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## Tail-Risk Hedging in Concept and Practice

Tail-risk hedging is clearly the topic *du jour*, and in this business, a bit of skepticism towards trend is usually warranted. There is, however, real merit to the concept of tail-risk hedging, and it has a place in a broader context of change that we will flesh out here. Because of broad demand for tail-risk hedging, and the increased costs associated with it as a result of heightened demand, it

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is, unfortunately, going to be much more challenging to effect in the near-future. We will need to be more creative about how we accomplish the goals we have for such hedging. In the pages that follow, we will describe where tail-risk hedging falls in the broader context, and in a companion paper that will follow shortly, my colleagues have explored some examples unique to First Quadrant that provide additional options for how our clients might begin to hedge their tails.

### Tail-Risk Hedging in Context

The first decade of the twenty-first century didn't go well at all for investors, beginning with the collapse of the tech bubble and ending with the credit crisis, as it did. Pension funds suffered doubly in that not only did assets generally fall in value, but with interest rates having fallen too, liabilities soared and funding ratios collapsed. Having traveled through generally smooth seas (by comparison) for much of the 1980's and 1990's, the rough waters of this first decade of the new century pressed upon investors to place a more active hand on the tiller, particularly in regards to asset allocation.

For those with the deepest passive instincts, this sounds like trouble. Such investors will worry about whether

there will be just a lot of costly over-steering as investors react – most likely in inefficient fashion – to whatever happened yesterday, or to empty conjecture about tomorrow. Passive instincts are rooted in the notion that the markets are largely efficient and therefore hard to beat, but we don't go to market just to win. We mostly go to market to get what we want, and deciding what we want and pursuing what we want are active, not passive, activities. This last decade should serve as a reminder to us that we need to fight for what we want when we go to market. We can't passively accept what's given to us in the form and quantity in which it has been provided.

Investors should adopt an *active* mindset about asset allocation and reject outright the notion that there is even such a thing as *passive* asset allocation. Different investors have different needs. As was clear during the course of the credit crisis, investors with significant private

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equity commitments needed more liquidity than other investors. Corporate pension funds need more long-duration fixed income assets to better manage the risk of a widening gap between assets and liabilities. They need more than most other investors, and they need more than they have. Plan sponsors need to hedge their downside risks, both for investment reasons, and sometimes for political reasons. Sovereign wealth funds, on the other hand, are most often in a position to be paid for bearing shorter-term risks that pension funds can't.

Investors are becoming more actively engaged in picking and choosing what risks they want to take, what shape

they'd prefer those risks to take, and what value assets hold *for themselves* as opposed to simply thinking in terms of what value assets hold in the market today. When, in the late 1990's institutional investors in the UK bought up long-duration gilts and drove yields at the long end of the curve below intermediate duration yields, it wasn't because they had an active view on the prospective return of long-term versus intermediate-term bonds. No, they had an active view as to what those gilts were worth to themselves in the context of their liabilities, and in the face of newly released regulation (the "minimum funding requirement").

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Those engaged in tail-risk hedging today are displaying an active preference for avoiding downside risk, and for shaping higher statistical moments in their return distribution. They are willing to pay a price for doing so. This isn't merely an attempt to fight "last year's battle," but rather it reflects on their decision to fight for what they want from the asset markets. Whether one thinks it is possible to "beat the market" or not, investors should engage in asset allocation on an active basis if they expect to come home with what they want or need. Decisions to hedge tail-risk are just one example of investors engaging actively in asset allocation.

### Managing Downside Risk Broadly

Downside risk comes in many forms and tail-risk hedging focuses only on a subset of those. Tail-risk hedging is defined by the desire to avoid, or at least minimize, large,

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**Tail-risk hedging only addresses short-term forms of managing downside risk.**

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*short-term* downdrafts in the value of the investment portfolio. Too little present in the discourse today are ideas about how to minimize exposure to a more gradual, but deep depreciation in asset values that might come, for example from persistently poor and weakening economic conditions, or that might come in the context of a cycle of destruction of capital and renewal, where previously dominant firms or industries are replaced by newly rising firms or industries. Both of these scenarios used as examples here are entirely plausible in the circumstances we find ourselves in today. Managing against the risk of longer-term, cumulative depreciation in asset values should, whether

one thinks these scenarios are relevant or not, be moved to the center of this discussion alongside concerns about shorter-term adjustments.

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**Managing against the risk of longer-term, cumulative depreciation in asset values is at least equally important.**

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Some of the tools proposed for managing against short-term downdrafts simply won't serve to protect against more gradual declines in asset values. Variance swaps, in particular, are not likely to provide any meaningful protection against more gradual declines as these are not likely to be accompanied by the high volatility that is required to generate the protective rewards that variance swaps may provide in more violent, shorter-term asset price adjustments. That doesn't mean they are a poor tool. It simply means there are additional tools needed.

Also lacking in the discourse is the need, for pension funds in particular, especially corporate pension funds, to manage the gap between the assets and the liabilities. What really matters to defined benefit plans is whether the value of assets grows less or shrinks more *relative to* the liabilities. As such, it will be more important to protect against a correlated decline in asset values and interest rates (as might, in the current context, be more likely to occur under long-term economic stagnation) than it would be to protect against, for example, a scenario where inflation rears its ugly head and drives equity values lower again. In the latter case, the value of the liabilities would be falling, easing the pain of the decline in asset values.

Finally, we would argue that there's as much an offensive element to tail-hedging strategies as there is a defensive element, the latter of which is where the focus has been placed. In the context of a sharp drop in asset values, a sub-portfolio that generates a strong positive return can

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provide "dry powder" to be opportunistically reinvested in assets at newly lower prices. Those who had the liquidity to take advantage of widening credit spreads in the course of the credit crisis know well the value of dry powder when markets are in disarray. It will be important that the

proceeds from tail-hedging portfolios be reinvested when these gains are generated to take advantage of depressed asset prices.

## Protective Approaches

Tail-risk hedging has been primarily described as a form of insurance. Investors expect to bear a cost for this insurance – at least in between storms, if not throughout the full investment period. Certainly we can expect that as long as there is broad demand for this insurance, the cost of this insurance is going to be unusually high. We see it today in the high levels of option-implied volatility, particularly in longer-dated options where one year, twenty delta put implied volatility eclipsed 40.0% for only the third time in almost fifteen years. The first episode was caused by Long Term Capital Management's forced cover of large, short implied volatility positions and the second was the period after Lehman's bankruptcy in the fourth quarter of 2008 into 2009. We also see it in the prices of variance swaps where ten year variance pricing as of mid-July was less than 10% from its all time high set in November 2008. In fact, at that point ten year implied variance pricing was above any ten year realized volatility period for the history of the S&P 500, back to the beginning of the Great Depression.

Purchasing insurance is, however, only one means of acquiring protection, and savvy investors will put several tools to work for themselves, paying careful attention to the relative "pricing" of a range of protective solutions to optimize their net-of-cost protection. Other solutions come in either the form of portfolio construction or portfolio management. In terms of portfolio construction, investors may seek to protect their portfolios against both significant short-term and longer-term depreciation in asset values by building portfolios that are more robust across a variety of likely economic or market scenarios.

Diversification is the oldest tool for minimizing exposure to downdrafts, so constructing portfolios that have a better balance of risks across key risk factors such as equity risk,

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sovereign risk, inflation risk and deflation risk would have, and would be expected to, provide good protection against

downdrafts. So-called "risk parity" portfolios generally aim to do this. Of course, a lesson learned in the recent credit crisis is that diversification across assets simply isn't enough if the lion's share of those assets all ultimately carry risk related to economic growth – through equities, corporate credit or otherwise.

There also exist what we would refer to as "conditional strategic" forms of portfolio construction which exploit attributes of both by providing a more balanced allocation of risks (risk "parity," however, is not the goal), but a balance that changes depending upon some feature or features of the market or economic environment. We run such a product where, instead of the goal being to provide better diversification of beta, the goal is to participate in economic growth (mostly through equities), while hedging against equity risk, inflation risk, and deflation risk.

Beyond portfolio construction, there are also solutions that come in the form of portfolio management. The two main approaches here are tactical asset allocation and portfolio insurance, the first of which is proactive, the latter reactive. Tactical asset allocation seeks to protect portfolios against declines in asset values when those valuations have become extreme, or when market or economic conditions make those valuations vulnerable to decline. Tactical asset allocation is one of the older investment strategy-based sources of "long volatility," and while it struggled during the most bullish years of the 1990's, it ultimately provided the protection that was expected of it. It should not, however, be expected to provide protection in all market downdrafts as it is a product that is meant to protect only against recurring sources of market imbalances, not one-time episodes.

The portfolio insurance approach is an approach that seeks to incrementally reduce risk as the value of a portfolio falls to some threshold. Once the threshold is hit, the goal is to fully protect against further declines by having sold off all exposure to the risk asset(s). This strategy was made infamous in 1987 when, it is presumed, programs prepared to trade out of equities as equities fell all triggered sells at the same time, driving the market past those lower thresholds before such investors could get out of their positions. Just as it has been difficult to explain the recent "flash crash," (May 6, 2010) we've never seen any formal proof that this is what happened in 1987, but the notion that this would happen in a rapidly moving market, is entirely plausible and concerning. Furthermore, we should be concerned if there is a lot of capital prepared to move on the same or similar triggers. Market movements are likely to become exaggerated, and those applying such techniques are likely

to sell at a liquidity-starved bottom then watch at least a partial recovery take place that they do not participate in.

Given the cost of insurance today, portfolio construction methods and tactical asset allocations should most likely carry more weight in investors' efforts to protect their portfolios today.

### Hedged Equities

To the extent to which investors are interested in forms of insurance against a significant and relatively short-term decline in asset values, they have to consider exchange traded equity index options as being a core component of their tool-kit. First of all, there is a longer-term history of the cost and benefit of these options to study. Variance swaps, VIX futures, swaptions and credit default swaps, for example, all have either shorter or less transparent price histories, making it more difficult to objectively evaluate their effectiveness. The exchange traded nature of these equity index options would seem to provide increasingly higher relative certainty of payout than instruments that carry specific counterparty risk, the more catastrophic the market decline.

**Investors *have* to consider exchange traded equity index options as being a core component of their tool-kit as most of the asset risk in portfolios today is either directly, or indirectly, related to equities.**

In addition, most of the asset risk in portfolios today is either directly imbedded in equities, or indirectly related to equities (e.g., corporate credit risk), so hedging equity risk directly is most important to consider. Again recognizing that most of the asset risk is equity-related, equity index options are the only direct hedge against a decline in equity prices. Variance-based hedges such as variance swaps and VIX futures indirectly hedge against equity price declines under the assumption that volatility, or the price of volatility rises significantly as equity prices fall.

It is interesting to think about how widespread tail-hedging might dampen volatility – realized and implied – in the context of a market decline. If a larger share of investors carries protection against an equity market decline, one would assume that these investors would be less reactive and create less volatility on the way down. On the other hand, it may be the case that those who have effectively written the insurance may substitute for the asset holders

by reacting to decline, selling equity to delta-hedge the insurance book they've sold, generating the very volatility the insured asset holders no longer generate. We can't know how such a scenario will play out, but suffice it to say, we know exactly how a 7% out-of-the-money put will pay off just before expiration if the market is down more than 7%, but we know with a lot less certainty how one of these other instruments will pay off because they only provide indirect (correlated) protection.

In a recent paper,<sup>1</sup> we demonstrated how a price-sensitive strategy of building a portfolio of options in a put-spread collar structure could significantly mitigate the downside risk of equities and improve the overall Sharpe Ratio of equities. At the close of that paper we advised that investors abstract the equity options portfolio from the underlying equities, by which we mean that the options portfolio can be treated as asset in its own right so that it could be scaled to whatever size provides the greatest utility in complement with the equity portfolio.

The table below shows how the variable put-spread collar portfolio would have performed when ranked by deciles of equity performance, and during the top and bottom

Worst to Best Deciles of Monthly S&P 500 Performance (June 1983 – June 2010)	Options Overlay Simulation <sup>2</sup>
Worst	6.65%
2	2.57%
3	1.74%
4	0.91%
5	0.19%
6	-1.21%
7	-1.02%
8	-2.68%
9	-2.61%
Best	-2.96%
Worst 5th %-ile	7.19%
Best 5th %-ile	-2.76%
Correlation with S&P 500	-65%
Skew	1.33
Excess Kurtosis	6.63
Excess Return	1.32%
Annualized Tracking Error	15%
Information Ratio	0.09

five percent of monthly equity returns. Please note that the performance results are all from a simulation, not an actual portfolio. A technical point is worth paying attention to here, the strategy we show has been scaled to a 15% annualized volatility so that differences in outcomes may be more easily inferred. This is accomplished by leveraging the portfolio. In the case of the variable put spread collar, or “options overlay,” this means we’ve leveraged the options 3.3 times. Such leveraging of positions to scale risk is something we do every day in derivatives portfolios, of course.

As expected, the portfolio of equity options would have provided very good protection during equity market declines. The cost of this strategy lies in the opportunity cost that comes with writing out-of-the-money calls to help finance the portfolio through time. When the equity market delivers its strongest performance, we expect this portfolio to bear its greatest cost.

Correlation with equity returns is not really an appropriate measure of how well the strategy suits our objectives, as the objective is to observe strong performance when equities deliver their weakest performance. (We’d be just as happy with a risk return profile that also does well when equities do well.) Nevertheless, correlations are commonly cited on this topic, so we’ve observed in our simulation that the options overlay would have had an attractive -65% correlation with equity returns. More to the point, the overlay would have had a positive skew and attractive kurtosis (we want the strategy to have outsized positive contributions – and we want that to happen when equities fall as the decile table indicates).

Whether the overlay adds value on its own or not isn’t our chief concern. We’d like it to cost as little as possible if it doesn’t add value. As you can see, the overlay would have done just better than breaking even over this particular historical period. What we do, of course, expect it to do is to reduce volatility and create “dry powder” which, if

reinvested in the equity market, will improve the compounded return to equities.

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As we look forward, a note of caution is warranted: for as long as we go through a period of heightened demand for protective strategies from investors broadly – a demand that will be reflected in higher options-implied volatility – we should expect that this strategy will provide less protection because the costs will be higher. This is an observation we would make regarding all of the forms of insurance being sought today, and this increases the need for other forms of protection that may not suffer from the increased demand for more explicit insurance.

## Conclusion

Tail-risk hedging is merely one element amongst others that investors are, and should be, pursuing in an active effort to define and shape the returns that they individually need and want from the financial markets. Portfolio construction methods that provide better downside protection (particularly “risk parity” or “conditional strategic asset allocation” approaches), as well as tactical asset allocation should be considered complementary tools in this effort. Furthermore, with the costs of buying explicit forms of insurance running very high today due to the broad increase in demand for such insurance, it will be important to look for other means of gaining long- or longer-volatility exposure such as looking to active investment strategies that have such characteristics.



<sup>1</sup> FQ Perspective: *Managing Committed Capital During the Drawdown and Reinvestment Periods*, Max Darnell, Ghene Falcon and Chuck Fannin, March 2010, Vol. 7, No. 03.

<sup>2</sup> **Variable Put Spread Collar Simulation** – The simulated performance results presented in this study are for illustrative and educational purposes only, and is not as of this writing, a strategy deployed by First Quadrant, L.P. No actual trading has taken place. Unless otherwise noted, performance returns for one year or longer are annualized. Performance returns for periods of less than one year are for the period reported. The simulation is based on the historical performance of the S&P 500 Total Return Index combined with a put spread collar on S&P future with the nearest maturity with strikes set at inception at a specified constant fraction of the standard deviation to maturity out of the money for the purchased put, based on the VIX twice as far out of the money for the sold put, based on the VIX and the corresponding strike for the short call to result in a zero net cost for the entire structure. This option structure is held until maturity at which point it is rolled into the next 3 month option position with new strikes as described above. Transaction costs of 7.5bp per transaction (30 bp per year) have been included in the performance calculations.

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