues to receive, a portfolio manager's approach to trading volatility has evolved. Generally speaking, volatility can be broken down into implied volatility and historical volatility. Simply stated, implied

volatility refers to the estimation of future volatility. Implied volatility has a prediction value because it can show directionality in investor sentiment about future fluctuations of a security. Realized volatility, on the other hand, is a measure of what actually occurred, and as such is a historical volatility measure. When used together, implied and realized volatility are the toolset behind volatility-based investing. Fund managers trade volatility by comparing current implied volatility with the expected historical volatility in the underlying instrument. However, the landscape of exploiting mispricing is dynamic, therefore successful fund managers are those who can adapt to the changing nature of the volatility market.

While implied and realized volatility are key components of how managers can exploit volatility, the way in which a manager might actually exploit both types of volatility can be quite unique. Managers will structure trades based on their implicit views on volatility using a multitude of different structures to achieve exposure. Each category of volatility-based strategies (Long Volatility, Short Volatility, Relative Value and Tail Risk) seeks to create value in different ways, therefore it is important for potential investors to have a good understanding of each approach.

Long Volatility

Dr. Kathryn Kaminski coined the term crisis alpha² as a way to categorize those managers who profit by exploiting trends in markets during times of crisis. While many long volatility-based strategies produce alpha on a continual basis, it is often in times of crisis when the greatest opportunity to capture significant alpha arises. These managers seek uncorrelated return streams with a risk/reward skew towards systematic opportunities, but without the constant negative carry associated with traditional tail-risk hedging.

“To achieve this end, a crisis alpha fund seeks out mispricing in the expectation of future uncertainty and may balance long volatility exposure with strategic shorts.”³

As one would expect, long-volatility strategies are likely to perform best during periods of volatile markets but often still provide positive returns in normal markets.

Viewed from a total portfolio perspective, the value of adding long volatility investments is even more apparent. Most portfolio investments have a consistent short volatility bias so exposure to long volatility can provide a significant source of positive return,

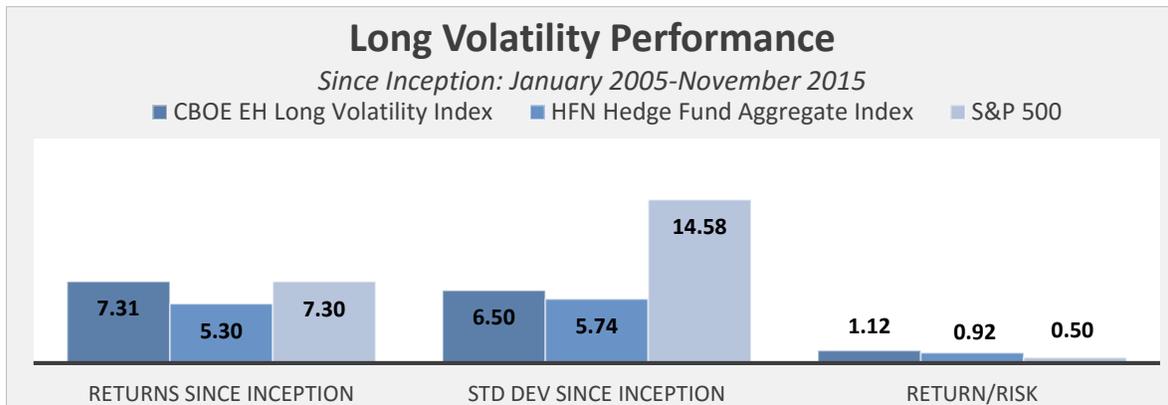
² Kathryn Kaminski (RPM Risk & Portfolio Management), “In Search of Crisis Alpha,” CME Group [5 April 2009], <http://www.cmegroup.com/education/featured-reports/in-search-of-crisis-alpha.html>.

³ Volatility: The Market Price of Uncertainty” Christopher Cole, CFA Artemis Capital Management

especially during times of market disruption. However, even in times of relative market calm, the diversification, return and flexibility provided by long volatility are palpable.

To highlight the effectiveness of Long Volatility Managers, Figure 4 charts the performance since inception of the CBOE EurekaHedge Long Volatility Index; note the Index has a higher since inception return than both the HFN Aggregate Hedge Fund Index and the S&P500. It is important to note the lower volatility (as measured by standard deviation) of the Long Volatility Index compared to the S&P500, while providing similar returns. The resulting return/risk ratio indicates the Long Volatility Index provides improved return per unit of risk versus the other two indexes.

Figure 4: CBOE EurekaHedge Long Volatility Performance



Data Source: CBOE, eVestment Alliance

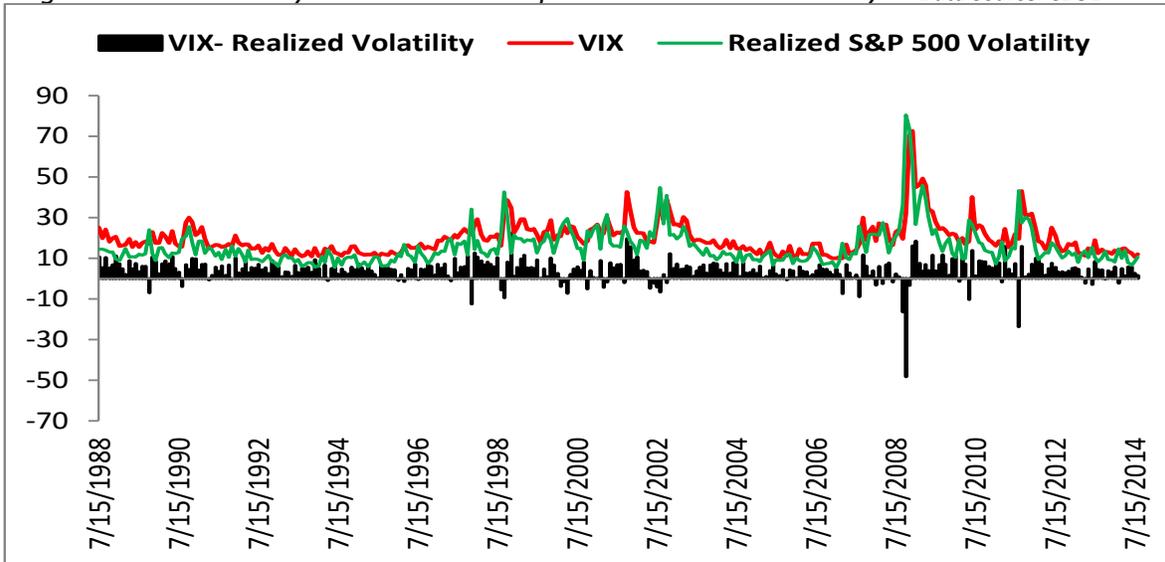
Short Volatility

Short volatility strategies seek to benefit from higher implied volatility of a security or index than actual, or subsequent realized, volatility over a specified period of time. Implied volatility for stock market indexes is frequently greater than realized volatility, creating significant return opportunities. This phenomenon has been studied and verified extensively, and is often referred to as the “volatility risk premium”. Investors have increasingly turned to equity market volatility-selling strategies based on the idea of capturing this risk premium. The volatility risk premium between implied and realized volatility exists because of consistent investor demand for equity downside protection. The volatility premium is rooted in basic supply and demand principles, and the premium relies on an imbalance between the two, meaning risk premiums are directly related to market sentiment. The fact that investors have an aversion to uncertainty, and hence a constant appetite for downside protection, means that the volatility premium is unlikely to be traded away over time.

To illustrate, Figure 5 shows the historical relationship between implied volatility as measured by the CBOE Volatility Index (VIX) (red line) and subsequent realized volatility (green line). As described above, in most cases, a return “premium” can be earned by

buying/selling options to exploit the relationship between higher implied volatility reverting to lower historical/realized volatility.

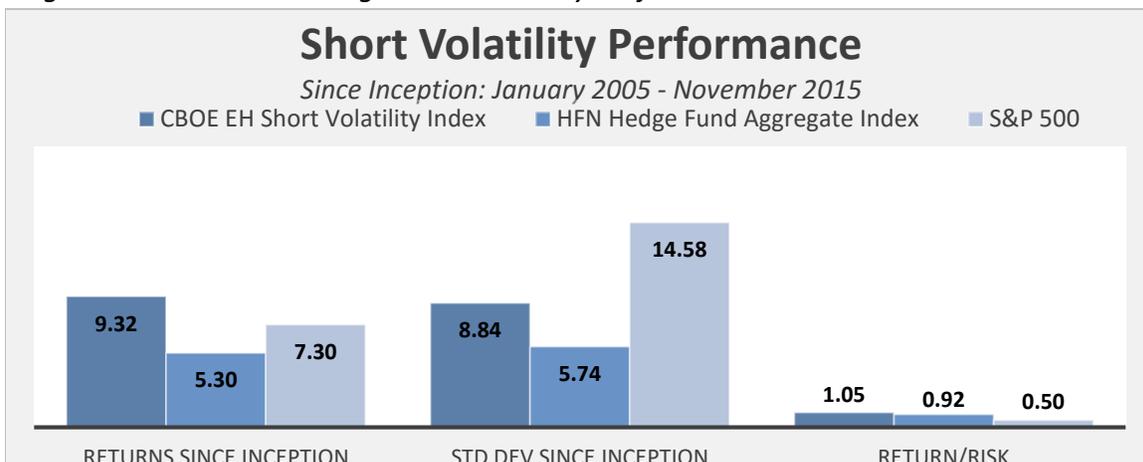
Figure 5: The Volatility Risk Premium: Implied vs. Realized Volatility *Data Source: CBOE*



Short volatility strategies often focus on indexes and are typically executed through buy-write/covered call or put write strategies on these various indexes (e.g. CBOE S&P 500 BuyWrite Index (BXMSM Index) and CBOE S&P 500 PutWrite (PUTSM Index) benchmarks), as well as through VIX futures or option contracts.

Short volatility-based strategies tend to have higher correlations with the stock market given the largest component of the strategy is being “long” the equity market. However, these strategies generally have lower downside risk compared to pure long equities because they capture additional yield from the options which helps buffer overall portfolio downside risk over a full market cycle.

Figure 6: CBOE EurekaHedge Short Volatility Performance



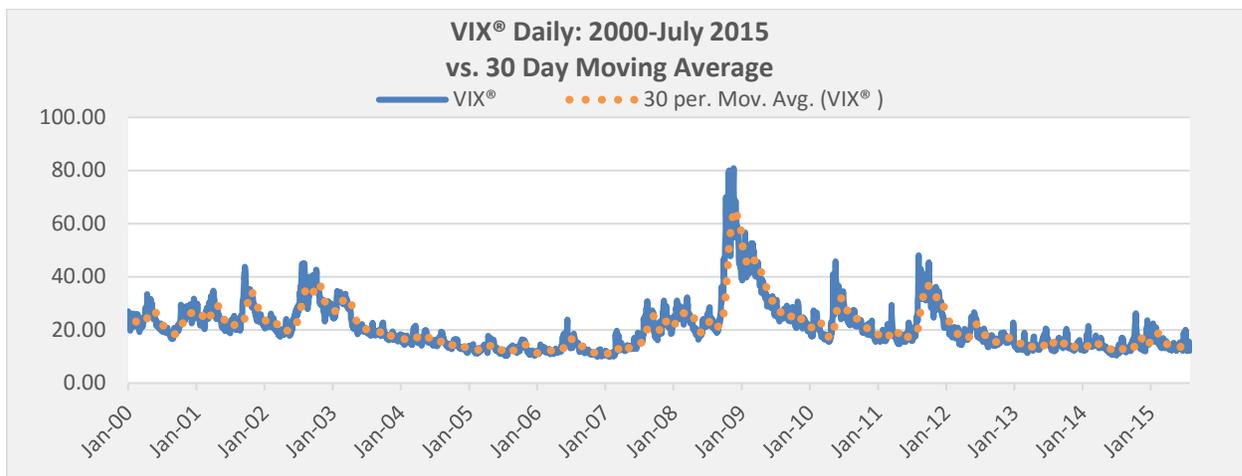
Data Source: CBOE, eVestment Alliance

Performance of the CBOE EurekaHedge Short Volatility Index has been quite strong relative to both the HFN Hedge Fund Aggregate Index and the S&P500 (Figure 6). These returns were achieved with lower risk than the S&P500 and an improved return/risk ratio. While Short Volatility funds can be as responsive as equities, the above chart suggests that Short Volatility managers may offer meaningful return with more muted risk than equities over a full market cycle.

Relative Value

Relative Value volatility-based strategies often involve trading one aspect of volatility against another. These are often executed as “spread trades” between securities with opposing market properties, although there are a wide variety of strategies employed by these type of managers. These strategies tend to be highly opportunistic in nature and, as such, this category is the broadest in terms of how the managers approach trading volatility. As a whole, Relative Value managers are greatly dependent on a divergence from a mathematical mean, and a mean reversion event. This approach tends to perform well in normal markets when mean reversion takes place and valuation reaches equilibrium, a concept known as convergence. As demonstrated in Figure 7, the VIX Index has elastic properties meaning it is by nature a mean reverting index.

Figure 7: Mean Reversion, Daily VIX vs. 30 Day Moving Average

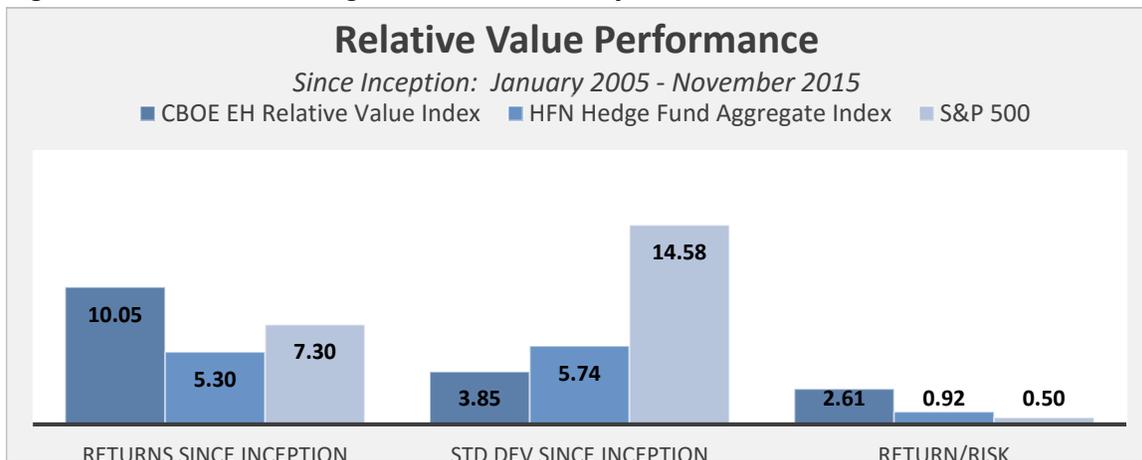


Data Source: CBOE, eVestment Alliance

Relative Value Volatility Strategies (often referred to as “Volatility Arbitrage”) seek to exploit these pricing inefficiencies to generate consistent, absolute, “market-neutral” returns. There are various trading strategies employed including dispersion, relative value across securities (geographic/asset class), relative value on the same security (term structure/skew), merger arbitrage, and convertible arbitrage, to name a few.

Due to the breadth and complexity, these, as well as the previous volatility strategies discussed, heavily rely on manager skill and experience to identify and exploit options mispricing.

Figure 8: CBOE EurekaHedge Relative Value Performance



Data Source: CBOE, eVestment Alliance

The CBOE EurekaHedge Relative Value Index outperformed both the HFN Hedge Fund Aggregate Index and the S&P500 since inception, with an exceptional return/risk ratio, making this volatility-based category the best since inception performer of the CBOE EurekaHedge Volatility Indexes (Figure 8). We believe that the outperformance of Relative Value managers is a result of the flexibility they have to use a wide range of techniques in various market environments.

Tail Risk

Tail Risk strategies are the only volatility-based strategies that by design do not, nor intend to, produce consistent returns if viewed in isolation. In other words, when implemented effectively, these strategies often do not produce a return in normal markets but produce significant alpha in times of extreme market dislocations (so called “Black Swans”). However, and perhaps most importantly, when evaluated in a total portfolio context, adding tail risk strategies often improves overall portfolio efficiency while providing significant downside protection during extreme market downturns. Tail risk strategies tend to be the most negatively correlated to other asset classes, providing a substantial benefit to an aggregate portfolio in terms of diversification (Figure 9). As we witnessed in 2008 and during other times of market stress, correlations between “return seeking” asset classes increase, exacerbating the downside risk of the overall portfolio. Incorporating a tail risk strategy can help to counterbalance this effect with returns that move inversely with equity markets.

Figure 9: Table of Tail Risk Correlations

	60% S&P 500, 40% Barclays US Agg	CBOE EH Tail Risk Idx	Barclays US Agg	HFN Hedge Fund Agg Idx	MSCI EAFE Index	MSCI EM Index	S&P 500	Thomson Private Equity Idx
60% S&P500, 40% Barclays US Agg	1.00							
CBOE EH Tail Risk Idx	-0.49	1.00						
Barclays US Agg	-0.05	0.24	1.00					
HFN Hedge Fund Agg Idx	0.86	-0.54	-0.11	1.00				
MSCI EAFE Index	0.87	-0.55	-0.10	0.87	1.00			
MSCI EM Index	0.75	-0.48	-0.01	0.78	0.83	1.00		
S&P 500	0.99	-0.52	-0.21	0.86	0.87	0.74	1.00	
Thomson Private Equity Idx	0.88	-0.41	-0.19	0.73	0.78	0.60	0.89	1.00

Data Source: CBOE, eVestment Alliance

One would be hard pressed to discuss tail risk strategies, and/or Black Swans, without talking about Nassim Taleb. Mr. Taleb launched his book “The Black Swan” in 2007 which brought the otherwise obscure statistical concept to light. It wasn’t until 2008 when the market incurred a true Black Swan event that investors took note of left tail risk and how best to limit downside risk. While the buzzword “Tail Risk” is relatively new, the concept dates back to Eugene Fama.

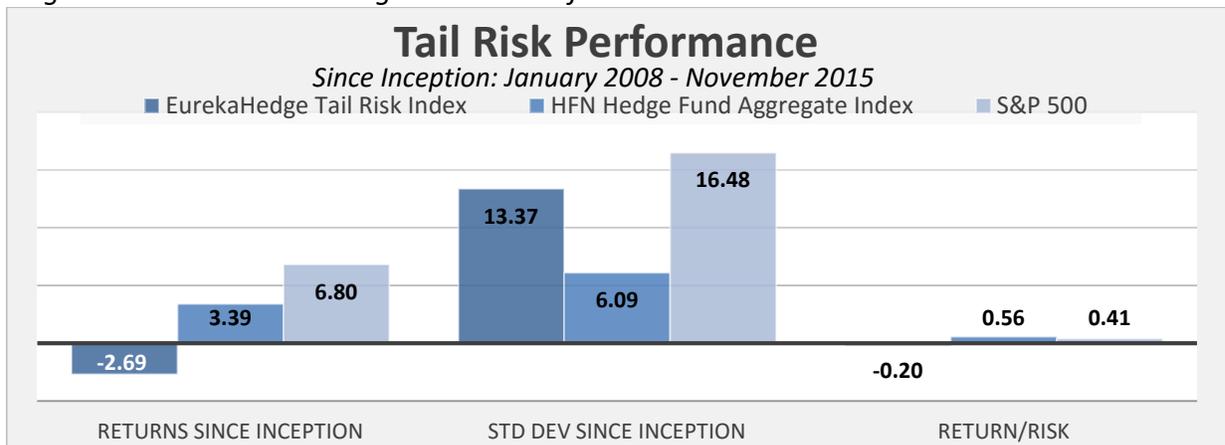
In fact in 1965, Fama stated “many studies show that equity market returns do not follow a normal distribution, with fatter tails than predicted.”⁴

Furthermore, in 2010 Bhansali and Davis demonstrated that “tail risk hedging can boost total portfolio profitability since a hedged portfolio allows for a more growth-oriented asset allocation.”⁵ Investors who employ a tail risk strategy are willing to accept small losses (“insurance premium”) during periods of low volatility in exchange for the “insurance benefit” of significant upside potential during periods of heightening market volatility. In addition, employing a tail risk strategy can allow for an increased equity/delta-one exposure to offset some or all of the tail risk “insurance premium”. This can greatly enhance the overall efficiency of a portfolio.

⁴ Eugene Fama, 1965

⁵ Davis, J. and V. Bhansali, “Offensive Risk Management: Can Tail Risk Hedging Be Profitable?” Working Paper. February 2010.

Figure 10: CBOE EurekaHedge Tail Risk Performance



As expected, performance of the CBOE EurekaHedge Tail Risk Index has been negative since inception given the market has experienced less volatility by way of significant market events since the 2008 Financial Crisis (Figure 10). When evaluated in isolation, tail risk managers tend to underperform during “normal” markets with less volatility, but can add significant value through negative market events.

Performance Analysis: Return-Oriented Benchmarks

While we have previously noted that one of the benefits of implementing a volatility-based strategy is that these strategies tend to have negative correlations to other asset classes, we would also point out that the strategies have negative correlations to each other. As demonstrated by Figure 11, the CBOE EurekaHedge Long Volatility Index has a negative correlation to both the CBOE EurekaHedge Relative Value Volatility Index (-.43) and the CBOE EurekaHedge Short Volatility Index (-0.54).

Figure 11: CBOE EurekaHedge Correlations (Five Years ending 9/30/15)

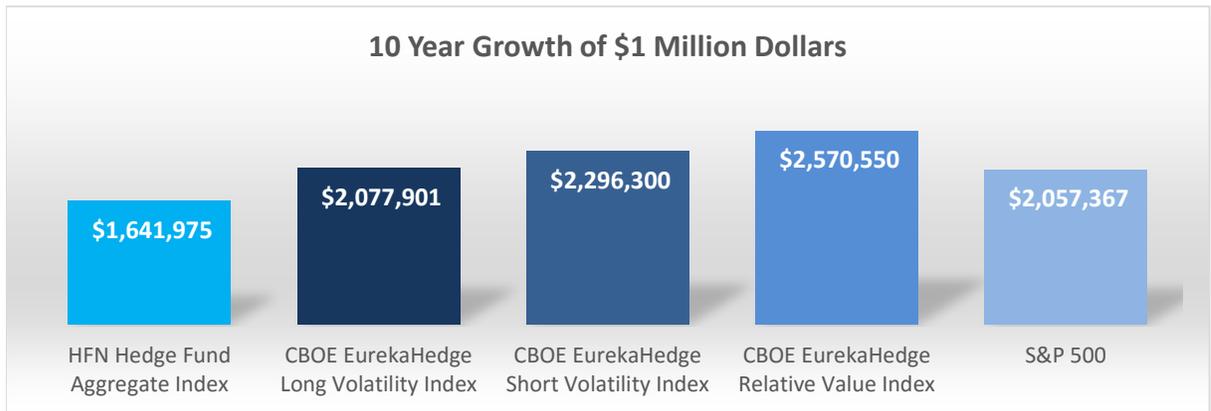
	CBOE EurekaHedge Long Volatility Index	CBOE EurekaHedge Relative Value Volatility Index	CBOE EurekaHedge Short Volatility Index	HFN Hedge Fund Aggregate Index	S&P 500
CBOE EurekaHedge Long Volatility Index	1.00				
CBOE EurekaHedge Relative Value Index	-0.43	1.00			
CBOE EurekaHedge Short Volatility Index	-0.54	0.63	1.00		
HFN Hedge Fund Aggregate Index	-0.36	0.58	0.62	1.00	
S&P 500	-0.43	0.56	0.59	0.87	1.00

Data Source: CBOE, eVestment Alliance

This supports the investment thesis that using multiple types of return seeking volatility-based strategies in a portfolio can provide additional diversification and improve portfolio efficiency. Additionally, the Long Volatility Index has a negative correlation to the HFN Hedge Fund Aggregate Index, so should be considered as another alternative to investing in just an aggregate hedge fund strategy. Furthermore, while both the Relative Value and Short Volatility Indexes have positive (but low) correlations to both the HFN Hedge Fund Aggregate Index and the S&P500 Index, we would conclude that while these strategies are more equity-like in nature, they still offer a lower correlation of returns versus other asset classes.

As Figure 12 illustrates, the return-oriented CBOE EurekaHedge Indexes compare favorably to the HFN Hedge Fund Aggregate index and the S&P500 over the 10 year time period ending 11/30/15.

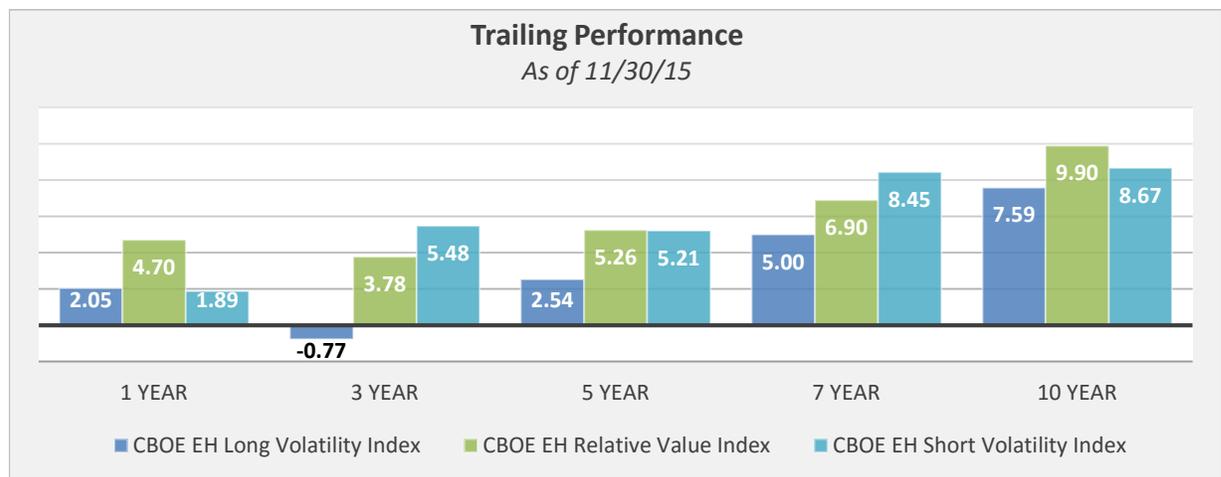
Figure 12: Growth of \$1 Million Dollars ending 11/30/15



Data Source: CBOE, eVestment Alliance

Figure 13 summarizes the trailing performance as of 11/30/15 for the three return-oriented CBOE EurekaHedge Indexes.

Figure 13: Trailing Performance



Data Source: CBOE, eVestment Alliance

Figure 14 compares up/down S&P 500 market capture of the indexes as well as the broader HFN Hedge Fund Aggregate Index

Figure 14: Up/Down Market Capture Statistics as of 11/30/15

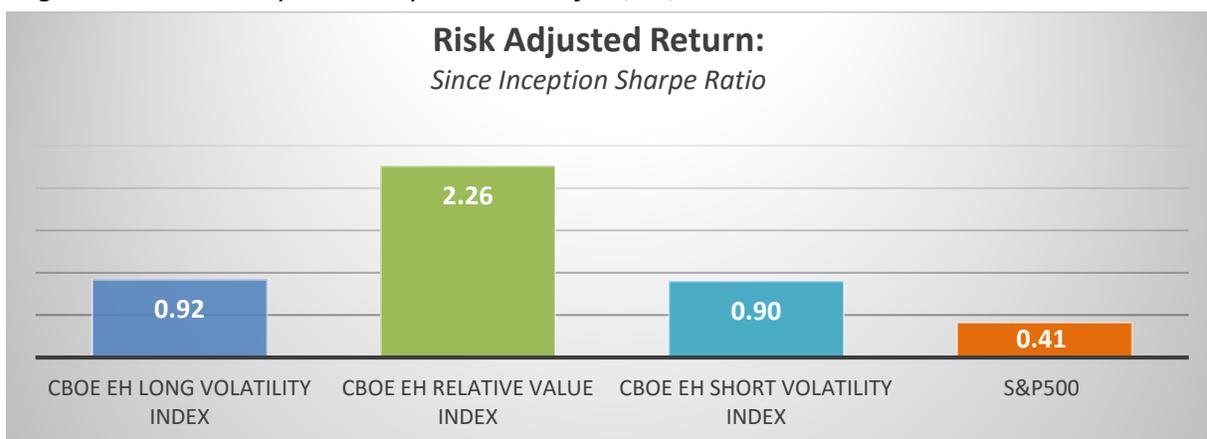
Product Name	Up Market Capture 10 Years using S&P500	Down Market Capture 10 Years using S&P500
CBOE EurekaHedge Long Volatility Index	7.13	-43.53
CBOE EurekaHedge Relative Value Index	29.25	-11.93
CBOE EurekaHedge Short Volatility Index	44.89	25.00
HFN Hedge Fund Aggregate Index	35.98	32.96

Data Source: CBOE, eVestment Alliance

As you can see, both the Long Volatility and Relative Value indexes provided significant negative down market capture (so an overall increase in return during S&P 500 declines) over the past ten years, consistent with expectations for these strategies. The Short Volatility Index down market capture behaved more similarly to the broader HFN index, but with higher up market capture and lower down market capture.

We further analyzed performance efficiency as measured by the Sharpe Ratio (return per unit of risk) for these three CBOE EurekaHedge Volatility Indexes compared to the S&P500 (Figure 15).

Figure 15: Since Inception Sharpe Ratio as of 11/30/15



Data Source: CBOE, eVestment Alliance

As you can see, all three indexes had significantly higher Sharpe Ratios compared to the S&P500. In particular, the CBOE EurekaHedge Relative Value Volatility Index had the highest Sharpe Ratio since inception demonstrating that this category provided highly impactful risk/reward characteristics.

Performance Analysis: Risk Management

Tail Risk volatility-based strategies can increase overall portfolio efficiency by allowing an investor to continue to maintain their long-term return objective while providing downside protection from extreme market downturns (“tail-events”). These strategies, viewed on their own, can exhibit high negative correlations with equities and a significant “drag” during flat or upwardly trending markets. However, when viewed as part of a diversified portfolio over a full market cycle, these strategies can provide significantly improved portfolio efficiency and deliver compelling downside protection. As seen in Figure 16, the CBOE EurekaHedge Tail Risk Index provided strong returns during down markets over the seven year period as of 11/30/15.

Figure 16: Tail Risk Up/Down Market Capture Statistics as of 11/30/15

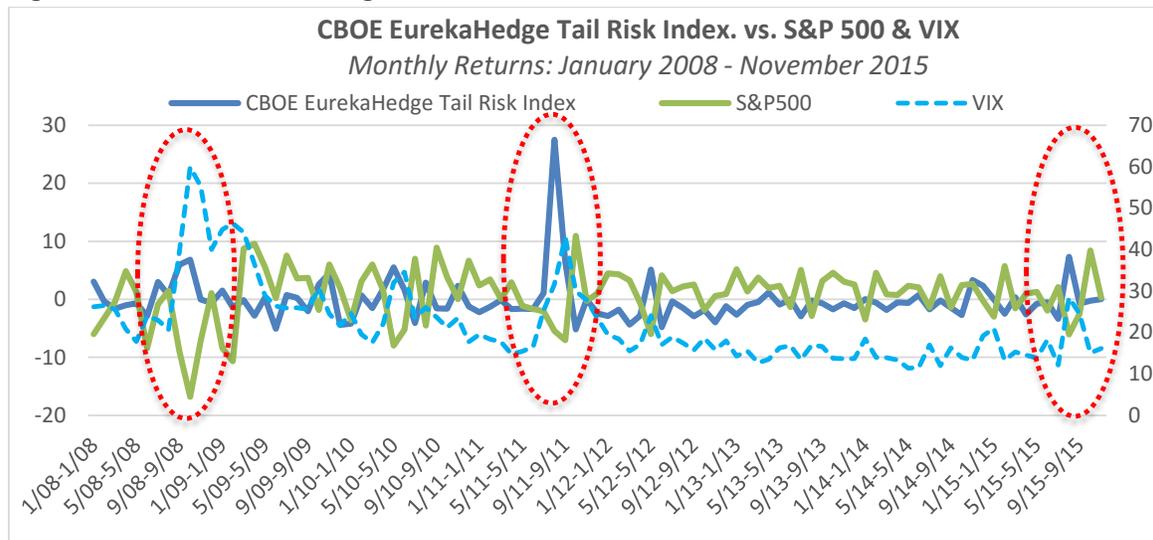
	Up Market Capture 7 Years using S&P500	Down Market Capture 7 Years using S&P500
CBOE EurekaHedge Tail Risk Index	-28.86	-58.32
HFN Hedge Fund Aggregate Index	30.95	30.82

Data Source: CBOE, eVestment Alliance

As expected, the CBOE EurekaHedge Tail Risk Index tends to move sharply upwards in times of extreme market stress and generally produces negative returns in normal markets. This type of return pattern is precisely how these managers provide value over full market cycles. Corrections are events that are typically 10% or less, while crashes are drops that are considered greater than 10% over a short time frame and often characterized by 20% drawdowns, an important distinction in terms of understanding when Tail Risk strategies add the most value.

Figure 17 highlights the sharp spikes in volatility, and in tandem, similar spikes in performance of the CBOE EurekaHedge Tail Risk Index during market shocks such as October 2008, August 2011 and August 2015.

Figure 17: CBOE EurekaHedge Tail Risk vs. S&P500/VIX



Data Source: CBOE, eVestment Alliance

Again, tail risk strategies should be viewed in the context of an aggregate portfolio. When viewed in isolation, especially in upward moving markets, it may be more difficult to appreciate the value of a tail risk strategy. A total portfolio perspective helps to better understand the potential for improved portfolio efficiency and downside protection during times of market stress.

Conclusion

The growth of volatility-based strategies demonstrates not only a surge in interest from qualified investors, but also the efficacy of including volatility-based strategies as part of a broader portfolio management approach. The diversification benefits offered by these types of strategies can be significant and the ability to offer meaningful downside protection in turbulent markets works to offset capital losses which can degrade an investor's ability to meet liabilities and overall investment goals. Significant strides have been made in terms of new product offerings and performance evaluation, though until recently due diligence of these strategies has been hindered by lack of appropriate benchmarks. The introduction of the CBOE EurekaHedge Volatility benchmarks helps to facilitate the due diligence and implementation processes, while giving consideration to return sources, a distinction that sets these benchmarks apart from all others.

The hedge fund industry has historically faced benchmarking challenges when evaluating volatility-based strategies. With the increase in volatility-based approaches, the lack of appropriate, differentiated benchmarks made implementation a challenge for many investors interested in these strategies. The CBOE EurekaHedge Volatility Indexes were introduced as a way to sensibly gauge one volatility manager from another, with emphasis placed on differentiating the types of strategies and return sources. The methodology behind the indexes has been carefully constructed to reduce

potential biases, and our analysis shows that they compare favorably to the SAMURAI benchmarking standards. We anticipate that as the hedge fund industry continues to evolve, the need for transparency, benchmarking and performance reporting standards will continue to increase. Additionally, as institutional investors seek out ways to specifically invest in volatility-based strategies as a source of return and diversification, the CBOE EurekaHedge Volatility Indexes provide a much needed solution for effective benchmarking and implementation. The performance metrics in this paper reveal the relevancy and utility in employing volatility-based strategies as part of an aggregate portfolio.

With the addition of the CBOE EurekaHedge Volatility Indexes, investors have the opportunity to achieve robust, appropriate benchmarking comparisons as they do with other major asset classes. The CBOE EurekaHedge Volatility benchmarks provide a thoughtful approach to the volatility-based asset class, with attention given to the different sources of return that hedge fund managers employ to help investors benefit from volatility. We expect continued growth of allocations to volatility-based strategies and, as a result, an expanded landscape of solutions and products.

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Disclosure

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