NEUBERGER BERMAN

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Chasing Your Tail

As we write, in mid-May, 2018, the premium payable to insure oneself against equity downside risk with a one-month S&P 500 Index put option at-the-money is approximately 1.5%. Earlier this year, it was 2.0 – 2.5%. Were consistent pricing to persist, it would cost an investor 18 – 30% to maintain that exposure for a year.

Either the people buying those puts know something we don't about an imminent major sell-off in equity markets or the people writing them are making a lot of money providing insurance. We suspect it's the latter.

It is not hard to understand the desire to buy protection or hedge the "tail risk" in one's equity portfolio right now. Investors have enjoyed significant gains since the financial crisis of 2008 – 09. While many remain positive on the equity markets, these investors know that trees don't grow to the sky, and that now feels like a good time to protect those gains and funding levels.

But is a tail-risk hedging program based on buying put options an effective way to do it? We do not believe so, and in this article we will show just how ineffective—and expensive—it can be over the long term.

A Costly Option, Whichever Way You Cut It

Because puts are expensive, most investors will compromise a little on the protection they buy. They can do this in three ways. We focus on two here: allocating a smaller budget to the program and accepting that a smaller part of the equity-portfolio value will be notionally covered by the "insurance"; and/or by selecting out-of-the-money puts, leaving the portfolio exposed to the first part of any market sell-off, until the index falls below the strike prices of the options. The third way is to sell call options, or create so-called "put spreads" by buying puts at different strike prices, to help finance expensive puts—these strategies are beyond the scope of this article, but in our view, a hedging solution that creates a problem that requires another solution is not really a solution.

Unfortunately, neither of the first two approaches makes a substantial difference to an investor's long-term outcome. We show this in figure 1.

Consider what happens when you deploy 1% of your overall equity allocation toward a budget to hedge with two-month puts—in other words, you are prepared to spend $1m per year to protect a $100m equity allocation. We assume that the options are held to expiry and then settled for cash if they have value.

Buy at-the-money puts (100% "moneyness") and you know that as soon as the market falls your options have value. On the other hand, you can afford to cover only 7% of your equity allocation. Over the 28 years between 1990 and 2018, which included the Asia and Russia crises of 1997 – 98, the dotcom crash and the 2008 – 09 financial crisis, on average you would have given up $400,000 of the $1m you spent on insurance each year.

To put it another way, spending $1m per year on put options occasionally paid off, but over time the expected value of purchasing puts was negative $400,000—the premiums you spend exceed the offsetting profits. In exchange for that, you would have been exposed to 97% of the market downside and your maximum drawdown would have been approximately -54%. Over the same period, the maximum drawdown for the S&P 500 Total Return Index was -55%.

The point of a hedging program is to get a hedge. Accepting 97% of the downside does not seem very hedged.

FIGURE 1. NB MODEL RESULTS OBTAINED WITH DIFFERENT HEDGING BUDGETS, AND PUTS OF DIFFERENT MONEYNESS
Equity Allocation = S&P 500 Option = 2-Month Puts on S&P 500

Using 1.0% of equity allocation to buy 2-month tenor S&P 500 put options

Moneyness	Notional Coverage Achieved	Annualized Effective Cost	Up Market Capture	Down Market Capture	Maximum Drawdown
100%	7%	-0.4%	97%	97%	-54%
94%	21%	-0.5%	96%	96%	-54%
85%	55%	-0.4%	96%	97%	-52%

Using 0.5% of the equity budget to buy 2-month put options

Moneyness	Notional Coverage Achieved	Annualized Effective Cost	Up Market Capture	Down Market Capture	Maximum Drawdown
100%	3%	-0.2%	98%	98%	-55%
94%	10%	-0.2%	98%	98%	-54%
85%	27%	-0.2%	98%	98%	-54%

Source: Neuberger Berman. For illustrative purposes only. Based on a hypothetical back-tested model, between January 1990 and March 2018. Market capture data is averaged over the whole period and based on daily returns. Please see important disclosures at the end of this paper.

Do Out-of-the-Money Puts or a Smaller Hedge Budget Help?

What would have happened had you bought puts 6% out-of-the-money (94% moneyness)? Your $1m per year would have covered 21% of your equity allocation rather than just 7%. But you would have still taken 96% of the down markets, your maximum drawdown would have been the same and, because you were not protected against the first six percentage points of any sell-off, the long-term effective cost would have been greater: on average you would have given up $500,000 of the $1m you spent on insurance each year. Even buying 15% out-of-the-money puts would not have made much difference.

What would the results have been had you spent less on the program? Let's say you spent $500,000 rather than $1m per year, or 0.5% of your $100m equity allocation. Based on our conversations with investors, that sort of budget is more realistic.

Unsurprisingly, you covered only half as much of your equity allocation (3%), and you were exposed to 98% of the market downside and had a maximum drawdown of -54%. You got a better result overall, in the sense that you only gave up $200,000 of the $500,000 you spent on insurance each year—but it still seems odd to pay $200,000 a year for downside protection that leaves you with 98% of the market downside and essentially the same maximum drawdown as the equity index (once dividends are taken into account).

Deploy one- or three-month put options and the results barely change. It is easy to conclude that the long-term results of a tail-risk hedging program based on buying put options do not justify the costs.

One objection to this conclusion would be that no one implements these programs on a long-term basis. But to do so tactically involves very precise market timing: an investor needs not only to buy its put options before a big sell-off occurs, it also needs to sell them before they expire or cross back out-of-the-money. If you can do that, why use options? Simply avoid paying insurance and time the market by reducing or increasing overall equity risk. No matter what way you look at it, buying put options appears to be a short-term and, dare we say, speculative endeavor.

Does Using Long-Dated Puts Help?

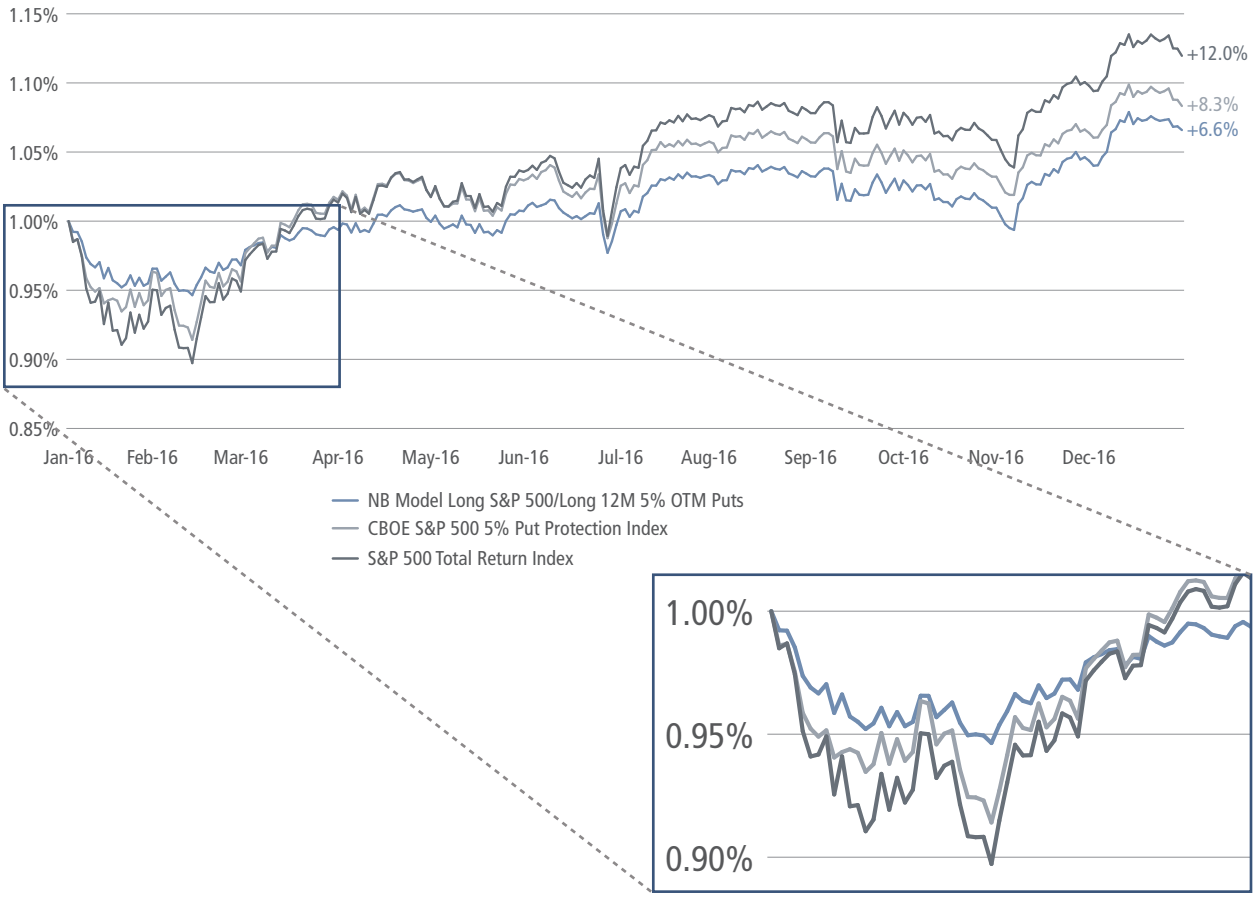
It is true that options with long tenors—12 months or more—tend to be cheaper, on a day-by-day basis, and operationally easier to manage than continually rolling shorter-dated, one-, two- or three-month puts. Perhaps that is a more efficient way to maintain a tail-risk hedge?

Unfortunately not. In fact, as we show in figure 2, holding a 12-month put can end up being more costly than rolling short-dated options over the same period.

We look at the performance of three different portfolios through 2016, whose first few weeks experienced a 10% drawdown in the S&P 500:

1. The S&P 500 Total Return Index
2. The CBOE S&P 500 5% Put Protection Index (which consists of a long-S&P 500 position paired with a rolled position in one-month, 5% out-of-the-money puts)
3. A long-S&P 500 position paired with a 12-month, 5% out-of-the-money put option with the same notional value as the S&P 500 allocation, held to expiration

FIGURE 2. A LONG-DATED PUT OPTION CAN END UP MORE COSTLY THAN ROLLING SHORT-DATED POSITIONS
Put option protection during the calendar year 2016



Source: Neuberger Berman. For illustrative purposes only. Based on a hypothetical back-tested model, between January and December 2016. Please see important disclosures at the end of this paper.

By the end of the year, the S&P 500 Total Return Index was up 11.96%. The holder of the CBOE S&P 500 5% Put Protection Index (the hedge using rolling 5% out-of-the-money, one-month puts) ended up 8.33%, having given away 3.6 percentage points in insurance costs. The hedge cost 6.4% in aggregate across 12 consecutive months and had a few short-term payoffs totalling 2.8%, leaving the net total cost of the hedge at 3.6%. The investor who purchased the 12-month put upfront spent 5.4% on insurance (that's $5.4m upfront to hedge $100m in exposure!) but had no value upon expiration, leaving the total cost of the hedge at 5.4%. (For comparison, as of April 17, 2018, a 12-month, 5% out-of-the-money put on the S&P 500 Index cost roughly 4.4% upfront through March 29, 2019.)

While it is true that the long-dated puts offered more protection at the worst point of the sell-off in February 2016, the advantage was very fleeting—by the end of February, all of the options were back out-of-the-money. It is classic hindsight to claim that one would have taken profits from the hedge at just the right time, but in reality that rarely happens. For most investors, loss aversion kicks in, and hedges with significant time to expiration are rarely taken off at the just the right time. Without that skill of timing the market, maintaining long put option positions is very costly, and that should not surprise us; after all, equity markets do tend to rise in value over the long term.

Don't Chase Your Tail

Either hedging strategy, using long-dated or short-dated options, may outperform the other in any given year depending on the path of the S&P 500. Over the long term, however, both have burdened investors with costs. Option markets typically are not in the business of losing money from selling investors insurance on portfolios any more than real insurance companies are in the business of losing money from insuring houses or lives. There are ways to address the challenge of down markets with options strategies, but in our view, simply buying and holding put options, whether short- or long-dated, at-the-money or out-of-the-money, is not one of them.

See disclosures at the end of this publication, which are an important part of this article.

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The hypothetical performance results included in this material are of various back-tested model portfolios that are shown for illustrative purposes only. The hypothetical results we calculated by running the model portfolios on a back-tested basis using the stated methodologies and assumptions below. The results are shown on a supplemental basis and do not represent the performance of any Neuberger Berman managed account or product and do not reflect the fees and expenses associated with managing a portfolio. The results assume no withdrawals and reinvestment of any dividends and distributions.

This following is a summary of the back-tested methodology and assumptions:

The option strategy back-testing platform is designed to estimate historical performance of portfolios that implement systematic option writing strategies. Models support a multitude of variables including option strategy, e.g., put writing or call writing, underlying exposure (index or stock), tenor, moneyness, risk management parameters and collateral investments. While models incorporate different parameter sets, they adhere to a consistent structure across all back-tested model scenarios and our model architecture is such that returns are estimated independent of account size.

All models rely on a Black-Scholes pricing to estimate option prices based on historical implied volatility surfaces. We compile daily implied volatility surfaces from exchange listed option price and/or option implied volatility data available from external data providers including the Chicago Board of Options Exchange ("CBOE") and Bloomberg LP. Additional inputs for option pricing (dividends, risk-free rate, etc.) are sourced from Bloomberg LP.

Daily implied volatility surfaces allow models to price weekly expiration dates even though weekly option expirations may not have been actively traded on an exchange over the full history of a model back-test. Models methodically allocate options across weekly expirations to promote diversification across expiration dates and are assumed to settle on each Friday consistent with current option market practices.

Exposures are rebalanced on a daily basis at the close of each trading day. Daily model rebalancing adjusts portfolio exposures and rolls (covers and writes) option positions consistent with specified risk management targets. Options are rolled in a manner that seeks to preserve exposures across multiple expiration dates, and risk management targets, e.g., option delta and or moneyness, are set at the inception of a back-test and applied over its full history. All trading is assumed to be transacted at market closing prices derived from closing implied volatility levels and includes estimates for transaction costs. Option strike prices follow standard option market conventions unique to the underlying index/security. Models may round up, down or to the nearest strike price when selecting option to write.

Hypothetical option models are fully collateralized such that model portfolios are assumed to hold fixed income securities whose aggregate market values are greater than or equal to the aggregate notional exposure of the options. Collateral is assumed to be invested in a widely followed index(es) that approximates the performance of short-term U.S. Treasuries. Models may vary from actual strategy performance due to assignment risk for American style options, exchanged traded option contract availability, intra-day trading and differences in transaction costs (implicit and explicit).

There may be material differences between the hypothetical back-tested performance results and actual results achieved by actual accounts. Back-tested model performance is hypothetical and does not represent the performance of actual accounts. Hypothetical performance has certain inherent limitations. Unlike actual investment performance, hypothetical results do 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. As a result, the back-tested models theoretically may be changed from time to time to obtain more favorable performance results. In addition, the results are based, in part, on hypothetical assumptions. Certain of the assumptions have been made for modeling 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 model assumptions may have a material impact on the hypothetical returns presented. There are frequently material differences between hypothetical performance results and actual results achieved by any investment strategy. Neuberger Berman does not manage accounts in this manner reflected in the models.

Unless otherwise indicated, results shown reflect reinvestment of any dividends and distributions. The hypothetical performance figures are shown gross of fees, which do not reflect the deduction of investment advisory fees and other expense. If such fees and expense were reflected, returns referenced would be lower. Advisory fees are described in Part 2 of Neuberger Berman's Form ADV. A client's return will be reduced by the advisory fees and any other expenses it may incur in the management of its account. The deduction of fees has a compounding effect on performance results. For example, assume Neuberger Berman achieves a 10% annual return prior to the deduction of fees each year for a period of 10 years. If a fee of 1% of assets under management were charged and deducted from the returns, the resulting compounded annual return would be reduced to 8.91%. Please note that there is no comparable reduction from the indices for the fees.

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