Designing equity solutions with managed volatility

Lionel Martellini and **Renata Guobuzaite**, of the Edhec-Risk Institute, report on the benefits of adding long volatility exposure to equity portfolios

THE EDHEC-RISK Institute has analysed the design of attractive equity solutions with managed volatility, based on mixing a well-diversified equity portfolio with volatility derivatives, as opposed to minimising equity volatility through minimum variance approaches.

Long volatility positions show a strongly negative correlation with respect to the underlying equity portfolio. Adding a long volatility exposure to an equity portfolio would result in a substantial improvement of the risk-adjusted performance of the portfolio. The benefits of the long volatility exposure are found to be strongest in market downturns, when they are most needed.

The Vstoxx index is based on Euro Stoxx 50 real-time options and designed to reflect the market expectations of equity price volatility by measuring the square root of the implied variance across all options of a given time to expiration.

We first estimated an unconditional correlation between Vstoxx and Euro Stoxx 50 index return series based on the full sample period ranging from January 1999 to April 2011. We used the daily (as well as weekly/monthly) return data available from Datastream.

Based on the analysis, the results confirm a substantial negative correlation of 0.74 (negative 0.73 and negative 0.66, for weekly/monthly) between two series for the sample period.

In order to prove that the relationship is consistent over time, we generated five-year rolling window correlation estimates between the two index return series.



Safety net: all diversified portfolios with allocations to three-month Vstoxx futures series outperformed a pure equity portfolio

The analysis confirms the correlation level to be systematically negative, irrespective of the time period under consideration and increasingly so for more recent time periods.

Analysing weekly Euro Stoxx 50 Index data, we distinguished between the states of high, medium and low volatility, using a Markov regime-switching model. The estimated correlation between Euro Stoxx 50 and Vstoxx index returns is negative 0.76, negative 0.73 and negative 0.62 for the periods of high, medium and low volatility, respectively. This tends to increase with higher volatility in the market.

In addition, we used the National Bureau of Economic Research recession/expansion indicators as a control variable. The negative correlation seems particularly pronounced during the periods indicated as recessions.

A number of studies find that the strong negative correlation between an implied volatility and underlying equity portfolio results in significant diversification benefits from adding a long volatility position to the equity portfolio.

We use the Euro Stoxx 50 index to represent a large cap European stock benchmark and we only simulate a long position in the Vstoxx index.

We constructed equity portfolios with increasing allocations to a long volatility exposure. Our analysis starts with the pure equity portfolio as a

benchmark case and adds (in 5% increments) a long volatility exposure to the portfolio. We use a number of traditional parameters, including portfolio returns, volatility, Sharpe ratio, skewness, excess kurtosis, and historical value at risk (daily) at 95% threshold, to compare performances of the portfolios.

The results show that a long volatility position itself would hardly generate any positive return – 100% investment in Vstoxx resulted in 0.3% per year over the sample period and 100% investment in Vix had a loss of 0.7% per year.

Gradually increasing the portfolio's allocations to volatility exposure increases total portfolio returns and decreases standard deviations of returns. After between 25 and 30% for Vstoxx allocations, further allocation to long volatility exposure starts increasing the overall portfolio volatility as well.

There is strong empirical evidence that returns on long volatility positions are not normal. We therefore extended our investigation to include the impact of skewness and kurtosis. The results indicate that equity portfolio returns are usually negatively skewed (negative 0.72 on the sample period for Euro Stoxx 50), and adding a long volatility exposure has a positive impact on the portfolio skewness.

For example, the maximum Sharpe ratio portfolio (that is 30% allocation to Vstoxx and 70% to Euro Stoxx 50) has the highest positive skewness value as well. On the other hand, adding a long volatility exposure to the portfolio also increased the portfolio kurtosis, which indicates higher probability of obtaining an extreme value in the future. In our sample, introducing an exposure to volatility risk leads to a relatively substantial reduction in the overall portfolio extreme downside risk, estimated in terms of the portfolio historical value at risk.

In another calculation, we construct several equity portfolios with a few different allocations to a Vstoxx futures position. As before, we use the Euro Stoxx 50 Index.

The investment in Vstoxx futures is represented by a long position in a fully collateralised Vstoxx futures position. To create this investment, a long position in the front-month futures contract is fully collateralised by holding a full value of the contract in a bank deposit paying Euribor interest rate.

Returns for all days between the roll-in day and maturity date are calculated using the mid-point between the bid and ask prices. The futures position is rolled into the next contract at the close on the day prior to maturity.

We analyse the carry and rollover costs of buy-and-hold Vix futures positions based on different rollover methodologies.

First, we consider an "efficient" investment in Vstoxx futures with no associated bid-ask spread costs. For instance, by assuming that each contract is rolled over to the next one based on the mid-price defined as the mid-point between the bid and ask prices. We constructed a number of equity portfolios with increasing allocations to Vstoxx futures. The analysis starts with the pure equity portfolio as a benchmark case and adds, in 5% increments, a long volatility exposure to the portfolio.

Given that both Euro Stoxx 50 and Vstoxx futures returns were negative over the sample period, we have adjusted the performance measure used to compare the portfolios.

The three-month Vstoxx Futures series was a clear winner in this case. All diversified portfolios with allocations to three-month Vstoxx futures series outperformed a pure equity portfolio over the sample period. The three-month series performed significantly better than one-month series where allocation to volatility exposure managed to reduce portfolio volatility, but failed to improve the returns. The three-month series also showed better results than longest-traded series.

Adding an exposure with three-month Vstoxx futures series is beneficial to the portfolio performance in both return and volatility terms. The best performing portfolio is achieved by allocating 30% to Vstoxx futures, which is a similar result to that obtained with Vstoxx index data.

When considering futures as an instrument for a long volatility exposure, we also need to take into consideration actual trading costs that are associated with the futures' rollover strategy. Including the bid-ask spread, costs significantly affect the performance of Vstoxx futures. The returns are decreased by 26.6%, 12.6% and 8.5% per year for one-month, three-month and longest-term futures, respectively.

"There is strong empirical evidence that returns on long volatility positions are not normal"

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