Options for Managing Volatility

-- Income
-- Diversification
-- Risk-adjusted Returns

By
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Please see the last slide for important disclosures
16 Challenging Months

Little diversification as stock and commodity indexes fell by more than 50%

US pension law requires pension fiduciaries to diversify so as to minimize the risk of large losses.
16 Challenging Months

Can volatility diversify and lessen portfolio volatility?

(Oct. 31, 2007 - Feb. 28, 2009)

Sources: CBOE and Bloomberg
Higher Correlations for Stock Indexes

Rolling One-year Correlations of Indexes' Weekly Returns to the S&P 500

0.93
0.85
-0.81

Jan-71 Jan-84 Jan-97 Jan-10
Sources: Bloomberg and CBOE

-1.0 -0.5 0.0 0.5 1.0

Russell 2000
MSCI Emerging Mkts
EAFE US
VIX - CBOE Volatility Index
Higher Correlations for Alternatives Indexes

Rolling One-year Correlations of Indexes' Weekly Returns to the S&P 500

Sources: Bloomberg and CBOE
# CBOE Performance Benchmark Indexes

<table>
<thead>
<tr>
<th>Index</th>
<th>Ticker</th>
<th>Introduced</th>
<th>Data beginning</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOE S&amp;P 500 2%OTM BuyWrite</td>
<td>BXY</td>
<td>2006</td>
<td>June 1, 1988</td>
<td><a href="http://www.cboe.com/BXY">www.cboe.com/BXY</a></td>
</tr>
</tbody>
</table>

Bloomberg provides historical data for all seven indexes.
CBOE S&P 500 BuyWrite Index (BXM)

- Benchmark for strategy --
  - buy portfolio of S&P 500 stocks
  - write (sell) cash-settled S&P 500 Index options every 3rd Friday for income
- Announced in 2002 – study by Duke U.
- Data history back to June 30, 1986
- “Innovative Index of the Year” in 2004
- More than $20 billion in buywrite funds
- www.cboe.com/BXM
Growth over more than 22 Years

Growth of $1


Sources: Bloomberg and CBOE

www.cboe.com/benchmarks
Histograms of Monthly Index Returns for 297 Months
(July 1986 – March 2011)  
Sources: CBOE and Bloomberg

S&P 500 Index TR

Low Month -21.5%  
(July 1986 - March 2011)

High Month 13.5%  
(July 1986 - March 2011)

BXM Index

Low Month -17.4%  
(July 1986 - March 2011)

High Month 8.2%  
(July 1986 - March 2011)

30-Yr Tr Bond Index Citigroup

Low Month 14.6%  
(July 1986 - March 2011)

High Month 16.2%  
(July 1986 - March 2011)

CLL Index

Low Month -8.6%  
(July 1986 - March 2011)

High Month 10.0%  
(July 1986 - March 2011)

Number of months in which the index returns are within 2 percentage points under the number on the x-axis
Histograms of Monthly Index Returns for 297 Months
(July 1986 – March 2011)  
Sources: CBOE and Bloomberg

**S&P GSCI Index**
- Low Month: -28.2% (July 1986 - March 2011)
- High Month: 22.9%

**PUT Index**
- Low Month: -17.7% (July 1986 - March 2011)
- High Month: 8.4%

**MSCI EAFE Index**
- Low Month: -20.2% (July 1986 - March 2011)
- High Month: 15.6%

**Russell 2000 Index**
- Low Month: -30.6% (July 1986 - March 2011)
- High Month: 16.5%

Number of months in which the index returns are within 2 percentage points under the number on the x-axis
Returns and Volatility Over Two Decades

**Annualized Returns**

- PUT - CBOE S&P 500 PutWrite Index: 10.2%
- BXY - CBOE S&P 500 2% OTM BuyWrite: 9.7%
- BXM - CBOE S&P 500 BuyWrite Index: 8.8%
- S&P 500: 8.7%
- Citigroup 30-yr Treasury: 7.1%
- CLL - CBOE S&P 500 95-110 Collar Index: 6.3%
- Citigroup 5-yr Treasury: 6.2%
- EAFE TR: 5.6%
- SP GSCI: 4.4%

**Standard Deviation**

- Citigroup 5-yr Treasury: 4.6%
- PUT - CBOE S&P 500 PutWrite Index: 10.3%
- BXM - CBOE S&P 500 BuyWrite Index: 10.7%
- CLL - CBOE S&P 500 95-110 Collar Index: 10.7%
- Citigroup 30-yr Treasury: 12.0%
- BXY - CBOE S&P 500 2% OTM BuyWrite: 12.4%
- S&P 500: 15.0%
- EAFE TR: 16.7%
- SP GSCI: 21.2%

Sources: CBOE, Bloomberg and Citigroup Fixed Income Indexes Total return indexes. Please see last slide for important risk disclosures.
Two Decades

PUT – CBOE S&P 500 PutWrite Index
BXM – CBOE S&P 500 BuyWrite Index
BXY -- CBOE S&P 500 2% OTM BuyWrite Index
CLL – CBOE S&P 500 95-110 Collar Index

Please see risk disclosures. Past performance is not a guarantee of future returns.
Source of return –
Sell richly priced options

Compare trade-offs for ATM (at-the-money) and OTM (out-of-the-money) options selling strategies

**Figure 5.** S&P 500 ATM One-Month Option: Implied vs. Realized Volatility Spread, 1 January 1990 to 31 October 2005

**Figure 7.** Risk–Return Trade-Off for Call-Selling Strategies and the S&P 500, 18 January 1990 to 17 November 2005

*Note:* The average spread was 2.4 percentage points; the median, 2.7 percentage points.
*Source:* Goldman Sachs.

*Sources:* CBOE, Standard & Poor’s, and Goldman Sachs.
Gross Monthly Income from Options Premiums

BXM Index - Monthly Premiums

Gross amount* received as a % of the underlying
Average was about 1.8% per month

(June 1988 - March 2011). Source: CBOE.

* Please note that these are gross amounts, and the net return usually will be less with a buywrite strategy. www.cboe.com/benchmarks
Studies on BuyWrites


[www.cboe.com/benchmarks](http://www.cboe.com/benchmarks)
Returns and Volatility for Select Indexes

Total Return Indexes, for Time Periods Ending March 31, 2011

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Year Annualized Return</td>
<td>BXM 6.3%</td>
<td>S&amp;P 500 15.6%</td>
<td>PUT 8.3%</td>
<td>CLL 4.0%</td>
<td>BXY 10.9%</td>
<td>30-Yr Tr 6.9%</td>
<td>EAFE 10.4%</td>
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<tr>
<td>Three-Year Annualized Return</td>
<td>0.0%</td>
<td>2.4%</td>
<td>3.2%</td>
<td>0.7%</td>
<td>3.0%</td>
<td>2.6%</td>
<td>-3.0%</td>
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<tr>
<td>Five-Year Annualized Return</td>
<td>2.3%</td>
<td>2.6%</td>
<td>5.2%</td>
<td>1.0%</td>
<td>4.0%</td>
<td>5.3%</td>
<td>1.3%</td>
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<tr>
<td>Ten-Year Annualized Return</td>
<td>3.4%</td>
<td>3.3%</td>
<td>5.2%</td>
<td>3.2%</td>
<td>4.5%</td>
<td>5.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Twenty-Year Annualized Return</td>
<td>8.8%</td>
<td>8.7%</td>
<td>10.2%</td>
<td>6.3%</td>
<td>9.7%</td>
<td>7.1%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Annualized Return Since 30-Jun-86</td>
<td>9.2%</td>
<td>9.5%</td>
<td>10.6%</td>
<td>7.0%</td>
<td></td>
<td>6.7%</td>
<td>6.9%</td>
</tr>
<tr>
<td>One-Year Standard Deviation</td>
<td>11.7%</td>
<td>18.0%</td>
<td>14.6%</td>
<td>13.1%</td>
<td>13.9%</td>
<td>14.7%</td>
<td>22.0%</td>
</tr>
<tr>
<td>Three-Year Standard Deviation</td>
<td>16.9%</td>
<td>21.9%</td>
<td>17.5%</td>
<td>13.5%</td>
<td>19.0%</td>
<td>19.7%</td>
<td>26.2%</td>
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<tr>
<td>Five-Year Standard Deviation</td>
<td>13.6%</td>
<td>17.9%</td>
<td>14.0%</td>
<td>11.5%</td>
<td>15.4%</td>
<td>16.1%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Ten-Year Standard Deviation</td>
<td>12.2%</td>
<td>16.0%</td>
<td>12.4%</td>
<td>10.7%</td>
<td>13.9%</td>
<td>14.3%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Twenty-Year Standard Deviation</td>
<td>10.7%</td>
<td>15.0%</td>
<td>10.3%</td>
<td>10.7%</td>
<td>12.4%</td>
<td>12.0%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Standard Deviation Since 30-Jun-86</td>
<td>11.2%</td>
<td>15.8%</td>
<td>10.5%</td>
<td>11.1%</td>
<td></td>
<td>0.12</td>
<td>17.9%</td>
</tr>
</tbody>
</table>

Sources: Bloomberg and CBOE  www.cboe.com/benchmarks

Please see the last slide for important risk disclosures.
Historic Volatility Since 1899

"Historic Volatility" is a measure of actual price changes during a specific time period in the past. Mathematically, historic volatility is the annualized standard deviation of daily returns during a specific past period.

Source: Bloomberg

High 101.62 on Nov. 29, 1929
Low 3.21 on Nov. 27, 1987
Mean 15.50
Median 12.91

(Jan. 1899 - March 4, 2011)
Select Implied Volatility Indexes in 2011
Weekly Highs through April 1st
Sources: Bloomberg and CBOE

Volatility Indexes - Global

Weekly Highs

Volatility Indexes - Commodities

Weekly Highs

Volatility Indexes - Tech Stocks & VIX

Weekly Highs

www.cboe.com/volatility
CBOE Volatility Index® (VIX®)

1. Premier barometer of investor sentiment and market volatility
2. Key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices
3. Up-to-the-minute market estimate of expected volatility that is calculated by using real-time S&P 500 Index (SPX) option bid/ask quotes
4. Uses near-term and next-term out-of-the-money SPX options with at least 8 days left to expiration, and then weights them to yield a constant, 30-day measure of the expected volatility of the S&P 500 Index
5. Related to amount of premium received by sellers of some index options
6. Data history back to 1990
7. www.cboe.com/VIX
Statistics for VIX daily values from January 3, 1995* through March 1, 2011 (4,070 trading days) --

Highest intraday value -- 89.53 on Oct. 24, 2008

Highest daily closing value -- 80.86 on Nov. 20, 2008

Average daily closing value – 21.51

Median daily closing value – 20.41

Lowest closing value – 9.89 on Jan. 24, 2007

• Pre-1995 data (some of it backtested) for VIX and VXO indexes are at www.cboe.com/VIX
**Big Weekly % Moves for S&P 500**

*More interest in managing “left tail” or “black swan” risk*

### Weekly % Changes for Select Indexes (Jan. 5, 2001 - Feb. 25, 2011)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Oct-2008</td>
<td>-18.1%</td>
<td>-15.6%</td>
<td>-21.7%</td>
<td>-20.2%</td>
<td>-14.7%</td>
<td>55.0%</td>
</tr>
<tr>
<td>21-Sep-2001</td>
<td>-11.6%</td>
<td>-14.0%</td>
<td>-7.0%</td>
<td>-5.8%</td>
<td>-9.8%</td>
<td>34.0%</td>
</tr>
<tr>
<td>3-Oct-2008</td>
<td>-9.3%</td>
<td>-12.1%</td>
<td>-7.6%</td>
<td>-9.9%</td>
<td>-11.2%</td>
<td>29.9%</td>
</tr>
<tr>
<td>21-Nov-2008</td>
<td>-8.3%</td>
<td>-10.9%</td>
<td>-10.3%</td>
<td>-11.8%</td>
<td>-9.1%</td>
<td>9.6%</td>
</tr>
<tr>
<td>19-Jul-2002</td>
<td>-8.0%</td>
<td>-6.5%</td>
<td>-2.9%</td>
<td>-2.0%</td>
<td>1.4%</td>
<td>15.9%</td>
</tr>
<tr>
<td>31-Oct-2008</td>
<td>10.5%</td>
<td>14.2%</td>
<td>8.9%</td>
<td>20.4%</td>
<td>5.0%</td>
<td>-24.3%</td>
</tr>
<tr>
<td>13-Mar-2009</td>
<td>10.8%</td>
<td>12.1%</td>
<td>6.0%</td>
<td>8.2%</td>
<td>0.6%</td>
<td>-14.1%</td>
</tr>
<tr>
<td>28-Nov-2008</td>
<td>12.1%</td>
<td>16.4%</td>
<td>11.9%</td>
<td>12.7%</td>
<td>6.0%</td>
<td>-23.9%</td>
</tr>
</tbody>
</table>

Sources: CBOE and Bloomberg.

*Past performance does not guarantee future results.*

One cannot invest directly in the VIX Index. Please read the last slide for more information.
# Key Specifications - VIX Futures and Options

<table>
<thead>
<tr>
<th>Futures</th>
<th>Options</th>
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</thead>
<tbody>
<tr>
<td><strong>Exchange</strong></td>
<td><strong>CFE</strong></td>
</tr>
<tr>
<td><strong>Ticker</strong></td>
<td><strong>VX</strong></td>
</tr>
<tr>
<td><strong>Multiplier</strong></td>
<td>$1,000 (and $100 in March 2009)</td>
</tr>
<tr>
<td><strong>Last Day of Trading</strong></td>
<td>Generally on <strong>Tuesday</strong>, the day before expiration date.</td>
</tr>
<tr>
<td><strong>Expiration Date</strong></td>
<td>Generally on <strong>Wednesday</strong> 30 days prior to the 3rd Friday of calendar month immediately following the expiring month.</td>
</tr>
</tbody>
</table>

## VIX Options

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Daily Volume</th>
</tr>
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<tbody>
<tr>
<td>2006</td>
<td>23,491</td>
</tr>
<tr>
<td>2007</td>
<td>93,181</td>
</tr>
<tr>
<td>2008</td>
<td>102,560</td>
</tr>
<tr>
<td>2009</td>
<td>132,255</td>
</tr>
<tr>
<td>2010</td>
<td>247,826</td>
</tr>
</tbody>
</table>

## VIX Futures

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Daily Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,731</td>
</tr>
<tr>
<td>2007</td>
<td>4,169</td>
</tr>
<tr>
<td>2008</td>
<td>4,301</td>
</tr>
<tr>
<td>2009</td>
<td>4,543</td>
</tr>
<tr>
<td>2010</td>
<td>17,430</td>
</tr>
<tr>
<td>Jan-Mar11</td>
<td>42,475</td>
</tr>
</tbody>
</table>

Source: CBOE  [www.cboe.com/VIX](http://www.cboe.com/VIX)
VIX Spot and Futures in Feb.-Mar. 2011

![Graph showing VIX Spot and Futures in Feb.-Mar. 2011]

<table>
<thead>
<tr>
<th>Date</th>
<th>VIX Futures Volume</th>
<th>VIX Futures Open Interest</th>
<th>VIX Put Volume</th>
<th>VIX Call Volume</th>
<th>VIX Spot Close</th>
<th>SPX % Change</th>
<th>VIX % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-Feb-2011</td>
<td>67,975</td>
<td>162,568</td>
<td>194,002</td>
<td>312,444</td>
<td>20.8</td>
<td>-2.1%</td>
<td>26.6%</td>
</tr>
<tr>
<td>15-Mar-2011</td>
<td>97,329</td>
<td>194,201</td>
<td>344,810</td>
<td>819,042</td>
<td>24.32</td>
<td>-1.1%</td>
<td>15.1%</td>
</tr>
<tr>
<td>16-Mar-2011</td>
<td>97,113</td>
<td>210,276</td>
<td>209,433</td>
<td>632,075</td>
<td>29.4</td>
<td>-1.9%</td>
<td>20.9%</td>
</tr>
<tr>
<td>21-Mar-2011</td>
<td>34,510</td>
<td>174,952</td>
<td>70,255</td>
<td>247,098</td>
<td>20.61</td>
<td>1.5%</td>
<td>-15.7%</td>
</tr>
<tr>
<td>Average for Feb-Mar</td>
<td>44,159</td>
<td>177,734</td>
<td>137,088</td>
<td>288,920</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Past performance does not guarantee future results.
Impact of Adding Long VIX Futures or Options to a Traditional Portfolio During the 5-Month Period Aug. 2008 – Dec. 2008
From: "VIX Futures and Options: A Case Study of Portfolio Diversification During the 2008 Financial Crisis." The Journal of Alternative Investments (Fall 2009)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>VIX Futures or Options</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>VIX Futures or Options</td>
<td>-19.7%</td>
</tr>
<tr>
<td>2.5%</td>
<td>VIX Futures</td>
<td>-15.9%</td>
</tr>
<tr>
<td>10%</td>
<td>VIX Futures</td>
<td>-4.0%</td>
</tr>
<tr>
<td>3%</td>
<td>ATM VIX Call Options</td>
<td>20.8%</td>
</tr>
<tr>
<td>3%</td>
<td>25%-OTM VIX Call Options</td>
<td>97.2%</td>
</tr>
</tbody>
</table>

Please see disclaimers at paper at www.cboe.com/VIX
The UMass Study on Diversification with VIX Futures & Options

Portfolio with 10% allocation to VIX futures (in black) ended at $94.37.

Portfolio with no allocation to VIX futures ended at $85.18 (with 54% higher standard deviation).

Indexes and Diversification

Five Indexes Since Dec. 2005

- SPVIX M TR
- 30-Yr Tr
- S&P 500
- MSCI EAFE
- SPVIX S TR

(Dec. 31, 2005 - March 31, 2011)
Sources: CBOE and Bloomberg
### Historic Volatility for Select Products

Please read applicable prospectus; CBOE does not endorse funds.

<table>
<thead>
<tr>
<th></th>
<th>60 Days</th>
<th>360 Days</th>
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<tbody>
<tr>
<td><strong>Equity ETFs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDR</td>
<td>13.2</td>
<td>16.7</td>
</tr>
<tr>
<td>iShares Russell 2000</td>
<td>18.1</td>
<td>23.3</td>
</tr>
<tr>
<td>iShares MSCI Emerging Markets</td>
<td>20.4</td>
<td>24.5</td>
</tr>
<tr>
<td><strong>BuyWrite Products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PowerShares S&amp;P 500 BuyWrite Portfolio</td>
<td>PBP 10.1</td>
<td>13.1</td>
</tr>
<tr>
<td>Eaton Vance Enh Eq Inc Fd</td>
<td>EOI 10.3</td>
<td>18.7</td>
</tr>
<tr>
<td>iPath CBOE S&amp;P 500 BuyWrite Index ETN</td>
<td>BWV 10.9</td>
<td>13.0</td>
</tr>
<tr>
<td>NFJ Div., Int., &amp; Prem Str Fd</td>
<td>NFJ 11.0</td>
<td>16.3</td>
</tr>
<tr>
<td>Nuveen Eq Premium Fd</td>
<td>JPZ 11.0</td>
<td>17.5</td>
</tr>
<tr>
<td>First Trust/FiduAstMgt Fd</td>
<td>FFA 12.2</td>
<td>19.7</td>
</tr>
<tr>
<td>Madison/Claymore Covered Call Fd</td>
<td>MCN 12.8</td>
<td>18.1</td>
</tr>
<tr>
<td><strong>Volatility Products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProShares VIX Mid-term Futures ETF</td>
<td>VIXM 29.6</td>
<td>n/a</td>
</tr>
<tr>
<td>ProShares VIX Short-term Futures ETF</td>
<td>VIXY 55.1</td>
<td>n/a</td>
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<tr>
<td>iPath Inverse VIX Short-Term Futures ETN</td>
<td>XXV 9.6</td>
<td>n/a</td>
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<tr>
<td>iPath S&amp;P 500 Mid-term VIX Futures ETN</td>
<td>VXZ 30.3</td>
<td>29.4</td>
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<tr>
<td>iPath Inverse Jan. 2021 Short-Term Futures ETN</td>
<td>IVO 51.9</td>
<td>n/a</td>
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<td>iPath S&amp;P 500 Short-term VIX Futures ETN</td>
<td>VXX 54.3</td>
<td>131.9</td>
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<td>VelocityShares Daily Inverse VIX Short-Term ETN</td>
<td>XIV 56.0</td>
<td>n/a</td>
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<tr>
<td>iPath Long Enhanced VIX Mid-Term Futures ETN</td>
<td>VZZ 81.9</td>
<td>n/a</td>
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<tr>
<td>VelocityShares Daily 2X VIX Short-Term ETN</td>
<td>TVIX 107.4</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: Estimates from Bloomberg on April 25, 2011
Investors turn to options to hold gains while trimming losses

After the scalding they took from the financial crisis, more institutional investors are embracing options strategies both to lock in upside gains and limit downside losses.

"It’s been going on for some time, but lately there’s a lot more activity because of two things," said Terrence Ransford, director of trading for Northern Trust Securities, the broker/dealer subsidiary of Northern Trust Corp., Chicago.

"Money managers are extremely anxious to mitigate some of the volatility in their portfolios," he explained. "And when the VIX (the Chicago Board Options Exchange’s gauge of stock market volatility) was hitting new highs, the swings were so dramatic that many end clients — foundations, endowments, corporate pensions — all became interested in ways to manage volatility."

And these days, because there are "no returns anywhere," investors are looking to options strategies to scrape any alpha they can out of the stock market, Mr. Ransford added.

... tions. According to the minutes of the Indiana Public Employees’ Retirement Fund’s May board meeting, trustees approved a plan that would allow staff to write up to $500 million in notional value of call options on domestic equity indexes as a way to manage the $12 billion fund’s overweight position in domestic equities.

And in December, the board of the $4.6 billion San Bernardino (Calif.) County Employees’ Retirement Association approved a covered call strategy for its S&P 500 index mandate, which was valued at $230.3 million at the end of last month. The strategy is managed by State Street Global Advisors, Boston. According to meeting minutes, the reasons for implementing the strategy included: record premium income from selling the options and the association’s need for liquidity.
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