NEUBERGER BERMAN

DEREK DEVENS, CFA®
Portfolio Manager

RORY EWING
Associate Portfolio Manager

BERYL LOU
Research Analyst

ERIC ZHOU
Associate Portfolio Manager

Index Option Writing Strategy Benchmarks

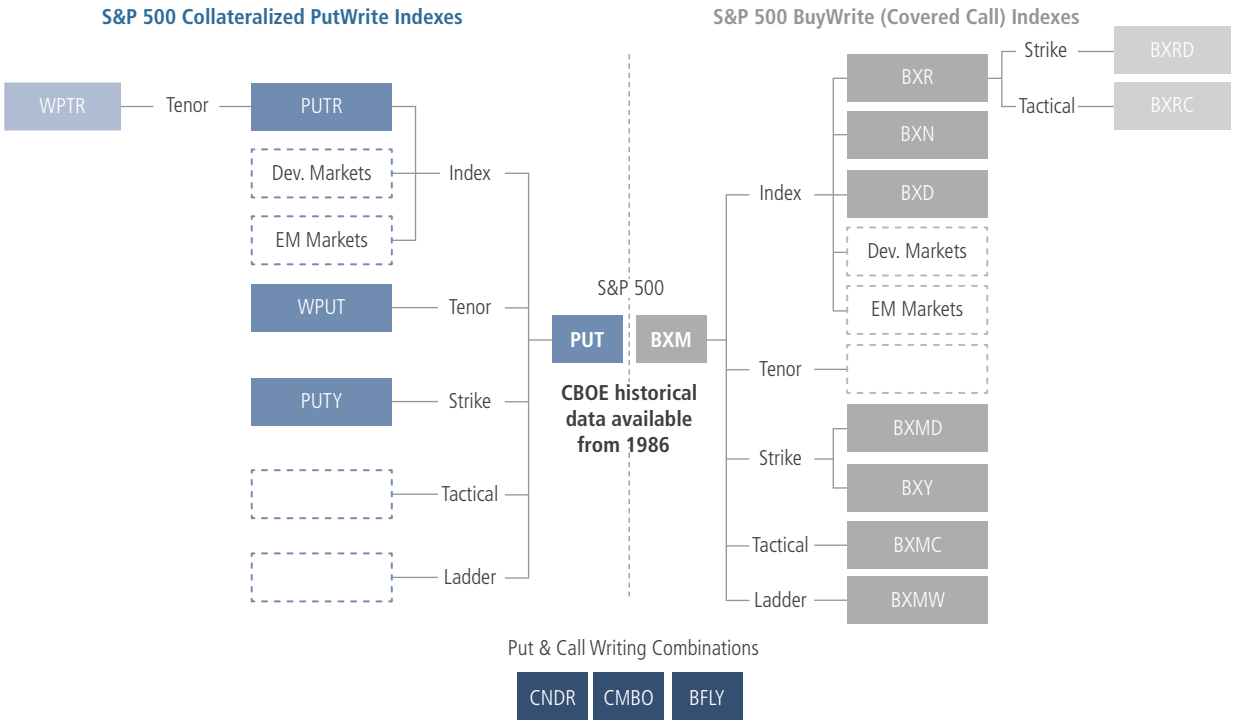
"What's measured, improves" – Peter Drucker

The growing adoption of index option writing strategies by institutions, consultants, advisors and individuals motivates us to share our thoughts on the current state of benchmarking option strategy performance. Despite the inherent 'structured' payoffs of option strategies, their diversity and flexibility can be both blessings and curses for allocators, particularly in years like 2018. While no easy answers exist, the 'options' for benchmarking risk and performance of option strategies continue to expand and evolve toward the benchmarking standards of more widely accepted alternative asset classes.

Just as investors solved for hedge funds' risk and performance measurement challenges with innovations like the composite manager indexes offered by Hedge Fund Research Inc. ("HFRI") or the development of multi-factor performance indexes, investors are solving for similar challenges inherent in option strategies. Hence, we believe a broader appreciation for and understanding of the nuances of index option writing strategies will empower investors with the investment context that is essential to long-term asset allocation inclusion. A reduction in relative performance 'mysteries' helps solve one of the bigger challenges for option strategies which, in turn, will create the potential for increased adoption of option strategies in a variety of portfolio contexts.

The Challenges of a Growing Family

The CBOE's universe of currently published and 'planned' option writing strategy indexes is the industry standard for option benchmarks. Our 'family tree' below attempts to provide a holistic view of the CBOE's off-the-shelf indexes and how they relate to each other. At the highest level, we divide the index option writing universe between putwrite and buywrite (covered call) strategies, which conveniently coincides with the natural dichotomy of put/call parity. As a baseline, we begin with two of the CBOE's cornerstone option strategy indexes that maintain S&P 500 Index exposures and branch out from there. For full index definitions, please refer to the Appendix.



For illustration purposes only, please see Appendix for official index names, definitions and additional descriptions of each index ticker listed above.
Note, this is not a comprehensive list of CBOE option strategy indexes. There are versions of indexes listed above that only vary by price calculation methods, e.g. volume weighted average prices versus time weighted average price, or by the timing of exposure rolling. We deem these indexes as too granular for this discussion as they are most relevant for providers of swaps and other products that require replication of one of the strategy indexes listed above.

The above illustration demonstrates not only a clear historical preference for the development of buywrite (covered call) indexes (10 out of 15 indexes), but also highlights the symmetry and unique degrees of freedom of index option writing strategies—index exposure, tenor (time to expiration), strike price selection, tactical exposure and diversification (laddered exposure). In our minds, option writing strategy index universes are already leaning toward more closely resembling common fixed income index universes that delineate along structural characteristics, e.g., strategy, credit rating, constant maturity or duration. CBOE offers a broad representation of strategy indexes (putwrite, buywrite, condor, risk reversals, collars), but its offering is relatively limited in scope across variations such as country or regional exposure, strike selection methodology and tenor (expiration) exposures.

Ironically, while the CBOE has been ahead of its time by launching a variety of buywrite indexes that should allow buywrite managers to be specific in choosing their benchmark, the vast majority of buywrite (covered call) strategies still benchmark to the at-the-money CBOE S&P 500 BuyWrite (BXM) Index even though most buywrite strategies are managed as out-of-the-money—they write call options with strikes well above current prices to preserve some upside participation. But, when we compare results over the longest-common period, shown below, it probably doesn't surprise the reader to learn that BXM has materially lagged the CBOE's out-of-the-

money buywrite strategy indexes (BXMD, BXY), which suggests a classic example of option managers taking credit for 'beta' exposure. To be fair, other buywrite benchmark options may not have been available at the time of strategy inception. However, over the longer term, we believe many option strategies will be forced to report improved assessments of performance and risk, especially when the future underlying market returns may prove more volatile and less biased to the upside.

Jan 1990 to Dec 2018 (monthly data)	Annual Total Return	Annual Volatility	Annual TE (%) to S&P 500	Beta to S&P 500	Correl. to S&P 500
S&P 500 Index ("SPX")	9.29	14.24	–	–	–
CBOE S&P 500 BuyWrite Index ("BXM")	8.14	10.11	7.24	0.62	0.88
CBOE S&P 500 30-Delta BuyWrite Index ("BXMD")	**9.59**	**12.31**	**4.62**	**0.82**	**0.95**
CBOE S&P 500 2% OTM BuyWrite Index ("BXY")	**9.26**	**11.86**	**5.22**	**0.78**	**0.94**

Source: Bloomberg, CBOE Gross of fees. The CBOE index performance includes historical backtested data published by the CBOE that pre-dates the launch date of its indexes.

To date, a lack of country or regional focused option writing indexes is the most limiting for those in pursuit of comprehensive benchmarks for index option strategies. Having managed a global put writing strategy since 2011, we are keenly aware of this. Based on our understanding, we expect progress to continue at a slow but steady pace as option index solutions require both viable index option listings with adequate trading history and the economic cooperation between underlying index providers, e.g., S&P 500, Russell, MSCI and the option exchanges, e.g., CBOE, EUREX.

Case in point, during the drafting of this paper, the CBOE announced a new partnership with MSCI to create, among other indexes, option strategy indexes based on the MSCI EAFE and MSCI Emerging Markets indexes, and it launched PUTY, a 2% out-of-the-money S&P 500 put writing index. While many details and historical data sets are still forthcoming for the new index offerings, we cannot overstate the importance of having a generally accepted and accessible suite of option strategy indexes to aid in the adoption of option writing strategies into long-term strategic portfolio allocations.

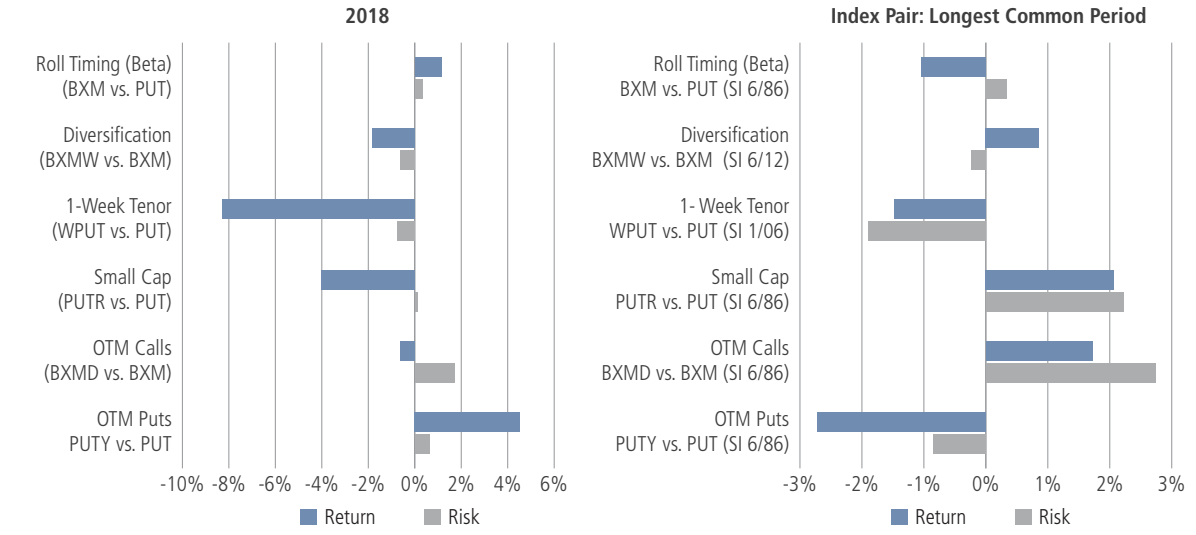
Butterfly Effects along the Trail of Path Dependence

As noted earlier, option strategy index results can be heavily influenced by the slightest differences in implementation—that is to say they can suffer from 'butterfly effects'.[1] For example, simply choosing to ladder monthly option writing across four Friday expirations (BXMW) versus concentrating exposure on every third Friday (BXM) detracted over 180bps of performance in 2018. A more extreme example is the 2018 performance differential between the PUT and WPUT indexes. Simply writing one-week S&P 500 index put options (WPUT) versus writing one-month index put options (PUT) resulted in over 800 basis points of return difference during the year (chart below). Both are relatively small implementation differences that yielded material performance dispersion.

One of the convenient virtues of the CBOE's index option writing strategy index universe is that many of the indexes only differ from PUT or BXM by one or two characteristics. This makes it easy for us to objectively quantify and illustrate the potentially material impacts of small strategy differences on risk/return and the overall degree of path dependence for a particular option writing strategy.

[1] In reference to a concept of chaos theory in which small changes in a complicated system can have outsized effects elsewhere in the system.

IMPLEMENTATION DIFFERENCES: RELATIVE PERFORMANCE & RISK ESTIMATES
(CBOE Index Pairs)



Source: Neuberger Berman analysis, Bloomberg LP, CBOE. The CBOE index performance includes historical backtested data published by the CBOE that pre-dates the launch date of its indexes.

Specifically, we estimate the risk and return impacts of different option writing parameters/methodologies by netting the performance of selected CBOE index pairs. Without these indexes, estimating such impacts can be quantitatively challenging given the variability and path dependence involved with even the least complex option strategies. Being able to estimate their impacts on returns and risk (volatility) is extremely helpful in discussing implementation decisions and strategy selections. The indexes afford investors the ability to evaluate strategies at a more granular level and, ultimately, they allow for blended benchmark constructions that are crucial to tracking and evaluating the performance profiles of option writing strategies.

Without continuity across methodologies and an intentional focus on simplicity, the overall value and efficacy of the CBOE's option writing strategy index universe would be greatly diminished. We believe the continued adoption of option writing strategies by investors depends on a universe of robust strategy indexes that accurately portray the long-term benefits of generalized strategy implementations without being overly burdened with excessive granularity—one might say to avoid 'over-engineering'. It's impractical for indexes to try to account for all possible implementation permutations and path dependence. We believe those details are better left to independent investment managers whose incentives are directly aligned with those of clients.

A Case Study

Solving for Regional Exposures

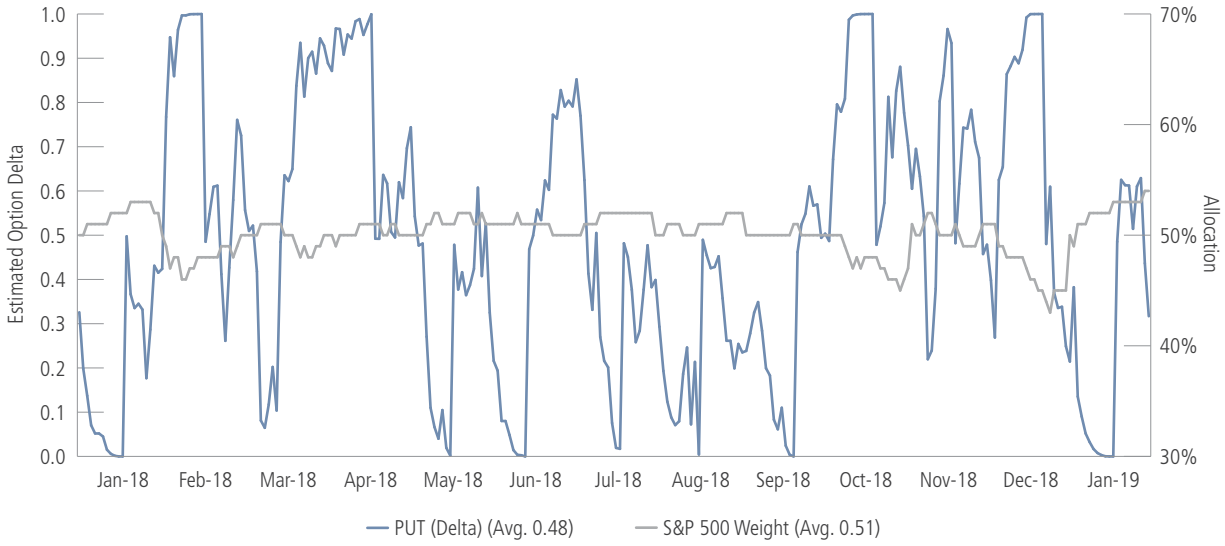
In 2011, at the inception of our global collateralized put writing strategies, the PUT Index was the only published U.S. equity collateralized putwrite benchmark at our disposal, which was an insufficient benchmark for a global putwrite strategy with non-U.S. developed and emerging market equity index exposures. So in order to approximate the non-U.S. exposures, we created a blended benchmark that combined the PUT Index with the underlying equity index and U.S. T-Bills to approximated a 0.50 beta exposure to the underlying equity index. Specifically, the index was 50% PUT, 25% MSCI ACWI ex-US Index and 25% U.S. T-Bills. Over longer-term investment horizons, we believe this is an adequate approach to approximating the performance and risk profile of our global put writing, but it is by no means the most complete method, in part because a beta-adjusted benchmark does not account for a constantly changing option delta.

March 2011 to Dec 2018 (monthly data)	Annual Total Return	Annual Volatility	Annual TE (%) to MSCI ACWI	Beta to MSCI ACWI	Correl. to MSCI ACWI
NB Global Putwrite Composite	**6.65**	**7.83**	**6.59**	**0.56**	**0.88**
Global PutWrite Benchmark*	3.89	6.93	6.11	0.54	0.95
MSCI ACWI (net)	5.90	12.31	–	–	–

Source: Bloomberg. Gross of fees. See Appendix for GIPS Disclosure. *50% CBOE S&P 500 PutWrite / 25% MSCI ACWI ex-USA / 25% ICE BAML 0–3 Month Treasury Bill Index. The CBOE index performance includes historical backtested data published by the CBOE that pre-dates the launch date of its indexes.

To visualize the challenges of a changing option delta, the chart below provides the estimated daily delta (equity exposure) exposures of the PUT Index over the past 13 months versus the daily percentage allocation (weight) of S&P 500 exposure in a monthly rebalanced 50/50 blended index of the S&P 500 and cash—a 0.50 beta portfolio. The stability of the gray line relative to the blue line illustrates the basis risk implicit in the PUT Index versus a targeted S&P 500 beta exposure. This risk translates directly into relatively high levels of short-term tracking error. The development of put writing indexes for additional regional exposures will allow investors to more closely track the evolution of option exposures as underlying index prices evolve.

ESTIMATED PUT INDEX OPTION DELTA VS. S&P 500 ALLOCATION OF 50/50 PORTFOLIO (%)
January 2018 – January 2019



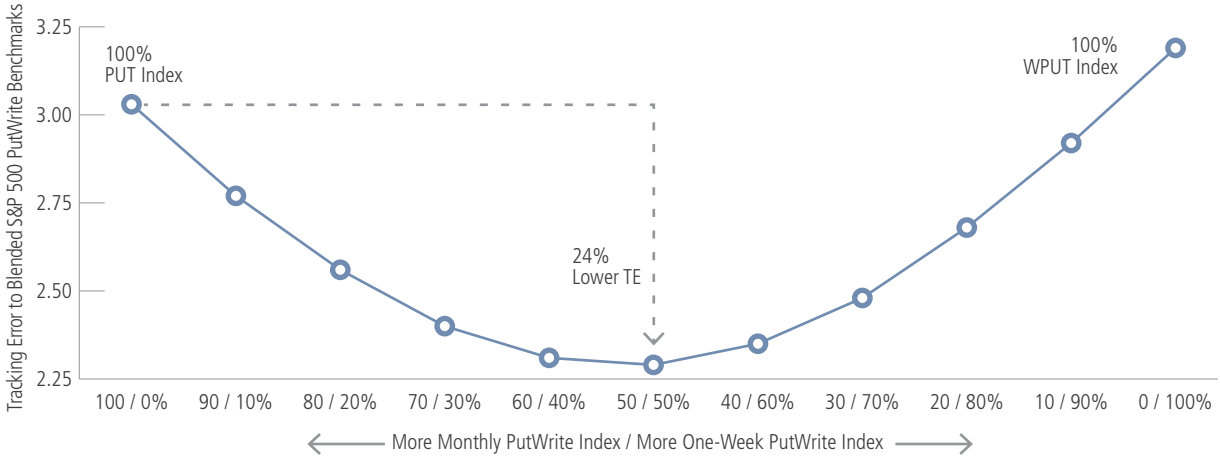
Source: Neuberger Berman analysis, Bloomberg LP, CBOE. S&P 500 Allocation is a monthly rebalanced 50% S&P 500 / 50% Cash Portfolio.

Accounting for Implementation Differences

In addition to matching the underlying index exposure, a 'good' option writing benchmark needs to account for material implementation differences such as strike price and/or tenor selection. The chart below compares the monthly tracking error of a representative at-the-money S&P 500 putwrite strategy account with the weighted combinations of PUT(monthly) and WPUT(one-week) indexes to account for differences in average put option tenor exposures over time. The reduction in the estimated historical tracking error created by blending the PUT and WPUT indexes is significant and, importantly, it yields tracking error levels consistent with those found within more traditional investment strategy universes.

ANNUAL TRACKING ERROR: NB S&P 500 PUTWRITE STRATEGY VS. BLENDED PUT AND WPUT BENCHMARKS

February 2011 – February 2019



Source: Neuberger Berman Analysis, Bloomberg LP, CBOE Bloomberg. See NB Strategy Performance Disclosures in Appendix.

'Alternative' Approaches

Some investors choose to allay the challenges of benchmarking index option writing strategies by simply focusing on the potential benefits within their existing asset allocation frameworks and to place less emphasis on stand-alone performance. To this end, strategies are typically classified under existing allocations to alternative investment strategies, i.e., equity hedge funds, or allocations to diversifying exposures, i.e., lower volatility, defensive, etc. Additionally, some option strategies are benchmarked against LIBOR+ type indexes even though they carry a modest amount of short-term directional (delta) exposure that tends to net out over longer time horizons.

101 Hedged Fund Way

The idiosyncratic nature of equity hedge funds can limit the efficacy of traditional benchmark methods in evaluating strategy success. Hence, hedge fund performance evaluation evolved to be primarily a 'peer relative' comparative process rather than a more objective strategy benchmark index comparison. The most prominent examples are Albourne's and Hedge Fund Research Index's (HFRI) composite indexes of hedge funds and peer relative universe reviews. There are more 'esoteric' examples such as the Eurekahedge CBOE Short Volatility, Eurekahedge CBOE Long Volatility and Eurekahedge CBOE Tail Risk indexes, which are constructed to follow three of the more well-known volatility-based strategies. Below, we summarize return statistics for the PUT and BXMD indexes alongside a selection of both these manager composite indexes and the S&P 500.

Jan 2005 to Dec 2018 (monthly data)	Annual Total Return	Annual Volatility	Annual TE S&P 500	Beta to S&P 500	Correl. to S&P 500
S&P 500 Index ("SPX")	7.79	13.84	–	–	–
CBOE S&P 500 PutWrite Index ("PUT")	6.25	10.37	7.18	0.65	0.86
CBOE S&P 500 BuyWrite 30-Delta Index ("BXMD")	6.84	12.14	4.56	0.83	0.95
HFRI Equity Hedge Index ("HFRIEHI")*	4.07	8.05	8.05	0.50	0.86
HFRI Fund Weighted Index ("HFRIFWI")*	4.22	5.83	9.65	0.35	0.82
EurekaHedge CBOE Short Volatility Index*	7.09	8.41	11.84	0.32	0.52
EurekaHedge CBOE Long Volatility Index*	4.50	6.45	17.10	-0.15	-0.33

Source: Bloomberg. Gross of fees unless otherwise noted (*) net of fees. The CBOE index performance includes historical backtested data published by the CBOE that pre-dates the launch date of its indexes.

We believe the case for comparing option writing strategies to equity hedge fund manager composite indexes is relatively straightforward. Hedge funds source equity risk, interest rates and leverage as primary sources of return. For those who enjoy more complicated arguments, in *The Cost of Capital for Alternative Investments*[2] Jakub Jurek and Erik Stafford showed that option writing strategies can approximate the long-term returns of the hedge fund industry as a whole, including hedge fund of funds. Their findings are insightful and they draw some interesting conclusions regarding what investors receive in exchange for hedge fund fees. To be clear, we are not advocating against allocations to equity hedge fund strategies. Rather, we are making the claim that some option writing strategy results may be more similar to hedge funds than most investors realize, and including them in their broader alternative investment allocations can be a beneficial diversifier and a path of least resistance from a benchmarking perspective.

Just One Piece of a Defensive Puzzle

Given the reduced beta/delta exposures of collateralized option writing strategies, some investors believe they can often reside alongside existing allocations to 'lower volatility' equity strategies or other 'equity-sensitive' asset classes like corporate high yield, leveraged credit or convertible bonds. Option strategies can 'roll up' into broader portfolio classifications that share common long-term investment objectives. The primary challenge with this approach is, of course, it blurs the lines of traditional asset classifications. As a result, we have found this approach is most often utilized by investors who have broad defensive allocations or tend to be 'benchmark-agnostic' at the individual strategy level.

Dec 1990 to Dec 2018 (monthly data)	Annual Total Return	Annual Volatility	Annual TE S&P 500	Beta to S&P 500	Correl. to S&P 500
S&P 500 Index ("SPX")	9.76	14.09	–	–	–
CBOE S&P 500 PutWrite Index ("PUT")	9.28	9.67	8.15	0.57	0.83
CBOE S&P 500 BuyWrite 30Delta Index ("BXMD")	9.80	12.16	4.66	0.82	0.95
S&P 500 Low Volatility ("SPLV")	10.72	10.85	9.26	0.58	0.75
MSCI U.S. Minimum Volatility ("MMV")	10.29	11.07	5.67	0.73	0.93
BBG Barc. U.S. Corp. High Yield ("HY")	8.81	8.38	11.32	0.35	0.60

Source: Bloomberg. Gross of fees. The CBOE index performance includes historical backtested data published by the CBOE that pre-dates the launch date of its indexes.

Final Remarks: Precise vs. Accurate

The continued success of option strategies growing into an 'asset class' arguably depends on the investment industry's ability to consistently benchmark the strategies in an intuitive and flexible manner. Once option strategies achieve broader adoption, composite indexes of manager returns similar to the hedge fund industry's approach will likely simplify the benchmark discussion. Unfortunately, we believe we remain several years away from their development.

So, for now, patience is required as there are no easy answers for how best to benchmark option writing strategies, particularly in years like 2018. Allocators must make trade-offs between accuracy and precision. A precise option writing strategy benchmark will closely track the short-term path of an option writing strategy, but it may be relatively obscure and overly complicated. Whereas an accurate benchmark index will provide a consistent view of long-term results and be more compatible with an overall portfolio allocation, but it may lack the precision to measure a strategy's efficacy and entail a high degree of short-term tracking error. Regardless, improving the means to measure option writing strategy success will lead to more robust product offerings, less confusion among strategy types and increased utilization within asset allocations, all of which we are strongly in favor of.

[2] *The Cost of Capital for Alternative Investments,* September 2011, Harvard Business School. Jakub W. Jurek: Bendheim Center for Finance, Princeton University. Erik Stafford: Harvard Business School.

NB Strategy Performance Disclosures

NB Strategy Returns are based on representative composite account(s) monthly gains/losses for fully collateralized put options for indicated index exposure. Representative account data is weighted by account notional exposure and modified to reflect collateral assumed to be held in short-term U.S. Treasuries. Actual collateral of representative account differs; if such actual collateral were reflected, returns shown would have been higher. Return estimates include transaction costs. Returns are presented on a supplemental basis and are based upon the S&P 500 component of representative fully collateralized NB Global PutWrite Equal Weight (ATM) composite account(s).

July 2011 is the first full month put writing account performance is available. † Volatility and beta statistics are calculated with monthly performance data.

Past performance is no guarantee of future results. Please refer to the attached GIPS® compliant composite presentation for complete performance information. All returns are gross of fees. Gross of fee returns do not reflect the deduction of investment advisory fees, trading cost or any other expenses. If such fees and expenses were reflected, returns referenced would be lower. Indexes are unmanaged and are not available for direct investment. Unless otherwise indicated, returns reflect reinvestment of dividends and distributions. Investing entails risks, including possible loss of principal. See Additional Disclosures at the end of this piece, which are an important part of this presentation

APPENDIX – INDEX DESCRIPTIONS

CBOE S&P 500 PutWrite Index (ticker symbol: PUT) The PUT strategy is designed to sell a sequence of one-month, at-the-money, S&P 500 Index puts and invest cash at one- and three-month Treasury Bill rates. The number of puts sold varies from month to month, but is limited so that the amount held in Treasury Bills can finance the maximum possible loss from final settlement of the SPX puts.

CBOE S&P 500 BuyWrite Index (ticker symbol: BXM) The BXM is a passive total return index based on selling the near-term, at-the-money S&P 500 Index (SPX) call option against the S&P 500 stock index portfolio each month, on the day the current contract expires. The SPX call that is sold (or written) will have one month remaining to expiration, with an exercise price just above the prevailing index level (i.e., slightly out-of-the-money). The premium collected from the sale of the call is added to the portfolio's total value. The SPX call is held until its expiration, at which time a new one-month, at-the-money call is written. The expired option, if exercised, is settled in cash.

CBOE S&P 500 2% OTM BuyWrite Index (ticker symbol: BXY) The BXY uses the same methodology as the widely accepted CBOE S&P 500 BuyWrite Index (BXM), but the BXY Index is calculated using out-of-the-money S&P 500 Index (SPX) call options, rather than at-the-money SPX call options.

CBOE S&P 500 Multi-Week BuyWrite Index (ticker symbol: BXMW) is designed to track the performance of a hypothetical weekly covered call strategy with staggered short positions in call options expiring in consecutive four-week options. The BXMW Index is constructed as a combined portfolio of four mini BuyWrite indexes. Expirations are staggered so that the BXMW Index sells four-week options on a rolling weekly basis.

CBOE S&P 500 One-Week PutWrite Index (ticker symbol: WPUT) is designed to track the performance of a hypothetical strategy that sells an at-the-money (ATM) S&P 500 Index (SPX) put option on a weekly basis. The maturity of the written SPX put option is always one week to expiry. The written SPX put option is collateralized by a money market account invested in one-month Treasury bills.

CBOE S&P 500 Iron Condor Index (ticker symbol: CNDR) is designed to track the performance of a hypothetical option trading strategy that 1) sells a rolling monthly out-of-the-money (OTM) S&P 500 Index (SPX) put option (delta ≈ - 0.15) and a rolling monthly out-of-the-money (OTM) SPX call option (delta ≈ 0.15); 2) buys a rolling monthly OTM SPX put option (delta ≈ - 0.05) and a rolling monthly OTM SPX call option (delta ≈ 0.05) to reduce risk; and 3) holds a money market account invested in one-month Treasury bills, which is rebalanced on option roll days and is designed to limit the downside return of the index.

CBOE S&P 500 Iron Butterfly Index (ticker symbol: BFLY) is designed to track the performance of a hypothetical option trading strategy that 1) sells a rolling monthly at-the-money (ATM) S&P 500 Index (SPX) put and call option; 2) buys a rolling monthly 5% out-of-the-money (OTM) SPX put and call option to reduce risk; and 3) holds a money market account invested in one-month Treasury bills, which is rebalanced on the option roll day and is designed to limit the downside return of the index.

CBOE S&P 500 Covered Combo Index (ticker symbol: CMBO) is designed to track the performance of a hypothetical "short strangle" strategy collateralized by a portfolio holding a long position indexed to the S&P 500 Index and a fixed income account. The CMBO Index sells a monthly at-the-money (ATM) S&P 500 Index (SPX) put option and a monthly 2% out-of-the-money (OTM) SPX call option. The short SPX put position is collateralized by a money market account invested in one-month Treasury bills and the 2% OTM SPX call is collateralized by the long S&P 500 Index position.

CBOE S&P 500 30-Delta BuyWrite Index (ticker symbol: BXMD) is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the S&P 500 Index and sells a monthly out-of-the-money (OTM) S&P 500 Index (SPX) call option. The call option written is the strike nearest to the 30 Delta at 10:00 a.m. CT on the roll date. The BXMD Index rolls on a monthly basis, typically every third Friday of the month.

CBOE S&P 500 Conditional BuyWrite Index (ticker symbol: BXMC) is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the S&P 500 Index and sells a monthly at-the-money (ATM) S&P 500 Index (SPX) call option. The written number of ATM call options will be either ½ unit or 1 unit and will be determined by the level of the CBOE Volatility Index (VIX Index) when the call option is written on the roll date. The BXMC Index rolls on a monthly basis, typically every third Friday of the month.

CBOE Russell 2000 PutWrite Index (ticker symbol: PUTR) is designed to track the performance of a hypothetical strategy that sells a monthly at-the-money (ATM) Russell 2000 Index put option. The written Russell 2000 put option is collateralized by a money market account invested in one-month Treasury bills. The PUTR Index rolls on a monthly basis, typically every third Friday of the month.

CBOE Russell 2000 30-Delta BuyWrite Index (ticker symbol: BXRD) is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the Russell 2000 Index and sells a monthly out-of-the-money (OTM) Russell 2000 Index call option. The call option written is the strike nearest to the 30 Delta at 10:00 a.m. CT on the Roll Date. The BXRD Index rolls on a monthly basis, typically every third Friday of the month.

CBOE Russell 2000 Conditional BuyWrite Index (ticker symbol: BXRC) is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the Russell 2000 Index and sells a monthly at-the-money (ATM) Russell 2000 Index call option. The written number of ATM call options will be either ½ unit or 1 unit and will be determined by the level of the CBOE Russell Volatility Index (RVX Index) when the call option is written on the Roll Date. The BXRC Index rolls on a monthly basis, typically every third Friday of the month.

CBOE Russell 2000 One-Week PutWrite Index (ticker symbol: WPTR) is designed to track the performance of a hypothetical strategy that sells an at-the-money (ATM) Russell 2000 Index put option on a weekly basis. The maturity of the written SPX put option is one week to expiry. The written SPX put option is collateralized by a money market account invested in one-month Treasury bills. The WPTR Index rolls on a weekly basis, typically every Friday.

CBOE NASDAQ-100 BuyWrite Index (ticker symbol: BXN) is a benchmark index that measures the performance of a theoretical portfolio that owns a portfolio of the stocks included in the NASDAQ-100 Index®, and "writes" (or sells) NASDAQ-100 Index (NDX) covered call options.

CBOE DJIA BuyWrite Index (ticker symbol: BXD) is a benchmark index that measures the performance of a theoretical portfolio that sells DJX call options against a portfolio of the stocks included in the Dow Jones Industrial Average℠ (the Dow).

CBOE Russell 2000 BuyWrite Index (ticker symbol: BXR) is a benchmark index that measures the performance of a theoretical portfolio that sells Russell 2000 Index (RUT) call options against a portfolio of the stocks included in the Russell 2000 Index.

NB Global Index PutWrite (ATM) Investment Performance Results – As of December 31, 2018

	Composite		Benchmark		Composite					3-Year Standard Deviation		
	Total Return (%, Gross of Fees)	**Total Return** (%, Net of Fees)	**Primary Custom Blend** (%)	**Secondary Custom Blend** (%)	**No. of Accounts**	**Market Value** ($, m)	**Total Firm Assets** ($, m)	**% of Firm Assets**	**Internal Dispersion**	**Composite** (%)	**Primary Custom Blend** (%)	**Secondary Custom Blend** (%)
2018	-6.02	-6.63	-4.52	-10.88	6	963.9	304.1	0.32	0.22	5.85	5.51	11.07
2017	14.28	13.54	13.67	27.97	6	1,038.5	295.2	0.35	–	5.70	5.61	11.18
2016	5.27	4.59	4.31	8.16	≤ 5	258.4	255.2	0.10	–	6.19	5.92	11.83
2015	-0.27	-0.92	-2.22	-4.87	≤ 5	–	240.4	–	–	6.31	5.59	11.19
2014	2.96	2.30	1.13	2.02	≤ 5	–	250.0	–	–	7.09	5.67	11.33
2013	9.18	8.47	8.22	16.76	≤ 5	–	241.7	–	–	–	–	–
2012	21.61	20.83	8.69	17.38	≤ 5	–	205.0	–	–	–	–	–
10 Months 2011	3.24	2.68	-5.75	-11.96	≤ 5	–	193.1	–	–	–	–	–

Compliance Statement

Neuberger Berman Group LLC ("NB", "Neuberger Berman" or the "Firm") claims compliance with the Global Investment Performance Standards (GIPS®) and has prepared and presented this report in compliance with the GIPS® standards. Neuberger Berman has been independently verified for the period January 1, 2011 to December 31, 2017. Verification assesses whether (1) the firm has complied with all the composite construction requirements of the GIPS® standards on a firm-wide basis and (2) the firm's policies and procedures are designed to calculate and present performance in compliance with the GIPS® standards. The NB Global Index PutWrite (ATM) composite has been examined for the periods January 1, 2016 to December 31, 2017. The verification and performance examination reports are available upon request. The GIPS® firm definition was redefined effective January 1, 2011. For prior periods there were two separate firms for GIPS® firm definition purposes and such firms were independently verified for the periods January 1, 1997 to December 31, 2010 and January 1, 1996 to December 31, 2010, respectively.

Definition of the Firm

The firm is currently defined for GIPS® purposes as Neuberger Berman Group LLC ("NB", "Neuberger Berman" or the "Firm"), and includes the following subsidiaries: Neuberger Berman Investment Advisers LLC, Neuberger Berman Europe Ltd., Neuberger Berman Asia Ltd., Neuberger Berman East Asia Ltd., Neuberger Berman Singapore Pte. Ltd., Neuberger Berman Taiwan Ltd, Neuberger Berman Australia Pty. Ltd., Neuberger Berman Trust Company N.A., Neuberger Berman Trust Company of Delaware N.A., NB Alternatives Advisers LLC and Neuberger Berman Breton Hill ULC.

Policies

Policies for valuing portfolios, calculating performance and preparing compliant presentations are available upon request.

Composite Description

The Global Index PutWrite (ATM) Composite (the "Composite") includes the performance of all fee-paying Global Index PutWrite (ATM) portfolios, with no minimum investment, managed on a fully discretionary basis by the Option Group. The Global Index PutWrite (ATM) strategy sells at-the-money puts across U.S., Developed and Emerging markets. Options are fully collateralized by a fixed income portfolio predominantly consisting of short duration Treasuries. The strategy seeks to increase long-term return potential and reduce investment volatility. Underlying index exposures are selected consistent with client asset allocations, and risk parameters are set with client's risk/return objectives. Collateral investments reflect investor preferences and are managed with an emphasis on capital preservation. Option exposure is managed to increase diversification across tenors and strike prices, and reduce downside risk from high delta option positions during down markets. Option positions with little

remaining time values can be rolled to collect additional premiums and increase capital efficiency. The Composite was created in September 2017 and the performance inception date is March 2011. From March 2011 to September 2017, the performance track record is the performance of the Global PutWrite Equal Weight (ATM) composite. The Global PutWrite Equal Weight (ATM) composite represented the performance of all fee-paying Global PutWrite Equal Weight (ATM) strategy accounts managed by the Option Group on a fully discretionary basis regardless of market value. The Global PutWrite Equal Weight (ATM) strategy sold at-the-money puts with notional exposure equally weighted across U.S., EAFE and EM markets. The composite was created in January 2016. The performance history of the composite prior to January 1, 2016 was comprised of the performance history of the accounts managed by the portfolio management team while at a predecessor firm. A complete list of Neuberger Berman's composites is available upon request.

Primary Benchmark Description
The benchmark is a Custom Blend. The blend consists of 50% ICE BofAML 0-3 Month U.S. Treasury Bill Index, 16.67% S&P 500 Index, 16.67% MSCI EAFE (Net) Index (Europe, Australasia and Far East) and 16.66% MSCI Emerging Markets (Net) Index. The blend is rebalanced monthly and is calculated on a total return basis. The ICE BofAML 0-3 Month U.S. Treasury Bill Index tracks the performance of the direct sovereign debt of the U.S. government. It tracks U.S. dollar-denominated U.S. Treasury Bills with a remaining term to maturity of less than three months. The S&P 500 Index is a capitalization-weighted index comprised of 500 stocks chosen for market size, liquidity and industry group representation. The S&P 500 Index is constructed to represent a broad range of industry segments in the U.S. economy. The S&P 500 focuses on the large-cap segment of the market with over 80% coverage of U.S. equities. The MSCI EAFE (Net) Index is a free float-adjusted market capitalization-weighted index that is designed to measure the equity market performance of developed markets, excluding the US and Canada. The MSCI Emerging Markets (Net) Index is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets. Net total return indexes reinvest dividends after the deduction of withholding taxes, using (for international indexes) a tax rate applicable to non-resident institutional investors who do not benefit from double taxation treaties.

Secondary Benchmark Description
The benchmark is a Custom Blend. The blend consists of 33.34% S&P 500 Index, 33.33% MSCI EAFE (Net) Index (Europe, Australasia and Far East) and 33.33% MSCI Emerging Markets (Net) Index. The blend is rebalanced monthly and is calculated on a total return basis. The S&P 500 Index is a capitalization-weighted index comprised of 500 stocks chosen for market size, liquidity and industry group representation. The S&P 500 Index is constructed to represent a broad range of industry segments in the U.S. economy. The S&P 500 focuses on the large-cap segment of the market with over 80% coverage of U.S. equities. The MSCI EAFE (Net) Index is a free float-adjusted market capitalization-weighted index that is designed to measure the equity market performance of developed markets, excluding the U.S. and Canada. The MSCI Emerging Markets (Net) Index is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets. Net total return indexes reinvest dividends after the deduction of withholding taxes, using (for international indexes) a tax rate applicable to non-resident institutional investors who do not benefit from double taxation treaties.

Reporting Currency
Valuations are computed and performance is reported in U.S. Dollars.

Fees
Composite Gross of Fee returns are the return on investments reduced by any trading expenses incurred during the period. Composite Net of Fee returns are the Gross of Fee returns reduced by investment advisory fees.

Fee Schedule
The annual investment advisory fee, generally payable quarterly, is as follows: 0.65% on the first $50mn; 0.55% on the next $50mn; 0.45% thereafter.

Internal Dispersion
Internal dispersion is calculated using the asset-weighted standard deviation of annual gross returns of those portfolios that were in the Composite for the entire year. Internal dispersion is not calculated if the Composite does not contain at least 6 portfolios for the entire year.

Annualized Standard Deviation
The three-year annualized standard deviation measures the variability of the Composite and the benchmark returns over the preceding 36-month period. The standard deviation is not required for periods prior to 2011.

NEUBERGER | BERMAN

Neuberger Berman
1290 Avenue of the Americas
New York, NY 10104-0001

www.nb.com