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A Smoother Ride for Near Retirees:

Incorporating Equity Index Put Writing into Near-Dated Target Date Funds

While there are many unknowns for employees when it comes to retirement planning—how much to save, where to invest, how long will retirement last—the most frightening may be whether the wealth they've accumulated over the years will last their entire post-work lives. Years of careful planning and diligent investment can be waylaid by a large loss in the critical 10–15 years before retirement and have a huge detrimental impact on the longevity of a retiree's savings.

This risk of experiencing a large drawdown near or in retirement is what drives the long-simmering "to versus through" debate within the target date fund community. "To" target date funds reach their most conservative asset allocation at the point of retirement, having reduced portfolio risk sharply over the previous 10–15 years to protect against large drawdowns as that date approaches. "Through" products, in contrast, embrace higher allocations to riskier assets near and even beyond the retirement date in an effort to generate growth and protect against longevity risk (the risk of outliving one's savings).

At the end of the day, participants nearing retirement need strategies that seek both to mitigate risk and to provide growth potential. We believe replacing a portion of a near-dated target date fund's equity exposure with a collateralized put write strategy—an option strategy in which the portfolio manager systematically sells fully collateralized short-dated put options on a variety of indexes in an effort to generate equity-like returns with lower volatility over time—can help in this pursuit. Because certain participants may not know how to effectively manage exposure to a put-write strategy, we believe these strategies belong within target date, asset allocation and other professionally managed retirement strategies rather than on a core plan menu.

In this white paper we discuss put write strategies and their potential benefits, explore the importance of providing downside mitigation for near retirees, and illustrate the hypothetical impact of a put write allocation on participant outcomes.

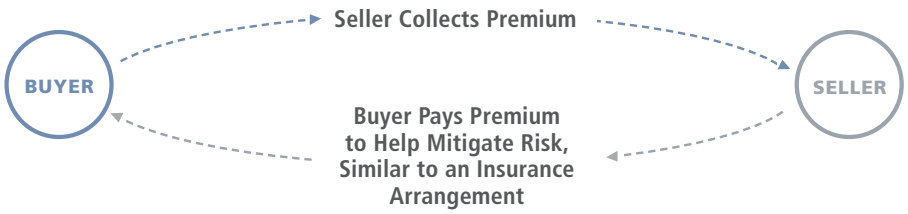
Let's start with an exploration of what put write strategies are and what benefits they can provide to retirement investors.

How Does Equity Index Put Writing Work?

We typically reference insurance underwriting, one of the oldest business models around, to explain why equity index put writing has the potential to deliver consistent profitability. There are countless "real world" examples in the insurance business in which both the insurance provider (seller) and the insured (buyer) derive mutual benefit from transacting—the former earns economic profit (premium plus interest on collateral) and the latter gains control (a hedge).

In terms of equity index put writing strategies, the put seller (or "writer") assumes a portion of the loss potential of the index over a specified term in exchange for a payment (premium), effectively insuring the buyer from potential losses net of the premiums paid. The put seller's downside risk is consistent with that of an investor who owns an index such as the S&P 500 Index outright, only the put writer demands upfront payments to assume the market's risk rather than buying the index and waiting for compensation via capital appreciation and dividends. It's a simple matter of accepting a cash flow "in" and waiting for the put contract to expire or be exercised versus paying a cash flow "out" and waiting for the market to deliver returns.

FIGURE 1. SELLING INDEX-BASED PUT OPTIONS



For illustrative purposes only.

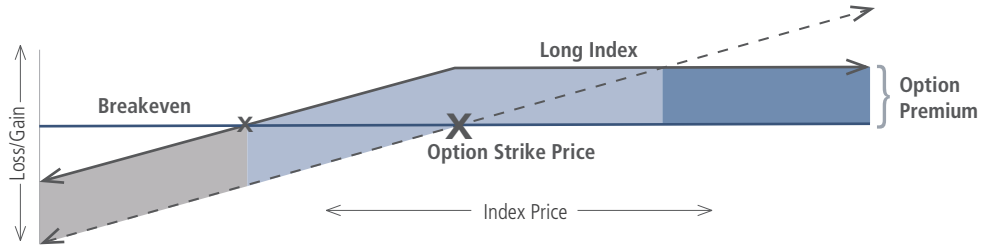
In more technical terms, the writer of a put gives the buyer the right to sell an index at a specified "strike" price on a specified date, receiving a payment in exchange for setting the price and assuming risk. If the price of the underlying index falls below the strike price of the put, the put is "in the money" and will be exercised at expiration. If the index remains above the strike price, it is "out of the money" and will expire worthless.[1] In either case, the put writer keeps any premium received. The risk for the equity index put writer is a decline in the level of the underlying index since the writer will be forced to pay to the option holder the difference between the strike price and the index's price at expiration (reduced by any premium received for selling the option).

[1] Index options (including those on the S&P 500) are so-called "European" options that cannot be exercised until the expiration date. In contrast, "American"-style options (such as those written on a single stock) can be exercised at any time before expiration.

A collateralized equity index put writer (who covers positions with short-term Treasury holdings or similar high-quality fixed income securities) seeks to manage a portfolio such that the premiums received for selling equity index put options plus the income from the collateral portfolio generates an equity-like return with less volatility than the underlying equity index over the long term. Equity index put writing strategies take such individual transactions and seek to systematize them for the benefit of investors.

FIGURE 2. HOW A PUT WRITE STRATEGY IS EXPECTED TO BEHAVE

Down Markets | Declines are similar to the underlying index, but may be partially offset by the premium collected.
Flat Markets | Put option seller keeps premium.
Up Markets | Does not participate in full gain of underlying index above the premium collected.



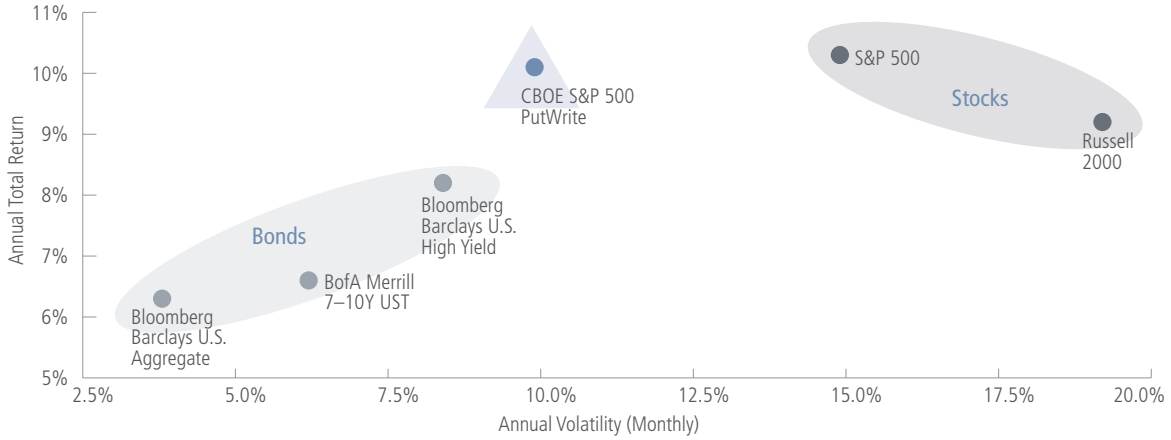
Options involve different risks than ordinary portfolio securities transactions. Option prices are volatile and influenced by a number of things, including actual or anticipated changes in the underlying instrument.

Put Write Strategies Can Enhance a Portfolio's Risk/Return Profile and Provide Downside Mitigation

Collateralized equity index put writing is well suited to improve the risk-return efficiency, liquidity, flexibility and cost-effectiveness of retirement-focused portfolios without compromising the potential for equity-like returns over the long run. Figure 3 illustrates the potential enhanced risk-efficiency index put writing strategies may offer versus a variety of traditional asset class indexes using the CBOE S&P 500 PutWrite Index (which we describe on the next page) as a proxy for a put writing strategy.

FIGURE 3. PUT WRITE STRATEGIES OFFER POTENTIAL TO ENHANCE PORTFOLIO RISK EFFICIENCY

Index Annual Return vs. Risk (June 1986 – December 2017)



Source: Bloomberg, CBOE. Selected time period reflects longest common history of indexes. The CBOE S&P 500 PutWrite (PUT) Index incepted in June 2007 with historical backtested data available since 6/30/1986.

Collateralized Put Writing and the CBOE S&P 500 PutWrite Index

In 2007 the Chicago Board of Exchange (the "CBOE") introduced the S&P 500 PutWrite Index (the "PUT Index"), which is designed to track the performance of a collateralized put writing strategy on the S&P 500 Index. The PUT Index represents a portfolio that maintains a short position in a 30-day, at-the-money put option on the S&P 500, rolled monthly, and a long position in U.S. T-bills equal to the potential obligation of the S&P 500 put options. As illustrated in Figure 4, since 1986, the PUT Index has achieved a return similar to that of the S&P 500 while experiencing a notably lower level of volatility, resulting in a more risk-efficient equity index exposure over the period. The PUT Index's beta and up-market and down-market statistics versus the S&P 500 highlight that its results are driven by structural differences in strategy payoffs. However, the PUT Index's complementary relative results are not achieved without unique risks. Accepting the PUT Index's differentiated return profile comes with a long-term annualized tracking error of approximately 8.7% versus the S&P 500.[2] Of course, higher tracking error levels allow smaller allocations to have an impact at the portfolio level.

FIGURE 4. ATTRACTIVE RISK-ADJUSTED RETURNS
Return and Risk Statistics (June 1986–December 2017)

	S&P 500 Index	CBOE S&P 500 PutWrite Index	
Annual Return (%)	10.28	10.08	**Attractive**
Volatility (%)	14.89	9.90	**Lower**
Risk-Adjusted Returns	0.69	1.02	**Higher**
Beta to the S&P 500	1.00	0.55	**Lower**
Maximum Drawdown (%)	-50.9	-32.7	**Reduced**
Up-Market Capture	1.00	0.62	**Lower**
Down-Market Capture	1.00	0.39	**Lower**

Source: Bloomberg, CBOE. The CBOE S&P 500 PutWrite (PUT) Index incepted in June 2007 with historical backtested data available since 6/30/1986.

Figure 5 provides the monthly return distribution for the PUT Index alongside return distributions of the S&P 500 Index and the S&P 500 Low Volatility Index. In converting traditional equity investment return potential (i.e., capital appreciation and dividends) into tangible upfront cash flows via the consistent collection of option premiums and interest income, equity index put writing strategies reshape the return distribution of the underlying equity index. This augmented return distribution can play a meaningful role in investor portfolios by diversifying traditional equity index allocations and supplementing the cash generation of yield-oriented investment allocations.

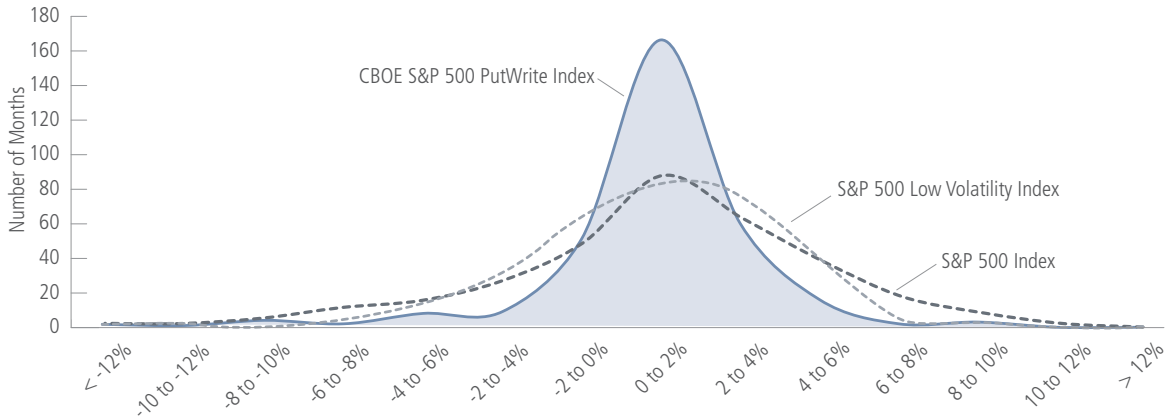
This return distribution has explicit tradeoffs:

- Limited up-market participation (i.e., reduces the "right tail")
- Down-market participation mitigated by receipt of premiums (i.e., reduces the "left tail")
- Opportunity to produce modest returns in a flat market

[2] The PutWrite Index performs well across additional statistics that address non-normal return distributions (such as option writing) and include, but are not limited to, Sortino ratio, Stutzer index, Treynor ratio and Leland's annual alpha, as further described in the paper http://www.cboe.com/rmc/2015/Day-1-Session-2-Black-Szado-projector.pdf.

FIGURE 5. RESHAPING THE S&P 500 INDEX MONTHLY RETURN DISTRIBUTION

Monthly Return Distributions (December 1990 – December 2017)



Source: Bloomberg. Selected time period reflects longest common history of indexes.

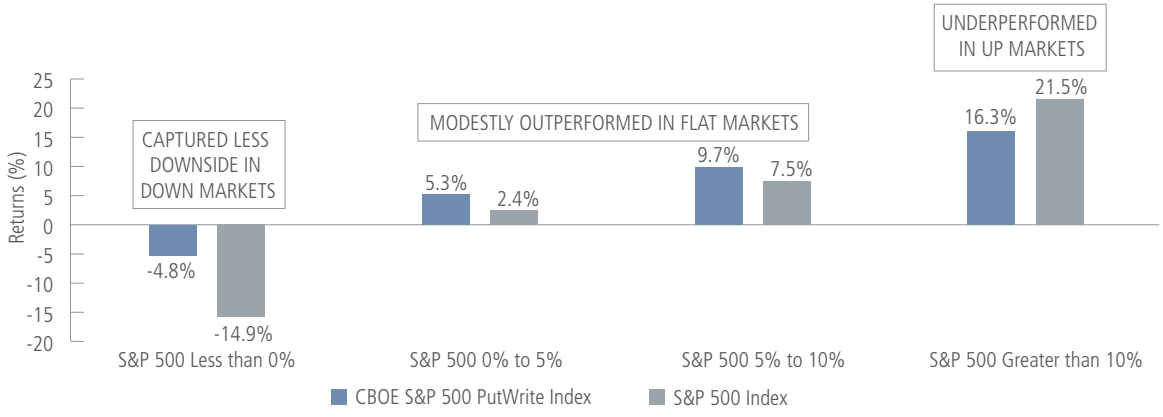
Smoother Ride than the S&P 500

The monthly up-market and down-market capture ratios presented in Figure 4 help quantify the structural return diversification illustrated in Figure 5, but neither offers a clear return profile across various S&P 500 return environments. In Figure 6 we compare the average one-year return of the PUT Index relative to that of the S&P 500 across various market scenarios. Although the PutWrite Index has tended to trail the S&P 500 Index in strong markets, it has historically outperformed the S&P 500 Index in flat, down and modest return environments, effectively achieving relative success in three of the four scenarios.

While the S&P 500 has spent a significant portion of rolling one-year periods compounding at an annual rate greater than 10%, we suspect many investors would agree that the PUT Index's relative performance profile can be additive to broader asset allocations that seek to improve overall portfolio efficiency, especially when considering downside protection.

FIGURE 6. PUT INDEX HAS OUTPERFORMED DURING DOWN, FLAT AND MODESTLY BULLISH MARKETS

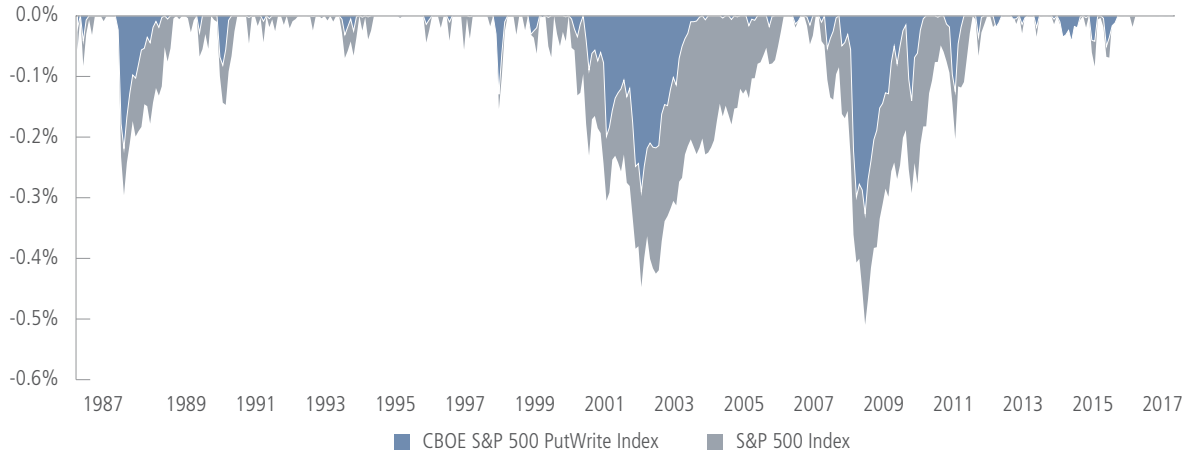
Average One-Year Rolling Returns by S&P 500 Index Return Scenarios (June 1986 – December 2017)



Source: CBOE and Bloomberg. The CBOE S&P 500 PutWrite (PUT) Index incepted in June 2007 with historical backtested data available since 6/30/1986.

Figure 7 provides a drawdown statistical analysis for the PUT Index versus its underlying S&P 500 exposure. Since 1986 the maximum drawdown for the PUT Index was -32.7%, compared to -50.9% for the S&P 500.

FIGURE 7. DRAWDOWNS CONSISTENTLY LESS THAN S&P 500 INDEX
Monthly Drawdown for PUT and S&P 500 (June 1986 – December 2017)



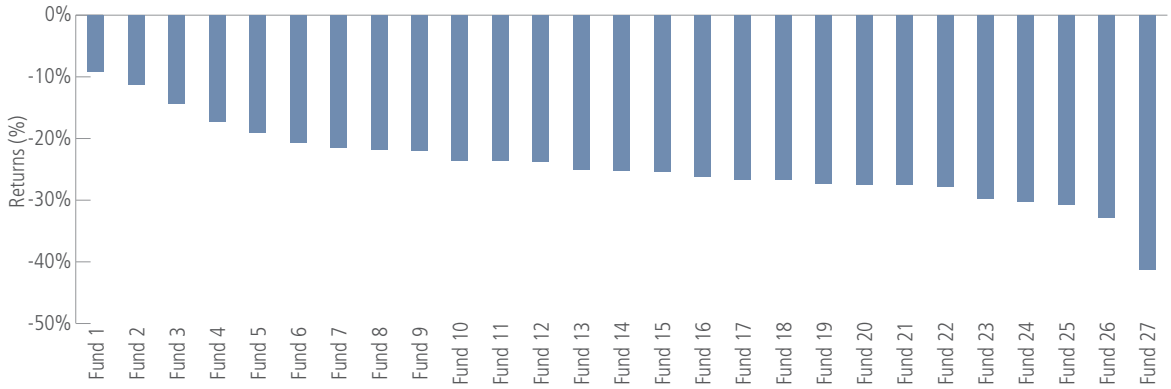
Source: CBOE and Bloomberg.

How do put writing strategies work in the context of target date funds?

As we've already discussed, put writing strategies can make a meaningful difference in mitigating the impact of market downturns while outperforming or keeping pace with the S&P 500 in modestly bullish markets. Why is this important? Significant losses in the years prior to and just after a participant's target retirement date can be devastating to that individual. Even if the participant has been diligent about contributing to their retirement account throughout their career and has made prudent investment decisions along the way, a significant drawdown near or at retirement can materially impact the participant's ability to retire on time or to have sufficient funds to last through retirement.

Participants become extremely vulnerable to unfavorable market conditions in the 10 – 15 years before retirement, as they don't have time to recoup the losses they may have incurred. Given the extended bull market of the past nine years, it can be easy to forget the danger of a severe market drop like the one experienced in 2008 that resulted in extreme losses for some near retirees invested in 2010 target date funds (see Figure 8).

FIGURE 8. NEAR RETIREES IN 2008 EXPERIENCED TARGET DATE FUND LOSSES OF UP TO 41%
2008 Returns for Near Retirees in 2010 Target Date Funds



Source: Morningstar "Target-Date Series Research Paper: 2010 Survey". Data represents period between 01/01/2008 – 12/31/2008.

Many of the participants invested in these 2010 target-date funds in 2008 were just two years away from their anticipated retirement. As Figure 9 shows, recovering from significant portfolio losses takes time, which may cause near retirees to stay in the workforce longer than planned or to retire with a significantly smaller nest egg.

FIGURE 9. NEAR RETIREES MAY NOT HAVE SUFFICIENT TIME TO RECOUP LARGE LOSSES

Years to Recover from Large Losses Based on Projected Rates of Return

Percentage Loss	0.5% return	2% return	4% return	6% return	8% return	10% return
-10% loss	21.12	5.32	2.69	1.81	1.37	1.11
-20% loss	44.74	11.27	5.69	3.83	2.90	2.34
-30% loss	71.51	18.01	9.09	6.12	4.63	3.74
-40% loss	102.42	25.80	13.02	8.77	6.64	5.36
-50% loss	138.98	35.00	17.67	11.90	9.01	7.27

This is a hypothetical illustration showing how many years it would take to recover from losses of different magnitudes at varying rates of returns. The illustration is based on mathematical principles and assumes monthly compounding. It is not meant as a forecast of future events or as a statement that prior markets may be duplicated. Recovery periods are rounded to the nearest quarter of a year. The hypothetical returns do not depict that of any Neuberger Berman fund.

We can't stress enough the detrimental impact a market loss can have on the investment outcomes of participants nearing retirement. While a market correction negatively affects all target date investors regardless of age, younger participants—given low account balances and a long time horizon to rebuild wealth—feel the impact less than late-career individuals with high balances and retirement looming. So while it's important to do all the "right" things over the course of one's career—saving adequately, taking advantage of an employer match, investing prudently—returns in the final 10–15 years can have the biggest impact on one's wealth accumulation going into retirement; as such, it's incumbent upon plan sponsors to consider ways to mitigate the potential for extreme drawdowns—particularly for those nearing retirement—in the target date portfolios they offer.

Adding Put Write Strategies to Specific Points along the Glidepath

To evaluate the impact a put write strategy could have on retirement outcomes in a typical target date fund, we ran a hypothetical simulation comparing two glidepaths: 1) a "standard" glidepath assuming varying allocations to stocks and bonds and 2) an "enhanced" glidepath assuming varying allocations to stocks, bonds and a put write strategy. In this simulation, stocks are represented by the S&P 500, bonds by the Barclays U.S. Aggregate Index and put write strategies by the CBOE S&P 500 PutWrite Index. We, of course, recognize that there are many different glidepath methodologies and that they vary greatly depending on the provider. Therefore, we are using a simplistic glidepath assumption as a starting point for this illustration; we would welcome further, customized discussions based on your provider's specific glidepath assumptions.

Putting it into practice

We think about the target date fund glidepath in three stages: pre-retirement, approaching retirement and near and at-retirement. We would recommend introducing a put write strategy in the approaching retirement stage, replacing a portion of the glidepath's equity exposure and gradually increasing the exposure to put write as you approach the near and at-retirement phase.

Pre-Retirement | 20–40 years from retirement: Participants far from retirement should strive to maximize the growth of their assets and need exposure to strong equity market upside potential. Therefore, for participants who are in farther-dated target date vintages, we recommend full exposure to the equity market and no allocation to put write strategies.

Approaching Retirement | 10–20 years from retirement: As participant assets grow and retirement approaches, risk mitigation becomes more important. Now is the time when it would be appropriate to replace some equity exposure with put write strategies, increasing the allocation over time.

Near and At Retirement | 10 years from retirement through retirement: Participants on the cusp of or at retirement are obviously the most vulnerable to an equity market selloff, thus funds for these participants should have the greatest exposure to put write strategies.

As you'll see in the glidepath illustrations below, we began replacing a very small portion of the equity allocation (2%) with S&P 500 PutWrite 25 years out from retirement and gradually increased the allocation from there, increasing to a 30% allocation 10 years from retirement and maintaining that exposure at the glidepath landing point (the retirement date).

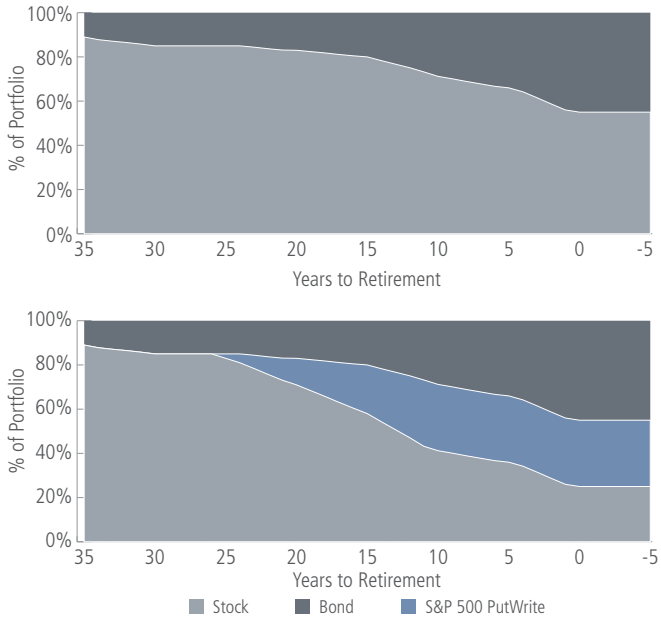
FIGURE 10. A PUT WRITE STRATEGY CAN REPLACE PART OF A NEAR-DATED TARGET DATE FUND'S EQUITY ALLOCATION
Sample Glidepath Allocations

Standard TDF Glidepath

Years to Retirement	35	30	25	20	15	10	5	0	-5
Stock (%)	89	85	85	83	80	71	66	55	55
Bond (%)	11	15	15	17	20	29	34	45	45
Total (%)	100	100	100	100	100	100	100	100	100

Enhanced TDF Glidepath with S&P 500 PutWrite Allocation

Years to Retirement	35	30	25	20	15	10	5	0	-5
Stock (%)	89	85	83	71	58	41	36	25	25
S&P 500 PutWrite (%)	0	0	2	12	22	30	30	30	30
Bond (%)	11	15	15	17	20	29	34	45	45
Total (%)	100	100	100	100	100	100	100	100	100



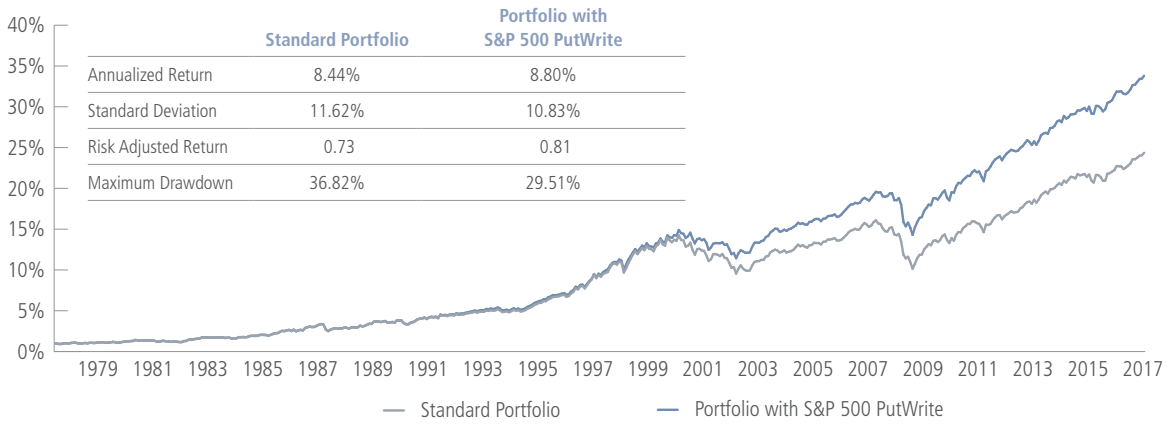
For illustrative purposes only. Asset allocations are rebalanced annually. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Results shown are hypothetical, do not represent the returns of any particular investment and do not reflect the fees and expenses associated with managing a portfolio. 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. **Past performance is no guarantee of future results.**

Portfolio with S&P 500 PutWrite Resulted in Improved Return and Less Volatility

In Figure 11 we generated hypothetical returns for the standard and enhanced glidepaths described above. The enhanced target date portfolios—in which we replaced a portion of the equity allocation with an allocation to the S&P 500 PutWrite—generated attractive long-term results. The enhanced portfolio generated excess returns and improved risk-adjusted return, dampened volatility and a reduced maximum drawdown.

FIGURE 11. ADDITION OF S&P 500 PUTWRITE RESULTED IN ATTRACTIVE LONG-TERM RESULTS

Hypothetical Results, Data from 1988–2017



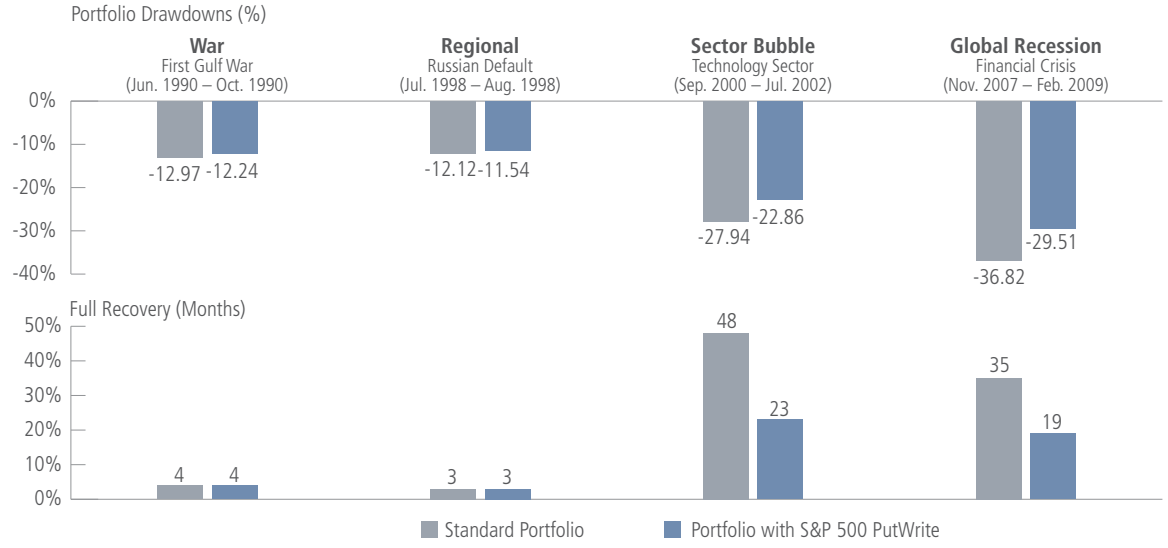
Source: Bloomberg. For illustrative purposes only. Asset allocations are rebalanced annually. Asset allocations and performance are represented by benchmarks and do not represent any Neuberger Berman investment product or service. See page 8 for allocation weightings and benchmarks. Results shown are hypothetical, do not represent the returns of any particular investment and do not reflect the fees and expenses associated with managing a portfolio. 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. **Past performance is no guarantee of future results.** Note: Descriptions of the Standard and Enhanced TDF glidepaths can be found on page 7.

Portfolio with S&P 500 PutWrite Resulted in Lower Drawdowns and Experienced Faster Recovery in Periods of Market Stress

Given that participants nearing, at or post-retirement are at the most risk from a market downturn, we conducted a drawdown analysis for the standard portfolio versus the enhanced portfolio for all periods of market stress that occurred over the course of the glidepath. In all cases presented, the portfolio with S&P 500 PutWrite declined less, and it never lagged the standard portfolio in time to recovery. No matter the nature of the crisis depicted in Figure 12, the enhanced portfolio proved to be a lower-volatility/lower-downside strategy relative to the standard portfolio.

FIGURE 12. ADDITION OF S&P 500 PUTWRITE RESULTED IN LESS DOWNSIDE RISK WITH SHORTER RECOVERY PERIODS

Hypothetical Performance in Periods of Market Stress



Source: Bloomberg LP. For illustrative purposes only. Asset allocations are rebalanced annually. Asset allocations and performance are represented by benchmarks and do not represent any Neuberger Berman investment product or service. See page 8 for allocation weightings and benchmarks. Results shown are hypothetical, do not represent the returns of any particular investment and do not reflect the fees and expenses associated with managing a portfolio. 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. **Past performance is no guarantee of future results.**

Conclusion

A sharp equity market shock near or early into retirement can have a major impact on the outcomes of participants who, at that stage of their lives, simply don't have enough time to recoup significant losses. Longer lifespans, however, suggest that larger nest eggs are necessary for retirees to avoid outliving their assets; thus a reasonable exposure to equities is necessary even in retirement.

While both market risk and longevity risk are important considerations in target date fund design, plan sponsors don't necessarily need to emphasize one at the expense of the other. Collateralized equity index put writing strategies may serve as a compromise. By generating equity-like returns with less volatility than the underlying equity index, put writing strategies may improve the risk-return efficiency, liquidity, flexibility and cost-effectiveness of retirement-focused portfolios without compromising their potential for growth.

Index Definitions

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.

The **S&P 500® Low Volatility Index** measures performance of the 100 least volatile stocks in the S&P 500. The index benchmarks low volatility or low variance strategies for the U.S. stock market. Constituents are weighted relative to the inverse of their corresponding volatility, with the least volatile stocks receiving the highest weights.

The **CBOE S&P 500 PutWrite Index (PUT)** is designed to track the performance of an index option put writing strategy that sells 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, i.e., put options are fully collateralized.

The **Barclays U.S. Aggregate Index** represents securities that are SEC-registered, taxable and dollar-denominated. The index covers the U.S. investment grade fixed rate bond market, with index components for government and corporate securities, mortgage pass-through securities and asset-backed securities.

The **Barclays U.S. High Yield Index** covers the universe of fixed rate, non-investment grade debt. Eurobonds and debt issues from countries designated as emerging markets (sovereign rating of Baa1/BBB+/BBB+ and below using the middle of Moody's, S&P, and Fitch) are excluded, but Canadian and global bonds (SEC registered) of issuers in non-EMG countries are included. Original issue zeroes, step-up coupon structures, 144-As and pay-in-kind bonds (PIKs, as of October 1, 2009) are also included.

The **Russell 2000 Index** measures the performance of the small-cap segment of the U.S. equity universe. The Russell 2000 Index is a subset of the Russell 3000® Index representing approximately 8% of the total market capitalization of that index. It includes approximately 2,000 of the smallest securities based on a combination of their market cap and current index membership.

The **BofA Merrill Lynch 7–10 Year US Treasury Index** is a subset of The BofA Merrill Lynch US Treasury Index including all securities with a remaining term to final maturity greater than or equal to 7 years and less than 10 years.

The PUT Index was introduced in 2007, the CBOE provides historical backtested data on the PUT Index starting from June 30, 1986.

The performance and risk estimates shown on page 9 are hypothetical in nature and simulation are based upon return and risk assumption which reflects the average index returns and volatility from 6/30/1986–12/31/17. The estimates do not reflect actual investment results and are not guarantees of future results. See page 8 for allocation weightings and benchmarks. Results shown are hypothetical, do not represent the returns of any particular investment and do not reflect the fees and expenses associated with managing a portfolio. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. 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.

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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. 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.

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