Improving Risk Adjusted Returns in Factor Investing

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Head of Global Equity
The Impetus for Factor Based Investing

Stock selection has historically been a drag on excess return, while factor exposures have been a significant source of excess returns.

<table>
<thead>
<tr>
<th>Excess Return Decile</th>
<th>Factor Exposures</th>
<th>Skill (Stock Selection)</th>
<th>Monthly Excess Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (High)</td>
<td>0.60% +</td>
<td>0.02%</td>
<td>0.62%</td>
</tr>
<tr>
<td>2</td>
<td>0.53% +</td>
<td>-0.06%</td>
<td>0.47%</td>
</tr>
<tr>
<td>3</td>
<td>0.52% +</td>
<td>-0.03%</td>
<td>0.49%</td>
</tr>
<tr>
<td>4</td>
<td>0.48% +</td>
<td>-0.05%</td>
<td>0.43%</td>
</tr>
<tr>
<td>5</td>
<td>0.52% +</td>
<td>-0.13%</td>
<td>0.39%</td>
</tr>
<tr>
<td>6</td>
<td>0.51% +</td>
<td>-0.11%</td>
<td>0.40%</td>
</tr>
<tr>
<td>7</td>
<td>0.55% +</td>
<td>-0.17%</td>
<td>0.38%</td>
</tr>
<tr>
<td>8</td>
<td>0.56% +</td>
<td>-0.16%</td>
<td>0.40%</td>
</tr>
<tr>
<td>9</td>
<td>0.56% +</td>
<td>-0.19%</td>
<td>0.37%</td>
</tr>
<tr>
<td>10 (Low)</td>
<td>0.62% +</td>
<td>-0.43%</td>
<td>0.19%</td>
</tr>
</tbody>
</table>

THE IMPETUS FOR FACTOR BASED INVESTING

Equity style factors have generated greater absolute and risk adjusted returns over the long-term.

Risk/Return of Common Factors
vs. MSCI World Index (1997-2015)

- MSCI World: 7.5% (0.48)
- Value: 13.0% (0.62)
- Size: 9.7% (0.54)
- Momentum: 11.5% (0.68)
- Low Volatility: 12.8% (0.63)
- Dividend Yield: 11.4% (0.72)
- Quality: 10.0% (0.90)

Source: Northern Trust Quantitative Research, Data as of 12/31/2015
Factor investing comes with inherent risks that asset owners must take into consideration...

- Cyclicality of factors can lead to pronounced periods of underperformance
- Unintended risks can impact returns
- Capturing “pure” factor exposure is difficult
- Failure to explicitly target factor exposures means return becomes a “coin toss”
Our Quality Score is compromised of three fundamental indicators applied quantitatively:

1. Management Efficiency Signals
2. Profitability Signals
3. Cash Generation Signals

Our Approach:
- Multi-Dimensional
- Sector Specific Analysis
- Sector Neutral Application
MULTI-FACTOR CONSTRUCTION REDUCES EFFECTS CYCLICALITY

Our research demonstrates that Quality is an excellent complement to other factors as it increases return, reduces volatility, and mitigates the effects of factor cycles.

The Impact of Quality on Annualized Returns

<table>
<thead>
<tr>
<th>Period</th>
<th>Value</th>
<th>Size</th>
<th>Low Momentum</th>
<th>Dividend Yield</th>
<th>Quality &amp; Value</th>
<th>Quality &amp; Size</th>
<th>Quality &amp; Momentum</th>
<th>Quality &amp; Low Vol</th>
<th>Quality &amp; Dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979 to 1982</td>
<td>1.9%</td>
<td>8.2%</td>
<td>15.9%</td>
<td>-1.7%</td>
<td>11.2%</td>
<td>17.7%</td>
<td>20.9%</td>
<td>4.6%</td>
<td>6.3%</td>
</tr>
<tr>
<td>1983 to 1986</td>
<td>13.0%</td>
<td>-4.1%</td>
<td>8.3%</td>
<td>29.5%</td>
<td>25.9%</td>
<td>7.0%</td>
<td>19.5%</td>
<td>29.4%</td>
<td>27.5%</td>
</tr>
<tr>
<td>1987 to 1990</td>
<td>-2.5%</td>
<td>-8.8%</td>
<td>21.8%</td>
<td>26.1%</td>
<td>12.4%</td>
<td>1.6%</td>
<td>25.9%</td>
<td>27.3%</td>
<td>19.9%</td>
</tr>
<tr>
<td>1991 to 1994</td>
<td>9.6%</td>
<td>5.4%</td>
<td>5.9%</td>
<td>-2.1%</td>
<td>15.7%</td>
<td>9.0%</td>
<td>12.4%</td>
<td>5.9%</td>
<td>7.2%</td>
</tr>
<tr>
<td>1995 to 1998</td>
<td>1.5%</td>
<td>-7.4%</td>
<td>12.6%</td>
<td>13.6%</td>
<td>9.7%</td>
<td>-3.7%</td>
<td>17.6%</td>
<td>15.7%</td>
<td>12.5%</td>
</tr>
<tr>
<td>1999 to 2002</td>
<td>15.3%</td>
<td>6.0%</td>
<td>9.3%</td>
<td>22.6%</td>
<td>35.9%</td>
<td>21.4%</td>
<td>21.0%</td>
<td>27.1%</td>
<td>26.0%</td>
</tr>
<tr>
<td>2003 to 2006</td>
<td>10.1%</td>
<td>4.3%</td>
<td>-4.4%</td>
<td>-5.6%</td>
<td>14.3%</td>
<td>6.3%</td>
<td>1.9%</td>
<td>-0.5%</td>
<td>1.9%</td>
</tr>
<tr>
<td>2007 to 2010</td>
<td>5.7%</td>
<td>4.5%</td>
<td>-11.9%</td>
<td>-9.9%</td>
<td>9.5%</td>
<td>10.8%</td>
<td>-4.3%</td>
<td>-2.9%</td>
<td>-1.4%</td>
</tr>
<tr>
<td>2011 to 2015</td>
<td>-4.7%</td>
<td>-3.1%</td>
<td>13.0%</td>
<td>14.3%</td>
<td>0.7%</td>
<td>0.0%</td>
<td>11.3%</td>
<td>11.7%</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

Source: Northern Trust Quantitative Research
CAPTURING “PURE” FACTOR EXPOSURE

It’s important to capture “pure” (true) factor exposure to reduce the propensity for return detractors inherent with uncompensated risks

Uncompensated Risks
Commonly Found in Factor-Based Strategies

- Stock Specific Risks¹
- Sector and Region Biases²

Factor-based equity strategies generate alpha through exposure to compensated risk factors

¹Carhart (1997)
²Jacobsen, et. al. (2010)
UNDERSTANDING THE DIFFERENCE

Much of the difference in smart-beta strategy performance can be attributed to how “efficiently” the factor tilt is implemented

- Due to correlations among compensated and uncompensated factors, naïve factor tilts may yield high uncompensated factor exposure

- Efficiency is defined as the risk exposure to the intended factor per unit of risk exposure to the unintended factors
ARE WE MAXIMIZING RISK ADJUSTED RETURNS?

To outperform meaningfully an investor must take considerable active risk within the concentrated risk bucket.

• However, it is well known that risk-adjusted returns, i.e., information ratios, decline with high levels of active risk.

• Strong empirical support for this phenomenon has been provided in the academic literature.

Information Ratio = \frac{\text{Excess Return}}{\text{Tracking Error}}

Decline in Information Ratio as Tracking Error Increases

1Petajisto (2013)
2Clarke, de Silva and Thorley (2002)
3Alford, Jones and Winkelmann (2003)
MEASURING EXPOSURE: FACTOR EFFICIENCY RATIO (FER)

In order to minimize uncompensated risks, factor based strategies must maintain a high (“pure”) exposure to only the targeted factor.

\[
\text{FER} = \frac{\text{Intended Factor Exposures}}{\text{Unintended Factor Exposures}}
\]

(Take Compensated Risks)

(Risk Weighted)

(Minimize Uncompensated Risks)

High FER = High Factor Exposure
NOT ALL STRATEGIES DELIVER PURE FACTOR EXPOSURE

While it is not possible to achieve a perfect FER ratio (1.00), the below example illustrates how disparate and low the true factor exposure is across the industry.

Did the low volatility factor outperform or underperform?

3 Year Excess Returns
As of March 31, 2015

Source: Northern Trust Quantitative Research
DO MORE EFFICIENT STRATEGIES DELIVER STRONGER PERFORMANCE?

Intuitively, we might expect a strategy with a high FER to produce high risk adjusted returns:

• Exposure to compensated factor is strong, thus generating higher alpha
• Unintended factor risk is minimized, thus generating lower volatility
• The net result is higher risk adjusted returns
Across all factors, inefficient, poorly designed strategies have yielded lower risk-adjusted returns.

Consider the relation between the actual Sharpe ratio and the Shape ratio predicted by the FER. Factor efficiency can explain between 50% and 80% of the variation in risk adjusted returns across smart-beta strategies.

Source: Bloomberg MSCI, Barra and Northern Trust Quantitative Research
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