From:	Steve Rich
To:	Sally Chan; James Cardamone
Subject:	Factset Attribution for the GFI Team: medium-term vision
Date:	Monday, September 25, 2017 12:05:28 AM
Attachments:	553 Ret Attr w Yld YTD June 2017.xlsx

Sally/James:

I wanted to offer a *medium-term* vision for Factset attribution in terms of how it is applied to GFI portfolios. Too many unknowns prevent me from outlining a *long-term* vision where we adopt a unified framework common to all portfolios. Overcoming roadblocks to executing a long-term vision require enhancements from Factset related to (a) the handling of off-benchmark sectors (specifically, mapping off-benchmark sectors to a relevant reference), (b) forecasting bank-loan yield, and (c) attributing excess returns against a hedged multi-currency benchmark. Since we cannot control how Factset prioritizes these enhancements, it is impossible to gauge when, if ever, a unified approach might be achievable.

Although a common standard is an admirable objective, its absence should not dilute the effectiveness and utility of the two deliverables that have arisen from your tremendous efforts:

* the four-factor (Shift, Twist, Allocation, Selection) framework for attributing excess return

* the five-factor (Shift, Twist, Yield, Spread, Currency) framework for parsing gross return

The one gap I am eager to fill over the medium-term is an approach for attributing excess return where the Allocation and Security Selection effects are spread-based, rather than returns-based, calculations. The five-factor gross-return model, which is a significant breakthrough, provides the foundation to develop a do-it-yourself (DIY) methodology for addressing the gap.

Before turning to the DIY methodology for spread-based attribution, let me make four observations:

- The existing four-factor (Shift, Twist, Allocation, Selection) framework is satisfactory for attributing excess return of *mostly high-yield portfolios* managed against *unhedged benchmarks*. With GFI's high-yield team comfortable with the format, I see limited upside from re-inventing the Allocation and Selection calculation schemes for high-yield portfolios.

- The local-currency four-factor framework with a currency-management footnote appears to be working well when attributing excess return of *mostly high-yield multi-currency portfolios* managed against *hedged multi-currency portfolios*.

- The five-factor (Shift, Twist, Yield, Spread, Currency) model for parsing gross return of unconstrained bond portfolios provides credible results. We achieved this milestone by re-sequencing the calculation scheme so Yield precedes Spread, thereby relegating Spread contribution-to-return to the residual position.

- In the realms of the core investment-grade, core-plus (CP), and core-plus opportunities (CPO) styles, a spread-based attribution of excess return would be a worthwhile addition to our tool kit.

With respect to the fourth bullet item, Factset's DTS attribution provides plausible results when a portfolio's constituents can be mapped to their respective benchmark sectors. Appending a sliver of a high-yield index to Barclays Aggregate helps facilitate the process for a mostly investment-grade account that migrates into high-yield. Similarly, appending a sliver of Barclays Securitized Index to a government/credit index facilitates analysis of a government/credit portfolio (long, standard, intermediate, and short) sporting off-index MBS and ABS positions. In fact, for our crossover (taxable / municipal mandates such as Georgia Power, combo-548), attaching a sliver of Barclays Municipal Index to Barclays Aggregate might be a workable option within the DTS framework.

The immediate downside to augmenting the policy benchmark to cover off-benchmark sectors is the "enhanced" report size, which could expand by hundreds to thousands of additional rows to accommodate all constituents of the "enhanced" benchmark. Moreover, core-plus opportunities (CPO) portfolios with bank loans and commingled funds are presenting insurmountable challenges in the DTS context due to (a) the inability to map the loans and funds to the high-yield sector, and (b) the challenges of conducting a spread-based analysis for loans and funds over their noisy data sets.

I believe we can pursue an alternate grassroots (DIY) pathway for a spread-based analysis of Allocation and Selection effects within the context of core, CP, and CPO styles. The scheme relies on spread change, rather than percentage spread change, to quantify Allocation and Selection; in other words, the analysis pivots on spread duration, not DTS. I prefer the simpler spread duration implementation for two reasons. First, a DTS return attribution is more difficult to interpret. Second, the spread-change approach (as opposed to the percentage spread change approach) does not explicitly reference option-adjusted spread, a quirky model-based characteristic that is fundamental to the DTS analysis, and which can be disruptive to sector-level results when the quirks express themselves.

Conceptually, the DIY spread-based attribution has three stages:

Stage 1: Analyze the portfolio's gross return with the five-factor (Twist, Shift, Yield, Spread, Currency) model (where Yield precedes Spread in the calculation sequence). From the security-level results, infer an implied spread move (ISM) for each of the portfolio's constituents using the following calculation:

ISM (in basis points) = -1 * contribution to return from Spread / duration-dollar exposure

In practice, the ISM implementation would look something like this:

ISM = -100 * Spread CTR / (0.01* average weight * spread duration)

We pre-multiply the numerator by 100 because Factset expresses Spread CTR as a %, and we

need ISM in basis points. The 0.01 in the denominator is required to convert the weight, which Factset expresses as a %, into a decimal format.

Stage 2: Analyze the benchmark's gross return with the five-factor model. From the security-level results, infer an implied spread move (ISM) for each of the benchmark's constituents. Consolidate security-level results to infer implied spread moves for benchmark sectors.

[Stage 2 need not be undertaken for each portfolio. Rather, a library of benchmark results would be developed at the beginning of each month by applying the gross-returns analysis to a suite of benchmarks. Stage 3 operations will search through the library to identify the applicable benchmark sector-level implied spread move (ISM) to associate with each portfolio constituent. Granted this library can grow quite large, as there will be multiple benchmarks and multiple analyses for a single benchmark covering a variety of time periods. If you thought it more practical and/or efficient, then it might be preferable to run a customized Stage 2 for each portfolio.]

Stage 3: Combine the results of Stages 1 and 2 to arrive at the finished product. We begin at the security-level, then consolidate results into sectors based on the attribution view (industry-class, credit-quality, region, etc.). There are six factors: Twist, Shift, Yield, Allocation, Selection, and Currency. The security-level return contributions for the portfolio from Twist, Shift, Yield and Currency are taken directly from Stage 1. The same applies to the benchmark security-level results for these four factors, except the benchmark return contributions from Stage 2 are pre-multiplied by -1. At the security-level, the Allocation and Selection effects are calculated as follows:

- Contribution to Allocation from Portfolio constituent = -1 * duration-dollar exposure * ISM of applicable benchmark sector

  (where duration-dollar exposure is portfolio constituent's weight * its spread duration)

- Contribution to Allocation from Benchmark constituent = duration-dollar exposure * ISM of applicable benchmark sector

  (where duration-dollar exposure is the benchmark constituent's weight * its spread duration)

- Contribution to Selection from Portfolio constituent = -1 * duration-dollar exposure * [ISM of portfolio constituent – ISM of applicable benchmark sector]

  (where duration-dollar exposure is the portfolio constituent's weight * its spread duration)

- Contribution to Selection from Benchmark constituent = 0

The security-level effects for the six factors then sum to achieve consolidated effects at higher levels of aggregation: sector and portfolio. The definition of "sector" is variable and

depends on the attribution view (industry class, credit quality, region, etc.). Also, it is permissible for a sector to have multiple levels of aggregation embedded within it (e.g., an industry class, such as Banking, lies within a broader sector, such as Investment-Grade Corporates).

Implementing Stage 3 is not a trivial exercise, and it is not amenable to execution within Factset; instead, we could implement the routine as a large-scale post-processing step via an Excel macro. I can readily visualize the logic flow for the macro, but do not feel sufficient urgency to undertake the coding myself – although there is room for improvement, the PMs and portfolio analysts appear satisfied with the existing four-factor results for core, CP, and CPO portfolios. Alternatively, I will either task Alex Davidovich and Susan Hutchison with the work, or try to worm the task onto the Application Group's development agenda. Towards this end, it would be helpful as a starting point if you could provide me the following *when you have the time*:

1. An analysis of the August 2017 performance of Arkansas CPO (portfolio 8065) using a similar format to the attached report for Centrica. Please extend the roster of sectors to include securitized product (residential MBS, commercial MBS, and ABS) absent from the Centrica portfolio. Please retain columns T (spread duration) and U (implied spread move). Include column U even if the calculation scheme has not been updated with the revisions suggested in our recent email dialogue – I can quickly make the adjustments to the ISM if necessary. If you find you cannot get to the task until October, then please run the analysis for September 2017 instead.

2. An analysis of the August (or September) 2017 performance of Barclays Aggregate (portfolio 8065's benchmark) using a similar format as in Step 1.

3. An analysis of the August (or September) 2017 performance of Barclays High-Yield Corporate using a similar format as in Step 1. From the high-yield index, I will abstract the benchmark-ISM references for the high-yield components of Arkansas CPO.

4. The standard four-factor treatment of excess-return attribution for Arkansas CPO (8065) managed against Barclays Aggregate for August (or September) 2017. The attribution will provide a useful sanity check for Twist and Shift since the DIY approach should arrive at the same results for these two factors.

Again, my sincere appreciation for all your fine work and substantial contributions.

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