

**Strategy Insights | September 2022****DEREK DEVENS, CFA**

Senior Portfolio Manager, Option Group

**ERIC ZHOU**

Portfolio Manager, Option Group

**RACHEL WHITE, CFA**

Portfolio Specialist, Option Group

**RORY EWING**

Portfolio Manager, Option Group

**BERYL LOU**

Research Analyst, Option Group

# Bye Bye Buy(Write)<sup>1</sup>

## A Short Tale of the Lost Right Tail

### Prologue

While the song 'Bye Bye Bye' was a much-loved hit at the turn of the century, over time, NSYNC ultimately evolved into its most efficient form: a solo Justin Timberlake. Perhaps it is time for index buywrite strategies to be viewed with a similar loving nostalgia as allocators say goodbye and move on to a more durable, efficient form going forward, i.e. the index putwrite.

<sup>1</sup>In a buywrite strategy an investor owns an equity index and sells/writes a call option on the index. Commonly referred to as a covered call strategy.

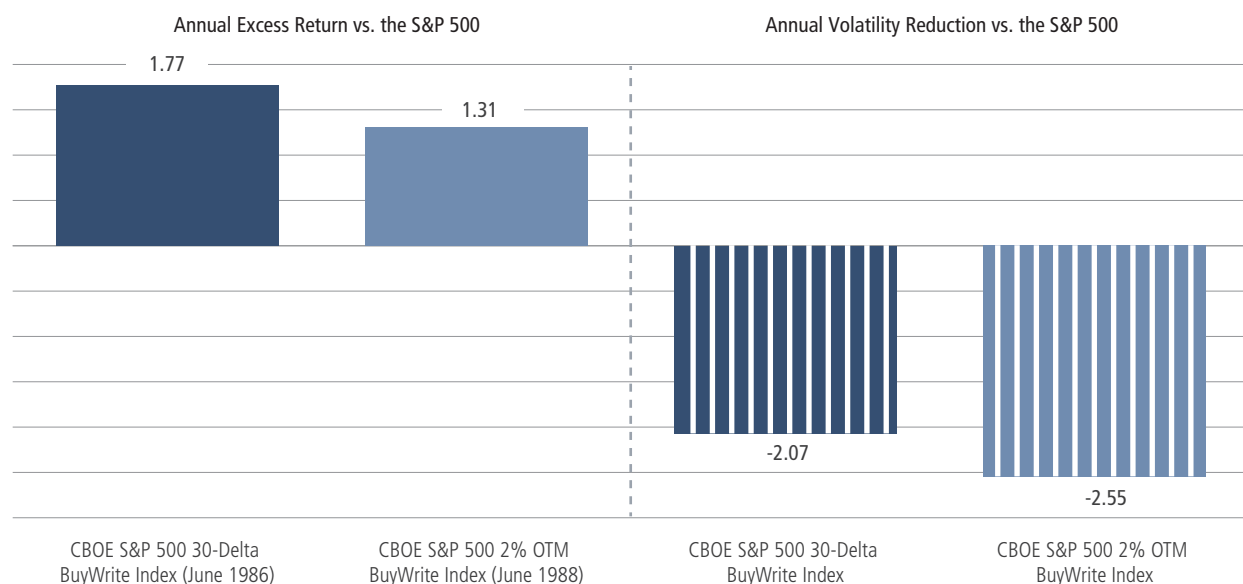
## Chapter 1: The Beginning

Once upon a time, writing/selling call options on equity indexes seemed to offer investors an opportunity to achieve the impossible. By simply selling away a portion of the upside potential of the equity index position, they could potentially reduce their portfolio volatility by collecting an upfront cashflow, i.e. generate income, and at the same time, earn a higher return than the underlying index. Ironically, this is not a portfolio management industry fairytale. To the contrary, over the last few decades billions of dollars have been invested in option strategies that sell away portions of equity index upside return potential, i.e. call writing. While the S&P 500 Index BuyWrite Strategies captured the vast majority of flows, our comments also apply to other option strategies that sell/write index call options like collars and condors.

The chart below illustrates the excess return and volatility reduction of the CBOE S&P 500 30-Delta BuyWrite Index and the CBOE S&P 500 2% Out-of-the-Money BuyWrite Index versus the S&P 500 Index from each of their inception up until 10 years ago (July 31, 2010).

### PAST PERFORMANCE IS NOT...

Index Inception – July 31, 2010

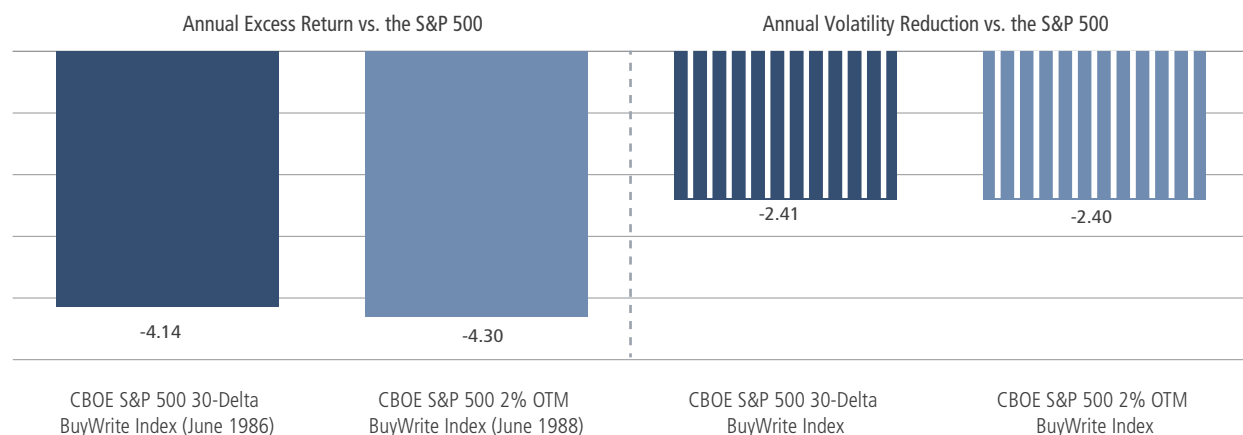


## Chapter 2: Too Good to Be True

The data tells a very compelling story. An investor would have earned 1 – 2% more than the S&P 500 Index per year with a 2 – 2.5% reduction in annual volatility. Ever meet an investor who doesn't like more return for less risk? We haven't either. Yet, as one might expect, the last decade has served as a closing act for the S&P 500 BuyWrite Strategy. Fortunately for investors, unlike some option strategy endings, this story is not a Shakespearean tragedy. Rather, it has been more of a 'fade to black'. The chart below provides the same statistics as above for the last decade. In short, S&P 500 BuyWrite Strategies continued to reduce volatility, but they have forfeited a significant portion of portfolio capital appreciation. Underperforming the S&P 500 Index, which annualized at 13.8%, by more than 450bps per year is well beyond most investor limits.

## ...INDICATIVE OF FUTURE RESULTS

July 31, 2010 – September 30, 2022

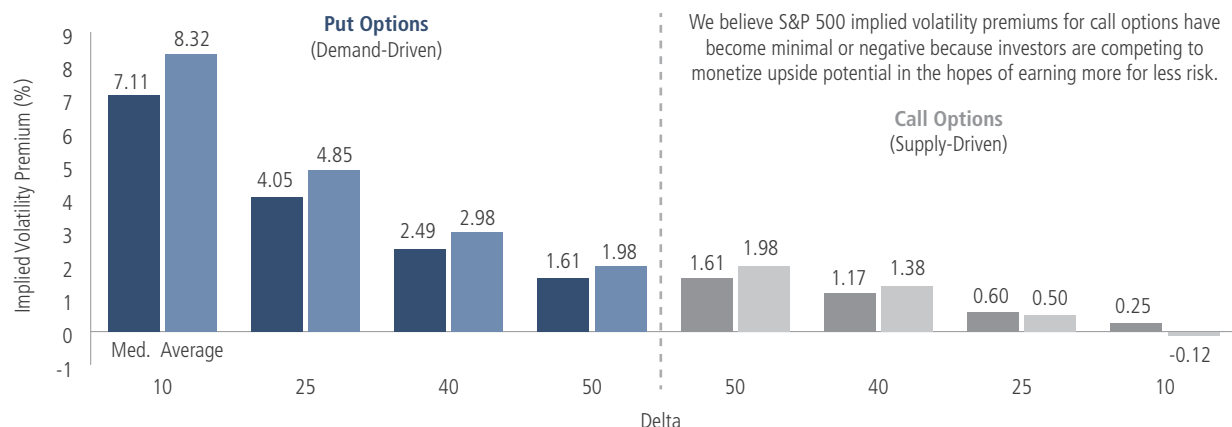


## Chapter 3: The Implied Volatility Premium

The fading of the buywrite excess returns naturally raises questions about the supposed vanishing of the S&P 500 Index implied volatility premium over the past 10 years. Yet, the decline in buywrite strategies only tells half the story of the implied volatility premium. The chart below plots the implied volatility premiums for S&P 500 Index put and call options.

### TWO SIDES TO EVERY STORY

July 31, 2010 – September 30, 2022







Source: CBOE, Bloomberg LP. Implied volatility premiums are estimated based data sourced from Bloomberg and standard option price calculations. Premium yields are calculated as the option premium divided by the option strike price.

The right-hand side of the chart affirms the decline in S&P 500 buywrite excess returns with zero-to-negative implied volatility premiums earned for selling out-of-the-money call options. To be clear, this does not mean that call sellers have not collected cash upon selling the option; it just means that without an 'overpayment' for selling that option, the seller would have likely been better off moving to cash to de-risk instead of selling the call option. Considering that S&P 500 BuyWrite Strategies are supported by investors that hold positions in the S&P 500 Index, we believe an efficient equity marketplace will not allow long-term investors to earn higher returns in exchange for accepting less risk relative to the underlying equity index (recall charts in previous section). Basically, option markets have evolved in the last decade. They have become wise to 'unjustified' excess returns once earned by call sellers and have adjusted the 'pricing' accordingly, at least in part due to the dramatically increased access to the option marketplace. Once an esoteric playground for PhDs, acceptance and knowledge about the use of options has grown to the point where any retail investor long the market can now partake in the options market.

## Chapter 4: Shorting Volatility or Equity Markets?

Over the years, we have found most investors do not view buywrite strategies as explicitly 'short vol' strategies. Whereas, putwrite<sup>2</sup> strategies are commonly considered the riskier sibling that ran off to live in short vol city. However, when we decompose the put/call writing/selling into their two basic exposures (table below), we find many investors begin to change their perspective.

Short Put		Short Call	
Short Volatility		Short Volatility	
Long Equity Index		Short Equity Index	

<sup>2</sup>Strategy in which an investor sells/writes a put option on an index and holds collateral in cash or cash-equivalents.

If we assume the short volatility exposures of the put and call options are roughly equivalent, which is a stretch given our previous illustration, then the only difference to consider is their directional exposure to the underlying index. In put writing, an investor sells volatility, but remains long the underlying index. In selling the call option, the investor similarly sells volatility, but becomes short the underlying index. Does it make sense for any long-term investor to be short the right-tail of the S&P 500? Of course not, we believe, and this is why a buywrite strategy holds the underlying index to limit that inherent upside risk of selling the call. Individual investors should ask themselves if it is prudent to be both long and short the index in an attempt to gain access to a volatility premium that is negligible at best when sourced through call selling. Perhaps there is a better ending to this internal conflict.

## Chapter 5: Rewriting This Tale

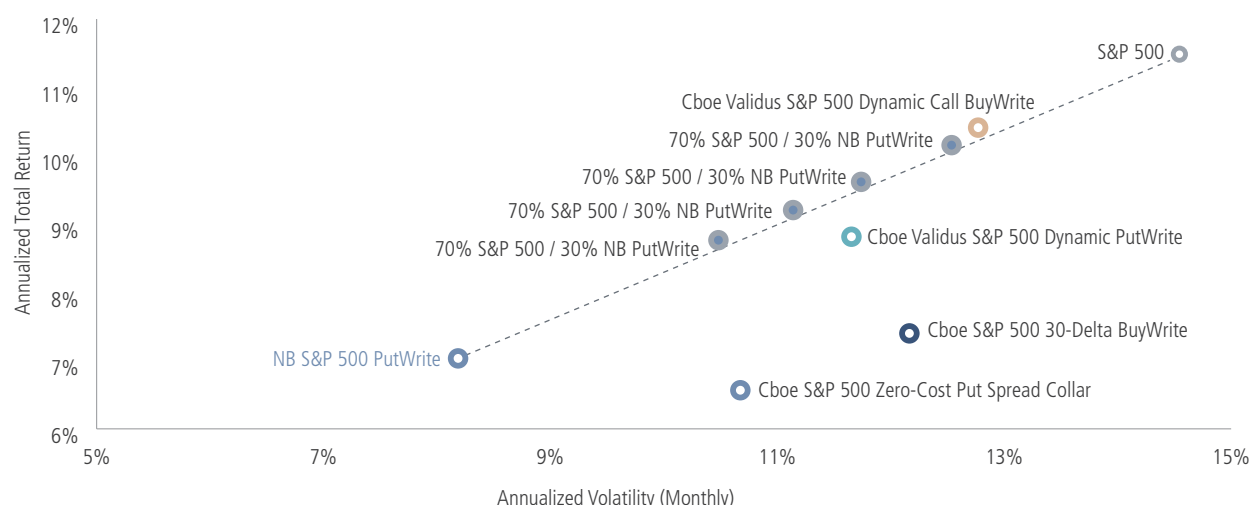
Philosophically, we believe investors own equity index exposure for the upside participation, i.e. right tail, and therefore should not sell a portion of it away in exchange for a modest call option premium. However, since an out-of-the-money buywrite strategy is simply a mix of an option premium and index beta exposure, a blend of a putwrite strategy and the underlying passive index exposure can be used to approximate risk-equivalent out-of-the-money buywrite strategies.

More specifically, a blend of a putwrite strategy with passive S&P 500 Index exposure can replicate a similar risk profile as popular out-of-the-money buywrite indexes, including the CBOE S&P 500 30-Delta BuyWrite Index and the CBOE S&P 500 Zero-Cost Put Spread Collar. Blending a putwrite with beta 1.0 exposure can produce a potentially superior long-term return due to the 'unencumbered' upside that is preserved by owning the S&P 500. The better up-market capture of the blend has potential to add value over time as periods of sharp reversals can erode the efficiency of selling call options (upside). Again, the efficiency of blending short put option premiums, collateral income and S&P 500 exposure has produced a more efficient equity exposure than the combinations of S&P 500 and short call option premiums.

## REWRITING PORTFOLIO ALLOCATION

July 31, 2011\* – September 30, 2022

		PutWrite			BuyWrite			Collar		
	S&P 500	NB Index PutWrite <sup>1</sup> (S&P 500 ATM)	Cboe Validus S&P 500 Dynamic PutWrite	48% S&P 500 / 52% NB PutWrite	CBOE S&P 500 30-Delta BuyWrite	57% S&P 500 / 43% NB PutWrite	Cboe Validus S&P 500 Dynamic Call BuyWrite	70% S&P 500 / 30% NB PutWrite	Cboe S&P 500 Zero-Cost Put Spread Collar	38% S&P 500 / 62% NB PutWrite
Option Notional (%)	--	100	100	52	100	43	100	30	100	62
Annual Return (% gross)	11.5	7.0	8.8	9.2	7.3	9.6	10.3	10.2	6.5	8.7
Annual Return (% net)	--	6.5	--	8.9	--	9.4	--	10.0	--	8.4
Annual Volatility (%)	14.6	8.2	11.7	11.1	12.2	11.7	12.8	12.6	10.7	10.5
Risk-Adjusted	0.79	0.85	0.76	0.83	0.60	0.82	0.81	0.81	0.61	0.83
Beta	1.00	0.54	0.76	0.76	0.80	0.80	0.86	0.86	0.71	0.71
Drawdown	-23.9	-18.5	-21.3	-21.0	-21.6	-21.5	-23.5	-22.2	-18.8	-20.5
Up-Mkt Cap. (%)	100	55	74	77	74	81	86	86	66	72
Down-Mkt Cap. (%)	100	51	71	74	80	79	84	85	72	70



<sup>1</sup> Supplemental portfolio sleeve model returns are hypothetical and reflect model portfolios constructed using the representative composite account(s) monthly gains/losses for fully collateralized put options for the indicated index sleeve exposure (S&P 500, MSCI EAFE Net and MSCI EM Net). Representative account data was weighted by account notional exposure and modified to reflect collateral assumed to be held in short-term U.S. Treasuries (BofA ML 1-3 Year U.S. Treasury Index) rebalanced monthly. Model returns include estimated transaction costs. Returns are presented on a supplemental basis and the performance of the fully collateralized representative NB Global PutWrite (ATM) account(s) are available upon request. Model portfolio returns are hypothetical and do not represent the performance of actual accounts. Hypothetical model performance has inherent limitations and is generally designed with the benefit of hindsight. Please see Hypothetical Performance Disclosures at the end of this material for additional hypothetical performance disclosures.

\*July 2011 is the first full month representative account performance is available. Volatility and beta statistics are calculated with monthly performance data.

See GIPS® composite report disclosures for details on fees and net calculations. Unless otherwise indicated, portfolio characteristics, including attribution, relative returns and risk statistics are shown gross of fees. Investing entails risks, including possible loss of principal. **Past performance is no guarantee of future results.** See Additional Disclosures at the end of this material which are an important part of this presentation.

## A Happier Ending

Based on our discussions with investors, we believe making smaller allocations to an index putwrite strategy and combining it with a passive equity index exposure—in some cases 'delta' completion to target a specific beta to an equity index—is preferable to committing a larger allocation to an equity index buywrite strategy. Maximizing the lower-cost passive index exposure helps to maintain a lower aggregate fee structure, to preserve a greater degree of full right-tail exposure to an equity index, and to limit the overall allocation to option strategies at the portfolio level, which reduces a portfolio's dependence on option premiums—all of which should resonate with allocators.

## GLOBAL INDEX PUTWRITE (ATM) ANNUALIZED RATES OF RETURN – AS OF SEPTEMBER 30, 2022

	3Q 2022	YTD	1 Year	3 Years	5 Years	10 Years	Since Inception (3/1/2011)
Total Portfolio Return (Gross of Fee)	-5.29	-16.83	-13.61	1.29	1.76	3.71	5.13
Total Portfolio Return (Net of Fee)	-5.44	-17.23	-14.17	0.64	1.10	3.04	4.45
Custom Blend	-6.83	-13.59	-8.96	0.25	0.01	2.84	3.48

## APPENDIX – GLOBAL INDEX PUTWRITE (ATM) COMPOSITE

Annualized Rates of Return – As of September 30, 2022

	Composite		Benchmark		Composite				3 Year Standard Deviation	
	Total Return (%, Gross of Fees)	Total Return (%, Net of Fees)	Custom Blend (%)	No. of Accounts	Market Value (\$, m)	Total Firm Assets (\$, bn)	% of Firm Assets	Internal Dispersion	Composite (%)	Custom Blend (%)
YTD Sep-2022	-16.83	-17.23	-13.59	≤ 5	33.4	--	--	--	11.97	13.68
2021	12.91	12.18	16.64	≤ 5	726.4	460.5	0.16	--	10.37	13.02
2020	6.08	5.40	-4.26	≤ 5	796.1	405.4	0.20	--	10.92	13.43
2019	13.58	12.85	8.83	≤ 5	809.1	355.8	0.23	--	6.02	6.65
2018	-6.02	-6.63	-6.93	6	968.8	304.1	0.32	0.21	5.80	6.50
2017	13.28	12.55	12.03	6	1,038.4	295.2	0.35	--	5.65	6.38
2016	5.27	4.59	4.89	≤ 5	258.4	255.2	0.10	--	6.19	7.26
2015	-0.27	-0.92	1.4	≤ 5	--	240.4	--	--	6.31	6.83
2014	2.96	2.30	2.62	≤ 5	--	250	--	--	7.09	6.47
2013	9.18	8.47	8.55	≤ 5	--	241.7	--	--	--	--
2012	21.61	20.83	10.21	≤ 5	--	205	--	--	--	--

Periods less than 1 year are not annualized.

**Past performance is no guarantee of future results.**

Please see attached important disclosures which contain complete performance information and definitions.

## INVESTMENT PERFORMANCE DISCLOSURE STATEMENT

### 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, 2021. A firm that claims compliance with the GIPS standards must establish policies and procedures for complying with all the applicable requirements of the GIPS standards. Verification provides assurance on whether the firm's policies and procedures related to composite and pooled fund maintenance, as well as the calculation, presentation, and distribution of performance, have been designed in compliance with the GIPS standards and have been implemented on a firm-wide basis. The NB Global Index PutWrite (ATM) composite has had a performance examination for the periods January 1, 2016 to December 31, 2021. 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. The Firm definition was most recently changed in 2020 to include the addition of Neuberger Berman Loan Advisers LLC and Neuberger Berman Loan Advisers II LLC.

### 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 and affiliates: 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, Neuberger Berman Canada ULC, Neuberger Berman Loan Advisers LLC and Neuberger Berman Loan Advisers II LLC.

### Policies

Policies for valuing investments, calculating performance, and preparing GIPS Reports are available upon request.

## Composite Description

The Global Index PutWrite (ATM) Composite (the "Composite") includes the performance of all 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 both 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 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% Cboe S&P 500 PutWrite Index, 35% Cboe MSCI EAFE PutWrite Index, and 15% Cboe MSCI Emerging Markets PutWrite Index. The blend is rebalanced monthly and is calculated on a total return basis. The Cboe S&P 500 PutWrite Index measures the performance of a hypothetical portfolio that sells S&P 500 index (SPX) put options against collateralized cash reserves held in a money market account. 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. The Cboe MSCI EAFE PutWrite Index is designed to track the performance of a hypothetical passive investment strategy that collects option premiums from writing an At-the-Money (ATM) MXEA Put option on a monthly basis and holds a rolling money market account invested in one-month T-bills to cover the liability from the short MXEA Put option position. The index is a total return index that is rebalanced monthly. The Cboe MSCI Emerging Markets PutWrite Index is designed to track the performance of a hypothetical passive investment strategy that collects option premiums from writing an At-the-Money (ATM) MXEF Put option on a monthly basis and holds a rolling money market account invested in one-month T-bills to cover the liability from the short MXEF Put option position. The index is a total return index that is rebalanced monthly.

## Reporting Currency

Valuations are computed and performance is reported in U.S. Dollars. Performance includes reinvestment of dividends and other earnings.

## 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 model investment advisory fees of 0.65%. Composite Net of Fee returns calculated using model fees deduct 1/12th of the highest tier of the fee schedule from the monthly composite gross returns.

Presented risk measures are calculated using gross-of-fee composite returns.

To the extent that a composite contains fund(s) whereby performance is calculated based on changes in monthly NAV's, net returns reflect miscellaneous fund expenses (admin, legal, etc.) in addition to investment management fees for the portion of composite containing these vehicles.

## 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.

## Availability and Trademark Disclosures

The firm's list of composite descriptions, limited distribution pooled fund descriptions, and broad distribution pooled fund descriptions are available upon request.

GIPS® is a registered trademark of CFA Institute. CFA Institute does not endorse or promote this organization, nor does it warrant the accuracy or quality of the content contained herein.

## Additional Notes and Disclosures

As of December 2019, the composite primary benchmark changed from a custom blend of 50% ICE BofA 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)/16.66% MSCI Emerging Markets (Net) Index to a custom blend of 50% CBOE S&P 500 PutWrite Index/35% CBOE MSCI EAFE PutWrite Index/15% CBOE MSCI Emerging Markets PutWrite Index as the investment team believes the updated benchmark blend more appropriately reflects the composite investment strategy.

## S&P INDEX PUTWRITE (ATM) COMPOSITE ANNUALIZED RATES OF RETURN – AS OF SEPTEMBER 30, 2022

	3Q 2022	YTD	1 Year	3 Years	5 Years	Since Inception (3/1/2017)
Total Portfolio Return (Gross of Fee)	-4.40	-15.62	-10.61	5.13	4.62	5.17
Total Portfolio Return (Net of Fee)	-4.51	-15.9	-11.01	4.66	4.15	4.70
Custom Blend	-7.26	-16.21	-11.41	0.22	0.28	1.08

## APPENDIX – S&P INDEX PUTWRITE (ATM) COMPOSITE

Annualized Rates of Return – As of September 30, 2022

	Composite		Benchmark		Composite				3 Year Standard Deviation	
	Total Return (%, Gross of Fees)	Total Return (%, Net of Fees)	Custom Blend (%)	No. of Accounts	Market Value (\$, m)	Total Firm Assets (\$, bn)	% of Firm Assets	Internal Dispersion	Composite (%)	Custom Blend (%)
YTD Sep-2022	-15.62	-15.90	-16.21	7	3,137.2	--	--	--	12.25	12.93
2021	19.41	18.87	16.87	≤ 5	2,505.6	460.5	0.54	--	10.20	11.17
2020	10.17	9.67	-2.44	≤ 5	1,984.6	405.4	0.49	--	11.15	12.31
2019	16.50	15.97	14.68	≤ 5	1,366.8	355.8	0.38	--	--	--
2018	-5.33	-5.76	-10.11	≤ 5	734.6	304.1	0.24	--	--	--
10 Months 2017	8.25	7.85	7.80	≤ 5	263.0	295.2	0.09	--	--	--

## INVESTMENT PERFORMANCE DISCLOSURE STATEMENT

### 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, 2021. A firm that claims compliance with the GIPS standards must establish policies and procedures for complying with all the applicable requirements of the GIPS standards. Verification provides assurance on whether the firm’s policies and procedures related to composite and pooled fund maintenance, as well as the calculation, presentation, and distribution of performance, have been designed in compliance with the GIPS standards and have been implemented on a firm-wide basis. Verification does not ensure the accuracy of any specific composite presentation. The verification 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. The Firm definition was most recently changed in 2020 to include the addition of Neuberger Berman Loan Advisers LLC and Neuberger Berman Loan Advisers II LLC.

### 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 and affiliates: 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, Neuberger Berman Canada ULC, Neuberger Berman Loan Advisers LLC and Neuberger Berman Loan Advisers II LLC.

### Policies

Policies for valuing investments, calculating performance, and preparing GIPS Reports are available upon request.

### Composite Description

The S&P Index PutWrite (ATM) Composite (the “Composite”) includes the performance of all S&P Index PutWrite (ATM) accounts with no investment minimum managed on a fully discretionary basis by the Option Group. The S&P Index PutWrite (ATM) strategy sells at-the-money puts with notional exposure to the S&P 500 Index. Options are fully collateralized by a fixed income portfolio predominantly consisting of short duration Treasuries. The strategy seeks to both 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 February 2017 and the performance inception date is March 2017. 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% Cboe S&P 500 PutWrite Index and 50% Cboe S&P 500 One-Week PutWrite Index. The blend is rebalanced monthly and is calculated on a total return basis. The Cboe S&P 500 PutWrite Index measures the performance of a hypothetical portfolio that sells S&P 500 index (SPX) put options against collateralized cash reserves held in a money market account. 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. The Cboe S&P 500 One-Week PutWrite Index 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 one week to expiry. The written SPX put option is collateralized by a money market account invested in one-month Treasury bills. The Index rolls on a weekly basis, typically every Friday.

### Reporting Currency

Valuations are computed and performance is reported in U.S. Dollars. Performance includes reinvestment of dividends and other earnings.

### 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 model investment advisory fees of 0.45%. Composite Net of Fee returns calculated using model fees deduct 1/12th of the highest tier of the fee schedule from the monthly composite gross returns.

Presented risk measures are calculated using gross-of-fee composite returns.

To the extent that a composite contains fund(s) whereby performance is calculated based on changes in monthly NAV's, net returns reflect miscellaneous fund expenses (admin, legal, etc.) in addition to investment management fees for the portion of composite containing these vehicles.

### Fee Schedule

The annual investment advisory fee, generally payable quarterly, is as follows: 0.45% on the first \$50mn; 0.40% on the next \$50mn; 0.35% 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.

### Availability and Trademark Disclosures

The firm's list of composite descriptions, limited distribution pooled fund descriptions, and broad distribution pooled fund descriptions are available upon request.

GIPS® is a registered trademark of CFA Institute. CFA Institute does not endorse or promote this organization, nor does it warrant the accuracy or quality of the content contained herein.

### Additional Notes and Disclosures

As of June 2020, the composite primary benchmark changed from the CBOE S&P 500 Putwrite Index to a custom blend of 50% CBOE S&P 500 Putwrite Index/50% CBOE S&P 500 One-Week PutWrite Index, as the investment team believes the updated benchmark more appropriately reflects the composite investment strategy.

## APPENDIX – INDEX DESCRIPTIONS

The CBOE S&P 500 2% OTM BuyWrite Index (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.

The CBOE S&P 500 30-Delta BuyWrite Index (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 CBOE S&P 500 Zero-Cost Put Spread Collar Index (CLLZ) is designed to track the performance of a hypothetical option trading strategy that 1) holds a long position indexed to the S&P 500 Index; 2) on a monthly basis buys a 2.5% - 5% S&P 500 Index (SPX) put option spread; and 3) sells a monthly out-of-the-money (OTM) SPX call option to cover the cost of the put spread.

The Cboe Validus S&P 500 Dynamic Call BuyWrite Index (CALD) tracks the value of an active rule-based investment strategy which consists of overlaying a basket of S&P 500 AM-settled short call options over a long position invested in the S&P 500 with dividends reinvested.

The Cboe Validus S&P 500 Dynamic PutWrite Index (PUTD) tracks the value of an active rule-based investment strategy which consists of overlaying a basket of S&P 500 AM-settled short put options over a money market account invested in one-month Treasury bills.

The S&P 500 Index consists of 500 stocks chosen for market size, liquidity, and industry group representation. It is a market value weighted index (stock price times number of shares outstanding), with each stock's weight in the Index proportionate to its market value. The 500 is one of the most widely used benchmarks of U.S. equity performance. As of September 16, 2005, S&P switched to a float-adjusted format, which weights only those shares that are available to investors, not all of a company's outstanding shares. The value of the index now reflects the value available in the public markets.

## Hypothetical Performance Disclosures

The hypothetical performance results included in this material are of various hypothetical portfolios, including simulated backtests portfolio, that are shown for illustrative purposes only. The results do not reflect actual performance results. The hypothetical results were calculated by running the hypothetical/model portfolios using the stated methodologies and assumptions. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the hypothetical results have been stated or fully considered. Changes in the model assumptions may have a material impact on the hypothetical returns presented. The results are shown on a supplemental basis and do not represent the performance of any Neuberger Berman managed account. There are frequently material differences between hypothetical performance results and actual results achieved by a Strategy or asset allocation portfolio. Unless otherwise indicated, results assume no withdrawals or additional contributions and reinvestment of any dividends and distributions.

Hypothetical performance has certain inherent limitations. Unlike actual investment performance, hypothetical results does not represent actual trading and accordingly the performance results may have under- or over-compensated for the impact, if any, that certain economic or other market factors, such as lack of liquidity or price fluctuations, might have had on the investment decision-making process or results if assets were actually being managed. Hypothetical performance may also not accurately reflect the impact, if any, of other material economic and market factors, or the impact of financial risk and the ability to withstand losses. Hypothetical performance results are also subject to the fact that they are generally designed with the benefit of hindsight and established at a point in time. As a result, the hypothetical assumptions, including any asset allocations, could theoretically be modified in order to produce more favorable simulated performance results. In addition, the results are based, in part, on hypothetical assumptions. Certain of the assumptions have been made for modeling or simulation purposes and may not have been realized in the actual management of accounts. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the hypothetical results have been stated or fully considered. Changes in the hypothetical assumptions may have a material impact on the hypothetical returns presented. To the extent a hypothetical portfolio or asset allocation includes asset class returns, such returns are for illustrative purposes only and not reflective of the returns of a specific strategy. There are frequently material differences between hypothetical performance results and actual results achieved by any investment strategy.

Hypothetical asset allocation models reflect the blended performance of the indicated components (i.e. strategy, model or index) with the indicated allocation percentages. Unless otherwise indicated the target allocations are static with no rebalancing, contributions, withdrawals, redemptions or corporate actions and reinvestment of any dividends or distributions.

This material is general in nature and is not directed to any category of investors and should not be regarded as individualized, a recommendation, investment advice or a suggestion to engage in or refrain from any investment-related course of action. Investment decisions and the appropriateness of this material should be made based on an investor's individual objectives and circumstances and in consultation with his or her advisors. Nothing herein constitutes investment, legal, accounting or tax advice, or a recommendation to buy, sell or hold a security. Information is obtained from sources deemed reliable, but there is no representation or warranty as to its accuracy, completeness or reliability. All information is current as of the date of this material and is subject to change without notice. Neuberger Berman products and services may not be available in all jurisdictions or to all client types. Diversification does not guarantee profit or protect against loss in declining markets. The use of tools cannot guarantee performance. Unless otherwise indicated, returns shown reflect reinvestment of dividends and distributions. Indexes are unmanaged and are not available for direct investment. Investing entails risks, including possible loss of principal. **Past performance is no guarantee of future results.**

Representative portfolio information (characteristics, holdings, weightings, etc.) is based upon the composite or a representative/model account. Representative accounts are selected based on such factors as size, length of time under management and amount of restrictions. Any segment level performance shown (equity only or fixed income only) is presented gross of fees and focuses exclusively on the investments in that particular segment of the portfolio being measured (equity or fixed income holdings) and excludes cash. Client accounts are individually managed and may vary significantly from composite performance and representative portfolio information. Specific securities identified and described do not represent all of the securities purchased, sold or recommended for advisory clients. It should not be assumed that any investments in securities, companies, sectors or markets identified and described were or will be profitable.

The portfolio composition, strategy, risks and fees and expenses, and accordingly the performance, of alternative products such as options strategies may differ significantly from other traditional asset class offerings, including equities and fixed income products. In up markets, the strategy typically will not participate in the full gain of the underlying index above the premium collected. Options involve investment strategies and risks different from those associated with ordinary portfolio securities transactions. By writing put options, an investor assumes the risk of declines in the value of the underlying instrument and the risk that it must purchase the underlying instrument at an exercise price that may be higher than the market price of the instrument, including the possibility of a loss up to the entire strike price of each option it sells but without the corresponding opportunity to benefit from potential increases in the value of the underlying instrument. If there is a broad market decline and the investor is not able to close out its written put options, it may result in substantial losses to the investor. The investor will receive a premium from writing options, but the premium received may not be sufficient to offset any losses sustained from exercised put options. Put writing makes an explicit trade-off between up-market participation and down-market participation, while still seeking reasonable returns in flat markets. As such, in up markets, an investor typically will not participate in the full gain of the underlying index above the premium collected.

Options involve investment strategies and risks different from those associated with ordinary portfolio securities transactions. By writing put options, an investor assumes the risk of declines in the value of the underlying instrument and the risk that it must purchase the underlying instrument at an exercise price that may be higher than the market price of the instrument, including the possibility of a loss up to the entire strike price of each option it sells but without the corresponding opportunity to benefit from potential increases in the value of the underlying instrument. If there is a broad market decline and the investor is not able to close out its written put options, it may result in substantial losses to the investor. The investor will receive a premium from writing options, but the premium received may not be sufficient to offset any losses sustained from exercised put options. Put writing makes an explicit trade-off between up-market participation and down-market participation, while still seeking reasonable returns in flat markets. As such, in up markets, an investor typically will not participate in the full gain of the underlying index above the premium collected.

All information as of the date indicated. Firm data, including employee and assets under management figures, reflect collective data for the various affiliated investment advisers that are subsidiaries of Neuberger Berman Group LLC (the "firm"). Firm history includes the history of all firm subsidiaries, including predecessor entities. Investment professionals referenced include portfolio managers, research analysts/associates, traders, and product specialists and team dedicated economists/strategists.

Neuberger Berman Investment Advisers LLC is a registered investment advisers. The "Neuberger Berman" name and logo are registered service marks of Neuberger Berman Group LLC.

NEUBERGER	BERMAN
-----------	--------

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

**www.nb.com**