

Historical Simulation in XENTIS

The identification, measurement and management of risks in the capital markets, and thus in the funds and portfolios of their customers, is crucial to the success of financial service providers. At the same time, prudential authorities are extending the requirements for risk management in light of the various financial crises in a move designed to protect investors. Various European directives, and their transposition into national law, regulate the requirements for investment companies to control market risks and the notification procedure to the regulator. These situations tend to arise from use of particular derivative financial instruments and fund risk profiles. Profidata, in collaboration with the Liechtenstein-based IFM Independent Fund Management AG, has implemented the regulations in force in Liechtenstein on risk measurement and notification procedure for use of derivatives in XENTIS. The root of this functionality is Value at Risk (VaR) calculation according to historical simulation methodology.

LEGAL BASIS

The following legislation constitutes the basis of XENTIS development and is applicable for financial service providers at European level:

- Commission Directive 2010/43/EU of 1 July 2010
- Committee of European Securities Regulators (CESR's) Guidelines on Risk Measurement and the Calculation of Global Exposure and Counterparty Risk for Undertakings for Collective Investment in Transferable Securities (UCITS), 28 July 2010 (CESR/10-788)
- Guidance note 3/03 in accordance with UCITS on financial derivative instruments, February 2013
- Guidelines published by the European Securities and Markets Authority (ESMA) on risk measurement and the calculation of global exposure for certain types of structured UCITS, 23 March 2012 (ESMA/2012/197)

These regulations became national law with the Liechtenstein Financial Market Authority (FMA) guideline 2012/02 on risk measurement and notification procedure for the use of derivative financial instruments by UCITS, 18 January 2012.

The Liechtenstein guideline corresponds with the German regulation on risk management and measurement on the use of derivatives, securities lending and repurchase agreements in investments in accordance with the German Capital Investment Code (German Derivatives Ordinance) 16 July 2013 and corresponds in Austria to the regulation of the FMA on risk measurement and notification of derivatives (4th derivatives risk measurement and notification regulation), 20 November 2013.

IMPLEMENTATION

Limited information on the detailed implementation of VaR calculation can be extracted from these legislative texts. XENTIS favours a pragmatic approach coordinated with auditors as well as with the FMA. Regulatory and customer expressed requirements can be summarised as follows:

- Commitment (simple) or VaR (qualified) approach depending on the derivative used and risk profile resulting from the fund investment strategy
- Adjustable parameters for historical simulation: holding period, confidence level, evaluation currency, number of simulation runs
- Absolute and relative VaR compared to a derivative-free reference portfolio (benchmark) as well as Conditional VaR (CVaR) resp. Expected Shortfall
- Risk factors: price, currency, interest, spread and volatility
- Stress testing: using definable (relative) stress definitions, the returns of the fund positions are subject to a market scenario on each reporting date of the valuation period in which the specific risk factors are stressed
- Clean backtesting to verify the forecasting quality of the applied risk model

- Monitoring of regulatory limits: VaR of the current portfolio may not exceed 200% or a multiple of the reference portfolio VaR
- Generation of regulatory reports: FMA forms (A) resp. (B) on the semi-annual reporting of derivatives in accordance with the Commitment/VaR approach according to art. 53, UCITSG
- Reconciliation list for auditing of database for prudential authorities and auditors
- Substitution and imputation procedures for the completion of time series in the event of missing prices

HISTORICAL SIMULATION

During VaR calculation, the evaluated positions of a fund/portfolio for each trading day in a previous evaluation period are the starting point for the historical simulation. Scenario changes (continuous/logarithmic returns) between the initial and final value are determined based on the holding period. These scenario changes are applied to the fund/portfolio status on a specific date. The gains/losses of the individual positions resulting from the scenario values are calculated, aggregated at fund/portfolio level and sorted in ascending order. The VaR is defined as a loss which may not be exceeded within a given time period with a specified probability (1 – confidence level). The results of the historical simulation can be analysed taking the following variably adjustable calculation parameters such as confidence level, holding period, simulation runs etc. into account, both online in XENTIS Front Office (**fig. 1**) and in the business rules (BR) simulation (**fig. 2**).

BACKTESTING

The forecasting quality of the risk model can be verified by regularly comparing the VaR values with the actual realised gains/losses. Backtesting determines how often the predicted VaR threshold is exceeded or fallen below during an evaluation period. VaR is calculated for each day of the evaluation period and compared to the actual portfolio gains and losses. The forecasting quality of the risk model applied is considered high if the number of exceedances events during the evaluation period does not differ to the value pre-determined by the confidence level. Accordingly, for a confidence level of 95%, the predicted value for the VaR may not be exceeded/fallen below in more than 5 in 100 cases in backtesting. All loss exceedances are shown in the regulatory reporting for a holding period of one trading day. Statistical distortions may occur in a

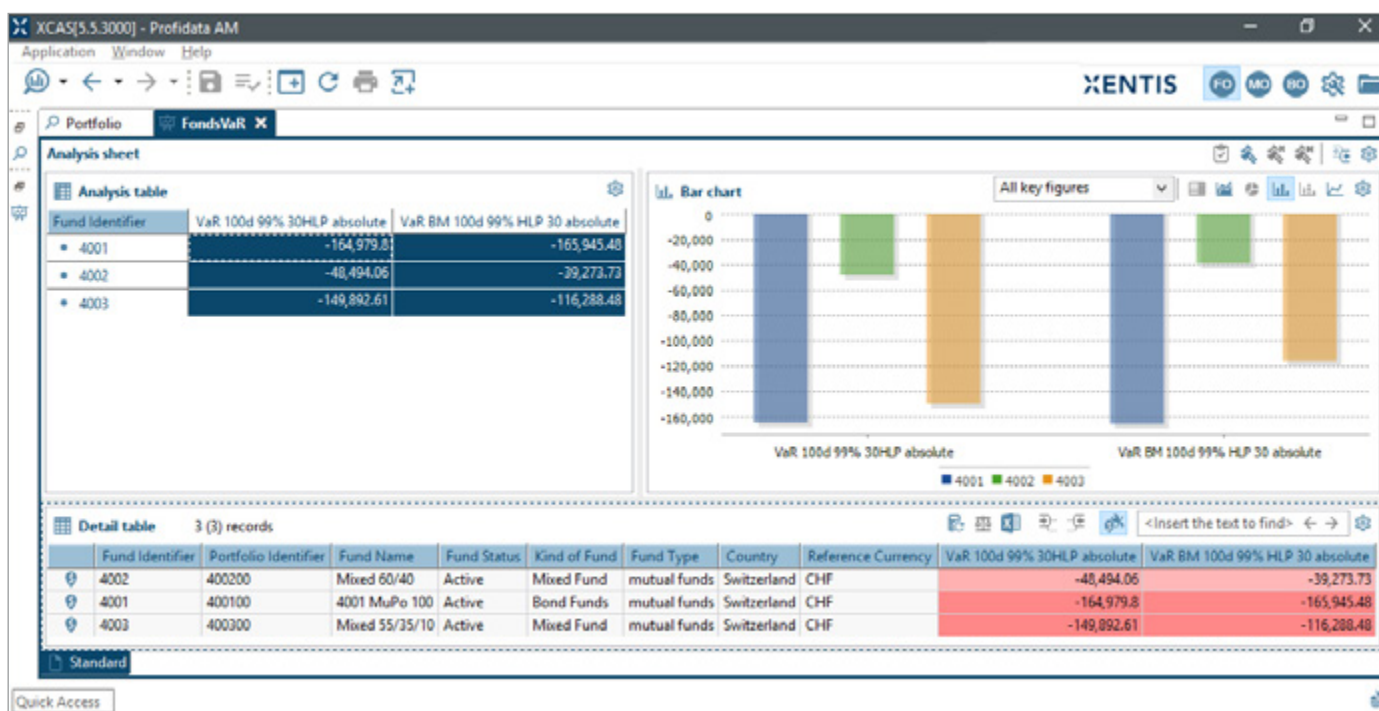


Fig. 1: VaR analysis in XENTIS Front Office

holding period of more than one trading day due to overlapping periods. These must be adjusted when specifying the number of loss exceedances. Clean backtesting can be used in XENTIS. The return that would have been achieved if no transactions and capital measures had taken place during the holding period is thus essential. In this context, this is often referred to as the 'freezing of portfolios' at a particular point in time in order to perform a fair comparison of the VaR calculation and backtesting based on the same portfolio configuration. Dirty backtesting applies the market-to-market return which, in contrast to clean backtesting, does include portfolio changes.

STRESS TESTS

Stress testing occurs when the positions on a reporting date are subject to a market scenario in which the continuous/logarithmic returns of a segment (e.g., shares, bonds, puts or calls, etc.) and the currency are tested individually or together in order to determine their reactions to different financial situations.

Using customisable (hypothetical) scenarios, users are able to simulate the VaR through individual or combined changes to the risk factors. Historical stress scenarios for current positions are likewise possible if the corresponding time series are available. According to regulatory standards, the stressed VaR of the portfolio should be compared to the VaR of a derivative-free benchmark portfolio and may not exceed 200% of the VaR of this portfolio. The number of exceedance events during a semester is likewise displayed for the stress testing limits for both the VaR limits and backtesting in the FMA form (B).

DATA MANAGEMENT

Historical returns are projected to the future in historical simulation, which means it is vital that the time series are complete in XENTIS. If the price histories are incomplete, or in extreme cases, none exist for the individual instruments, the arising risk key figures are inaccurate and/or unusable. XENTIS offers imputation and substitution procedures which help to fill price/return gaps which occur in incomplete time series. Imputation procedures complete missing price data within incomplete time series. Missing prices

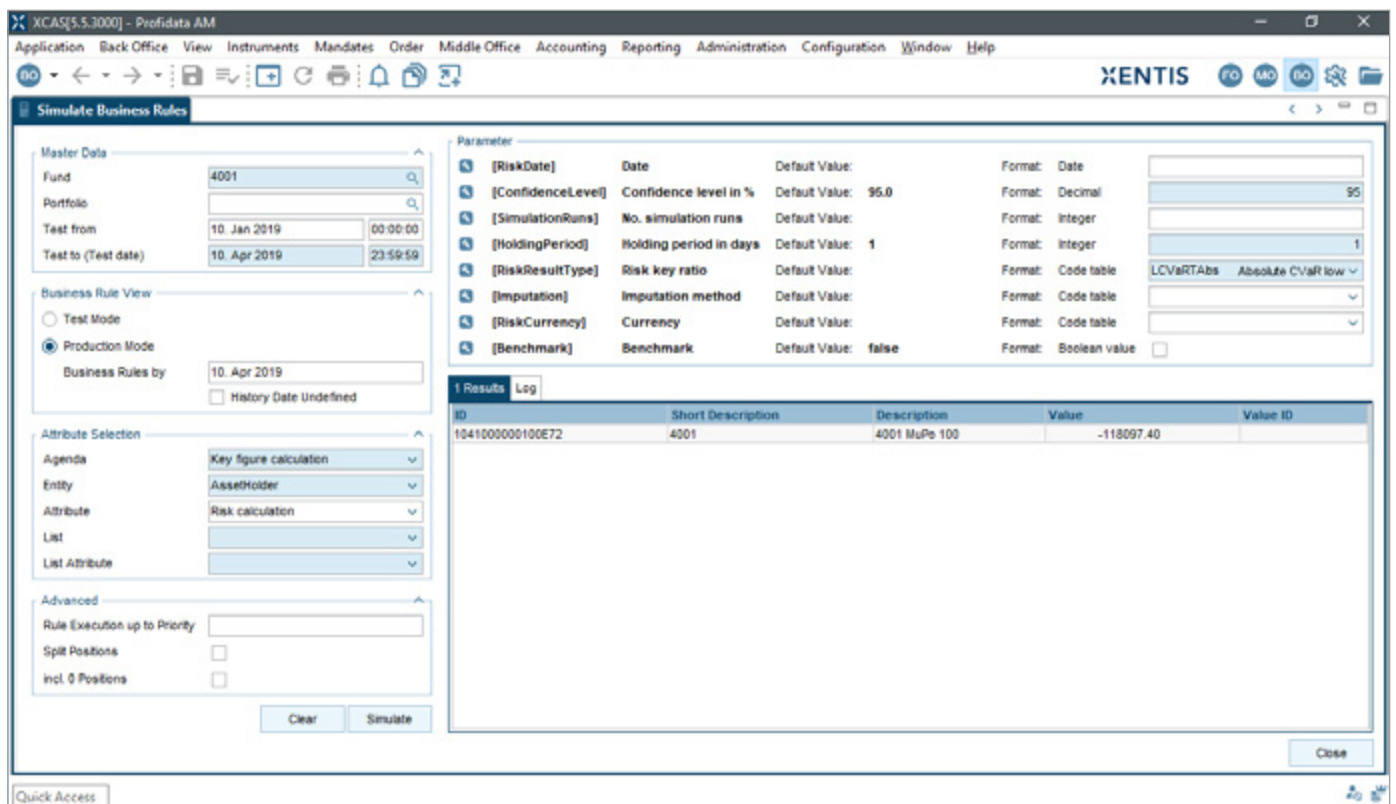


Fig. 2: VaR analysis in BR simulation

can also be interpolated linearly or completed using the last available price. Substitution procedures help to pair financial instruments with insufficient or unavailable price history to a substitute financial instrument with a complete time series. For example, a price series can be derived from an index using the Beta factor for a newly issued share. Missing prices are substituted when a financial instrument is defined as substitute in the financial instrument master data; otherwise the data are completed using an imputation procedure.

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