Barra Insight

Sector Models: An Insightful View of Risk and Return

Using Barra Models to Better Understand the Investment Environment

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An important component of an effective risk model is its ability to evaluate relevant sources of risk. There are various determinants of what make these sources relevant: data, factor structure, and methodology. This document examines the effects of using a sector model built from a specific estimation universe that mimics the investment universe of the portfolio manager, leading to risk and performance attributions that may reflect the manager's investment philosophy more accurately.

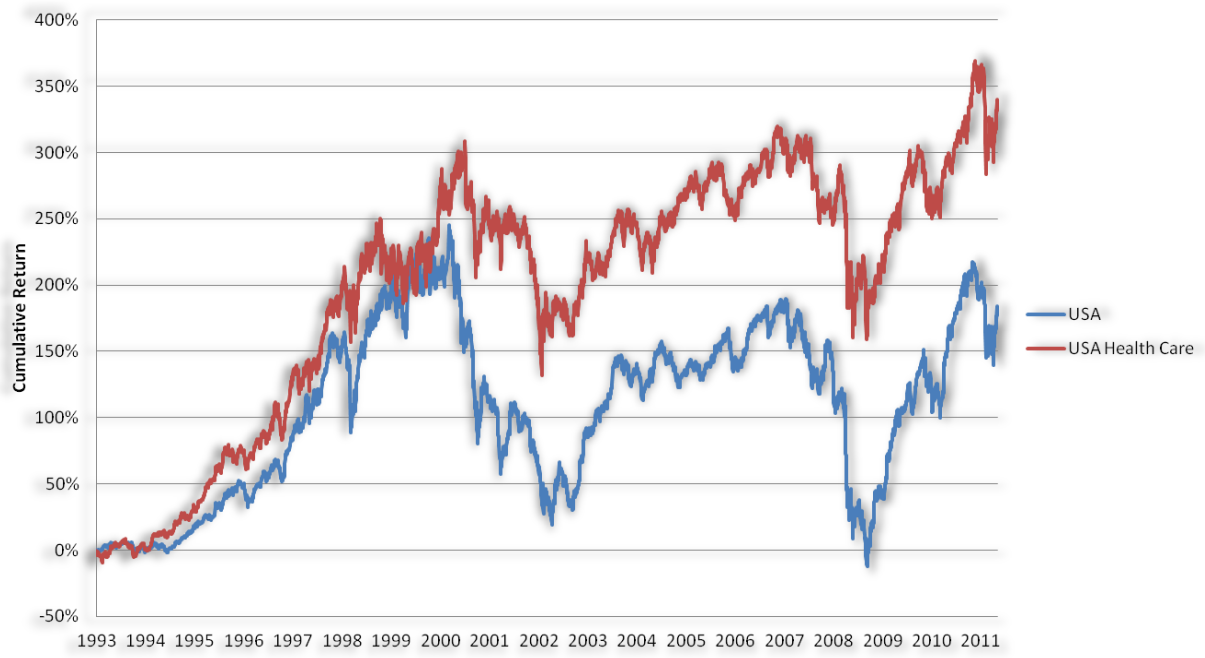
Rationale of Sector Models

A risk model built from a broad estimation universe has many benefits, among them the reflection of the risk and return dynamics from a large set of securities. As a result, portfolio managers gain comprehensive views of risk and return that apply to a diversified set of securities. This kind of risk model, however, may not be appropriate in all cases. For example, sector-specific quant strategies, as well as active managers with a sector benchmark and a constrained investment universe may all benefit from a model consistent with their investment universe.

Another example is a health care portfolio manager benchmarked against the MSCI USA Health Care Index with a health care-only investment universe (e.g. the MSCI USA Health Care Investable Market Index). This portfolio manager could benefit from a risk model that is designed to take into account health care assets only. In such a model, the factor structure, returns, and volatility estimates would only consider information relevant to the portfolio manager, consistently reflecting his investment philosophy.

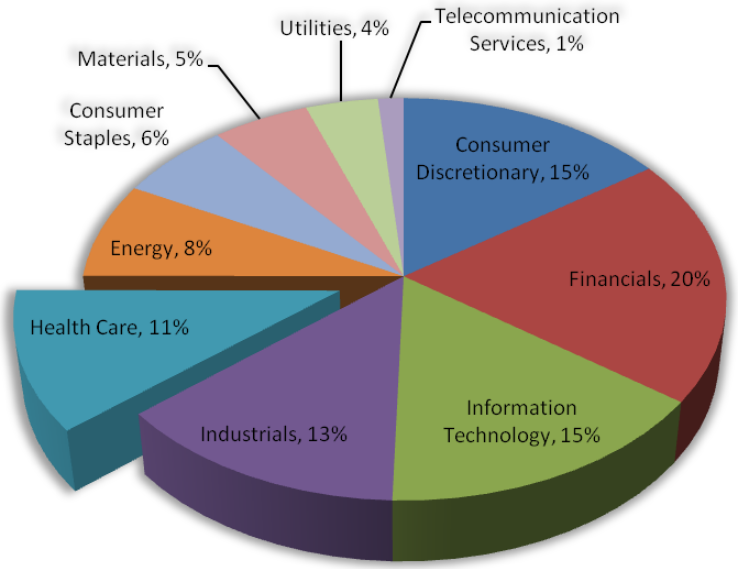
To understand why sector models may produce more factor returns and volatility estimates that are more consistent with the investment universe, the portfolio manager can use a broad US equity model to analyze the risk and return of his portfolio, such as the Barra US Equity Model (USE4). USE4 is built to model the volatility of a large number of equities traded in the United States. The universe used to estimate the factor returns in USE4 is the MSCI USA Investable Market Index (IMI), a broad index that includes a large number (2,500+) of small, mid, and large cap stocks. However, if the portfolio manager is constrained to a restricted investment universe, using a sector risk model with an estimation universe that mimics this investment constraint can improve how the risk model represents the portfolio's risk and return profile. Therefore, when building the US Health Care Model (USHC), only the relevant health care stocks in the MSCI USA IMI (~300 stocks) are taken into account. The differences in performance of these two estimation universes can be large, as observed in Figure 1, next page.

Figure 1. MSCI USA IMI vs MSCI USA Health Care IMI: Monthly Cumulative Returns



As mentioned, the differences in performance are large; they are also expected. Health care stocks account for only 11% of the estimation weights[1] in USE4, as seen in Figure 2. This means that the factor returns from USE4 reflect the risk and return dynamics of a large number of sectors, which is precisely what makes it representative of the entire US market.

Figure 2. Sector Composition of the Estimation Universe in USE4 (as of the end of 2012)



[1] USE4 uses square-market cap weights, winsorizing the top 1%

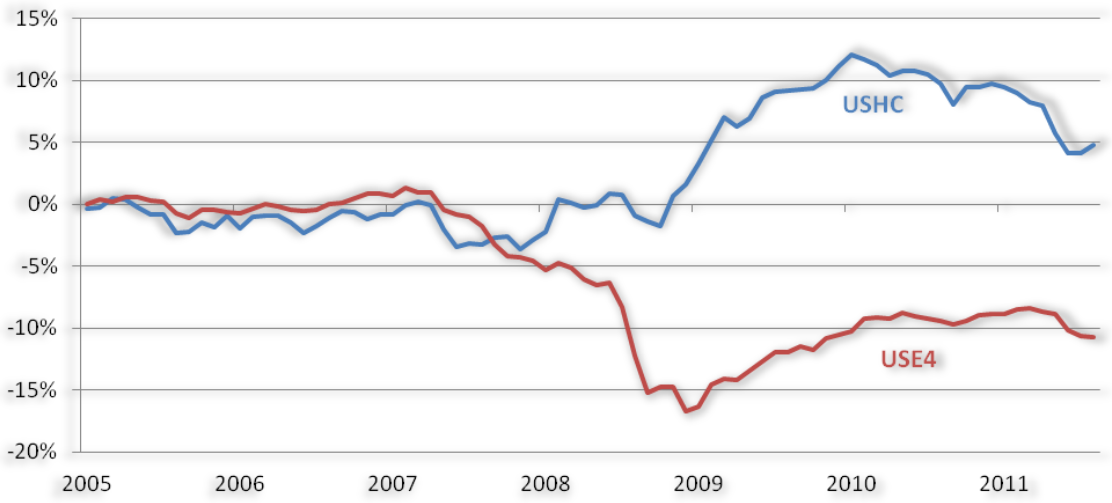
Would a portfolio manager feel comfortable using a broad risk model, knowing that his investment universe is constrained? Our historical observations show the use of sector risk models for sector portfolios provided more intuitive risk and performance attributions, and more relevant factor returns to better explain the return of a given portfolio.

Differences in Factor Returns

As explained earlier, USE4, and USHC are built from different estimation universes. USE4 uses the MSCI USA IMI weighted with square-root of market cap, with the top percentile winsorized. USHC uses the same weighing scheme but only for the stocks in the MSCI USA IMI that belong to the health care GICS® sector. As shown in Figure 2, health care stocks represent only 11% of the broad US estimation universe, which leads to large differences in performance of the estimation universes themselves.

The factor returns estimated from these universes can present large differences as well. Take the leverage factor in Figure 3.

Figure 3. Leverage Factor Returns: USE4 vs USHC



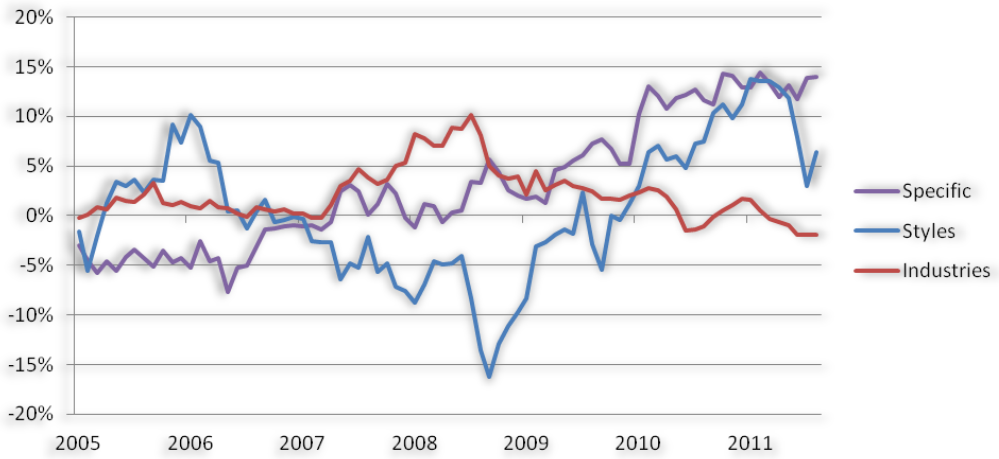
Note how, during the financial crisis of 2008-2009, the performance of the leverage factor between these two models diverged significantly. The explanation is intuitive and straightforward: in the USE4 estimation universe, there was about 20% of weight coming from financials. Highly levered financials did poorly as did other highly levered sectors like industrials and materials (driven by construction). The entire leverage factor in USE4 shows a marked negative performance during this period. However, in general, highly levered health care stocks did not underperform when compared with other less levered companies. In fact, they generally outperformed, leading to positive returns to the leverage factor in the health care sector risk model.

Historical Improvements in Risk Forecasts

We have shown that sector models can lead to more relevant risk and performance attributions. Next, we show the returns to the MSCI USA Health Care Small Cap Index, which includes small cap US stocks in the health care

sector, benchmarked against the MSCI USA Health Care Index. Two return attributions are shown, one using USE4 (Figure 4) and one using USHC (Figure 5):

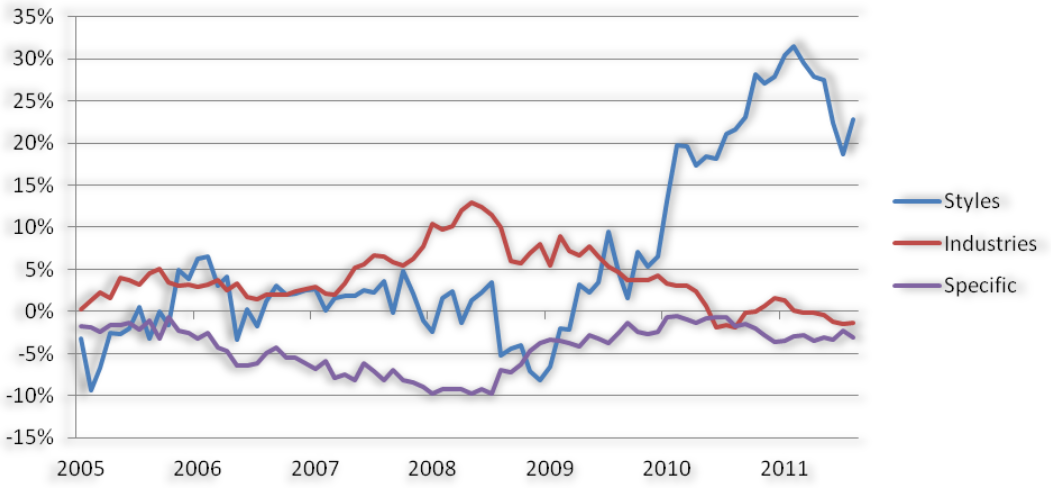
Figure 4. Cumulative Active Return Contributions Using the USE4 Model



When viewed through the lens of USE4, this basic small-cap strategy has a cumulative active return of +18.40% over the seven-year period. The active return can be broken down into contributions from styles (+6.39%) and industries (-1.98%), with +14.0% coming from the specific component. Looking at this return attribution, one could conclude there was some degree of effective stock selection, given that the specific contribution is positive with relatively low volatility.

A very different story stems from using USHC to run the attribution. The differences between Figure 4 and Figure 5 are striking. As expected, the cumulative active return remains unchanged at +18.40% over the seven-year period. The contributions to return, however, change significantly: the active return can be broken down into contributions from styles (+22.76%) and industries (-1.30%). The specific contribution to active return is down from 14.0% in USE4 to a negative 3.04% in USHC. The apparent stock selection skill shown in Figure 4 evaporates when looking at the very same strategy through the lens of a more relevant risk model.

Figure 5. Cumulative Active Return Contributions Using the USHC Model



The striking difference between the USE4 and USHC return attributions can be ascribed to the following styles:

Figure 6. Active Return Contributions by Factor

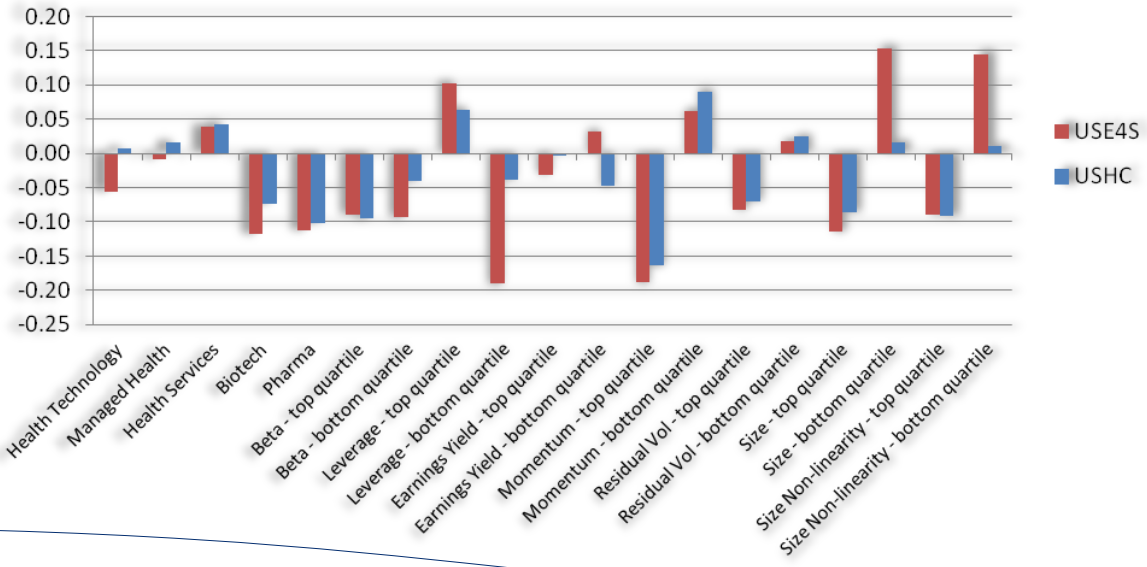
	USE4	*USHC*
Beta	-3.36%	0.37%
Non-linear Beta	0.57%	N/A
Book-to-Price	0.21%	N/A
Dividend Yield	-2.69%	N/A
Earnings Yield	-7.17%	-19.75%
Growth	4.29%	N/A
Leverage	-2.01%	3.46%
Liquidity	-0.40%	N/A
Momentum	3.72%	9.16%
Residual Volatility	-22.52%	-0.75%
Size	31.84%	25.29%
Non-linear Size	3.91%	4.98%
TOTAL	***6.39%***	***22.76%***

Note how the health care model explained significantly more return through the common factors, reducing the return contribution from the asset's specific return.

In this example we look at the bias statistics for USHC, compared with USE4. We built 19 long-only, market-cap weighted portfolios by screening the MSCI USA Health Care IMI for special characteristics (like membership to an industry or being in the top/ bottom quintile in exposure to a factor). We then produced risk forecasts for these portfolios using USE4S and USHC for a 10-year period. The risk forecasts produced by the risk models were compared with the realized return of the portfolios in the following period, producing a z-score, or standardized returns. The standard deviation of these standardized returns over the entire analysis period is shown in Figure 6.

Since values closer to one indicate more accurate risk forecasts, we show the deviations from one in the chart, making it easier to identify improvements in the bias statistics. Note how the bias statistics produced by the USHC are, on average, closer to one than those produced by USE4. This illustrates the improvement in risk forecast from using a sector model over a broad-based one.

Figure 7. Bias Statistics for USE4 and USHC (Deviation from 1)



Conclusion

We observed the advantages of using a sector model instead of a broad-based model by providing improved intuition and risk forecasts in the examples. While USE4 is very effective in representing the risk and return profiles of broad investment strategies in US stocks, many investors face restrictions in the stocks they can actually purchase, like sector-specific strategies. By using sector models built from a specific estimation universe that mimic the portfolio manager's investment universe, the risk and performance attributions may reflect the manager's investment philosophy more accurately.

Further potential benefits of using sector models include:

- More relevant factor returns, volatilities, and correlations computed from an investment universe that aligns more closely to the investment set available to the portfolio manager.
- More relevant factor returns means that a larger portion of the portfolio's return will be captured by common factors, effectively highlighting the drivers of return and realized risk.
- Sector models may produce better risk forecasts (as illustrated by the historical analysis of bias statistics) by better aligning the sources of a portfolio's forecast risk with the portfolio manager's investment strategy.

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[1] *As of September 30, 2012, as published by eVestment, Lipper and Bloomberg on January 31, 2013* *Apr 2013*