Beyond Brinson: Establishing the Link Between Sector and Factor Models

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Introduction

The objective of performance attribution is to explain the sources of portfolio return. To be meaningful, the attribution model must reflect the investment process and attribute portfolio return to intuitive sources. The Brinson model (1985) has become an industry standard precisely because it reflects a straightforward sector-based investment process and attributes portfolio return to intuitive sector allocation and stock selection effects. Positive contributions are earned by overweighting outperforming sectors and stocks and underweighting underperformers.

Despite the clear benefits of the Brinson framework, attempts to extend it to more general investment processes expose some limitations. One basic limitation is that it requires a strict classification of stocks by sector. For countries or industries, such classification can be straightforward and unambiguous. Styles, on the other hand, do not naturally lend themselves to strict classification schemes. For instance, although it is possible to group stocks into style quintiles, the cutoff points separating one quintile from the next are essentially arbitrary.

A more significant drawback arises for investment processes based on *both* styles and industries. One approach for adapting the Brinson model to such investment processes is to group stocks jointly into style/industry buckets. The problem with this approach is that the number of groups can quickly spiral out of control. For instance, grouping assets into 10 economic sectors and 5 style buckets leads to 50 distinct groups. Adding a second style factor segmented into quintiles would result in 250 separate groups. If countries are added, the number of groupings can easily exceed the number of stocks. Clearly, the Brinson framework is not suited to describe investment processes that go beyond a simple sector approach.

In this paper, we show that factor-based performance attribution represents an intuitive and powerful generalization of the familiar Brinson sector-based framework. In particular, we show that the Brinson model is exactly replicated within a basic type of factor model, aptly termed the *Brinson-replicating* factor model. In this model, the factor and residual return contributions have a clear financial interpretation as benchmark-relative sector returns and sector-relative stock returns. The Brinson-replicating model can be easily generalized to explain multiple effects, such as industries and styles (or countries, in a global model). In this extension, returns are decomposed into style effects and pure industry effects, net of styles. We also discuss how "stock selection" in the classic Brinson model can be attributed instead to contributions from a handful of style factors. Finally, we discuss the importance of attributing risk and return to the same set of decision variables. This provides a means of comparing return contributions on a risk-adjusted basis.

Brinson Sector-Based Attribution

A sector-based investment process consists of two basic types of decisions. The first is sector allocation, where the portfolio manager seeks to overweight sectors that outperform the overall benchmark. The second is stock selection, where the portfolio manager seeks to overweight stocks that outperform the sector.

Denoting each sector's portfolio and benchmark weights by w_i^P and w_i^B respectively, with corresponding sector returns r_i^P and r_i^B, the Brinson sector-based attribution of active return R^A is

$$R^A = \sum_i (w_i^P - w_i^B)(r_i^B - R^B) + \sum_i w_i^P (r_i^P - r_i^B). \tag{1}$$

The terms of the first sum are the allocation effects and those of the second sum are the selection effects. In the case where the portfolio holds cash or cash-equivalents, the return contribution of these instruments is best attributed by including Cash as a sector. In this case, the Cash allocation effect (cash drag) is given by[1]

$$\text{Cash Allocation} = (w_{Cash}^P - w_{Cash}^B)(0 - R^B). \tag{2}$$

Overweighting Cash creates positive cash drag in a down market, but detracts from performance in an up market. Certain cash-equivalents, such as commercial paper, may have returns that differ from the risk-free rate, and this is captured by the Cash selection effect,

$$\text{Cash Selection} = w_{Cash}^P (r_{Cash}^P - 0). \tag{3}$$

Although the validity of the Brinson model can be easily verified algebraically, it is conceptually beneficial to obtain the attribution formula from security-level considerations. The excess return of a single stock r_n can be decomposed into three terms,

$$r_n = R^B + (r_i^B - R^B) + (r_n - r_i^B). \tag{4}$$

The first component is the benchmark return, and represents the aggregate movement of all stocks. The second term is the relative return of the sector, and describes how the sector performed compared to the overall benchmark. The last term explains how the individual stock performed relative to the sector. Later, we will see that each of the three terms in Equation (4) has an exact counterpart within the Brinson-replicating factor model.

Consider a portfolio with asset weights w_n^P. Equation (4) rolls-up to the portfolio level as

$$R^P = R^B + \sum_i w_i^P (r_i^B - R^B) + \sum_i \sum_{n \in i} w_n^P (r_n - r_i^B)\,. \tag{5}$$

The final summation in Equation (5) simplifies to

$$\sum_{n \in i} w_n^P (r_n - r_i^B) = w_i^P (r_i^P - r_i^B). \tag{6}$$

Combining Equations (5) and (6) leads to

$$R^P = R^B + \sum_i w_i^P (r_i^B - R^B) + \sum_i w_i^P (r_i^P - r_i^B). \tag{7}$$

In the case of the benchmark, the attribution becomes

$$R^B = R^B + \sum_i w_i^B (r_i^B - R^B) + 0\,. \tag{8}$$

[1] We consider returns in excess of the risk-free rate so that cash has zero return.

Note that the last term vanishes since the weighted average of stock relative return is zero within each sector, i.e.,

$$\sum_{n\in i} w_n^B (r_n - r_i^B) = 0. \tag{9}$$

Taking the difference of the portfolio and benchmark return attributions in Equations (7) and (8) immediately yields the Brinson sector-based performance attribution in Equation (1). In other words, the sector allocation effect is precisely the difference between the portfolio and benchmark sector-relative components, and the corresponding selection effect is precisely the difference between the portfolio and benchmark stock-relative components.

We give a concrete example using the MSCI *USA Investable Market Index* (USA IMI) as our benchmark, which aims to capture the full breadth of investment opportunities available in the US market. We take our portfolio to be 95 percent invested in the MSCI *USA Investable Market Value Index* (USA Value), and a 5 percent cash position in US dollars. We select as our analysis period August 2009, and choose the US dollar as the base currency.

A Brinson sector-based attribution is presented in Table 1, classified according to the Global Industry Classification Standard (GICS®) sectors. The active return was 132 bps, of which 46 bps was due to allocation effect, with the remaining 86 bps due to selection effect. The most significant contribution to allocation effect was 69 bps from Financials. The portfolio was 8.55 percent overweight in the Financials sector, which outperformed the benchmark by 8.13 percent in August 2009. Cash drag cost the portfolio 18 bps of active return as the benchmark was up 3.64 percent for the month. Financials also drove selection effect with a 28 bps contribution as the portfolio outperformed the benchmark by 1.21 percent.

Table 1

Brinson sector-based performance attribution

Sector	Portfolio Weight	Bench Weight	Active Weight	Portfolio Return	Bench Return	Relative Return	Active Return	Allocation Effect	Selection Effect	Total Effect
Cash	5.00%	0.00%	5.00%	0.00%	0.00%	-3.64%	0.00%	-0.18%	0.00%	-0.18%
Energy	15.50%	11.34%	4.15%	0.50%	0.84%	-2.80%	-0.34%	-0.12%	-0.05%	-0.17%
Materials	3.68%	3.81%	-0.13%	4.58%	2.77%	-0.88%	1.81%	0.00%	0.07%	0.07%
Industrials	11.79%	10.47%	1.31%	5.54%	4.03%	0.39%	1.51%	0.01%	0.18%	0.18%
Consumer Discretionary	7.20%	9.95%	-2.75%	6.36%	4.22%	0.58%	2.13%	-0.02%	0.15%	0.14%
Consumer Staples	6.75%	10.35%	-3.60%	0.63%	0.89%	-2.75%	-0.26%	0.10%	-0.02%	0.08%
Health Care	10.30%	13.47%	-3.17%	3.49%	2.35%	-1.30%	1.15%	0.04%	0.12%	0.16%
Financials	23.37%	14.82%	8.55%	12.98%	11.77%	8.13%	1.21%	0.69%	0.28%	0.98%
Information Technology	4.27%	18.75%	-14.48%	4.89%	2.64%	-1.01%	2.25%	0.15%	0.10%	0.24%
Telecommunications	5.04%	3.04%	2.00%	-1.68%	-2.42%	-6.06%	0.74%	-0.12%	0.04%	-0.08%
Utilities	7.11%	3.99%	3.12%	0.65%	0.66%	-2.99%	-0.01%	-0.09%	0.00%	-0.09%
Total	100.00%	100.00%	0.00%	4.96%	3.64%		1.32%	0.46%	0.86%	1.32%

Factor-Based Attribution

Factor models decompose asset returns into a systematic component that is explained by factors, and a residual component that is not,

$$r_n = \sum_k X_{nk} f_k + u_n. \tag{10}$$

Here, X_{nk} is the exposure of stock n to factor k, f_k is the factor return, and u_n is the residual return of the stock. Stock exposures are known at the start of the period, and factor returns are estimated by cross-sectional regression at the end of the period. Factor returns can be written in the following general form

$$f_k = \sum_n \Omega_{kn} r_n , \tag{11}$$

where Ω_{kn} is the weight of stock n in pure factor portfolio n. Factor-replicating portfolios have unit exposure to the factor in question and zero exposure to other factors. For example, industry factor portfolios are style neutral, and style factor portfolios have net zero weight in every industry. A thorough discussion of this interpretation is provided by Menchero (2010).

Active return can be attributed by rolling up contributions from the asset level,

$$R^A = \sum_k X_k^A f_k + \sum_n w_n^A u_n , \tag{12}$$

where w_n^A is the active weight of asset *n*, and X_k^A is the active exposure to factor *k*,

$$X_k^A = \sum_n w_n^A X_{nk}. \tag{13}$$

Positive contributions to active return are earned through positive exposure to factors with positive returns and by overweighting assets with positive residual returns.

The Brinson-Replicating Factor Model

In this section we describe a special type of factor model that exactly replicates the Brinson model. This model has five defining characteristics: (a) it includes an intercept term; (b) it contains a set of dummy variables with (0,1) exposure to indicate group membership; (c) the estimation universe is the set of all stocks within the benchmark; (d) benchmark weights are used for regression weights, and (e) group factor returns are constrained to be benchmark-weighted mean zero.

As a concrete illustration, let the intercept term represent the country factor (denoted by c) and the groups correspond to industries (denoted by i). Stock returns can therefore be expressed as:

$$r_n = f_c + f_i + u_n. \tag{14}$$

Note that the factor structure in the Brinson-replicating model exhibits an exact collinearity. That is, the country column of the factor exposure matrix is equal to the sum of the industry columns. To obtain a unique regression solution, we impose the constraint that the benchmark cap-weighted industry factor returns sum to zero:

$$\sum_k w_k^B f_k = 0. \tag{15}$$

As discussed by Menchero (2010), under this regression scheme, the country factor return is exactly equal to the benchmark return,

$$f_c = R^B, \tag{16}$$

which is the first term of Equation (4). Furthermore, the industry factor return is given by

$$f_i = r_i^B - R^B, \tag{17}$$

where r_i^B is the benchmark return of industry i . Equation (17) is precisely the relative return of the sector in Equation (4). The industry factor portfolio is therefore 100 percent long the benchmark industry and 100 percent short the overall benchmark. The residual return of Equation (14) is given by

$$u_n = r_n - r_i^B, \tag{18}$$

which is the third and final term of Equation (4). Thus, for the Brinson-replicating factor model, the factor-based attribution of stock return in Equation (10) is precisely equal to the sector-based attribution in Equation (4). Moreover, the corresponding roll-ups to the portfolio level are also equal, thus demonstrating that the Brinson-replicating factor-based attribution is identical to the conventional Brinson sector-based attribution.

In Table 2, we present a performance attribution analysis using the Brinson-replicating factor model. The portfolio, benchmark, and analysis period are the same as those used in Table 1. Note that the factor return and residual return contributions in Table 2 exactly match the Brinson allocation and selection effects from Table 1. Moreover, the exposures and returns are also identical. For instance, the portfolio residual return in each sector is identical to the active sector return in the Brinson model. Similarly, the factor return for each sector exactly corresponds to the relative sector return in the Brinson model. The only exception is that the Cash sector differs from USA country factor by a trivial sign. This is offset by the active exposure, which also differs by a sign.

Table 2

Factor-based performance attribution using the Brinson-replicating factor model

Factor	Port Exp	Bench Exp	Active Exp	Factor Return	Factor Return Contrib	Portfolio Residual Return	Bench Residual Return	Residual Return Contrib	Total Return Contrib
USA Country	95.00%	100.00%	-5.00%	3.64%	-0.18%	—	—	0.00%	-0.18%
Energy	15.50%	11.34%	4.15%	-2.80%	-0.12%	-0.34%	0.00%	-0.05%	-0.17%
Materials	3.68%	3.81%	-0.13%	-0.88%	0.00%	1.81%	0.00%	0.07%	0.07%
Industrials	11.79%	10.47%	1.31%	0.39%	0.01%	1.51%	0.00%	0.18%	0.18%
Consumer Discretionary	7.20%	9.95%	-2.75%	0.58%	-0.02%	2.13%	0.00%	0.15%	0.14%
Consumer Staples	6.75%	10.35%	-3.60%	-2.75%	0.10%	-0.26%	0.00%	-0.02%	0.08%
Health Care	10.30%	13.47%	-3.17%	-1.30%	0.04%	1.15%	0.00%	0.12%	0.16%
Financials	23.37%	14.82%	8.55%	8.13%	0.69%	1.21%	0.00%	0.28%	0.98%
Information Technology	4.27%	18.75%	-14.48%	-1.01%	0.15%	2.25%	0.00%	0.10%	0.24%
Telecommunications	5.04%	3.04%	2.00%	-6.06%	-0.12%	0.74%	0.00%	0.04%	-0.08%
Utilities	7.11%	3.99%	3.12%	-2.99%	-0.09%	-0.01%	0.00%	0.00%	-0.09%
Total					0.46%			0.86%	1.32%

Style Factors

Investment style represents another major source of portfolio return. For equities, the major styles include Value, Momentum, Size, and Volatility. Style factor exposures are constructed from intuitive stock attributes called descriptors. For instance, price-to-book ratio, earnings yield, and dividend yield are all attributes that can be used to identify value stocks. For the Volatility factor, the dominant descriptor is historical beta, whereas for Size it is log of market cap. Momentum descriptors include relative strength of the stock over the trailing 6-12 months.

We standardize style factor exposures to be benchmark cap-weighted mean 0 and standard deviation 1. As a consequence, the benchmark has zero exposure to all styles, and other portfolios have positive or negative exposures to the extent that they tilt on that particular factor. For instance, a portfolio tilted to high beta stocks will have positive exposure to the Volatility factor.

A factor-based performance attribution analysis that augments the Brinson-replicating factor model with Volatility, Momentum, Size, and Value is presented in Table 3. The style exposures are taken from the Barra US Equity Model (USE3), with the factors re-standardized to be cap-weighted mean 0 over the MSCI USA Investable Market Index. The regression weights and constraints are identical to those in the Brinson-replicating factor model.

Table 3

Industries and styles factor-based performance attribution

Factor	Port Exp	Bench Exp	Active Exp	Factor Return	Factor Return Contrib	Portfolio Residual Return	Bench Residual Return	Residual Return Contrib	Total Return Contrib
USA Country	95.00%	100.00%	-5.00%	3.64%	-0.18%	—	—	0.00%	-0.18%
Energy	15.50%	11.34%	4.15%	-3.63%	-0.15%	-0.09%	0.00%	-0.01%	-0.16%
Materials	3.68%	3.81%	-0.13%	-1.23%	0.00%	0.08%	0.00%	0.00%	0.00%
Industrials	11.79%	10.47%	1.31%	-0.58%	-0.01%	0.33%	0.00%	0.04%	0.03%
Consumer Discretionary	7.20%	9.95%	-2.75%	0.92%	-0.03%	-0.52%	0.00%	-0.04%	-0.06%
Consumer Staples	6.75%	10.35%	-3.60%	-0.56%	0.02%	-0.58%	0.00%	-0.04%	-0.02%
Health Care	10.30%	13.47%	-3.17%	0.29%	-0.01%	0.16%	0.00%	0.02%	0.01%
Financials	23.37%	14.82%	8.55%	4.29%	0.37%	0.45%	0.00%	0.11%	0.47%
Information Technology	4.27%	18.75%	-14.48%	0.48%	-0.07%	-0.65%	0.00%	-0.03%	-0.10%
Telecommunications	5.04%	3.04%	2.00%	-5.87%	-0.12%	0.68%	0.00%	0.03%	-0.08%
Utilities	7.11%	3.99%	3.12%	-2.51%	-0.08%	0.06%	0.00%	0.00%	-0.07%
Volatility	0.10	0.00	0.10	1.92%	0.20%	—	—	0.00%	0.20%
Momentum	-0.21	0.00	-0.21	-3.02%	0.63%	—	—	0.00%	0.63%
Value	0.30	0.00	0.30	2.15%	0.65%	—	—	0.00%	0.65%
Size	0.01	0.00	0.01	0.60%	0.01%	—	—	0.00%	0.01%
Total					1.23%			0.09%	1.32%

With the factor model extended to include styles, we see that factors now explain the vast majority (123 bps) of active return, leaving a residual contribution of only 9 bps. What appeared as “stock selection” in the Brinson model is now attributed to a few style factors. Value returned 2.15 percent for the month and so the positive tilt (0.30) on Value contributed 65 bps to active return. Momentum was down 3.02 percent for the month, and so the negative tilt (-0.21) contributed an additional 63 bps of active return. The pure Financials factor returned 4.29 percent, and the overweight of this sector contributed 37 bps to the active return.

Notice that the return of pure Financials (4.29 percent) is significantly less than the relative return of Financials (8.13 percent). This is because the pure Financials factor measures the performance of the Financials sector net of the Country factor *and* style effects. In other words, much of the relative performance of the Financials sector is explained by styles.

In Table 4, we attribute relative sector return to the pure sector and styles. Nearly half of the relative sector return of Financials is explained by style factors. The Financials sector had large tilts on Volatility, Momentum, and Value which significantly boosted the return of the sector. Taking the sum-product of these style exposures with the style factor returns yields the styles return contribution (3.83 percent) of the Financials sector. Adding the styles return contribution with the return of pure Financials (4.29 percent) yields the relative return of the Financials sector (8.13 percent).

Table 4
MSCI USA IMI GICS sector style tilts and relative return attributions

Benchmark Sector	Volatility Exposure	Momentum Exposure	Value Exposure	Size Exposure	Styles Return Contrib	Pure Industries Return	Relative Sector Return
Energy	-0.11	-0.15	0.12	0.54	0.83%	-3.63%	-2.80%
Materials	0.40	-0.10	-0.15	-0.68	0.35%	-1.23%	-0.88%
Industrials	0.17	-0.32	-0.04	-0.41	0.97%	-0.58%	0.39%
Consumer Discretionary	0.38	0.22	0.00	-0.65	-0.34%	0.92%	0.58%
Consumer Staples	-0.75	0.12	-0.32	0.50	-2.19%	-0.56%	-2.75%
Health Care	-0.40	0.11	-0.24	0.05	-1.59%	0.29%	-1.30%
Financials	0.71	-0.37	0.71	-0.24	3.83%	4.29%	8.13%
Information Technology	0.01	0.33	-0.32	0.30	-1.49%	0.48%	-1.01%
Telecommunications	-0.44	0.00	0.10	0.70	-0.19%	-5.87%	-6.06%
Utilities	-0.54	-0.06	0.37	-0.69	-0.48%	-2.51%	-2.99%
Factor Return	1.92%	-3.02%	2.15%	0.60%	—	—	—

Consumer Staples also saw a large contribution coming from style factors. This sector, which contains mostly low-beta stocks, had a large negative exposure (-0.75) to Volatility. The 192 bps return to Volatility therefore detracted 144 bps from the sector performance. The Value and Momentum factors also detracted considerably from the performance of Consumer Staples.

Risk Attribution

In this paper, we showed two ways of attributing return, corresponding to two distinct investment processes. The first considered only sectors and could be fully explained by the classic Brinson model. The second investment process included sectors and style factors, and could only be explained by means of the extended factor model.

Whatever the investment process, it is always possible to attribute return and risk to the same set of sources. Furthermore, alignment of risk and performance attribution along the same decision variables is essential to properly evaluate the tradeoff between risk and return.

Davis and Menchero (2010) describe the *x-sigma-rho* framework for aligning risk and performance attribution. In this approach, the most general performance attribution is written as

$$R = \sum_m x_m g_m , \tag{19}$$

where x_m is the portfolio exposure to source m, and g_m is the return of the source. The source exposures are known at the start of the analysis period, and the source returns are realized at the end. The risk attribution corresponding to the general return attribution of Equation (19) is given by the *x-sigma-rho* formula,

$$\sigma(R) = \sum_m x_m \sigma(g_m) \rho(g_m, R), \tag{20}$$

where $\sigma(g_m)$ is the volatility of the source, and $\rho(g_m, R)$ is the correlation of the source with the portfolio. In the factor-based attribution of Equation (12), the return sources are the factor and residual returns, and the source exposures are the active factor exposures and active stock weights. Applying the *x-sigma-rho* formula to the factor-based performance attribution in Equation (12) immediately yields the corresponding risk attribution,

$$\sigma(R^A) = \sum_k X_k^A \sigma(f_k) \rho(f_k, R^A) + \sum_n w_n^A \sigma(u_n) \rho(u_n, R^A). \tag{21}$$

We measure tracking error using the Barra USE3L (long horizon) risk model. However, we want to attribute risk to a different set of factors — namely, the ten sectors and four style factors contained in Table 3. This can be accomplished using the custom factor attribution methodology of Menchero and Poduri (2007). The resulting risk attribution is presented in Table 5. Forecast tracking error for August 2009 was 1.22 percent, stated on a monthly basis. Factors contributed 108 bps to tracking error, with residual risk accounting for the remaining 14 bps.

Table 5

Factor-based *x-sigma-rho* risk attribution

Factor	Port Exp	Bench Exp	Active Exp	Factor Volatility	Factor Corr	Factor Risk Contrib	Residual Volatility	Residual Correlation	Residual Risk Contrib	Total Active Risk Contrib
USA Country	95.00%	100.00%	-5.00%	8.53%	0.32	-0.14%	—	—	0.00%	-0.14%
Energy	15.50%	11.34%	4.15%	7.09%	0.10	0.03%	0.94%	0.21	0.03%	0.06%
Materials	3.68%	3.81%	-0.13%	3.58%	0.13	0.00%	1.72%	0.15	0.01%	0.01%
Industrials	11.79%	10.47%	1.31%	2.72%	0.26	0.01%	0.90%	0.16	0.02%	0.03%
Consumer Discretionary	7.20%	9.95%	-2.75%	3.03%	0.00	0.00%	1.43%	0.05	0.00%	0.01%
Consumer Staples	6.75%	10.35%	-3.60%	2.75%	-0.10	0.01%	1.47%	0.14	0.01%	0.02%
Health Care	10.30%	13.47%	-3.17%	3.75%	-0.22	0.03%	1.53%	0.11	0.02%	0.04%
Financials	23.37%	14.82%	8.55%	4.74%	0.57	0.23%	0.47%	0.43	0.05%	0.28%
Information Technology	4.27%	18.75%	-14.48%	3.25%	-0.70	0.33%	2.78%	-0.04	0.00%	0.33%
Telecommunications	5.04%	3.04%	2.00%	5.24%	-0.07	-0.01%	0.80%	0.03	0.00%	-0.01%
Utilities	7.11%	3.99%	3.12%	4.43%	0.08	0.01%	0.22%	0.02	0.00%	0.01%
Volatility	0.10	0.00	0.10	3.42%	0.38	0.14%	—	—	0.00%	0.14%
Momentum	-0.21	0.00	-0.21	2.18%	-0.54	0.24%	—	—	0.00%	0.24%
Value	0.30	0.00	0.30	1.24%	0.53	0.20%	—	—	0.00%	0.20%
Size	0.01	0.00	0.01	1.04%	0.28	0.00%	—	—	0.00%	0.00%
Total				1.13%	0.96	1.08%	0.35%	0.38	0.14%	1.22%

Interestingly, the USA country factor reduced tracking error by 14 bps. This effect can be easily understood within the *x-sigma-rho* framework. The return source in this case is the benchmark return, as stated in Equation (16). The active exposure was -5.0 percent due to the cash position. The factor volatility (8.53 percent) is just the predicted benchmark volatility, stated on a monthly basis. The factor correlation of 0.32 says that when the benchmark return is positive, the active return tends to be positive. This is due to the high beta tilt of the portfolio, as reflected in the positive exposure to the Volatility factor. Note that the benchmark has zero exposure to all style factors. This is due to the standardization convention that the benchmark be style neutral.

The main drivers of industry risk were pure Financials (23 bps) and pure Information Technology (33 bps). The latter contribution is the result of a large negative exposure (-14.48 percent), a source volatility of 3.25 percent, and a strong negative correlation (-0.70) with the active return.

This negative correlation is intuitive, because when Information Technology performs well, the active return tends to be negative.

Styles contributed 58 bps to tracking error, with Volatility (14 bps), Momentum (24 bps), and Value (20 bps), accounting for all of the contribution. This is about the same as the tracking error contribution (56 bps) coming from Financials and Information Technology. However, from Table 3, we see that these three style factors accounted for 148 bps of active return, whereas the two sectors combined for only 30 bps. Therefore, on a risk-adjusted basis the style factors performed much better than the sectors.

Conclusion

Classic Brinson sector-based attribution is widely used in the asset management industry because it explains active return in terms of intuitive allocation and selection decisions. While there is significant value in its simplicity, a shortcoming is that it cannot easily explain the effects of multiple variables. We introduced a special type of factor model with five defining characteristics that exactly replicates the classic Brinson model. The strength of this model, however, is that it can be easily extended to explain more general types of investment processes. Finally, by means of the *x-sigma-rho* formula, we attribute risk along the same factors as performance. This allows return contributions to be analyzed on a risk-adjusted basis.

References

Brinson, G., and N. Fachler. 1985. “Measuring Non-U.S. Equity Portfolio Performance,” *Journal of Portfolio Management,* vol. 11, no. 3 (Spring): pp. 73-76.

Davis, B., and J. Menchero. 2010. “Risk Contribution is Exposure times Volatility times Correlation: Decomposing risk using the *x-sigma-rho* formula,” *Journal of Portfolio Management,* to appear.

Menchero J., V. Poduri. 2008. “Custom Factor Attribution,” *Financial Analysts Journal*, vol. 64, no. 2: (March/April): pp. 81-92.

Menchero J. 2010. “The Characteristics of Factor Portfolios,” *working paper*.

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