EXECUTIVE SUMMARY OF KEY HIGHLIGHTS

Tail Risk in the Past 25 Years: Since mid-1986 the worst monthly declines for select indexes include: down 28.2% for the S&P GSCI Index, down 21.5% for S&P 500, down 20.2% for MSCI EAFE, and a decline of only 8.6% for the CLL Index (Exhibit B).

Tail Risk and Diversification in 2008: Changes for indexes in 2008 - S&P 500 down 37.0%; two indexes with options and stocks - CLLSM down 23.6% and VXTHSM down 19.3%; three futures-based indexes (with no stock positions) -- VXMT, DyVX and VTRsk, respectively increased 83.9%, 132.3% and 174.3% (Exhibit A).

Lower Volatility: The CLL has incurred about 70% of the volatility of the S&P 500 over the last 26 years. Select portfolios with the VXTH and the future-based indexes have had less volatility than the S&P 500 over the last 70 months (Exhibits C, F, and O).

BENCHMARK INDEXES

This article analyzes five benchmarks that are designed to provide protection during declining equity markets (visit www.cboe.com/benchmarks and www.spvixviews.com/indices for more details).

Exhibit A: Benchmark Indexes

<table>
<thead>
<tr>
<th>Index</th>
<th>Ticker (Bloomberg)</th>
<th>Options or Futures Position(s)</th>
<th>Hold stocks?</th>
<th>Price History Begins</th>
<th>Annual % Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOE S&amp;P 500 95-110 Collar Index (CLL)</td>
<td>CLL</td>
<td>Buys three-month out-of-the-money S&amp;P 500 put options at 95% of the S&amp;P 500 value. Sells one-month out-of-the-money S&amp;P 500 call options at 110% of the S&amp;P 500 value.</td>
<td>S&amp;P 500</td>
<td>June 1986</td>
<td>-23.6% 17.6% 4.1% -8.8%</td>
</tr>
<tr>
<td>CBOE VIX Tail Hedge Index (VXTH)</td>
<td>VXTH</td>
<td>Buys one-month 30-delta VIX call options. The weight of the VIX calls in the portfolio varies at each roll depending on the perceived likelihood that a black swan event could occur in the future.</td>
<td>S&amp;P 500</td>
<td>March 2006</td>
<td>-19.3% 16.0% 21.1% 5.9%</td>
</tr>
<tr>
<td>S&amp;P 500 VIX Mid-term Futures Index (VXMT)</td>
<td>SPVXMT</td>
<td>Buys a combination of VIX futures positions in order to reflect the expectations of the VIX Index level in 6 months. The VIX futures are rolled daily in order to maintain an average five-month term.</td>
<td>No stocks</td>
<td>Dec. 2005</td>
<td>83.9% -23.6% -13.2% -7.6%</td>
</tr>
<tr>
<td>S&amp;P 500 Dynamic VIX Futures Index (DyVX)</td>
<td>SPDYVX</td>
<td>Buys a combination of VIX futures positions in order to reflect dynamic allocation between the S&amp;P 500 Short-Term VIX Futures Index and S&amp;P 500 Mid-Term VIX Futures Index. The rules-based allocation is done with the goal of lowering the roll cost of investments linked to future implied volatility.</td>
<td>No stocks</td>
<td>Dec. 2005</td>
<td>132.3% 0.7% 20.7% 8.8%</td>
</tr>
<tr>
<td>S&amp;P 500 VIX Futures Tail Risk Index - Short-Term (VTRsk)</td>
<td>SPVXTSTR</td>
<td>Calculated using a weight of 45% of 2x the S&amp;P VIX Short-Term Futures Index and 55% of the Inverse S&amp;P 500 Short-Term Futures Index. The goal of the index is to provide a long volatility exposure whose cost is partially or completely mitigated (due to negative roll yield) via a rebalanced short exposure.</td>
<td>No stocks</td>
<td>Dec. 2005</td>
<td>174.3% -21.0% -3.0% 10.1%</td>
</tr>
<tr>
<td>S&amp;P 500 Index (Total Return)</td>
<td>SPTR</td>
<td>none</td>
<td>S&amp;P 500</td>
<td>Jan. 1970</td>
<td>-37.0% 26.5% 15.1% 2.1%</td>
</tr>
</tbody>
</table>

COLLAR OVER MORE THAN 25 YEARS

Exhibit B: Histogram with Frequency of Monthly Returns for CLL and S&P 500 (July 1986 - January 2012)

Exhibit C: Returns and Volatility (July 1986 – January 2012)

Enhanced Returns for Portfolios: Portfolios with small allocations to the futures-based indices and the VXTH had higher returns (and lower volatility) than the S&P 500. The annualized returns over the past 70 months were 2.4% for the S&P 500; 3.4% for a portfolio of 20% VXTH and 80% S&P 500; and 6.0% for a portfolio of 10% VTRsk (or 10% DyVX) and 90% S&P 500 (Exhibits I and O).

Higher Risk-adjusted Returns: Certain portfolios with the VXTH and the future-based indexes have had a higher Sortino Ratio than key stock indices over the last 70 months (Exhibits F and L).
TAIL RISK AND OPTIONS-BASED INDEXES - VXTH AND CLL (April 2006 - January 2012)

Exhibit D: Growth of $1 for VXTH, CLL and S&P 500 Indexes (April 2006 - January 2012)

The growth in the value of a dollar invested on March 31, 2006. The VXTH has outperformed the S&P 500 since inception.


The worst monthly declines were down 15.1% for S&P 500 and down 10.7% for VXTH.


The VXTH index had risk-adjusted performance that was superior to that of the S&P 500 per metrics such as the Sortino Ratio, Sharpe Ratio and Jensen's Alpha. Please note that the above indices had negative skewness, and the measures of risk-adjusted returns are imperfect when measuring non-normal distributions.

Exhibit G: Changes for 5 Indexes in Months in Which S&P 500 had Big Moves (More than 8.8%) (April 2006 - January 2012)

The CLL and the VXTH provided a cushion during the worst three months for the S&P 500 and MSCI EAFE since April, 2006. The trade-off is reduced upside participation in the three best months.


In the 4th quarter, 2008, the VXTH increased 0.16% versus a decline of 22% for the S&P 500.

Exhibit I: Return and Volatility (April 2006 - January 2012)

The portfolio with an allocation of 20% VXTH and 80% S&P 500 had a return of 3.4% and standard deviation of 16.4%.

Sources for all Exhibits on this page: Bloomberg, Ibbotson, ACG.
In the 4th quarter of 2008, 10% VTRsk 90% S&P 500 declined 3.3% versus a decline of 22% for the S&P 500.


Exhibit N: Allocating 10% to the VTRsk and DyVX provided cushion during declines while also participating in rising markets.

Exhibit M: The futures-based indices realized significant increases during September and October 2008. Conversely, they experienced double-digit declines during October 2011, a month when the S&P 500 rose 10.9%.

Exhibit M: The CII and VXTH have a high correlation to the S&P 500 due to their stock exposure. All of the futures-based indices are negatively correlated to the stock indexes.


Exhibit L: A 10% allocation to the futures-based indices had risk-adjusted performance that was superior to that of the S&P 500 per metrics such as the Sortino Ratio, Sharpe Ratio and Jensen’s Alpha. Please note that the measures of risk-adjusted returns are imperfect when measuring non-normal distributions with negative skewness.

Exhibit O: Returns and Volatility (April 2006 – January 2012)

Exhibit O: The portfolio with an allocation of 10% VTRsk and 90% S&P 500 had a return of 6.0% and standard deviation of 13.4%.

S&P 500 | VIX | VXMT | DyVX | VTRsk | CLL | VXTH | MSCI EAFE | S&P GSCI
---|---|---|---|---|---|---|---|---
1.00 | -0.72 | 1.00 | -0.70 | 0.73 | 1.00 | -0.63 | 0.53 | 0.83 | 1.00 | -0.06 | 0.56 | 0.82 | 1.00 | 0.89 | -0.70 | -0.68 | -0.48 | -0.42 | 1.00 | 0.87 | -0.49 | -0.53 | -0.39 | -0.33 | 1.00 | 0.84 | -0.64 | -0.64 | -0.59 | -0.61 | 0.77 | 0.69 | 1.00 | 0.46 | -0.30 | -0.37 | -0.36 | -0.41 | 0.41 | 0.36 | 0.55 | 1.00

Exhibit K: Correlations of Weekly Changes for Select Indexes (April 7, 2006 - February 3, 2012)

Exhibit J: The three futures-based indices added value due to the fact that they all rose more than 80% in 2008 (see also the annual returns table Exhibit A).

Pricing of VIX Spot and Futures

Exhibit P: Pricing of VIX Spot Index and VIX Futures

Exhibit Q: % Changes in October 2008

Capacity

Exhibit R: Average Daily Volume for SPX Options, VIX Futures, and VIX Options (2004 – 2011)

Exhibit S: VIX Index and the PUT and Call Volume for SPX and VIX Options (January 2007 - January 2012)

Capacity

Exhibit R: Our rough estimates for average daily notional dollar value of trading in 2011 (with a delta-adjustment of 0.5 for options, and a beta adjustment of 3.0 for VIX products) are more than $48 billion for SPX options, $3 billion for VIX futures, and $1 billion for VIX options. Assets in VIX-related exchange-traded products (ETPs) reached $6 billion in February 2012.

Exhibit S: As noted in Exhibit A on the first page, the CLL Index buys SPX puts and sells SPX calls, and the VXTH Index buys VIX calls. The index option volume often has spiked when the VIX Index rose sharply. The put-call ratios during the time period above were 1.68 for SPX options and 0.54 for VIX options.

Source: Bloomberg, CBOE.