NEUBERGER BERMAN

DEREK DEVENS, CFA
Senior Portfolio Manager
Option Group

DOUGLAS KRAMER
Co-Head, Quantitative and
Multi-Asset Class Investments

RORY EWING
Research Analyst
Option Group

ERIC ZHOU
Research Analyst
Option Group

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UNCOVERING THE EQUITY INDEX PUTWRITE STRATEGY

Evolutionary, Not Revolutionary

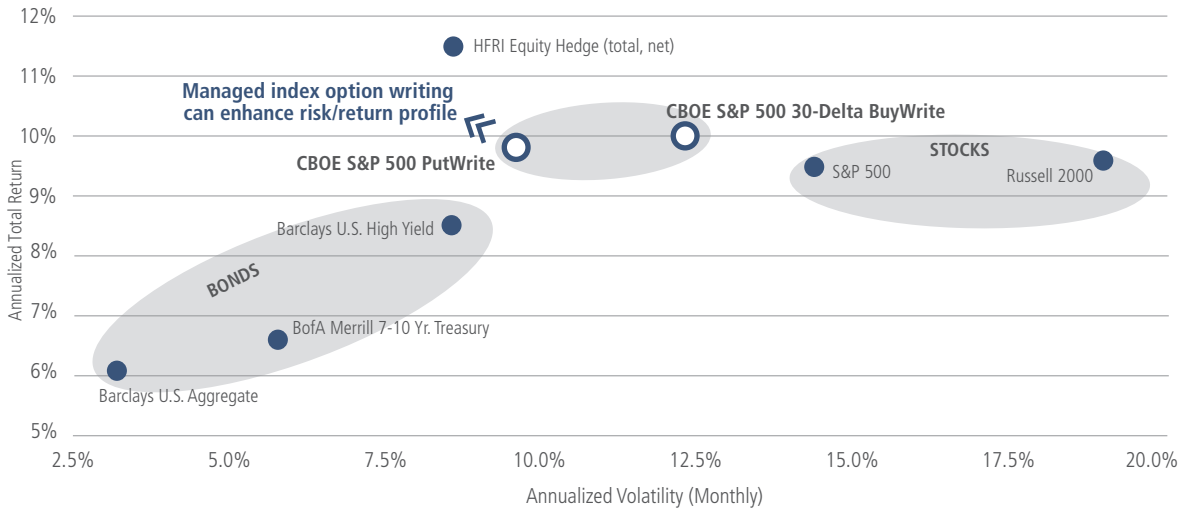
When we contemplate the evolution of the investment management industry in aggregate, it appears to us that an increased desire to control risk and isolate and/or to define investment outcomes is a persistent, likely permanent, feature of the financial market landscape. Waning investor preference for stock pickers is being partially reborn in hopes of identifying and capturing market factors and risk premiums. In response, investment strategy innovation is becoming less about honing active stock selection and more about engineering and delivering a unique, identifiable return distribution. That said, innovation does not necessarily require increased complexity. Invariably, risks must be managed, and if risks are not managed by a "stock picker", then precautions must be taken at the portfolio level. We view the increasing adoption of risk-based allocations and the success of products such as risk-premia, smart-beta, low-volatility, factor-based and multi-asset class strategies as first-hand confirmation of this tectonic shift.

The perennial investor challenge is to source investment strategies that can offer both total returns consistent with long-term portfolio targets and manageable levels of risk (volatility and drawdown). Naturally, investors seek to maximize their return earned per unit of risk assumed, i.e. risk-adjusted returns. However, such risk-efficiency can't be "spent" to meet future obligations without the application of meaningful leverage, usually a less desirable risk element.

We believe strategies that can preserve portfolio return potential while freeing up "risk budget" for incremental investments in asset classes that offer higher long-term return potential such as private equity or credit, venture capital, real estate and infrastructure, are particularly valuable to an asset allocator.

In this vein, we present collateralized equity index put writing as a strategy well suited to improve the risk-return efficiency, liquidity, flexibility and cost-effectiveness of investor portfolios, be they passive or active. Figure 1 illustrates the potential enhanced risk-efficiency index option writing strategies offer versus a variety of traditional asset class indexes. What follows is an anthology of sorts on collateralized index put writing that is guided by our investment philosophy, years of research and implementation and investor conversations.

FIGURE 1. POTENTIAL TO ENHANCE PORTFOLIO RISK EFFICIENCY
Index Annual Return vs. Risk (January 1990 – March 2017)



Source: Bloomberg LP, CBOE.

Option Markets are Capital Markets

At a macro level, we believe index option markets serve as a necessary capital market for risk transfer not too dissimilar to other risk underwriting markets such as debt or equity capital markets or even traditional insurance markets. Equity index option premiums efficiently price the transfer of equity index risk between buyers and sellers, much like bond market yields price interest rate and credit risks. Figure 2 plots the CBOE S&P Volatility Index (the "VIX") level against the option-adjusted spread of the Barclays U.S. High Yield Index to illustrate our idea that index option implied volatility is a risk-pricing mechanism that is similar to high yield bond yields.

FIGURE 2. IMPLIED VOLATILITY VS. HIGH YIELD CREDIT SPREADS

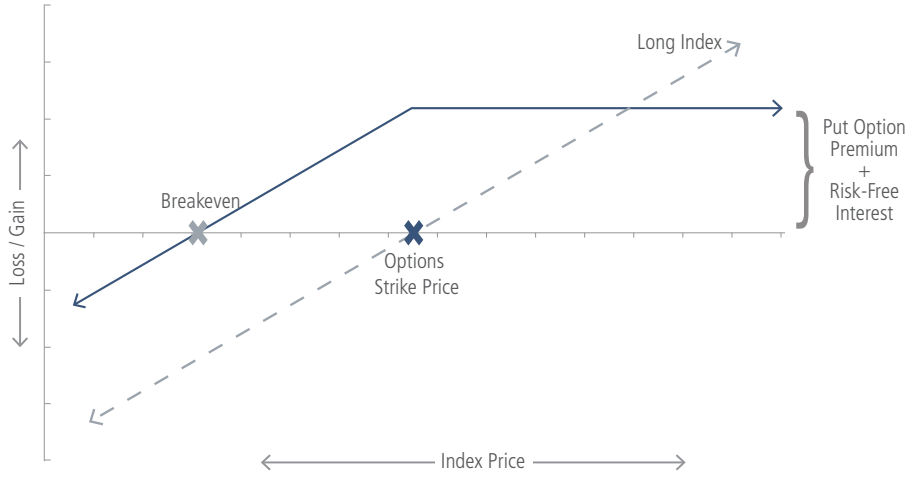
CBOE S&P 500 Volatility Index (VIX) vs. Barclays U.S. High Yield OAS (January 1994 – March 2017)

Source: Bloomberg LP, Barclays.

While bonds and stocks are exclusively underwritten by investment banks, almost any sophisticated investor is free to write an option contract on an exchange. This allows longer-term, well-capitalized investors to take advantage of the market structure built by the larger players—including the information flow and established options pricing. Imagine an accessible insurance marketplace where the clearing price was set by insurers with high operating costs and high costs of capital. Underwriters with lower fixed costs or access to lower cost long-term capital could underwrite similar risks and generate similar revenue, but with higher profit margins.

Collateralized Put Writing and the CBOE S&P 500 PutWrite Index ("PUT")

FIGURE 3. PUTWRITE PAY-OFF DIAGRAM



For Illustration Purposes Only.

A collateralized put writing strategy consists of a short position in an equity index put option and an investment in short-term U.S. Treasuries with a value equal to the strike price of the put option. Selling (Writing) an equity index put option accepts a future, contingent liability equal to no more than the option's strike price, i.e. fully collateralized or unlevered, in exchange for an up-front cash premium. Much like an insurance business, cash put option premiums can be used to partially offset losses that may result from the underlying index's price falling below the option's strike price.

When introducing put writing as an investment strategy, we like to dispel the inconsistent view that while investors buy put options for negative beta exposure, i.e. hedging, sellers of put options tend to be viewed solely as "selling volatility" rather than gaining efficient positive beta exposure, i.e. long equity, with a volatility premium.

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 Index, 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 Index 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.[1] Of course, higher tracking error levels allow smaller allocations to have an impact at the portfolio level.

FIGURE 4. PUTWRITE RETURN STATISTICS

Return and Risk Statistics (December 1990 – March 2017)

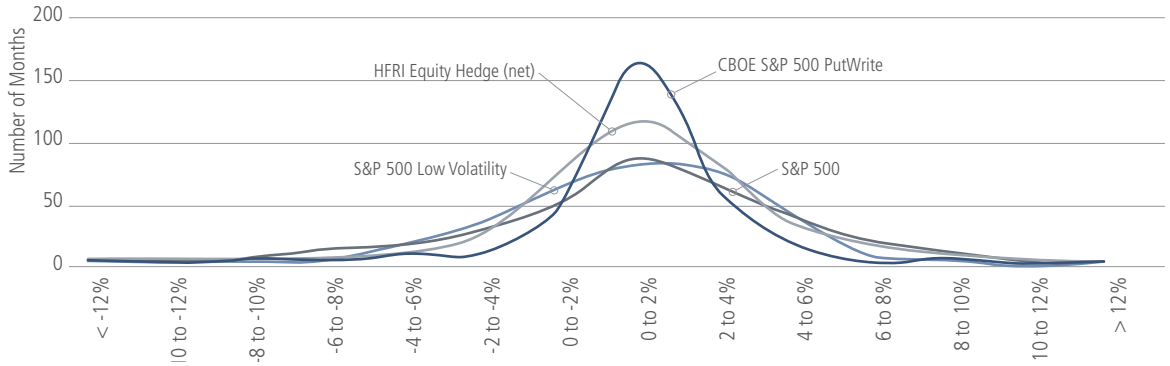
	CBOE S&P 500 PutWrite		S&P 500
Annualized Return	9.9%		10.1%
Annualized Volatility	9.7%		14.2%
Risk-Adjusted Return	1.02		0.71
Beta (S&P 500)	0.56		1.00
Maxium Drawdown	-33%		-50%
Up-Market Capture	63%	Structurally different index based return	100%
Down-Market Capture	40%		100%

Source: Bloomberg LP, CBOE.

Figure 5 provides the monthly return distribution for the PUT Index alongside return distributions of the S&P 500 Index, the S&P 500 Low Volatility Index and the HFRI Equity Hedged (Total) Index (Net). In converting traditional equity investment return potential, i.e., capital appreciation and dividends, into tangible up-front 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.

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

Monthly Return Distributions (January 1990 – March 2017)



Source: Bloomberg LP.

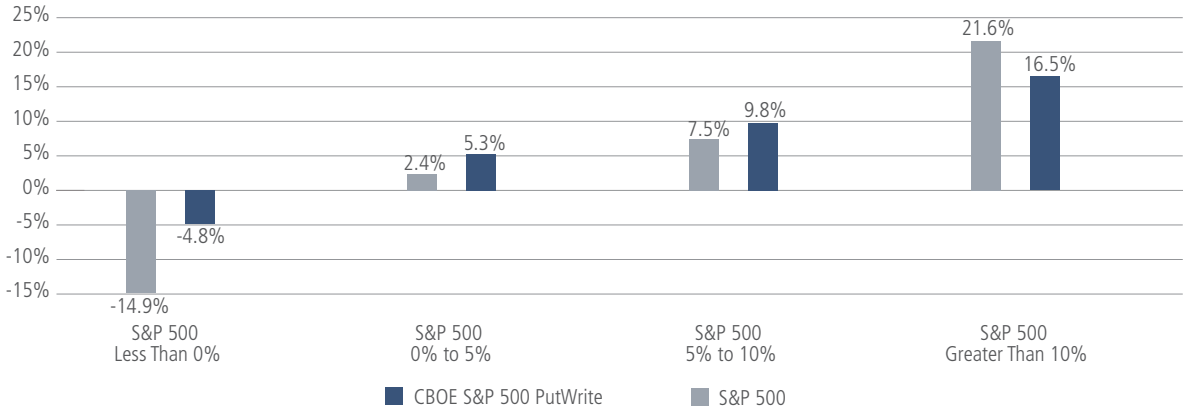
[1]The PutWrite Index performs well across additional statistics that address non-normal return distributions (such as option writing) and include, but are not limited to, Sortino ratio, Stutzer index, Treynor ratio and Leland's annual alpha, as further described in the paper http://www.cboe.com/rmc/2015/Day-1-Session-2-Black-Szado-projector.pdf.

Structural Return Diversification

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 one-year return scenarios. By tending to outperform the S&P 500 during negative, flat and modest return environments, the PUT Index achieves its relative success in three out of four scenarios with the periods of relative underperformance coinciding with periods where the PUT Index generated an attractive total return. Granted, 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 in their efforts to fulfill future obligations.

FIGURE 6. PUTWRITE RETURNS BY S&P 500 INDEX RETURN REGIME

Average Rolling 1-Year Returns by S&P 500 Index Return Scenario (June 1986 – March 2017)



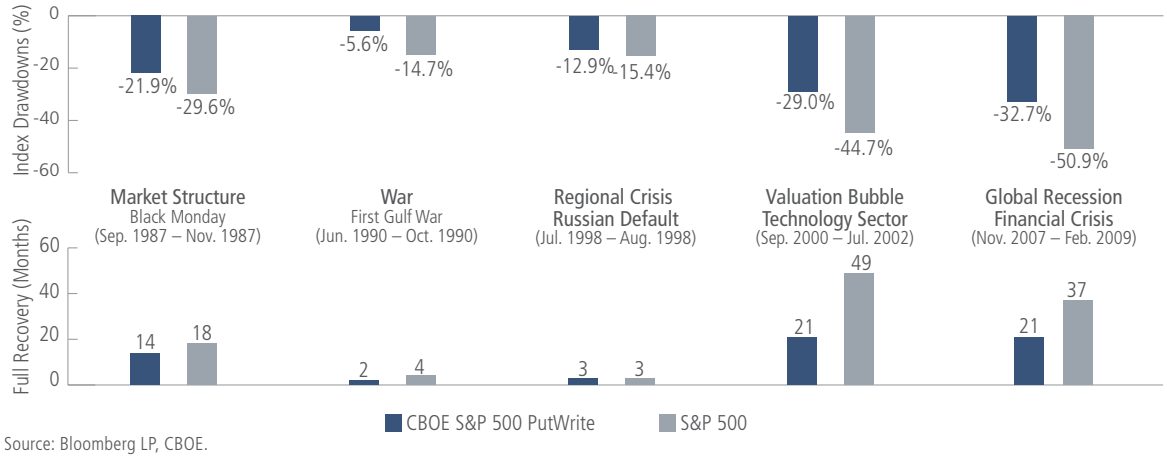
Source: Bloomberg LP, CBOE.

Drawdowns; Perception Does Not Make for Reality

Figures 7 and 8 provide a drawdown statistical analysis for the PUT Index versus its underlying S&P 500 exposure. In all cases presented, the PUT Index declined less and had more expedient recoveries than the S&P 500. No matter the nature of the crisis depicted in Figure 7, the strategy of collecting put option premiums proved to be a lower volatility/lower downside strategy relative to the S&P 500. Over the last 10 years the maximum drawdown for PUT Index was -32.7%, compared to -50.9% for the S&P 500.

FIGURE 7. LESS DOWNSIDE WITH SHORTER RECOVERY PERIOD

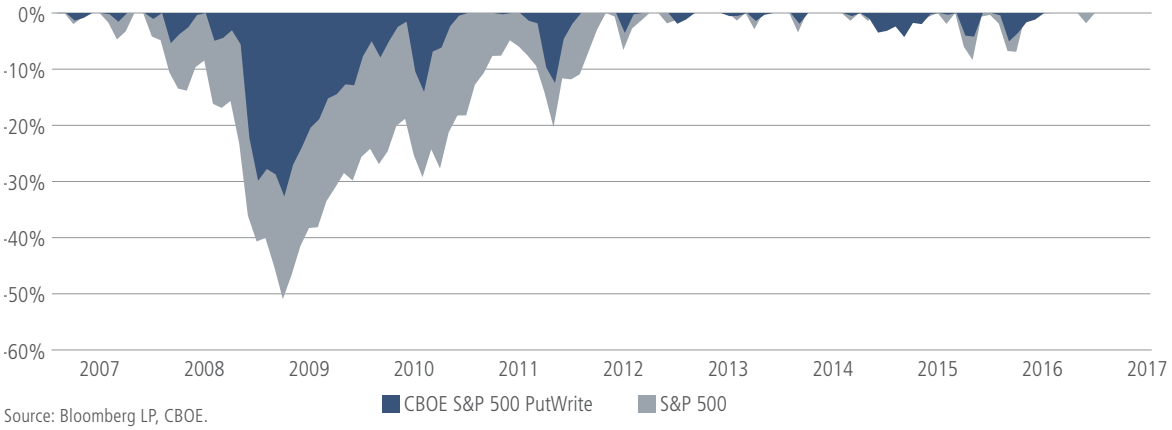
Notable S&P 500 Drawdowns (June 1986 – March 2017)



Source: Bloomberg LP, CBOE.

FIGURE 8. CUMULATIVE DRAWDOWN COMPARISON

Monthly Drawdown for PutWrite and S&P 500 (January 2007 – March 2017)



Source: Bloomberg LP, CBOE.

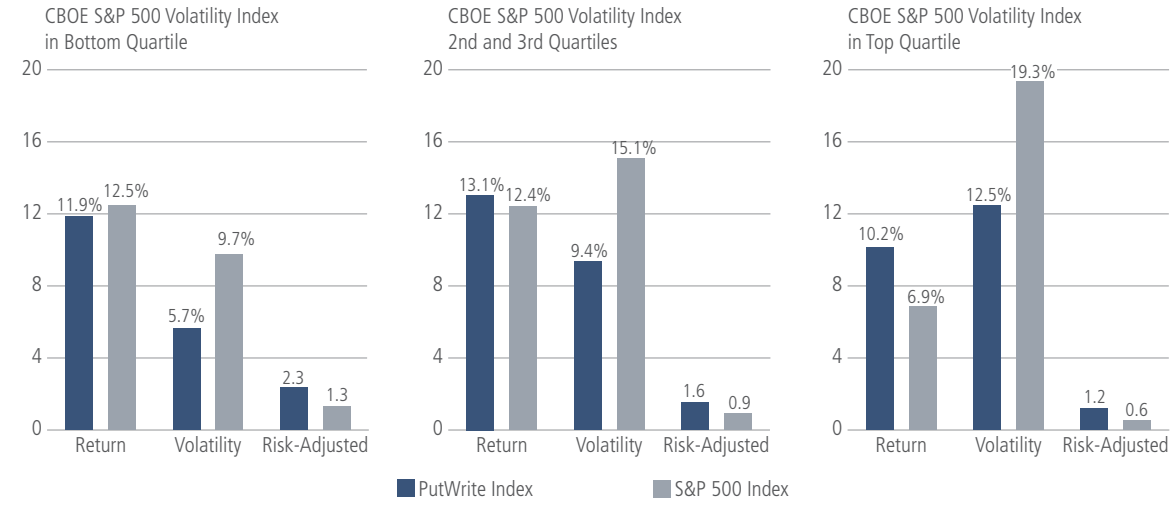
Time is Money; What are Investors Waiting For?

We find the reactive nature of implied volatility often promotes the perception that it has a predictive nature. So much so, it tempts many investors into forecasting implied volatility levels with elaborate models that produce compelling results most of the time. Unfortunately, it only takes a rare event that happens every few years to render a model ineffective.

In our minds, consistently trying to add value by successfully forecasting a market derived "forecast"—option implied volatility is an explicit forecast of an index's underlying return distribution over an explicit timeframe—is not a viable long-term business model. In the context of collateralized put writing strategies, in which the sensitivity to implied volatility (vega) is relatively limited due to unlevered positioning, timing implied volatility can only have a marginal impact. When it comes to option investing, time literally is money and it is generally better to be compounding it continuously. Figure 9 provides average 1-year return statistics for the PUT Index based on levels of the VIX as evidence that the success of the PUT Index has not been materially dependent on the level of implied volatility as estimated by the VIX. Notably the PUT exhibited a higher average risk-adjusted return in all scenarios.

FIGURE 9. PUTWRITE RETURNS BY IMPLIED VOLATILITY REGIME

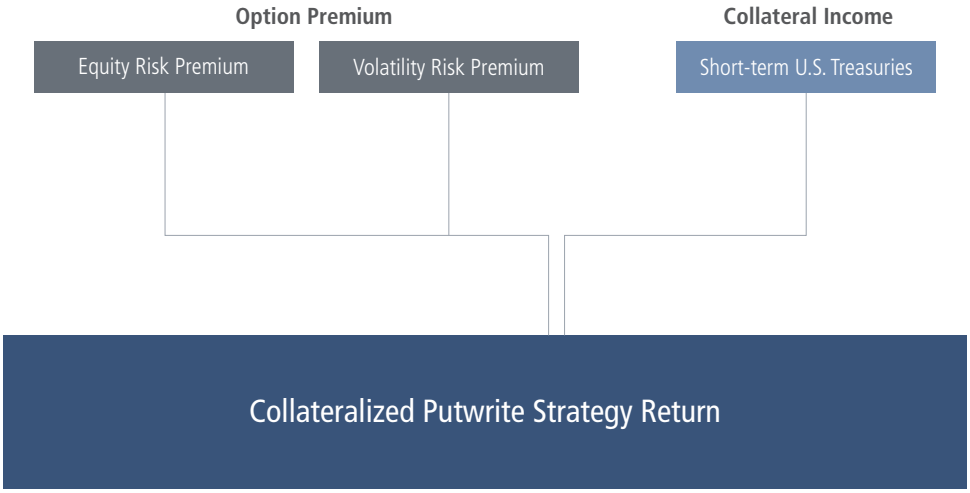
Average 1-Year Returns by Volatility Regime (Quartiles) (January 1990 – March 2017)



Source: Bloomberg LP, CBOE.

Definable and Potentially Sustainable Returns

FIGURE 10. EQUITY INDEX PUTWRITE RETURN SOURCES

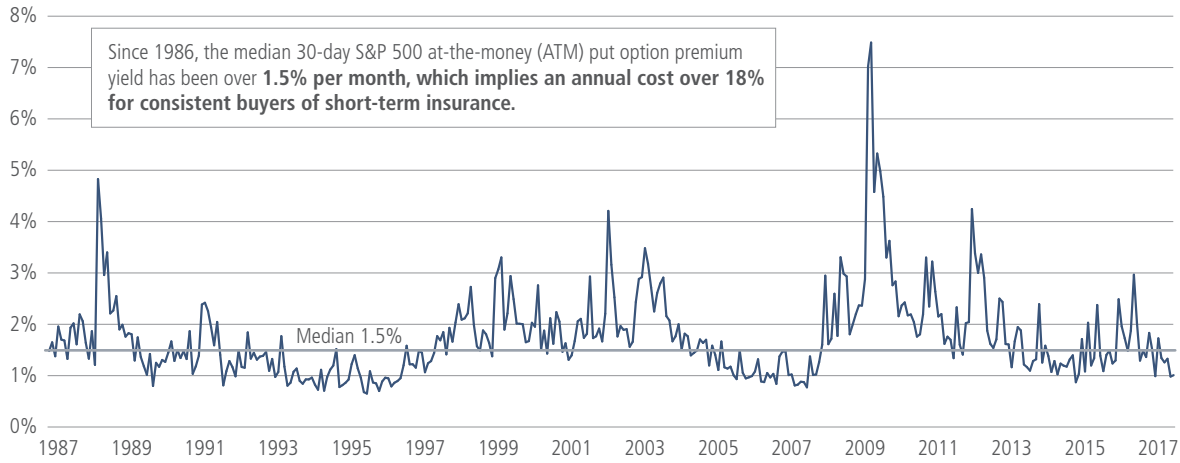


For Illustration Purposes Only.

Collateralized put writing returns are sourced from the collection of put option premiums and collateral income (Figure 10). We view a put option premium as accounting for two principal risk components. The larger of the two is an expectation of the underlying equity index's prospective volatility (equity risk premium). The second reflects the inherent uncertainty involved in underwriting the equity risk premium for a finite period of time (volatility risk premium). When translated into option implied volatility, we relate the former to the anticipated realized volatility of an equity index and the latter to the well-known implied volatility premium. Figure 11 provides the historical premium yields—defined as option premium as a percent of option strike price—of the PUT Index. Since 1986, the median put option premium yield collected by the PUT Index has been over 1.5% per month, which implies an annual cost of over 18% for consistent S&P 500 put option buyers. Option markets are constantly reappraising equity market risk to adjust for both perceived and realized risks.

FIGURE 11. OPTION PREMIUMS ADJUST TO REFLECT EQUITY MARKET RISK LEVELS

S&P 500 At-The-Money, 30-Day Put Option Premium Yield (June 1986 – March 2017)



Source: Bloomberg LP, CBOE.

Equity Risk Premium: Market Efficiency Applies Here, Too

The persistent substantiation of equity market efficiency has driven most equity allocations toward some degree of passive investment strategies. In accepting that stock prices reflect "all" or "most" information, we believe that an investor must acknowledge a natural corollary related to options on diversified stock portfolios, i.e. indexes.

> For equity markets to be efficient, investors who assume the downside risk of an equity index should expect to earn the long-term equity risk premium consistent with owning the index. Essentially, the underwriters of equity risk should earn a long-term equity risk premium as a component of their returns regardless of how the risk is assumed.

Were this not the case, then we believe equity markets would fail to meet an important condition of market efficiency.

Hence, a portion of put option premiums must compensate for the anticipated sensitivity of the option price to the underlying index—the delta risk of the option.[2] Were markets omniscient, an index put option premium would simply be priced based on the realized volatility of the index over the life of the option—implied volatility would equal realized volatility. This portion of an option premium is compensation for assuming index beta/delta risk, i.e. an equity risk premium. However, markets are obviously not "all-knowing" and the realized volatility of an equity index is difficult to predict, so surely they must demand further compensation for the added uncertainty.

Volatility Risk Premium: The Making of a Profit Margin

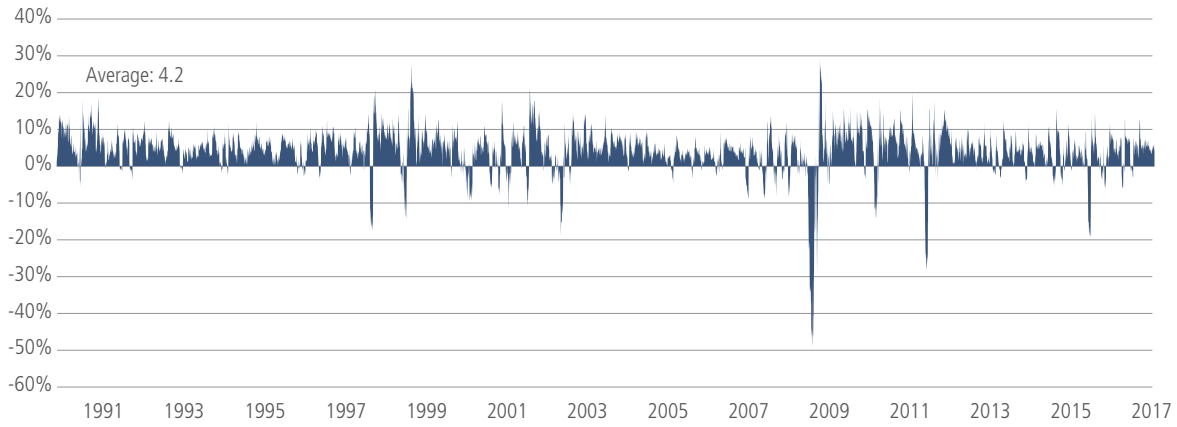
Option market makers, broker dealers, large trading firms and trading desks of large banks are the primary participants in the options market and are typically focused on trading volatility rather than underwriting equity index risk in a collateralized format. Specifically, listed index option markets ("option markets") are comprised of profit-seeking investors (speculators, hedgers and arbitrageurs) that set exchange traded option prices (premiums), intending for the majority of the options they sell to expire at a loss to the buyer. Investors don't assume risk with the intention of losing money over time, and option markets are not an exception. So, understanding how option market participants seek to earn profits is important to understanding the implied volatility premium.

As a broad generalization, option market makers buy/sell options and seek to hedge resulting exposures to the underlying index and implied volatility, aka "the greeks". Profits are earned when aggregate premiums collected exceed the costs of hedging and any additional fixed expenses associated with their operations, including corporate taxes. However, unlike a typical business model, the cost-of-goods sold, which is realized volatility of the underlying index, isn't known until the expiration of the

[2]Realized volatility translates directly into an expense for option market makers (an expense of hedging) that motivates them to price in expectations for index price volatility in their market-making activities.

options.[3] Of course, option market makers still seek to maximize their profits in the face of this additional uncertainty. Therefore, option premiums (implied volatility levels) of exchange traded index options are constantly adjusting to reflect a clearing price of risk (implied volatility premium) that accounts for world events, supply and demand dynamics and investor utility. Figure 12 charts an estimate of the implied volatility premium for the S&P 500 Index using the VIX as a proxy for 30-day implied volatility levels of the S&P 500. The implied volatility premium as estimated using VIX has averaged 4.2% and been positive in approximately 86% of the daily observations since 1990.

FIGURE 12. OPTION MARKETS DEMAND A PREMIUM TO UNDERWRITE RISK
CBOE Volatility Index (VIX)[4] vs. S&P 500 Realized Volatility (January 1990 – March 2017)



Source: Bloomberg LP, CBOE.

Collateral Interest Income: Not to be Underestimated

There are several notable benefits derived from the collateral portfolio within a Putwrite strategy. First, when short-term U.S. Treasuries are held as collateral, the value of the collateral portfolio tends to increase (yields decline) during periods of significant market stress. This can directly serve to offset both realized and unrealized (mark-to-market) losses stemming from short index option positions. Second, regular income into the collateral portfolio increases the potential rate of compounding and lowers the overall volatility of the strategy. Over the life of the PUT Index (commencing in 1986[4]), short-term U.S. T-bills had an average yield of just of 3%, which is obviously well above the current rates. Should rates revert toward their longer-term averages by even a modest amount, the return potential and efficiency of a Putwrite strategy may increase materially. These positive collateral interactions can be even more robust when investors utilize existing bond allocations as collateral for index put writing strategies, i.e., overlay implementations.

Thoughts on Competing Ideas

The volatility (option) investment landscape can be difficult to navigate given its relatively limited history, complexity, opacity and broad diversity of implementations. Below we elaborate on why we feel that Putwrite strategies continue to stand out among what we see as the most common competing ideas.

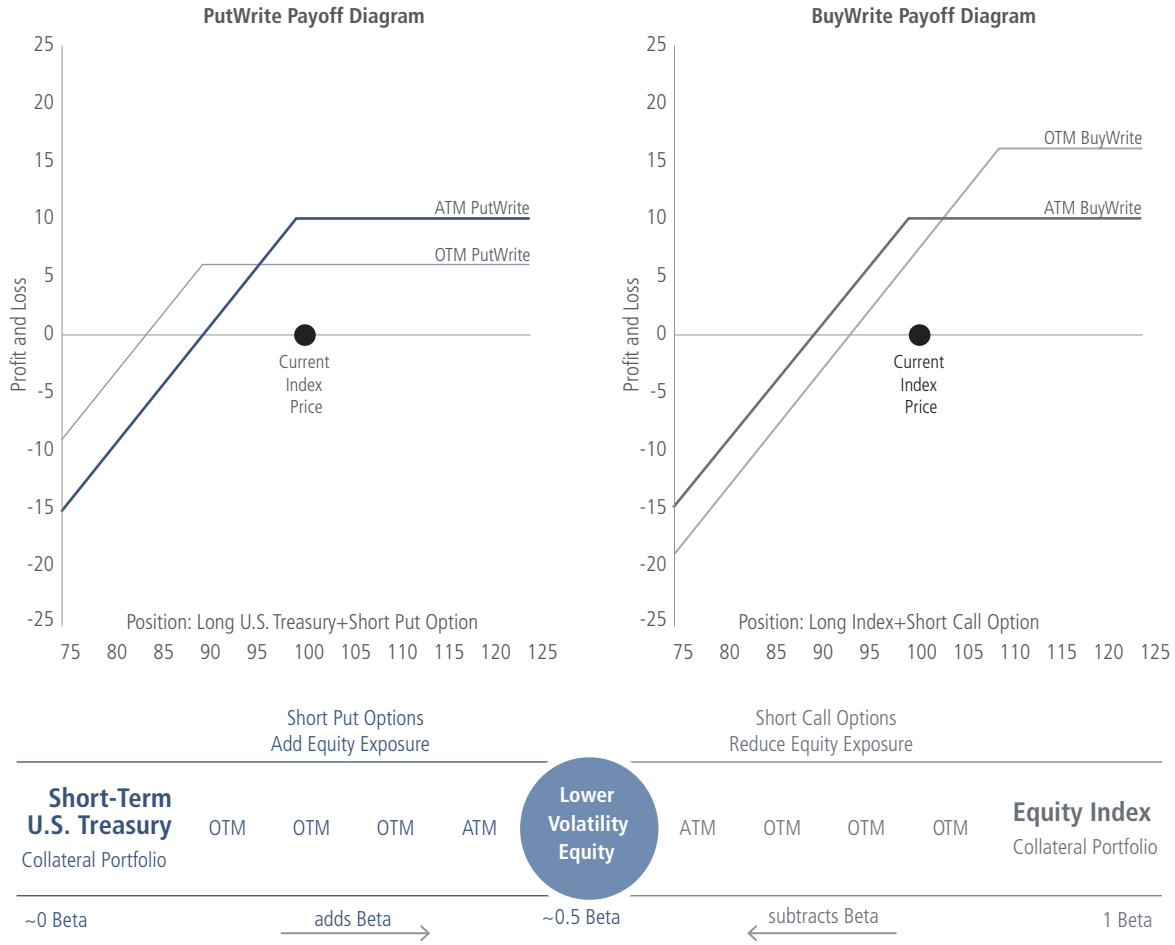
The Equity Index BuyWrite; Simply Less Efficient

When we initially researched option writing strategies and began developing our put writing methodologies, we had the luxury of starting with a blank sheet of paper and without an existing option writing doctrine to preserve. In other words, we weren't on record selling Buywrite strategies, so we could be objective and pursue whichever strategies we felt offered clients the most direct, risk-efficient and complementary exposure to their existing portfolios.

[3]As an aside, investment banks that sell index volatility swaps have the benefit of structuring their hedges at the time they underwrite an over-the-counter swap for a known cost. Further, terms of the contracts typically include "stops" or "limits" that coincide with limitations of their ability to hedge in the option markets. Hence, they are able to earn fees and transaction costs on relatively riskless exposures. Needless to say, this can be a very profitable business given the notional sizes involved.
[4]Though the PUT Index was introduced in 2007, the CBOE provides historical back-tested data on the PUT Index starting from June 30, 1986.

With the exception of at-the-money PutWrite and BuyWrite (covered call) strategies, Putwrite and Buywrite strategies offer markedly different exposures over time. The diagram in Figure 13 illustrates their structural differences and highlights what we believe to be key advantages of the Putwrite strategy.

FIGURE 13. PUTWRITE VERSUS BUYWRITE



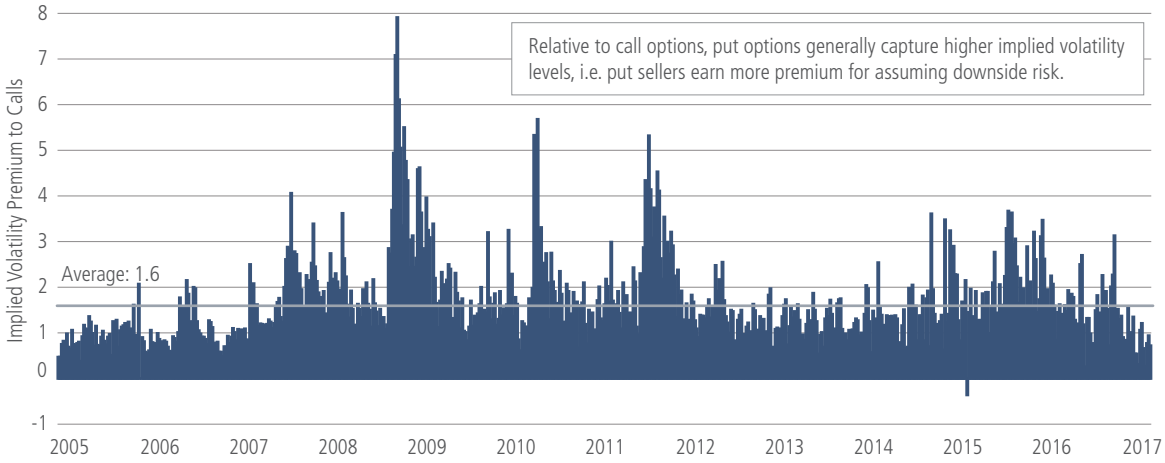
Source: Bloomberg LP, CBOE.

Advantages of PutWrite Strategy vs. BuyWrite

- **Greater demand.** Market participants are naturally long equity indexes at little to no expense, which promotes a market in which there is greater demand for downside mitigation than upside participation.
- **Investor utility.** Investors find financial losses more painful and are thus generally willing to pay to avoid them.
- **Liquidity premium.** Obligation to provide liquidity during periods of market losses.
- **Equity index exposure from options.** Since a PutWrite strategy does not own the underlying index, it has more freedom in managing downside risk.
- **Collateral portfolio.** Flexibility to hold collateral that may exceed the risk-free rate of return and provide additional diversification.

One of the most direct contributors to a Putwrite strategy's ability to generate greater risk efficiency relative to buy writing is its ability to capture higher levels of option implied volatilities, i.e. implied volatility skew. Figure 14 illustrates the implied volatility differential between 40-delta put and call options. In practice, option markets do not price down-market protection commensurate with up-market participation—that is not to say option markets are not generally arbitrage-free. Rather, they simply recognize that risk and investor utility do not tend to be truly symmetric and price options accordingly.

FIGURE 14. PUTWRITE STRATEGIES CAN EARN GREATER PREMIUMS FOR ASSUMING DOWNSIDE RISK
S&P 500 Index Put Option Skew (40-Delta) (January 2005 – March 2017)



Source: Bloomberg LP, CBOE.

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. Investors appear to partially agree with our view as out-of-the-money Buywrite strategies are typically preferred to at-the-money Buywrite implementations as the former maintain degrees of upside participation in an underlying index's price appreciation. 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.

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 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 persistence in option premiums—all of which should resonate with allocators.

The Hedge Fund Handshake

Put writing isn't a strategy built on a philosophy of explicit risk avoidance; rather, it is rooted in seeking compensation to underwrite risks that investors often overpay to mitigate. It doesn't swing for home runs; rather, it seeks to consistently hit singles and doubles and limit strikeouts. Sound familiar? We like to refer to investors' willingness to accept limited upside returns in exchange for less frequent, smaller return drawdowns as the "hedge fund handshake." **The structured payoffs provided by strategies like the PUT Index can offer a similar trade-off without the onerous terms and additional limitations many equity hedge funds demand.**

Truly riskless return strategies don't exist; even the ones that appear to be so require additional risk factors, e.g., leverage and/or illiquidity, to achieve desirable net of fee returns. Knowing the risks taken and capturing adequate compensation for those risks leads to more reliable results and higher utility. Figure 15 draws comparisons of the PUT Index to various hedge fund indexes.

FIGURE 15. PUTWRITE VS. HEDGE FUND INDEXES
Return and Risk Statistics (December 1990 – March 2017)

	CBOE S&P 500 PutWrite	HFRI Equity Hedge	HFRI Market Neutral	HFRI Fund of Funds	S&P 500
Annualized Return	9.9%	11.4%	6.0%	6.3%	10.0%
Annualized Volatility	9.7%	8.8%	3.1%	5.6%	14.2%
Risk-Adjusted Return	1.02	1.30	1.96	1.13	0.71
Beta	0.56	0.46	0.07	0.23	1.00
Maximum Drawdown	-33%	-31%	-9.0%	-22%	-51%
Up-Market Capture	63%	65%	21%	34%	100%
Down-Market Capture	40%	35%	-5%	16%	100%

Source: Bloomberg LP, CBOE.

Putting a Swap to it

To date, most investors we talk to have sought to isolate the implied volatility premium (Figure 12) via swaps or structured option trades like delta hedged straddles. Their results are often eroded by some combination of high implementation fees/expenses (both explicit and implicit), illiquidity, leverage, counterparty risk, strategy complexity and/or tactical missteps. We like to refer to leverage, illiquidity and complexity as the "Bermuda Triangle" of option investing, an area we wish to avoid.

What is important is the recognition that while index Putwrite returns capture a volatility risk premium as a portion of the option premiums collected, strategy losses are directly related to the underlying index price upon expiration rather than the relationship between implied volatility and realized volatility. A negative implied volatility premium does not necessarily equate to a loss for an index putwrite strategy. Indexes can and do increase in value during periods when realized volatility exceeds implied volatility. Hence, we are of the opinion that it is better to take a holistic view of monetizing the entirety of option implied volatility (realized volatility and implied volatility premium) and generate the returns as efficiently as possible rather than pay to isolate and profit from a relatively slim and unstable piece of it.

Passive is not an Option

As option writing and volatility-based strategies continue to grow as a strategic allocation for investors, we believe that the benefits of passive equity investing will not translate into option strategies over the long term. To date, the relatively popular out-of-the-money Buywrite strategies have worked well in passive formats because strategy returns are predominantly based on the underlying equity indexes which have tended to go up over time. Investors essentially accept whatever additional return they can glean from call premiums. However, option markets are transparent and sizable positions in specific option contracts are widely observed by the relatively limited number of exchange participants and option dealers. Consider that hundreds of billions in notional value in S&P 500 index options trade each day in one trading pit on the CBOE.

This leads us to anticipate that as passive option strategies scale, they will not invoke the same positive feedback loop that can occur in passive equity investing. Passively buying stocks in an index can drive the index value higher. Conversely, passively selling options can result in a reduction of the premium yield collected by investors. Option markets are likely to see to it that passive investors collect incrementally lower premium yields—even 5bps per month is 60bps per year in opportunity cost—which will directly affect the premium used in calculating the index investors are tracking. There are risks in both passive and tactical implementations. We believe a balanced systematic approach[5] to collateralized option writing offers the highest probability of long-term success for us and our clients.

[5]Concerns about the potential for return erosion due to actively trading index options tend to be overblown. Rolling index options does not increase trading costs materially for unlevered index option writing strategies as option contracts must be rolled regularly in both active and passive implementations. In practice, the benefits derived from a systematic management process can far outweigh the incremental costs.

Incorporating a PutWrite Strategy into Diversified Portfolios

As with any new investment idea, finding a seat in the portfolio can be challenging, even for the most compelling strategies. Hence, investors generally do not have a direct "bucket" in which to place this strategy. This challenge, of course, is not an entirely new problem. Now-popular investments like REITs, high yield bonds, CTAs and hedge funds faced similar challenges in the past.

The one overarching theme is that we, like many, believe investors should not pay for implicit beta exposure and set out years ago to develop risk-efficient equity index put option writing strategies that would provide attractive risk-adjusted return distributions to complement traditional investments that limited the implicit beta exposures. Our intention is for allocators to harness the risk/return efficiency of equity index put writing with lower-cost beta strategies or in overlay formats to target a specific risk profile or investment outcomes, for example, lower-volatility equity or liquid alternatives.

We have found investors are considering index PutWrite strategies in a multitude of contexts and formats, which we summarize below.

Objective	Strategy	Implementation
Lower-Volatility Equity	Index PutWrite (At-the-Money)	• Fully collateralized equity index put option exposure provides structurally lower delta/beta equity exposure (see recent paper, *"Low Volatility" Equity Investing: Structural vs. Statistical,* for greater detail), monetizes implied volatility through short put options and collects collateral coupons. • Seeks to earn superior risk-adjusted returns and beta-adjusted excess returns. • Typical allocation size 5% – 10% of equity allocation.
Equity L/S Exposure	Index PutWrite (Out-of-the-Money)	• Out-of-the-money options provide delta/beta exposure consistent with equity long/short strategies, but are index-based, liquid, transparent and lower fee. • Typical allocation equivalent to that of one or two hedge fund allocations.
Yield Enhancement (Overlay)	Index PutWrite (Out-of-the-Money)	• Supplemental portfolio income from selling out-of-the-money index equity options collateralized by investors' existing portfolio holdings. • For taxable investors; potential for 1256 tax treatment; 60/40 long-term/short-term capital gains rates. • Typical overlay notional exposure represents 5% – 10% of portfolio net asset value.
Asset-Liability (Target Date Funds)	Index PutWrite (Variable Moneyness)	• Equity index option (delta) and collateral (duration and credit) exposures can be systematically adjusted over time to aid glide path portfolios in achieving increased risk efficiency. • Reduced volatility and drawdowns dampen the funding risk.

While most investors we encounter do not allocate directly to option writing strategies, many of them have familiarity with the matter and acknowledge that many of their alternative exposures (hedge funds) have explicit or implicit exposure to equity volatility strategies, e.g. options, swaps, hedging, overlay. This embedded exposure has been a significant driver of the return distributions that historically made alternative strategies such attractive additions to portfolio allocations. Ironically, the structure and inflexibility of many of them have served to undermine the aggregate results of their peer groups. This has left investors seeking to pivot toward accessing similar return distributions more directly in liquid, transparent and cost-effective formats.

Conclusion

We believe that an index Putwrite strategy can offer a cost-effective opportunity for improved risk efficiency, flexibility and liquidity in asset owners' portfolios. Our clients continue to seek methods that will allow them to earn returns more efficiently, thereby freeing up scarce risk budgeting capacity to spend in other asset classes. The index put write may offer investors a way to earn an equity-like return with less volatility, providing allocators with valuable flexibility to increase investments in less-efficient and/or less-liquid asset classes where return potential may be higher (e.g. private equity and debt, infrastructure). Implementing an appropriate option writing strategy for an institutional portfolio requires an in-depth analysis of asset owners' investment goals and existing portfolio allocations and an evaluation of how an option writing strategy (funded or overlay) can work toward improving the likelihood of investment success. Asset owners should seek to partner with experienced asset managers and consultants that have long and successful track records in the options space. Managers should emphasize transparency, consistency and cost-effectiveness of strategies while helping institutional investors address a variety of allocation needs and risk/return profiles.

Addendum: How Institutions Are Employing Options Strategies

Corporate Defined Benefit Plans

The two persistent trends we are seeing across corporate defined benefit (DB) plans are (1) a greater focus on downside risk and (2) de-risking through increased fixed income allocations. These two are not mutually exclusive, but may be at odds with generating returns to improve funded status. The average funded status of S&P 500 corporate DB plans remains in the low 80% range. Companies can improve this ratio by contributing more cash, generating more returns from their assets, or from rising interest rates (or a combination of the three). We believe that the return profile of collateralized index Putwrite strategies provides attractive upside exposure while mitigating downside risks.

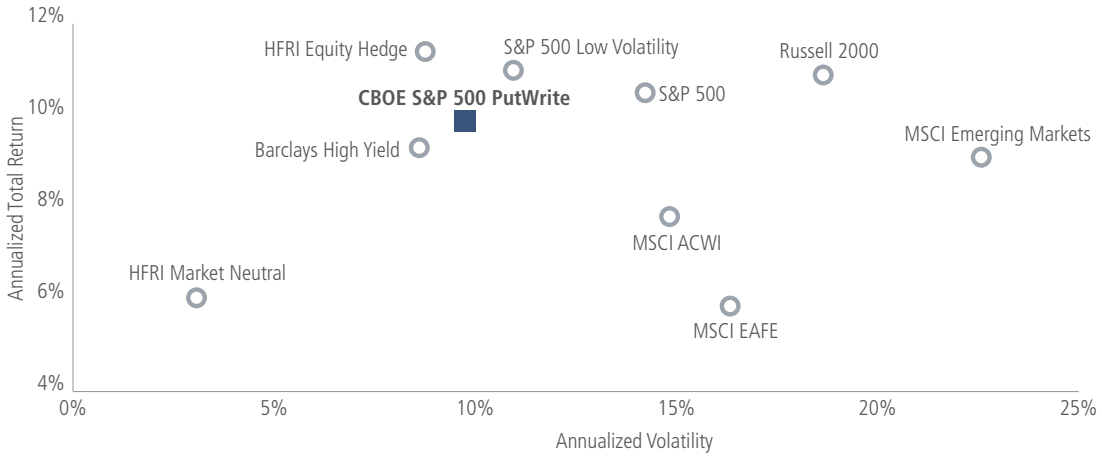
Corporate DB plans are increasingly focused on downside risk for several reasons:

- Pension Benefit Guaranty Corporation (PBGC) variable rate premiums have been steadily increasing and will continue to do so, effectively creating a higher tax when funded status drops.
- Discount rate volatility is likely to increase as the current, more beneficial, discount rate regulations phase out and lower rates begin to impact the long-term averages used for calculations.
- Many corporations have made significant discretionary pension contributions (financed from balance sheet cash or debt issuance) and risk tolerance often declines after such contributions.

Increasing the fixed income allocation is a common tactic to reduce risk for a corporate DB plan. But unless the plan is fully funded, returns from risk assets are a means to reduce the deficit. As a compromise, many corporate plans have implemented low volatility equity strategies to mitigate downside risk. However, these often contain embedded sector biases and may become "high volatility" equity strategies during certain market environments, such as rising rates. This topic is examined in greater detail in our paper, *"Low Volatility" Equity Investing: Structural vs. Statistical.* The expectation is that a pension's funded status will improve as rates rise (present value of liabilities goes down), so having risk assets decline in such an environment will be counterproductive.

Asset owners are left with the option to either explicitly buy downside protection, which can be expensive, or to incorporate lower-volatility strategies such as collateralized put writing. Illiquid assets have also attracted risk capital, but liquidity is often at a premium for corporate DB plans exploring risk transfer alternatives such as annuitization or lump sum payouts. Figure 16 shows that the PUT Index has generated a total return consistent with the S&P 500 Index, but has exhibited a risk/return profile more in line with fixed income or low-volatility strategies.

FIGURE 16. PUTWRITE STRATEGY OFFERS ATTRACTIVE RISK/RETURN
Risk & Return (December 1990 – March 2017)



	CBOE S&P 500 PutWrite	S&P 500	HFRI Equity Hedge	HFRI Market Neutral	Barclays High Yield	S&P 500 Low Volatility	Russell 2000	MSCI ACWI	MSCI EAFE	MSCI Emerging Markets
Annualized Return	9.9%	10.0%	11.4%	6.0%	9.3%	11.0%	10.9%	7.8%	5.9%	9.1%
Annualized Volatility	9.7%	14.2%	8.8%	3.1%	8.6%	11.0%	18.7%	14.8%	16.3%	22.6%
Risk-Adjusted Return	1.02	0.71	1.30	1.96	1.08	1.00	0.58	0.53	0.36	0.40
Beta	0.56	1.00	0.46	0.07	0.36	0.58	1.05	0.96	0.89	1.13
Maximum Drawdown	-33%	-51%	-31%	-9.0%	-33%	-35%	-53%	-55%	-56%	-61%
Up-Market Capture[7]	63%	100%	65%	21%	51%	72%	114%	92%	83%	113%
Down-Market Capture[7]	40%	100%	35%	-5%	23%	48%	115%	100%	96%	117%

Source: Bloomberg LP, CBOE.

Public Pension Plans

As public plans face pressure from negative cash flows and growing liabilities, we find they are increasingly cautious of downside risk, and willing to reduce upside potential to mitigate it. Other plans have moved toward a more risk-based allocation framework, willing to utilize index put option writing as a lower volatility or diversified growth allocation alongside other lower-volatility or diversifying strategies.

Endowments and Foundations

Endowments and foundations continue to search for more attractive total return oriented strategies, with recent modest performance prompting many to reevaluate their investments and manager relationships. Many are attempting to better leverage existing manager relationships—and potentially limit total manager relationships—for enhanced access to resources and "the best thinking" investment ideas.

Endowment and foundation clients have been much more versatile in both the structure and the portfolio placement of index option-writing strategies, which is consistent with their broader range of objectives and less-constrained liability profile. We have seen clients use index option writing strategies for a variety of purposes, including:[8]

- Liquid, cost-effective hedge fund replacement
- Lower volatility equity exposure
- Defensive equity

Endowments and foundations interested in more transparent and cost-effective alternative equity strategies may consider an equity index PutWrite strategy as a replacement or complement to existing equity or alternative exposures.

[7]All up-market and down-market capture figures are relative to the S&P500 Index.
[8]Client defined allocations and risk/return profiles are for illustrative purposes only. Options strategies may be classified in a variety of manners and client defined allocations and risk/return profiles may not be reflective of the risk and return factors of options strategies as more fully described in this material. Investing entails risks, including possible loss of principal.

Appendix

Index Definitions

The S&P 500 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 CBOE Volatility Index® (VIX Index) is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. Since its introduction in 1993, the VIX Index has been considered by many to be the world's premier barometer of investor sentiment and market volatility. Several investors expressed interest in trading instruments related to the market's expectation of future volatility, and so VIX futures were introduced in 2004, and VIX options were introduced in 2006.

The MSCI ACWI (All Country World Index) Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed and emerging markets. As of November 27, 2013, the MSCI ACWI consists of 46 country indices comprising 23 developed and 23 emerging market country indices. The developed market country indices included are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States. The emerging market country indices included are: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Thailand, Turkey, and United Arab Emirates.

MSCI EAFE Index (Europe, Australasia, Far East) is a free float-adjusted market capitalization index that is designed to measure the equity market performance of developed markets, excluding the U.S. and Canada. The MSCI EAFE Index consists of the following 21 developed market country indices: Australia, Austria, Belgium, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom.

The MSCI Emerging Markets Index is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets. The MSCI Emerging Markets Index consists of the following 23 emerging market country indices: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Thailand, Turkey and United Arab Emirates.

The MSCI USA Minimum Volatility (USD) Index aims to reflect the performance characteristics of a minimum variance strategy applied to the large and mid cap USA equity universe. The index is calculated by optimizing the MSCI USA Index, its parent index, in USD for the lowest absolute risk (within a given set of constraints). Historically, the index has shown lower beta and volatility characteristics relative to the MSCI USA Index.

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 HFRI EH Equity Market Neutral Index strategies employ sophisticated quantitative techniques of analyzing price data to ascertain information about future price movement and relationships between securities, select securities for purchase and sale. These can include both Factor-based and Statistical Arbitrage/Trading strategies. Factor-based investment strategies include strategies in which the investment thesis is predicated on the systematic analysis of common relationships between securities. In many but not all cases, portfolios are constructed to be neutral to one or multiple variables, such as broader equity markets in dollar or beta terms, and leverage is frequently employed to enhance the return profile of the positions identified. Statistical Arbitrage/Trading strategies consist of strategies in which the investment thesis is predicated on exploiting pricing anomalies which may occur as a function of expected mean reversion inherent in security prices; high frequency techniques may be employed and trading strategies may also be employed on the basis on technical analysis or opportunistically to exploit new information the investment manager believes has not been fully, completely or accurately discounted into current security prices. Equity Market Neutral Strategies typically maintain characteristic net equity market exposure no greater than 10% long or short.

The HFRI Equity Hedge Index Investment Managers who maintain positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques; strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. EH managers would typically maintain at least 50% exposure to, and may in some cases be entirely invested in, equities, both long and short.

HFRI Fund of Funds Index invests with multiple managers through funds or managed accounts. The strategy designs a diversified portfolio of managers with the objective of significantly lowering the risk (volatility) of investing with an individual manager. The Fund of Funds manager has discretion in choosing which strategies to invest in for the portfolio. A manager may allocate funds to numerous managers within a single strategy, or with numerous managers in multiple strategies. The minimum investment in a Fund of Funds may be lower than an investment in an individual hedge fund or managed account. The investor has the advantage of diversification among managers and styles with significantly less capital than investing with separate managers. PLEASE NOTE: The HFRI Fund of Funds Index is not included in the HFRI Fund Weighted Composite Index.

The BofA Merrill Lynch Option-Adjusted Spreads (OASs) are the calculated spreads between a computed OAS index of all bonds in a given rating category and a spot Treasury curve. An OAS index is constructed using each constituent bond's OAS, weighted by market capitalization. The BofA Merrill Lynch High Yield Master II OAS uses an index of bonds that are below investment grade (those rated BB or below).

The BofA Merrill Lynch U.S. T-Bill 0-3 Month Index tracks the performance of the U.S. dollar denominated U.S. Treasury Bills publicly issued in the U.S. domestic market with a remaining term to final maturity of less than 3 months.

Glossary of Terms

ATM option: An option with a strike price equal to the current price (or in some cases the forward price) of an asset. An ATM option has a delta of 0.5.

OTM option: An option with a strike price lower than the current asset price (for a put option), and higher than the current asset price (for a call option). The delta of an OTM option will be lower than an ATM option.

Delta: The sensitivity of an option's price to small changes in the price of the underlying asset. An ATM option has a delta of 0.5.

Implied volatility: A measure of the expected volatility, or movement, in an asset's price. A key determinant of an option's value; generally backed out from the option's price quoted in the market.

Realized volatility: The actual volatility, or movement, in an asset's price, as measured after the fact.

Skew: The tendency for lower strike options (i.e. OTM puts) to be priced with a higher implied volatility than ATM options. While it may seem counterintuitive, this can be explained by several factors:

- Greater demand for lower strike options by hedgers (and implied volatility is calculated from the option's price)
- Higher possibility of downside shocks in an asset class relative to upside shocks
- For index options, correlations of assets in a decline are generally higher than in a rally. Higher correlation will increase the volatility of an index relative to the average volatility of the components.

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

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

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