ASSET MANAGEMENT

Improving Risk Adjusted Returns in Factor Investing

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NORTHERN TRUST

THE IMPETUS FOR FACTOR BASED INVESTING

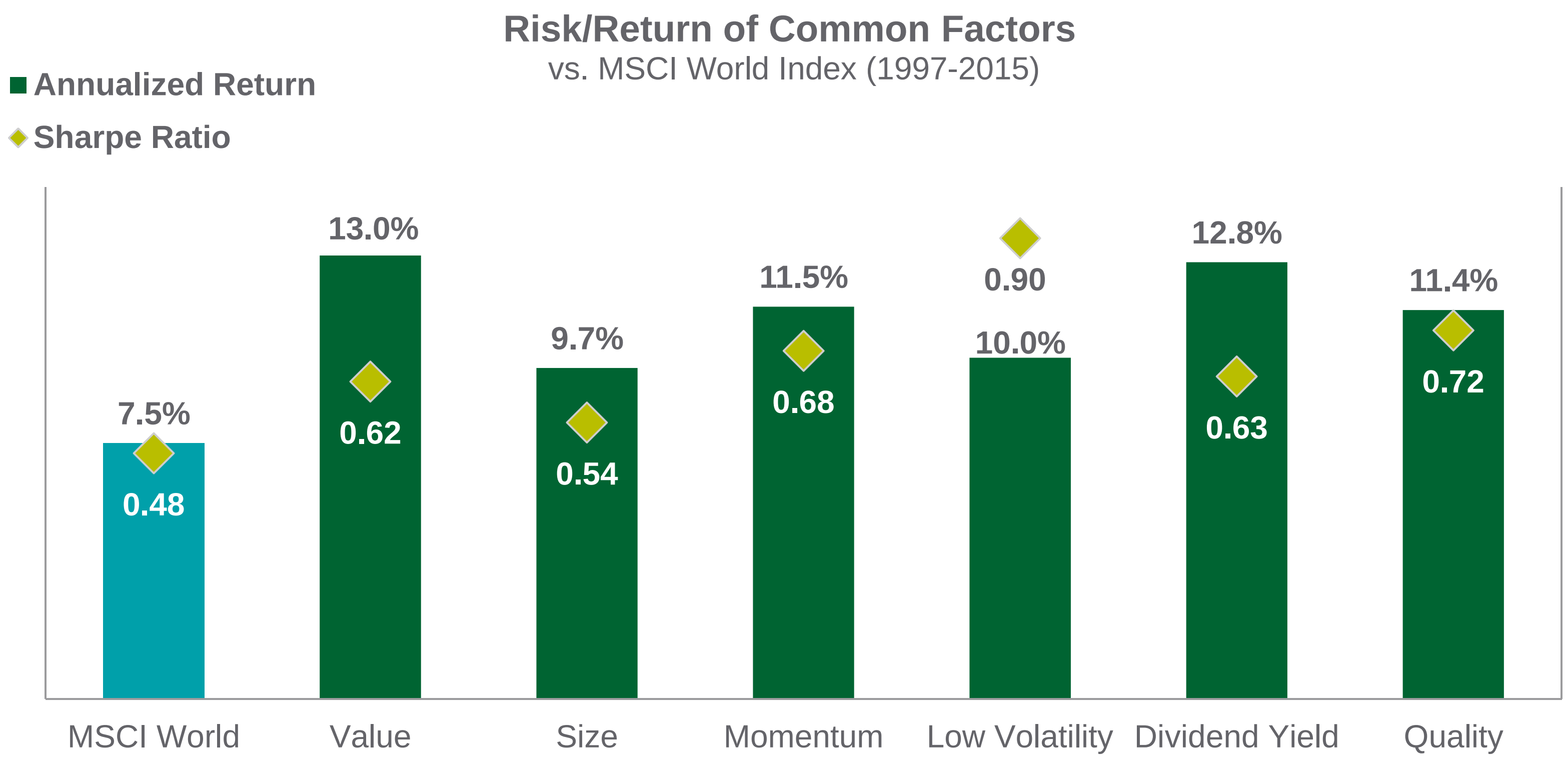
Stock selection has historically been a drag on excess return, while factor exposures have been a significant source of excess returns

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

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance*, *52*(1), 57-82.

THE IMPETUS FOR FACTOR BASED INVESTING

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



Source: Northern Trust Quantitative Research, Data as of 12/31/2015

FACTOR-INVESTING: THE IMPORTANCE OF EXECUTION

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"**

NORTHERN TRUST QUALITY SCORE

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

Period	Value	Size	Momentum	Low Volatility	Dividend Yield	Quality & Value	Quality & Size	Quality & Momentum	Quality & Low Vol	Quality & Dividend
1979 to 1982	1.9%	8.2%	15.9%	0.6%	-1.7%	11.2%	17.7%	20.9%	4.6%	6.3%
1983 to 1986	13.0%	-4.1%	8.3%	29.5%	16.3%	25.9%	7.0%	19.5%	29.4%	27.5%
1987 to 1990	-2.5%	-8.8%	21.8%	26.1%	8.5%	12.4%	1.6%	25.9%	27.3%	19.9%
1991 to 1994	9.6%	5.4%	5.9%	-2.1%	-1.9%	15.7%	9.0%	12.4%	5.9%	7.2%
1995 to 1998	1.5%	-7.4%	12.6%	13.6%	5.0%	9.7%	-3.7%	17.6%	15.7%	12.5%
1999 to 2002	15.3%	6.0%	9.3%	22.6%	12.0%	35.9%	21.4%	21.0%	27.1%	26.0%
2003 to 2006	10.1%	4.3%	-4.4%	-5.6%	-3.3%	14.3%	6.3%	1.9%	-0.5%	1.9%
2007 to 2010	5.7%	4.5%	-11.9%	-9.9%	-4.8%	9.5%	10.8%	-4.3%	-2.9%	-1.4%
2011 to 2015	-4.7%	-3.1%	13.0%	14.3%	2.6%	0.7%	0.0%	11.3%	11.7%	6.9%

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 Risks[1]	Sector and Region Biases[2]

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

[1]Carhart (1997)
[2]Jacobsen, 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**

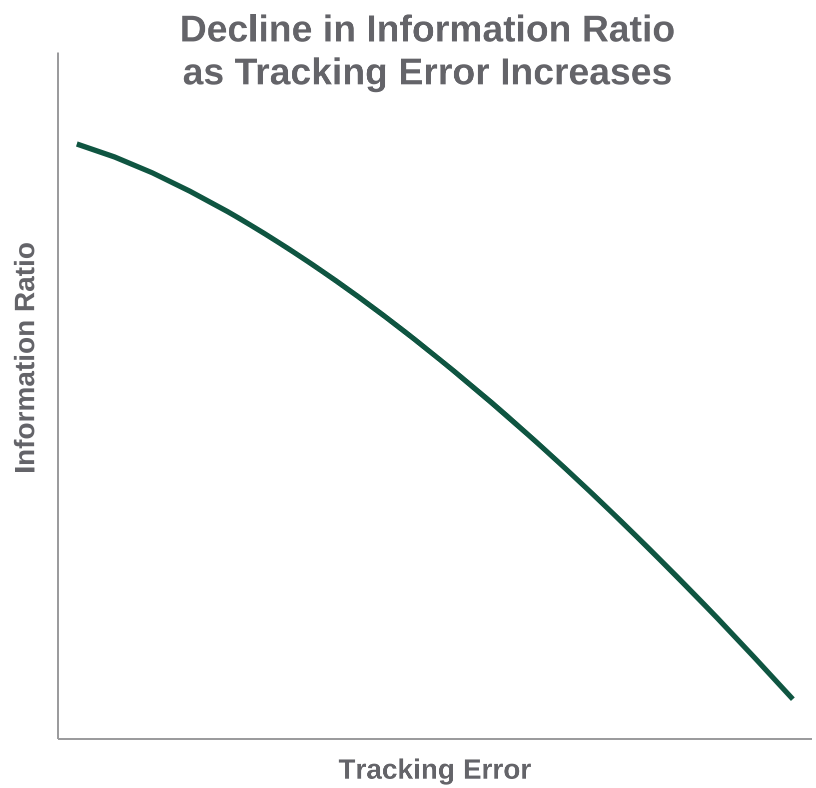
- **Efficiency is defined as the risk exposure to the intended factor per unit of risk exposure to the unintended factors**

ARE WE MAXIMIZING RISK ADJUSTED RETURNS?

To outperform meaningfully an investor must take considerable active risk within the concentrated risk bucket[1]

- However, it is well known that risk-adjusted returns, i.e., information ratios, decline with high levels of active risk[2]
- Strong empirical support for this phenomenon has been provided in the academic literature[3]

$$\textbf{Information Ratio} = \frac{\textbf{Excess Return}}{\textbf{Tracking Error}}$$



[1]Petajisto (2013)
[2]Clarke, de Silva and Thorley (2002)
[3]Alford, 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

(Take Compensated Risks)

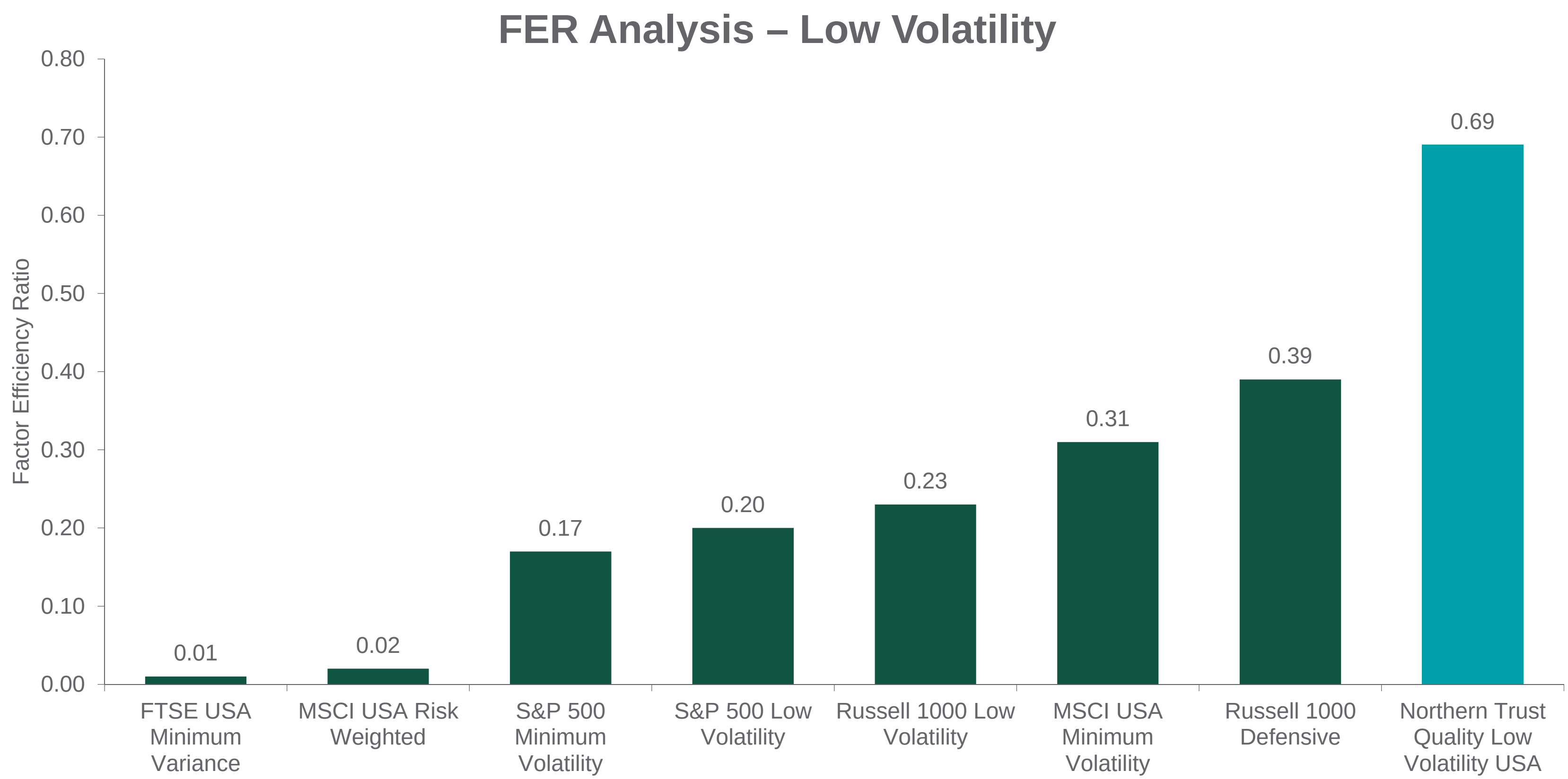
$$\text{FER}_{\text{(Risk Weighted)}} = \frac{\textbf{Intended Factor Exposures}}{\textbf{Unintended Factor Exposures}}$$

(Minimize Uncompensated Risks)

High FER = High Factor Exposure

NOT ALL STRATEGIES DELIVER PURE FACTOR EXPOSURE

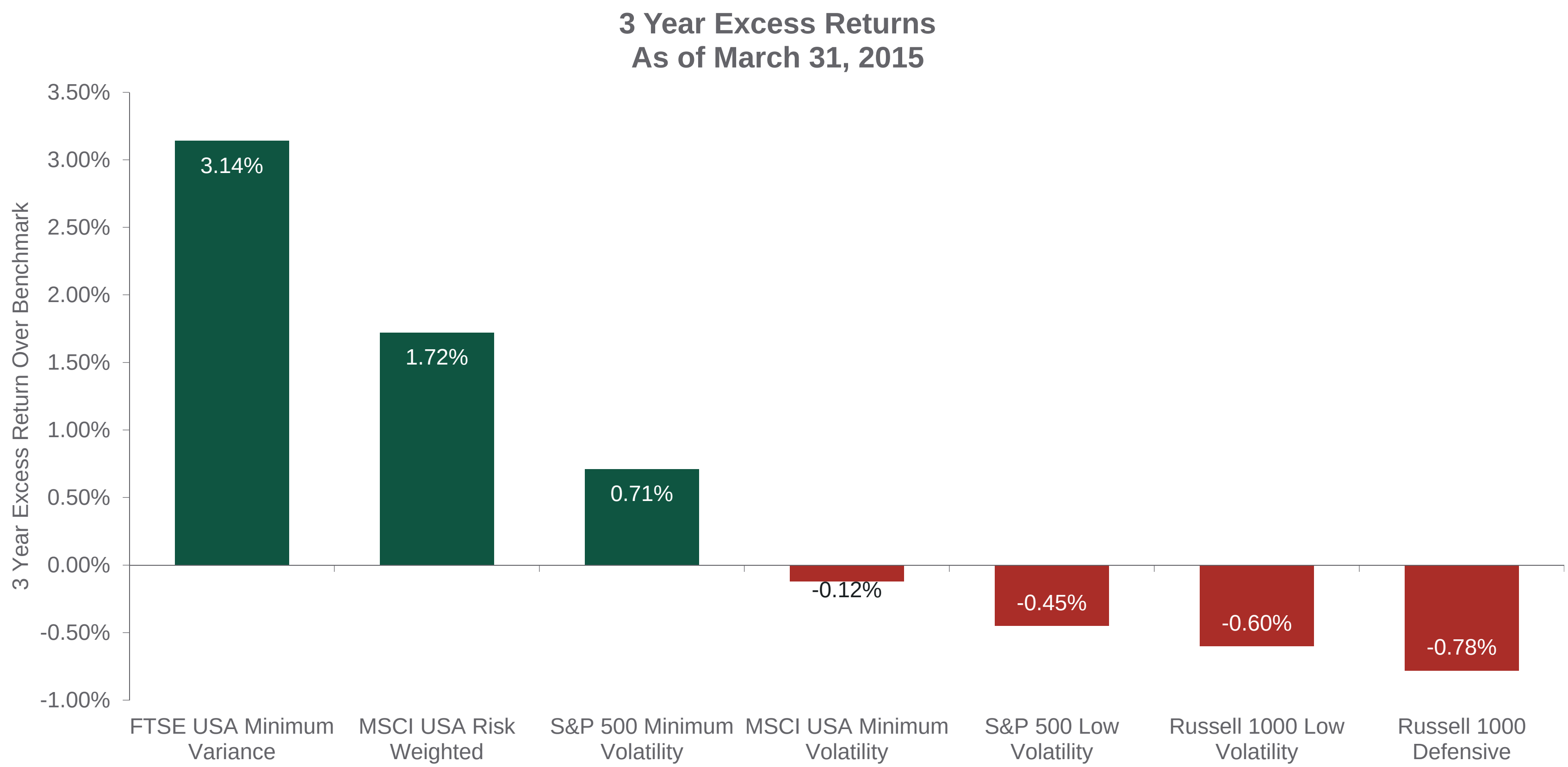
While it is not possible to achieve a perfect FER ratio (1.00), the below example illustrates how disparate and low the true factor exposure is across the industry



Source: Northern Trust. Quantitative Research Data as of March 31, 2015

SMART BETA – LOW VOLATILITY INDEX COMPARISON

Did the low volatility factor outperform or underperform?



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

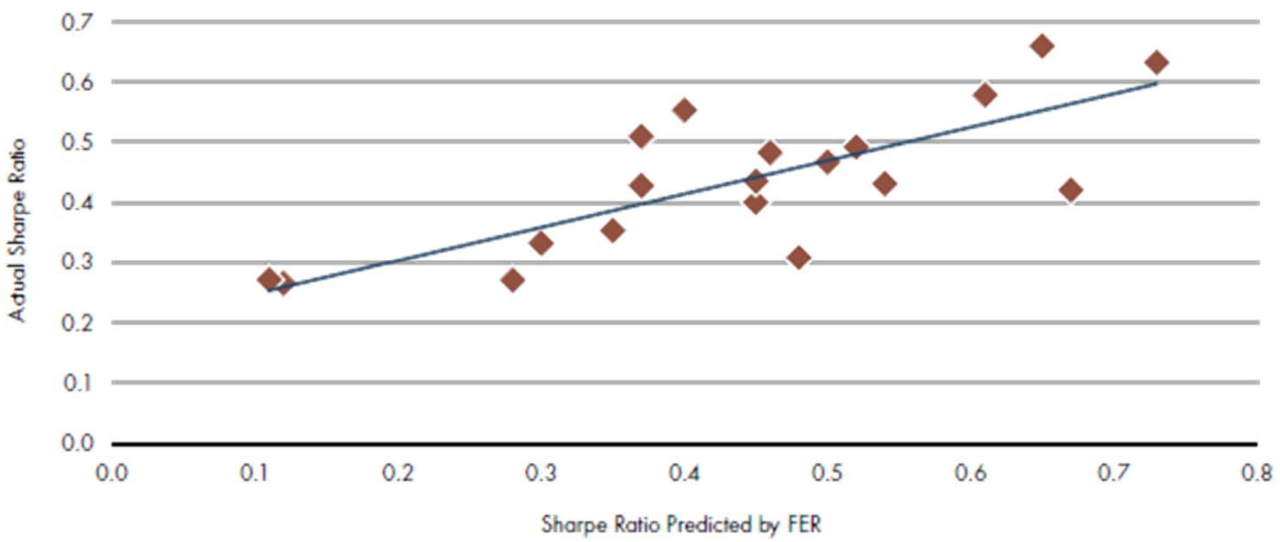
- **Exposure to compensated factor is strong, thus generating higher alpha**
- **Unintended factor risk is minimized, thus generating lower volatility**
- **The net result is higher risk adjusted returns**

DESIGN MATTERS!

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.

Random Effects Estimation



Source: Bloomberg MSCI, Barra and Northern Trust Quantitative Research

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