Attribution Analysis in FactSet

3-Factor Brinson Attribution
Decompose active return by allocation, stock selection, and manager conviction in a bottoms-up approach. All effects are calculated daily and compounded through time.

Allocation Effect
Represents the portion of portfolio excess return attributable to taking group bets which vary from the benchmark. A group’s allocation effect is equal to the group’s variation in weight multiplied by the difference in the benchmark’s group return versus the benchmark’s total return.

\[(\text{Port. Wt.} - \text{Bench. Wt.}) \times (\text{Bench. Grp. Return} - \text{Bench. Total Return})\]

Selection Effect
Represents the portion of portfolio excess return attributable to choosing different securities than the benchmark within groups. A group’s selection effect is equal to the benchmark’s group weight multiplied by the variation in group return.

\[(\text{Bench. Wt.}) \times (\text{Port. Grp. Return} - \text{Bench. Grp. Return})\]

Interaction Effect
Represents the portion of portfolio excess return attributable to combining allocation decisions with relative performance. This effect measures the strength of a manager’s convictions. A group’s selection effect is equal to the variation in weight multiplied by the variation in return.

\[(\text{Port. Wt.} - \text{Bench. Wt.}) \times (\text{Port. Grp. Return} - \text{Bench. Grp. Return})\]

Total Effect
Total Effect is the sum of all three effects. It represents the opportunity cost of your investment decisions in a group relative to the overall benchmark.
For global portfolios, you can also evaluate the effect of currency exposures. For global portfolios:

\[
\text{Total Effect} = \text{Total Effect (Local)} + \text{Currency Effect}
\]

**Currency Effect**

Represents the portion of Total Effect which explains the impact of the manager’s currency management decisions. The Currency Effect can be thought of as either the sum of Currency Allocation Effect and Currency Selection Effect or as the difference between Total Effect and the Total Effect in local currency. Currency Allocation and Currency Selection are calculated in the same manner as Allocation Effect and Selection Effect but use currency return instead of total return.
2-Factor Brinson Attribution

2-Factor Brinson follows the same methodology and structure as 3-Factor except in that 2-Factor takes the Interaction Effect and combines it with Allocation or Selection. Typically, managers using a top-down investment approach combine Interaction with Allocation as their convictions lie first with their group allocation decisions whereas bottoms-up managers combine Interaction with Selection to align conviction at the stock-picking level.

**Allocation Effect**

Represents the portion of portfolio excess return attributable to taking group bets which vary from the benchmark. A group’s allocation effect is equal to the group’s variation in weight multiplied by the difference in the benchmark’s group return versus the benchmark’s total return.

\[(\text{Port. Wt.} - \text{Bench. Wt.}) \times (\text{Bench. Grp. Return} - \text{Bench. Total Return})\]

**Allocation + Interaction Effect**

Represents the portion of portfolio excess return attributable to taking group bets which vary from the benchmark. By combining Allocation and Selection, the two-factor model accounts for variation in return in this calculation.

\[(\text{Port. Wt.} - \text{Bench. Wt.}) \times (\text{Port. Grp. Return} - \text{Bench. Total Return})\]

**Selection Effect**

Represents the portion of portfolio excess return attributable to choosing different securities than the benchmark within groups. A group’s selection effect is equal to the benchmark’s group weight multiplied by the variation in group return.

\[(\text{Bench. Wt.}) \times (\text{Port. Grp. Return} - \text{Bench. Grp. Return})\]

**Selection + Interaction Effect**

Represents the portion of portfolio excess return attributable to choosing different securities than the benchmark within groups. By combining Selection and Interaction, the two-factor model accounts for variation in return in this calculation.

\[(\text{Port. Wt.}) \times (\text{Port. Grp. Return} - \text{Bench. Grp. Return})\]
Total Effect
Total Effect is the sum of the effects (either Allocation + Interaction and Selection or Allocation and Selection + Interaction). It represents the opportunity cost of your investment decisions in a group relative to the overall benchmark.

For global portfolios, you can also evaluate the effect of currency exposures. For global portfolios:

\[
\text{Total Effect} = \text{Total Effect (Local)} + \text{Currency Effect}
\]

Currency Effect
Represents the portion of Total Effect which explains the impact of the manager’s currency management decisions. The Currency Effect can be thought of as either the sum of Currency Allocation Effect and Currency Selection Effect or as the difference between Total Effect and the Total Effect in local currency. Currency Allocation and Currency Selection are calculated in the same manner as Allocation Effect and Selection Effect but use currency return instead of total return.
Geometric Attribution

Like Brinson Attribution, Geometric Attribution decomposes active return by asset allocation and security selection. The key distinction between the two models is that, while Brinson Attribution breaks out the excess returns as a percentage of the initial investment, Geometric Attribution views excess returns as a percentage of the ending benchmark value.

Arithmetic Excess Return = Port. Total Return – Bench. Total Return

Geometric Excess Return = (1 + Port. Total Return) / (1 + Bench. Total Return) - 1

Asset Allocation Effect

Represents the portion of geometric excess return attributable to taking group bets which vary from the benchmark. A group’s Asset Allocation Effect is equal to the group’s variation in weight multiplied by the geometric excess return of the total benchmark relative to the benchmark group.

(Port. Wt. – Bench. Weight) * ((1 + Bench. Grp. Return / 100) / (1 + Bench. Total Return / 100) - 1

Security Selection Effect

Represents the portion of geometric excess return attributable to choosing different securities than the benchmark within groups. A group’s Security Selection Effect is equal to the benchmark’s group weight multiplied by the variation in group return.

(Port. Wt. * (1 + Port. Return / 100) / (1 + Bench. Return / 100) – 1) * (1 + Bench. Return / 100) / (1 + Semi-Notional Port. Total Return / 100))

Semi-Notional Portfolio Return

Portfolio allocations are combined with benchmark returns to facilitate the Security Selection Effect. A group’s Semi-Notional return is equal to the portfolio group weight multiplied by the benchmark group return. The total notional return is the sum of the group-level figures.


Geometric Total Effect

Geometric Total Effect is calculated as the percent difference in the geometric Asset Allocation and Security Selection Effects.

(Asset Allocation Effect / 100 +1) * (Security Selection Effect / 100 +1) -1

For global portfolios, you can also evaluate the effect of currency exposures. For global portfolios:

Geometric Currency Effect

Represents the portion of Total Effect which explains the impact of the manager’s currency management decisions. The Geometric Currency Effect is equal to percent difference in Geometric Total Effect and the Geometric Total Effect calculated in local currency.
Top-Down Attribution

A top-down investment decision-making process is one made in a previously specified, sequential order defined by the asset manager. This method of attribution treats each step of the investment process separately from one another.

First set of investment decisions:
Strategic asset allocation decisions, such as allocations to different asset classes, regions, etc. No selection of individual securities occurs at this decision-making level.

Second set of investment decisions:
Second set of allocation decisions, such as allocations to different sectors, countries, etc. No selection of individual securities occurs at this decision-making level.

Third set of investment decisions:
Selection of individual securities. These investment decisions occur after all group level asset allocations have been determined.

Allocation Effect
Represents the portion of excess return attributable to taking group bets which vary from the benchmark. At the first grouping level, Allocation Effect is calculated in the same manner as it is calculated in bottoms-up Brinson Attribution. At the secondary grouping levels, weights and returns are relative to the next highest grouping so that prior steps of the investment process do not carry through. The total Allocation Effect is equal to the sum of all Allocation Effects at every grouping level.

\[
\text{Top-Level: } (\text{Port. Grp. Wt.} - \text{Bench. Grp. Weight}) \times (\text{Bench. Grp. Return} - \text{Bench. Total Return})
\]

\[
\text{Lower-Levels: } (\text{Port. Wt}_{gn} - (\text{Port. Wt}_{gn-1} \times (\text{Bench. Wt}_{gn} / \text{Bench Wt}_{gn-1}))) \times (\text{Bench. Ret}_{gn} - \text{Bench. Ret}_{gn-1})
\]

where “gn” refers to the current grouping level and “gn-1” refers to the next highest grouping level.

Selection Effect
Represents the portion of excess return attributable to choosing different securities than the benchmark. A group’s Selection Effect is equal to the benchmark’s group weight multiplied by the variation in group return.

\[
(\text{Port. Wt}_{gn} - (\text{Port. Wt}_{gn-1} \times (\text{Bench. Wt}_{gn} / \text{Bench Wt}_{gn-1}))) \times (\text{Bench. Ret}_{gn} - \text{Bench. Ret}_{gn-1})
\]

If security-level returns in the portfolio and benchmark differ, the calculation becomes:

\[
\text{Port. Wt}_{gn} \times (\text{Bench. Ret}_{gn} - \text{Bench. Ret}_{gn-1}) + (\text{Port. Wt}_{gn} \times \text{Port. Ret}_{gn})
\]

Total Effect
In Top-Down Attribution, Total Effect is calculated as the sum of all Allocation Effects plus the sum of all security-level Selection Effects.

For global portfolios, you can also evaluate the effect of currency exposures. For global portfolios:

Currency Effect
Currency Effect for any group is the sum of the Currency Allocation and Currency Selection decisions made within that group. If Currency Effect is included in your report, the Currency Allocation and Currency Selection Effects are calculated using the same formulas as the standard top-down Allocation and Selection Effects. The only difference is that currency returns are used instead of total returns. Currency return is defined as the difference between the local currency return and the report currency return.
Macro Attribution

Macro Attribution is similar to traditional Top-Down Attribution, where the investment manager makes asset allocation decisions according to a specified mandate. The mandate traditionally comes from the fund sponsor and includes broad asset allocation guidelines. For example, the fund sponsor might require an investment policy allocation of 55% US equity, 35% global equity, and 10% fixed income. The mandate is created in FactSet as a returns composite referred to as the Policy Benchmark. Each individual manager’s benchmark combines to make up the Blended Benchmark.

** Because Macro Attribution leverages fund-level returns through FactSet’s SPAR application. **

First set of investment decisions:
The manager determines how closely to follow the allocation guidelines set by the fund sponsor. The extent to which the guidelines are followed will be measured by the Asset Allocation Effect.

Second set of investment decisions:
The manager determines how to invest within each asset class. This will be measured by the Style Selection Effect.

Third set of investment decisions:
The manager chooses which specific funds to invest in. The quality of these decisions will be measured by the Manager Selection Effect.

Asset Allocation Effect

Asset Allocation represents the first set of decisions and accounts for the portion of excess return attributable to taking group bets which vary from the benchmark. At the first grouping level, Allocation Effect is calculated in the same manner as it is calculated in bottom-up Brinson Attribution. If the Policy Benchmark weight is zero, there is no Asset Allocation Effect. At the secondary grouping levels, weights and returns are relative to the next highest grouping so that prior steps of the investment process do not carry through. The total Allocation Effect is equal to the sum of all Allocation Effects at every grouping level.

Top-Level: (Blnd. Bench. Wt. – Policy Bench. Weight) * ((1 + Bench. Grp. Return / 100) / (1 + Bench. Total Return / 100) – 1


where “gn” refers to the current grouping level and “gn-1” refers to the next highest grouping level.
Style Selection Effect
Style Selection represents the second set of decisions and accounts for the portion of excess return attributable to varying from the Policy Benchmark’s style within a given asset class. Selection Effect is equal to the Blended Benchmark weight multiplied by the variation in Blended Benchmark return and Policy Benchmark group return. The total Style Selection Effect is the sum of all fund-level Style Selection Effects.


Manager Selection Effect
In the final set of investment decisions, the returns of each fund are compared to its benchmark to quantify the value added or detracted by the manager’s selections.


When using gross returns in Macro Attribution, the effect of management fees can be isolated:

Manager Fee Effect
To calculate Manager Fee Effect, management fees are deducted from fund returns. This allows Portfolio Analysis to measure the benefit of paying a higher fee to a particular manager.

Port. Wt. * (Total Return Net – Total Return Gross)

Total Effect
The variation in return between the Blended Benchmark and the Policy Benchmark is explained by the Asset Allocation Effects. The variation in return between the portfolio and the Blended Benchmark is equal to the Manager Selection Effect. Combining Asset Allocation, Style Selection, and Manager Selection results in the Total Effect which is also equal to the variation in return between the portfolio and the Policy Benchmark.
Alpha-Beta Attribution decomposes portfolio returns into two separate return streams – one for beta returns and one for alpha returns. By applying the standard two-factor Brinson Attribution framework to each stream, this model helps determine how your market timing impacted returns and how successfully the manager captured alpha.

** Alpha-Beta Attribution requires access to Alternative Investments in Portfolio Analysis (AIPA) **

**Understanding Alpha and Beta Returns:**

Beta Return = Security Beta * Bench. Total Return
Alpha Return = Total Return – Beta Return
Total Return = Alpha Return + Beta Return

Beta can be historical via MPT or predicted via a risk model. This can be modified within Columns → Risk

** The Long/Short grouping must be applied in the report. If a risk model is selected, a market-neutral benchmark must also be used **

**Beta Effect**

Beta returns are substituted in place of total returns in the two-factor Brinson Attribution model. At the group level, Beta Effect represents the impact of your beta exposure bets on returns. Beta Effect is equal to the sum of Beta Allocation and Beta Selection + Interaction.

Beta Allocation Effect = (Port. Wt. – Bench. Wt.) * (Bench. Beta Return – Bench. Overall Beta Return)

**Alpha Effect**

Alpha returns are substituted in place of total returns in the two-factor Brinson Attribution model. At the group level, Alpha Effect represents how successful a manager was in capturing returns that were uncorrelated to the portfolio’s beta. Alpha Effect is equal to the sum of Alpha Allocation and Alpha Selection + Interaction.

Alpha Allocation Effect = (Port. Wt. – Bench. Wt.) * (Bench. Alpha Return – Bench. Overall Alpha Return)

**Total Effect**

Total Effect is the sum of Beta Effect and Alpha Effect. As in Brinson Attribution, the Total Effect is equal to the variation in return between the portfolio and the benchmark.
### Risk-Based Attribution

Variation in return can be decomposed based on active exposures to risk factors provided by a specified risk model. To determine the excess return attributable to systematic or factor risk, a risk-based performance column can be added to the report. The remaining excess return is either attributable to security-specific (idiosyncratic) risk or intra-month transactions.

### R: Risk Attribution Detail

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Economic Sector</th>
<th>Brinson Attribution</th>
<th>Risk Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/31/2015 - 3/31/2015</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>Allocation Effect</td>
<td>Selection Effect</td>
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<tr>
<td>Consumer Discretionary</td>
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<tr>
<td>Consumer Staples</td>
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<td>-0.24</td>
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</table>

### Risk Factors Effect

The Risk Factors Effect is the sum of all Factor Impacts across the risk model. Factor Impact is equal to the product of Factor Exposure and Factor Return. Over time, this column represents the compounded calculation period Risk Factors Effect.

### Risk Average Factors Effect

The Risk Factors Effect is the sum of all Factor Impacts across the risk model. Factor Impact is equal to the product of Factor Exposure and Factor Return. Over time, this column represents the average of each calculation period’s Risk Factors Effect.

### Risk Stock Specific Effect

The difference between Risk Factors Effect and Risk Total Effect cannot be explained by the risk model and is therefore determined to be stock-specific or idiosyncratic. Over time, this column represents the compounded calculation period Risk Stock Specific Effect.

### Risk Stock Specific Effect

The difference between Risk Factors Effect and Risk Total Effect cannot be explained by the risk model and is therefore determined to be stock-specific or idiosyncratic. Over time, this column represents the average of each calculation period’s Risk Stock Specific Effect.
**Risk Total Effect**
The monthly-linked excess return between the portfolio and benchmark.

**Total Effect**
The daily-linked excess return between the portfolio and benchmark.

**Risk Transaction Effect**
The difference between the daily and monthly-linked excess return between the portfolio and benchmark.

Risk Transaction Effect = Total Effect – Risk Total Effect
Fixed Income Attribution

FactSet's Fixed Income Attribution model was designed to explain the arithmetic difference between the portfolio and the benchmark total return using additive attribution effects. The model was built on the Lord model framework which uses factors that correspond to the most common investment decisions made by fixed income portfolio managers of investment grade portfolios: the portfolio’s duration bet, curve positioning bets, sector bets, and the portfolio’s individual security bets.

Basic Return Decomposition

The core concept in FactSet’s Fixed Income Attribution model is that a security’s total return can be decomposed into additive subcomponent returns. Each subcomponent return corresponds to an investment decision and is subsequently used to calculate the attribution effect that quantifies the impact of that particular investment decision.

The basic form of total return decomposition is as follows:

Total Return = Shift Return + Twist Return + Currency Return + Residual Return

<table>
<thead>
<tr>
<th>Return Component</th>
<th>Formula</th>
<th>Investment Decision Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift Return</td>
<td>$-1 \cdot E_{\text{Duration}} \cdot \Delta_{\text{ShiftPoint Yield}} + \frac{1}{2} \cdot E_{\text{Convexity}} \cdot (\Delta_{\text{ShiftPoint Yield}})^2$</td>
<td>Duration</td>
</tr>
<tr>
<td>Twist Return</td>
<td>$-1 \cdot E_{\text{Duration}} \cdot (\Delta_{\text{Duration Matched Treasury Yield}} - \Delta_{\text{ShiftPoint Yield}})$</td>
<td>Curve positioning</td>
</tr>
<tr>
<td>Currency Return</td>
<td>Total Return – Total Return (local)</td>
<td>Currency management</td>
</tr>
<tr>
<td>Residual Return</td>
<td>Total Return – (Shift Return + Twist Return + Currency Return)</td>
<td>Group allocation &amp; Security selection</td>
</tr>
</tbody>
</table>
FactSet uses the following factors to quantify benchmark-relative performance:

### Advanced Attribution Model Calculations

#### Carry Effect
Carry Effect quantifies the impact of the portfolio manager's ability to manage the passage of time.

\[(\text{Port. Wt.} \times \text{Port. Carry Return}) - (\text{Bench. Wt.} \times \text{Bench. Carry Return})\]

#### Spread Effect
Spread Effect quantifies the impact of the portfolio manager's ability to manage spreads.

\[(\text{Port. Wt.} \times \text{Port. Spread Return}) - (\text{Bench. Wt.} \times \text{Bench. Spread Return})\]

#### Income Effect
Income Effect quantifies the impact of the portfolio manager’s ability to manage income.

\[(\text{Port. Wt.} \times \text{Port. Inc. Return}) - (\text{Bench. Wt.} \times \text{Bench. Inc. Return})\]

#### Inflation Effect
Inflation Effect quantifies the impact of the portfolio manager’s ability to manage inflation.

\[(\text{Port. Wt.} \times \text{Port. Infl. Return}) - (\text{Bench. Wt.} \times \text{Bench. Infl. Return})\]
Fixed Income Return Attribution helps you isolate the components of a bond’s total return. More specifically, Fixed Income Return Attribution isolates the price, coupon, paydown, and currency components of a bond’s total return.

Understanding How a Bond’s Total Return is Calculated

Price Return
Measures the portion of a bond’s total return that can be attributed to changes in its clean price. Changes in a bond’s clean price can be attributed to the following:

Accretion Return
Measures the portion of a bond’s price return that can be attributed to a discount (premium) bond’s increase (decrease) in value as it approaches maturity and par. Accretion Return is calculated by holding the yield of the bond constant, moving the settlement date forward to the ending date, then pricing the bond.

Rolldown Return
Measures the portion of a bond’s price return that can be attributed to an increase in price due to a declining yield as a bond’s maturity shortens on the upward sloping part of the curve. Rolldown Return is calculated by holding the spread of the bond constant, moving the settlement date forward to the ending date, then repricing the bond.

Shift Return
Measures the portion of a bond’s price return that can be attributed to a parallel movement of “shift” in the on-the-run yield curve. Shift is defined as the average change in the spot rates of the 2, 5, 10, and 30-year points on the yield curve.

Twist Return
Measures the portion of a bond’s price that can be attributed to the steepening or flattening, or “twist”, of the yield curve. Twist Return is calculated by moving the settlement date forward and repricing the bond using the change in spot rates implied by the twist amount while holding the spread constant.

Shape Return
Measures the portion of a bond’s price return that can be attributed to the residual return that is not explained by the Shift and Twist Returns. Shape return is calculated by repricing the bond with the yield curve while holding volatility and spread constant.

Volatility Return
Measures the portion of a bond’s price return that can be attributed to the rising or falling of interest rate volatility. Volatility Return is calculated by holding OAS constant, changing the term structure of the volatility to the ending yield curve’s term structure of volatility, moving the settlement date forward, and then repricing the bond.

Ex-Ante Inflation Return
Measures the portion of a bond’s price return that can be attributed to movement based on inflation expectations for an inflation-linked security.
Spread Change Return
Measures the portion of a bond’s price return that can be attributed to the widening or tightening of spreads. It is the residual price change after all of the previous price return components have been calculated.

Coupon Return
Measures the portion of a bond’s total return that can be attributed to coupon cash flows and changes in accrued interest.

Paydown Return
Measures the portion of a bond’s total return that can be attributed to the repayment of principal. If the beginning price of the bond is par, paydown return is zero. If the beginning price of the bond is at a premium (discount), paydown return is negative (positive).

Inflation Return
Measures the portion of the bond’s total return that can be attributed to changes in inflation.

Currency Return
Measures the portion of the bond’s total return that can be attributed to currency movements.
Balanced Attribution

Balanced Attribution is a blend of the Top-Down Attribution and Fixed Income Performance Attribution models. Balanced Attribution follows the top-down approach where the investment decision-making process is made in a previously specified, sequential order defined by the asset manager. The Balanced Attribution model is similar to Fixed Income Performance Attribution in that the yield curve positioning decision can be explained for the fixed income portion of the portfolio.

Asset Class Allocation Effect

The Asset Class Allocation Effect quantifies the portion of benchmark-relative return that can be attributed to the asset class allocation decision.

\[
\text{(Port. Wt. – Bench. Wt.)} \times \left( \frac{\text{Asset Class Bench. Return} - \text{Bench. Total Return}}{\text{Bench. Total Return}} \right)
\]

Group Allocation Effect

The Group Allocation Effect quantifies the portion of benchmark-relative return that can be attributed to group allocation decisions after adjusting for duration and curve positioning.

\[
\text{(Port. Wt. – Port. Proportional Wt.)} \times \left( \frac{\text{Bench. Residual Return} - \text{Bench. Residual Return}_{g-1}}{\text{Bench. Residual Return}} \right)
\]

where \(g-1\) refers to the next highest grouping level

Shift Effect

The Shift Effect quantifies the portion of benchmark-relative return that can be attributed to the portfolio’s overall duration bet.

\[
\text{(Port. Wt. – Port. Proportional Wt.)} \times \left( \frac{\text{Bench. Shift Return} - \text{Bench. Shift Return}_{g-1}}{\text{Bench. Shift Return}} \right) + \text{(Port. Shift Return – Bench. Shift Return)}
\]

where \(g-1\) refers to the next highest grouping level
Twist Effect
The Twist Effect quantifies the portion of benchmark-relative return that can be attributed to the portfolio yield curve positioning bet.

\[(\text{Port. Wt.} - \text{Port. Proportional Wt.}) \times (\text{Bench. Twist Return} - \text{Bench. Twist Return}_{g-1}) + \text{Port. Wt.} \times (\text{Port. Twist Return} - \text{Bench. Twist Return})\]

where "g-1" refers to the next highest grouping level

Selection Effect
The Selection Effect quantifies the portion of benchmark-relative return that can be attributed to bond selection decisions after adjusting for duration and curve positioning.

\[(\text{Port. Wt.} - \text{Port. Proportional Wt.}) \times (\text{Bench. Residual Return} - \text{Bench. Residual Return}_{g-1}) + (\text{Port. Residual Return} - \text{Bench. Residual Return})\]

where "g-1" refers to the next highest grouping level

Currency Effect
The Currency Effect quantifies the portion of benchmark-relative return that can be attributed to currency management decisions. It is calculated by subtracting the total effect in local currency from the total effect in common currency.

Additional Performance Attribution Effects

Carry Effect
The Carry Effect quantifies the isolated impact of the passage of time to a portfolio’s benchmark-relative performance, assuming that all other factors remain constant. The Carry Effect measures the systemic impact of accretion (the pull to par) and rolldown (rolling down the yield curve) returns in terms of opportunity cost.

\[(\text{Port. Wt.} - \text{Port. Proportional Wt.}) \times (\text{Bench. Carry Return} - \text{Bench. Carry Return}_{g-1}) + \text{Port. Wt.} \times (\text{Port. Carry Return} - \text{Bench. Carry Return})\]

Spread Effect
The Spread Effect quantifies the portion of benchmark-relative return that can be attributed to spread management.

\[(\text{Port. Wt.} - \text{Port. Proportional Wt.}) \times (\text{Bench. Spread Return} - \text{Bench. Spread Return}_{g-1}) + \text{Port. Wt.} \times (\text{Port. Spread Return} - \text{Bench. Spread Return})\]

Income Effect
The Income Effect quantifies the portion of benchmark-relative return that can be attributed to accrued interest and coupon payments.

\[(\text{Port. Wt.} - \text{Port. Proportional Wt.}) \times (\text{Bench. Inc. Return} - \text{Bench. Inc. Return}_{g-1}) + \text{Port. Wt.} \times (\text{Port. Inc. Return} - \text{Bench. Inc. Return})\]
**Inflation Effect**
The Inflation Effect quantifies the portion of benchmark-relative return that can be attributed to changes in inflation.

\[(\text{Port. Wt.} – \text{Port. Proportional Wt.}) \times (\text{Bench. Infl. Return} – \text{Bench. Infl. Return}_{\text{t-1}}) + \text{Port. Wt.} \times (\text{Port. Infl. Return} – \text{Bench. Infl. Return})\]

**Paydown Effect**
The Paydown Effect quantifies the portion of benchmark-relative return that can be attributed to the repayment of principal.

\[(\text{Port. Wt.} – \text{Port. Proportional Wt.}) \times (\text{Bench. Paydown Return} – \text{Bench. Paydown Return}_{\text{t-1}}) + \text{Port. Wt.} \times (\text{Port. Paydown Return} – \text{Bench. Paydown Return})\]

**Price Effect**
The Price Effect quantifies the impact of using different pricing sources for securities that are held in both the portfolio and the benchmark.

It is calculated as follows:

1. Calculate the total return of each security in the portfolio using the portfolio pricing source(s). To calculate a portfolio-level return, take a weighted average of the security-level returns.
2. Calculate the total return of each security in the portfolio using the benchmark pricing source(s). To calculate a new portfolio-level return, take a weighted average of the security-level returns.
3. To calculate Price Effect, find the difference to the returns in steps 1 and 2.
Decision Analysis

Decision Analysis attributes absolute or excess return to the different portfolio management decisions made during the investment process. The decomposition focuses on the fundamentals of portfolio management:

**Positioning:** Did the manager’s active positioning decisions contribute or detract from absolute or excess return?

**Purchasing:** Did the manager have an informational advantage when deciding to purchase new securities?

**Selling:** Did the manager hold his or her investments for the right amount of time?

In order to calculate the impact of these decisions, Portfolio Analysis creates two synthetic portfolios to isolate positioning and purchasing decisions: a Passive Weighted Portfolio and a Passive Purchase Portfolio.

**Passive Weighted Portfolio**

The Passive Weighted Portfolio is used to isolate active positioning decisions. This portfolio holds the same securities as the actual portfolio but all securities have equal active weights relative to the benchmark. A security’s weight in the Passive Weighted Portfolio is calculated as follows:

\[
\text{Bench. Wt.} + \frac{\text{Sum of Port. Active Weights}}{\text{# of Securities}}
\]

**Passive Purchase Portfolio**

The Passive Purchase Portfolio uses the same construction as the Passive Weighted Portfolio to remove active positioning decisions and overlays a fixed-period selling rule to remove all active selling decisions. This allows Portfolio Analysis to isolate the timing of a portfolio manager’s purchases. The fixed holding period can be specified in terms of days, weeks, or months and will be calculated from the actual purchase date of each security, not the report’s start date.

The graphic below demonstrates how this is calculated. Portfolio Analysis will feel back prior to the report’s start date to capture purchases and determine sell dates based on the fixed-period selling rule. With a six month selling rule, security A is held for one month of the report period as it was purchased five months prior to the start date. Security B is sold at the end of November as it was purchased at the end of May.
Excess Return-Based Decision Analysis

**Positioning Decision**
At the total portfolio level, Positioning Decision is calculated as:

Base Port. Excess Return – Passive Weighted Port. Excess Return

At the security level, Positioning Decision is calculated as:

\[
((\text{Base Port. Wt.} \times (\text{Base Port. Return} – \text{Bench. Return})) – (\text{Passive Wtd. Port. Wt.} \times (\text{Passive Wtd. Port. Return} – \text{Bench. Return})))
\]

**Purchasing Decision**
At the total portfolio level, Purchasing Decision is calculated as the Passive Purchase Portfolio excess return.

At the security level, Purchasing Decision is calculated as:

Selling Decision
At the total portfolio level, Selling Decision is calculated as:

At the security level, Selling Decision is calculated as:

Absolute Return-Based Decision Analysis

Positioning Decision
At the total portfolio level, Positioning Decision is calculated as:
Base Port. Return – Passive Weighted Port. Return

At the security level, Positioning Decision is calculated as:

Purchasing Decision
At the total portfolio level, Purchasing Decision is calculated as the Passive Purchase Portfolio return.

At the security level, Purchasing Decision is calculated as a security’s contribution to return in the Passive Purchase Portfolio.

Selling Decision
At the total portfolio level, Selling Decision is calculated as:

At the security level, Selling Decision is calculated as: