

# PORTFOLIO OPTIMISER

A technical guide



STRUCTURED  
PRODUCTS  
ASSOCIATION



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# Knowledge at your fingertips

The Portfolio Optimiser, developed and powered by FVC on behalf of the UK Structured Products Association, allows users to analyse the benefits of adding structured products into a model portfolio for the first time.

It enables advisers to easily see the impact on expected risk and returns of adding a structured product to an existing portfolio of funds and ETFs, by generating a detailed report of both historical and forward-looking analysis of both the original model portfolio and the 'modified' portfolio (i.e. with the structured product included). This guide provides a technical overview of the content of that report, looking into how the analysis is generated and what metrics are included.

For a more general introduction and instructions on how to generate a report using Portfolio Optimiser, please view 'Portfolio Optimiser: Quick start guide'.

Reports generated by Portfolio Optimiser contains two sections: the **timeseries analysis** and the **backtesting and forward-looking simulations**. Both sections include various charts and metrics, which are detailed in this guide.

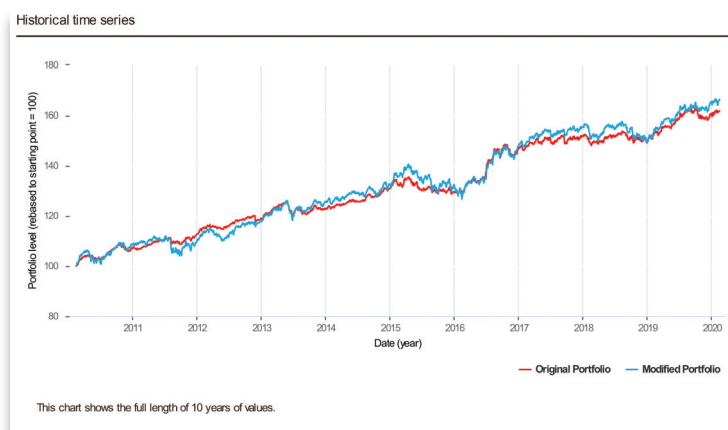
*Please note that we use the term 'original portfolio' to refer to the portfolio of funds originally selected for the analysis (being either one of our defined model portfolios, a customised version of one of our model portfolios or a user-created portfolio), and 'modified portfolio' to refer to the portfolio of funds with the addition of the structured product selected for the analysis.*

# Time series

The timeseries analysis compares the historical performance of the original portfolio and modified portfolio.

## A. HISTORICAL TIMESERIES

The first chart shows the historical performance for both the original and modified portfolios, over a target period of ten years (although a shorter period may be shown if there is less than 10 years' of performance data for all the funds in the original portfolio). It is only possible to complete the analysis if there is at least one year of data for all funds in the portfolio.



The timeseries analysis for the original portfolio starts with a value of 100 at the start date of the timeseries and allocates to each fund with the weightings specified for the portfolio. The portfolio is then tracked through the period to calculate daily values for the entire data period.

If we denote  $w_i$  as the weighting to the  $i$ th fund and the value of  $i$ th fund at time  $t_j$  is  $F_{ij}$ , then the original portfolio has value at time  $t_j$  given by:

$$P_j = 100 * \sum w_i F_{ij} / F_{i0}$$

The modified portfolio contains both funds and a structured product. The timeseries for the modified portfolio needs to combine historical performance for both of these.

The fund components' performance is calculated by using the same techniques for the original portfolio, however it is not possible to apply the same methodology historically to the structured product, as it did not exist historically. It would also give potentially misleading and unstable results to rely on tracking the performance of a single product historically, as there would be a discontinuity in performance as the structured product matures, and the investment proceeds rolled into a new product at that point (and also because the precise investment start date may affect events such as early maturity observations).

Instead, a special methodology has been devised to simulate the result of a regular investment into structured products of the same profile as the one selected. Using the methodology described for forward-looking simulations on page 5 of this document, FVC is able to calculate the expected returns and volatility of the structured product, as well as the correlation with the underlying asset. They then take the historical performance of the underlying asset, and use the correlation, expected returns and volatility of the structured product to adjust the performance of the underlying asset, so that it simulates the performance of a continuous investment into the structured product (and provides a better assessment of its contribution to the return of the overall portfolio).

Finally, this estimate of the structured product return is combined with the funds to produce a timeseries for the modified portfolio.

## B. SUMMARY STATISTICS

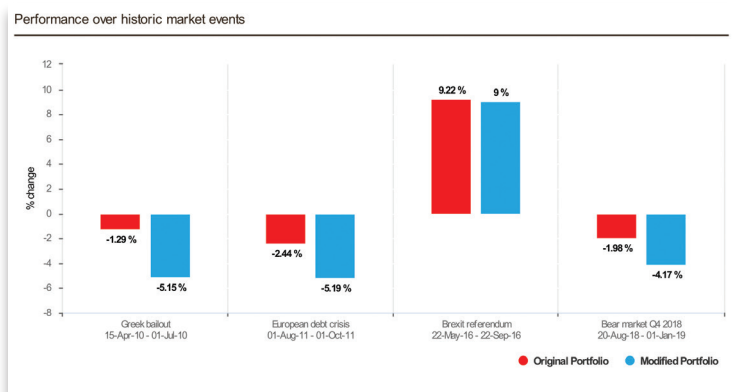
Standard fund data techniques are applied to calculate volatility, annualised returns, drawdowns and Sharpe ratios of both portfolios.

Summary statistics		
	Original Portfolio	Modified Portfolio
Volatility	3.3 %	5.18 %
Return p.a.	4.92 %	5.23 %
Drawdown	4.99 %	9.92 %
Sharpe ratio	1.2713	0.8887

Volatility is calculated from daily log returns, the annualised return is the final value divided by the initial value decomposed by the length of the data window. The Sharpe ratio is the excess of the average return minus the risk-free rate observed over the period divided by the volatility level.

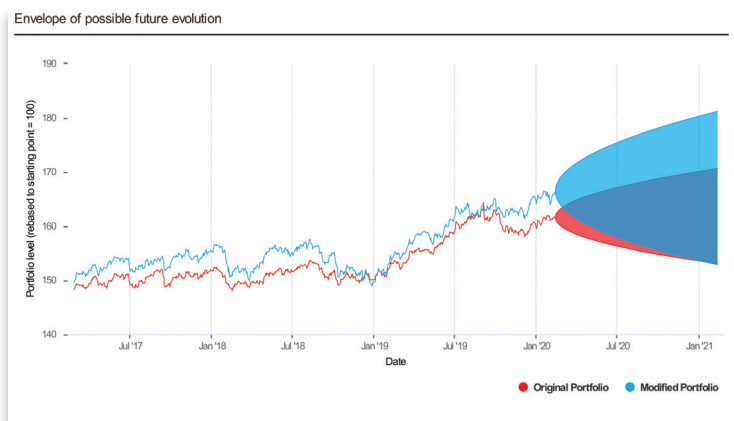
## C. PERFORMANCE OVER HISTORIC MARKET EVENTS

Various key events in recent history that have had a significant effect on financial markets have been defined on the system. Each event has a start date and end date across which performance is measured. The changes in the original and modified portfolio for these key events are then calculated and displayed to examine the relative performance of both portfolios.



## D. ENVELOPE OF POSSIBLE FUTURE EVOLUTION

The volatility of the original and modified portfolios is used to create envelopes (representing one standard deviation either side of the mean return over time) to give an idea of possible reasonable future portfolio performance.



The methodology used for the timeseries calculation is slightly different to the backtesting and simulation approaches. Backtesting and simulation results are calculated in a way that is consistent with market accepted techniques, and the results are based on the outcomes at maturity of a single product. This reflects the 'buy-to-hold' nature of structured products and their capital protection and other features. The timeseries calculation represents more of a 'mark-to-market' performance of the structured product, by simulating the performance of a continuous investment into the product being analysed.

# Backtesting and forward-looking simulations

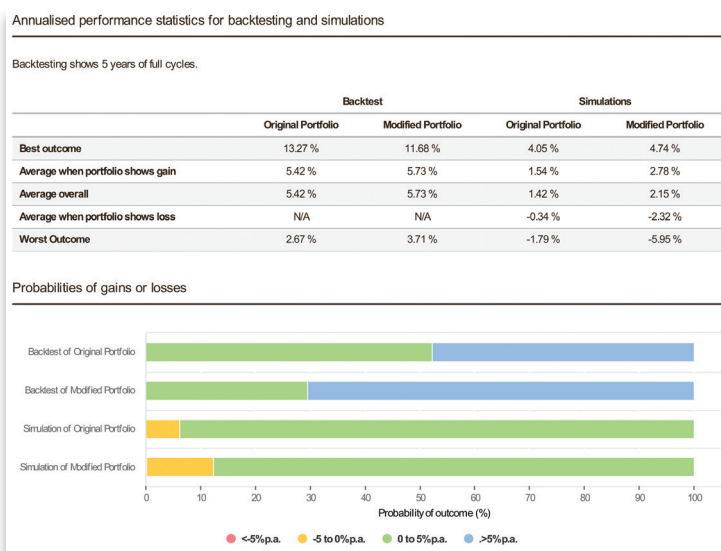
Backtested performance for the original portfolio is simply calculated by looking back at the actual performance of the portfolio historically.

Backtested performance for the modified portfolio uses the actual historical performance of the portfolio for the fund components, but also needs to simulate historical performance for the structured product component, as actual historical performance is not available.

For this report, backtested performance for structured products is calculated in the standard way used for structured product analysis. This calculates by looking back at what the return of the product would have been if it had started on every day historically during the data window, based on the underlyings' actual performance over this period. A structured product's performance can be 'backtested' this way across a range of start dates moving daily across the data window, measuring a single structured product cycle on each occasion.

For products with early maturity features such as Kick Outs, it may be that certain backtested cycles mature earlier than the stated term, meaning that the maturity dates are not sequential in line with the set of strike dates. For this reason it is important that the returns of the original portfolio and fund component of the modified portfolio are then calculated by using the actual fund data from matching start and end dates of each cycle in the backtesting analysis, as this is the only way to achieve proper consistency.

Five key metrics are presented: the best and worst outcomes (meaning the highest and lowest annualised return generated across all the backtested cycles), the average return when the portfolio shows a gain or loss (calculated as the average annualised return across all backtested cycles), and the average return when the portfolio shows a gain or loss respectively).



**Forward-looking simulations for the structured product are calculated in a way consistent with the backtesting analysis by generating Monte Carlo simulations, following the methodology used by FVC in their widely used research analysis at [www.structurededge.co.uk](http://www.structurededge.co.uk).**

These simulations typically use levels that reflect both implied volatility and long term historic volatilities, to provide a balance between historic levels and current market pricing. They also use an expected growth rate equal to long run estimates of equity markets. These simulations are performed for one cycle of the structured product and take all product features into account.

The historical data for the funds in the original and modified portfolio allows us to calculate volatilities and correlations and the results can be combined in the same way as for the backtested results (including matching the start and end dates for the fund with the structured product, if there is an early maturity feature).

The same five metrics are calculated for the forward-looking simulations and the results are presented next to the backtesting outcomes on the report.

#### **Insufficient fund history**

The analysis in the reports generated by Portfolio Optimiser depend on historical data for the funds in the portfolio. If you select funds that do not have sufficient history, some of the outputs cannot be calculated and will be blank on the report:

- All funds must have been publishing a NAV for a minimum of one year in order for the time series chart to appear
- All funds must have been publishing a NAV for a minimum of five years PLUS the term of the selected structured product in order for the backtesting and simulations to appear

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