

Using options to improve portfolio risk/returns

How can investors use options to improve the overall risk/return of a portfolio? Knowing that implied volatility has empirically exceeded realised levels, how do they choose between various yield-enhancement and risk-reduction strategies? Our analysis shows that systematic call overwriting is ideally suited to capturing volatility behaviour, simultaneously raising expected return and reducing risk, thus significantly improving equity portfolios' risk/return

Volatility as an asset class – the current status

During the past few years, one focus of the equity derivatives market has been capturing volatility returns and using them for portfolio diversification or yield enhancement, i.e. 'volatility as an asset class'. But what does volatility as an asset class mean? The term is frequently used, but appears to have various interpretations:

- 1) capturing historical excess returns by selling volatility;
- 2) the use of long volatility instruments to hedge portfolios; or
- 3) various relative-value strategies involving combinations of option positions. Of these, (1) and (3) are often (mis)labelled as 'volatility arbitrage', in that the investor appears to be capturing the mispricing between two similar financial variables.

Prior to the 2008–2009 financial crisis, short volatility strategies tended to receive more attention than long volatility strategies. The persistent overpricing of implied volatility (versus realised) could be explained by an 'insurance premium', reflecting investors' willingness to pay over the odds for portfolio protection and their natural preference for limited loss but unlimited gains. The generation of this volatility-based 'alpha' could take the form of 'yield-enhancement' strategies on existing positions or outright shorting of volatility, typically through variance swaps. The key drawbacks of short volatility strategies, however, are their susceptibility to sudden large losses and the high (positive) downside market beta. While these characteristics are well known, the pre-2008 position was that the trade-off between collecting the volatility alpha and suffering the occasional large loss was generally considered favourable. Moreover, volatility arbitrage strategies outperformed simple equity investing according to traditional risk/return measures such as Sharpe ratios.

Following the spike in volatility in 2008–2009, many short volatility trading strategies suffered large losses, causing re-evaluation of the returns relative to risk. The question is: could such crashes, while rare, happen often enough to wipe out the gains in more typical years? More fundamentally, perhaps, historical standard deviations (the second moment of the distribution) were inadequate to measure risk for 'assets' such as volatility with highly non-normal distributions and large tails. Similarly, relative-value strategies suffered from a lack of liquidity on the back of reduced supply and demand for exotic derivative structures. Long volatility strategies have gained popularity since 2008, primarily as a hedge against catastrophic scenarios, often referred to as 'tail risk'. In a market crash, long volatility positions – especially those with non-linear payouts –

perform well and, because of this negative correlation, provide an extremely effective hedge to a long equity portfolio. The challenge in holding such a position is to minimise the cost of carrying such insurance, as realised volatility continues to fall short of implied levels.

So, in today's markets, should one go long or short volatility? In reality, investors considering volatility-based strategies may find themselves at something of a loss. An increasing search for returns in the current low interest rate environment, while implied volatility continues to trade above realised levels, raises the question of whether investors should focus on yield-enhancing short volatility strategies. Alternatively, should they seek insurance-like long volatility products, ideally paying as little as possible per unit of protection offered? We believe that this trade-off is inevitable and perhaps unanswerable – only in certain circumstances will it be clear that one dominates the other. A possible consequence of this uncertainty has been a marked decrease in the use of pure volatility strategies in recent years.

Instead of advocating pure long or short volatility strategies, we now concentrate on the merits of combining a vanilla option strategy with a simple long equity portfolio position, which can have significant benefits for portfolio management. With a heightened awareness of risk, institutional investors have become more active in using equity derivatives as a financial tool to help manage portfolios. Less concerned with pure volatility strategies and complex pricing methodologies, these managers are concerned with two central questions, which will be the focus in the remainder of this article: What can derivatives do for me? Where can derivatives add value to portfolio management?

The effective use of derivatives in an equity portfolio

It is important to ask how derivatives affect the risk, return and risk-adjusted return of a typical long equity portfolio. The answers to these questions determine the optimal mix of long/short, put/call options to achieve the desired results of higher return and lower risk.

Risk. Clearly, adding or subtracting options alters a portfolio's payout profile and thus the overall risk of the investment. For example, adding a long put position to a portfolio truncates the left-hand-side tail (of negative returns) in exchange for lowering the return by the option premium (paid) for all possible outcomes. Likewise, adding a short call to a long underlying position shortens the right-hand-side tail (of positive outcomes) in exchange for raising the return by the option premium (received) (see figure 1).

Combining a long put and short call in the form of a collar, it is possible to reduce risk further. Taking this to a logical extreme, when the put and call have the same strike, one can eliminate risk entirely (ignoring any difference due to borrow and dividends) – effectively selling the underlying forward at a fixed price. There are, of course, also risk-increasing trades, which we exclude here in order to limit the scope of this discussion.

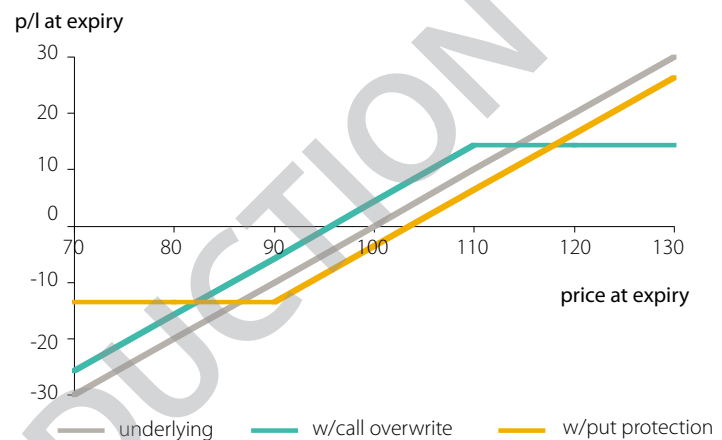
Return. Buying puts or selling calls on an equity portfolio reduces one's exposure to the underlying, shifting the portfolio more towards the safe investment of cash. To the extent that the expected return on equity is higher ('the equity risk premium'), shifting away from equity towards the risk-free asset can reduce expected returns. Selling calls or buying puts should have no effect on expected returns if the equity risk premium is absent. Indeed, if options are efficiently priced, then the expected present value (or, technically, the 'risk-neutral expected present value') of an option at expiry is simply the option premium. Empirically, however, implied volatility has systematically traded above realised volatility, so – over a wide range of underlying assets, time periods, and geographies – it has proven more profitable on average to sell options than to buy them (in a systematic strategy). Within equities, stock-stock correlation tends to be slightly overpriced, making it, on average, more attractive to short index options than single-stock options.

Risk/return. Derivative overlays alter return distributions in any period but, if fairly priced, should be unable to improve the long-run, risk/return properties of a portfolio beyond those of a simple cash/equity portfolio (with allocation dependent on the option strike). Empirically the risk/return from systematic call overwriting on equity indexes has been significantly superior to the risk/return of simple equity or cash/equity combinations. Some of this outperformance can be attributed to the premium in implied volatility, discussed above, but there is also further risk reduction due to the negative correlation of market returns and implied volatility. When the market falls, implied volatility typically spikes and usually so much so that selling volatility post-fall generates disproportionately high rewards. Systematic call overwriting tends to be especially profitable right after a market downturn and this negative autocorrelation results in overall lower return volatility when measured over longer holding periods. This is another attractive feature of call overwriting strategies.

As an example, we can compare monthly excess returns from June 1988 to September 2010 of the S&P 500 total return (S&P) and the Chicago Board Options Exchange BuyWrite Index (BXY), a strategy where the investor is long the S&P and then every month, on the listed expiry date, also sells a one-month 102% call (the nearest listed strike above 102%). After isolating the option return, it can be seen, as table A demonstrates, that the short naked call adds some value, reflecting the overpricing of implied volatility, but this added value carries risk. When the short call and the S&P are recombined, we get the BXY risk and return. Returns are simply additive, but the risk (standard deviation) depends on the correlation of the S&P and short call, which is negative. The resulting Sharpe ratio for the BXY is better than either the S&P or the short call strategy. The negative correlation is critical. Hypothetically, if the correlation were nearer zero, the Sharpe ratio of the BXY would not show much improvement compared with the S&P alone. Thus, the superior risk/return of the overwriting strategy is due to both the overpricing of implied volatility and the excess negative correlation of the index and the short call.

Over the long term, unless equity market behaviour shifts dramatically, systematic overlay strategies that are net short volatility are likely to maintain their outperformance. In practical terms, how does one exploit the phenomenon of 'overpriced' implied

1 Option overlay strategies alter a portfolio's risk/return profile



A. Monthly excess returns of three portfolio strategies: June 1988–September 2010

	S&P	BXY	Short call
Average (monthly)	0.46%	0.52%	0.06%
Standard dev. (monthly)	4.67%	3.69%	1.74%
Sharpe Ratio (annual)	0.34	0.49	0.11
Best month	13.69%	6.89%	3.78%
Worst month	-25.21%	-23.20%	-9.13%
Correlation with S&P	1.00	0.94	-0.69

S&P and BXY excess returns computed as actual (total) returns minus one month Libor. Short call return = (BXY return) minus (S&P return)

volatility? In choosing an optimal short volatility overlay strategy, investors will continue having to balance the expected return of the underlying asset against the expected spread between implied and realised volatility, which can obviously vary from region to region. Furthermore, studies have also shown that systematic overwriting can sometimes be improved by selective overwriting based on simple rules of market momentum or volatility richness/cheapness – so this could be an additional source of risk/return improvement.

Even the most risk-averse investors focused on protection can benefit from these market opportunities by limiting their long exposure to implied volatility. For example, alternative strategies such as put-spread collars can be superior to simpler overlays and reduce the erosion of returns over time. Another approach would be to use strategies that reduce dependence on option pricing, such as volatility control. By targeting the volatility of the underlying asset, the option price is based on this target volatility rather than potentially overpriced implied volatility (see RBS article, *Risk* September 2010, for more details www.risk.net/1731252).



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