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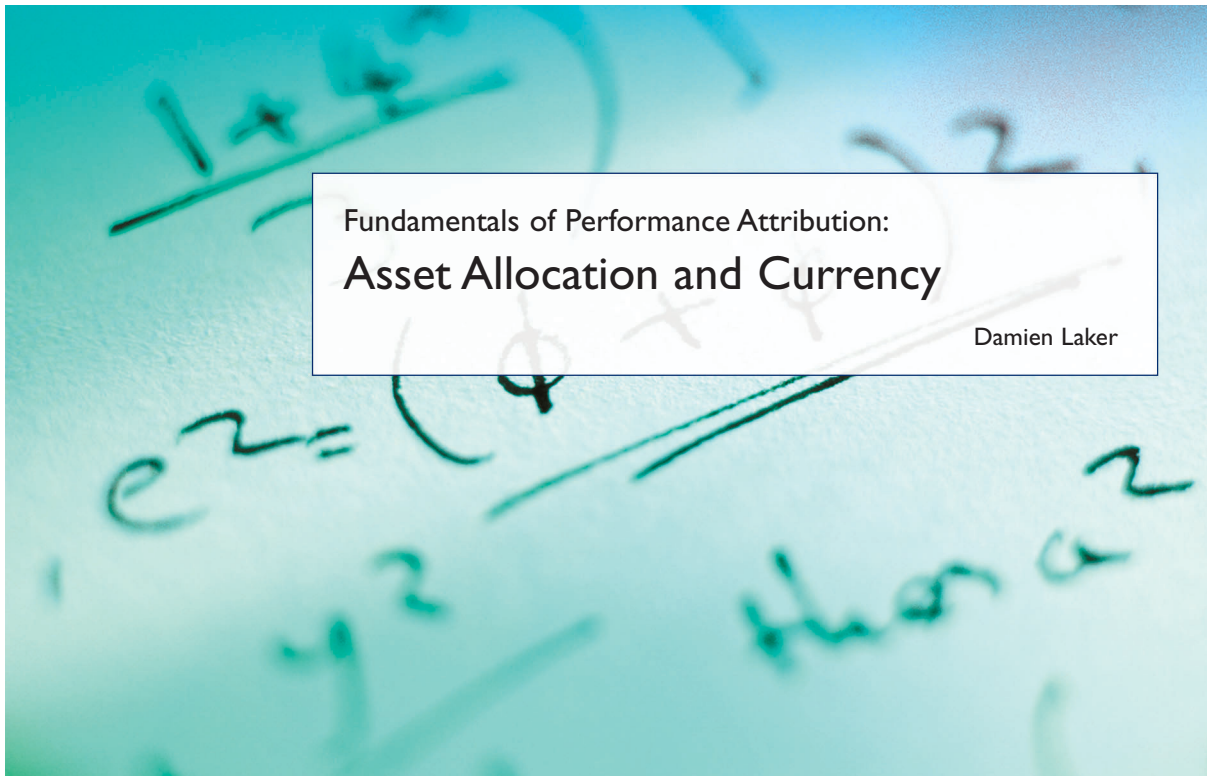

Fundamentals of Performance Attribution:

Asset Allocation and Currency

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Damien Laker is Director of Performance Attribution Strategy at Barra. Damien joined Barra in December 2002 when Barra acquired Investment Performance Objects (IPO), a company that Damien founded in 1998. IPO provided cutting edge investment performance analytics software for global asset managers. At the time of the acquisition, IPO had five clients in Australia, and one client in the UK.

Damien has been involved full-time in developing and delivering innovative solutions for performance measurement, attribution and reporting for about ten years.

Over the past year, Damien has done consulting and workshops in Sydney, London, Singapore, Hong Kong, Malaysia and the USA. He has also published half a dozen journal articles on various aspects of performance attribution. He has practical experience doing attribution and other performance analysis on hundreds of portfolios valued at many hundreds of billions of dollars.

Damien has a B.Sc. and a B.A. from the University of New South Wales, Australia.

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Introduction

The first article in this series explained the first principles behind the Brinson model. It also showed how simple it is to calculate exact multi-period attributes at the total level using those first principles.

In the second article, we looked at different ways to measure the value added by stock selection.

This article is about how to measure the value added by asset allocation and currency allocation. It is based on the example on pages 21-40 of Karnosky and Singer (1994). The Karnosky Singer spreadsheet (http://www.barra.com/products/spreadsheets.aspx) shows the data and equations for this example. The example has been edited so that it adopts the perspective of an Australian investor, rather than a US investor. The numbers, however, remain unchanged. In particular, the example was constructed before adoption of the Euro, so the example still uses DEM as the currency for Germany.

Currency Basics

In multicurrency funds, a key distinction is between local currency, the currency to which each asset is exposed, and base currency, the single currency used for reporting fund performance to investors. For example, a fund managed for a UK investor would most likely have GBP as its base currency. If that fund held shares in Sony and Microsoft, the local currencies for those assets would be JPY and USD respectively.

While it is meaningful to speak of base currency returns and local currency returns, no such distinction is necessary when it comes to weights. The weight of a stock is currency-independent.

The distinction between base and local returns is reasonably intuitive for a single asset. For example, it is intuitive that the GBP and USD returns for Microsoft will differ, and that the difference will depend on movements in the GBP/USD exchange rate. However, when assets with different local currencies are combined, this issue becomes less intuitive. For example, a portfolio holding only Microsoft and Sony will have local currency returns, but as a practical matter, these local currency returns are not easy to convert into base currency because they are actually in a combination of USD and JPY. Thus, most performance systems calculate and store both base and local returns.

One of the most important multicurrency performance concepts is hedging. By using forward rate agreements (FRAs), fund managers can achieve any currency exposure they want, regardless of the countries in which a fund's assets are invested. For example, it would not be terribly unusual for a fund manager to manage an international equities fund on a fully hedged basis, so that it gave no exposure to non-domestic currencies. The arithmetic for calculating currency hedges is by no means intuitive, but it is vital to the Karnosky Singer (KS) model, so we'll come back to that later on.

What Is Different About KS?

The KS model extends the Brinson model to deal with multicurrency investment management. KS introduces two new ideas:

1. It introduces the notion of a "return premium", which accurately reflects the way that currency markets actually work (see below for an explanation).
2. It effectively does two attributions: one explains asset allocation and stock selection, while the other attribution explains currency allocation.

Each of these extensions to the Brinson model is conceptually very sound. However, many people struggle to understand even the "plain vanilla" Brinson model. This means that many people find KS very unintuitive. This has impeded adoption of the KS model, despite that it has clear advantages over more naïve approaches to currency attribution.

Despite that the practical task of implementing KS in a performance department can be a massive undertaking, it is helpful to remember that KS is simply an extension of the Brinson model. Hence, many of the ideas discussed in the first two articles of this series are applicable to KS.

Sample Portfolio Data

Table 1 shows benchmark data for the sample fund over the analysis period. There is enough information in the table to determine the investment strategy (i.e. country allocation and currency allocation) that would provide the highest return over the period. As an exercise, you may like to try working this out before reading any further. Most columns in the table are fairly self-explanatory. Each country has a benchmark weight of 25%. The returns are all continuously compounding, so that the exchange rate conversions can be done arithmetically rather than geometrically. The "eurodeposit returns" are simply the cash returns available to foreign investors in each currency. The "local currency return premium" for each market is simply the extent to which that equity market outperformed its eurodeposit return.

Table 1

Benchmark data for the analysis period

			Benchmark			Eurodeposit Return		Local CCY
Country	Local CCY	Exchange Rate Return	Weight	Local CCY Return	Base CCY Return	Local CCY	Base CCY	Benchmark Return Premium
Germany	DEM	1.00%	25%	7.00%	8.00%	5.00%	6.00%	2.00%
UK	GBP	-3.00%	25%	10.50%	7.50%	11.25%	8.25%	-0.75%
Japan	JPY	-1.00%	25%	9.50%	8.50%	9.00%	8.00%	0.50%
Australia	AUD	0.00%	25%	8.40%	8.40%	7.50%	7.50%	0.90%
Total	**Blend**	**-0.75%**	**100%**	**8.85%**	**8.10%**	**8.19%**	**7.44%**	**0.66%**

Perhaps the UK would have been the best market for a fund manager to favour, because its local currency return (10.5%) is the highest. Or maybe Japan would be the best market because its base currency return is highest. Neither of these answers is correct: in fact, Germany was the country that would have produced the highest return (see below for the explanation).

Turning to currency allocation, maybe DEM would have been the best currency to select because it appreciated the most compared with base currency. Again, this answer is wrong. GBP would have been the currency that produced the highest return for investors (see below for the explanation).

The rationale for adopting the KS attribution model should become abundantly clear when we work through the arithmetic of hedged investing.

Currency Hedging

As already mentioned, FRAs enable fund managers to decide on currency allocations quite separately from country allocations. As an example, suppose we wanted to invest in the country with the highest local return (UK), and the currency with the highest return (DEM). The arithmetic to justify the assertion that this would not have been the most profitable investment strategy revolves around currency hedging.

If an Australian investor wanted to hedge UK equities into DEM, they would buy a GBP/DEM forward rate agreement from a bank. This would allow the Australian to invest into UK equities, while locking-in a guaranteed future exchange rate for converting the investment back into DEM. There is a small transaction cost for this, which is almost negligible. However, a much more important consideration is that the forward rate will differ from the spot rate depending upon interest rates in UK and Germany. From the bank's perspective, the risk-free way to provide the FRA is:

- The bank will transfer some of its UK cash into German cash at the spot rate;
- On the maturity date for the FRA, the German cash will be just enough to cover the bank's obligation under the FRA;
- The bank then accepts the agreed amount of GBP from the fund manager, providing the agreed amount of DEM in return.

The opportunity cost for the bank is that, for the period of the FRA, they will be earning a return on German cash instead of UK cash. In general, this would mean that the forward rate would be more favourable to the fund manager than the spot rate if German cash returned more (in local currency) than UK cash. Conversely, the forward rate would be less favourable to the fund manager than the spot rate if German cash returned less (in local currency) than UK cash.

In this particular case, German cash (5.00%) returned much less than UK cash (11.25%), so if the fund manager hedged into DEM they would be locking-in an exchange rate much less favourable than the spot rate. Even though the 1% appreciation of DEM relative to the base currency would mitigate the impact of this, DEM would still in fact be the currency that produced the lowest base currency return in this example.

The key insight behind KS is that eurodeposit (cash) rates are essential to currency calculations, because of their role in hedge calculations.

What If I Don't Hedge?

The reasoning above is all based on the assumption that the fund manager is able to hedge into any currency they choose. A frequent objection is that fund managers may not have this amount of latitude in their mandates, or simply that they may simply go unhedged anyway. The answer to these objections is that currency allocation is just like asset allocation. If a fund manager is prevented by their mandate from making the investment they would prefer, this doesn't mean that attribution analysis is inapplicable. Rather, it simply means that the mandate has constrained the bets that the manager could take. Similarly, if a manager chooses to go unhedged, that is a bet that they are making — attribution analysis can still show the opportunity cost of this bet however.

There is no "free lunch" to be had by only hedging when the forward rate is more favourable to the fund manager than the spot rate because currencies with high cash rates tend to be high inflation currencies with steadily depreciating exchange rates.

Return Premiums

The fact that eurodeposit rates are vital to assessing the value added by currency allocation also has implications for assessing the value added by asset allocation. Going back to the example of an Australian investor who overweights UK equities because of their 10.50% local return, we have already seen that the 11.25% cash return in the UK will make it very expensive for that investor to hedge out of GBP into any other currency. In general, the relative merit of each equity market in a KS attribution depends not on the local market return, but on the local market return premium. This value is shown in the rightmost column of Table 1.

Ranking Each Member of the Opportunity Set

The return premiums in Table 1 provide a clear ranking of the attractiveness of each equity market. From the perspective of KS attribution, Germany would have been the best market allocation (with a return premium of 200 basis points) while the UK would have been the worst market allocation (with a return premium of minus 75 basis points).

Similarly, the base currency eurodeposit returns in Table 1 provide a clear ranking of the attractiveness of each currency. This is because the base currency eurodeposit return captures the "currency surprise", *i.e.* the extent to which each currency's actual performance (measured by the exchange rate) exceeded its expected performance (measured by the eurodeposit rates).

All of this might seem very theoretical to someone who is not accustomed to currency hedge calculations. However, it is possible to do a few calculations to determine the base currency return for each possible combination of country and currency. This is shown in Table 2. Using the data in Table 2, it is possible to evaluate the opportunity set based purely on the criterion of base currency return because the return on each line includes the effect of currency conversion. This demonstrates that KS is not just a matter of theory: KS attribution would show German equities as the most value-adding asset allocation decision, and GBP as the most value-adding currency. On the other hand, a naïve attribution might consider UK equities as the best asset class (since they had the highest return), and Germany as the best currency (since DEM appreciated more than any other currency). To put it bluntly, KS would reward the investment strategy that delivered a base currency return of 10.25%, while a naïve approach might reward the investment strategy that delivered a base currency return of 5.25%. This does make it hard to justify using any approach other than KS for doing attribution on multicurrency portfolios.

Table 2

Ranked base currency returns for each combination of market and currency

Rank	Strategy	AUD Return
1	German equities hedged into GBP	7.00% + (11.25% – 5.00%) – 3.00% = 10.25%
2	German equities hedged into JPY	7.00% + (9.00% – 5.00%) – 1.00% = 10.00%
3	German equities hedged into AUD	7.00% + (7.50% – 5.00%) – 0.00% = 9.50%
4	Australian equities hedged into GBP	8.40% + (11.25% – 7.50%) – 3.00% = 9.15%
5	Australian equities hedged into JPY	8.40% + (9.00% – 7.50%) – 1.00% = 8.90%
6	Japanese equities hedged into GBP	9.50% + (11.25% – 9.00%) – 3.00% = 8.75%
7	Japanese equities in JPY (no hedge)	9.50% + (9.00% – 9.00%) – 1.00% = 8.50%
8	Australian equities in AUD (no hedge)	8.40% + (7.50% – 7.50%) + 0.00% = 8.40%
9	Australian cash hedged into GBP	7.50% + (11.25% – 7.50%) – 3.00% = 8.25%
=10	German equities in DEM (no hedge)	7.00% + (5.00% – 5.00%) + 1.00% = 8.00%
=10	Japanese equities hedged into AUD	9.50% + (7.50% – 9.00%) + 0.00% = 8.00%
=10	Australian cash hedged into JPY	7.50% + (9.00% – 7.50%) – 1.00% = 8.00%
=13	UK equities in GBP (no hedge)	10.50% + (11.25% – 11.25%) – 3.00% = 7.50%
=13	Australian cash (no hedge)	7.50% + (7.25% – 7.50%) + 0.00% = 7.50%
15	UK equities hedged into JPY	10.50% + (9.00% – 11.25%) – 1.00% = 7.25%
16	Australian equities hedged into DEM	8.40% + (5.00% – 7.50%) + 1.00% = 6.90%
17	UK equities hedged into AUD	10.50% + (7.50% – 11.25%) + 0.00% = 6.75%
18	Japanese equities hedged into DEM	9.50% + (5.00% – 9.00%) + 1.00% = 6.50%
19	Australian cash hedged into DEM	7.50% + (5.00% – 7.50%) + 1.00% = 6.00%
20	UK equities hedged into DEM	10.50% + (5.00% – 11.25%) + 1.00% = 5.25%

For details on the calculations behind Table 2, please see the Karnosky Singer spreadsheet and the Karnosky Singer Worked Example. Those documents also contain the portfolio data and the formulas for calculating the KS attribution.

In the example provided by Karnosky and Singer, the main asset allocation bet in the portfolio was a tilt toward German equities (specifically, a portfolio weight of 60% compared with a benchmark weight of 25%). As we have seen above, a naïve approach would penalise this tilt. However, because Germany had a local return premium of 200 basis points while the benchmark's local return premium was only 66 basis points, a KS attribution shows the overweight position as adding value (see Equation 1). This equation was described in the previous article of this series (although in single-currency attribution there is no need to use return premiums because by definition there would be no currency effect).

Equation 1

$$\begin{aligned}\text{Asset Allocation} &= \left(w_j^p - w_j^b\right) \times \left(r_j^b - r_{total}^b\right) \\ &= \left(60\% - 25\%\right) \times \left(2.00\% - 0.66\%\right) \\ &= 0.47\%\end{aligned}$$

The equation for measuring the value added by currency allocation takes exactly the same form as the asset allocation equation. The only difference is that the weights are based on currency exposures (not market exposures), and the returns are base currency eurodeposit returns. Putting it simply, KS does a Brinson attribution on the markets, then a separate Brinson attribution on the currencies.

In the case of Germany, the fund only had 10% of its currency exposure in DEM, compared to a benchmark weight of 25%. Once again, we've seen that a naïve approach might regard this as a bad bet because DEM appreciated against the base currency. However, Germany had a very low cash rate, and this detracted from the return one would have obtained by having a currency exposure to DEM. Equation 2 calculates the value added by the underweight position in DEM.

Equation 2

$$\begin{aligned}\text{Currency Allocation} &= \left(W_k^p - W_k^b\right) \times \left(R_k^b - R_{total}^b\right) \\ &= \left(10\% - 25\%\right) \times \left(6.00\% - 7.44\%\right) \\ &= 0.22\%\end{aligned}$$

All of the detailed calculations are available in the sample spreadsheet.

Summary

The key insight behind KS is that currency hedging depends on eurodeposit (cash) rates. Hence, to achieve a clean separation between market allocation and currency allocation, one needs to use eurodeposit rates in calculating the value added by currency decisions. Similarly, one needs to use local currency return premiums (rather than just local currency

returns) in calculating the value added by asset allocation decisions. In essence, the trick is simply to remove the cash component from market returns, and instead to deal with cash as part of the currency calculation.

The calculations for stock selection are exactly the same in KS (using local returns) as they are in the Brinson model.

In a brief article such as this one, it is relatively easy to demonstrate the theoretical superiority of the KS model. However, as every performance analyst knows very well, performance attribution can be much harder in practice than it seems in theory. Apart from all the usual issues with data quality and the availability of adequate software, KS presents another challenge because the currency hedging calculations involved in KS are unintuitive to many people. This can present a great practical dilemma because attribution reports are of little value if the people receiving them don't understand what they mean. From a practical perspective, it may be prudent to try achieving high quality single currency and "naïve" multicurrency attribution before attempting to implement the Karnosky Singer approach.

Reference

Karnosky, Denis S. and Brian D. Singer, *Global Asset Management and Performance Attribution,* The Research Foundation of the Institute of Chartered Financial Analysts, 1994.