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ALLOCATION ATTRIBUTION WITH FIA

FLAMETREE TECHNOLOGIES PTY LTD

Introduction

FIA is a powerful and flexible tool for running bottom-up attribution on fixed income portfolios of all types. But the program also offers a wide range of top-down attribution options, such as

- multi-level Brinson attribution on equity portfolios;
- hybrid attribution for balanced portfolios, in which equity and fixed income risks are measured in the same report;
- Brinson attribution on carry or credit return;
- duration allocation on curve and spread returns, including Duration-Times-Spread (DTS) analysis.

This paper provides a brief overview of FIA's allocation-driven attribution capabilities. For more detailed information on the algorithms employed, please refer to Flametree's documentation wiki at `www.flametreetechnologies.com`.

Partitions

Allocation attribution is based on the idea of a *partition*. A partition simply classifies a security as being of a particular type. For instance, a security might be classified by country, industry type or sector group.

A partition can be used to measure the effects of asset allocation decisions. Consider a partition based on country of issuance. If a manager decides to overweight stocks from a particular country in her portfolio, an asset allocation analysis based on that partition can then calculate and compare the weight of that country in the portfolio compared to that of the benchmark, and thus measure how much additional return was generated by taking this decision.

FIA defines a partition by assigning a header and a set of values to each security in the portfolio and the benchmark. The header is the name of the partition, and the value shows what name that header takes for the current

security. To illustrate, a security's country of issue is used as a partition by setting up a string of the form

Country=US

in the classification field in the security master file.

FIA allows you to set up as many partitions as you like, in any order. For instance, to set up partitions for country, industry type and sector type, enter

Country=US | IndustryType=Transport | SectorGroup=Airline

into the security's classification field. If a classification value is missing, FIA assigns a value of 'unknown'.

FIA sets up some partitions automatically based on security master data, including currency, credit rating, duration and maturity buckets. Duration and maturity bucket holdings are calculated taking into account the passage of time and changes in market conditions.

Partitions can also be used for reports. For more on this topic, please refer to our wiki.

Running Brinson attribution

Once your partitions are set up, assign the name of the partition you want to use for attribution to *BrinsonAllocationSectors* in the configuration file. For instance,

BrinsonAllocationSectors=Country

will use *Country* as the basis for a Brinson attribution analysis.

Equity securities do not generate return from any of the usual sources of fixed income return. FIA therefore allocates all their return to *residual*. In an equity context, residual return should be labelled as stock selection, so override the default value of *ResidualReturnLabel*:

ResidualReturnLabel=Stock selection

Be aware that FIA's performance reports will now only show active return, rather than absolute and relative portfolio and benchmark return. A portfolio's asset allocation

return is only defined relative to a benchmark, so in this case only active attribution return has meaning.

If you choose to run Brinson attribution, the overall active return of the portfolio against the benchmark is unchanged. Brinson attribution simply decomposes returns in a new way, without affecting the overall return.

Multi-level Brinson attribution

Portfolio managers often make asset allocation decisions at several levels. For instance, an investment committee might decide how much capital to invest in different geographical regions, leaving individual managers to decide on allocation by industry sector or country. In this case, the Brinson model will measure the return generated by each level of decision.

To model this process in FIA, simply provide the names of the relevant partitions in the required order, separated by commas. For instance, if the first decision level is *Country* and the second is *Sector*, enter

BrinsonAllocationSectors=Country, Sector

in the configuration file. FIA will then generate an attribution report with returns due to country allocation, sector allocation and stock selection. There is no limit to how many classification levels can be used, although it is unusual to use more than three or four in an attribution analysis.

Variants of the Brinson model

FIA supports two variants of the Brinson allocation algorithm: Brinson-Fachler (BF) and Brinson-Hood-Beebower (BHB). To set up the version you require, *BrinsonModel* to *BF* or *BHB* in the configuration file. If you leave this variable undefined, FIA uses Brinson-Fachler attribution by default.

Interaction attribution

FIA also calculates interaction return, if required, by setting

InteractionAttribution = true

This switch allows you to display interaction return separately, or to combine it with stock selection return.[1] If *InteractionAttribution* is active, interaction return is shown as a separate source of return in all your reports.

[1] Combining interatction with stock selection is sometimes known as the Parilux approach. See equation 3.17, 'Mastering Attribution in Finance', Colin, A., 2016., Pearsons

Hybrid attribution for fixed income portfolios

In some cases, a fixed income portfolio manager may make a combination of top-down asset allocation decisions together with decisions around curve movements and credit spreads. For instance, a global fixed income fund manger might make an asset allocation decision by country, as well as positioning assets in each country against expected credit spread movements.

FIA makes this case straightforward to model. Simply assign the name of a partition to *BrinsonAllocationSectors*, just as for an equity portfolio. Your attribution report will now show an additional source of return due to asset allocation, in addition to the usual sources of fixed income return. Note that fixed income returns will be adjusted to take this new source of return into account. Also, attribution reporting will only show active portfolio return, rather than absolute portfolio and benchmark return.

Hybrid attribution supports multiple levels of asset allocation decisions, and all the other features described above.

Brinson attribution on fixed income subreturns

In some cases, you may wish to apply Brinson attribution to particular sources of return, while leaving other returns untouched. For instance, one variant of the Campisi fixed income model suggests applying asset allocation at-

tribution to bond credit returns, while leaving return due to carry and risk-free curve movements unchanged.[2]

FIA supports this type of analysis on both carry return and credit returns, at multiple levels if required, by using the *CarryAllocationSectors* or *ResidualAllocationSectors* variables.[3]

[2] 'Primer on Fixed Income Performance Attribution', Campisi,S., Journal of Performance Measurement, June 2000

[3] Note that this type of analysis cannot be combined with a full Brinson analysis. Also, FIA does not calculate interaction return for such subreturns.

Duration allocation attribution

Brinson attribution measures the effect of over or underweighting portfolio sectors against benchmark, Here, weight means market weight. However, there are other ways to define the exposure of a sector, of which the most widely used is duration weight, or interest rate exposure.

A manager may decide to assign extra duration weight to a particular market sector, in which case its exposure to changes in interest rates will be higher than the corresponding sector in the benchmark. If interest rates fall in that sector, the decision to add duration weight will generate outperformance.

Duration allocation attribution (or DAA) is a technique to measure the returns generated by this type of strategy. While DAA has clear parallels with Brinson attribution, there are some extra complications that arise from the additional degree of freedom available in taking duration decisions. In particular, the market allocation of portfolio and benchmark must always be one, but there is no such constraint on the durations of portfolio and benchmark, which can have any value.

The result is that three types of return arise in a duration allocation analysis:

- Market direction return
- Duration allocation return
- Stock selection return

Just as for Brinson attribution, existing curve returns are assigned to stock selection and are rescaled. For instance, if you previously measured the effects of shift and twist movements in the curve, then overlaying a DAA analysis will rescale the overall return from curve movements into

return from market direction, duration allocation, and shift and twist returns.

Setting up such an analysis in FIA is straightforward. For duration allocation, set the variable *CurveAllocationSectors* to one or more partitions. For instance, to use duration buckets for DAA, set

CurveAllocationSectors=Duration

in the configuration file.

Duration allocation attribution only applies to returns generated by movements in yields. Returns due to carry, or FX returns, are unaffected. It is therefore possible to run Brinson attribution on carry returns, and duration allocation attribution on curve returns, in the same analysis.

Spread duration attribution

Spread duration attribution works in a very similar way to duration allocation attribution. The main difference is that returns are generated by changes in security spreads, rather than by movements in the underlying curve.

To run a spread duration analysis, set *SpreadAllocationSectors* to one or more partitions. To convert a spread duration analysis to a duration-times-spread (DTS) analysis, set

DTS=true

If required, duration allocation and spread duration allocation attribution can be combined in the same reports.

Summary

FIA supports five types of allocation attribution:

- Brinson (includes hybrid)
- Carry allocation
- Credit allocation

- Duration allocation
- Spread allocation (includes DTS)

FIA allows either

- Brinson attribution over all sources of return, *or*
- any combination of carry allocation, residual allocation, curve allocation and credit allocation.

In other words, Brinson attribution cannot be combined with any other allocation analysis.

Together, these cover all cases used in the marketplace.

Biography

ANDREW COLIN is founder and CEO of Flametree Technologies, a company that provides innovative performance and attribution software to fund managers of all sizes. He was previously Head of Fixed Income Research at StatPro Ltd, and has held positions in finance, academia and defence in the UK and Australia.

Andrew holds a PhD in applied mathematics from the University of St Andrews. He is a Fellow of the Institute of Mathematics and its Applications, and holds Chartered Mathematician (C.Math) accreditation.

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