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Multi-Asset Investing
EVERY LITTLE HELPS: THE BASICS OF HEDGED OPTION WRITING

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KEY POINTS

- To implement hedged option writing strategies, investors sell options while at the same time owning enough of the underlying security or index to hedge their exposure to price fluctuations.
- These strategies collect premiums on selling options, similar to an insurer collecting premium on selling insurance policies. The strategy harvests the volatility risk premium, or the difference between implied and realised volatility.
- Our research suggests that a well-managed hedged option writing overlay can be attached to any portfolio, adding a stream of stable returns over the long term, capable of enhancing performance by over 1% per year.

INTRODUCTION TO HEDGED CALL WRITING

Investment returns over the next 10 years are likely to be more modest than those of the past three decades. Equity prices have been inflated, partly by years of ultra-loose monetary policy from central banks, and rates on cash and bonds are near all-time lows, offering little income and the prospect of capital losses if rates rise.

It has also become harder to find return sources that can diversify equity and bond market exposure. In interconnected financial markets, weakly correlated returns are scarce. And when more assets tend to move in tandem, independent returns are more valuable.

For many investors, simple buy-and-hold exposure to equity and bond markets via index trackers no longer satisfies their needs. Today's environment calls for dynamic asset management, creativity and innovation. Investors should tap as many uncorrelated sources of return as possible, including robust long-term design of portfolios, active asset allocation, active security selection and overlays designed to mitigate risks and enhance performance.

One source of independent return is to use an equity index option overlay which sells options on an index, and simultaneously buys the index[1]. If properly and dynamically

[1] Typically, we buy an actively managed basket of equities and trade equity futures to dynamically manage the changing exposure of the option position.

managed, this strategy collects the premiums from selling options while controlling exposure to price fluctuations of the underlying index, generating a stream of stable returns that is proportional to the difference between implied and realised volatility.

Our strategy differs from a traditional "covered call" strategy because we are not "selling away the upside." As our strategy is typically attached to a basket of equities, it adds an additional source of absolute returns without giving up participation in the market. Through our futures programme, we immunise the strategy to market direction, so it does not add to the investor's already existing exposure to equity markets.

A well-managed option overlay can be attached to any portfolio, adding a stream of stable returns over the long term that (as we will argue) is potentially capable of enhancing performance by more than 1% a year. In a challenged investment environment every little helps, and such excess return can make a significant difference compounded over long time horizons, helping investors meet their desired outcomes.

In this paper we briefly explain the high-level mechanics of call options; describe an efficient way to implement an option writing overlay; discuss the volatility risk premium that the strategy harvests; and highlight some of the risks.

THE MECHANICS OF CALL OPTIONS

A call option is a derivative contract giving its buyer the right, but not the obligation, to buy (*call*) an agreed quantity of the underlying security or index at a predetermined price (*strike price*) before the option's expiration date. The seller (*writer*) of the option is obliged to sell the underlying asset to the buyer if the buyer exercises the option. The buyer pays the seller a fee (*premium*) for the option.

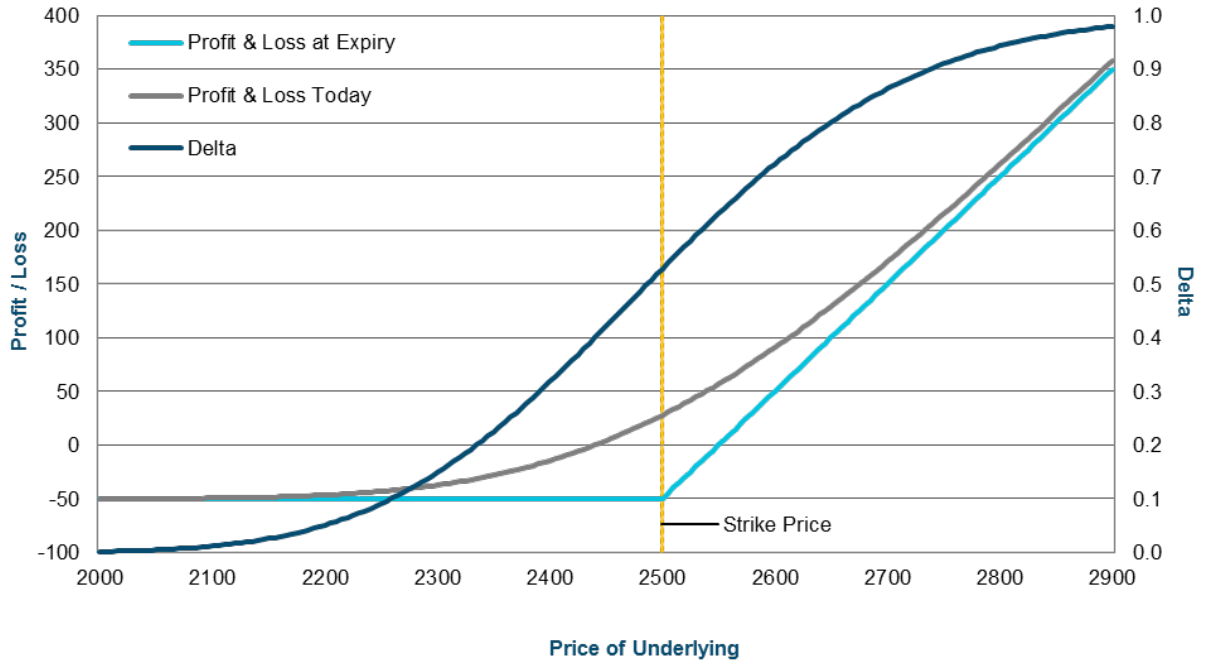
For example: say a call option written on the S&P 500 Index has a strike price of 2,500, a three-month expiration, a premium of $35 and the S&P 500 Index is currently priced at 2,400. If the index stays where it is or closes below the strike price, the option will expire worthless as the underlying's price is below the strike price (the option is *out of the money*). In this case, the buyer has lost the entire premium, or 100% of the investment in the option.

If, by expiration, the S&P 500 reaches 2,600 (the option is in the money) the buyer can buy the index from the seller for the strike price of 2,500 and sell the index for its prevailing market price of 2,600, earning $100. The buyer's profit will be $65 ($100 minus the premium of $35). That would be a profit of 185% on the $35 premium paid. In theory, the buyer's profit is limitless as the price of the index can rise indefinitely. If the index rallies 16.7% to 2,800 the buyer's profit will be $265—a massive 757% gain on the premium.

Before expiration, the option has value even if the price of the index is below the strike price because the underlying's price can still move above the strike price. The more volatile the underlying is, the more likely it is to exceed the strike price at some point before expiration. The longer the time to expiration, the higher the chances of the option getting into the money. So, the underlying's volatility and option's time to expiration are two factors determining the price (premium) of the option today.

Another factor affecting the option's price is changes in the price of the underlying asset relative to the strike price. If the price of S&P 500 Index is 2,000, an increase of $1 in its price will have very little impact on the price of a 2,500 strike option. The option is deep out of the money and $1 change in the underlying's price does not materially increase the chances of the option getting into the money. If the price of the index is 2,500 (equal to the strike price) the option's price will be sensitive to changes in the underlying asset's price as it can move the option into or out of the money. And if the underlying's price is 2,900 (the option is *deep in the money*) the price of the option will change nearly one-to-one with changes to the underlying's price. The sensitivity of the price of the option to changes in the underlying's price is called its *delta*.

Figure 1: Illustrative Call Option Profit and Loss and Delta



Source: T. Rowe Price. For illustrative purposes only. The chart shows profit and loss (left y-axis) and delta (right y-axis) as a function of the underlying's price (x-axis) of a call option with 3-month time to expiration and strike price of 2,500.

Figure 1 plots the profit and loss of a call option at maturity, its price today, and its delta as of today (three months before expiration). The light blue line (profit and loss at expiry) is flat when the underlying's price is below the strike price of 2,500 (the option is worthless) and rises by $1 for every $1 the underlying's price is above the strike price. The grey curve (profit and loss today) shows the option's value today and it is above the profit and loss at expiry, representing the option's premium. The dark blue line shows how the option's delta changes for different prices of the underlying.

A HEDGED CALL OPTION OVERLAY

The idea behind our hedged call option strategy is to take the side of the seller, not that of the buyer, of the call option, while owning the right proportion of the underlying. The seller takes a short position in the call option and corresponding long position in the underlying.

In the example above, the seller collects a premium of $35 for each option contract sold. If the option expires with the S&P 500 Index below the strike price, the seller keeps the premium. However, if the index rises, the seller's profit is reduced by $1 for every dollar the index ends above the strike price. In theory, as the price of the S&P 500 is not capped, the potential loss of the seller is limitless. Writing *naked calls*, without owning the underlying security or index, carries unlimited downside risk and is not recommended.

Hedged call option writing, on the other hand, means that the seller of the option also owns the underlying asset, covering the short option. In this case, if the S&P 500 Index rallies, the call option seller's gains on the underlying should offset losses on the short call.

The amount of underlying that the seller needs to own depends on the option's delta. Delta of 0.50 (in Figure 1, this is roughly the at-the-money point where the underlying index's price equals the option's strike price) means that for every $1 change in the underlying's price the option's price changes by $0.50. Therefore, when selling a notional amount of $1,000,000 call options, the seller needs to own $500,000 of the S&P 500 so changes in the price of the underlying roughly offset changes in the option's price. In theory, when the short option is *delta hedged*, the seller can collect the premium without having any initial exposure to price changes of the index.

In practice, this strategy is not as simple. The option's delta changes as the price of the S&P 500 Index changes, its volatility changes, and the time to expiration declines. The key to a successful hedged call option strategy is that the delta hedge is dynamic, changing the amount invested in the underlying in line with the delta of the short options: *dynamic delta hedging*.

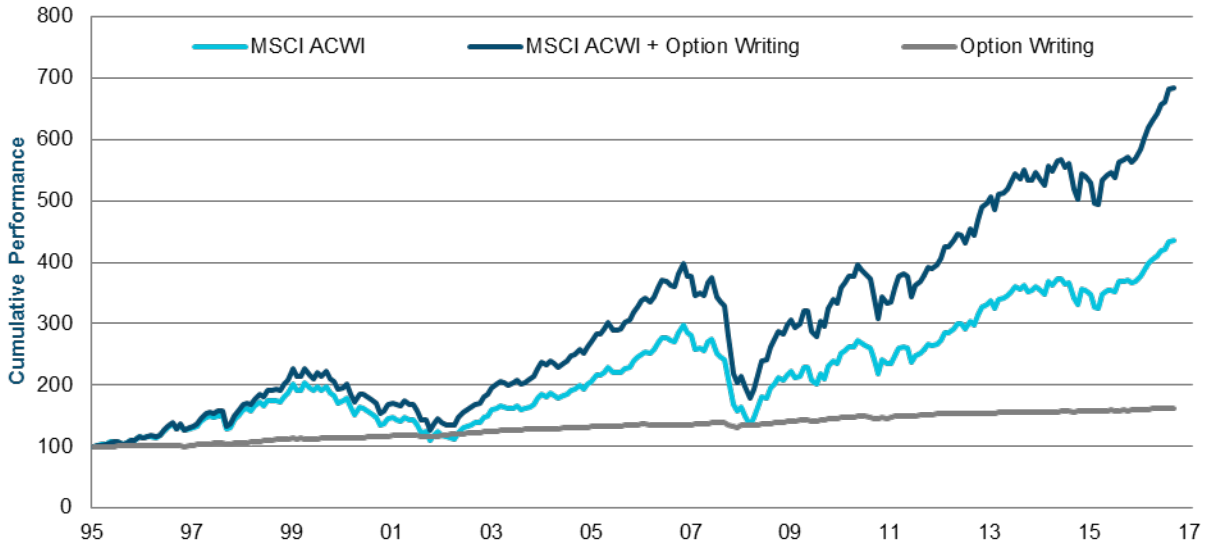
An efficient way to implement a hedged call option strategy is by buying the underlying through listed futures contracts. Futures are liquid and can be readily and cost-effectively traded, allowing easy adjustment in the amount of the underlying owned. If the hedged call option strategy is implemented via call options and futures contracts, then it becomes an *overlay*.

An overlay is *unfunded*, meaning that no cash (funding) is required to gain full exposure to the underlying market. The only cash required is to cover the margin (collateral required by the securities exchange) for the listed derivatives, but the margin is but a fraction of the full exposure gained through the options and futures[2]. As a result, a hedged call overlay can be attached to any existing portfolio, adding a source of return.

Figure 2 shows the performance of global equities (MSCI All Country World Index, or ACWI) with and without a hedged call writing overlay on the S&P 500 Index, as well as the overlay's standalone performance. As the option writing programme could fit any portfolio, the underlying of the options and futures (S&P 500) does not need to match the assets to which it is attached (global equities). We are using options and futures on the S&P 500 as they are liquid and easy to trade.

Over the time period shown, the overlay added 2.3% per year on average. Without the overlay the ACWI index returned 7.0% per annum with 15.4% annualised volatility, while with the overlay the average return rose to 9.3% per annum with 16.3% annualised volatility. Adding the call writing overlay served to enhance performance while only marginally increasing volatility.

Figure 2: Cumulative Performance of MSCI ACWI With and Without Covered Call Writing



Source: T. Rowe Price and Bloomberg, monthly returns January 1996 to August 2017. The underlying of the option writing strategy is S&P 500 Index. The equity index is MSCI All Country World Index. The light blue line is the cumulative performance of MSCI ACWI (based on monthly returns). The grey line is the cumulative performance of an option-writing strategy selling calls on the S&P 500 Index and delta hedging the short calls with futures contracts on the S&P 500 Index (based on monthly returns). The dark blue line is the cumulative performance of MSCI ACWI plus the option-writing strategy.

[2] Our hedged option overlay can be implemented using call and put options. So far we have chosen using call options in our strategies because they are more efficient from a margining perspective when adding the overlay to a physical basket of equities. We are exploring adding put options to the strategy.

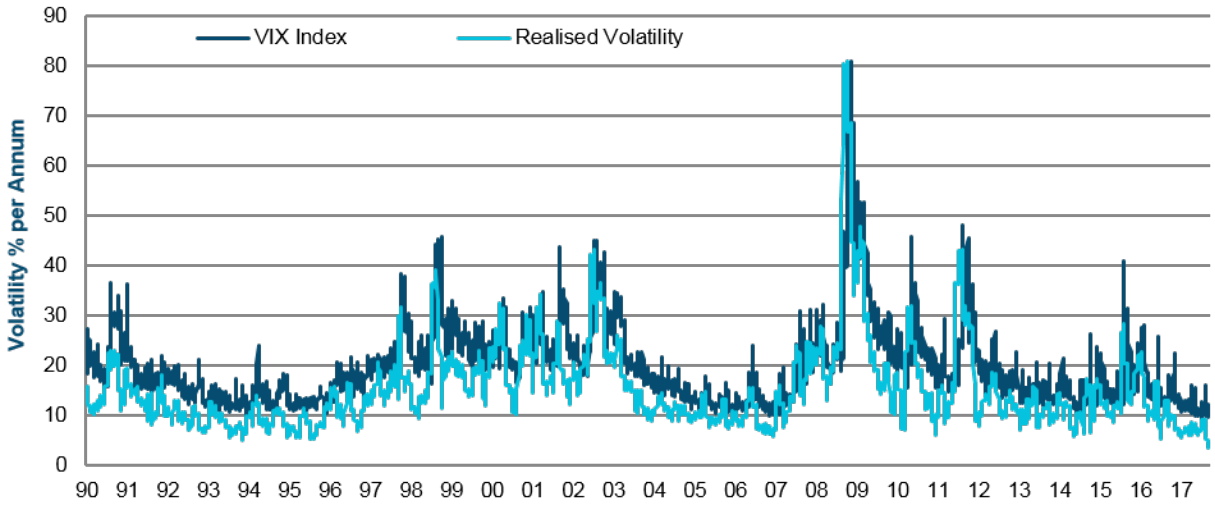
THE VOLATILITY RISK PREMIUM

One of the factors determining the price of options is the anticipated volatility of the underlying. As market forces of supply and demand determine the prices of traded options, it is possible to calculate the *implied volatility* from prices of traded options. The implied volatility reflects the market expectations for the volatility of the underlying, as market participants use their assumption about volatility when determining the prices they are willing to buy or sell options.

Realised volatility is the actual volatility of the underlying security or index. While implied volatility is forward-looking, expected volatility, realised volatility is observed after the fact.

The CBOE Volatility Index, known as the VIX, measures the implied volatility of options written on the S&P 500 Index. It is calculated and published by the Chicago Board Options Exchange (CBOE). **Figure 3** compares the VIX and the annualised realised volatility of the S&P 500 Index. Clearly, implied volatility as represented by the VIX is typically higher than the realised volatility (i.e. the dark blue line is almost always higher than the light blue line).

Figure 3: VIX (Implied Volatility) and Realised Volatility of the S&P 500 Index



Source: T. Rowe Price and Bloomberg, daily VIX levels and S&P 500 Index returns 2 January 1990 to 7 November 2017. Realised volatility is the annualised volatility of the following 30 daily returns of the S&P 500 Index.

The *volatility risk premium* reflects the phenomenon that implied volatility tends to exceed the *subsequent* realised volatility of the same indices over time. One behavioural basis for this imbalance is risk aversion. Investors tend to overpay for options to insure portfolios against downside risk, bidding up the price of options and their implied volatility. This creates an opportunity for sellers of volatility to profit as option premiums tend to be more expensive than their theoretical fair price. Option sellers are doing something akin to selling insurance and can benefit from the positive insurance risk premium, or "harvest" the volatility risk premium. This explains why a hedged call writing strategy can generate returns.

RISKS OF THE STRATEGY

Like every investment strategy that offers expected excess returns over cash, hedged call writing comes with risks. The main risk of the strategy is large and abrupt moves in the price of the underlying security or index. If the underlying's price moves materially and quickly, the delta of the option will change, causing the long futures position to provide an imperfect hedge to the price changes of the underlying. The hedged option might become "partially naked."

The key for a successful hedged call writing strategy is risk management. A successful risk management programme will be able to trade futures contracts nimbly and dynamically to adjust the market exposure of the underlying to bring it into line with the delta of the options. Ideally, the options and futures positions should be monitored intra day and adjusted swiftly when needed.

As the cover provided by the futures is not perfect, investors should expect to suffer occasional losses on the strategy. However, short-term losses tend to reverse if the investors can hold on to the option and futures positions. So, a hedged call writing strategy is generally appropriate for investors with a long investment horizon, meaning they are not forced sellers in times of market stress. Investors should not use the strategy if they think they might have to sell the options and futures at a loss.

Other risks of the strategy involve the operational complexity of trading listed options and futures contracts, as well as managing a margin account. It is therefore recommended that an option writing strategy is operated and monitored by trusted investment professionals.

CONCLUSIONS

In a world of modest expected returns, investors should aim to dynamically blend as many independent sources of return as possible in their portfolios. If a number of sources deliver even modest returns, the aggregate could suffice to meet the investor's needs. A hedged call-writing strategy could be a valuable source of return, weakly correlated with equity and bond markets. The key for the success of the strategy is dynamic delta hedging using futures contracts to mitigate its risks. A well-managed option overlay can be added to any portfolio, enhancing its performance. We believe that investors with appropriate investment horizons should consider this strategy as, in a low-yield world, every little helps.

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