NORTHERN TRUST
ASSET MANAGEMENT

EXECUTIVE SUMMARY

FOUNDATIONS IN FACTORS

THE QUEST TO CAPTURE EFFICIENT ALPHA MEANS CHALLENGING MODERN PORTFOLIO THEORY

MICHAEL HUNSTAD, PHD
Head of Quantitative Strategies
Northern Trust Asset Management

ROBERT LEHNHERR, CFA
Quantitative Research Analyst
Northern Trust Asset Management

Historically, style factors have been shown to deliver superior risk-adjusted returns to passive capitalization weighted indexes and more persistent performance than traditional active management, making them a compelling alternative for investors. Although the efficacy of style factors conflicts with modern financial theory, they have been successfully employed for more than 40 years to improve upon passive capitalization weighted equity portfolios. Empirical studies have repeatedly shown that style factors outperform capitalization weighted benchmarks across most global markets. However, these results are considered anomalous because they are inconsistent with the concept that expected return is determined solely by beta.

Like all investment strategies, style factors are not without potential drawbacks. They are susceptible to prolonged periods of poor relative performance. This cyclicality is problematic because investors commonly evaluate strategies on a three- to five-year horizon. Style factors, like any active investment strategy, are prone to underperforming over short holding periods and can ultimately lead to divestment at inopportune times. This is why we believe factor diversification improves the chances of investors benefiting from style factors. However, diversification is not the only way to reduce the potential style factor underperformance; we believe portfolios can be explicitly designed to address this risk.

HISTORY AND EVOLUTION OF STYLE FACTORS

William Sharpe introduced the first factor model in 1964 that only included a single factor (beta) and was quite straightforward. This is known as the Capital Asset Pricing Model (CAPM).

Even though the CAPM encompasses all financial assets, equity markets are commonly used as a proxy for the aggregate market portfolio. In this context, the CAPM tells us a stock's expected excess return is entirely determined by its beta, and that the only reliable manner to outperform the market is by holding stock(s)

with higher systematic risk than the market (beta greater than one). However, according to the CAPM, investors would be foolish to do so because a superior alternative exists with leverage. By borrowing at the risk-free rate and investing in a market portfolio, investors can increase beta beyond one and achieve a higher expected return than an unlevered portfolio with the same underlying investment volatility. If investors are either unwilling or unable to employ leverage, they must accept lower Sharpe Ratios if they wish to outperform the market.

The importance of the CAPM to passive capitalization weighted investing cannot be overstated, as it provides the theoretical justification for holding the market portfolio. However, despite its wide acceptance, there are two assertions of the CAPM that have been consistently challenged.

CAPM ASSERTION #1: MARKET BETA IS THE ONLY SYSTEMATIC RISK FACTOR

If we accept the CAPM as the true market model, we must reject the possibility that other factors are driving returns. If portfolios reliably generate high (low) excess returns, it must be solely the result of higher (lower) beta. Unfortunately for the CAPM, there is plenty of evidence to suggest otherwise.

Dividend yield is only one of several well-documented CAPM inconsistencies. For example, research shows that the average returns of high dividend yield portfolios are greater than those of low dividend portfolios, and that this difference in returns is not attributable to beta. In fact, the betas of the top dividend yield portfolios are actually lower than those of the bottom dividend yield portfolios, which directly conflicts with the CAPM. Either this finding is incongruent with the CAPM assumption that return is solely a function of beta, or these findings are anomalous.

Even though anomalous findings began piling up almost immediately after the publication of Sharpe's paper, it took almost 30 years for a serious CAPM competitor to emerge. In 1992, Eugene Fama and Kenneth French introduced a three-factor model that had much better success in explaining historic stock returns. Although Fama and French's model included Sharpe's beta factor, it rejected market beta as the only systematic risk factor and addressed CAPM anomalies by including factors for size and value.

In 1997, Carhart extended the Fama and French model to include a fourth factor - momentum. Although the three-factor model could explain over 90% of the variation in diversified portfolio returns, momentum was a statistically robust addition to the model that increased its predictive power. Perhaps more importantly, Carhart's model explained the three most prevalent equity market anomalies in one succinct package – value, size, and momentum.

CAPM ASSERTION #2: THE MARKET PORTFOLIO OFFERS THE HIGHEST ATTAINABLE SHARPE RATIO

The existence of factors beyond market beta is of great interest to academics, but not necessarily investors. If these insights cannot be applied to achieve superior risk-adjusted returns relative to a passive market index, they have little relevance beyond the classroom. Exhibit 1 shows the Sharpe ratios for various factors alongside their respective indices. As you can see below, individual factors have superior Sharpe ratios relative to passive capitalization weighted indices.

EXHIBIT 3: PERFORMANCE OF CAPM ANOMALIES

	Russell 1000 (1980-2018)		MSCI World ex US (1997 - 2018)		MSCI Emerging Markets (1999 - 2018)	
	Avg CW Return	Sharpe Ratio	Avg CW Return	Sharpe Ratio	Avg CW Return	Sharpe Ratio
Panel A: Capitalization weighted index performance						
Market Index	12.5%	0.53	6.2%	0.25	11.8%	0.45
Panel B: Portfolio performance						
Book to Price (Value)	13.2%	0.52	8.6%	0.32	14.5%	0.49
Earnings to Price (Value)	14.6%	0.65	9.1%	0.39	16.8%	0.60
Dividend Yield (Value)	13.7%	0.69	9.1%	0.42	16.2%	0.68
Low Size	15.4%	0.56	8.0%	0.31	14.6%	0.54
Momentum	14.2%	0.55	6.7%	0.28	14.0%	0.53
Low Volatility	11.9%	0.71	6.6%	0.34	11.5%	0.56
ROE (Quality)	13.6%	0.57	7.0%	0.30	12.2%	0.46
Low ROE Variability (Quality)	13.3%	0.65	7.2%	0.33	11.5%	0.49
ROIC (Quality)	13.7%	0.58	7.1%	0.32	12.7%	0.50
Gross Profitability (Quality)	15.1%	0.67	7.7%	0.39	13.0%	0.53

SOURCE: Northern Trust Quantitative Research, FTSE Russell, MSCI, Worldscope, Compustat

IMPLICATIONS FOR INVESTORS

The implications of this to passive investors are obvious. Style factors offer a simple, systematic alternative to generating higher risk-adjusted returns than capitalization weighted indices. Perhaps a less obvious outcome is the disruptive effect this research has had on traditional active investors.

While the CAPM offers no insight into the source of alpha, conventional wisdom has attributed it to the ability of portfolio managers. Managers who consistently generated positive alpha were thought to have superior stock-picking abilities and were highly coveted by investors, as evidenced by their fees. However, the advent of multi-factor pricing models has changed this perception. The explanatory power of multi-factor models is greater than Sharpe's single factor model, and reduces the amount of unexplained active manager alpha, implying that manager skill could be explained by other systematic factors.

This topic was thoroughly explored in the landmark paper by Carhart (1997), in which he examined the performance of more than 1800 mutual funds between 1962 and 1992. Initially, he found strong persistence in active returns, supporting the notion that managers with superior insights can consistently generate positive alpha. However, after the returns were subsequently adjusted for style factors, the persistence disappeared and alpha was found to be negative, indicating that manager skill actually decreased returns on average.

The interest in style factor investing should not be surprising, given its appeal to both passive and active investors. Similar to capitalization weighted investing, style factors offer a systematic, diversified, and transparent source of return, but with the added benefit of higher Sharpe ratios. Just like traditional active investing, style factors offer the ability to outperform the market, but in a more reliable and cost-effective manner.

Of course, these potential benefits assume that style factors will continue to behave similarly in the future. However, this assumption lacks consensus and represents a key consideration for investors. Despite their success in explaining historic stock returns, multi-factor models face some theoretical difficulties. In particular, they do not address why a premium should result from investing in high value, small size, high momentum, low volatility, and high quality stocks. Unlike the CAPM, which provides an intuitive justification for returns (high systematic risk = high return), the connection between style factors and returns is not so clear.

The genesis of style factor return premia is still open to interpretation, but explanations generally fall into one of three categories:

- **Risk-based explanations** imply that volatility alone is not enough to describe risk, and measures like the Sharpe ratio do not truly represent risk-adjusted performance. In other words, style factor investors earn a premium because they are actually bearing more risk.
- **Structural explanations** assert there are constraints that prevent the CAPM assumptions from holding. The most common of these explanations is that if investors are unable to use leverage, but have high return requirements, they have no choice but to invest in high beta assets. This creates inefficiencies as high beta assets become mispriced relative to the market.
- **Behavioral explanations** suggest that investors are prone to persistent behavioral biases that ultimately manifest as factor anomalies.

THE PERILS OF FACTOR CYCLICALITY

Although the benefits of style factor investing are enticing to investors, they should not be viewed as a free lunch. There are three deterrents that collectively create a high hurdle for style factor adoption:

1. Style factors are prone to sustained periods of underperformance.
2. Investors commonly evaluate strategies on a three- to five-year horizon.
3. Investors tend to resent losses more than they value gains of an equal amount.

These considerations suggest style factor investors will be inclined to abandon the strategy at some point during the holding period, potentially to their detriment, just as they do with traditional active strategies. On average, investors who evaluate strategy performance on a three-year horizon would be unhappy with various factors even though they may earn a positive active return over longer holding periods. This propensity paints a grim picture for style factor investors because the length and depth of drawdowns threaten to force divestment. If style factors are to be useful for investors, the downturns must become shorter and shallower. So how do we do this?

DIVERSIFY WITHIN AND ACROSS FACTORS

There are a number of techniques to mitigate the risk of cyclicality. One of the most prominent methods involves a concept that predates style factor investing itself – diversification. Instead of choosing a single style factor with the most desired characteristics, a reasonable alternative is to combine them. For example, a value investor may wish to favor stocks that rank high in book to price, earnings to price, and dividend yield dimensions. Similarly, a quality investor may seek firms that exhibit both high ROE and low ROE variability. This means there are considerations that must be taken into account to deliver the benefits of style factors in an acceptable manner for investors. A few of the most important considerations are:

- **Exogenous systematic risks** often accompany style factor strategies, potentially creating significant tracking error. Examples include fundamental risk factors such as industries and countries, and macroeconomic risks such as growth and inflation. Factors may be designed to minimize these extraneous risks without sacrificing the style factor risk premium.
- **Structural differences** across sectors (industries) and regions (countries) can make cross comparing style factors difficult. Naïve factor definitions that fail to acknowledge the unique economics or accounting standards of a particular industry group or region may become persistently biased.

Considerations for style factor implementation

Style factors are not perfectly independent from one another and the relationships among them vary over time. An effective multi-factor strategy must account for this to prevent the dilution of the style factor premium. For example, high value stocks tend to be high volatility, and high momentum stocks become synonymous with low value during periods of valuation multiple expansion. If investors are not careful, the way they diversify style factors can lead to loss of active return.

Style factor volatilities differ significantly, which can lead to concentrated active risk. A simplistic multi-factor weighting scheme often results in the active return being heavily influenced by one or two strategies. Low volatility strategies are the most common example, as they notoriously generate high levels of tracking error relative to the other style factors and tend to dominate active risk when used in combination.

While factor cyclicality cannot be completely eliminated, strategies that account for these considerations exhibit downturns that are significantly shorter and shallower than naïve alternatives. Given the importance of factor cyclicality on the investment outcome, it is imperative that investors are mindful of these issues when evaluating a factor strategy.

CONCLUSION

Historically, style factors have been shown to deliver superior risk-adjusted returns to passive capitalization weighted indexes and have more persistent performance than traditional active management, making them a compelling alternative for investors. However, the benefits of style factors come with the cost of cyclicality and expose investors to the risk of sustained underperformance.

Style factor cyclicality can be mitigated by employing multi-dimensional factor definitions and diversifying across factors on top of other methods of reducing risk without sacrificing return. Through intelligent factor design and implementation, drawdowns can be made less severe, which makes it easier for investors to stay the course. Given the potential benefits style factors afford, we recommend investors seek out portfolios designed explicitly to improve the investor experience and avoid divestment.

IMPORTANT INFORMATION: The information contained herein is intended for use with current or prospective clients of Northern Trust Asset Management. The information is not intended for distribution or use by any person in any jurisdiction where such distribution would be contrary to local law or regulation. Northern Trust and its affiliates may have positions in and may effect transactions in the markets, contracts and related investments different than described in this information. This information is obtained from sources believed to be reliable, and its accuracy and completeness are not guaranteed. Information does not constitute a recommendation of any investment strategy, is not intended as investment advice and does not take into account all the circumstances of each investor. Opinions and forecasts discussed are those of the author, do not necessarily reflect the views of Northern Trust and are subject to change without notice.

This report is provided for informational purposes only and is not intended to be, and should not be construed as, an offer, solicitation or recommendation with respect to any transaction and should not be treated as legal advice, investment advice or tax advice. Recipients should not rely upon this information as a substitute for obtaining specific legal or tax advice from their own professional legal or tax advisors. References to specific securities and their issuers are for illustrative purposes only and are not intended and should not be interpreted as recommendations to purchase or sell such securities. Indices and trademarks are the property of their respective owners. Information is subject to change based on market or other conditions.

All securities investing and trading activities risk the loss of capital. Each portfolio is subject to substantial risks including market risks, strategy risks, adviser risk and risks with respect to its investment in other structures. There can be no assurance that any portfolio investment objectives will be achieved, or that any investment will achieve profits or avoid incurring substantial losses. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. Risk controls and models do not promise any level of performance or guarantee against loss of principal. Any discussion of risk management is intended to describe Northern Trust's efforts to monitor and manage risk but does not imply low risk.

Past performance is no guarantee of future results. Performance returns and the principal value of an investment will fluctuate. Performance returns contained herein are subject to revision by Northern Trust. Comparative indices shown are provided as an indication of the performance of a particular segment of the capital markets and/or alternative strategies in general. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index. Net performance returns are reduced by investment management fees and other expenses relating to the management of the account. Gross performance returns contained herein include reinvestment of dividends and other earnings, transaction costs, and all fees and expenses other than investment management fees, unless indicated otherwise. For additional information on fees, please refer to Part 2a of the Form ADV or consult a Northern Trust representative.

Investing involves risk- no investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment.

Forward-looking statements and assumptions are Northern Trust's current estimates or expectations of future events or future results based upon proprietary research and should not be construed as an estimate or promise of results that a portfolio may achieve. Actual results could differ materially from the results indicated by this information.

If presented, hypothetical portfolio information provided does not represent results of an actual investment portfolio but reflects representative historical performance of the strategies, funds or accounts listed herein, which were selected with the benefit of hindsight. Hypothetical performance results do not reflect actual trading. No representation is being made that any portfolio will achieve a performance record similar to that shown. A hypothetical investment does not necessarily take into account the fees, risks, economic or market factors/conditions an investor might experience in actual trading. Hypothetical results may have under- or over- compensation for the impact, if any, of certain market factors such as lack of liquidity, economic or market factors/conditions. The investment returns of other clients may differ materially from the portfolio portrayed. There are numerous other factors related to the markets in general or to the implementation of any specific program that cannot be fully accounted for in the preparation of hypothetical performance results. The information is confidential and may not be duplicated in any form or disseminated without the prior consent of Northern Trust.

This information is intended for purposes of Northern Trust marketing of itself as a provider of the products and services described herein and not to provide any fiduciary investment advice within the meaning of Section 3(21) of the Employee Retirement Income Security Act of 1974, as amended ("ERISA"). Northern Trust is not undertaking to provide impartial investment advice or give advice in a fiduciary capacity to the recipient of these materials, which are for marketing purposes and are not intended to serve as a primary basis for investment decisions. Northern Trust and its affiliates receive fees and other compensation in connection with the products and services described herein as well as for custody, fund administration, transfer agent, investment operations outsourcing and other services rendered to various proprietary and third party investment products and firms that may be the subject of or become associated with the services described herein.

The Northern Trust Company of Hong Kong Limited (TNTCHK) is regulated by the Hong Kong Securities and Futures Commission. In Singapore, TNTCHK, Northern Trust Global Investments Limited (NTGIL), and Northern Trust Investments, Inc. are exempt from the requirement to hold a Financial Adviser's Licence under the Financial Advisers Act and a Capital Markets Services Licence under the Securities and Futures Act with respect to the provision of certain financial advisory services and fund management activities. In Australia, TNTCHK is exempt from the requirement to hold an Australian Financial Services Licence under the Corporations Act. TNTCHK is authorized and regulated by the SFC under Hong Kong laws, which differ from Australian laws.

Northern Trust Asset Management is composed of Northern Trust Investments, Inc. Northern Trust Global Investments Limited, Northern Trust Fund Managers (Ireland) Limited, Northern Trust Global Investments Japan, K.K, NT Global Advisors Inc., 50 South Capital Advisors, LLC, Belvedere Advisors LLC and investment personnel of The Northern Trust Company of Hong Kong Limited and The Northern Trust Company.

northerntrust.com Q62745 (6/19)