

Factor Investing

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Road Map

1. Factor Investing in practitioners' world
2. Caveats in Factor Investing
3. What do we do?

What Is Factor Investing?

Factor Investing in the Practitioners' World

Definition:

Factor investing is an investment approach that harvests persistent sources of excess returns and offers above market returns

Most popular applications:

- Equity: Style investing ; smart beta
- Multi-Asset classes

Factor investing/smart beta index funds have many benefits:

- Exposure to well-studied sources of return
- Typically low fees
- Transparency

The Promise

Influential 2009 paper

Evaluation of Active Management of the Norwegian Government Pension Fund – Global

December 14, 2009

Andrew Ang

Ann F. Kaplan Professor of Business, Columbia Business School

William N. Goetzmann

Edwin J. Beinecke Professor of Finance and Management Studies, Yale School of Management

Stephen M. Schaefer

Professor of Finance, London Business School

The Realization Disappointment

MAGAZINE ISSUES » APRIL 2019

Factor investing: Is factor investing broken?



Factor investing held out a promise to replicate the investment styles of the world's top active managers. So, why has this method let investors down? *George Mitton* reports.

Blame it on the Norwegians. It was an influential study of that nation's national oil fund that made factor investing the most fashionable investment method for institutions in the past decade.

Caveats in Factor Investing?

Reality of Factor Investing

Factor investing has failed to live up to many of its promises. It's success is compromised by three risks often underappreciated by investors:

1. Exaggerated expectation about factor performance due to
 - Data mining
 - Crowding and rising valuations
 - Ignorance of trading costs and implementability
2. Factors sometimes experience drawdowns that far exceed expectations
3. Diversification vanishes as correlations sometimes soar

Unrealistic Expectations

Factor Performance in the Long Run, United States, July 1963–June 2018

| Factor | Average Year of Discovery | Average Return | Average Volatility | t-stat | CAPM Alpha | CAPM Alpha t-stat | CAPM Beta | CAPM Beta t-stat |
|-----------------------------|------------------------------|-------------------|-----------------------|--------|---------------|----------------------|--------------|---------------------|
| Market | 1964 | 4.20 | 10.00 | 3.11 | | | | |
| Value | 1990 | 4.15 | 10.00 | 3.07 | 5.24 | 3.99 | -0.26 | -6.90 |
| Size | 1975 | 2.53 | 10.00 | 1.87 | 1.32 | 1.02 | 0.29 | 7.69 |
| Operating profitability | 2013 | 3.70 | 10.00 | 2.74 | 4.74 | 3.60 | -0.25 | -6.57 |
| Investment | 2003 | 4.32 | 10.00 | 3.20 | 5.80 | 4.56 | -0.35 | -9.69 |
| Momentum | 1989 | 5.48 | 10.00 | 4.06 | 6.06 | 4.50 | -0.14 | -3.57 |
| Low beta | 1966 | 0.16 | 10.00 | 0.12 | 3.18 | 3.36 | -0.72 | -26.46 |
| Idiosyncratic volatility | 2000 | 1.62 | 10.00 | 1.20 | 4.34 | 4.18 | -0.65 | -21.73 |
| Short-term reversals | 1987 | 5.34 | 10.00 | 3.96 | 4.13 | 3.17 | 0.29 | 7.70 |
| Illiquidity | 1997 | 3.01 | 10.00 | 2.23 | 3.96 | 2.99 | -0.23 | -5.99 |
| Accruals | 1991 | 4.31 | 10.00 | 3.20 | 4.93 | 3.67 | -0.15 | -3.81 |
| Cash flow to price | 1990 | 4.82 | 10.00 | 3.57 | 6.34 | 5.01 | -0.36 | -9.98 |
| Earnings to price | 1971 | 3.76 | 10.00 | 2.78 | 5.49 | 4.44 | -0.41 | -11.65 |
| Long-term reversals | 1982 | 3.43 | 10.00 | 2.55 | 3.50 | 2.57 | -0.02 | -0.39 |
| Net share issues | 2003 | 5.28 | 10.00 | 3.91 | 6.97 | 5.60 | -0.40 | -11.26 |
| Average of factors 1–6 | 1989 | 3.39 | 10.00 | 2.51 | 4.39 | 3.50 | -0.24 | -7.58 |
| Average of factors 7–14 | 1990 | 3.95 | 10.00 | 2.92 | 4.96 | 3.95 | -0.24 | -7.14 |
| Average of other 33 factors | 2000 | 3.58 | 10.00 | 2.64 | 4.44 | 3.48 | -0.20 | -5.89 |

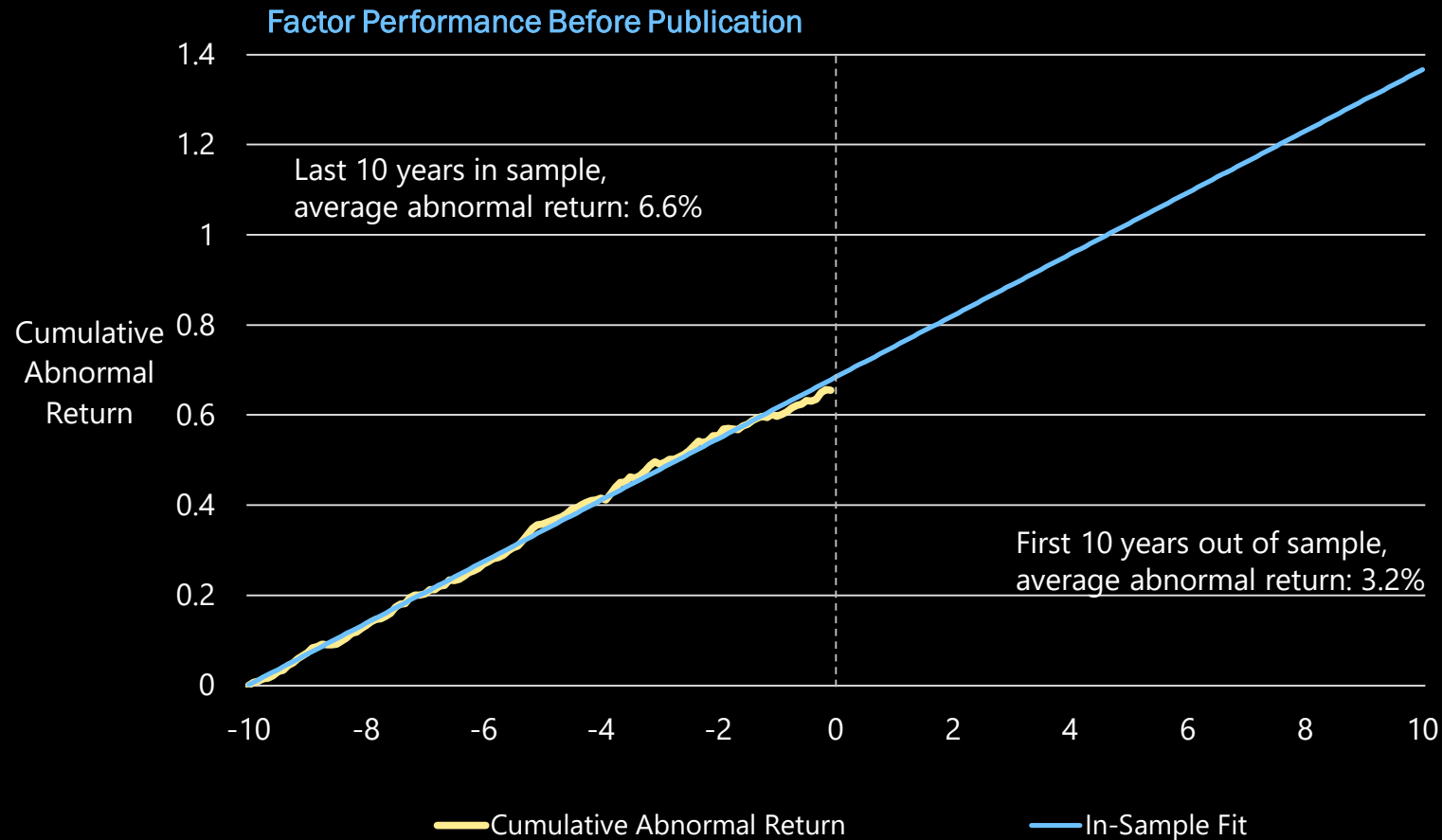
Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Factor Performance in the Long Run, United States, July 1963–June 2018

| Factor | | | Average Year of Discovery | Average Return | Average Volatility | t-stat | CAPM Alpha | CAPM Alpha t-stat | CAPM Beta |
|-----------------------------|---|----------|---------------------------------|-------------------|-----------------------|--------|---------------|-------------------------|--------------|
| Average of factors 1–6 | | | 1989 | 3.39 | 10.00 | 2.51 | 4.39 | 3.50 | -0.24 |
| Average of factors 7–14 | | | 1990 | 3.95 | 10.00 | 2.92 | 4.96 | 3.95 | -0.24 |
| Average of other 33 factors | | | 2000 | 3.58 | 10.00 | 2.64 | 4.44 | 3.48 | -0.20 |
| Portfolios of factors | No rebalancing, no vol. scaling | 1–6 | 1989 | 3.61 | 5.17 | 5.18 | 4.44 | 6.82 | -0.20 |
| | | 7–14 | 1990 | 3.91 | 5.20 | 5.57 | 4.67 | 7.04 | -0.18 |
| | | Other 33 | 2000 | 5.14 | 4.79 | 7.94 | 6.14 | 10.89 | -0.24 |
| | Monthly rebalancing, no vol. scaling | 1–6 | 1989 | 3.39 | 4.60 | 5.47 | 4.39 | 8.22 | -0.24 |
| | | 7–14 | 1990 | 3.95 | 5.42 | 5.40 | 4.96 | 7.51 | -0.24 |
| | | Other 33 | 2000 | 3.57 | 3.47 | 7.62 | 4.42 | 11.53 | -0.20 |
| | Monthly rebalancing, 10% vol. scaled | 1–6 | 1989 | 7.38 | 10.00 | 5.47 | 9.55 | 8.22 | -0.52 |
| | | 7–14 | 1990 | 7.28 | 10.00 | 5.40 | 9.15 | 7.51 | -0.44 |
| | | Other 33 | 2000 | 10.28 | 10.00 | 7.62 | 12.73 | 11.53 | -0.58 |

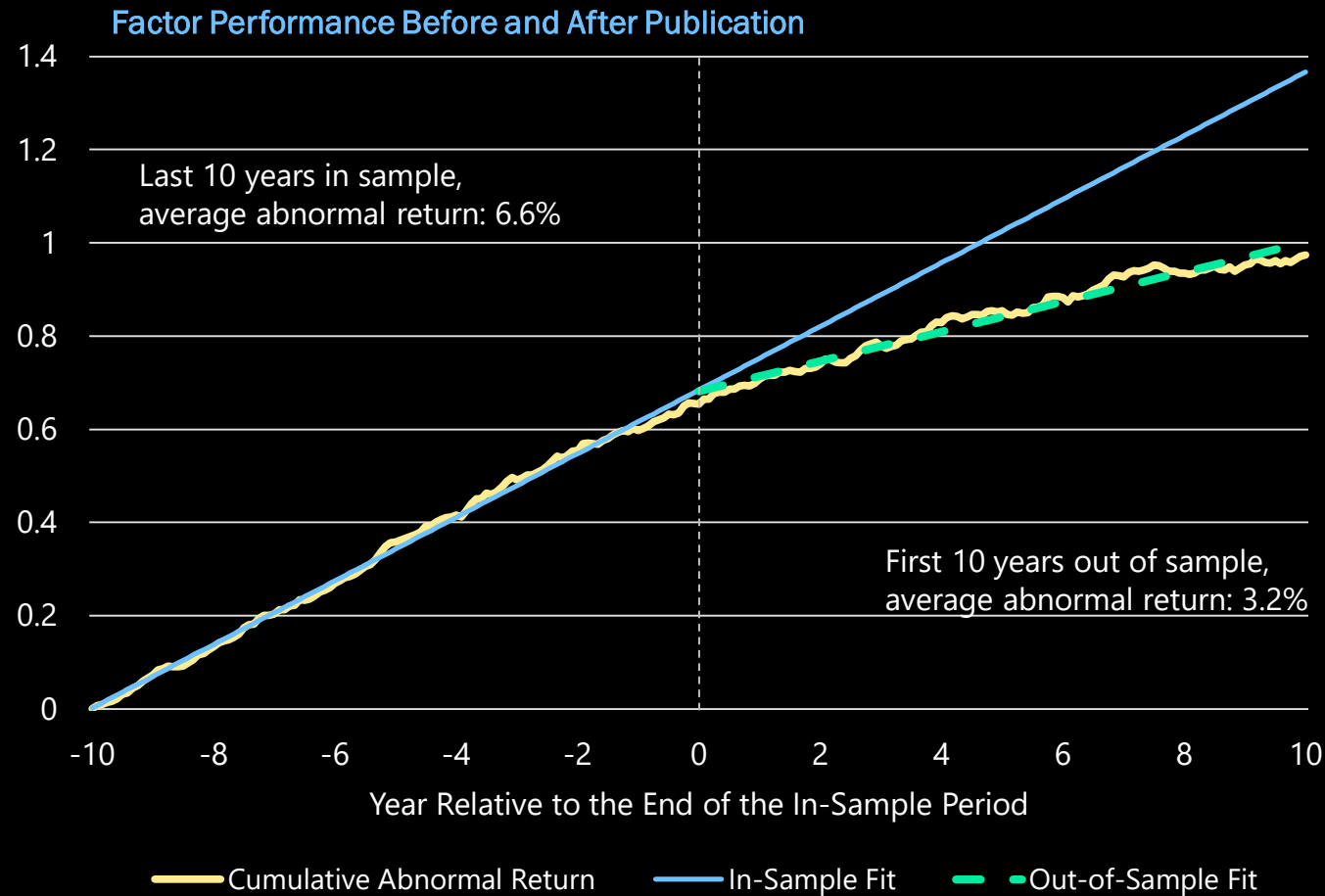
Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Cumulative Factor Performance Before and After Publication



Source: Research Affiliates, LLC, using data from CRSP/Compustat from July 1963–June 2018.

Cumulative Factor Performance Before and After Publication



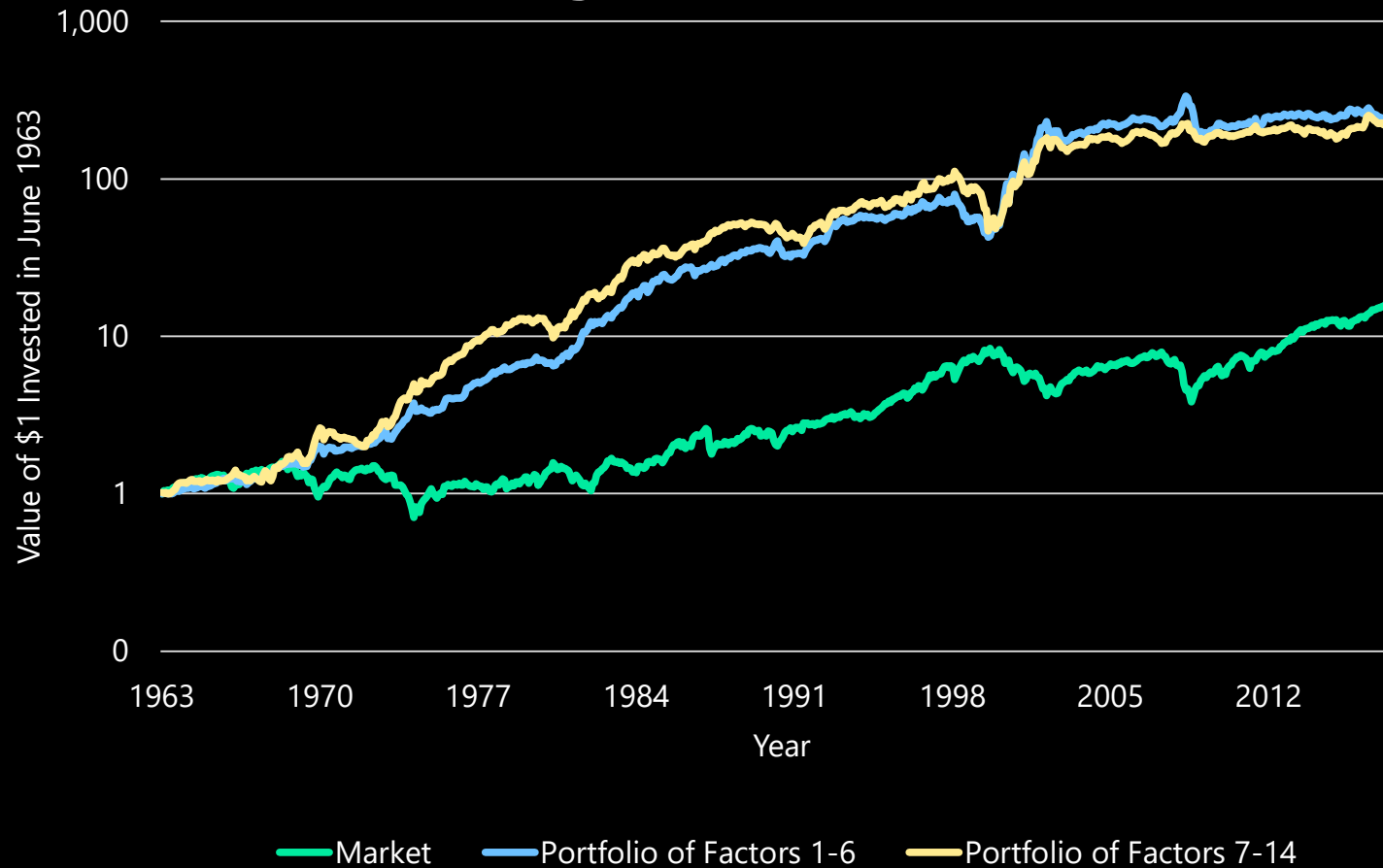
Source: Research Affiliates, LLC, using data from CRSP/Compustat from July 1963–June 2018.

Recent Average Annual Factor Returns, United States, July 2003–June 2018

| Factor | | | Average Year of Discovery | Average Return | Average Volatility | t-stat | CAPM Alpha | CAPM Alpha t-stat | CAPM Beta |
|-----------------------------|---|----------|---------------------------------|-------------------|-----------------------|--------|---------------|-------------------------|--------------|
| Average of factors 1–6 | | | 1989 | 1.20 | 10.00 | 0.46 | 2.12 | 0.96 | -0.14 |
| Average of factors 7–14 | | | 1990 | 1.17 | 10.00 | 0.45 | 1.64 | 0.69 | -0.07 |
| Average of other 33 factors | | | 2000 | 1.64 | 10.00 | 0.63 | 2.86 | 1.23 | -0.18 |
| Portfolios of factors | No rebalancing, no vol. scaling | 1–6 | 1989 | 1.12 | 3.97 | 1.09 | 1.98 | 1.99 | -0.13 |
| | | 7–14 | 1990 | 1.04 | 4.31 | 0.93 | 1.49 | 1.32 | -0.07 |
| | | Other 33 | 2000 | 1.70 | 3.34 | 1.96 | 3.02 | 4.23 | -0.20 |
| | Monthly rebalancing, no vol. scaling | 1–6 | 1989 | 1.20 | 3.86 | 1.20 | 2.12 | 2.23 | -0.14 |
| | | 7–14 | 1990 | 1.17 | 4.07 | 1.11 | 1.64 | 1.55 | -0.07 |
| | | Other 33 | 2000 | 1.64 | 3.11 | 2.04 | 2.86 | 4.27 | -0.18 |
| | Monthly rebalancing, 10% vol. scaled | 1–6 | 1989 | 3.10 | 10.00 | 1.20 | 5.50 | 2.23 | -0.36 |
| | | 7–14 | 1990 | 2.89 | 10.00 | 1.11 | 4.03 | 1.55 | -0.17 |
| | | Other 33 | 2000 | 5.29 | 10.00 | 2.04 | 9.20 | 4.27 | -0.58 |

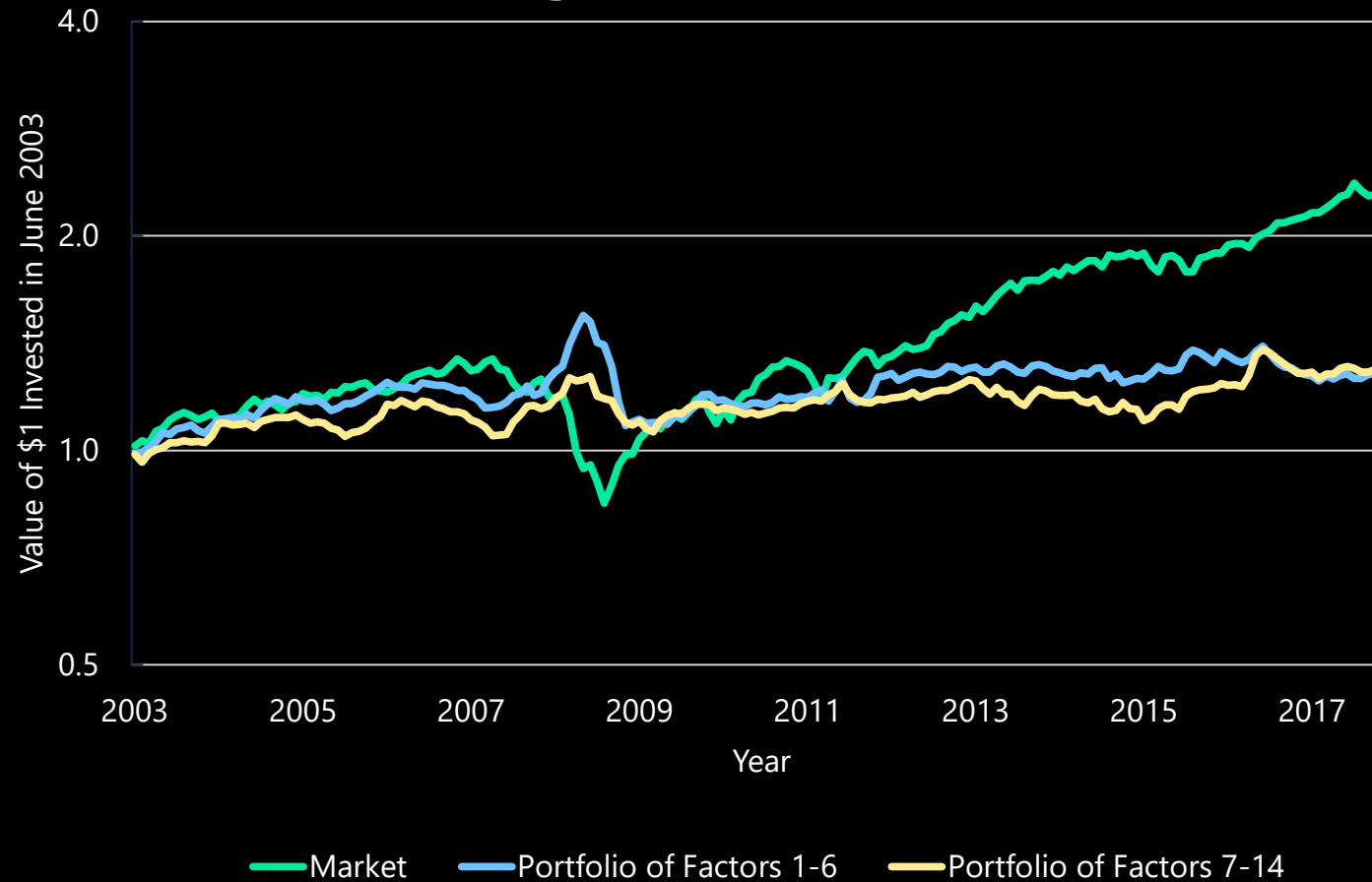
Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Factor Performance in the Long Run, United States, July 1963–June 2018



Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Recent Average Annual Factor Returns, United States, July 2003–June 2018

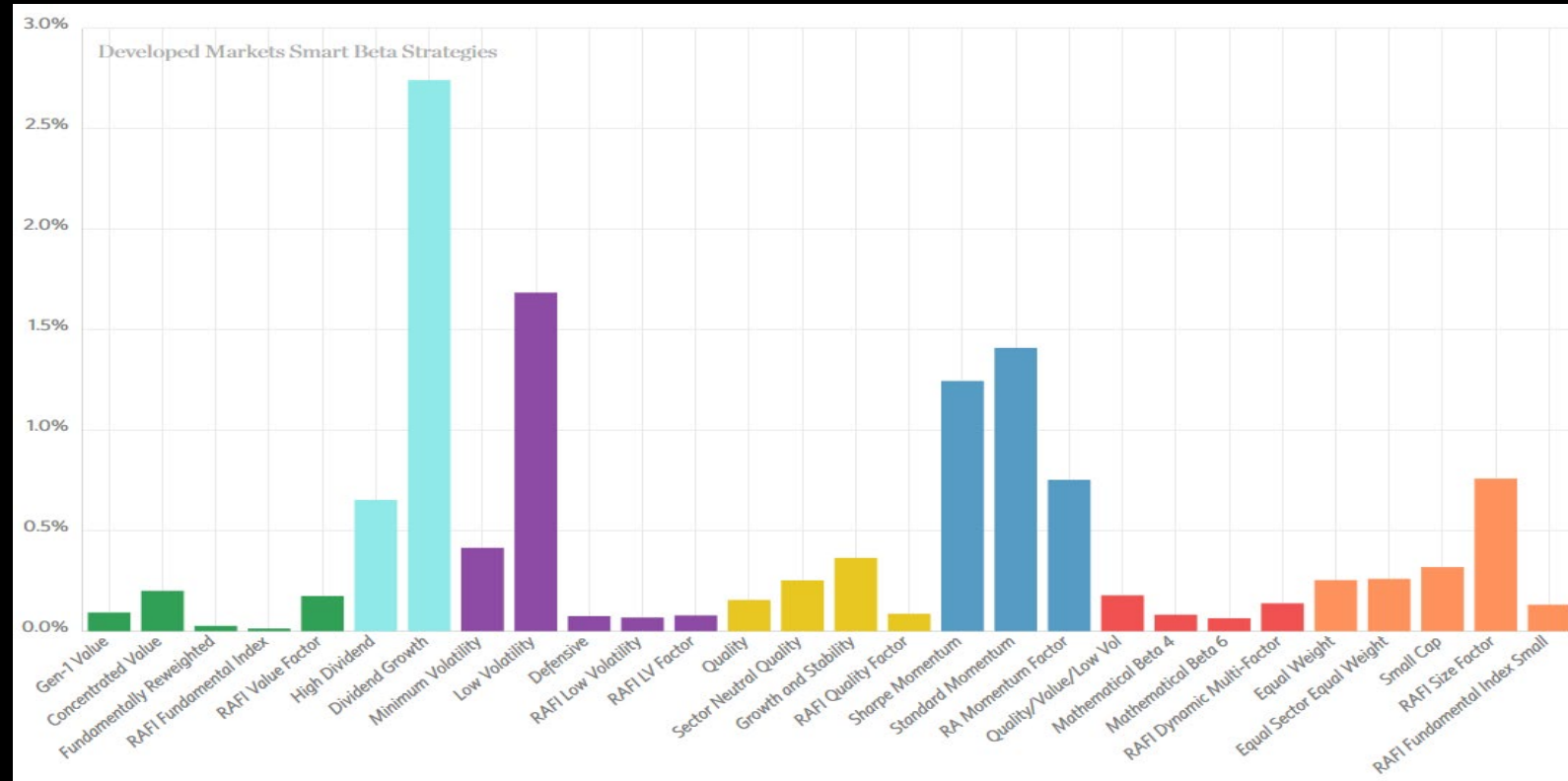


Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Implementation Costs Make Things Worse

Poor Smart Beta Index Design Can Lead to High Costs


Trading Costs – Developed Markets



<https://interactive.researchaffiliates.com/smart-beta.html>

Source: Research Affiliates, LLC, using data from CRSP/Compustat and Datascope/Worldstream as of 12/31/2018.

Annualized trading costs are estimated as the market impact of transactions, assuming \$10B in AUM. For descriptions of the strategies shown, please see <https://interactive.researchaffiliates.com/smart-beta.html>. Strategy returns and characteristics are simulated. Please see important information at the end of this presentation regarding simulated data.

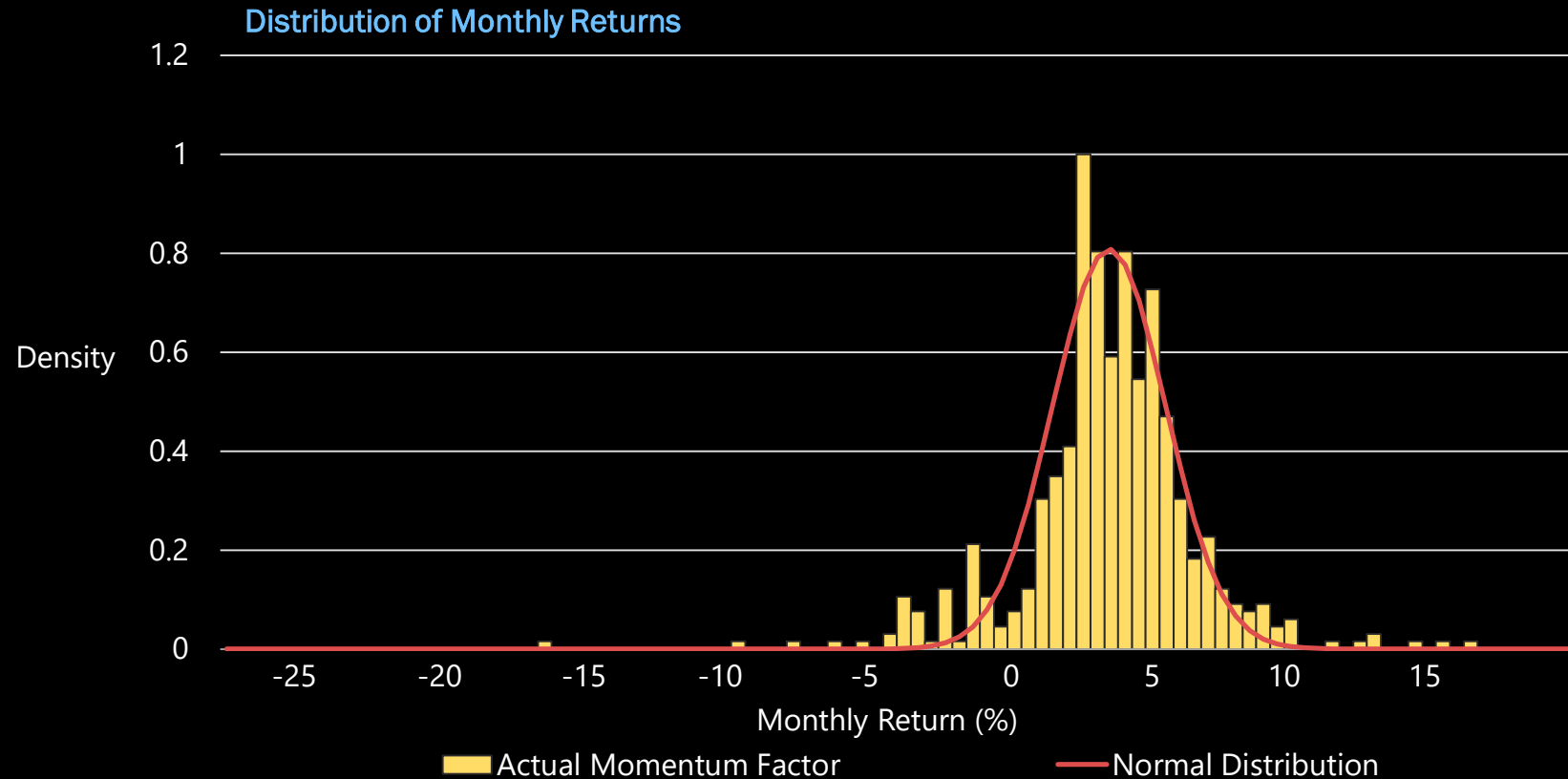
An iceberg floating in the ocean. The tip of the iceberg is visible above the water line, while the much larger, jagged mass of the iceberg is submerged below the surface. The water is a deep blue, and the sky is a lighter blue with some wispy clouds.

Difference in expense ratios
for smart beta strategies:
2 – 20 bps.

*Market Impact
by poorly
engineered funds:
200+ bps!*

Factors Are Prone to Crashes

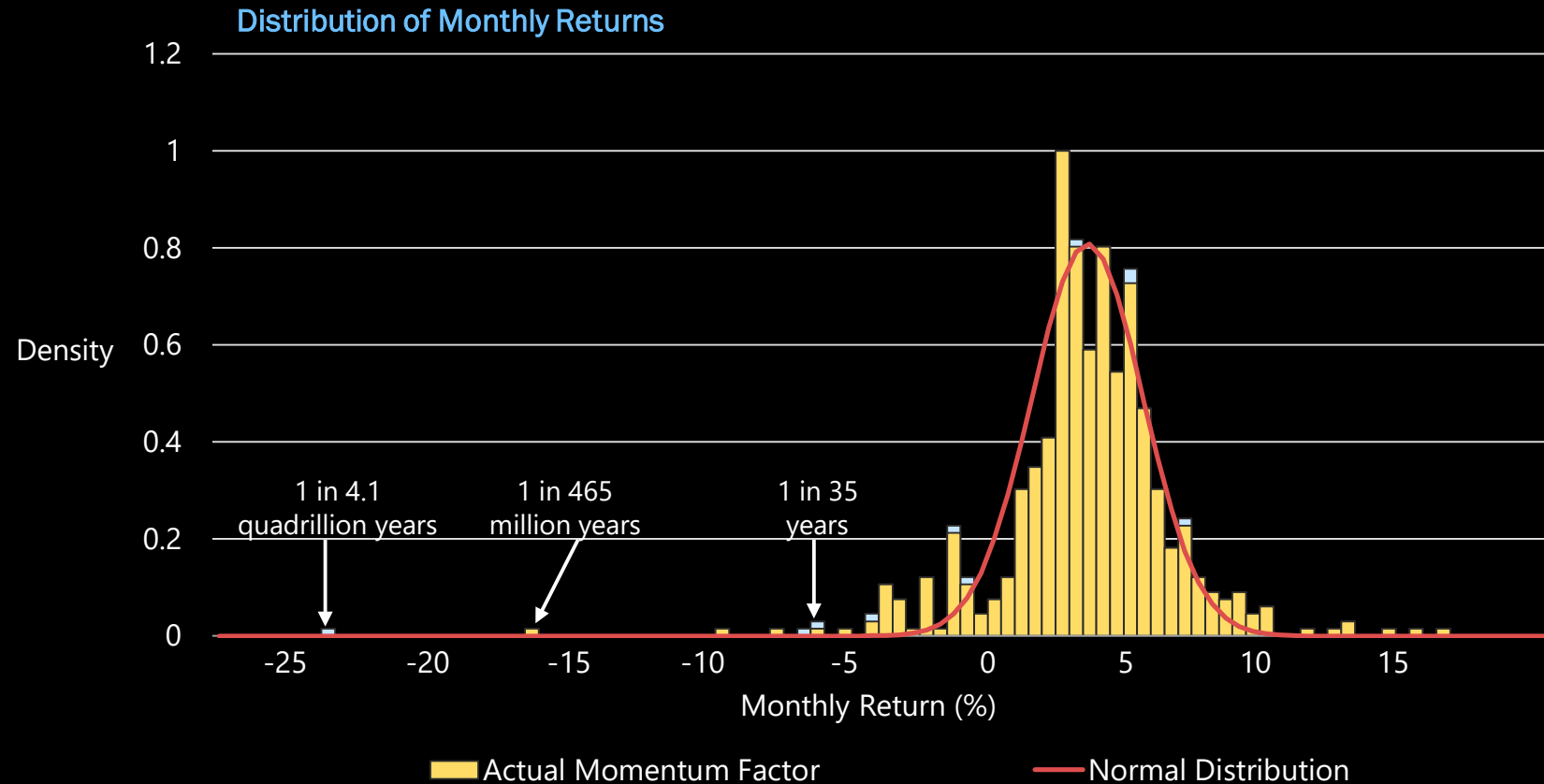
“Normally” Distributed Momentum



This is the monthly momentum return distribution from July 1963 through February 2009.

Source: Research Affiliates, LLC, using data from CRSP/Compustat.

“Normally” Distributed Momentum



The light blue bars denote the monthly momentum returns from March 2009 through December 2009.

Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Momentum Crash: Actual vs. Hypothetical, United States, July 2003–June 2018



Source: Research Affiliates, LLC, using data from CRSP/Compustat.

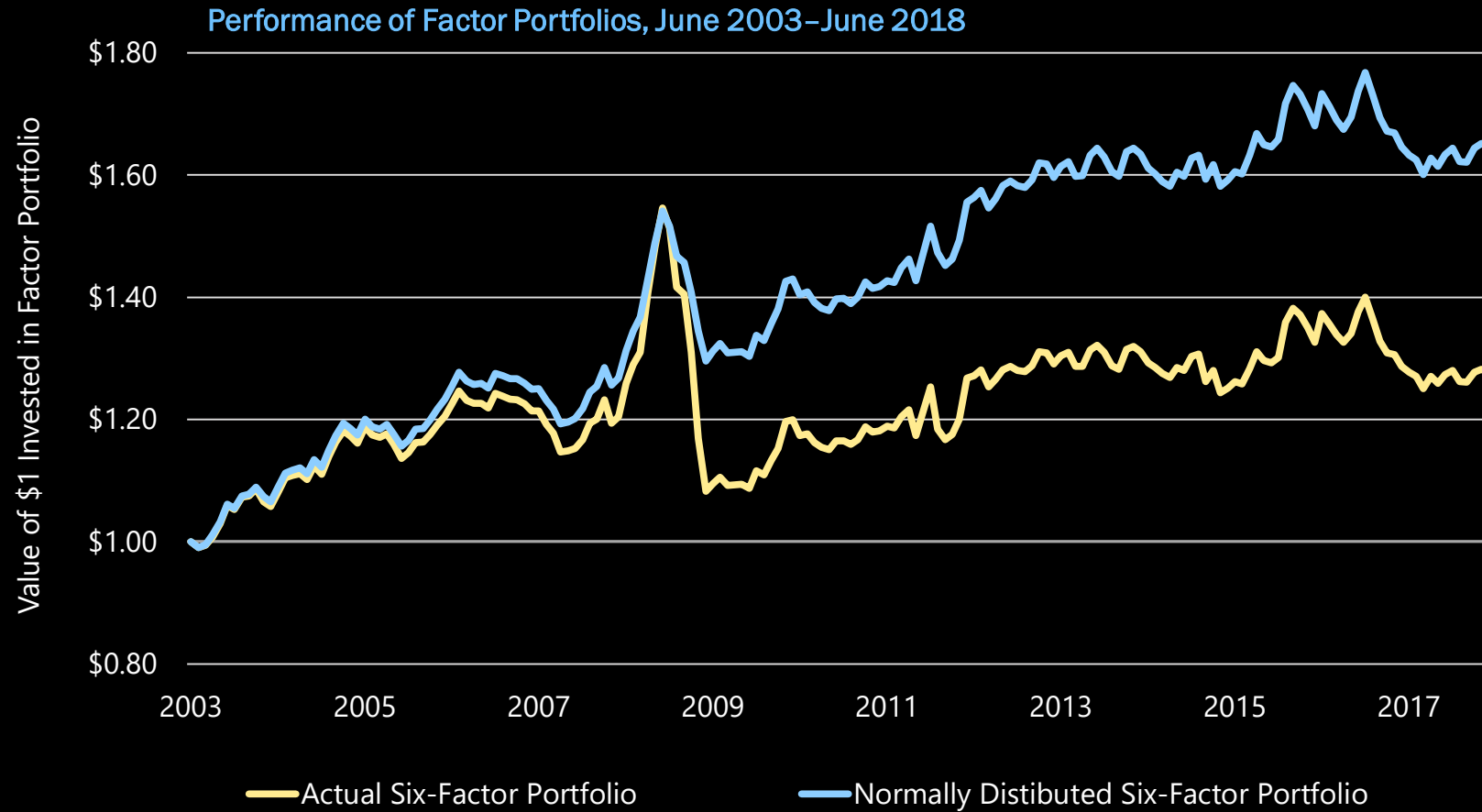
Non-Normality of Monthly Factor Returns, United States, July 1963–June 2018

| Factor | Average Annualized Return | Skewness | Excess Kurtosis | Worst Monthly Return | Frequency (in Years) of Expected Worst Realized Monthly Return, Assuming Normal Return Distribution |
|--------------------------|---------------------------|----------|-----------------|----------------------|---|
| Market | 4.20% | -0.54 | 2.03 | -15.30% | 1 in 1.6 million |
| Value | 4.15% | 0.11 | 2.05 | -11.50% | 1 in 2,522 |
| Size | 2.53% | 0.46 | 5.54 | -16.20% | 1 in 8.9 million |
| Operating profitability | 3.70% | -0.25 | 12.64 | -24.30% | 1 in 4.7 quadrillion (10^{15}) |
| Investment | 4.32% | 0.2 | 0.79 | -9.20% | 1 in 109 |
| Momentum | 5.48% | -1.41 | 11.38 | -24.30% | 1 in 4.1 quadrillion (10^{15}) |
| Low beta | 0.16% | -0.39 | 3.33 | -17.10% | 1 in 49.8 million |
| Idiosyncratic volatility | 1.62% | -0.32 | 4.39 | -16.40% | 1 in 12.3 million |
| Short-term reversals | 5.34% | 0.37 | 5.82 | -13.50% | 1 in 58,097 |
| Illiquidity | 3.01% | -0.58 | 5.11 | -17.10% | 1 in 55.8 million |
| Accruals | 4.31% | -0.11 | 0.97 | -10.00% | 1 in 320 |
| Cash flow to price | 4.82% | -0.35 | 5.81 | -18.90% | 1 in 2.5 billion (10^9) |
| Earnings to price | 3.76% | -0.32 | 5.94 | -19.50% | 1 in 10.5 billion (10^9) |
| Long-term reversals | 3.43% | 0.65 | 2.62 | -9.10% | 1 in 106 |
| Net share issues | 5.28% | -0.4 | 9.85 | -23.40% | 1 in 357.5 trillion (10^{12}) |

Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Diversification Falls Short of Expectations

Factor Portfolio Crash: Actual vs. Hypothetical, United States, July 2003–June 2018



Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Non-Normality of Monthly Factor Returns, United States, July 1963–June 2018

| Factor | Average Annualized Return | Skewness | Excess Kurtosis | Worst Monthly Return | Frequency (in Years) of Expected Worst Realized Monthly Return, Assuming Normal Return Distribution |
|-------------------------------|---------------------------|----------|-----------------|----------------------|---|
| Market | 4.20% | -0.54 | 2.03 | -15.30% | 1 in 1.6 million |
| Portfolio of factors 1–6 | 7.38% | 0.46 | 8.12 | -16.10% | 1 in 6.5 million |
| Portfolio of factors 7–14 | 7.28% | 0.12 | 5.04 | -17.60% | 1 in 147.6 million |
| Portfolio of other 33 factors | 10.28% | 0.63 | 4.93 | -13.30% | 1 in 38,989 |

Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Worst Drawdowns in Portfolios of Factors, United States, July 1963–June 2018

| Worst Simulated Drawdown and [% of samples worse than actual] | | | | | | |
|---|-------------------------|------------------|-------------------------------|---------------|--|---|
| Bootstrap (Resampling Returns from Realized History) | | | | | | |
| Factors | Worst Realized Drawdown | | Simulation Assuming Normality | Independent | 1m Blocks, Preserving x-Factor Correlation | 12m Blocks, Preserving x-Factor and Time-Series Correlation |
| 1–6 | -33.4% | Return [p-value] | -21.5% [2.7%] | -21.9% [3.7%] | -25.8% [12.4%] | -30.4% [29.1%] |
| 7–14 | -42.9% | Return [p-value] | -13.3% [0.0%] | -13.5% [0.0%] | -26.4% [2.2%] | -32.5% [11.6%] |
| Other 33 | -22.8% | Return [p-value] | -6.9% [0.0%] | -6.5% [0.0%] | -20.3% [26.1%] | -23.2% [44.3%] |

Note: All factors are scaled to 10% volatility. Factor portfolios are equally weighted and also scaled to 10% volatility.
Source: Research Affiliates, LLC, using data from CRSP/Compustat.

Summary

Set up realistic expectations for factor investing

- Focus on real sources of economic risk premia
- Pay attention to implementation shortfall and crowding
- Diversification needs to be actively managed

What do we do?

Philosophy

Every investor should ask five questions before investing in a strategy:

1. Why does the strategy work?
2. Does the strategy produce similar results across different regions and show out-of-sample performance?
3. Does the strategy produce similar results across slightly different definitions (e.g., P/B vs. P/S)?
4. Does the strategy still work net of real-life transaction costs?
5. Does the majority of the strategy's excess return survive after controlling for changes in valuation?

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