

# PERFORMANCE MEASUREMENT AND ATTRIBUTION

## Performance Measurement and Attribution

Active assessment of performance sources and the effectiveness of managed portfolios, in the light of selected benchmarks or the competition's portfolios, is one of the key aspects of an efficient investment portfolio management policy. The solutions offered by the Comarch Asset Management platform enable you to assess the strengths and weaknesses of your investment strategy and thus make appropriate investment decisions that maximize profitability and minimize the risk to your portfolio. The system allows you to make more effective investment decisions, which increase the profitability of managed portfolios, thereby increasing the competitiveness of the institution.

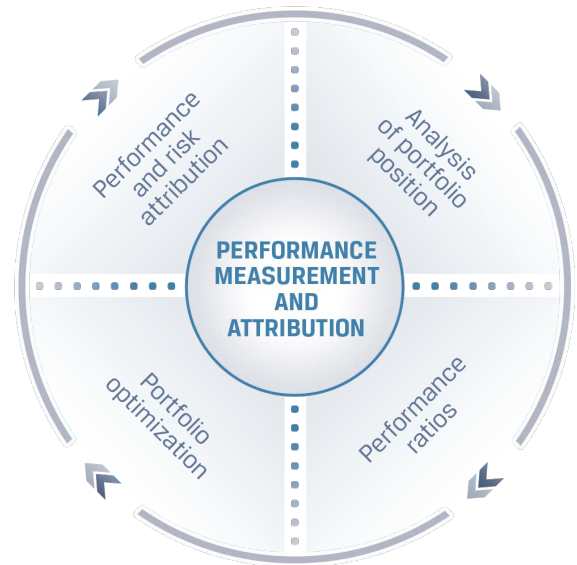
## Business and operational benefits

### Business benefits:

- » Active assessment of the performance sources and effectiveness of managed portfolios in the light of the risk taken by portfolio managers affecting the efficiency of investment decisions
- » Flexible analysis of your investment strategy
- » Identification of the areas which saw the best and weakest performance based on presentation of a chosen asset group's influence on the overall investment result
- » Results reporting, according to own guidelines or internationally accepted standards, ensuring the comparability and transparency of the presented data
- » Comparing the achieved results with the competition or market indexes
- » Support of investment decisions with buying and selling suggestions – the effect of the optimization module

### Operational benefits:

- » Access to applications through a web browser eliminates the need to install a development environment on the user's computer
- » Intuitive and ergonomic user interface
- » Interactive charts and tables
- » Drill-down analysis
- » Automation of the processes with scheduler functionality
- » Possibility of integration with different external systems (market data systems, transaction systems)
- » Calculation logs
- » Notification of process completion
- » Granting access to presented information for chosen user groups



## Utilized solutions:

PERFORMANCE RATIOS	<ul style="list-style-type: none"> <li>» Rate of return (arithmetic, logarithmic)</li> <li>» TWR, MWR</li> <li>» Alpha</li> <li>» Beta</li> <li>» Sharpe</li> <li>» Modified Sharpe</li> <li>» Tracking error</li> <li>» Information ratio</li> <li>» Jensen alpha</li> <li>» Sortino</li> <li>» Modigliani-Modigliani</li> <li>» Treynor</li> </ul>
ATTRIBUTION EFFECTS	<p><b>Equity portfolios</b> (Brinson-Hood-Beebower/Brinson-Fachler):</p> <ul style="list-style-type: none"> <li>» Selection effect</li> <li>» Allocation effect</li> <li>» Interaction effect</li> </ul> <p><b>Fixed-income portfolios:</b></p> <ul style="list-style-type: none"> <li>» Selection effect</li> <li>» Allocation effect</li> <li>» Interaction effect</li> <li>» Duration effect</li> <li>» Return impact</li> <li>» Yield change</li> </ul> <p><b>Multicurrency portfolios (Karnosky-Singer):</b></p> <ul style="list-style-type: none"> <li>» Selection effect</li> <li>» Allocation effect</li> <li>» Interaction effect</li> <li>» Currency effect</li> </ul>
ATTRIBUTION METHODS	<ul style="list-style-type: none"> <li>» Singleperiod</li> <li>» Multiperiods (Carino, Menchero)</li> </ul>

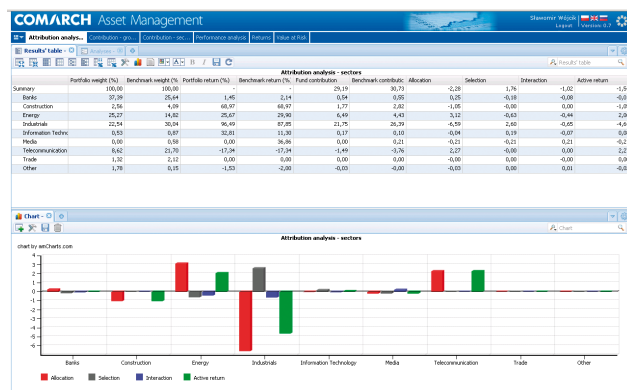
## Key features

### Analysis of portfolio position

The functionality enables a clear and quick preview of the current portfolio's positions and calculated performance ratios (e.g. GIPS standards). With a wide configuration possibility for tables and charts the user can define aggregation levels (e.g. portfolio, security, currency, sector, issuer), the scope of the presented positions with self-defined filters and calculated ratios and their parameterization list. The solution offers industry-standard methodologies and a high flexibility which reflects your investment process accurately. With an interactive interface which allows you to drill-down the presented data, format a table's columns and active work with created charts, it is easy to decompose performance and risk based on your investment strategy and understand the sources of profit and loss. Defined tables and charts can be grouped in views, as a part of the user menu, and can be also exported to pdf reports. With the functionality of the scheduler and events notifications it is possible to plan future analysis (to be carried out once or periodically) and a chosen group of the users can be informed about the results of the analysis (e.g. excess the limit of tracking error).

### Performance ratios

Performance ratios are a basic tool for calculating the effectiveness of the portfolios or security in respect to the selected benchmarks or competitor's portfolios. Measures can be calculated at different levels of aggregation – instrument, instrument groups or the entire portfolio, taking into account the risk taken to achieve the rate of return. Parameterization of the ratios allows the user to specify: the horizon, type of cash-flows, type of rates of return and which set of data should be calculated – gross or net value for portfolio performance calculations or security' quotations from a chosen market and specified time.



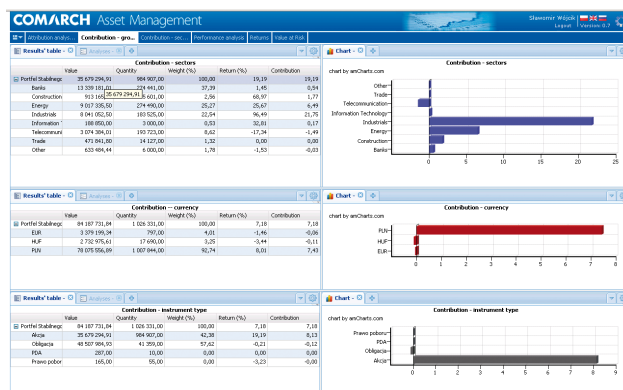
Performance attribution analysis

### Performance and risk attribution

This functionality enables an active performance and risk assessment of the impact of individual assets or asset group's (sectors, regions, currency, instrument class) on the overall outcome of the investment portfolio. Available performance and risk attribution models present different attribution effects such as allocation, selection, interaction, duration, return impact, yield change or currency effect – according to well-known models like Brinson-Hood-Beebower or Brinson-Fachler used in equity portfolios or more sophisticated portfolios for fixed-income and derivatives. It is possible to construct your own attribution analysis in respect to positions contribution to portfolio return, excess return, volatility or tracking error. This helps portfolio managers to determine investment features – e.g. selection of portfolio instruments or allocation of selected portfolio instruments – which contribute to better or weaker performance or risk (volatility or tracking error) of the portfolio compared to the benchmark.

### Portfolio optimization

The optimization module allows for the portfolio structure to be shaped in accord with the user's specified criteria. This includes the maximization of the portfolio performance (rate of return, Sharpe, Information Ratio) with assumed maximum risk (volatility, tracking error) or the opposite: a minimization of the risk with assumed minimum portfolio performance. This is based on Markowitz optimization theory. The functionality takes into account weight limits imposed on a chosen group of instruments as well as rates of return for particular securities or sectors, historical or projected, by asset managers. The effect of the optimization process is a proposal to modify the weight of securities which leads to an optimum portfolio structure.



Performance contribution by sectors, currency and instrument types

#### Comarch SA

Al. Jana Pawła II 39 a

31-864 Kraków

Poland

tel.: +48 12 64 61 000

fax: +48 12 64 61 100

e-mail: finance@comarch.com

#### www.assetmanagement.comarch.com

www.comarch.com www.comarch.pl www.comarch.de www.comarch.ru

ComArch Spółka Akcyjna with its registered seat in Kraków at Aleja Jana Pawła II 39A, entered in the National Court Register kept by the District Court in Kraków-Śródmieście in Kraków, the 11th Commercial Division of the National Court Register under no. KRS 000057567. The share capital amounts to 7,960,596.00 zł. The share capital was fully paid, NIP 677 - 00 - 65 - 406

Copyright © Comarch 2009. All Rights Reserved.