

Performance Attribution of Multi-Asset Class Portfolios using BarraOne

Nick Sharp, Nancy Roth

Nick.Sharp@msci.com

Nancy.Roth@msci.com

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1 Introduction

BarraOne, MSCI's multi-asset class, multi-currency, risk and performance platform, covers a multitude of use cases for the investment management community across all asset classes and for numerous investment styles. This type of breadth and flexibility is necessary as investment managers make better and more informed decisions with deeper insight which can only be gained when their investment decision tools are perfectly aligned with the way in which they invest.

This paper focuses on BarraOne's Performance Analytics solution and describes how we have modified standard performance attribution tools to address several interesting use cases which arise for increasingly popular multi-asset class investment strategies, by providing the ability to create flexible grouping schemes which align with a MAC investment process, ensuring attribution calculations incorporate the allocator's view of the benchmark, and provided the ability to control the granularity of ETF's performance attribution results. The paper also illustrates, through a practical case study, how the Visualization tool within the BarraOne Performance Analytics solution can be employed to understand the performance due to the allocation of capital both across different asset classes and within each asset class for Multi-Asset Class (MAC) portfolios.

Section 2 covers some popular multi-asset class investment themes. Section 3 explains how performance attribution can be carried out in alignment with a MAC investment process. Section 4 introduces the case study and Section 5 presents the attribution results for the MAC portfolio under investigation. Section 6 summarizes the use cases that are addressed throughout the paper. Finally, the steps required to setup the analysis followed in the paper are described in the Appendix.

2 Multi-Asset Class Investment

Multi-asset class investment strategies are increasingly popular and consist of highly varied asset allocations.

To motivate the case study introduced in Section 4, we begin with some popular MAC investment themes based on a review of the largest MAC Exchange Traded Funds (ETFs) from BlackRock, State Street Global Advisors, Vanguard, and Invesco.¹

MAC ETFs are typically constructed using a basket of single-asset class ETFs, where their allocation across equity, fixed income and alternative asset classes is broadly implied by the name of the ETF, where "growth", "income" and "alternatives" typically implies the following:

- **Growth** signifies the MAC ETF is usually more than 60 per cent invested in equity assets, where the aim is to introduce capital growth through increased volatility.
- **Income** signifies there is greater than 20 per cent invested in fixed income assets, where the aim is to provide an ongoing income stream, and "High Income" implies greater than 30 per cent is invested in fixed income assets.

¹ Where largest MAC ETFs refers to largest by assets under management (AUM)

- **Alternatives** signifies there is greater than 30 per cent invested in alternatives assets, where the most common alternative asset types within MAC ETFs are REITs and Preferreds but there is often investment in commodities, infrastructure and Master Limited Partnerships relating to energy firms.

To put some context around the MAC ETF market, the current global AUM for MAC ETFs is over USD 7 billion. With several new MAC ETFs being issued recently this market is growing, most likely due to appetite from investors for the passive way MAC ETFs diversify exposure across several asset classes while aiming to deliver equity like returns with a controlled level of portfolio volatility.

Another type of MAC portfolio which furthers the need for appropriate performance attribution analysis, are multi-asset class mutual funds. These are available from a host of popular providers and are typically constructed using a basket of index tracker funds to provide exposure to various asset classes.

In the United Kingdom Diversified Growth Funds (DGFs) had an AUM in 2014 of USD 150 billion and market research firm Spence Johnson predicated this will double to USD 300 billion in the next 5 years.² DGFs typically contain a highly varied asset allocation, ranging from 65 per cent equity to less than 20 per cent, with most DGFs containing bond and alternative allocations and some with as large as 50 per cent allocated to alternatives.

It is difficult to say how large the overall multi-asset market is, mainly due to classification differences across fund providers. For example multi-asset funds are commonly classified as “multi-asset” but also as “allocation”, “mixed allocation”, or “diversified” funds, and sometimes even misleadingly classified as “equity” funds.

3 Attribution for Multi-Asset Class Portfolios

Performance attribution concerns the explanation of investment performance and provides insightful results when it is carried out in alignment with the investment process. Attribution effects then allow us to understand whether decisions paid off and why.

3.1 Single-Asset Class Portfolios

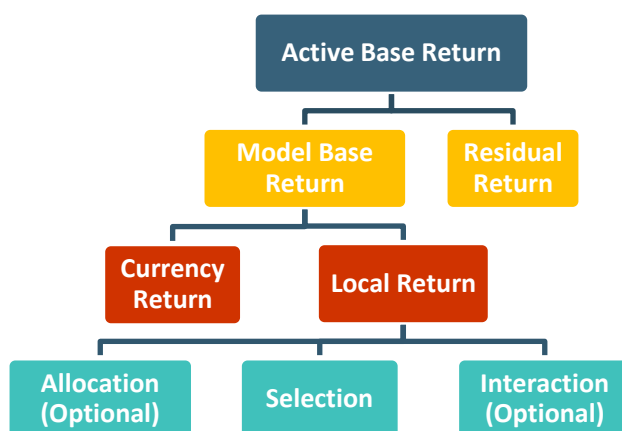
For portfolios consisting of holdings in a single-asset class, invested using a top-down approach, the Classic Attribution model in BarraOne, based on the Brinson-Fachler (1985) allocation-selection attribution model, is an appropriate way to attribute active return made through sector allocation and security selection decisions. By setting up a grouping scheme which is aligned with the investment process we can attribute the active return to allocation effects which capture the active return due to overweighting or underweighting groups in the portfolio against groups in the benchmark; to selection effects which capture the extent to which a group outperforms the benchmark group; and finally the interaction effect which is due to the inevitable interaction of top-down allocation decisions and bottom up selection decisions which can optionally be included in the selection effect. For multi-currency portfolios we extend the standard Brinson-Fachler model to separate out the effect of asset performance in non-base currencies by considering assets’ base and local currency returns. The Classic Attribution model is illustrated in Exhibit 1.

² Spence Johnson, European Growth Opportunities, Deeper Perspectives, November 2014 <http://www.spencejohnson.com/research#deeper-perspective>

3.2 Multi-Asset Class Portfolios

With such a varied mix of assets types contained within in a MAC portfolio it is necessary to understand the performance due to the allocation of capital both *across* different asset classes and *within* each asset class. To achieve this it is essential the attribution model is aligned with the investment decisions relevant to each asset class. The same attribution diagram, in Exhibit 1, applies for allocation-selection attribution for MAC portfolios but the underlying methodology needed to be modified.

Exhibit 1: Classic Attribution for Single and Multi-Asset Class Attribution



3.2.1 Modifications to Classic Attribution for MAC Portfolios

1. Flexible MAC Grouping Scheme – For the attribution effects which explain the return of a MAC portfolio to be insightful we provide the ability to setup a multi-level grouping scheme, which is aligned with different asset classes and then subsequently to investment decisions made independently for each asset class.
2. Attribution calculated according to the allocator's view of the benchmark – Attribution must always be carried out according to the allocator's view of their benchmark. For the performance attribution of a MAC portfolio this required that the standard allocation-selection model was modified to support something called cascading attribution. This is explained in detail in Section 5.3.

These two modifications enable the Classic Attribution model to capture the following for MAC portfolios:

- An allocation effect for each asset-class
- Attribution effects within each asset class that are aligned with investment decisions made independently for each asset class
- Return contributions that aggregate to the portfolio return across different asset classes and within each asset class

A host of ex post risk and risk-adjusted return measures are also provided to support the performance appraisal process.

3.2.2 Changing the Granularity of the Results

As discussed in Section 2, multi-asset investment often occurs by investing in a basket of single-asset class ETFs or through a basket of index tracker funds. BarraOne Performance Analytics provide the ability to change the granularity of the results for these types of composite style investments to match the client's appetite for detail. Each underlying fund's results can be presented in the report output as follows:

1. On a single line corresponding to each underlying ETF or index tracker fund
2. Look through and re-aggregate to carve-outs according to each underlying fund's exposure across different markets
3. Look through to view all of the constituents individually

The three alternative ways to examine the performance of ETFs are illustrated for the results of the case study using the Visualization tool within the BarraOne Performance Analytics solution in Section 5.4. Providing flexibility in the granularity of results is always important, even for passive investments in ETFs and index tracker funds so that investors, as for any investment, can understand the risk exposures and associated sources of return.

For further details on single and multi-asset class allocation-selection attribution using the Classic Attribution model see Section 2.6 in the [BarraOne Performance Analytics Handbook](#).

3.2.3 MAC Performance Analytics Beyond Brinson

The solutions outlined in this paper provide a deep understanding of performance due to asset allocation decisions for MAC portfolios by ensuring consistency with investment decisions within each asset class. However, it may be required to understand MAC performance from a factor perspective; or understand MAC performance over multiple portfolios simultaneously such as for a pension plan, a total portfolio, or for a fund-of-fund investment structure.

Factor Attribution

The Factor Attribution model in BarraOne Performance Analytics allows you to understand performance due to exposure across countries, to equity industry, equity style, equity implied volatility and commodity factors. We plan to extend this model to support fixed income factors in the future to form a truly MAC factor attribution model. To find out more about the current Factor Attribution model see Section 2.7 in the [BarraOne Performance Analytics Handbook](#).

Multi-Portfolio Attribution

The Multi-Portfolio Attribution model in BarraOne Performance Analytics is suitable for Asset Owners and Asset Managers and attributes the performance of a hierarchical investment structure simultaneously across all asset classes, strategies, managers and fund-of-funds. This model captures tactical allocation, manager selection, benchmark mismatch and return contributions. To find out more about the Multi-Portfolio Attribution model see Section 2.9 in the [BarraOne Performance Analytics Handbook](#), here [Multi-Portfolio Attribution Across all Asset Classes, Strategies, Managers and Fund-of-Funds using BarraOne](#) for a recorded webinar demonstrating an important use case the model addresses, and here for the corresponding slides [Multi-Portfolio Attribution Across all Asset Classes, Strategies, Managers and Fund-of-Funds using BarraOne](#).

4 Case Study

The following case study illustrates how the Visualization tool within the BarraOne Performance Analytics solution can be employed to understand the performance due to the allocation of capital both across different asset classes and within each asset class for MAC portfolios. The study follows the investment decisions and the resulting performance of a hypothetical MAC portfolio manager, “the PM”, throughout 2014.

The PM is mandated to actively manage against a typical multi-asset income ETF benchmark, which in this example is a combination of several single-asset class ETFs, which has an asset allocation of approximately 42 per cent to equity and 58 per cent to fixed income. Deviations from the benchmark were permitted by making allocation decisions at the asset class level and then independent allocation decisions within each asset class.

The purpose of this paper is to provide as much insight as possible using a fairly straightforward example. Hence, the portfolio used in the case study contains only equity and fixed income assets. However, the attribution model used in the analysis supports any number of asset classes, including various alternative asset classes.

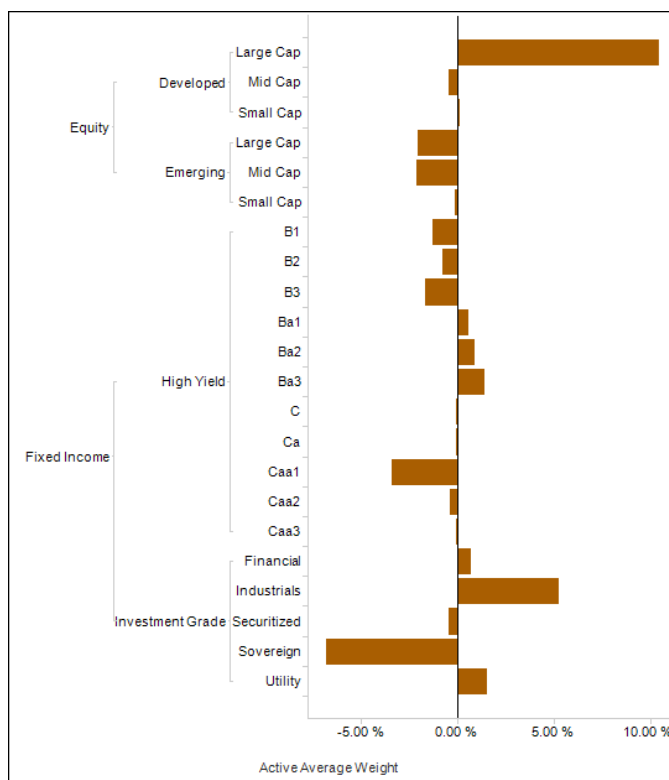
4.1 Portfolio Allocation

The PM rebalanced the multi-asset income portfolio at the start of 2014 by making several allocation bets, firstly to overweight equity and underweight fixed income by 5 per cent compared to the benchmark, and then some more detailed allocation bets within each asset class. The allocation bets within each asset class are illustrated in Exhibit 2.

Equity investments were allocated to different countries across developed and emerging market equities, in the next step an allocation decision was made to allocate according to small, mid and large cap stocks, and finally within each of these categories bets were made for different GICS sectors.

Fixed income investments were initially allocated across investment grade and high yield bonds. For high yield bonds, allocation bets across the different Moody ratings were made. For investment grade bonds, allocation bets were made for different Merrill sectors. Allocation bets were made for sovereign bonds across nominal and inflation-protected, then for corporate bonds across different sectors, and finally for securitized bonds across current, discount, and premium priced bonds.

Exhibit 2: Active Portfolio Allocation



The Main Allocation Bets

The main equity bets that were made were first to overweight developed market equities and overweight several GICS sectors specifically for DM large cap stocks. The main fixed income bets were to underweight high yield, place a large bet to overweight Industrial corporates and a final bet to underweight sovereign bonds compared to the benchmark.

The Appendix describes the general setup to carry out the analysis in BarraOne Performance Analytics, and shows that it is straightforward to align the attribution model to match any number of allocation decisions made for different asset classes and within each asset class.

5 Multi-Asset Class Performance Attribution Results

The results presented in Sections 5.1 and 5.2 include screenshots of the MAC performance attribution dashboards from the Visualization tool within the BarraOne Performance Analytics solution. They are intended to illustrate the range of results that are provided as well as showing how the graphical dashboards can be used interactively to investigate the performance attribution results.

5.1 Reviewing Portfolio Performance

We begin by reviewing the performance of the portfolio and benchmark, described in Section 4, during 2014. The screenshots presented in Exhibit 3 are a sample of the results from the Summary dashboard. In this executive summary style dashboard, high level performance attribution results are provided, as well as ex post risk and risk adjusted return measures which support the performance appraisal process.

Exhibit 3: Sample of Results From the Summary Dashboard

[31 Dec, 2013 - 31 Dec, 2014]							
Portfolio	Benchmark	Base Currency	Portfolio Base Return	Benchmark Base Return	Active Base Return	Opening MV	Closing MV
Multi-Asset Income Portfolio	Multi-Asset Income Index	USD	10.65 %	7.92 %	2.72 %	277,804,399.58	296,269,318.44

Attribution Summary		Attribution Summary Chart		Ex Post Measures	
Attribute	Value			Statistic	Value
Active Base Return	2.72 %	Active Currency Allocation Selection		Variance	0.00
Active Model Base Return	2.89 %			Portfolio Volatility (%)	5.29
Active Currency	0.64 %			Benchmark Volatility (%)	4.71
Active Local Return	2.25 %			Covariance	0.00
Allocation	0.96 %			Correlation	0.98
Selection	1.29 %			R-Squared	0.97

Trailing Performance								
Base Return	Full Period	MTD	QTD	YTD	1 month	3 month	6 month	1 year
Portfolio	10.65 %	-0.19 %	4.29 %	10.65 %	-0.19 %	4.29 %	2.90 %	10.65 %
Benchmark	7.92 %	-0.56 %	3.05 %	7.92 %	-0.56 %	3.05 %	1.28 %	7.92 %
Active	2.72 %	0.37 %	1.23 %	2.72 %	0.37 %	1.23 %	1.62 %	2.72 %

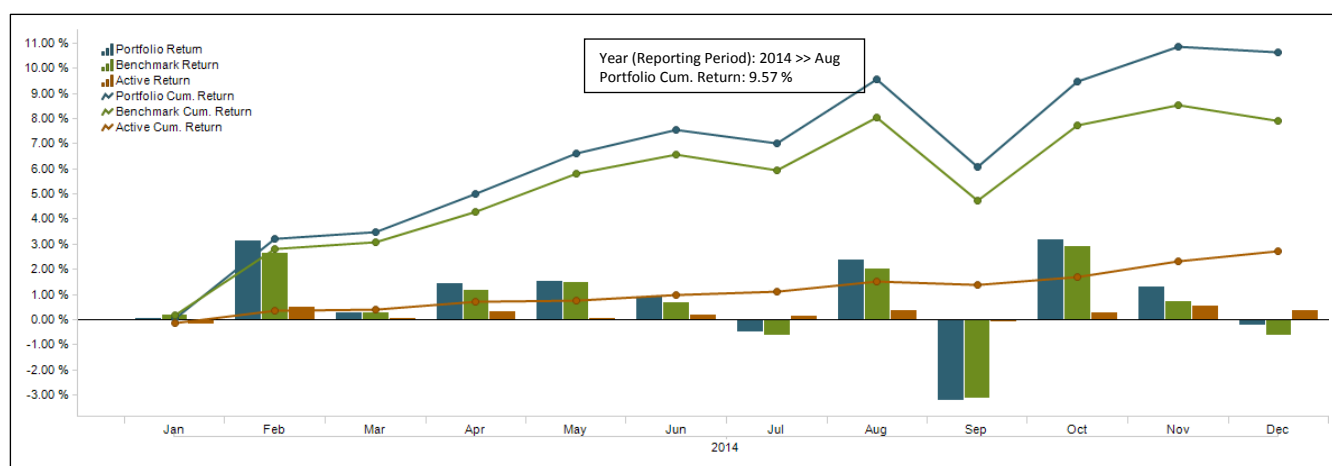
Statistic	Value
Beta	1.10
Sharpe Ratio	2.01
Sortino Ratio	3.48
Treynor Ratio	0.10
Alpha (%)	1.91
Jensen's Alpha (%)	1.91
M-Squared (%)	9.50
Tracking Error (%)	1.07
Information Ratio	2.56
T-Statistic	2.56
Upside Capture Ratio (%)	118.56
Downside Capture Ratio (%)	104.38
Maximum Drawdown (%)	-3.52

The MAC income benchmark achieved a large return of 7.9 per cent during 2014. The allocation decisions applied at the start of 2014 led to an even healthier portfolio return of 10.7 per cent, resulting in an arithmetic active return of 272 basis points.³ Of the 272 basis points of active return 96 basis points came from successful allocation decisions, 129 basis points from selection decisions and 64 basis points due to currency effects. The results will be attributed in detail to the various allocations decisions in Section 5.2.

The portfolio return was achieved with a slightly higher realized volatility of 5.3 per cent compared to a realized volatility of 4.7 per cent for the benchmark over 2014, see the ex post measures results in Exhibit 3. However, the Sharpe ratio and the information ratio are fairly high, at 2.01 and 2.56, respectively, which indicate that the active performance was also large on a risk-adjusted basis.⁴

Exhibit 4 presents the trend in the performance over 2014 for both a monthly and cumulative trend. It can be seen from the blue line that the portfolio led its benchmark from February and continued to generally outperform over the whole year.

Exhibit 4: Performance Trend Chart



In the Attribution Trend dashboard, shown in Exhibit 5, the monthly and cumulative trend in the allocation (dark blue), selection (navy blue) and currency (sky blue) effects over 2014 are presented. This provides a detailed breakdown of the active return month-by-month with the orange curve showing the change in the total attribution effect, i.e. the aggregation of the individual attribution effects.

In Exhibit 6, the daily performance is shown by the growth in the market value of the portfolio over 2014. The worst an investor could have done was lose 3.5 per cent, which is the maximum drawdown corresponding to the dip in performance starting in the third quarter of 2014, highlighted in yellow in Exhibit 6 and shown in Exhibit 3. This time series view of the daily performance can be configured to display the growth in the benchmark as well the portfolio, as either a percentage or market value. It is possible to change the date range to focus on any window during the reporting period.

³ Active performance can also be calculated geometrically in the BarraOne Performance Analytics solution.

⁴ A Sharpe ratio above 2 is considered to be very good and an information ratio above 0.5 is usually considered adequate.

Exhibit 5: Attribution Trend Dashboard

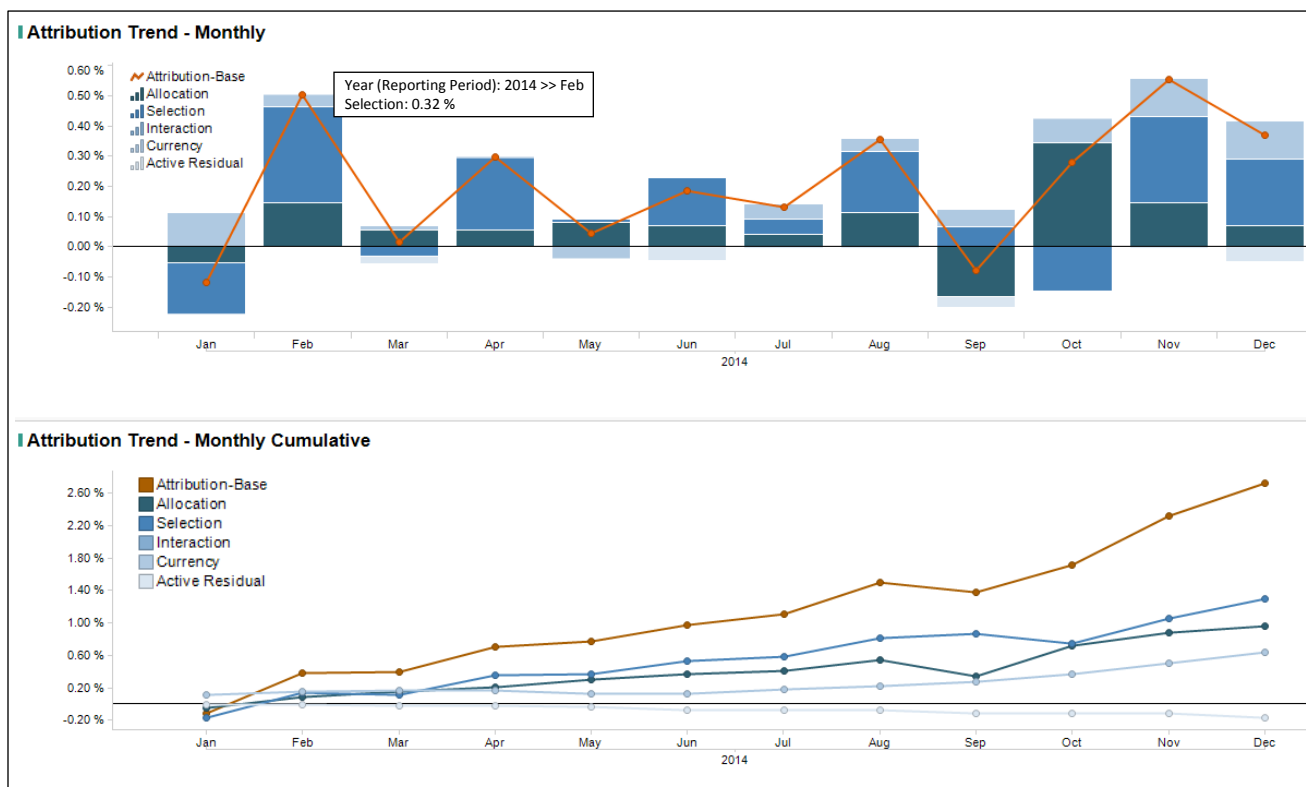
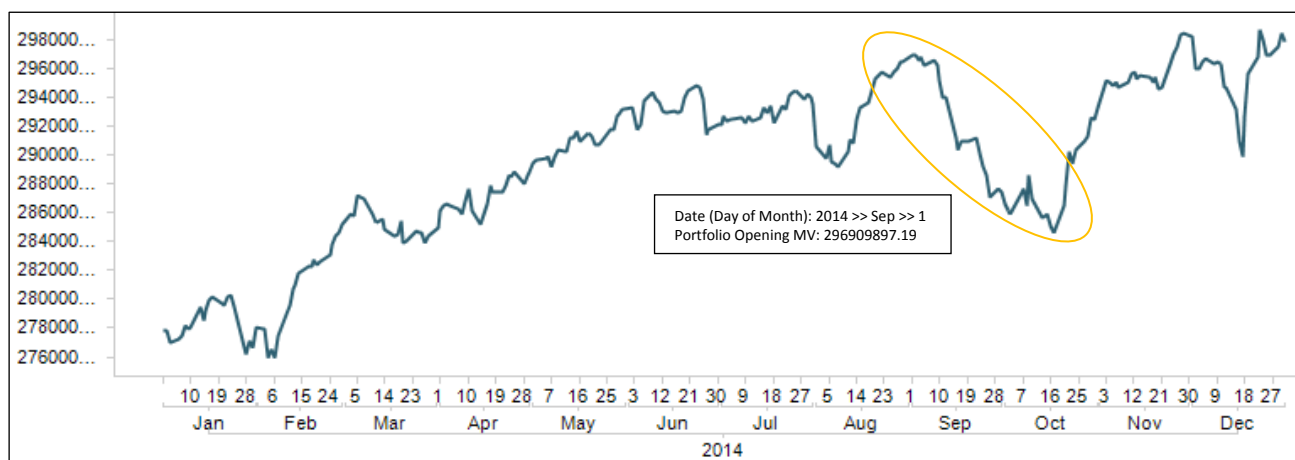


Exhibit 6: Daily Performance Chart

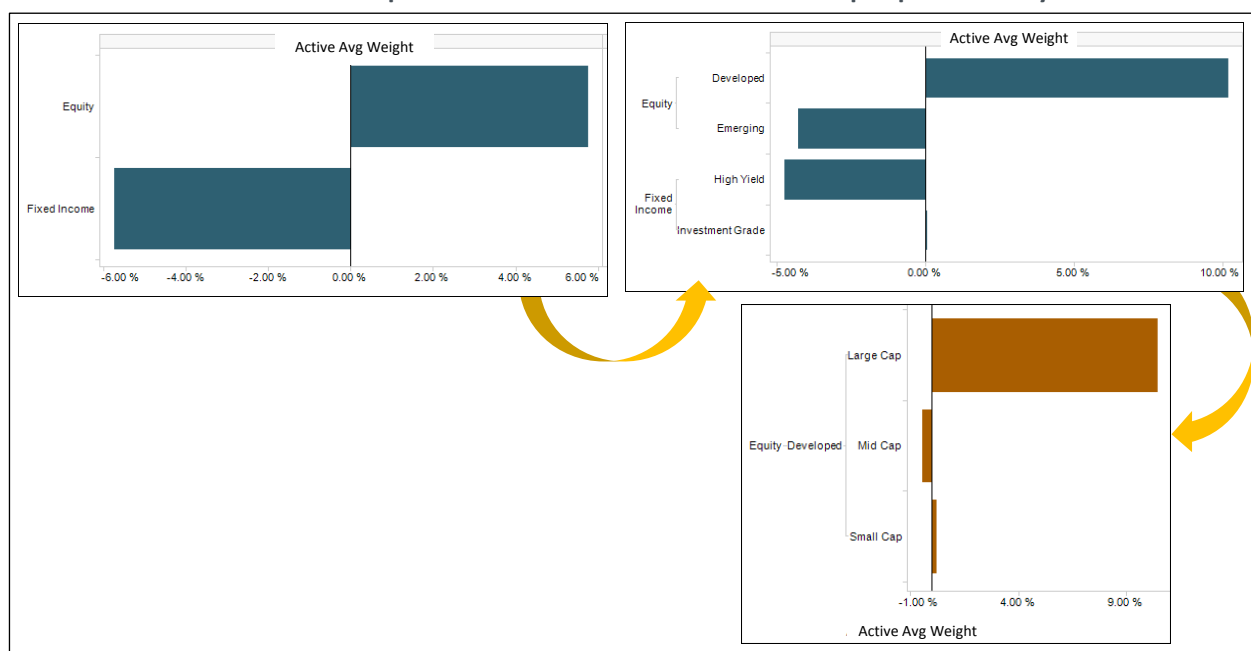


5.2 Analyzing Allocation Bets Across Asset Classes and Within Each Asset Class

The Visualization dashboards in Section 5.2 show how you can understand the performance due to the allocation of capital both across different asset classes and within each asset class for MAC portfolios.

To analyze the success of the PM's allocation bets to different asset classes and markets in which the portfolio was invested, as described in Section 4.1, firstly the various bets are reviewed in an exposure analysis, then the over and under performance compared to the benchmark are analyzed by drilling down into the attribution effects. Finally, the trend in the attribution effects month-by-month is analyzed to gain a deeper insight into the drivers of the portfolio's performance.

Exhibit 7: Drilldown on Active Exposure Within Asset Classes in the Group Exposure Analysis Dashboard



In Exhibit 7, an illustration is given of the steps taken in the Group Exposure Analysis dashboard to verify the exposure within an asset class. The initial view shows the average exposure over the reporting period for the different asset classes. The active portfolio was overweight/underweight equity/fixed income by around 4.5 per cent. The first arrow shows how it is possible to step in to review the exposure within each asset class, revealing the various markets and their average overweight and underweight compared to the benchmark. The interactive nature of the dashboard makes it possible to focus on a specific asset class and specific market as you drilldown through each successive level of allocation.

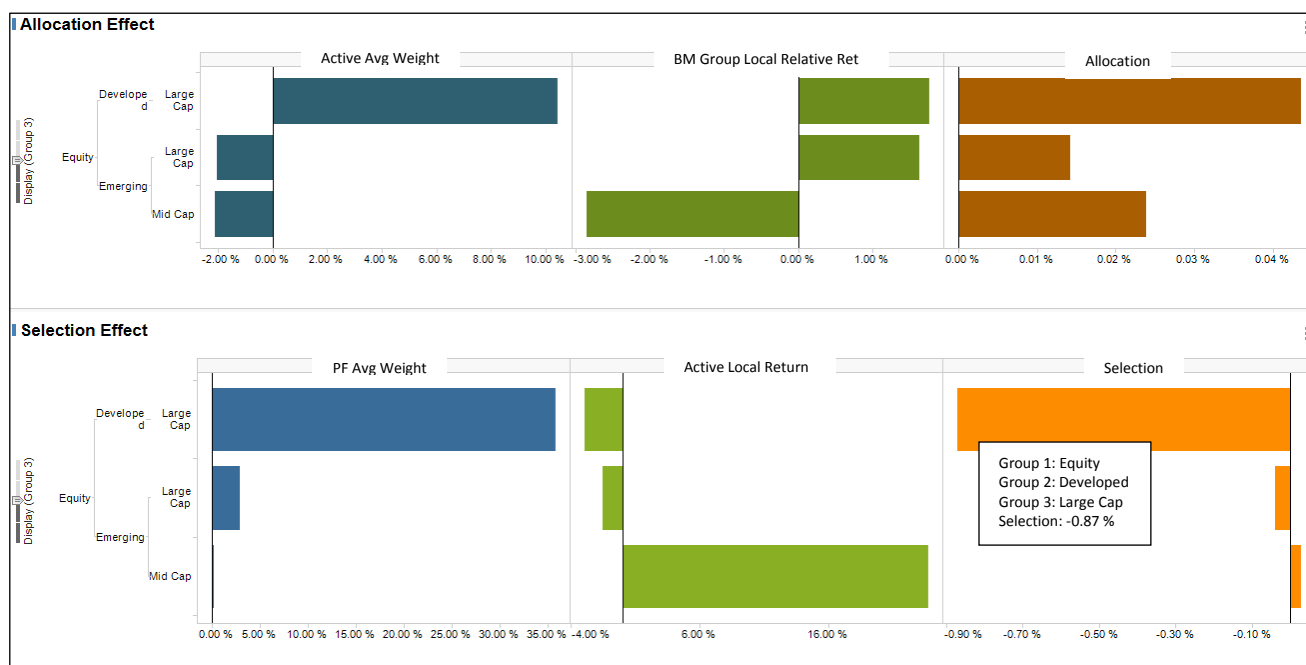
5.2.1 Analyzing Equity Bets

Focusing first on the equity portion of the portfolio, it is appropriate to review the exposure across different markets and then analyze the corresponding attribution results to understand which bets paid off and why.

It is straightforward to verify the main bets that were placed for equity assets, described in Section 4.1 and shown in Exhibit 7, which were to overweight developed market equities, particularly for large cap stocks.

In Exhibit 8, the Attribution Details dashboard is shown; it has been filtered to display the equity asset class and the attribution results for the second level of allocation. The decision to overweight Large Cap Developed Market stocks caused a large exposure in the portfolio of over 35 per cent for this market, shown by the portfolio average weight in the Selection Effect chart. This resulted in a large and negative selection effect as the portfolio's large investment in this market underperformed the benchmark's investment in this market by close to 2 per cent, leading to the selection effect of minus 87 basis points. The black box in Exhibit 8 is an example of the information that is available in the dashboards by holding the pointer over any of the content.

Exhibit 8: Understand equity attribution in the Attribution Details Dashboard



In Exhibit 9, the source of the underperformance within the Developed Market equity market can be investigated further by drilling down into that market to review the performance across the different GICS sectors in which the portfolio was invested. It can be seen that it was the investment in the Large Cap Developed Market Financials sector which was the main source of underperformance. Just from Financials the active portfolio lost 30 basis points from poor allocation and another 14 basis points due to selection decisions within that sector. It is very easy to focus on particular bets even within multiple levels of allocation decisions.

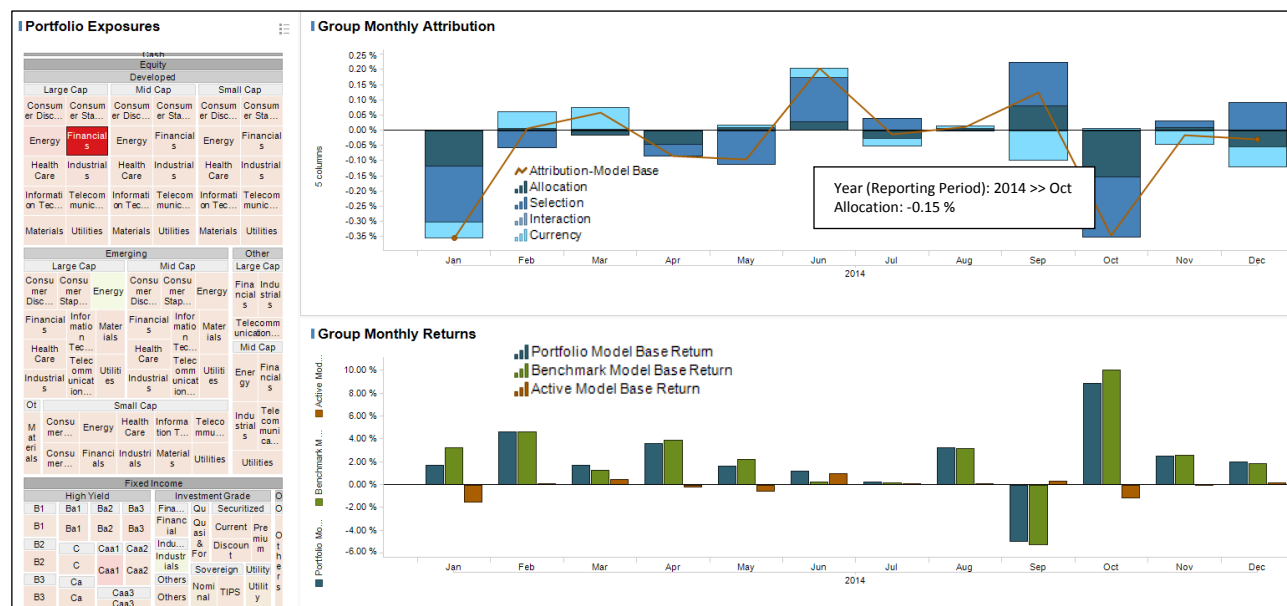
It is very interesting that for Financials it appears, from Exhibit 9, that although the portfolio was on average overweight by 1.5 per cent, for a sector which outperformed equities as a whole, by around 7 per cent, this resulted in negative allocation effect of -30 basis points. Intuitively this scenario should lead to a positive allocation effect. To understand the attribution results in more detail we can analyze the trend in the attribution effects over the reporting period.

Exhibit 9: Focus on the Equity Financials Sector in the Attribution Details Dashboard



It is possible to focus on the trend for any particular market within any asset class by simply selecting a market from the portfolio exposures treemap in the Group Attribution Trend dashboard, see Exhibit 10. The trend in the attribution results displayed for the Financials sector for developed market large cap stocks has been selected. It can be seen from the trend in the allocation effect (shown in dark blue) that it was negative for 6 months which dominated the months when it was positive. This led to the allocation effect for this market being negative overall.

Exhibit 10: Look Deeper at the Trend for the Equity Financials Sector in the Group Attribution Trend Dashboard



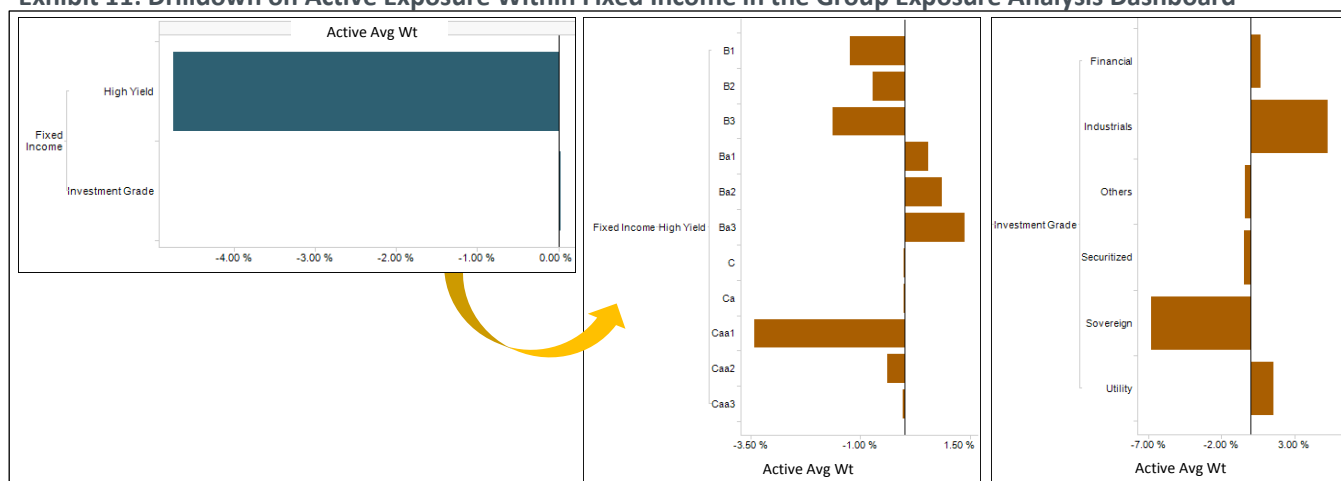
In this example the attribution effect changed sign during the year and illustrates why it is important to look at trends in attribution effects as well as over the whole reporting period. The interactive nature of the dashboards allows you to tailor the charts to focus exactly on the asset class and market you are interested in analyzing further.

5.2.2 Analyzing Fixed Income Bets

Turning now to focus to the fixed income portion of the portfolio it is appropriate to review the exposure across different markets and then analyze the attribution results to understand which bets paid off and why.

In Exhibit 11, the active exposure within the fixed income asset class is shown for high yield and investment grade bonds using a screenshot from the Group Exposure Analysis dashboard. The three views illustrate again how it is possible to interactively drilldown into the Visualization results. It is straightforward to verify in the dashboard the main bets that were placed for fixed income, which were (from Section 4.1) to underweight high yield, apply several spread market bets, place a large bet to overweight Industrial corporates and a bet to underweight sovereign bonds compared to the benchmark.

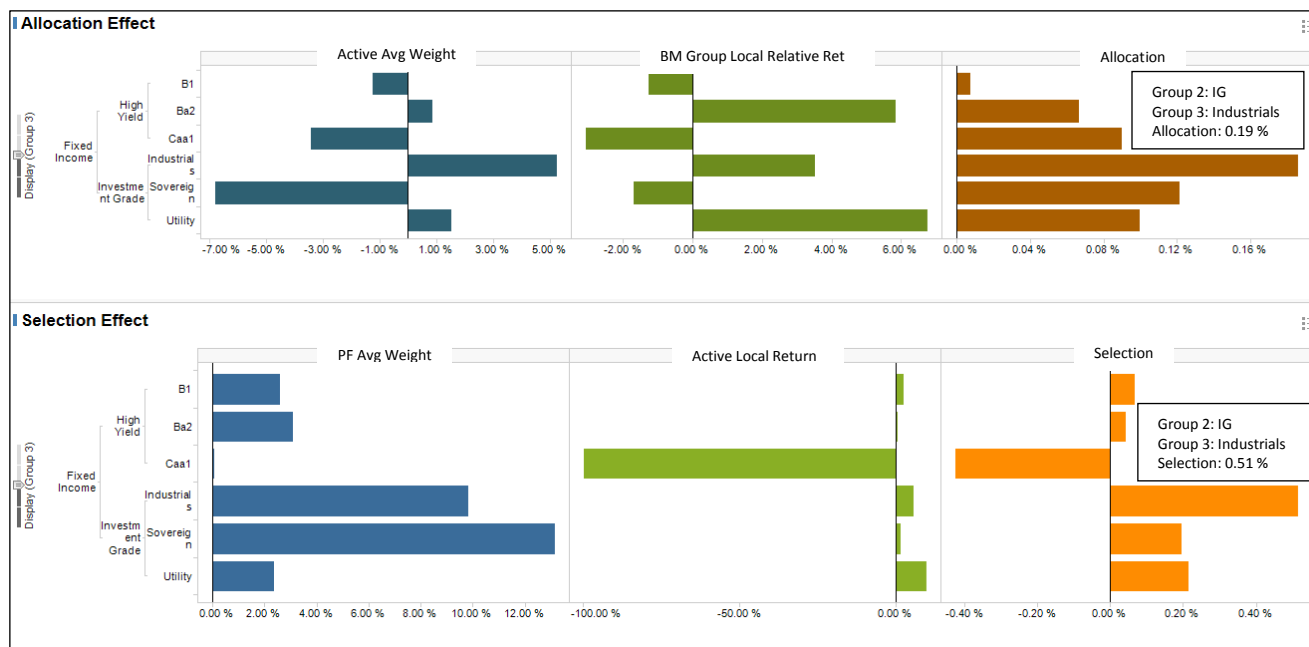
Exhibit 11: Drilldown on Active Exposure Within Fixed Income in the Group Exposure Analysis Dashboard



In Exhibit 12, the performance attribution of the fixed income asset class is shown. Here, the Attribution Details dashboard has been filtered to focus on fixed income results for the second allocation level. It is clear to see the bets for several spread markets paid off in terms of allocation but the selection results were mixed and particularly poor for the bonds with a rating of Caa1. Looking at the investment grade bonds we see the bet to overweight Industrial corporates resulted in an allocation effect of 19 basis points, due to the portfolio being overweight by 5.2 per cent in a market which outperformed fixed income as a whole by 3.5 per cent, and a large selection effect of 51 basis points due to careful selection of assets within this market.

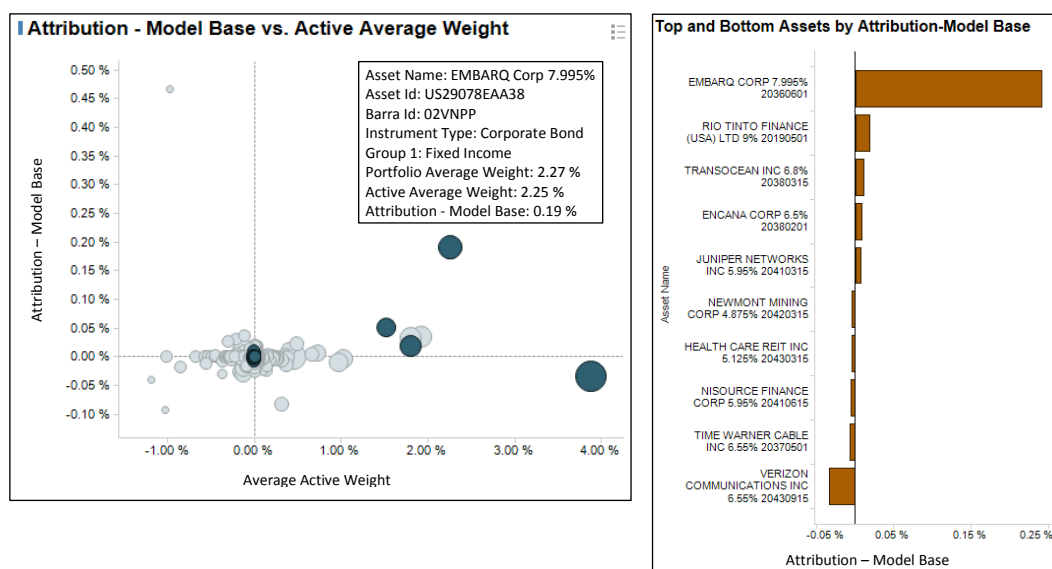
It is possible to examine the trend in the attribution effects for the fixed income asset class over the reporting period for the Industrials corporates sector, or any other market, in the Group Attribution Trend dashboard (not shown).

Exhibit 12: Understand Fixed Income Attribution in the Attribution Details Dashboard



Staying with the Industrials corporates sector, two charts from the Asset Level Attribution dashboard are shown in Exhibit 13 which allows an even more granular analysis to be carried out. The scatter plot shows the active bet for each asset and its total attribution effect, where the size of the dot indicates the weight of each asset in the portfolio. The top contributing asset was Embarq Corp, which provided 19 basis points. This type of chart is perfect for analyzing outliers across multiple asset classes and markets quickly and effectively. Top and bottom performing assets are displayed for ease of reference in the bar chart next to the scatter plot.

Exhibit 13: Review Outliers and the Top and Bottom Assets in the Asset Level Attribution Dashboard



Once an asset or several assets have been selected in the scatter plot, the table in the same dashboard, shown in Exhibit 14, displays a huge amount of detailed attribution results corresponding to the selected assets. The table in the Asset Level Attribution dashboard is also interactive as columns can be sorted or moved for further investigation.

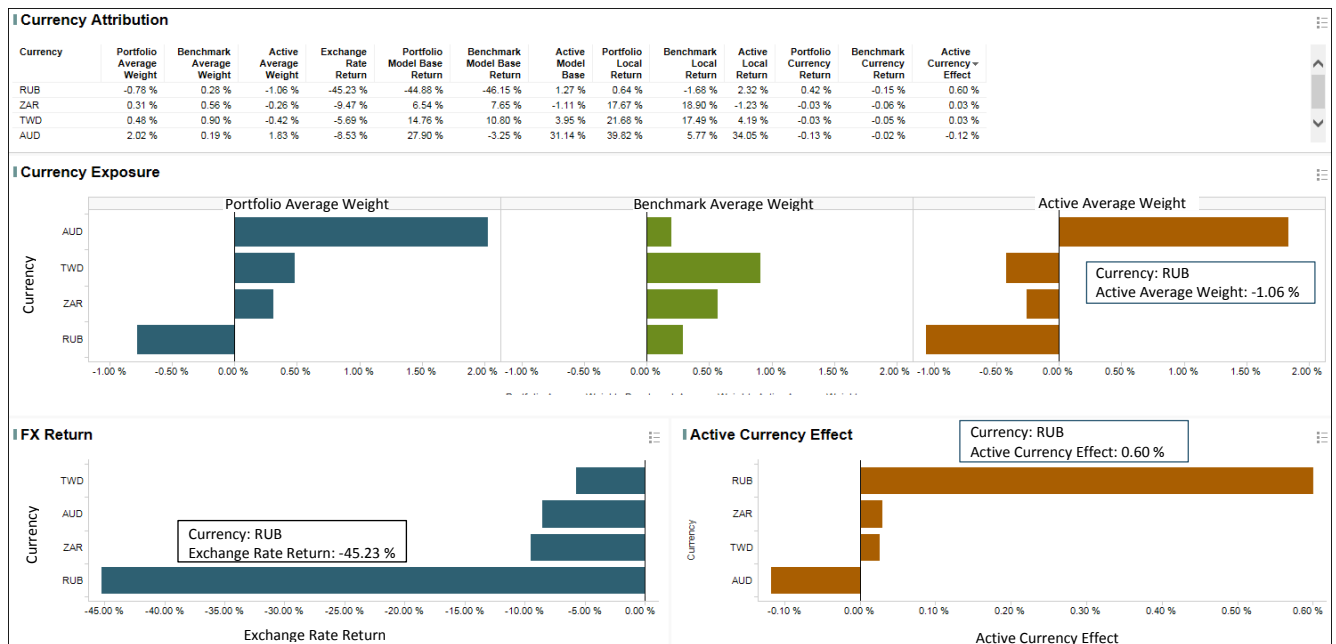
Exhibit 14: Analyze Asset-level Attribution Results in Tabular Format in the Asset Level Attribution Dashboard

Asset Level Attribution								
Asset Name	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Model Base Return	Portfolio Local Return	Benchmark Local Return	Attribution - Selection	Attribution - Local
EMBARQ CORP 7.995% 20360601	2.27 %	0.02 %	2.25 %	9.46 %	9.46 %	9.46 %	0.19 %	0.19 %
WESTFIELD CORP	1.80 %	0.00 %	1.80 %	32.65 %	45.01 %	45.01 %	0.15 %	0.15 %
EMBARQ CORP 7.995% 20360601	1.53 %	0.01 %	1.51 %	7.71 %	7.71 %	7.71 %	0.05 %	0.05 %
WALTER ENERGY INC 9.875% 20201215	0.00 %	0.11 %	-0.11 %	0.00 %	0.00 %	-23.48 %	0.04 %	0.04 %
EXELON GENERATION CO LLC 5.75% 204110...	2.02 %	0.10 %	1.92 %	23.60 %	23.60 %	23.60 %	0.04 %	0.04 %
LINN ENERGY LLC 8.625% 20200415	0.07 %	0.28 %	-0.21 %	-16.29 %	-16.29 %	-16.29 %	0.03 %	0.03 %
FRESENIUS MEDICAL CARE US FINANCE II L...	0.00 %	0.30 %	-0.30 %	0.00 %	0.00 %	3.63 %	0.03 %	0.03 %
FRONTIER COMMUNICATIONS CORP 7.125%...	0.62 %	0.13 %	0.49 %	0.39 %	0.39 %	0.39 %	0.02 %	0.02 %
GLOBAL A&T ELECTRONICS LTD 10% 201902...	0.06 %	0.05 %	0.01 %	16.71 %	16.71 %	16.71 %	0.02 %	0.02 %
PROLOGIS INC	0.90 %	1.05 %	-0.14 %	20.30 %	20.30 %	20.30 %	0.02 %	0.02 %
LUKOIL OIL COMPANY	0.06 %	0.05 %	0.01 %	-37.20 %	14.67 %	14.67 %	0.02 %	0.02 %

5.2.3 Analyzing Currency Management

In the Currency Attribution dashboard, shown in Exhibit 15, the portfolios exposure to different currency markets are shown, as well as the exchange rate moves verses the portfolio's base currency (US dollar) over the reporting period. These are the components required to understand the currency effect for each currency market. From the chart at the bottom left we can see that the Russian ruble depreciated by over 45 per cent against the US dollar but since the active exposure to the ruble was negative this resulted in a positive currency effect of 60 basis points.

Exhibit 15: Understand Currency Management in the Currency Attribution Dashboard



5.3 The Allocator's View of the Benchmark

The allocator's view of the benchmark must be incorporated in the calculation of the attribution effects.

Within any nested or multi-level investment process the portfolio allocator may be investing by making allocation decisions relative to the overall benchmark, or alternatively relative to a carve-out of the benchmark at each step.

For a MAC portfolio, such as the one described in the case study in Section 4.1, allocation decisions can be made within each asset class to outperform the overall benchmark; or to outperform the corresponding asset class in the benchmark.

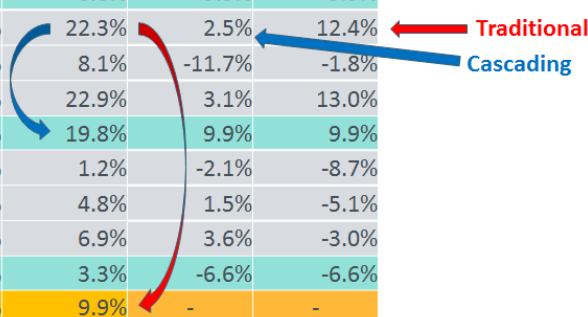
BarraOne Performance Analytics incorporates the allocator's view of their benchmark in the calculation of attribution effects. Clients can choose either Traditional Allocation-Selection for when allocation decisions are made to outperform the overall benchmark, or Cascading Allocation-Selection for when allocation decisions made within carve-outs of the portfolio and benchmark, to outperform the benchmark at specific levels.

5.3.1 Alternative Benchmark Relative Returns

Recall that allocation effects are calculated by multiplying the active weight, i.e. the bet on a market, by the benchmark relative return, which is how well a market outperforms its benchmark. The allocator's view of the benchmark is incorporated into the allocation calculation according to how the benchmark relative return is determined. Exhibit 16 presents the two alternative benchmark relative returns which determine the outcome of allocation decisions.

Exhibit 16: Alternative Benchmark Relative Returns

Group 1	Group 2	Benchmark Average Weight	Benchmark Local Return	Cascading Relative Return	Traditional Relative Return
Cash	-	0.1%	0.0%	-9.9%	-9.9%
Equity	DM	34.4%	22.3%	2.5%	12.4%
Equity	EM	7.2%	8.1%	-11.7%	-1.8%
Equity	Other	0.1%	22.9%	3.1%	13.0%
Equity	Total	41.7%	19.8%	9.9%	9.9%
FI	HY	24.6%	1.2%	-2.1%	-8.7%
FI	IG	32.6%	4.8%	1.5%	-5.1%
FI	Other	1.1%	6.9%	3.6%	-3.0%
FI	Total	58.2%	3.3%	-6.6%	-6.6%
Total	-	100.0%	9.9%	-	-


Traditional
Cascading

We can see, from Exhibit 16, the different asset classes and different markets in which the MAC benchmark was invested, the benchmark active weight and the return for each asset class and each market. The final two columns show the different relative returns which depend on whether “the benchmark” is considered to be the overall benchmark (see the traditional relative return column) or the corresponding asset class (see the cascading relative return column).

Focus on the equity developed market (shown as Equity DM) in the third row of Exhibit 16. The traditional allocation effect applies when allocation decisions are made relative to the overall benchmark; here the benchmark relative return is determined by subtracting the overall benchmark return of 9.9 per cent from the

Equity DM return of 22.3 per cent (following the red arrows). This results in a traditional relative return of 12.4 per cent. Whereas the cascading relative return applies when allocation decisions are made relative to the corresponding asset class in the benchmark; here the benchmark relative return is determined by subtracting the equity benchmark performance of 19.8 per cent from the Equity DM return of 22.3 per cent (following the blue arrows). This results in a cascading relative return of 2.5 per cent. These different measures of benchmark relative return will lead to two very different allocation effects, as shown in Exhibit 17. If the approach used does not correspond to the allocator's view, attribution effects may have the wrong magnitude and even the opposite sign, as illustrated with the Fixed Income Investment Grade (shown as IG) example in the fourth row from the bottom.⁵

5.3.2 Attribution for Carve-Outs of the Portfolio and Benchmark

The highlighting in Exhibit 17 indicates how attribution effects at the total level (the bottom row) are explained by cascading attribution effects, appropriate when the portfolio allocator is assumed to make decisions which apply to a carve-out of the portfolio and benchmark.

Performance at the total level is explained by aggregating the attribution effects at the asset class level. The 96 basis points of total allocation is the aggregation of the 56 basis points of equity allocation and 40 basis points of fixed income allocation. The same applies for total selection, such that the 129 basis points of total selection is the aggregation of minus 13 basis points of equity selection and 142 basis points of fixed income selection.

Performance at the asset-class level is explained differently due to the carve-out approach followed. The selection effect for each asset class is explained by the allocation *and* selection effects from within each asset class. Hence, the 142 basis points of fixed income selection is the aggregation of the allocation and selection effects from the different fixed income markets. The same approach applies to explain the performance of the equity asset class.

Exhibit 17: Attribution Relative to Carve-outs of the Portfolio and Benchmark Using Cascading Attribution

Group 1	Group 2	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Local Return	Benchmark Local Return	Cascading Relative Return	Active Local Return	Allocation - Cascading	Selection - Cascading	Attribution Total
Cash	-	0.1%	0.1%	0.0%	0.0%	0.0%	-9.9%	0.0%	0.00%	0.00%	0.00%
Equity	DM	44.6%	34.4%	10.2%	20.1%	22.3%	2.5%	-2.2%	0.12%	-0.85%	-0.72%
Equity	EM	2.9%	7.2%	-4.3%	9.2%	8.1%	-11.7%	1.1%	0.57%	0.03%	0.60%
Equity	Other	0.0%	0.1%	-0.1%	0.0%	22.9%	3.1%	-22.9%	0.00%	0.00%	0.00%
Equity	Total	47.4%	41.7%	5.7%	19.4%	19.8%	9.9%	-0.4%	0.56%	-0.13%	0.44%
FI	HY	19.8%	24.6%	-4.8%	0.7%	1.2%	-2.1%	-0.4%	0.05%	-0.09%	-0.04%
FI	IG	32.6%	32.6%	0.0%	9.1%	4.8%	1.5%	4.3%	0.05%	1.44%	1.49%
FI	Other	0.1%	1.1%	-1.0%	1.5%	6.9%	3.6%	-5.4%	-0.03%	0.00%	-0.03%
FI	Total	52.5%	58.2%	-5.7%	3.3%	3.3%	-6.6%	2.6%	0.40%	1.42%	1.82%
Total	-	100.0%	100.0%	0.0%	12.2%	9.9%	-	2.3%	0.96%	1.29%	2.25%

⁵ Multi-period results are displayed with average weights. Therefore, is not possible to recalculate group returns directly.

5.3.3 Attribution Against the Overall Benchmark

The highlighting in Exhibit 18 indicates how attribution effects at the total level (the bottom row) are explained by traditional attribution effects, appropriate when the portfolio allocator is assumed to make decisions to outperform the overall benchmark.

Performance at the total level is explained by aggregating the attribution effects at the asset class level. Performance at the asset-class level by aggregating the attribution effects at the group level. Hence, the selection effect at the total level and for each asset class is simply the aggregation of the selection effects in the level below. The same applies for the allocation effect. For example, the minus 28 basis points of equity selection is the aggregation of the minus 12 and minus 16 basis points of equity DM and EM selection, respectively.

Exhibit 18: Attribution Relative to Overall Portfolio and Benchmark Using Traditional Attribution

Group 1	Group 2	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Local Return	Benchmark Local Return	Traditional Relative Return	Active Local Return	Allocation - Traditional	Selection - Traditional	Attribution Total
Cash	-	0.1%	0.1%	0.0%	0.0%	0.0%	-9.9%	0.0%	0.00%	0.00%	0.00%
Equity	DM	44.6%	34.4%	10.2%	20.1%	22.3%	12.4%	-2.2%	0.47%	-0.12%	0.35%
Equity	EM	2.9%	7.2%	-4.3%	9.2%	8.1%	-1.8%	1.1%	0.26%	-0.16%	0.10%
Equity	Other	0.0%	0.1%	-0.1%	0.0%	22.9%	13.0%	-22.9%	-0.02%	0.00%	-0.02%
Equity	Total	47.4%	41.7%	5.7%	19.4%	19.8%	9.9%	-0.4%	0.72%	-0.28%	0.44%
FI	HY	19.8%	24.6%	-4.8%	0.7%	1.2%	-8.7%	-0.4%	0.57%	-0.23%	0.34%
FI	IG	32.6%	32.6%	0.0%	9.1%	4.8%	-5.2%	4.3%	1.14%	0.29%	1.43%
FI	Other	0.1%	1.1%	-1.0%	1.5%	6.9%	-3.0%	-5.4%	0.04%	0.00%	0.05%
FI	Total	52.5%	58.2%	-5.7%	3.3%	3.3%	-6.6%	2.6%	1.75%	0.06%	1.82%
Total	-	100.0%	100.0%	0.0%	12.2%	9.9%	-	2.3%	2.47%	-0.22%	2.25%

5.4 Changing the Granularity of the ETF Results

Recall from Section 3.2.2, that MAC portfolios are often created by investing in a basket of single-asset class ETFs or through a basket of index tracker funds. When carrying out performance attribution on MAC portfolios constructed in this way it is important to be able to change the granularity of the results according to the client's appetite for detail. BarraOne Performance Analytics provides 3 options for displaying the results of composite style investments, such as ETFs, in the report output:

1. On a single line corresponding to each underlying ETF or index tracker fund
2. Look through and re-aggregate to carve-outs according to each underlying fund's exposure across different markets
3. Look through to view all of the constituents individually

5.4.1 Viewing ETF Results on a Single Line

The MAC portfolio from the case study contains several ETFs. In Exhibit 19, a sample of the position-level attribution results is shown with each ETF's results shown on a single line, as well as the attribution summary results. For instance you can see the iShares Core S&P 500 ETF accounts for over 20% of the portfolio's exposure.

Exhibit 19: No Look Through – Attribution Summary and Sample Position-level Attribution Results

Attribute	Value	Asset Name	Instrument Type	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Local Return	Benchmark Local Return	Attribution - Selection
Active Base Return	2.72 %	ISHARES CORE S&P 500 ETF	Exchange Traded Fund	20.14 %	9.31 %	10.83 %	11.45 %	11.45 %	-0.69 %
Active Model Base Return	2.72 %	ISHARES COHEN & STEERS REIT ETF	Exchange Traded Fund	15.23 %	17.91 %	-2.69 %	29.60 %	29.60 %	-0.58 %
Active Currency	0.69 %	ISHARES MSCI EAFE ETF	Exchange Traded Fund	2.89 %	2.46 %	0.44 %	-9.28 %	-9.28 %	0.00 %
Active Local Return	2.03 %	ISHARES CORE S&P SMALL-CAP ETF	Exchange Traded Fund	2.30 %	1.96 %	0.35 %	4.44 %	4.44 %	0.03 %
Allocation	0.75 %	ISHARES CORE S&P MID-CAP ETF	Exchange Traded Fund	2.21 %	2.60 %	-0.39 %	8.19 %	8.19 %	0.13 %
Selection	1.28 %								
Interaction									
Active Residual	0.00 %								
Portfolio Residual	0.00 %								
Benchmark Residual	0.00 %								
Look Through Residual	0.00 %								

5.4.2 Viewing ETF Results with Look-Through to Carve-Outs

In Exhibit 20, the same sample of the position-level attribution results is shown as in Exhibit 19 but instead with a “look-through to carve-out view” applied for each ETF, as well as the attribution summary results. Under this mode, ETFs are decomposed according to their exposure across the different classifications used to group the portfolio. This is extremely powerful as the attribution groupings were setup according to the different steps in the investment process, which means each carve-out's results are perfectly aligned with the investment process within each asset class, and thus provide a deeper insight into the drivers of performance. Instead of a single line for the iShares Core S&P 500 ETF, as in Exhibit 19, there is a single line for each carve-out of the ETF according to its underlying exposure across the PM's three step equity allocation process for developed & emerging market, market capitalization and GICS sector.

Exhibit 20: Look Through and Re-Aggregate – Attribution Summary and Sample Position-level Attribution Results

Attribute	Value	Asset Name	Instrument Type	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Local Return	Attribution - Selection
Active Base Return	2.72 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Consumer Discretionary	Exchange Traded Fund	2.24 %	1.04 %	1.20 %	10.22 %	0.00 %
Active Model Base Return	2.89 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Consumer Staples	Exchange Traded Fund	1.92 %	0.89 %	1.03 %	16.29 %	0.00 %
Active Currency	0.64 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Energy	Exchange Traded Fund	1.95 %	0.90 %	1.05 %	-6.88 %	0.00 %
Active Local Return	2.25 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Financials	Exchange Traded Fund	3.14 %	1.45 %	1.69 %	15.59 %	-0.20 %
Allocation	0.96 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Health Care	Exchange Traded Fund	2.68 %	1.24 %	1.44 %	25.76 %	0.00 %
Selection	1.29 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Industrials	Exchange Traded Fund	2.01 %	0.93 %	1.08 %	10.25 %	0.00 %
Interaction		ISHARES CORE S&P 500 ETF Equity Developed Large Cap Information Technology	Exchange Traded Fund	3.77 %	1.74 %	2.03 %	20.65 %	0.00 %
Active Residual	-0.16 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Materials	Exchange Traded Fund	0.61 %	0.28 %	0.33 %	7.67 %	0.00 %
Portfolio Residual	0.00 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Telecommunication Services	Exchange Traded Fund	0.47 %	0.22 %	0.25 %	2.20 %	0.00 %
Benchmark Residual	-1.10 %	ISHARES CORE S&P 500 ETF Equity Developed Large Cap Utilities	Exchange Traded Fund	0.56 %	0.26 %	0.30 %	28.68 %	0.00 %
Look Through Residual	-1.27 %	ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Consumer Discretionary	Exchange Traded Fund	0.17 %	0.08 %	0.09 %	2.58 %	-0.01 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Consumer Staples	Exchange Traded Fund	0.03 %	0.01 %	0.01 %	-3.16 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Energy	Exchange Traded Fund	0.06 %	0.03 %	0.03 %	-30.64 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Financials	Exchange Traded Fund	0.13 %	0.06 %	0.07 %	4.55 %	-0.02 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Health Care	Exchange Traded Fund	0.07 %	0.03 %	0.04 %	11.17 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Industrials	Exchange Traded Fund	0.12 %	0.05 %	0.06 %	3.37 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Information Technology	Exchange Traded Fund	0.07 %	0.03 %	0.04 %	0.15 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Materials	Exchange Traded Fund	0.08 %	0.04 %	0.04 %	2.57 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Telecommunication Services	Exchange Traded Fund	0.01 %	0.01 %	0.01 %	34.09 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Mid Cap Utilities	Exchange Traded Fund	0.05 %	0.02 %	0.03 %	33.26 %	0.00 %
		ISHARES CORE S&P 500 ETF Equity Developed Small Cap Information Technology	Exchange Traded Fund	0.00 %	0.00 %	0.00 %	3.21 %	0.00 %

For example, consider the Equity Developed Market Large Cap Financials carve-out highlighted in red, under this granular view it is revealed that 3 per cent of the portfolio was exposed to this market implicitly through investment in the iShares Core S&P 500 ETF.

Look Through Impact

By looking through each ETF to its underlying constituents, and then forming carve-outs aligned with the investment process, we're able to use the position-level weights and returns to enrich the attribution results. Notice in the attribution summary for this more granular view, see Exhibit 20, that the top-level return is the same as in Exhibit 19 but there is now a look through residual or look through impact. This quantity captures the difference in return due to holding ETFs compared to if the PM had invested in each ETF's underlying constituents directly. It shows the portfolio return would have been 1.27 per cent higher had the PM invested in each ETF's underlying constituents directly.⁶

5.4.3 Viewing ETF Results with Look-Through to the Constituents

In Exhibit 21, the same sample of the position-level attribution results is shown as in Exhibit 19 but instead with a "look-through to constituents view" applied for each ETF, as well as the attribution summary results. In this final view we see the ETFs have been disaggregated to display all underlying constituents.

Exhibit 21: Look Through – Attribution Summary and Sample Position-level Attribution Results

Attribute	Value	Asset Name	Instrument Type	Portfolio Average Weight	Benchmark Average Weight	Active Average Weight	Portfolio Model Base Return	Portfolio Local Return	Benchmark Local Return	Attribution - Selection
Active Base Return	2.72 %	WESTFIELD CORP	Equity Security	1.80 %	0.00 %	1.80 %	32.65 %	45.01 %	45.01 %	0.15 %
Active Model Base Return	2.89 %	SIMON PPTY GROUP INC NEW	Equity Security	1.26 %	1.44 %	-0.18 %	31.05 %	31.05 %	31.05 %	0.00 %
Active Currency	0.64 %	PUBLIC STORAGE	Equity Security	1.11 %	1.28 %	-0.18 %	26.83 %	26.83 %	26.83 %	0.01 %
Active Local Return	2.25 %	EQ RESIDENT PROP	Equity Security	0.96 %	1.11 %	-0.15 %	42.95 %	42.95 %	42.95 %	-0.03 %
Allocation	0.96 %	PROLOGIS INC	Equity Security	0.90 %	1.05 %	-0.14 %	20.30 %	20.30 %	20.30 %	0.02 %
Selection	1.29 %	HEALTH CARE REIT INC	Equity Security	0.87 %	1.00 %	-0.14 %	48.51 %	48.51 %	48.51 %	-0.03 %
Interaction		VENTAS INC	Equity Security	0.84 %	0.98 %	-0.13 %	31.27 %	31.27 %	31.27 %	0.00 %
Active Residual	-0.16 %	HEALTH CARE PROP	Equity Security	0.84 %	0.97 %	-0.13 %	27.80 %	27.80 %	27.80 %	0.00 %
Portfolio Residual	0.00 %	BOSTON PROPERTIES INC	Equity Security	0.81 %	0.93 %	-0.13 %	35.53 %	35.53 %	35.53 %	-0.01 %
Benchmark Residual	-1.10 %	VORNADO RLTY TR	Equity Security	0.80 %	0.93 %	-0.13 %	36.40 %	36.40 %	36.40 %	-0.01 %
Look Through Residual	-1.27 %	AVALONBAY COMM	Equity Security	0.79 %	0.91 %	-0.12 %	42.72 %	42.72 %	42.72 %	-0.02 %
		HOST HOTELS & RESORTS INC	Equity Security	0.72 %	0.84 %	-0.11 %	26.49 %	26.49 %	26.49 %	0.01 %
		APPLE INC	Equity Security	0.66 %	0.30 %	0.35 %	40.60 %	40.60 %	40.60 %	0.00 %
		GEN GROWTH PROP	Equity Security	0.59 %	0.68 %	-0.09 %	43.85 %	43.85 %	43.85 %	-0.02 %
		EXXON MOBIL CORP	Equity Security	0.49 %	0.23 %	0.26 %	-6.07 %	-6.07 %	-6.07 %	0.00 %
		MICROSOFT CORP	Equity Security	0.39 %	0.18 %	0.21 %	27.48 %	27.48 %	27.48 %	0.00 %
		ESSEX PPTY TR INC	Equity Security	0.38 %	0.44 %	-0.06 %	21.18 %	21.18 %	21.18 %	0.00 %
		SL GREEN RLTY	Equity Security	0.37 %	0.44 %	-0.06 %	25.36 %	25.36 %	25.36 %	0.00 %
		JOHNSON & JOHNSON	Equity Security	0.33 %	0.15 %	0.18 %	17.34 %	17.34 %	17.34 %	0.00 %

It is the author's opinion that the second option, presented in Section 5.4.2, to view ETF results using a "look-through to carve-out view" has the most advantages. The carve-outs correspond to the different steps in the investment process and the results are not overly granular, and therefore are more insightful. This provides a great deal of visibility into the underlying exposure and performance of each ETF, and the look through residual quantifies the return that would have been achieved if the PM had invested in the ETF's underlyings directly.

6 Summary

This Product Insight began by discussing the popularity of MAC investment strategies, how they come in a variety of different flavors and typically involve investing in a basket of ETFs or index tracker funds. This motivated the investment style followed in the practical case study.

⁶ The benchmark residual in this case study is due to the look through impact from the ETFs held in the benchmark. Typically, benchmarks do not hold composite style investments and so look through impact is not decomposed to an explicit look-through residual.

The central theme in the paper was that it is vital for performance attribution to be carried out in alignment with the investment process so that insightful explanations of investment performance can be provided. The paper described in detail how BarraOne's Performance Analytics solution provides performance attribution tools which are appropriate for MAC portfolios, and how standard attribution techniques have been modified to address several interesting use cases which arise for MAC investment strategies. Namely, the ability to create flexible grouping schemes which align with a MAC investment process, and ensuring attribution calculations incorporate the allocator's view of the benchmark. Also, how it is possible to control the granularity of ETF's performance attribution results and the deeper insight this provides.

The practical case study showed how the Visualization tool within the BarraOne Performance Analytics solution can be used interactively to understand the performance due to the allocation of capital both across different asset classes and within each asset class for MAC portfolios. The case study used a balanced equity and fixed income portfolio constructed using a basket of single-asset class ETFs. This provided insightful results using an example without unnecessary complexity. However, the same type of analysis can be carried out for a MAC portfolio containing any number of asset classes, including various alternative asset classes, such as Commodity, Hedge Fund, Real Estate, and Private Equity.

To find out more and see a demonstration of a performance attribution of a MAC portfolio using the Visualization tool within the BarraOne Performance Analytics Solution a recorded webinar corresponding to this paper can be found here:

[Performance Attribution of Multi-Asset Class Portfolios Using BarraOne Webinar](#)

[Performance Attribution of Multi-Asset Class Portfolios Using BarraOne Webinar Slides](#)

There are also dashboards available in BarraOne Performance Analytics which were not shown in this paper. There are separate dashboards for Fixed Income Attribution, to tie back-return to term-structure and spread-bets as well as capturing income, paydown and rolldown; for Factor Attribution to tie back-return to Barra equity, equity implied volatility and commodity factors; and for Multi-Portfolio Attribution to attribute return across all asset classes, strategies, managers and fund-of-funds.

Appendix

The Appendix presents the general setup to run a Performance Visualization analysis in BarraOne for a MAC portfolio; how to align the attribution model with any MAC investment process; and how to work with the dashboards to gain insight into the results.

Visualization Setup for MAC Performance Attribution

The general setup to run a Performance Visualization analysis in BarraOne for a MAC portfolio is covered in detail in the [BarraOne Performance Analytics Visualization Handbook](#). An overview is presented here:

Running MAC Performance Attribution using the flexible multi-asset class grouping schemes begins by selecting the *Multi-Asset Class* option (highlighted in red in Exhibit 22) within the Allocation Groups section of the Allocation Selection Visualization setup. This is done within:

Visualization > Setup > Analysis Setting > Attribution Model > Allocation-Selection > Allocation Groups

or within the following if using the setup wizard:

Visualization > Setup > Portfolio Group > Configure Analysis > Attribution Model > Allocation-Selection > Allocation Groups

Exhibit 22: Setting Up the Multi-Asset Class Allocation-Selection Analysis Setting

Attribution Model
☒ Allocation Selection

Allocation Groups
☒ Cascading
 ☒ Multi-Asset Class
 Multi-Asset Class_SYSTEM

Asset Class	Attribute	Grouping Scheme
Alternatives		
Cash		
Equity		
Fixed Income		
Other		

Add Edit Up Down Delete

☐ Custom Asset Class
 Select User Data Attribute

Asset Class	Attribute	Grouping Scheme
Equity		
Equity	Country	Developed - Emerging_SYSTEM
Equity	Market Capitalization	Sm, Mid, Lg Cap_PA
Equity	GICS Sector	distinct

Asset Class	Attribute	Grouping Scheme
Fixed Income		
Fixed Income	Lvl1 Split IG and HY by Moodys	distinct
Fixed Income	Lvl2 IG by CI2 and HY by Moodys	distinct
Fixed Income	Lvl3 Sov by Nominal and TIPS Sec by Price ...	distinct

System or custom asset class schemes can be chosen. Flexibility is provided to edit system asset classes or to create user-defined asset classes.

There are over 200 instrument types in BarraOne, these have default asset classes which can be easily amended. It is also possible to control asset classification by applying user data attributes to define asset classes on an instrument-specific basis to group composites instruments such as, ETFs, mutual funds, and Link Proxys, into multiple asset classes. For example, this allows equity mutual funds and fixed income mutual funds to be easily classified into their appropriate asset class according to any user-defined criteria.

Check the *Cascading* option if the allocator views the benchmark as a carve-out of the portfolio and benchmark, otherwise the attribution effects are calculated relative to the overall benchmark.

It is straightforward to align the attribution model to match any number of allocation decisions made for different asset classes and within each asset class. There is no limit on the number of levels of attributes that can be specified for each asset class to match the investment process. The following provides some information about the grouping schemes that are possible for each asset class:

Equity

The grouping scheme for the equity asset class can be constructed using GICS, ICB, Russell, FTSE, country, currency, sector, market capitalization, MSCI ESG categories, or user defined.

Fixed Income

The grouping scheme for fixed income can be specified in a very flexibly manner to match the investment process.

There are 42 descriptive data attributes available from the system. A non-exhaustive list is as follows:

Barclays Rating	Coupon Currency	IBOXX Subsector
Barclays Sector Class 1	Coupon Frequency	Inst. Sub-Type
Barclays Sector Class 2	Coupon Type	Inst. Type
Barclays Sector Class 3	Currency	Issuer

Barclays Sector Class 4	FRN Index	Loan Type
Citi Country Code	iBoxx L0 – Market	Local Market
Citi GLIC Classification	iBoxx L1 – Index Family	Merrill Rating
Citi Industry	iBoxx L2 – Sub-index	Merrill Sector Class 1
Citi Rating	iBoxx L3 – Industry	Merrill Sector Class 2
Collateral	iBoxx L4 – Supersector	Merrill Sector Class 3
Country	iBoxx L5 – Sector	Merrill Sector Class 4
Country Of Exposure	iBoxx L6 – Subsector	Moody Rating
Country Of Incorporation	IBOXX Rating	Pool Type
Country Of Quotation	IBOXX Sector	S&P Rating

There are 24 valuation data attributes, all with predefined grouping schemes, and the ability to amend these or add your own. The following valuation data attributes have predefined system grouping schemes and can be used:

- Yield: Current Yield, Yield to Best (%), Yield to Maturity (%), Yield to Next (%), Yield to Worst (%)
- Duration: Dollar Duration, Duration to Worst, Effective Duration, PA Effective Duration, Macaulay Duration, Modified Duration, PA Spread Duration, Spread Duration, Spread Dollar Duration, Weighted Average Life
- Time: Time to Maturity and Time to Coupon
- Spread: PA OAS to Base (bp), OAS (bp), OAS to Swap (bp), OAS to Treasury (bp), Model Spread (bp)
- Convexity: OA Convexity, Spread Convexity

Formulas can be used as User Data attributes to create very flexibly defined grouping schemes. The fixed income allocation decisions, from Section 4.1, were applied as formula attributes in the grouping scheme when setting up the case study. For reference, the formulas applied were as follows:

For fixed income, at level 1 split by HY and IG:

```
IF([Moody Rating]='Ba1' OR [Moody Rating]='Ba2' OR [Moody Rating]='Ba3' OR [Moody Rating]='B1' OR [Moody Rating]='B2' OR [Moody Rating]='B3' OR [Moody Rating]='C' OR [Moody Rating]='C1' OR [Moody Rating]='C2' OR [Moody Rating]='C3' OR [Moody Rating]='Ca' OR [Moody Rating]='Ca1' OR [Moody Rating]='Ca2' OR [Moody Rating]='Ca3' OR [Moody Rating]='Caa' OR [Moody Rating]='Caa1' OR [Moody Rating]='Caa2' OR [Moody Rating]='Caa3' OR [Moody Rating]='D','High Yield',IF([Moody Rating]='A1' OR [Moody Rating]='A2' OR [Moody Rating]='A3' OR [Moody Rating]='Aa1' OR [Moody Rating]='Aa2' OR [Moody Rating]='Aa3' OR [Moody Rating]='Aaa' OR [Moody Rating]='B1' OR [Moody Rating]='B2' OR [Moody Rating]='B3' OR [Moody Rating]='Ba1' OR [Moody Rating]='Ba2' OR [Moody Rating]='Ba3' OR [Moody Rating]='Baa1' OR [Moody Rating]='Baa2' OR [Moody Rating]='Baa3','Investment Grade','Others'))
```

At level 2 split IG by Merrill Sector Class 2 and split HY by Moodys Rating:

```
IF([Lvl1 Split IG and HY by Moodys]='Investment Grade',[Merrill Sector Class 2],IF([Lvl1 Split IG and HY by Moodys]='Others','Others',[Moody Rating]))
```

At level 3 split sovereign by Nominal and TIPS and split securitized into price buckets:

```
IF([Lvl2 IG by Cl2 and HY by Moodys]='Sovereign',[New Inst. Type],IF([Lvl2 IG by Cl2 and HY by Moodys]='Securitized',[New Price Buckets],IF([Lvl2 IG by Cl2 and HY by Moodys]='Industrials' OR [Lvl2 IG by Cl2 and HY by Moodys]='Quasi & Foreign Sovereign' OR [Lvl2 IG by Cl2 and HY by Moodys]='Financial' OR [Lvl2 IG by Cl2 and HY by Moodys]='Utility',[Lvl2 IG by Cl2 and HY by Moodys],IF([Lvl2 IG by Cl2 and HY by Moodys]='Others','Others',[Lvl2 IG by Cl2 and HY by Moodys]))))
```

Alternatives

FX, Equity Implied Volatility, Commodity, Hedge Fund, Real Estate and Private Equity assets can be grouped according to their own asset classes. Alternatively, users can use custom asset level attributes grouping purposes.

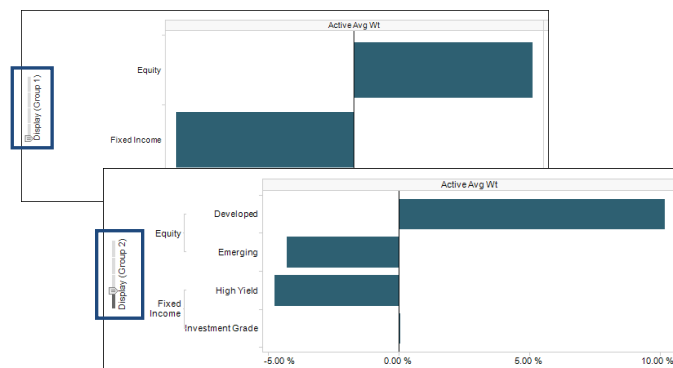
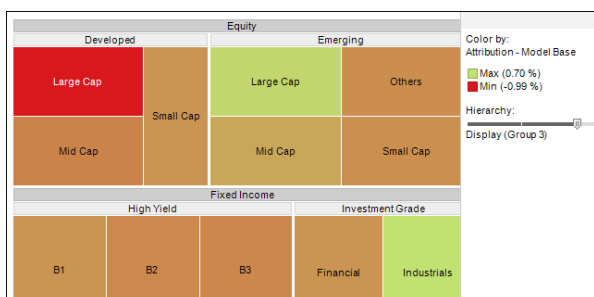
Controls for Multi-Level Dashboards

The Visualization dashboards in BarraOne Performance Analytics are interactive and can be used to view, analyze, and communicate the complexity of the attribution results produced very efficiently.

There are hierarchy sliders in many of the tables. These can be used to expand and collapse the number of levels of data displayed in each table. The example below shows a table that has been expanded using the hierarchy slider (highlighted in blue) to display results at over the first 2 levels from the multi-asset class grouping scheme.

Group 1	Group 2	Portfolio Average Weight	Benchmark Average Weight
Equity	TOTAL	47.43 %	41.69 %
	Developed	44.56 %	34.41 %
	Emerging	2.87 %	7.16 %
Fixed Income	TOTAL	52.51 %	58.24 %
	Investment Grade	32.61 %	32.58 %
	High Yield	19.84 %	24.59 %
TOTAL	-	100.00 %	100.00 %

There are also hierarchy sliders in many of the treemaps and charts. These operate in much the same way as hierarchy sliders for tables, and they are used to set the number of levels displayed. The additional feature for treemaps is that once a group selected in the treemap is selected it will affect the data displayed in charts linked to that treemap.



To avoid the charts becoming overloaded with information as more data is added as you zoom into each subsequent level, advanced filters are provided to be used in tandem with the dashboards.

List filters (left) can be used to isolate a single group at a particular level. This is very useful for stepping into the data for a particular group and investigating results at subsequent levels. Group filters (right) can be used to remove particular groups in the corresponding charts.

Filters

Type to search filters

Group 1

Type to search in list

(All) 3 values

Equity

Fixed Income

TOTAL

Filters

Type to search filters

Group Attribution

Display

☐ Cash

☒ Equity

☒ Developed

☒ Emerging

☒ Large Cap

☒ Mid Cap

☒ Others

References

BarraOne Performance Analytics Handbook; <https://support.msci.com/docs/DOC-4040>

BarraOne Performance Analytics Visualization Handbook; <https://support.msci.com/docs/DOC-8651>

Brinson, G., and Fachler, N., "Measuring Non-U.S. Equity Portfolio Performance," *Journal of Portfolio Management*, Spring 1985, pp. 73-76

Performance Attribution of Multi-Asset Class Portfolios Using BarraOne Webinar;
<https://support.msci.com/videos/1569>

Performance Attribution of Multi-Asset Class Portfolios Using BarraOne Webinar Slides;
<https://support.msci.com/docs/DOC-10464>

Multi-Portfolio Attribution Across all Asset Classes, Strategies, Managers and Fund-of-Funds using BarraOne Webinar; <https://support.msci.com/videos/1579>

Multi-Portfolio Attribution Across all Asset Classes, Strategies, Managers and Fund-of-Funds using BarraOne Webinar Slides; <https://support.msci.com/docs/DOC-10884>

CONTACT US

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
Sao Paulo	+ 55 11 3706 1360
Toronto	+ 1 416 628 1007

EUROPE, MIDDLE EAST & AFRICA

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800 91 59 17 *

ASIA PACIFIC

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
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