Equity and Fund of Funds Performance Attribution
Methodology and Limitations

Methodology
MFS employs the FactSet system to calculate performance attribution for equity and asset allocation portfolios using the widely accepted Brinson-Fachler methodology. The attribution methodology is holdings-based, which calculates the return of portfolio and benchmark components based upon the price and foreign exchange rate changes applied to daily snapshots of constituent securities. Returns are based upon projecting the daily total return of the constituent securities forward in time (backwards projection is also an option). Because it is buy and hold, it will miss the impact of traded versus end of day price changes, intra day trades and exogenous events such as a significant class action settlement. Daily holding loads do provide a reasonably accurate approximation of total portfolio return in most circumstances.

FactSet's equity model allows us to attribute performance to allocation and selection factors (we combine pure “selection” and an “interaction” factor) and results may be grouped by country, industry, or sector. We can also group the analyses by characteristics such as price-earnings ratio, capitalization, or earnings growth rates to see how they compare relative to a selected benchmark.

FactSet's Macro Model is similar to traditional top-down attribution, where asset allocation decisions are made according to a specified investment policy (or fund sponsor mandate) which includes broad asset allocation guidelines. Other attribution models in Portfolio Analysis analyze portfolios on a bottom-up basis. Macro attribution highlights the decisions made in implementing a fund of fund or asset allocation strategy by focusing on the top-level return of each fund and asset class within a strategy.

MFS uses vendor pricing and split source based on benchmark family (e.g., MSCI for MSCI benchmarked analyses, FTSE for FTSE benchmarked analyses, etc.) where available, else FactSet pricing (IDC for domestic security prices and Exshare for international) is used as the primary pricing source for all attributions; MFS price is used as a secondary pricing source. Split sources used are as follows: S&P for S&P benchmarks; Factset for S&P specialized indices (e.g., S&P North American Technology Index); Russell Global for Russell global benchmarks; Factset for Russell domestic benchmarks; FTSE Global for FTSE benchmarks; MSCI for MSCI benchmarks; Factset for all other benchmarks, e.g., Citigroup. Foreign exchange rates used are from FactSet as well (WM 4:00 p.m. London rates). We use these defaults to preserve consistency with the benchmarks.

Limitations
The methodology behind Portfolio Analysis Tool Version 2.0 (PA2) adheres to generally accepted standards in the industry. Users of the output should realize that performance

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attribution is not an exact science. The goal is to provide useful data for interpreting performance differences between a portfolio and a benchmark.

The data used in the analysis is either provided by FactSet or loaded by MFS into FactSet. PA2 allows stocks to be grouped by any data in the system. Sector is the primary grouping we use.

Performance attribution results may differ from actual results for several reasons:

Data: The data used include daily portfolio holdings for the period, daily benchmark positions for the period, prices, returns and sectors or relevant grouping. Any error in the data will affect the analysis.

Transactions: This is a daily buy and hold analysis based on daily closing prices. Securities are included as of the end of the day in which they are bought and excluded as of the end of the day in which they are sold. This can introduce a variance from performance when the transaction price is very different from the closing price or when turnover is high.

Coverage: Some securities may not be included in the analysis. Newly issued securities may not be set up immediately by FactSet and thus be missing from the analysis. This is usually remedied quickly. The FactSet database is an equity based system, thus derivatives are excluded or may not be handled properly. Fixed income securities are excluded as well. Cash, however, can be included.

Prices: The pricing source and the returns used in FactSet may differ from the returns used for performance calculations. These differences should not be material, nor should they have a long term impact, but they can account for some discrepancies between returns in this analysis and actual results.

Fees: FactSet does not penalize performance for fees. Attribution returns model a gross of fee return.

Sector: Sector assignments are based on tables and can sometimes be missing for new securities. These errors are usually caught and corrected. Stocks are assigned to a single sector for the entire period of analysis, thus there is no accounting for the occasional stock which may change sectors due to merger or spinoff, for example.

Shorts: Returns on short positions are not displayed properly in the analysis, but the total impact on relative performance from short positions is correct.

Linking: Over time the allocation, selection and interaction returns are linked. In order to get the total impact to add up to the appropriate value added, FactSet applies a smoothing algorithm. This smoothing process may differ from the smoothing done by other performance attribution software.

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Below is a summary of the interpretation of the various columns in the FactSet Equity attribution report.

**Interpreting the FactSet Equity Performance Attribution Report**

The portfolio, benchmark, time period and the currency should be indicated at the top of the page. The typical report is divided into sector attribution and the 10 most positive and negative stock contributors.

**Columns 1-3 refer to the Portfolio:**

**Average Weight**
Average weight for each security or sector over the time period. If a security is bought or sold during the period, the average will reflect the variation in weight. For example, if IBM is a 2% holding for 3 months and then sold, the average IBM weight will average 50 basis points for the year.

**Total Return**
Total return over the period during which the weight of the security or sector was greater than zero. A stock which is in the portfolio for only part of the period will show a return different from the benchmark return for the same security due to the holding period differences. If a stock is held for the entire period and is also in the benchmark, the returns will be the same.

**Contribution to Return**
This is the percentage points of return from the holding. For a single day it is the product of the weight and the return. The daily contributions are geometrically linked therefore you cannot derive the contribution from the weights and returns in the report. These numbers are not the focus of the report, but may be useful in cases where absolute contribution to return rather than benchmark relative return is of interest.

**Columns 4-6 refer to the Benchmark:**

**Average Weight, Total Return and Contribution to Return** are calculated the same way as for the portfolio.

**Columns 7-9 are the Variations or differences between the Portfolio and the Benchmark:**

**Average Weight Variation** is the difference in portfolio and benchmark weight for the security or the sector. As noted above, these are based on average weights for the entire period, so must be used with caution.

**Total Return Variation** is the difference in portfolio and benchmark return for the security or the sector.
Contribution to Return Variation is the difference in portfolio and benchmark contributions to return for the security of the sector. Variation differs from attribution and should generally not be used to support statements in shareholder letters.

Columns 10-13 are the attributions of return to portfolio management decisions including sector weights and stock selection. Goal is to explain the difference in return between the portfolio and the benchmark (excess return). All attribution effects are computed daily and then compounded over time therefore they cannot be reconstructed from the 6-month or 12-month reports.

Allocation Effect (Local) is the portion of portfolio excess return that is attributable to taking different sector bets from the benchmark. A sector’s allocation effect is the weight of the portfolio in the sector minus the weight of the benchmark in the sector times the return of the benchmark’s sector minus the return of the benchmark in aggregate. The return of the stocks the portfolio manager actually owned in the sector is not part of this effect – it is simply whether the portfolio was over (under) weighted a sector which out (under) performed the benchmark. For global portfolios, the allocation effect is computed using local returns.

Selection + Interaction (Local) – as a standard, we combine the pure “Selection Effect” with “Interaction Effect” (each as defined below) and attribute the sum of these two columns to “selection”. For global portfolios, the selection + interaction effect is computed using local returns.

- Selection Effect is the portion of portfolio excess return attributable to the difference in return of the portfolio’s stocks in a sector vs. the benchmark’s sector return. A sector’s selection effect is the weight of the sector in the benchmark times the return of the portfolio’s stocks in the sector minus the return of the benchmark’s stocks in the sector. This effect does not consider the portfolio’s weight, just the return differential.

- Interaction Effect is the portion of portfolio excess return attributable to combining allocation decisions with relative performance. Did the manager play to his/her strengths by over (under) weighting a sector where he/she out (under) performed? Interaction will be positive if the portfolio was overweight a sector which outperformed or underweighted in a sector which underperformed. It will be negative if the portfolio was overweight a sector where the portfolio underperformed the benchmark’s sector or if the portfolio was underweight a sector with good relative performance. Many people using these reports will simplify them by combining selection with interaction and attributing the sum of the two columns to selection effect.

Total Currency Effect is the portion of total effect attributable to investing the portfolio in a mix of assets with a net currency exposure different than that of the currency exposure implied by the benchmark.

Total Effect for each sector is the sum of the allocation, selection, interaction, and currency effects. The sector level Total Effect represents the opportunity cost of the investment decisions within a group relative to the overall benchmark. The sum of the sector level total effects is the portfolio’s excess return over the benchmark.

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Interpreting the Factset Macro Attribution Report

In the following description of macro attribution, the portfolio is a fund of funds. The blended benchmark is created dynamically within Portfolio Analysis. It represents the return a manager would have received if they had invested directly in the fund's benchmark.

Default benchmark data for mutual funds is received directly from vendor returns databases.

The policy benchmark refers to the fixed benchmark weights mandated by the fund sponsor. Policy benchmarks are generally set up and created as custom composites.

Attribution analysis using a macro attribution model yields the following results:

Columns 1-2 refer to the Portfolio:
- **Average Weight**: Average weight for each asset class or group over the time period. If an asset class is bought or sold during the period, the average will reflect the variation in weight.
- **Total Return**: Total return over the period during which the weight of the asset class or group was greater than zero. An asset class which is in the portfolio for only part of the period will show a return different from the benchmark return for the same asset class due to the holding period differences. If an asset class is held for the entire period and is also in the benchmark, the returns will be the same.

Columns 3-4 refer to the Blended Benchmark:
- **Average Weight and Total Return** are calculated the same way as for the portfolio.

Columns 5-6 refer to the Policy Benchmark:
- **Average Weight and Total Return** are calculated the same way as for the portfolio.

Columns 7-10 are the attribution of relative returns, which yields the following results:

- **Asset Allocation Effect**
  - **First set of investment decisions**: Broad-level asset allocation.
  - **Asset Allocation Effect** – The asset allocation effect is calculated as the top-down allocation effect between the blended benchmark and the policy benchmark.

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Asset Allocation Effect = (Blended Benchmark Group Weight - Policy Benchmark Group Weight) * (Policy Benchmark Group Return - Policy Benchmark Total Return)

Because this is a top-down allocation effect, lower-level groups use proportional (i.e., group relative) weights. To view the proportional weight, select the "Group Relative" column option.

Asset allocation effects are only available on the group level. Security-level effects will always be zero.

- **Style Selection Effect**

  **Second set of investment decisions:** Allocation among asset classes (e.g. value vs. growth for equity, corporate bonds vs. government bonds for fixed income).

  **Style Selection Effect** - The style selection effect is calculated as the top-down selection effect between the blended benchmark and policy benchmark.

  \[
  \text{Style Selection Effect} = \text{Blended Benchmark Weight} \times (\text{Blended Benchmark Return} - \text{Policy Benchmark Group Return})
  \]

  The sum of all security-level selection effects is equal to the total selection effect.

- **Manager Selection Effect**

  **Final set of investment decisions:** Selection of mutual fund managers with which to invest.

  **Manager Selection Effect** - The manager selection effect is calculated as the portfolio fund-level weight multiplied by the difference between the portfolio fund-level return and the blended benchmark fund-level return. The blended benchmark fund-level return is assigned at the asset class level. For example, in LRT, the individual fixed income fund returns would be compared to the Bar Cap US Agg.

  \[
  \text{Manager Selection Effect} = \text{Portfolio Weight} \times (\text{Portfolio Return} - \text{Blended Benchmark Return})
  \]

- **Total Effect**

  **Conclusion:**

  The variation in return between the blended benchmark and the policy benchmark is explained by the asset allocation and style selection effects. The variation in return between the portfolio and the blended benchmark is equal to the manager selection.
Combining the asset allocation, style selection, and manager selection results in the total effect, which is the difference in return between the portfolio and the policy benchmark. Macro attribution analysis allows you to decompose the alpha of your portfolio and determine where value was added in the investment process.

MFS® investment products are offered through MFS Fund Distributors, Inc., 111 Huntington Avenue, Boston, MA 02199.