The Flametree Hybrid Performance Attribution model

Contents

OVERVIEW

This paper presents an attribution model that meets all the requirements of the vast majority of fixed income, equity and balanced portfolio managers. The Flametree Hybrid Performance Attribution (FHPA) model blends bottom-up and top-down approaches to attribution with unprecedented levels of flexibility, allowing precise tailoring of attribution reports to the investment process.

The algorithms behind FHPA encapsulate many years of experience and feedback from a wide range of portfolio managers, and represent a 'best of breed' approach to performance attribution.

The FHPA model is designed to work with a wide range of asset classes, including equity, fixed income, derivatives (IR, currency, equity and credit), and funds of funds. Other asset types, such as real estate and unlisted, can also be handled if the attribution model is suitable.

The Flametree Attribution program implements the FHPA model in code as a library, which may be called from a wide range of languages, as well as via a RESTful Web API. Sections labelled 'Implementation' below indicate ways in which the program can be configured to offer the functionality described.

INTRODUCTION

FHPA satisfies three core requirements:

- Outperformance is decomposed by source of risk in the portfolio.
- The sum of all performance drivers equals the overall return. Unexplained return is minimised.
- The reported performance risk factors are the same as those used when making investment decisions. Attribution reports can always be tailored to match the investment process.

The last requirement is worth expanding further. There are as many investment processes in use in the market as there are investment managers. In particular, there is no such thing as a 'one size fits all' model.

Instead of trying to impose a model on its users, FHPA supplies a number of process building blocks that allow the attribution analysis to be precisely matched to the requirements of the manager and the target audience, both in terms of the depth of analysis, and the factors used. Further, by using modern software techniques, it is straightforward and quick to reconfigure and (if necessary) recompute a report with different assumptions about the model and granularity of results.

Some attribution models, such as the Brinson approach, are cast in terms of a portfolio's outpeformance against a benchmark. Other approaches allow the return of an individual security to be decomposed by source of risk. For this reason, some attribution approaches require a benchmark, while others allow the returns of portfolio and benchmark to be decomposed separately and only compared at the end of the analysis. Throughout this document we indicate where a benchmark is required for attribution.

The Brinson family of models require a sector classification such that each security in the portfolio and benchmark falls into exactly one category. We refer to such sector classifications as *partitions* throughout this document.

The FHPA model decomposes portfolio returns into the categories shown in Figure 1. Each category is described further below.

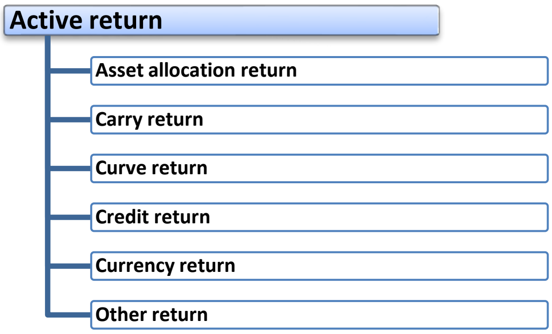


Figure 1: Top-level decomposition of active portfolio return effects

ASSET ALLOCATION ATTRIBUTION

OVERVIEW

Asset allocation attribution decomposes the active return of a portfolio against its benchmark in terms of two types of decision: *asset allocation* and *stock selection*.

Asset allocation is measured at the sector level. It measures the outperformance made by over- or underweighting individual portfolio sectors against the benchmark. The Brinson-Fachler attribution model measures excess return made in this way as

$$r_{AA} = \sum_s (w_s^P - w_s^B) \times (r_s^B - r^B)$$

where w_s^P and w_s^B are the weights of sector s in the portfolio and benchmark, respectively, r_s^B is the return of sector s in the benchmark, and r^B is the overall return of the benchmark.

Stock selection can be measured at the security level but is often aggregated to the same sector level as asset allocation returns. Stock selection measures the value made by investing in individual securities within a sector, rather than broader sector-level decisions. It is measured as

$$r_{SS} = \sum_s w_s^B \times (r_s^P - r_s^B)$$

The sum of these two terms does not equal the overall outperformance of the portfolio against the benchmark, and the difference is usually referred to as an *interaction* effect, given by

$$r_I = \sum_s (w_s^P - w_s^B) \times (r_s^P - r_s^B)$$

so that the portfolio's active return equals the sum of these three terms:

$$\sum_s w_s^P r_s^P - \sum_s w_s^B r_s^B = r_{AA} + r_{SS} + r_I$$

The interaction term does not have a straightforward physical interpretation. It is often combined with the stock selection term to give

$$r_{SS} = \sum_{s} w_s^P \times (r_s^P - r_s^B)$$

The Brinson-Hood-Beebower model measures asset allocation term in a slightly different manner:

$$r_{AA} = \sum_{s} (w_s^P - w_s^B) \times r_s^B$$

For cases where several levels of asset allocation decision are active, the Brinson model can be extended using *recursive allocation*. Once asset allocation returns have been calculated at the highest level, the process is repeated recursively at lower levels, treating each sector as a portfolio in its own right. As with the single-level Brinson model, the sum of the asset allocation returns, stock selection and interaction returns equals the overall active return.

The Brinson model runs in a top-down manner as it assumes investment decisions are initially made at a broad sector level, with further asset allocation and stock selection decisions at progressively more granular levels. For this reason, Brinson attribution is a *top-down* attribution process. In contrast, fixed income attribution returns are usually calculated at the security level and aggregated upwards. For this reason, fixed income attribution is a *bottom-up* attribution process.

IMPLEMENTATION

The FHPA model allows one or more sectors to be selected for Brinson attribution by assignment to the `BrinsonAllocationSectors` parameter. If this parameter is not set, or its value is blank, no asset allocation or stock selection return is calculated, and all return is treated as residual. If set, its value should be one or more existing sector classification names, separated by commas. For instance,

```
BrinsonAllocationSectors=CURRENCY
```

generates a single-level Brinson attribution report, using `currency` as the sector classification, while

```
BrinsonAllocationSectors=CURRENCY,COUNTRY,INDUSTRY
```

generates a three-level recursive Brinson attribution report, using `currency`, `country` and `industry` as the sector classifications.

Interaction return is displayed as a separate source of return if the `Interaction` switch is set to True.

The Brinson-Fachler model is selected if the `BrinsonModel` parameter is set to a value of `BF`, or is left unset. The Brinson-Hood-Beebower model is selected if this parameter is set to `BHB`.

HYBRID ATTRIBUTION

The Brinson top-down model may be combined with a bottom-up fixed income analysis to provide a *hybrid* attribution analysis – for instance, to assess the returns of a multi-currency bond portfolio in which an asset allocation decision was made by country, and then each country's fixed income exposures were managed according to local conditions. To set up such an analysis, set `BrinsonAllocationSectors=Country`, and then set up fixed income attribution as described in the following sections. The report will then show return due to both asset allocation and to fixed income risks.

The reader should note that the introduction of top-down attribution into what was previously a bottom-up analysis can substantially change its results.

CARRY ATTRIBUTION

OVERVIEW

Carry return is generated by the passage of time and arises from the payment of coupons and forthcoming payments at preset prices, such as maturity redemptions.

The FHPA model calculates carry return by generating a yield to maturity (YTM) for each security. Carry return is then calculated as the YTM, times the length of the calculation interval as a fraction of a year:

$$r_{carry} = y \cdot \delta t$$

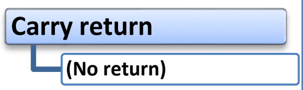
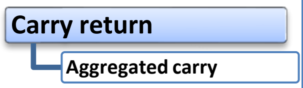
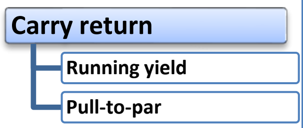
For instance, the aggregated carry return r_{carry} of a bond with a YTM of 5% over a month is

$$r_{carry} = 0.05 \times \frac{1}{12} = 0.00417 = 41.7\ bp$$

IMPLEMENTATION

The FHPA model measures daily carry return at the security level, and aggregates return to provide carry return at the sector and portfolio levels. Active carry return may then be calculated by measuring the difference between portfolio and benchmark carry at these levels.

Security-level carry return may be measured and decomposed in the following ways:

Analysis	FHPA settings	Description	Decomposition graph
No measurement	CarryDecomposition =NONE	Carry return is assumed to be zero. If the portfolio generates any carry return, it is assigned to residual. $$r_{carry} = 0$$	
Aggregated carry	CarryDecomposition =AGGREGATED	All carry return is treated as a single source of return: $$r_{carry} = y \cdot \delta t$$	
Pull-to-par and running yield	CarryDecomposition =PULL_TO_PAR	Carry return is decomposed into instantaneous return (or running yield) arising from coupons, and pull-to-par return, driven by the movements in the price of the security from its current level to the maturity payment level. The sum of the two is the overall carry return: $$r_{carry} = \left(\frac{c}{p} + y_{ptp}\right) \cdot \delta t$$ where c is the security's coupon, p its clean price, y_{ptp} its yield due to pull-to-	

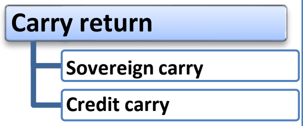
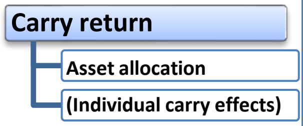
		par effects, and δt the width of the calculation interval.	
Curve carry and credit carry	CarryDecomposition =CREDIT_CARRY	Curve carry return is the carry that the security would have made if it were risk-free. Credit return is generated when the security pays a higher yield than a risk-free security. The sum of the two is the overall carry return: $$r_{carry} = \left(y_{risk-free} + y_{credit\ spread}\right) \cdot \delta t$$	
Carry asset allocation and stock selection	CarryDecomposition= [decomposition] CarryAllocationSectors= [partition names]	The FHPA model also allows active carry return to be decomposed into asset allocation and stock selection (security-specific) returns, using the multi-level Brinson model, independently of other sources of risk in the portfolio. This allows, for instance, detailed analysis and feedback on a high yield strategy that holds assets generating a higher yield than the benchmark.	

Table 1: Attribution on carry return

CURVE ATTRIBUTION

OVERVIEW

Curve return is generated by movements in the risk-free curve that underpins the prices of all fixed income securities held in the portfolio. Curve return is usually one of the major drivers of return in any fixed income portfolio.

BOTTOM-UP CURVE ANALYSIS

Curve return r_{curve} for a single security is approximated by the expression

$$r_{curve} = -MD \times \delta y + \frac{1}{2} \times C \times \delta y^2$$

where δy is the change in the security's risk-free yield over the calculation interval, MD its modified duration, and C its convexity.[1]

IMPLEMENTATION

The FHPA model allows sovereign curve movements to be decomposed using any of the settings shown in Table 2.

[1] For a derivation of this equation, see 'Mastering Attribution in Finance', Colin, A.M., Pearson/FT Press, 2016.

Analysis	FHPA setting(s)	Description	Decomposition graph
No measurement	*SovereignCurve Decomposition =NONE*	Curve return is assumed to be zero. If the portfolio generates any carry return, it is assigned to residual.	**Curve return** – **(No return)**
Aggregated curve	*SovereignCurve Decomposition =AGGREGATED*	All curve return is treated as a single source of return. No decomposition of δy is performed.	**Curve return** – **Aggregated curve**
Duration and curve reshape	*SovereignCurve Decomposition =DURATION* *See also AverageCurveLevel, ShiftMaturity*	Curve movements are described as a parallel shift in the yield curve and a curve reshaping, equivalent to the change in shape of the yield curve, after this shift is discounted.	**Curve return** – **Duration return** – **Curve reshape return**
Shift, twist, butterfly	*SovereignCurve Decomposition =STB* *See also AverageCurveLevel, LowerTwistMaturity, UpperTwistMaturity, ShiftMaturity*	Curve return is assumed to be generated by a parallel shift in the yield curve, plus a steepening or flattening in the yield curve, plus a reshaping effect, typically a torsion movement. Twist is measured as the change in slope of a straight line drawn between the value of the curve at two user-selected maturities, typically 3 and 10 years.	**Curve return** – **Shift** – **Twist** – **Curvature**
PCA (Principal component analysis)	*SovereignCurve Decomposition =PCA*	Movements in the yield curve are decomposed using principal component analysis. The first eigenfunction is treated as parallel shift, the second as twist motion, and the third as curvature movement in the yield curve.	**Curve return** – **Shift** – **Twist** – **Curvature**
KRD (Key rate duration)	*SovereignCurve Decomposition =KRD* *See also KRDList*	Movement in the curve are decomposed in terms of movements at given tenor points. These can be specified by the user using the KRD flag.	**Curve return** – **0.5 year** – **1 year** – **2 year** – **5 years** – **10 years**
CCB (Colin-Cubilie-Bardoux)	SovereignCurve Decomposition =CCB	Similar to STB model, except that the twist movement is measured by a curve fit rather than using a pre-defined pair of maturities.	**Curve return** – **Shift** – **Twist** – **Curvature**
Duration allocation attribution	SovereignCurve Decomposition =[decomposition] CurveAllocationSectors =[partition names]	Described in the section 'Top-down curve analysis' in this document.	

Table 2: Attribution on curve return

TOP-DOWN CURVE ANALYSIS

The FHPA model also allows curve return to be decomposed using a *duration allocation* model.

The Brinson model measures the effects of over- or under-weighting particular sectors in the portfolio and benchmark. Active market weights are combined with the observed returns of each sector to generate the overall outperformance of the portfolio in terms of contribution from each sector.

However, this approach completely ignores interest rate risk. If a portfolio has equal allocations to one-year bank bills and 30-year treasuries, a market weight approach treats the two asset classes as equal, despite their very different durations and probable contributions to return.

The duration allocation model is formally similar to the Brinson model, but instead of using market weights, it uses duration weights (or contribution to duration) in place of market weights, and yield change in place of return. If the manager has pursued a strategy of overweighting the portfolio's duration contribution by currency, then a duration allocation attribution that decomposes returns in the same way will provide immediate feedback on the value generated by this strategy. Similarly, a strategy of overweighting particular regions on the yield curve can also be assessed.

The duration allocation return for a sector s is given by

$$r_s^{DAA} = -(w_s^P MD_s^P - w_s^B MD_s^B) \times (\delta y_s^B - \delta y^B)$$

and the duration stock selection return for the same sector by

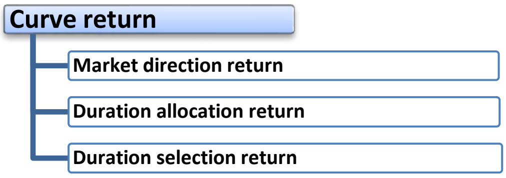
$$r_s^{DSS} = -w_S^P \times MD^P \times (\delta y_s^P - \delta y_s^B)$$

Note that this expression assumes that all curve return is generated by a single source of risk. If a different curve decomposition has been selected, then this analysis will generate a duration selection return for each risk. For instance, setting `SovereignCurveDecomposition=STB` will result in three selection returns: one for shift, one for twist, and one for curvature.

A duration allocation analysis generates results that look superficially similar to a Brinson analysis, with asset allocation and stock selection returns displayed at the sector level. However, the underlying weights are returns are entirely different from the corresponding quantities used in a conventional Brinson analysis, and a third source of return is present called market direction effect, arising from the extra degree of freedom that arises from possibly different durations between portfolio and benchmark. It is given by

$$r_s^{DIR} = -w_S^P \times \delta y^P \times (MD^P - MD^P)$$

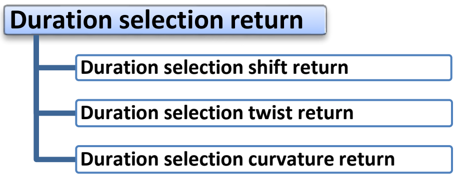
When a duration allocation model is in use, curve returns are decomposed into the following three sources of return:



In addition, duration selection return is decomposed according to the curve decomposition option selected. For instance, if curve returns are decomposed into (shift, twist, curvature) returns by setting

```
SovereignCurvedecomposition=STB
```

then the duration selection return will made up of three sub-returns:



The FHPA allows one or more sectors to be selected for duration allocation attribution by assigning a value to the `CurveAllocationSectors` parameter. If this parameter is not set, or its value is blank, then curve return is treated as a bottom-up source of return. If set, its value should be one or more existing sector classification names, separated by commas. For instance,

```
CurveAllocationSectors=MATURITY
```

instructs FHPA to use the existing curve returns in a duration allocation analysis where the sectors are maturity buckets.

CREDIT ATTRIBUTION

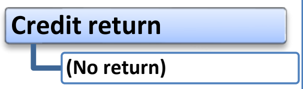
OVERVIEW

Credit return is generated by movements in the spread between a security's yield and the yield an identical risk-free security would make, as well as movements between risk-free curves and credit or country curves.

Credit return is often used as a 'catch-all' for return that does not fall into other categories.

IMPLEMENTATION

The FHPA model allows credit return to be decomposed in the following ways:

Analysis	FHPA settings	Description	Decomposition graph
No measurement	(No setting)	Credit return is assumed to be zero. If the portfolio generates any carry return, it is assigned to residual. $$r_{carry} = 0$$	

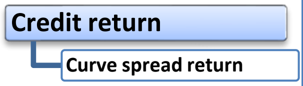
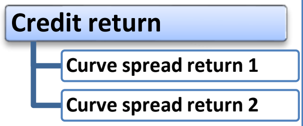
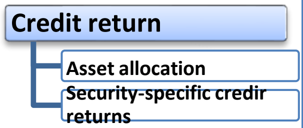
Curve spread return	Curves field must hold at least two curve names	If a credit curve is supplied in the CURVES field in the security's master record as well as a risk-free curve, then $$r_{curve} = -MD \cdot \delta y_{spread}$$ Any return generated by changes in spread between the second curve and the security's yield is assigned to residual.	
Multiple curve spread return	Curves field must hold at least three curve names	Returns generated by movements between successive curves are measured as for the single credit curve case.	
Credit asset allocation and stock selection	CreditAllocationSectors = [partition names]	The FHPA model also allows active credit return to be decomposed into asset allocation and stock selection (security-specific) returns, using the multi-level Brinson model, independently of other sources of risk in the portfolio. This allows, for instance, detailed analysis and feedback on a credit portfolio where the user has overweighted credit exposures by sector or county.	

Table 3: Attribution on credit return

TOP-DOWN CREDIT ANALYSIS

Return generated by credit spreads can also be decomposed using a duration allocation approach, as detailed in the previous section. The algorithm is identical, except that we use option-adjusted spread durations (OASD) in place of modified duration, and changes in the credit spread in place of changes in the risk-free rate.

DURATION-TIMES-SPREAD

A refinement of the spread duration allocation model is the *duration-times-spread* model, or DTS. This is based on the observation that the volatility of a corporate bond is proportional to the product of its spread duration and its spread. This quantity is called, naturally enough, duration times spread, or DTS.

It is typically much more straightforward to work with durations and spreads than with volatilities, so this measure is a popular metric with which to measure portfolio risk.

Assuming that the market spread S is available, we can write the credit spread return r of a bond as

$$r = -SMD \times S \times \frac{\delta y}{S}$$

This reduces to

$$r = -DTS \times \overline{\delta y}$$

where

$$DTS = SMD \times S$$

and

$$\overline{\delta y} = \frac{\delta y}{S}$$

where SMD is the bond's spread duration, δy its change in spread yield, and $\overline{\delta y}$ its relative change in spread against the actual spread, rather than the absolute change in spread used previously. Using this transformation allows us to rewrite the duration allocation equations as follows:

The *DTS market direction return* is given by

$$r^{MD} = -(SMD^P - SMD^B) \times \overline{\delta y^B}$$

where $\overline{\delta y^B}$ is the overall change in yield for the entire benchmark, and SMD^P and SMD^B are the spread durations for the portfolio and benchmark respectively.

The *DTS allocation return* for each sector s is given by

$$r_S^{AA} = -(w_s^P \times DTS_s^P - w_s^B \times DTS_s^B) \times \left(\overline{\delta y_s^B} - \overline{\delta y^B}\right)$$

where $\overline{\delta y_s^B}$ is the change in benchmark yield for sector s, and DTS_s^P and DTS_s^B are the values of DTS for sector s in the portfolio and benchmark respectively.

Lastly, the *DTS selection return* for each sector s is given by

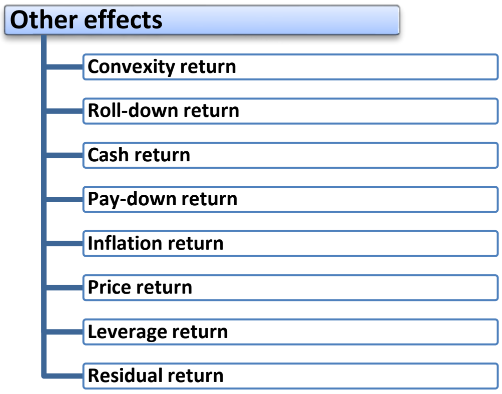
$$r_s^{SS} = -w_s^P \times DTS_s^P \times \left(\overline{\delta y_s^P} - \delta y_s^B\right)$$

When spreads are very low, the relationship between spreads and volatility has been observed to break down. To handle this case, we impose a *DTS floor*. If the value of DTS falls below 0.001 $(years \times \%)$, it is set to 0.001 in the same units.

To run a DTS analysis on your portfolio,

- set `SpreadAllocationSectors` to the names of the sectors you wish to use in your analysis;
- set the DTS switch to 'true'.

OTHER EFFECTS



CONVEXITY RETURN

Convexity return is generated by nonlinearity in the relationship between movements in a security's yield and its price. When this option is active, the variation of a security's price in response to changes in its yield is decomposed into linear and non-linear components, with the non-linear component aggregated over all movements and labelled as convexity return.

ROLL-DOWN RETURN

Rolldown return is that portion of return generated by a sloped yield curve. If market conditions remain unchanged over a year and the yield curve shows a slope of 10 bps points per year, then the yield of a security priced off that curve will have decreased by 10 bp over the year, with a corresponding increase in price, and hence return. Over an arbitrary calculation interval, rolldown return $r_{rolldown}$ is given by

$$r_{rolldown} = -MD \times \delta y_{rolldown}$$

where

$$\delta y_{rolldown} = Y^t(m_1) - Y^t(m_0)$$

and Y^t is the yield curve at time t, and m_0 and m_1 are the security's maturities at the start and end of the calculation interval, respectively.

CASH RETURN

Cash return is generated by interest paid on cash deposits. Rates of return are specified in a risk function, which either uses an externally supplied rate, or a rate read at a given tenor from the market yield curve. Given a cash rate i_{cash} and an interval δt, the return from cash r_{cash} is given by

$$r_{cash} = i_{cash} \times \delta t$$

PAY-DOWN RETURN

Pay-down return is generated when an amortizing security pays back its capital faster than anticipated in the amortizing schedule. Paydown return r_p is given by

$$r_p = \frac{100 - P}{p} \times \delta f$$

where P is the security's market price, and δf is the change in the amount outstanding on the security's capital.

If the security is trading at a premium ($P > 100$), paydown of principal generates a loss. The converse applies if the security is trading at a discount.

INFLATION RETURN

Inflation return is generated by the indexation of an inflation-linked bond's cash flows to an underlying index.

The simplest way to calculate this return $r_{inflation}$ is to find the value of the appropriate inflation index R at the beginning and end of the calculation interval $[t-1, t]$, and to set the inflation return to be the fractional increase in this quantity. Equivalently,

$$r_{inflation} = \frac{R^t}{R^{t-1}} - 1$$

PRICE RETURN

Price return is generated by using different valuations $P_{portfolio}$ and $P_{benchmark}$ for the same security held in the portfolio and the benchmark. Pricing differences can arise because the security is valued at different times of day, or because of different assumptions in pricing models.

Price return r_{price} is given by

$$r_{price} = \frac{P_{portfolio} - P_{benchmark}}{P_{benchmark}}$$

Pricing return is always zero for securities that do not occur in both the portfolio and the benchmark. Where it does occur, the FHPA model assumes the benchmark price is the correct one, and assigns any price return to the portfolio.

LEVERAGE RETURN

In some circumstances, a portfolio may be leveraged so that the effect of changes in the prices of its securities are amplified. For instance, a portfolio containing bond futures in which the value of the cash assets held is half that of the nominal exposure of the futures assets has a leverage of 2. Flametree Attribution allows leverage to be measured as an amplification of returns on risk from existing assets, or as a source of return in its own right.

RESIDUAL RETURN

Residual return $r_{residual}$ is defined as return that has not been generated by any other measured source of return. It is calculated as the difference between the known market rate of return r_{market} and the sum of all other calculated returns:

$$r_{residual} = r_{market} - (r_{carry} + r_{curve} + r_{credit} + \cdots)$$

CURRENCY RETURN

FHPA uses a simple currency attribution model, in which the returns due to exchange rate fluctuations are reported separately. Base currency returns are therefore shown as an FX return, plus a local currency return, which is decomposed further as shown above. A Karnosky-Singer currency attribution model is in development.

REALLOCATION OF RISK

The FHPA model offers an extremely flexible approach to relabelling risk, including

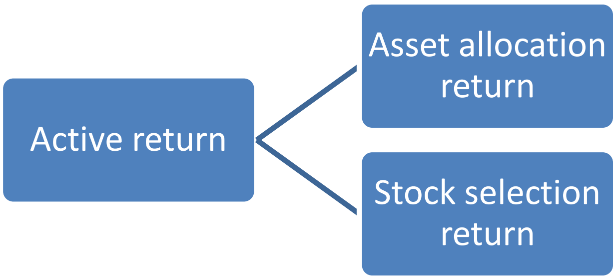
- assignment of returns from one source of return to any other, including residuals, at the portfolio, security and risk levels
- return can be relabelled at the security level. For instance, an IRS can have all its return assigned to duration return
- residuals can be relabelled using custom categories. For instance, return from CDS can be directed to a new category called 'CDS return'.

APPENDIX A: ATTRIBUTION MODELS

EQUITY ATTRIBUTION

DESCRIPTION

This model implements standard Brinson attribution.



IMPEMENTATION

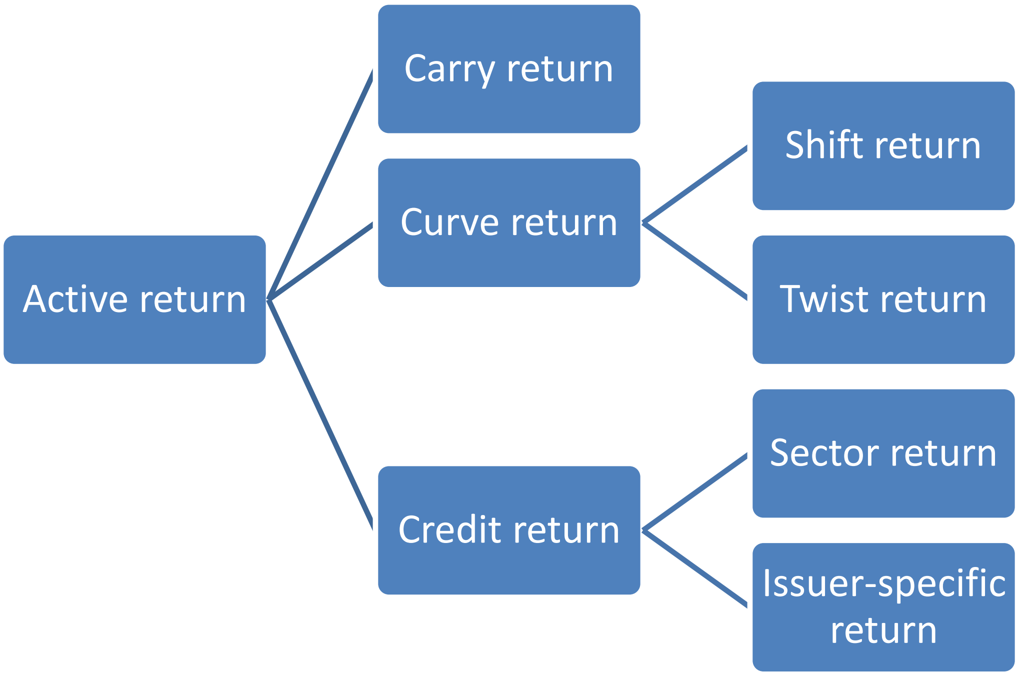
To implement this model, use the following settings:

Setting and value	Comments
CarryDecomposition=none	No carry decomposition is performed
CurveDecomposition=none	No curve decomposition is performed
BrinsonAllocationSectors=industry	Asset allocation attribution uses the industry sector
ResidualReturnLabel=Stock selection	After calculating return due to asset allocation, and the remainder will be assigned to residual, which is labelled stock selection.

TIM LORD ATTRIBUTION

DESCRIPTION

This model forms the basis of several commercial systems, including FactSet and Bisam's B-One. The model is based on a paper published by Lord in 1997. The model is bottom-up, with curve returns generated by parallel shifts and curve reshaping movements, and spread return decomposed into sector allocation returns and issuer-specific returns. FX returns are not specifically mentioned.



IMPEMENTATION

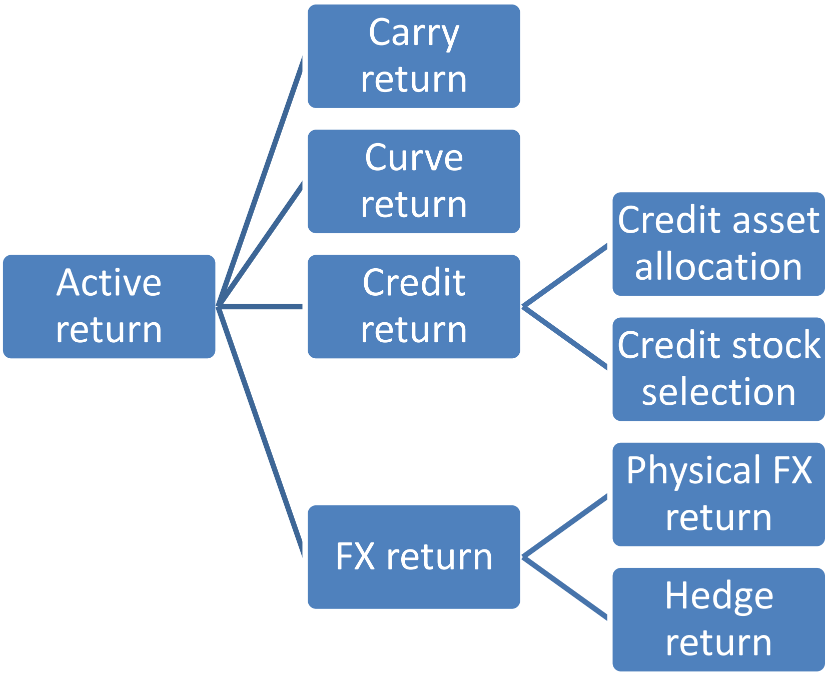
To implement this model, use the following settings:

Setting and value	Comments
CarryDecomposition=aggregated	All carry return is reported as a single source
CurveDecomposition=duration	Curve return is decomposed into parallel shift and curve reshaping components
ResidualAllocationSectors=Sector	This setting decomposes the portfolio's residual return, which contains the actual active return, using a Brinson analysis, with the name of each security's sector as the classification. Note that all residual return will be assigned to 'issuer-specific return'.

GLOBAL CREDIT PORTFOLIO

DESCRIPTION

This portfolio generates return by investing in corporate bonds. Returns are generated from credit spread compression and stock picking. Interest rate risk and FX risk are fully hedged. Credit returns are decomposed using Brinson decomposition, with 'industry' as the sector classification.



Carry return and curve return are shown in the report at the aggregate level, to verify that these sources of risk are not generating any active return.

The FX returns of the portfolio and its hedge are shown to verify that the hedge is working correctly.

IMPEMENTATION

To implement this model, use the following settings:

Setting and value	Comments
CarryDecomposition=aggregated	All carry return is reported as a single source
CurveDecomposition=aggregated	All curve return is reported as a single source
ResidualAllocationSectors=Curve	This setting decomposes the portfolio's residual return, which contains the actual active return, using a Brinson analysis, with the name of each security's curve as the sector classification. The attribution report will therefore replace 'credit return' with 'curve allocation return' and 'stock-specific return', where 'curve allocation return' measures the return generated by over or underweighting exposures to particular credit curves. Note that this can give different results to a true bottom-up attribution that

	measures returns generated by movements between risk-free and credit curves.

To ensure that the hedge return appears in a separate reporting category, we suggest treating all hedge instruments as cash securities, and setting their ‘residual sector’ in the security master file to ‘Hedge instrument’. The FX return from the hedge will then appear in a separate reporting column called ‘Hedge instrument’. If hedging has been performed correctly, this return should be equal and opposite to the FX return of the portfolio.