Morningstar Risk Model Performance Attribution Methodology

Overview
In this methodology, we provide the framework for Morningstar Risk Model’s performance attribution capabilities. This document describes:

► Performance Attribution Calculations
► Data Requirements
► Portfolio Exceptions

Performance Attribution
Ex-Post
Inputs:

► A portfolio with respective weightings.
  ► If no weightings are provided, the holdings are equally weighted.
► A benchmark with respective weightings.
  ► If no weightings are provided, the holdings are equally weighted.
► A start and end date of a historical time period.

Outputs:

► Portfolio Factor Exposure
► Benchmark Factor Exposure
► Active Factor Exposure
► Factor Return
► Portfolio Contribution
► Benchmark Contribution
► Active Contribution
► Idiosyncratic Return

Calculation Details
Portfolio/Benchmark Exposure

\[ \bar{F} = \frac{\sum_{k} F_k}{K} \]

Where:
\( F \) is the average factor exposure
\( F_k \) is a factor exposure on day \( k \) during the specified time period
\( K \) is the number of trading days during the specified time period
Active Exposure
Active Exposure = Portfolio Exposure - Benchmark Exposure

Factor Return

\[ P_j = \left( \prod_{k=1}^{K} (1 + r_{j,k}) \right) - 1 \]

Where:
\( P_j \) is the factor return for \( j \) during \( K \) trading days, and \( 1 \leq k \leq K \)

Portfolio/Benchmark Contribution

\[ R_j = \sum_{i} (1 + F_i P_{ij}) - 1 \]

Where:
\( R_j \) is the contribution of factor \( j \), where \( 1 \leq j \leq J \) and \( J \) is the total number of factors
\( F_i \) is the portfolio/benchmark’s exposure on the first day of month \( i \), where \( i = 1, ..., \) the number of months in the selected time period
\( P_{ij} \) is factor \( j \)'s premium for month \( i \), in absolute value term, not in percentage

Active Contribution
Active Contribution = Portfolio Contribution - Benchmark Contribution

Total Return
Total is the portfolio’s realized return during the specified time period. Additionally,
Total = Factor Contribution + Idiosyncratic Return

Factor Total

\[ R_F = \sum_{j} R_j \]

Where:
\( R_j \) is the contribution of factor \( j \), where \( 1 \leq j \leq J \) and \( J \) is the total number of factors

Idiosyncratic Risk

\[ \epsilon_P = R_P - R_F \]

Where:
\( \epsilon_P \) is the portfolio’s idiosyncratic risk
\( R_P \) is the portfolio’s total return
\( R_F \) is the portfolio’s factor total
Data
The return stream used varies depending on the style of investment vehicle. Below outlines the criteria:
► Open End Fund: Total Return
► ETF, Index, Stock: Market Return
► Separate Account: Gross Return

Returns are converted into USD.

Exceptions
An investment is not eligible for the performance attribution ex post calculation if any of the following criteria holds:
► Portfolio exposure or factor premium of any month of selected time period is not available
► Factor Return for selected time period is not available
► Portfolio Return for selected time period is not available

If benchmark data is not available, then Portfolio Exposure, Factor Return and Portfolio Contribution will still generate.
Appendix A: Performance Attribution Ex-Post Definitions

Portfolio Exposure
A portfolio’s average monthly exposure on specific risk factor, for selected time period

Benchmark Exposure
A benchmark’s average monthly exposure on specific risk factor, for selected time period

Active Exposure
The difference between the Portfolio's Exposure and the Benchmark's Exposure

Factor Return
The factor’s cumulative return during the selected time period

Portfolio Contribution
Each factor’s contribution to portfolio’s cumulative return during selected time period, which equals the sum of compound return on each factor through the selected time period

Benchmark Contribution
Each factor’s contribution to benchmark’s cumulative return during selected time period, which equals the sum of compound return on each factor through the selected time period

Active Contribution
Each factor’s contribution to active return (portfolio minus benchmark) during selected time period, which is the difference of Portfolio Contribution minus Benchmark Contribution

Total
Cumulative return gained by portfolio/benchmark during selected time period, the active return is the difference of portfolio minus benchmark

Factor Total
The portion of cumulative return/active return, which can be explained by factors

Idiosyncratic Risk
The portion of cumulative return/active return, which cannot be explained by factors

Factor Group Sum (e.g. Style, Sector, Region, and Currency)
The contribution of each factor group, which is the sum of all factors in the same column
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For More Information
+1 312 244-7541
lee.davidson@morningstar.com

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