Two effective risk management strategies for volatile markets

Tail-risk hedging and downside protection overlays

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INTRODUCTION

In today's volatile world institutional investors (including superannuation funds) should consider downside risk protection strategies. These risk management tools are designed to reduce the frequency and magnitude of capital losses due to severe market sell-offs.

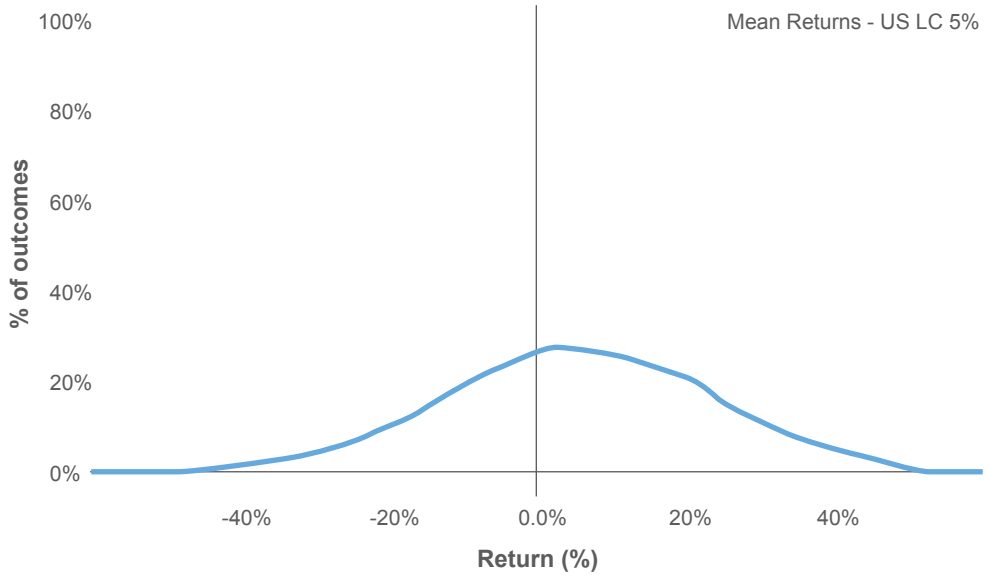
While hedging generally comes at the price of a reduced expected return, protection from the most problematic outcomes can allow an investor to retain enough investment exposure to meet long-term wealth goals with a lower risk of failure relative to that key objective. This paper discusses two specific approaches for structuring protection programmes: tail-risk hedging and downside protection overlays.

"Volatility tends to rise as markets correct, and unfortunately, it can take considerable time to recover losses after a market drawdown."

There is always a risk of loss in any investment in equity markets. However, for many investors, the downside risk is currently larger than they are prepared to tolerate. The prolonged rise in equity markets since mid-2011 has stalled over the past year, and the global economy is in a precarious position after a prolonged expansion phase. Combine that with a fairly tired earnings cycle in developed markets, an extended period of low short-term interest rates due to central bank policy coordination, the continued slowdown in China and early cracks in the foundation of the European Union; it is no wonder that the risk of a correction is on the mind of investors. Some even fear a global recession as the coming catalyst for the next correction.

Such concerns can drive bouts of increased equity market volatility, and we expect this trading environment to continue for a number of years. Volatility tends to rise as markets correct, and unfortunately, it can take considerable time to recover losses after a market drawdown. As a result, investors are recognising that in a low-return environment, the expected reward for taking on equity risk can pale in comparison to the potential extreme outcomes in a given year. Figure 1 shows Russell Investments' one-year distribution forecast for U.S. equity returns. The mean of just over 5% is lower than what we have come to expect, but the distribution is as wide, if not wider, than before – reflecting today's exceptional volatility.

Figure 1: Expected return distribution for the S&P 500 Total Return Index



Source: Russell Investments (as of 30 June 2016 forecast data)

The paper introduces two types of downside risk protection strategies:

- Tail-risk hedging; and
- Equity downside protection overlays.

It then takes a more detailed look at each strategy in turn providing specific examples of each strategy and considering the pay-off profile and level of hedging provided.

The tail risk hedging section notes two types of strategies (a rules-based strategy and active strategy) and walks through an example of a rules-based strategy. It then provides further details on how to manage such a strategy and how diversifying and gaining exposure to a number of such strategies provides diversification benefits.

In order to explain and contextualise to downside protection overlays we compare a simple put strategy with that of a put spread. We then consider the cost and the potential benefits of implementing such strategies tactically.

The challenge of protecting against market corrections cannot be met with a 'one size fits all' solution. Indeed actual implementation often means combinations of tail-risk hedging and downside protection overlays. Such programmes can also range from client-directed trading relationships to an ongoing rules-based mandate with adviser discretion. In each case they are specifically designed to match clients' individual desires, balancing the level of downside protection with the level of upside participation.

THIS PAPER IS TECHNICAL IN NATURE AND ASSUMES A DEGREE OF PRIOR KNOWLEDGE ON THE SUBJECT OF OPTIONS AND DERIVATIVE TRADING. READERS WHO ARE LESS FAMILIAR WITH SUCH TOPICS MAY WANT TO DO SOME ADDITIONAL READING ON THIS SUBJECT.

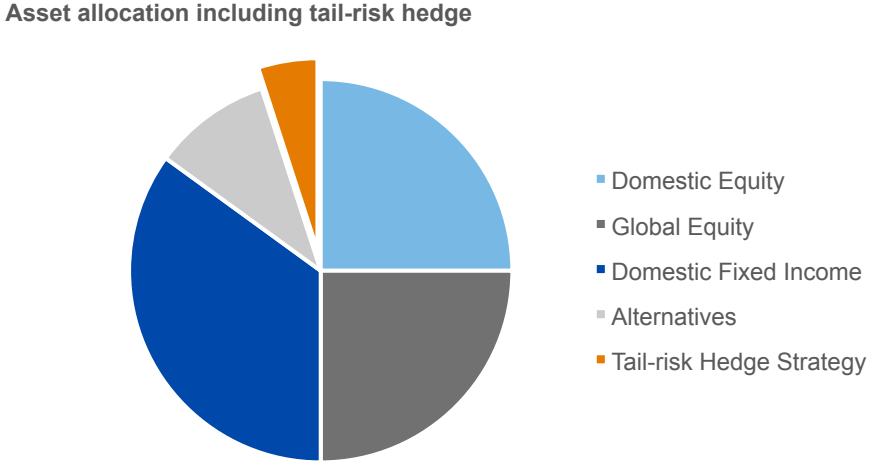
Overview of strategies: tail-risk hedging and equity downside protection overlays

In simple terms, the two strategies operate at slightly different points on the left side of the bell curve shown in Figure 1. This document will examine these two strategies in more detail suggesting templates to build upon in structuring hedges for a specific portfolio and situations of concern. For a more extensive look at a framework to help define hedging needs prior to designing a protective overlay programme, please refer to my paper, 7 considerations for establishing a hedging program, (Fletcher, March 2016).

Tail-risk hedging refers to a strategy of buying derivative contracts that are expected to perform well in times of significant market stress. These derivatives can be based on several available market indexes around the world (or on a few available volatility indexes reflecting the degree of investor fear in the most liquid equity markets). An allocation to such a strategy should act as a significant diversifier or downside dampener, due to negative correlation in the face of negative equity market moves.

A tail-risk hedge functions on a standalone basis, similar to a traditional investment mandate. Capital in the account is set to the maximum possible loss over the period of concern. Unlike an overlay solution, such as that discussed next, this mandate's performance is evaluated in isolation (based on the capital in the account) rather than as a complement to other portfolio holdings outside of the overlay account. Such solutions have a performance pattern that gradually declines over time, but benefits from a large gain when significant market corrections occur. The performance pattern generally corresponds to the size and suddenness of the correction, with deeper and more violent corrections generating larger tail-risk hedge gains.

Figure 2: How a tail-risk strategy fits into a multi-asset portfolio



There is some debate about the definition of a 'tail event'. Most academic observers describe it as a three-sigma event or the worst 1% of potential investment outcomes. Unfortunately, that leaves out the aspect of fear that accompanies a tail-risk event. A more pragmatic description is "something sudden and troubling that does not happen very often". By almost any definition, the global financial crisis (GFC) was a tail-risk event.

To illustrate the potential impact of such extreme events, Figure 3 shows percentile levels from the estimated return distribution shown in Figure 1.

Figure 3: Forecast percentile-ranked returns from U.S. equity distribution forecast

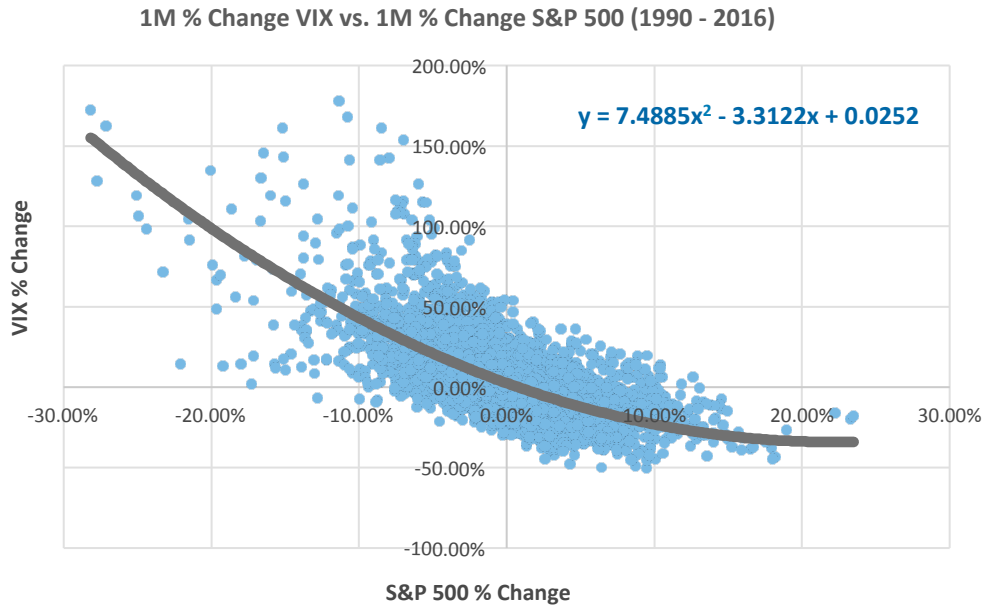
	1st	5th	25th	40th	50th	60th	75th	95th	mean
US.LC	-34.3%	-22.5%	-6.2%	0.8%	4.8%	9.2%	16.4%	32.9%	5.0%

Source: Russell Investments (as of 30 June 2016 forecast data)

The depth of a market correction is not sufficient information to predict size of the offsetting gain from a tail-risk hedge. The scatter chart in Figure 4 clearly shows that there is not a univariate relationship between the extent of market decline and the percentage change in the VIX[1] index. The VIX index is one of the most commonly used tail-risk hedging exposures (given that volatility spikes when markets fall, a positive exposure to rising volatility provides the desired hedge).

[1] VIX) is the ticker symbol for the Chicago Board Options Exchange (CBOE) Volatility Index

Figure 4: Relationship between size of decline and VIX behaviour



For illustrative purposes only

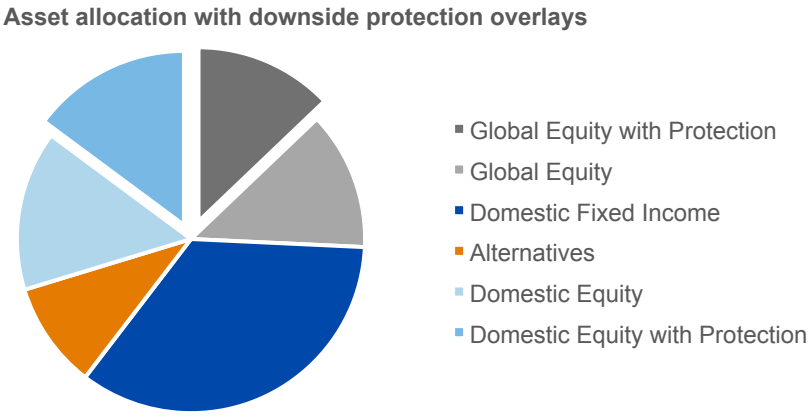
Source: Russell Investments

Contrary to the downside protection overlay (to be discussed later), a tail-hedge response depends primarily on implied volatility changes, and that is related to the speed and severity of a correction but not explicitly to the depth of a drawdown. While put options provide a more predictable offset (i.e. protection) to particular decline levels, the VIX structure provides a directionally correct response to the tail event and makes this tail-hedge a good diversifying holding in extreme market stress scenarios. Allocations to tail-risk hedging strategies do not necessarily have a directly proportional relationship to an investor's equity allocation. Position sizing requires an estimation of the market volatility increase as well as the extent of the market decline. Sizing tail-risk positions is a bit of an inexact science based on quantifying sensitivity to increases in implied volatility (often referred to as **vega**).

Downside protection overlays refer to strategies in which risk mitigation steps are taken to reduce the downside risk of the specific equity exposures held. This hedge is more explicit than a tail-risk hedge as the hedging instrument and underlying investment are usually based on the same benchmark exposure. Unlike tail-risk hedging (where the protection is provided by exposure to jumps in implied volatility), equity downside protection has a much bigger component of the hedge return coming from actual market movements of the underlying exposure (known as **delta** exposure). Downside protection overlays deliver protection from bad outcomes that do not have to be of the severity of the far left tail event, but might deliver less of a hedging gain than a tail-risk hedge in the event of a sudden and extreme correction. Performance of a downside protection overlay is considered in combination with the equity exposure it is hedging - the combination of the two should behave as a less risky form of equity exposure. The overlay mandate is complementary protection for an underlying portfolio holding, and allows for protection with set floors, more precise drawdown limits or target volatility levels. Index options are suitable instruments for this purpose. Examples of downside protection overlay structures include puts, and put spreads[2], and in some circumstances a portion of market upside may be sold to finance the protection. **Figure 5** demonstrates a portfolio with a downside protection overlay on half of the value of domestic equity and global equity allocations.

[2] An example put spread is where the investor is protected from 90% of the starting market (using a put) but then exposed to additional downside if the market is below 78%. Reassuming some downside exposure (by selling a put below 78%) reduces the cost of the protection or allows the initial protection level to be increased for the same cost.

Figure 5: How downside protection overlays fit into a multi-asset portfolio



Tail-risk hedging in greater detail

A tail-risk mandate serves as a diversifier within the total multi-asset portfolio, rather than an overlay to an equity allocation. Such strategies can be split into two broad camps:

- **Rules-based strategies**: these more complex solutions are more defined and feature a medium-level fee for management. These can be a broker strategy index[3] or an investment management mandate.
- **Active strategies**: these discretionary strategies are often classified as hedge fund mandates, with much higher fee structures.

The size of a tail-risk hedging mandate should be based on one of the following considerations:

- **Impact:** the desired loss offset if a major event occurs. Using the insurance analogy, this is akin to the coverage amount.
- **Cost:** an acceptable rate of loss in the scenario that no event occurs. This is similar to the concept of an insurance premium. Car owners understand that without insurance their liability from a car accident could ruin them financially, so they pay premiums just in case that unlikely event occurs. That said, they do not want to over-insure, and usually accept deductible amounts (or protect less than the replacement value) to reduce the cost of a policy.

Tail-risk hedge example: rules-based strategy using VIX call options

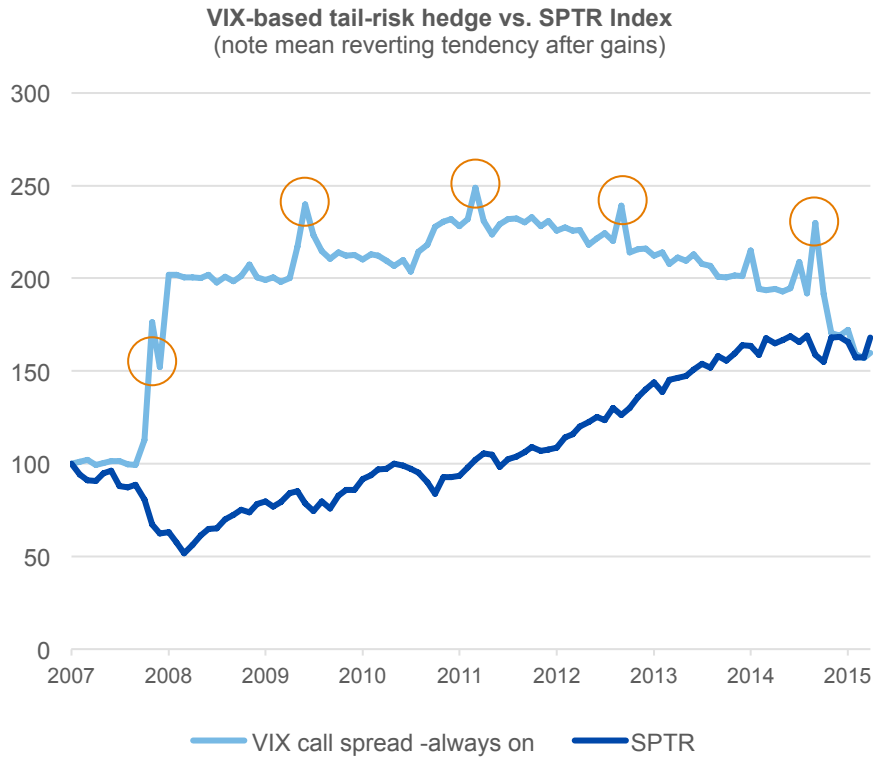
It is easiest to use an example to show how tail-risk mandates behave, and for the purpose of this paper I will elaborate on a rules-based strategy. The time period is recent history, including the GFC, a fairly indisputable tail event. The analysis is further simplified by comparison with the S&P 500 as a proxy for equity in general (and allows for very liquid index options and VIX instruments). Rules-based strategies can be accessed directly by hiring an asset manager, or indirectly by accessing a broker's strategy index (in some cases this requires an additional agent to act on the client's behalf). The asset management assignment is exactly what it sounds like: hiring a manager to run this hedging portfolio on your behalf.

The particular hedge behaviour illustrated in Figure 6 is attained by a ratio call spread with VIX options. With a long position in further out-of-the money contracts and a smaller (hence the 'ratio') short position in closer to-the-money contracts, the time-decay[4] of this position is more manageable, yet it still reacts net positively to large volatility shocks. The option structure is maintained continuously, with three-month options that are rolled forward at one month prior to expiration. This simple roll strategy avoids the steepest rate of time decay in the last month of the option's life, and this helps focus the exposure on the primary objective of sensitivity to jumps in implied volatility.

[3] A broker strategy index is an index created to replicate the particular trading strategy or algorithm designed by a specific broker. Exposure to this index is then gained by entering into total return swaps on that index.

[4] Time decay refers to the decrease in an option's value as the time until expiry declines.

Figure 6: Back-test performance of tail-risk mandate example relative to the S&P 500 total return



Source: Bloomberg, Russell Investments

The cost and imperfections of tail-risk protection

As noted, Figure 6 shows performance of the ratio VIX call-spread (described above). Hedging has a negative impact on expected return from such an investment. That does not mean that hedging always results in underperformance, as it can certainly generate excess return when the most problematic of potential return paths occur. A VIX-based hedge results in performance drag from time-decay as there is generally a negative cost of carry to the hedge – this can be thought of as paying an ongoing premium for the protection provided. That cost is evident over periods where there is no tail-event and these premiums did not 'pay off'. A perfect example of this is evident in the fairly steadily declining performance of the example strategy since mid-2012. The corrections were too small over this period to trigger hedging gains in an always-on strategy. While this strategy provided a large gain in the significant correction of 2008/2009, absent that jump, the always-on tail hedge did not add consistent value.

Managing a tail-risk mandate

Managing a tail-risk mandate requires daily, if not continuous oversight. The VIX cannot be directly traded, and the instruments that are based on VIX are forward exposures. Given that the structure of the volatility curve does not always react the same way as the spot VIX index (i.e. the relationship between the actual volatility of the index and the implied volatility of an option is not constant through time) management of such strategies cannot be run on a 'set and forget' basis.

One of the most interesting aspects of this particular structure is the spike in performance with a jump in implied volatility, with a tendency to give gains straight back as the volatility term structure normalises. This relatively quick mean reversion in performance happens for all but the biggest of corrections – the big GFC notably producing a doubling in value of the tail hedge in a matter of several months.

Tail-risk hedging positions are structured to have large pay-offs in certain conditions. However, after an event those positions can lose time-value at an accelerated pace when markets start to calm down, so knowing when to close or roll a position (via active investment decisions or well-designed rules) is as critical to success as choosing the right structure in the first place. Russell Investments believes performance can be improved in

this regard by applying switching rules to monetise, or take off the hedge, until conditions return to a more normal state.

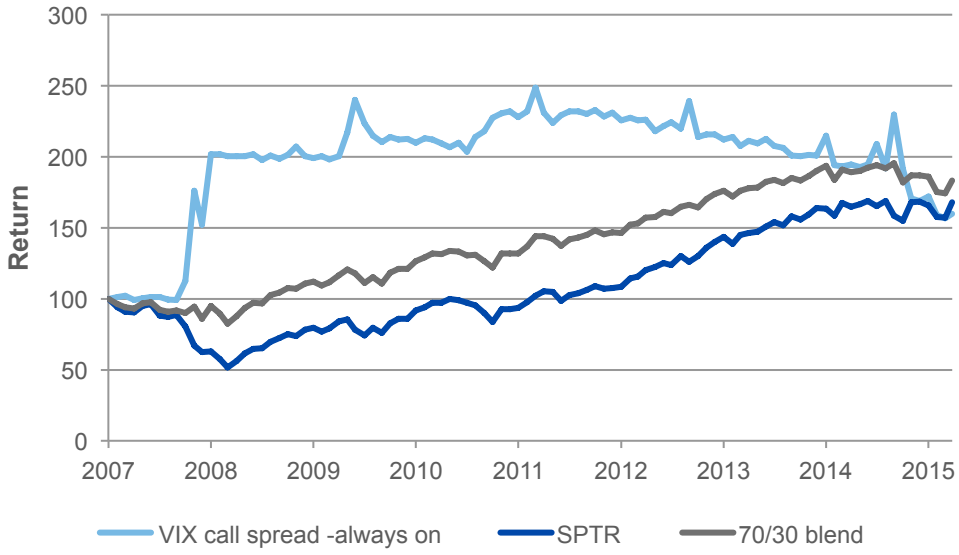
Such rules will be described in more detail in a subsequent research piece by the Options Portfolio Management team, whichwould ultimately manage such a hedge for a client in an ongoing tail-risk hedge mandate. *In short, it is Russell Investments' belief that establishing such 'off' periods with this hedging structure can result in a greater return over time with less overall risk (as measured by tail-risk hedge portfolio volatility).*

Given the complexity of these tail-risk mandates, the potentially higher management fees (than simpler index option-based hedges), and the propensity for long periods with zero to negative absolute returns, fiduciaries may find it challenging to keep such a strategy alive long enough to do its job. Where implemented we would recommend regularly educating boards to ensure the role of these mandates is understood as members change. It is also important to diversify across more than one strategy as there are challenging return paths for any given strategy.

Diversification benefit of a tail-risk hedge

Even without improving this strategy via more complex rules, it has been a very efficient diversifier of equity over the period shown. Figure 7 shows the diversification benefit of adding a tail-risk hedge along with an equity holding. It is not surprising that the illustrated tail-risk hedge has a negative correlation to the equity market - it was designed with that criterion in mind. In fact, over the period shown, correlation of monthly returns was an admirable -0.34.

Figure 7: Diversification benefit of adding 30% tail-risk hedge in lieu of equity



Assumes monthly rebalancing to 70/30 mix

Source: Russell Investments, assumes monthly rebalancing to 70/30 mix

	Annualised return	Standard deviation	Sharpe Ratio
SPTR index	6.49%	16.40%	0.40
VIX call spread - always on	5.85%	28.10%	0.21
70/30 blend	7.64%	11.70%	0.65

It should be noted that the tail-risk hedge does not have anywhere near a normal distribution of returns - it has a longer distorted right tail from those cases where the hedge was beneficial - so the term standard deviation can be a little misleading. That said, it is still a good diversifier of equity risk.

Downside protection overlays in greater detail

We now turn to the second approach investors may use to structure a protection programme. A downside protection overlay (or strategic risk overlay) is left in place on an ongoing basis, and its impact on expected return and risk can generally be understood and accepted.

This discussion centres on downside-protected equity exposures, a less risky form of equity exposure. These exposures usually outperform in a down market with more modest corrections and are generally more affordable than tail-risk hedges due to reduced complexity. More modest corrections happen more frequently than the severe, violent corrections a tail-risk hedge offers protection against. As a result, these exposures may be useful instead of, or in addition to, tail-risk hedging strategies.

An overlay can be used to protect equity exposures already held in large amounts in the strategic asset allocation. This brings the added capital efficiency benefit of hedging a return-seeking asset rather than holding a risk-offset position, such as a tail hedge, in lieu of other risk-seeking exposures in the policy asset allocation.

Downside protection seeks to complement equity market exposure such that total exposure outperforms in a down market. The performance of the overlay and the equity exposure it is hedging are generally considered in combination. The resulting mean of the distribution of returns when including option-based protection should be lower over time than that of the underlying equity exposure. However, since some of the most painful outcomes in the potential return distribution are mitigated, it outperforms in cases where protection was warranted.

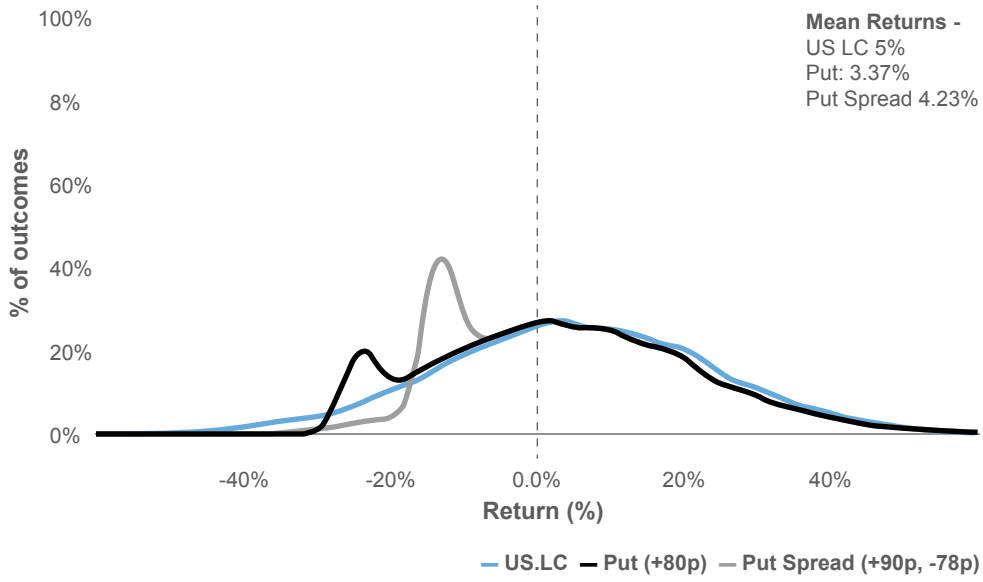
These strategies often make sense where an investor is more risk-averse for reasons such as funding regulations, aged populations in a particular pool or the presence of outflows -- all of which might be more heavily penalised by asset value drawdowns. The following example demonstrates how particular protection strategies impact expected returns and displays the nature of the modified return distribution of these milder forms of equity exposure in relation to the underlying equity benchmark.

Comparison: equity protected with annual 90/78 put spread vs. 80 put

Figure 8 shows the expiration payoff diagrams and projected return distribution for a put struck at 80% of starting market value and a similar put spread (where the investor is protected from 90% of the starting market but exposed to additional downside if the market is below 78% of the starting market value at expiry). These two structures in Figure 8 were chosen because they had an equivalent upfront premium of 2.04% based on sample market prices and illustrate different nuances of protection.

By adding a put hedge to the underlying equity position, the expected return will be reduced from its starting value of 5% to 3.47%. By making the protection weaker, yet set to the same up-front premium (2.04%), the drag on expected return is reduced (i.e. there is an increased expected return of 4.23% with the put spread strategy compared to with 3.47% with the put strategy). The caveat is that this hedge allows for a very challenging negative annual return in the event of a major correction (that is, a decline in US LC value much greater than 22%).

Figure 8: Equity replacement strategy returns relative to equity

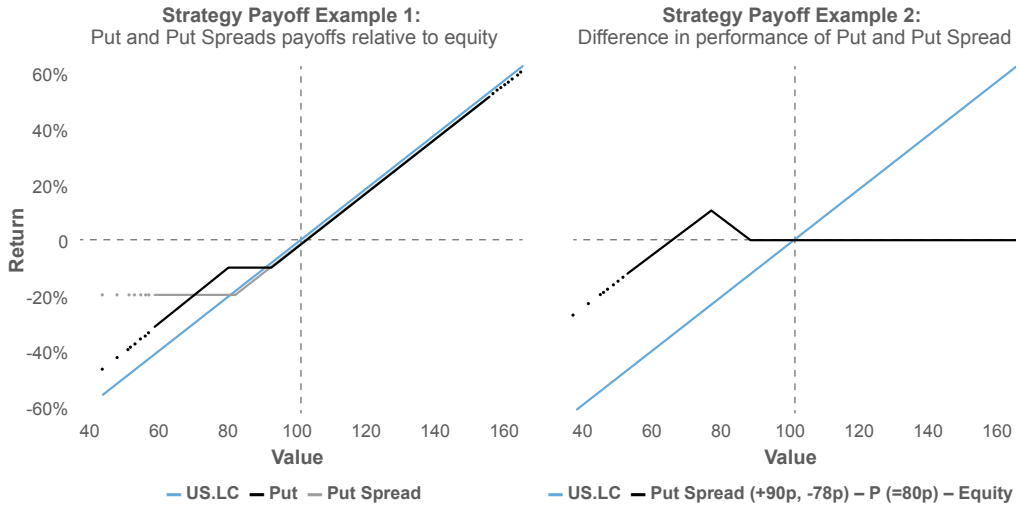


	1st	5th	10th	25th	50th	75th	95th	mean
US.LC	-34.3%	-22.5%	-16.5%	-6.2%	4.8%	16.4%	32.9%	5.0%
Put-80	-22.0%	-22.0%	-18.5%	-8.3%	2.8%	14.3%	30.9%	3.5%
PS-90-78	-24.7%	-12.9%	-12.0%	-8.3%	2.8%	14.3%	30.9%	4.2%

Source: Russell Investments

The put hedges the tail, while the put spread is protecting the left shoulder of the distribution and this is possible at a much lower drag on expected return than a more extreme tail-hedge. There is a much higher probability of the market expiring in the zone where the put spread outperforms the put (16.6% probability), than in the zone where the put outperforms (1.5% probability). However, if this were to occur the severity of that 1.5% could be quite significant. Example 1 in Figure 9 show the individual payoff profiles for the put and put spread and Example 2 (through subtraction of the pay-offs of the relative strategies) illustrates the relative difference in performance payoff of the two strategies[5].

Figure 9: Pay off diagrams in downside protected examples



Source: Russell Investments

[5] It can be seen that both strategies (the Put and Put Spread perform inline from 90% and above. Between 90% and 68% the Put Spread outperforms, but from 68% down the Put Spread underperforms the Put.

Cost considerations for equity downside protection

Ongoing protection can cost dearly in terms of return expectations and can be readily estimated with accepted techniques. Protected equity strategies can be reasonably priced, in terms of management fees, and are available via an advisory relationship with an overlay manager, or fairly straightforward rules-based strategies – both with lower fees than fully discretionary active management. If ongoing protection is desired, investors can pick a strategy whereby the hedging activity does not result in an intolerable reduction in expected return, even if that involves some imperfections in the protection. If hedges have imperfections, it is recommended that investors diversify those imperfections by choosing complementary strategies rather than loading up on a single one. Because it is hedging against a different outcome, protecting the left shoulder of the distribution with an equity downside protection overlay can also be very complementary to a VIX-based tail-risk hedge. Over time, protecting against a tail-event is much more expensive with index puts than it is with a well-structured volatility trade like the one we outlined, but puts can be useful for tactical purposes. There are situations where the investor places value on a lower return with less volatility and downside risk, but not every situation has such a utility function. In today's low-return environment, we can scarcely afford to give up returns if we have the luxury of a longer time horizon to grow wealth.

Tactically hedging equity downside (with authority to take or delegate discretion)

While tactical hedging programmes may face less time decay with hedges not running continuously, there is still a negative impact on expected returns. The challenge is to add value in timing of hedging decisions and to minimise drag on expected returns as much as possible.

To improve the chances of success in a tactical hedging programme:

1. diversify timing of hedge trades, and diversify execution points and equity exposures hedged.
2. align executions with forward-looking market views. If you do not have a forecasting capability with an intermediate time horizon, align with a partner that can advise in this capacity.
3. alter specifics of hedges according to the volatility environment. Even strategic hedgers should adapt positions to current market conditions when rolling forward protection on a recurring basis. Make sure the size the of position and strike levels are consistent with forward-looking volatility views.

Russell Investments believes that active investing within a solid investment decision framework with in-depth knowledge of options and volatility markets can add value over time. Timing is as important as direction. Success requires a sound, disciplined investment process to drive the size and timing of hedging transactions, otherwise the influence of human behavioural biases (in this case fear and greed) in the face of turmoil can be very counterproductive.

HOW RUSSELL INVESTMENTS CAN HELP

The challenge of protecting against market corrections cannot be met with a 'one size fits all' solution. At Russell Investments, we understand our clients' needs are different. Given our expertise and global reach, we are able to provide customised solutions for investors. We have access to highly specialised expertise in options and volatility markets with our focused Options Portfolio Management team that runs discretionary mandates for tail-risk hedging. We also have general derivative expertise in our Overlay Services team that can help investors find a way of working these strategies into their portfolio in a manner congruent with specific governance structures. These programmes can range from a client-directed advisory trading relationship to an ongoing rules-based mandate with adviser discretion and are specifically designed to match clients' individual desires, balancing the level of downside protection with the level of upside participation.

ABOUT RUSSELL INVESTMENTS

Russell Investments has been successfully managing multi-asset portfolios since 1980. Today, clients trust us to manage A$321 billion of their assets globally (as of 31 March 2016). We have built up expertise, scale and capabilities in each of the five core areas needed to successfully design, construct and manage global multi-asset portfolios: capital market insights, asset allocation, manager research, factor exposures and portfolio implementation.

Clients access our core capabilities in aggregate via our multi-asset, single-asset funds or fiduciary management relationships. Drawing on our multi-asset capabilities, we have designed a suite of services that can be customised in combination or as individual services to deliver portfolio solutions for superannuation and investment funds to extend their in-house resources. We have partnered with funds to help reduce investment management costs, enhance returns, access discrete factor exposures more precisely and reduce portfolio risks.

FOR MORE INFORMATION:

Speak to **Nicki Ashton, Head of Strategic Partnerships** on (02) 9229 5521 or email nashton@russellinvestments.com.

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