



*Three Decades of Options-Based
Benchmark Indices with
Premium Selling or Buying:
A Performance Analysis*

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Key Highlights

This study analyzes the performance of five option-based indices spanning a period of 30 years (June 30, 1986 – June 30, 2016), with comparisons to the risks and returns of asset classes typically found in the investment portfolios of institutions and individual investors. Highlights of our findings include the following:

- **Total Return:** Compared to a wide variety of asset classes, option-based indices offered above-average returns over the past 15 years; the BXMD and PUT indices consistently outperformed the U.S. Equity market over 30 years (*Exh. 2 and 3*).
- **Heat Map:** BXMD and PUT typically had above-average returns and were rarely among the lower performing indices representing a variety of asset classes (equities, fixed income and commodities).
- **Volatility:** Each of the five option-based indices had lower volatility than any other asset class included in the study other than fixed income, a traditionally low-volatility asset class (*Exh. 4*).
- **Downside Risk:** The maximum drawdown for the option indices over 30 years was 24% lower, on average, than for the S&P 500[®] Index. Income captured by option-selling strategies enhances returns and cushions downside risk (*Exh. 5*).
- **Risk-adjusted Return:** The BXMD and PUT indices were highest on the mean/variance Efficient Frontier. Compared to the S&P 500[®], all three option-writing strategies had superior Sharpe Ratios while both the BXMD and PUT indices had both a higher return *and* lower volatility (*Exh. 6 and 7*).
- **Tail Risk:** All three option-writing strategies had Sortino ratios equal to or better than the S&P 500[®], with more “Up” months (positive returns) and fewer “Down” months (negative returns) than the S&P 500[®] (*Exh. 7*).
- **Implied vs. Realized Volatility:** Implied Vol, as measured by the CBOE Volatility Index[®] (VIX[®]) exceeded Realized Vol in all but one of the past 18 years, rewarding option sellers. Average monthly gross premiums from writing options trended upward during the study period (*Exh. 8 and 9*).
- **Liquidity:** Average Daily Volume (notional) for S&P 500[®] options has quadrupled over the past 10 years and indicates sustained liquidity regardless of the level of market volatility (*Exh. 10*).
- **Implications for Plan Sponsors:** Analysis based on actual pension plan asset allocations indicate plan sponsors would have benefitted from the addition of index-based buy-write option strategies (*Exh. 11*).
- **Fund Analysis:** 14 Mutual Funds & ETFs that regularly use options had an average beta over 5 years of 0.7 (*Exh. 12*).

Index Descriptions

Exhibit 1

Ticker *	Description
BXM	<i>CBOE S&P 500 BuyWrite Index. Strategy that purchases stocks in the S&P 500 index and each month sells at-the-money SPX index call options.</i>
BXMD	<i>CBOE S&P 500 30-Delta BuyWrite Index. Covered call strategy that holds a long position indexed to the S&P 500 Index and sells monthly 30-delta out-of-the-money SPX index call options.</i>
CLLZ	<i>CBOE S&P 500 Zero-Cost Put Spread Collar Index. Strategy that (1) holds a long position indexed to the S&P 500 Index; (2) on a monthly basis buys a 2.5% - 5.0% SPX put option spread; and (3) sells a monthly out-of-the-money SPX call option to cover the cost of the put spread.</i>
PPUT	<i>CBOE S&P 500 5% Put Protection Index. Strategy that holds a long position indexed to the S&P 500 Index and buys a monthly 5% out-of-the-money SPX put option as a hedge.</i>
PUT	<i>CBOE S&P 500 PutWrite Index. Strategy that purchases Treasury bills and sells cash-secured at-the-money put options on the S&P 500 Index.</i>

**unless otherwise noted, all indices used in this presentation are Total Return indices (return includes price change + dividends/interest).*

Visit www.cboe.com/benchmarks to see full descriptions of methodologies of these indexes.

Since 2002, dozens of benchmark indices that use index options have been introduced. This study analyzes the performance of five indices above. The BXM Index was the initial major options-based benchmark index offered, and is probably the best known of all options-based benchmark indices.

Market Indices

Exhibit 1a

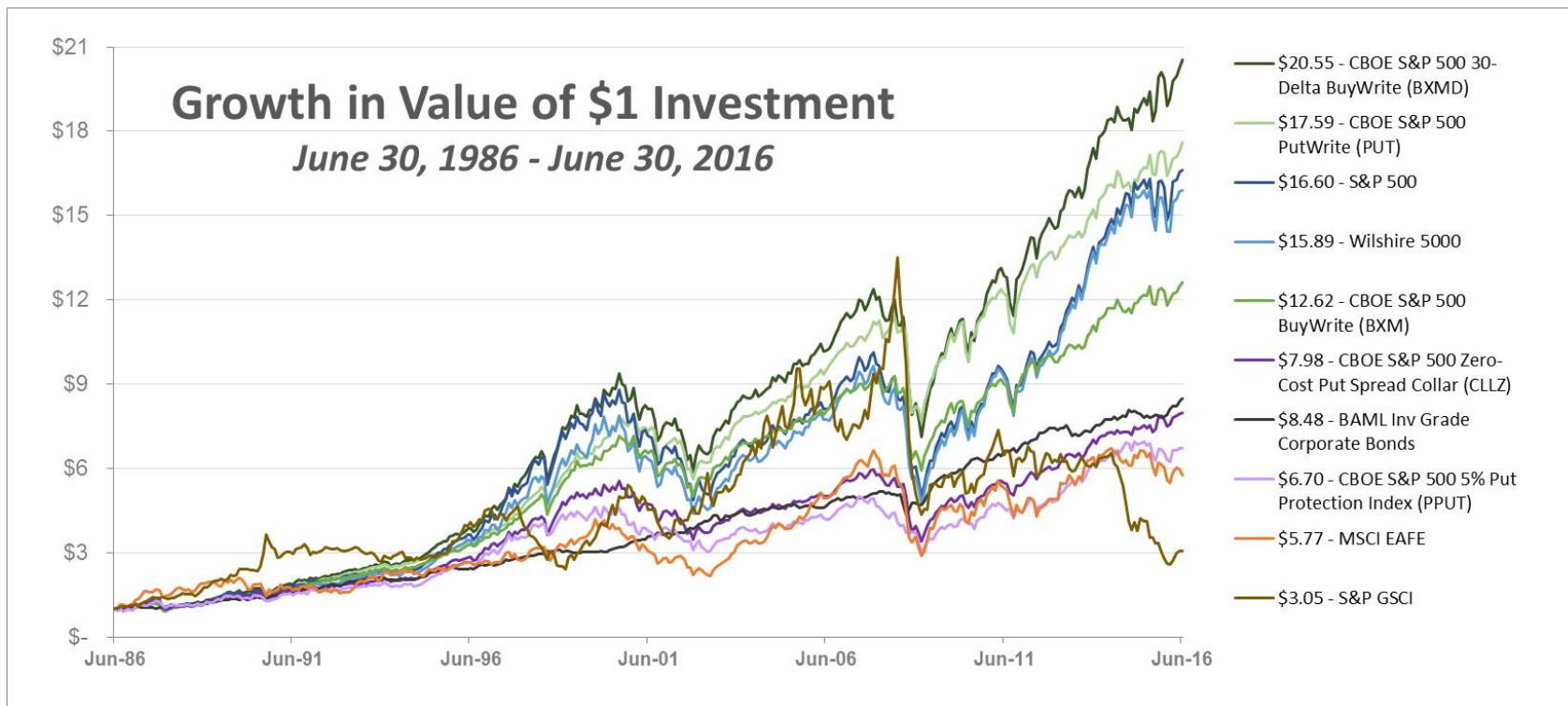
In addition to the S&P 500[®] index, which represents the performance of Large-Cap U.S. Equities, the analysis includes the following additional indices that reflect other key asset classes that form a typical investor's opportunity set.

Index Name *	Description
Wilshire 5000[®]	<i>measures the performance of all U.S. equity securities with readily available price data (including large-cap, mid-cap, small-cap and some micro-cap stocks).</i>
MSCI EAFE[®] (US\$)	<i>represents the performance in USD of large- and mid-cap securities across 21 developed markets, including countries in Europe, Australasia and the Far East, excluding the U.S. and Canada.</i>
Bank of America Merrill Lynch (BAML) Investment Grade Corporate Bond Index	<i>tracks the performance of investment grade, USD-denominated, publicly issued corporate bonds with maturities > 1 year.</i>
Citigroup 10-year Treasury	<i>shows the total return from investing in a constant-maturity 10-year Treasury security.</i>
S&P GSCI[®]	<i>a broad-based, production weighted index representing the global commodity markets, constructed from the most liquid commodity futures.</i>

**unless otherwise noted, all indices used in this presentation are Total Return indices.*

Benchmark Indexes Over 30 Years

Exhibit 2



Selected Indices - Returns since 2007	2007	2008	2009	2010	2011	2012	2013	2014	2015
CBOE S&P 500 30-Delta BuyWrite Index	6.22%	-31.25%	32.12%	11.25%	7.25%	11.03%	19.13%	6.17%	3.99%
CBOE S&P 500 PutWrite Index	9.51%	-26.77%	31.51%	9.02%	6.17%	8.14%	12.28%	6.38%	6.40%
S&P 500 Total Return	5.49%	-37.00%	26.46%	15.06%	2.11%	16.00%	32.39%	13.69%	1.38%

Over the past 30 years, two option-based indices that **sold** index options (BXMD and PUT) had higher returns than the US Equity market (both large cap and total market), and higher than option-based indices that **bought** index put options (CLLZ and PPUT). The BXMD and PUT indices have produced strong returns since the 2008 Financial Crisis but lagged the S&P 500 in 2012-2013 when equities surged.

Past performance is not predictive of future returns. Sources: Bloomberg, CBOE, St. Louis Federal Reserve Bank and Wilshire Associates. Please read important disclosures on Slide 17 and at www.cboe.com/benchmarks.

Asset Class Relative Performance

Exhibit 3

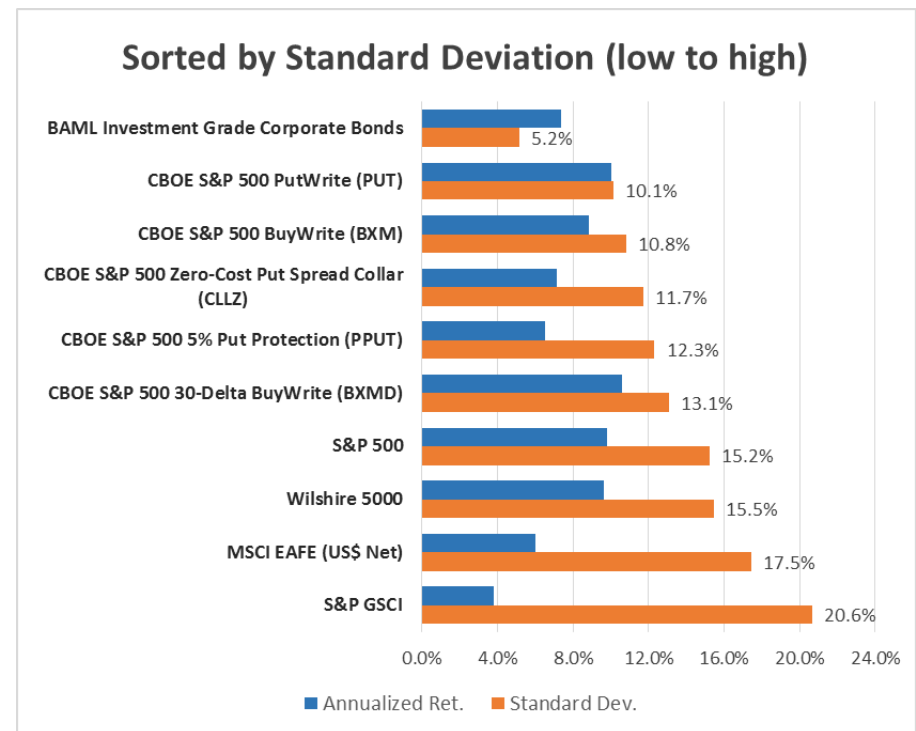
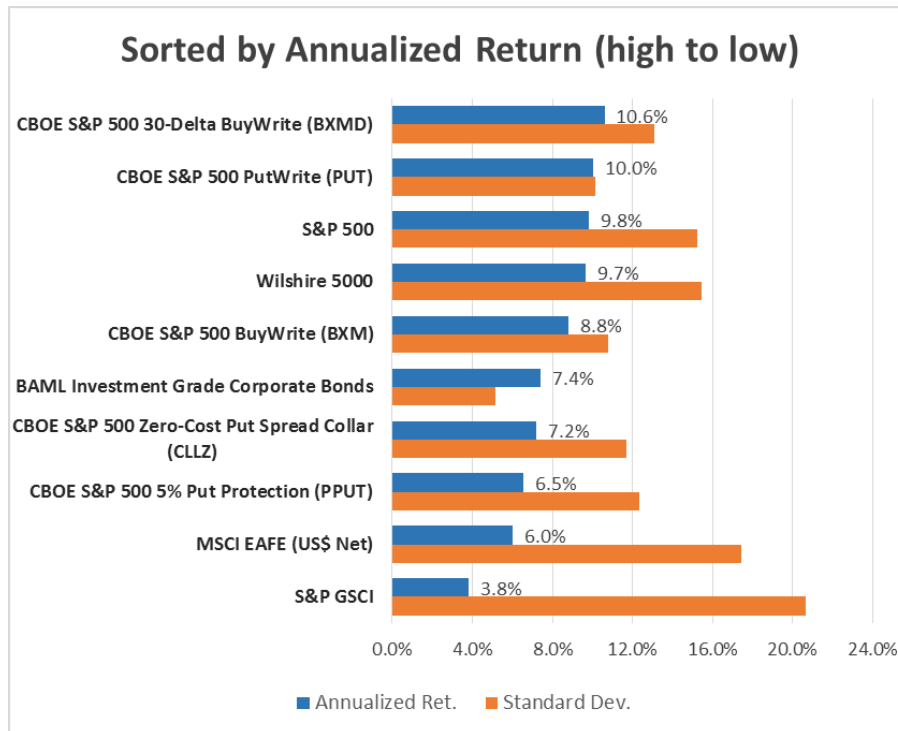
	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>
CBOE S&P 500 BuyWrite (BXM)	-10.9%	-7.6%	19.4%	8.3%	4.2%	13.3%	6.6%	-28.7%	25.9%	5.9%	5.7%	5.2%	13.3%	5.6%	5.2%
CBOE S&P 500 30-Delta BuyWrite (BXMD)	-8.9%	-13.2%	25.9%	10.4%	5.0%	17.8%	6.2%	-31.3%	32.1%	11.2%	7.3%	11.0%	19.1%	6.2%	4.0%
CBOE S&P 500 PutWrite (PUT)	-10.6%	-8.6%	21.8%	9.5%	6.7%	15.2%	9.5%	-26.8%	31.5%	9.0%	6.2%	8.1%	12.3%	6.4%	6.4%
CBOE S&P 500 Zero-Cost Put Spread Collar (CLLZ)	-10.1%	-16.0%	18.0%	6.2%	3.0%	13.9%	4.4%	-31.7%	24.7%	6.7%	3.1%	11.1%	16.4%	4.2%	2.0%
CBOE S&P 500 5% Put Protection (PPUT)	-2.1%	-17.6%	19.3%	6.0%	2.3%	12.3%	-0.5%	-20.1%	8.7%	11.7%	-1.4%	10.0%	27.1%	11.2%	-5.1%
S&P 500	-11.9%	-22.1%	28.7%	10.9%	4.9%	15.8%	5.5%	-37.0%	26.5%	15.1%	2.1%	16.0%	32.4%	13.7%	1.4%
MSCI EAFE (US\$ Net)	-21.4%	-15.9%	38.6%	20.2%	13.5%	26.3%	11.2%	-43.4%	31.8%	7.8%	-12.1%	17.3%	22.8%	-4.9%	-0.8%
BAML Invest. Grade Corporate Bonds	8.4%	10.0%	9.1%	5.1%	4.6%	0.9%	5.8%	-7.6%	21.8%	7.6%	9.6%	7.2%	1.0%	8.5%	-2.9%
S&P GSCI	-31.9%	32.1%	20.7%	17.3%	25.6%	-15.1%	32.7%	-46.5%	13.5%	9.0%	-1.2%	0.1%	-1.2%	-33.1%	-32.9%

This “heat map” uses color to rank returns across asset class by year (within each column). Over the past 15 years, option-writing strategies, particularly the BXMD and PUT strategies, typically had above-average returns and were rarely among the lower-performing asset classes. Other asset classes were occasionally top performers but also were ranked at or near the bottom more than once.

Returns and Volatility

Exhibit 4

June 30, 1986 - June 30, 2016

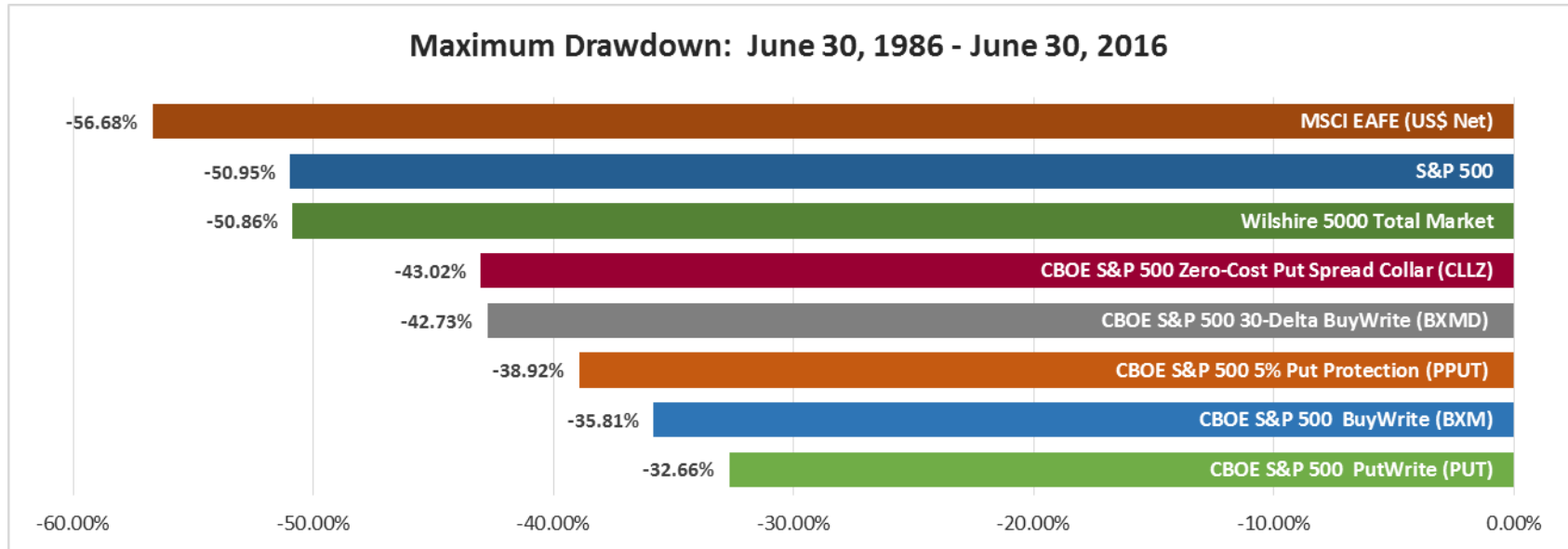


Over 30 years, the volatility of all five option-based indices was lower than for the equity and commodity indices; only the bond market index volatility was lower. The PUT and BXM Indexes, which write at-the-money (ATM) options, were the least volatile of the equity-based indices.

Even with their relatively low volatilities, option-writing strategies delivered strong returns over this period. The BXMD and PUT indices had the highest annualized returns across all indices, which represent a wide spectrum of asset classes.

Maximum Drawdowns

Exhibit 5

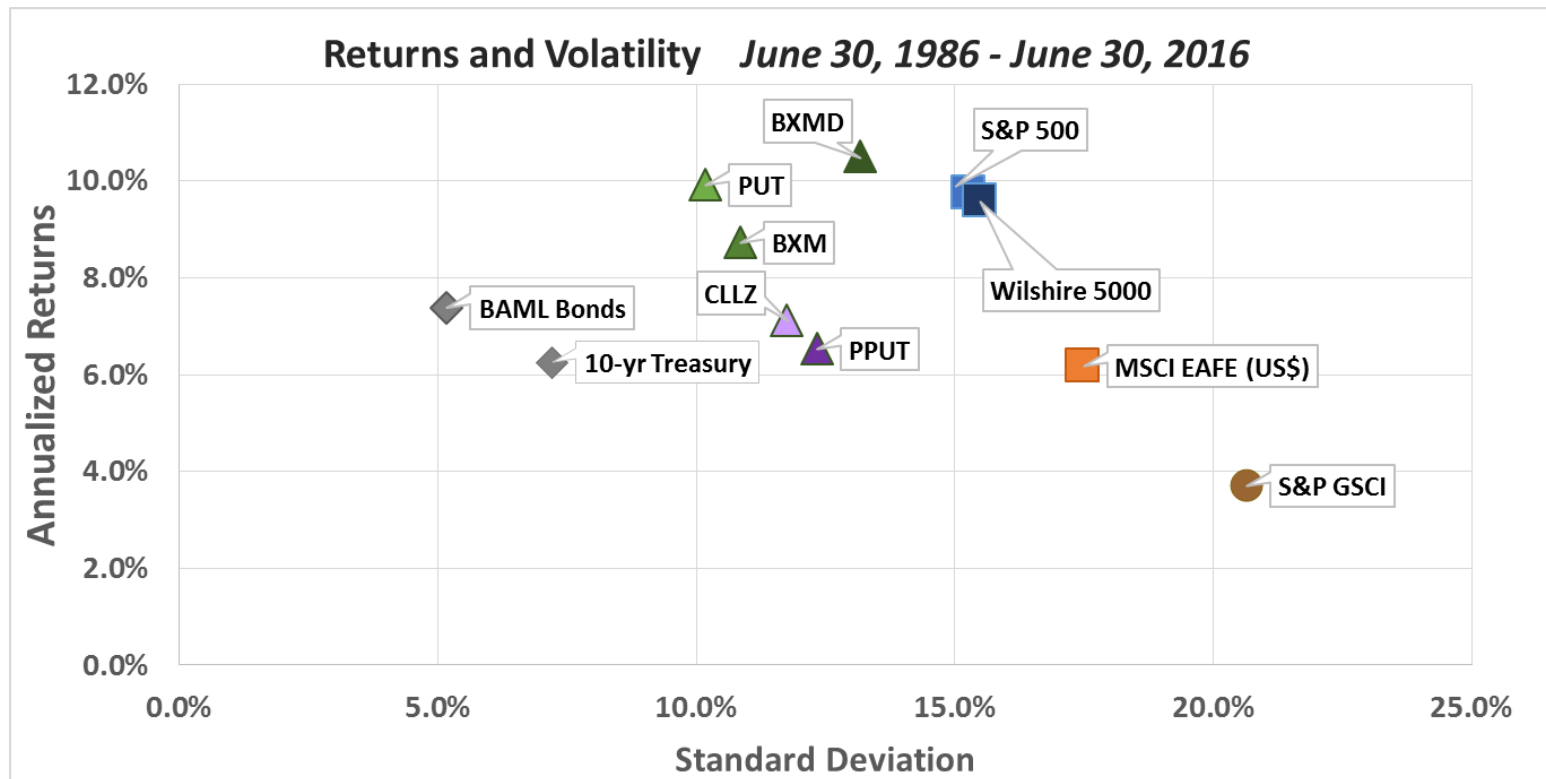


	CBOE S&P 500 PutWrite (PUT)	CBOE S&P 500 BuyWrite (BXM)	CBOE S&P 500 5% Put Protection (PPUT)	CBOE S&P 500 30-Delta BuyWrite (BXMD)	CBOE S&P 500 Zero-Cost Put Spread Collar (CLLZ)	Wilshire 5000 Total Market	S&P 500	MSCI EAFE (US\$ Net)
Max. Drawdown	-32.66%	-35.81%	-38.92%	-42.73%	-43.02%	-50.86%	-50.95%	-56.68%
Max. Drawdown Begin Date	Jun-08	Jun-08	Jun-07	Nov-07	Nov-07	Oct-07	Nov-07	Nov-07
Max. Drawdown End Date	Feb-09	Feb-09	Feb-09	Feb-09	Feb-09	Feb-09	Feb-09	Feb-09
Max. Drawdown Length	9	9	21	16	16	17	16	16
Max. Drawdown Recovery Date	Nov-10	Dec-11	Jan-13	Jan-11	Aug-12	Dec-12	Mar-12	Jun-14

Over 30 years, the worst peak-to-trough drawdowns were smaller for option-based indices than for equity market indices. PUT and BXM index max drawdowns were short-lived.

Efficient Frontier

Exhibit 6



BXMD - CBOE S&P 500 30-Delta BuyWrite Index
BXM - CBOE S&P 500 BuyWrite Index
PUT - CBOE S&P 500 PutWrite Index

CLLZ - CBOE S&P 500 Zero-Cost Put Spread Collar
PPUT - CBOE S&P 500 5% Put Protection Index

In a three-decade analysis of the indexes above, the BXMD and PUT indexes had the strongest risk-adjusted returns of the equity-related investments in this study.

Risk & Return Metrics

Exhibit 7

June 30, 1986 - June 30, 2016

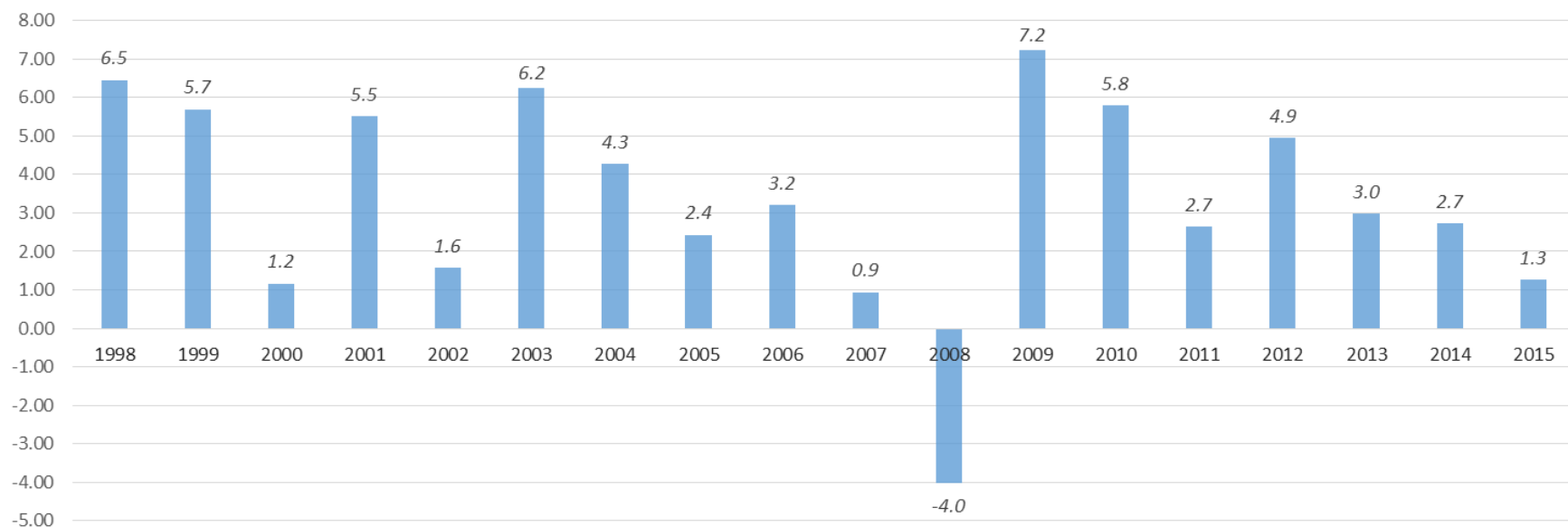
	CBOE S&P 500 BuyWrite (BXM)	CBOE S&P 500 30-Delta BuyWrite (BXMD)	CBOE S&P 500 PutWrite (PUT)	CBOE S&P 500 Zero-Cost Put Spread Collar (CLLZ)	CBOE S&P 500 5% Put Protection (PPUT)	S&P 500	Wilshire 5000	MSCI EAFE (US\$ Net)	BAML Inv Grade Corporate Bonds	S&P GS Commodities
Annualized Return	8.82%	10.60%	10.03%	7.17%	6.55%	9.82%	9.66%	6.02%	7.38%	3.79%
Standard Deviation	10.81%	13.11%	10.13%	11.71%	12.32%	15.24%	15.45%	17.46%	5.18%	20.64%
Auto-correlation	0.09	0.05	0.13	0.05	-0.04	0.04	0.08	0.08	0.18	0.18
Max. Drawdown	-35.81%	-42.73%	-32.66%	-43.02%	-38.92%	-50.95%	-50.86%	-56.68%	-16.07%	-80.90%
Skew	-1.54	-1.09	-2.10	-1.10	-0.25	-0.79	-0.91	-0.39	-0.79	-0.19
Kurtosis	6.24	3.76	9.70	3.75	0.47	2.42	2.80	0.90	4.15	1.95
# of Up months	253	237	272	231	216	232	228	208	248	201
# of Down months	106	123	88	129	144	128	132	152	112	159
(Jensen's) Ann. Alpha	1.16%	1.71%	2.74%	-1.05%	-1.61%	-	0.00%	-1.79%	3.98%	0.86%
Leland's Annual Alpha	0.90%	1.58%	2.30%	-1.12%	-1.21%	-	-0.16%	-2.44%	3.91%	-0.51%
Beta	0.63	0.82	0.56	0.74	0.74	-	1.00	0.80	-0.01	0.23
Leland's Beta	0.66	0.84	0.61	0.75	0.68	1.00	1.01	0.89	-0.01	0.41
Sharpe Ratio	0.48	0.53	0.63	0.31	0.24	0.40	0.39	0.14	0.74	0.02
Sortino Ratio	0.75	0.89	0.91	0.55	0.51	0.75	0.72	0.37	1.25	0.20
Correl. to S&P 500	0.89	0.95	0.84	0.96	0.92	1.00	0.99	0.70	-0.04	0.17

All three option-writing strategies (BXM, BXMD and PUT) provided a superior mean-variance risk/return profile versus the S&P 500 over the past 30 years, as measured by their Sharpe ratios, due to the lower volatility that results from premiums earned from writing options and/or the options' protection against large market moves. The BXMD index had a higher return **and** lower volatility than the S&P 500 index over the past 30 years. Although returns for the option-based strategies are more negatively skewed with fatter tails (kurtosis) than the S&P 500's returns, Sortino ratios (which focus on downside risk) are favorable for option-writing strategies, which also have more "Up" and fewer "Down" months than the S&P 500.

Implied > Realized Volatility Rewards Sellers

Exhibit 8

Implied Volatility (VIX) Minus Subsequent S&P 500 Realized Volatility
1998 - 2015 (Average Per Year)



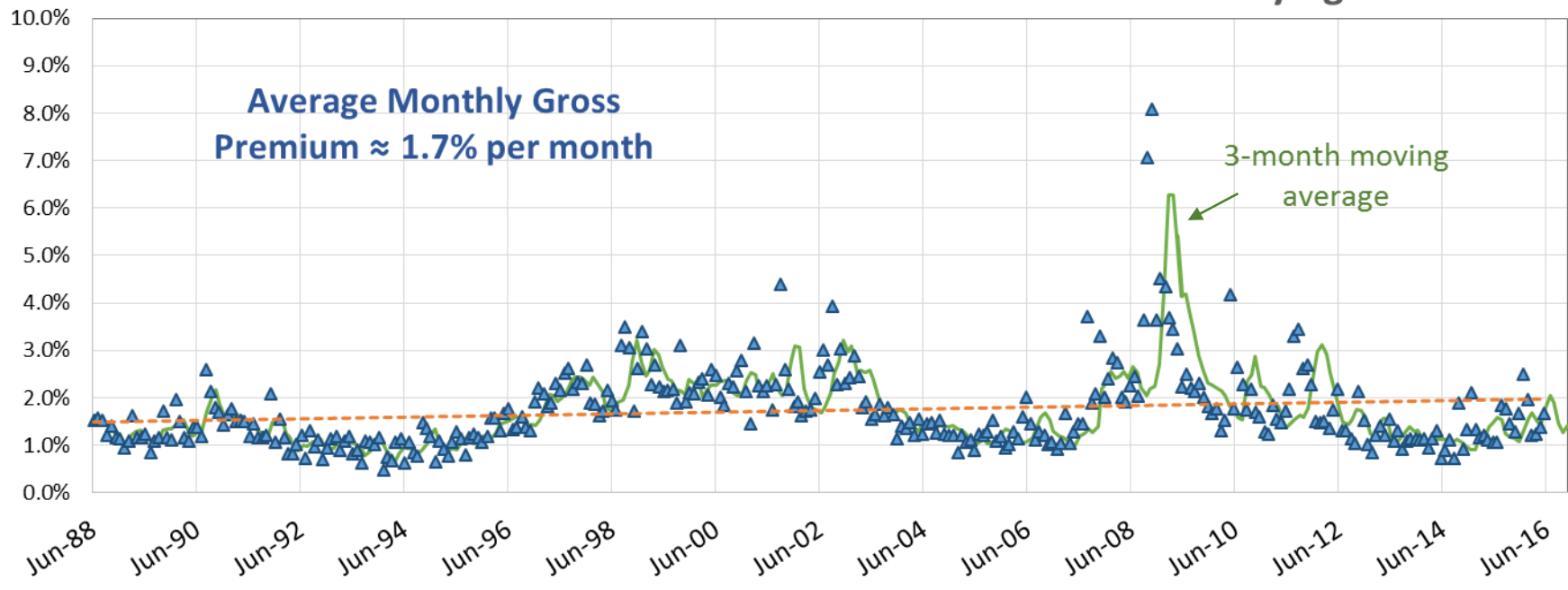
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Implied Volatility (VIX)	25.6	24.4	23.3	25.7	27.3	22.0	15.5	12.8	12.8	17.5	32.7	31.5	22.5	24.2	17.8	14.2	14.2	16.7
Realized Vol (S&P 500)	19.1	18.7	22.1	20.2	25.7	15.7	11.2	10.4	9.6	16.6	36.7	24.2	16.7	21.6	12.9	11.2	11.5	15.4

Implied Volatility (as measured by the VIX) usually exceeds the realized volatility of the S&P 500. This suggests a strategy of writing covered calls will often be profitable, as the option premium increases with implied volatility but the likelihood of call exercise is a function of realized volatility. Over the past 18 years, 2008 was the only year in which, on average, realized volatility exceeded implied volatility. In the 30 years covered by this study, the option-selling indices (BXMD, PUT, and BXM) all had much higher returns than the PPUT and CLLZ option-buying indices.

Monthly Gross Premiums Received

Exhibit 9

BXM Index - Monthly Gross Premiums
Gross amount* received as a % of the underlying

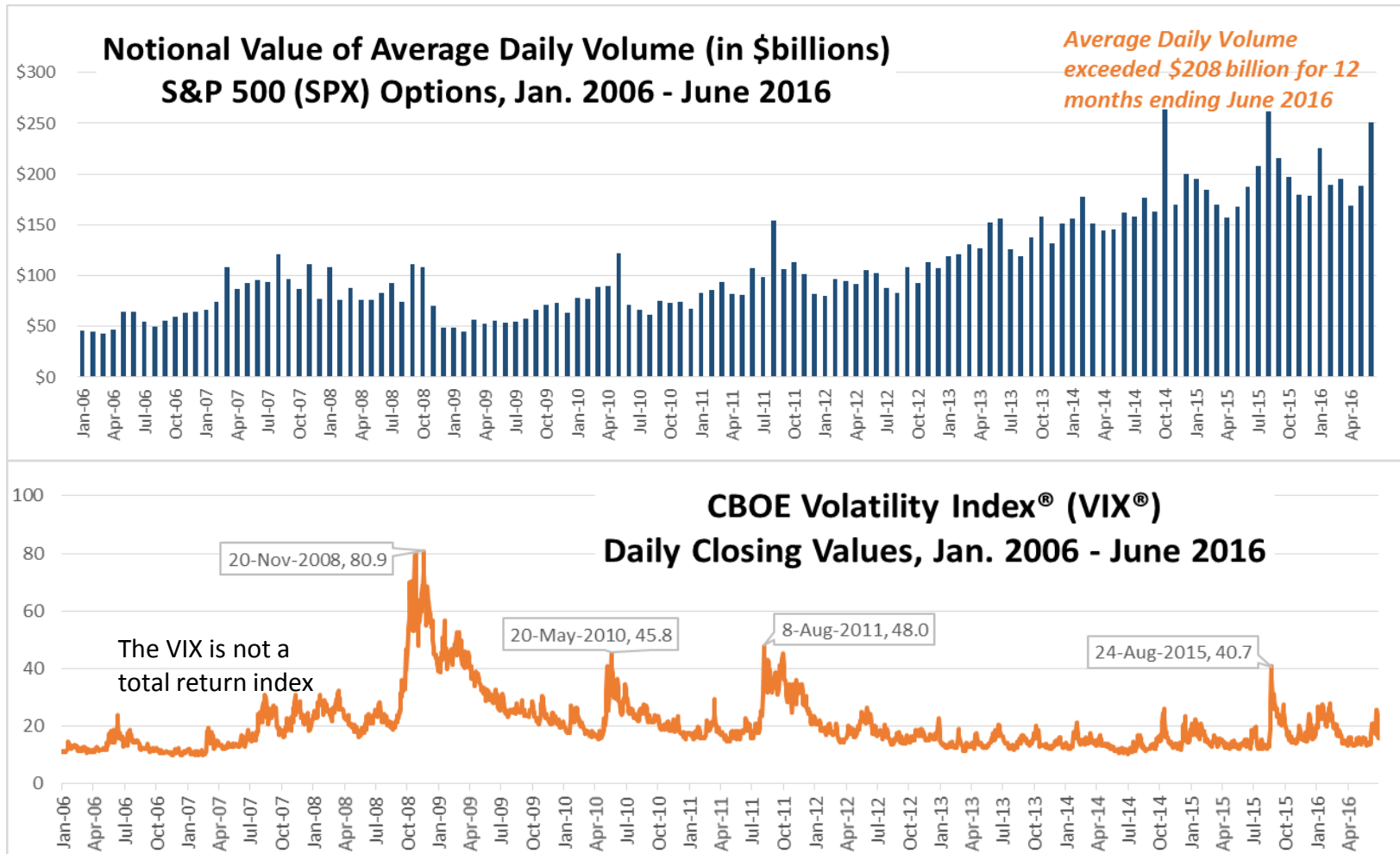


Note that these are Gross Premiums. Net returns will typically be smaller for a Buy-Write strategy. www.cboe.com/benchmarks

Monthly gross premiums as a % of the underlying increased during periods of high market volatility (“dot-com” boom/bust and 2008 Financial Crisis) but soon returned to normal levels. The 3-month moving average shows the short-term trend within individual monthly values, while the long-term trend line shows the average monthly premium has increased from approx. 1.5% to 2.0% since June 1988.

Market Capacity and Trading Volume

Exhibit 10



Notional value of average monthly trading volume in SPX Options has grown significantly over the past 10½ years; it was 4.5x greater in Q1 2016 versus Q1 2006. Trading volume shows SPX option liquidity is strong regardless of the level of the VIX, indicating market depth is sustained regardless of volatility spikes or lulls.

Metrics with Pension Plan Allocations

Exhibit 11

Using average asset allocations from actual pension plan holdings, we estimate the impact on average large and small public pension plan return profiles from reallocating 20% of assets to one of three option-writing strategies.¹

LARGE PUBLIC PENSION PLANS	39% S&P500 + 16% EAFE + 25% US Fixed Inc + 15% Commdty + 5% Cash	29% S&P500 + 16% EAFE + 25% US Fixed Inc + 5% Commdty + 5% Cash + 20% BXMD	29% S&P500 + 16% EAFE + 25% US Fixed Inc + 5% Commdty + 5% Cash + 20% BXM	29% S&P500 + 16% EAFE + 25% US Fixed Inc+ 5% Commdty + 5% Cash + 20% PUT
Annualized Return	8.02%	8.61%	8.25%	8.49%
Standard Deviation	9.35%	9.45%	8.93%	8.76%
Maximum Drawdown	-40.81%	-38.98%	-37.58%	-36.75%
Skew	-0.85	-0.89	-0.99	-1.05
Kurtosis	2.78	2.64	3.08	3.43
# of Up/Down months	232/128	241/119	240/120	242/118
(Jensen's) Annual Alpha	0.84%	1.09%	0.98%	1.30%
Beta	0.55	0.59	0.55	0.54
Sharpe Ratio	0.47	0.53	0.52	0.56
Sortino Ratio	0.81	0.89	0.86	0.91

SMALL PUBLIC PENSION PLANS	49% S&P500 + 12% EAFE + 30% US Fixed Inc + 5% Commdty + 4% Cash	34% S&P500 + 12% EAFE + 25% US Fixed Inc + 5% Commdty + 4% Cash + 20% BXMD	34% S&P500 + 12% EAFE + 25% US Fixed Inc + 5% Commdty + 4% Cash + 20% BXM	34% S&P500 + 12% EAFE + 25% US Fixed Inc + 5% Commdty + 4% Cash + 20% PUT
Annualized Return	8.56%	8.80%	8.44%	8.69%
Standard Deviation	9.39%	9.61%	9.08%	8.90%
Maximum Drawdown	-39.09%	-39.15%	-37.75%	-36.93%
Skew	-0.77	-0.89	-0.99	-1.05
Kurtosis	2.28	2.65	3.10	3.44
# of Up/Down months	234/126	243/117	245/115	243/117
(Jensen's) Annual Alpha	1.02%	1.16%	1.06%	1.37%
Beta	0.59	0.61	0.57	0.56
Sharpe Ratio	0.53	0.54	0.53	0.57
Sortino Ratio	0.90	0.91	0.88	0.93

Results show both large and small Plans would have benefitted from an allocation to these option-based strategies, as indicated by improved Sharpe and Sortino ratios and/or smaller maximum drawdowns.

¹ Using monthly returns, June 30, 1986 – June 30, 2016

Option-based Funds with 5-year History

Exhibit 12

Results from 13 Mutual Funds & ETFs using Option-based Strategies with 5-year return history

	--- TOTAL ANNUALIZED RETURN ---					BETA	--- SHARPE RATIO ---			STANDARD DEVIATION		
	2011	2012	2013	2014	2015		5 yrs	3 yrs	1 yr	5 yrs	3 yrs	1 yr
Average	3.0	5.6	13.2	4.1	-0.5	0.7	0.6	0.6	-0.4	7.0	6.2	7.7
Maximum	8.2	13.9	29.4	6.0	7.1	1.0	1.0	1.0	0.8	10.6	9.5	11.2
Minimum	-4.1	-3.4	-1.4	-0.2	-13.8	0.4	-0.5	-0.8	-2.9	4.1	3.4	2.5
Std. Dev.	3.9	4.1	6.7	1.9	5.8	0.1	0.4	0.5	1.0	1.9	1.6	2.4

Source: Bloomberg, July 25, 2016

At least 30 Mutual Funds and ETFs use options as a key feature of their investment strategies. Typically, the stated objective of these Funds is to capture the majority of equity market returns while taking less risk and/or generating additional income compared to other equity investments. The table above shows some statistics for the 13 funds in this category that have a five-year track record.

Implementation of these strategies varies considerably. Some funds buy and/or write index options only, others use individual stock options. Some primarily write covered calls, others buy and/or write both puts and calls. Some invest in large cap stocks, others in mid-cap, most with some degree of active management; some are highly leveraged. For these reasons, there is wide variation in their results. For example, while the average of these 13 funds' annualized returns over the past 5 years was 3.0, the standard deviation around that average was 3.9, indicating that 2/3rds of the Funds has 5-year returns between -0.9 and +6.9.

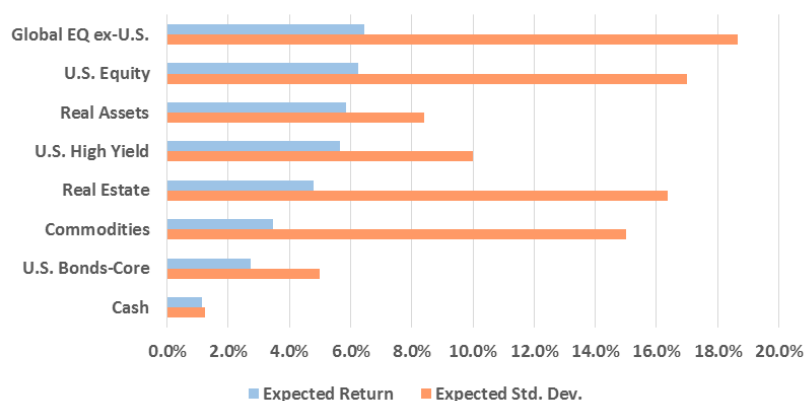
Looking forward...

Exhibit 13

Capital Markets forecasts for traditional asset classes and historical relationships between equity markets and option-based strategies are used to project plausible future return and risk measures for option-based indices.

INDEX	CBOE S&P 500 BuyWrite (BXM)	CBOE S&P 500 30-Delta BuyWrite (BXMD)	CBOE S&P 500 PutWrite (PUT)	CBOE S&P 500 Zero-Cost Put Spread Collar (CLLZ)	CBOE S&P 500 5% Put Protection (PPUT)	S&P 500	MSCI EAFE (US\$ Net)	S&P GSCI
Forecast *								
Annualized Return	5.33%	6.51%	5.97%	4.45%	4.14%	6.25%	6.45%	3.45%
Std. Deviation	12.6%	14.9%	12.8%	13.0%	13.0%	17.0%	18.7%	15.0%
Sharpe Ratio	0.33	0.36	0.38	0.25	0.23	0.30	0.28	0.15
Historical measures								
Annualized Return	9.47%	11.57%	10.61%	7.92%	7.35%	11.11%	7.65%	6.03%
Beta (past 30 yrs)	0.63	0.82	0.56	0.74	0.74	1.00	0.80	0.23
Beta (past 10 yrs)	0.66	0.83	0.65	0.73	0.66	1.00	1.08	0.78
Std. Dev. (30 yrs)	10.8%	13.1%	10.1%	11.7%	12.3%	15.2%	17.5%	20.6%
Std. Dev. (10 yrs)	11.4%	13.4%	11.5%	11.7%	11.7%	15.3%	18.5%	23.7%

Capital Markets Assumptions - 10 yrs, annualized



Although equity market returns are expected to be significantly lower over the next ten years compared to historical returns, these projections show the option-writing strategies may offer superior risk/return profiles over the next 10 years, with lower standard deviations and higher Sharpe ratios than projected for the U.S. equity market.

* Expected return and standard deviation capital markets forecasts for 2015-2025, provided by Wilshire Associates.

Past performance is not predictive of future returns. Sources: Bloomberg, CBOE. Please read important disclosures on Slide 17 and at www.cboe.com/benchmarks.

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