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# Derivatives

## Long-term investment and portfolio insurance

The declines in stock markets over the last few months have destroyed billions of dollars worldwide. For natural long-term investors such as pension funds, this drop may cause a lower future net worth. Our study shows that hedging makes sense in anticipation of high volatility. However, now may be the time to unwind hedges, since the cost associated with portfolio insurance also destroys value.

The problem of volatile portfolios is not the downside risk itself, but the downside risk combined with a high degree of volatility and the distribution of the returns, which is best described as normal. The latest correction has decreased the market capitalisation of the Swiss Market Index by about 30%. To reach its previous peak, the index would have to increase by about 43%. In a normal distribution, the event of an increase in absolute terms has a lower probability than a drop of the same magnitude.

In the following study, we simulate the performance of protected funds including hedging costs and the performance of unhedged portfolios over a period of 30 years.

### The binomial model used

For all the simulations, we use a binomial model with the following definition:

$$u = e^{\sigma\sqrt{\Delta t}}, \quad d = \frac{1}{u}, \quad p = \frac{e^{\mu\Delta t} - d}{u - d},$$

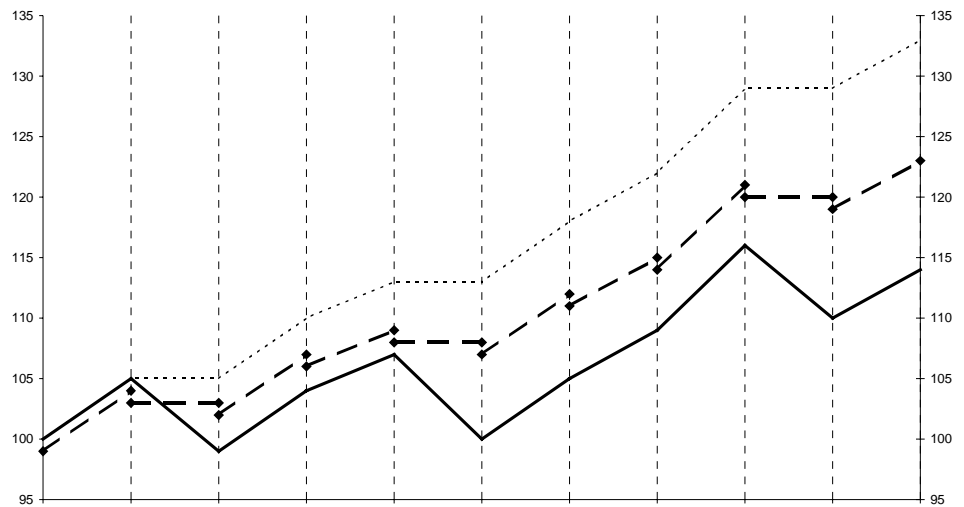
where,

- $\Delta t$ : is a small interval of time, one trimester;
- $\mu$ : is the growth rate of the portfolio; the expected proportional return earned by an investor in a short period of time (annualised and expressed as a proportion); and
- $\sigma$ : is the annual volatility of stock price returns.

With the binomial model, a stochastic share price diffusion process, as illustrated in the graph below, can be generated. Without protection against losses, net worth may decrease over the course of one period. The protected portfolio's drawbacks stem from the hedging costs, ie, put premiums paid up-front, slippage costs in technical trading, or an opportunity loss in the event of the portfolio being neutralised in an upswing where it has been hedged with a short futures position.

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## Stock price process versus protected portfolio process



Stock price process (—), Zero cost protected portfolio (---), Costly protected portfolio (···)

Source: Warburg Dillon Read

## The risk/return framework for multiple periods

The risk/return framework most often used in finance is the Capital Asset Pricing Model (CAPM). It states that the higher the systematic risk of a portfolio, the higher the returns.

The CAPM in its original version<sup>1</sup> is a one-period model. The long-term investor, however, invests over multiple time periods. Does this framework still have the same outcome?

Assuming a world with a growth rate of 7% for stocks (see graph on the next page), the average of 240,000 simulations over 90 trimesters shows a decrease in terminal cumulative wealth as volatility of the yearly stock returns increases.

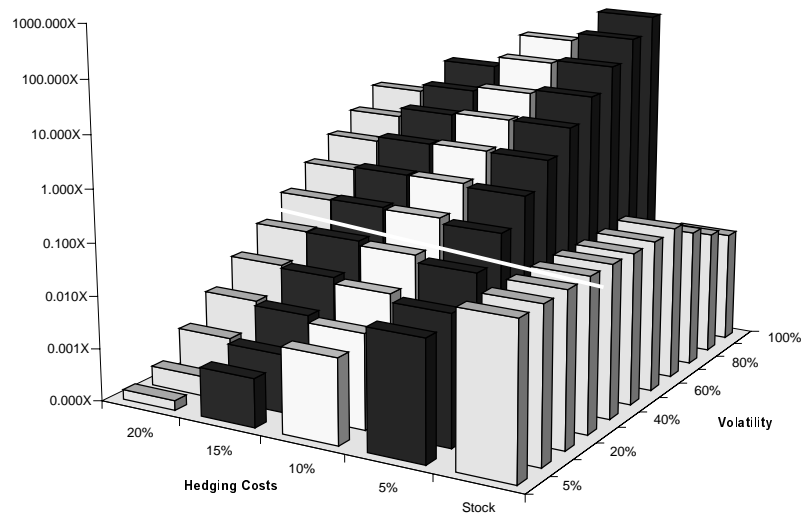
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<sup>1</sup> William F Sharpe: "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance* 19, No 3 (September 1964), pp 425-42; John Lintner: "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", *Review of Economics and Statistics* 47, No 1 (February 1965), pp 13-37; and "Security Prices, Risk, and Maximal Gains from Diversification", *Journal of Finance* 20, No 4 (December 1965), pp 587-615; and Jan Mossin: "Equilibrium in Capital Asset Market", *Econometrica* 34, No 4 (October 1966), pp 768-83.

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These simulations support the findings of Fama and French (1992)<sup>2</sup> of preferring value stocks to growth stocks<sup>3</sup> and Haugen's (1995)<sup>4</sup> findings that low volatility stocks are to be preferred to high volatility stocks.

### Long-term end net worth and hedging costs



Source: Warburg Dillon Read

### The protection

When seeking maximum terminal cumulative wealth, low volatility stocks only maximise the wealth for outright positions. High volatility stocks on the other hand may have large upside potential, but as volatility increases the average return of these stocks diminishes. When combining a volatile stock portfolio with protective puts, investors can achieve downside protection while maintaining the large upside potential.

In our simulations, we included yearly protection costs of 5%, 10%, 15% and 20% of the portfolio value at the end of the previous year. We defined the diffusion process for the capital protected portfolio as shown in the first graph.

The results of our simulations are shown in the second graph.

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<sup>2</sup> Fama, E and French, K, "The Cross-section of Expected Stock Returns", Journal of Finance, June 1992.

<sup>3</sup> Value stocks in their study are defined as stocks with high book value to market value ratios. These stocks normally have lower volatility in share price returns.

<sup>4</sup> Robert A Haugen (1995): "The New Finance: The Case Against Efficient Markets", Prentice Hall Press, April 1995.

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Outright stock portfolios without any protection outperform protected portfolios with yearly hedging costs of 5% up to a volatility of 30%. On a 30% volatility level however, hedging costs are closer to 10% per annum. The outperformance of protected portfolios compared with a naked portfolio begins at a stock return volatility of 30% for costs of 5%, at 40% for costs of 10%, and at 50% for costs of 15% and 20%.

### **Conclusions**

For portfolios with a low volatility, hedging costs are too high. On average, hedged portfolios in a low volatility world underperform the outright stock positions over a multiple time period.

In a world of high share price volatility, hedged portfolios outperform unhedged portfolios over a multiple time period. This is because the probability of a large drop in absolute terms is larger than the corresponding absolute price increase and the overall hedging costs are lower than the cumulated losses in the outright stock positions.

Investors are well advised to protect portfolios in expectation of large corrections of share prices even at high prices, but not on a regular rollover basis. If investors hedge on a rollover basis while implied volatilities are high, hedging costs reduce the ultimate value of the portfolio. A permanent hedge is not advisable for low volatility portfolios due to the high hedging costs. As hedging gets more expensive, portfolio insurance only maximises terminal cumulative wealth for high volatility portfolios.

As the Swiss Market Index has decreased by about 30% and implied volatilities have soared over the last few weeks, we believe that over the next few months stock return volatilities and implied volatilities should come down from current peak levels. Now might be the right time to unwind expensive protections and return to outright stock positions in order to maximise terminal net wealth.