FIRST QUADRANT

Slimming Your Tails: Constructing a Superior Tail-Risk Hedging Portfolio

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FQ Perspective

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In the conceptual companion piece to this paper, "Tail-Risk Hedging in Concept and Practice," we described briefly the problem that investors currently face in obtaining tail-risk hedging at sensible cost. Demand for tail-risk hedges is high and likely increasing, as witnessed through high prices of equity index implied volatility and variance swaps. The implication is the need to identify cost-effective sources of explicit and approximate forms of tail-risk hedging.

In the examples that follow, we have, for illustration purposes, demonstrated what can be done by identifying and combining active investment strategies that will have a tendency to provide long-volatility offsets to declines in equity prices. Such an approach will, of course, risk that the offsets don't occur when needed, which is the nature of an approximate hedge. As described in the other paper, however, much of what is being used for tail-risk hedging – e.g., variance swaps, and credit default swaps – are similarly approximate and may fail to provide the desired hedge as well. One may find economically superior solutions by shifting approximate hedging methodologies.

Tail-Risk Hedging Portfolio

Given the current, and likely sustained, high costs associated with various forms of insurance (equity and bond options, variance swaps, VIX futures, credit default swaps, etc.), it is important to include other sources of potential protection if we wish to build an effective tail-risk hedging portfolio today. This means looking for investment strategies that tend to do well during periods of economic or market stress. Investors have come to refer to these as "long-volatility strategies," which means they perform best during high and rising periods of volatility.

Since periods of high and rising volatility occur relatively infrequently, long volatility strategies can require more patience and are often rejected by investors for their lower risk-adjusted rewards – lower than their short-volatility cousins that benefit more frequently, but often experience unobserved or unreported[1] episodes of significant disappointment. Evaluated based upon such strategies' marginal contribution to the fund as a whole, these long volatility strategies appear to be more valuable than many of the "high quality" short-volatility strategies because they are designed to provide greater diversification to the fund as a whole and serve to improve the higher moments of funds' expected return distributions.

In thinking about possible approximate hedges for an equity portfolio, our goal is to mute the undesirable characteristics of the equity returns distribution through the use of strategies that have offsetting characteristics. For instance, we know that during periods of market stress, correlations among beta instruments tend to increase positively as standard deviations also increase. Additionally, beta instruments tend to experience numerous small gains while experiencing relatively large losses, resulting in a negatively skewed returns distribution. In order to complement an equity portfolio, we not only need strategies that exhibit negative correlations to betas, but also maintain negative correlation during stressful periods. Ideally, the standard deviation of the hedge portfolio would increase during stressful times, which when coupled with the negative

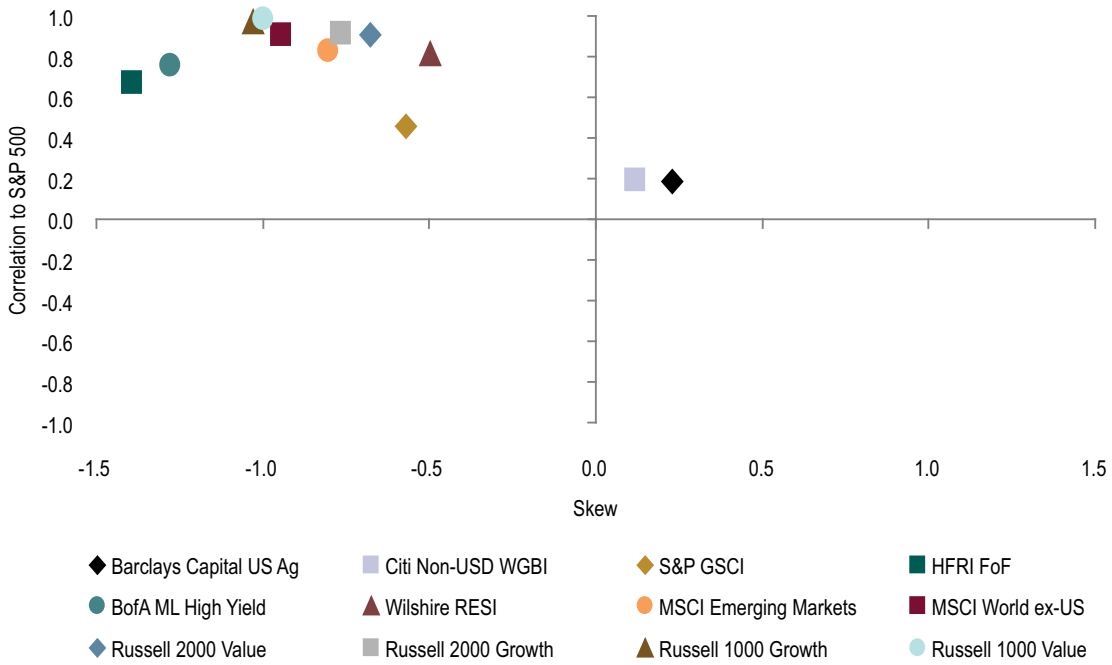
correlation, will offer excellent diversification benefits during these periods. These attributes should result in a positively skewed returns distribution.

In Figure 1, we plotted five year correlations of monthly data of various asset classes to the S&P 500 on the y-axis and the skew of the returns distributions of those asset classes on the x-axis. We see that most of the classic asset classes, with the exception of government bonds, fall in the top left quadrant which is characterized by negatively skewed returns distributions and strong positive correlations to the S&P 500. Government bonds provide some diversification benefits by exhibiting positive skewing returns distributions. We like new strategies to fall within the lower, right quadrant, exhibiting positively skewed returns distributions and negative correlations to equities. The strategies we discuss throughout the balance of this paper fall into that quadrant and, from a returns distribution standpoint, offer the desired diversification benefits. Importantly, we will highlight why these should perform well during market turmoil.

this paper are based on factor model simulations. While we bend over backwards to avoid overfitting (and, we suspect, have some of the lowest backtest information ratios in the business… we only care about maximizing actual performance), however inevitably some hindsight bias will exist. We have in no way, however, optimized or chosen the strategies based upon the downside protection they provide, which is what we care about here.

We have included two broad investment categories that tend to have long volatility like characteristics over time, the first is relative value. Relative value seeks to exploit value relationships that are extended beyond what one would normally expect. These relationships tend to be most stretched after long periods of economic growth and low volatility when investors often chase investment return without respect to valuation measures. Many relative value relationships tend to have 'carry' type characteristics, where a higher yielding asset is purchased in place of a lower yielding asset in order to increase portfolio expected return. Credit spreads tend to exhibit this type of relationship; investors often overweight high yield late into an economic expansion in order to match investment returns of yesteryear. When stress is introduced to the economic system, credit spreads expand rapidly and investors are forced to unwind positions.

FIGURE 1: Classic Portfolio Problems
Five Years through June 2010



Source: StyleAdvisor

Through the marriage of a beta portfolio and long volatility-like strategies, we intend to balance the pros and cons of both. Because the strategies we discuss are tactical in nature, these offsets will not be perfect, hence the approximate hedge classification. The returns presented in

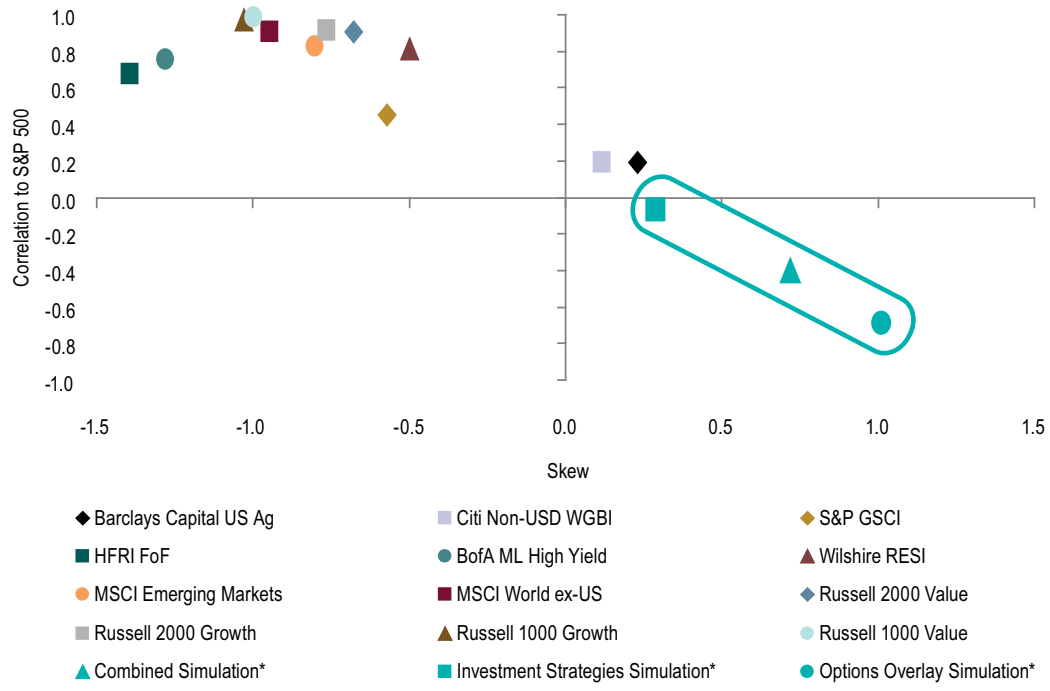
Relative value in currency seeks to take advantage of valuation relationships similar to those just described in credit space. During steady economic seas, investors purchase higher yielding currencies, often pushing them well beyond what might be expected from longer term fair value metrics. When capital ceases to flow freely, these often times levered positions unwind quickly causing the high yielding currency to experience precipitous losses in value over short periods of time, as was the case in late 2008.

The second notable area of relative value we will discuss is in Tactical Asset Allocation (TAA), or in stocks versus bonds space. The concept is similar to that of relative value currency in that investors tend to overvalue equities after long economic expansions, but this relationship reverses as the monetary punchbowl is removed. Stock/bond value relationships can reverse quickly, but this is not always the case. Industry-wide, notable periods of TAA performance were October 1987 and from 1997 to 2002. During the fall of 1987, value relationship reversed quickly and from 1997 to 2000 TAA struggled as equity values continued to rise but eventually reverted to more normal levels during the 2000 to 2002 period.

We include trend following as the second category of long volatility investment strategies. Trend following has several attractive characteristics that provide a good complement to relative value. Trend following seeks to take advantage of situations where we may not have a good sense of historical relative value relationships, or when those relationships have gone beyond what we might expect using either theory or history as a guide. As a result, this strategy will often be on the correct side of large, volatile moves which are the type of returns characteristics in which we are interested.

In Figure 2, we have added three additional points to our correlation/skew chart. The first point is the Investment Strategies Simulation, which was created by equally risk weighting the three previously described investment strategies. We have also added a point to present a simulation of the Variable Put Spread Collar Options Overlay, which, as we described in our paper, Tail-Risk Hedging in Concept and Practice, is expected to offer excellent diversification benefits and is also an explicit hedge which is designed to offer 100% confidence in our payout at expiration. Finally, we represented a Combined Strategies Simulation ("Combined Simulation") which equally risk weights each invest-

FIGURE 2:Hedging Solutions at Work
Five Years through June 2010



Sources: StyleAdvisor, Global Financial Data (GDF), First Quadrant, LP
*Please see Simulation Disclosures found at the end of this presentation for further information regarding simulation construction.

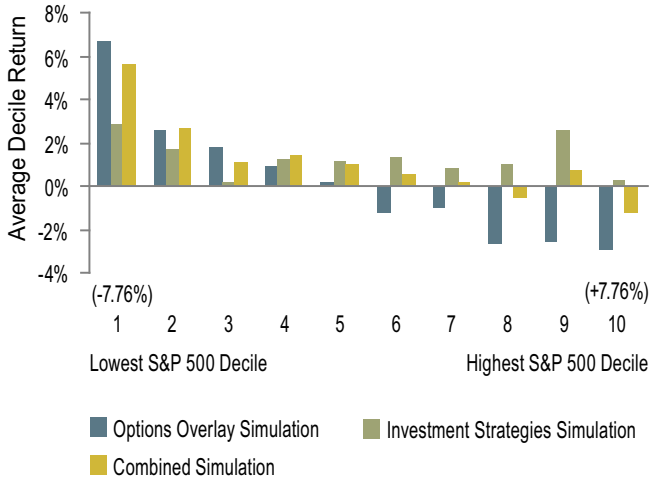
ment strategy and the options overlay. From a distributional standpoint, all of these strategies should provide diversification benefits by falling into the lower right quadrant.

Distributional complements are well and good, but do these strategies offer protection when needed? Does the combination of the strategies provide tail event protection? In order to answer these questions, we sorted S&P 500 monthly returns from June 1983 – June 2010 into deciles and took a look at the various strategies' simulated performance, the result of which is represented in Figure 3. Figure 3 shows that the Options Overlay performs very well during the worst periods for the S&P 500 but struggles during the best periods which is what we would have expected. The Investment Strategies also performs well during equity downturns, but perform positively during equity rallies, which offers an offset to the losses that the Options Overlay experiences during these periods. The Combined Strategies offers the best of both worlds – providing excellent downside protection during down markets, yet providing only a small drag in positive equity months. The self funding nature of the Combined Strategies is an important aspect to consider, as most investors give up on the hedge after a long period of returns drag on the portfolio, which is generally when it is needed the most.

Downdraft Protection

FIGURE 3: Hedging Solutions at Work

Ranked According to Deciles of S&P 500 Price Performance
June 1983 – June 2010



Sources: StyleAdvisor, Global Financial Data (GDF), First Quadrant, LP

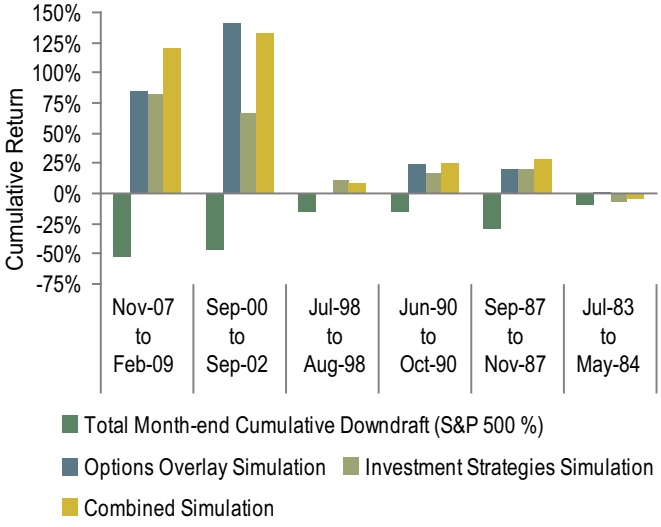
Please see Simulation Disclosures found at the end of this document for further information regarding simulation construction.

We do not believe one should limit hedging activities strictly to short-term, volatility induced tail exposure. Investors should also be concerned about protecting against significant cumulative downdrafts that may take many months to unfold, and might conceivably occur without a large jump in the volatility of equities – a period during which volatility based instruments will fail to pay off. To that end, Figure 4 shows, over the period in which index options have traded on the S&P 500, how these various approaches would have fared in the six cases where the S&P 500 fell by 10% or more cumulatively. Recall, again, that we have scaled the risk of all of these strategies to 15% annualized volatility so that the outcomes are directly comparable. Additionally, returns for the hedging strategies are compounded, so there was no rebalancing between the hedging portfolio and an underlying equity portfolio along the way.

The strategies offer benefit both during extended bear markets, as we see by looking at the 2000-2002 period and the 2007-2009 periods, as well as during the quick tail events such as October 1987. The intention through the combination of strategies is to cover many different types of scenarios including financial shocks and slow, grinding bear markets. Figure 4 gives us evidence that they were able to do that.

FIGURE 4: Hedging Solutions at Work

Deciles of Monthly S&P 500 Price Performance
Worst to Best from June 1983 – June 2010



Sources: StyleAdvisor, Global Financial Data (GDF), First Quadrant, LP

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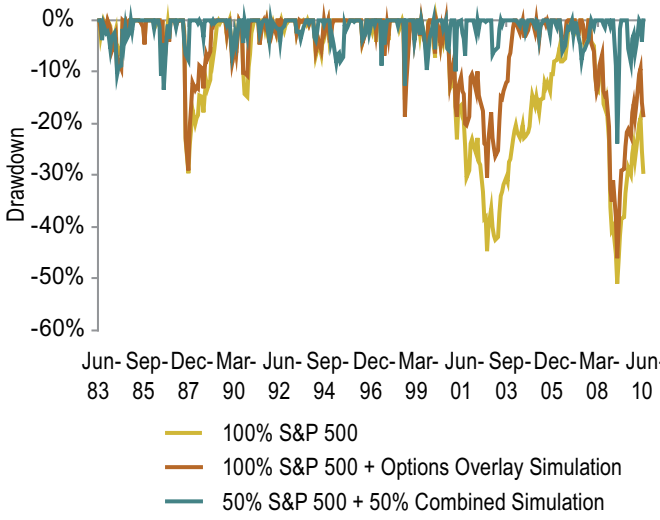
The strategies presented in this form are not currently employed by First Quadrant, LP. If an investment firm were to offer these strategies, they would probably charge a fee of 100 to 150 bps per annum. The returns shown would be reduced by 1.00% to 1.49%, 2.96% to 4.41%, and 4.88% to 7.2% for the one-, three- and five-year periods, respectively.

Figure 5 illustrates drawdown and recovery periods for the S&P 500, the S&P 500 with the Options Overlay Simulation, and 50% S&P 500 combined with 50% Combined Simulation. While the Options Overlay helps reduce the severity and length of equity drawdowns, a strong dose of positively skewed and negatively correlated strategies can have dramatic effects on a portfolio. While a 50/50 combination goes well beyond the limits with which most investors would be comfortable, we thought it important to depict the potential power of these combinations.

FIGURE 5: Hedging Solutions at Work
Drawdown and Recovery Periods
June 1983 – June 2010



Sources: StyleAdvisor, Global Financial Data (GDF), First Quadrant, LP

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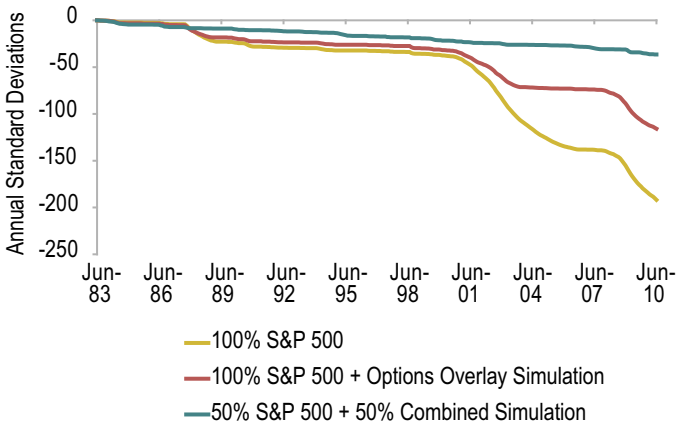
Figure 6 depicts cumulative drawdowns for the same strategies used in Figure 5. By continually summing the negative days, we get an idea of the magnitude and the speed of the relative drawdowns. This measure allows for drawdown comparisons to be made across all types of assets and strategies by assessing the average monthly cumulative downdraft exposure observed historically in the asset, asset class or investment strategy. In this case, for example, we see that the S&P 500 has an average monthly downdraft exposure of 0.59 standard deviations, whereas if combined with the 50%/50% Combined Strategies, that exposure is reduced to 0.11 standard deviations. Again, the Options Overlay does a good job slowing the drawdown velocity and the 50% S&P 500 / 50% Combined Simulation does an excellent job normalizing periods during which equity downdrafts were quick and severe. In our view, this is another illustration of the power of distributional complements.

FIGURE 6: Hedging Solutions at Work
Cumulative Drawdown and Recovery Periods
June 1983 – June 2010



Sources: StyleAdvisor, Global Financial Data (GDF), First Quadrant, LP

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A good deal of cumulative downside protection appears to have been achieved over varied types of equity markets through the addition of complementary strategies. While we are unsure of the characteristics of the next equity downturn, we are confident it will occur. We believe a diversified approach to hedging, including both explicit and approximate hedges that provide specifically desired characteristics, serves one well.

Conclusion

Tail-risk hedging is one element amongst others that investors should evaluate in an active effort to define and shape the returns that they individually require from 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 in this effort. Furthermore, with the costs of tail hedging insurance running high today due to the broad increase in demand for such protection, it will be important to look for other means of gaining longer-volatility exposure such as active investment strategies that have such characteristics. Through the combination of explicit and approximate hedges, we have provided techniques investors can use to shape expected portfolio returns to match their preferences.

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Endnote

[1] "Unreported" in the sense that after a short-volatility biased strategy blows up, the strategy shuts down, only to be restarted again, creating a new track record that no longer includes the blow up.

Simulation Disclosures

The simulated performance results presented are for illustrative and educational purposes only and are not strategies employed by First Quadrant, LP. No actual trading has taken place. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. 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. Back tested returns are calculated by the retroactive application of a current model, the results of which are derived on the basis of historical data and based on assumptions integral to the model. Changes in these assumptions may have a material impact on the back tested returns presented. The simulation assumes all trading takes place once a month. The simulation assumes that the guidelines are constant through the life of the portfolio.

OPTIONS OVERLAY SIMULATION – The variable put spread collar 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. For more detail, please see "FQ Perspective: Managing Committed Capital During the Drawdown and Reinvestment Periods," Max Darnell, Ghene Faulcon and Chuck Fannin, March 2010, Vol. 7, No. 03.

INVESTMENT STRATEGIES SIMULATION: The Investment Strategies Simulation is constructed by equal weighting of 1) Stock Bond Asset Class Strategy Simulation, 2) Trend Following Strategy Simulation, and 3) the Currency Relative Valuation Strategy Simulation, described below:

Stock Bond Asset Class Strategy Simulation – The simulation utilizes the Firm's Stock Bond Asset Class Selection model. Beginning with March 1990, a global approach was used in the simulation. Prior to March 1990, a domestic approach is used. In both cases, the simulation was constructed using current model signals. The global portion of the Stock Bond Asset Class simulation uses liquid CFTC approved equity contracts (AUS, CAN, FRA, GER, HKG, ITA, JPN, NEH, SPA, SWD, SWI, UK and US markets) and fixed income contracts (AUS, CAN, EMU, JPN, UK and US markets) with +/-28% active equity ranges, +/-84% active fixed income ranges. The domestic portion of the Stock Bond Asset Class simulation uses S&P 500 equity contracts and US Government long bond contracts, with +/-117% active equity and fixed income ranges. Per trade transaction costs were assumed to be 0.20% and 0.10% for equity futures and fixed income futures, respectively.

Trend Following Strategy Simulation - The simulation uses current model signals of the Firm's Supply/Demand Dynamic model on active currency (AUD, CAD, EUR, JPY, NZD, CHF, and GBP), commodities futures (copper, wheat, soybeans, corn, natural gas, crude oil, heating oil, RBOB, live cattle, and lean hogs), and bond futures (US 1year, 2 year, and 10 year Treasury, Gilt, Bund, Aussie 10 year Treasury, Japanese government, and Canadian government). Individual instrument weight is determined according to its historical risk and the predictive power of the corresponding signal. The portfolio is managed toward an annual risk target of 15%. Per trade transaction costs are assumed to be 0.10%.

Currency Relative Valuation Strategy Simulation - The simulation is constructed using current model signals of the Firm's Currency Relative Valuation model with +/-389% ranges on active currencies (AUD, CAD, EUR, JPY, NZD, SEK, CHF, GBP and USD) and implemented via forward contracts and a "synthetic Euro" for the period before January 1999. The simulation is based in US Dollars and uses a benchmark rate of return of zero. The overall risk management system threshold was set to +/- 20% of the target risk level. Per trade transaction costs were assumed to be 0%.

COMBINED SIMULATION – The simulation is constructed by equal weighting of the simulation results of the Options Overlay Simulation and the Investment Strategies Simulation.

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