



NORTHERN TRUST

ASSET MANAGEMENT

FACTOR
INVESTING

THE ROAD TO IMPLEMENTATION

Scott Bennett

Head of Quantitative Research and Client Solutions,
Australia and New Zealand

Northern Trust Asset Management

Today's Speaker



Scott Bennett

Head of Quantitative Research & Client Solutions, Australia and New Zealand

Scott Bennett is head of quantitative research and client solutions, Australasia where he is responsible for working with institutional clients across Australian and global equity markets.

Scott has more than 18 years of investment experience. Prior to joining Northern Trust Asset Management, Scott led the global quantitative research effort at Russell Investments, where he was responsible for \$40 billion of systematic strategies. Scott began his career managing Australian equity portfolios that included after-tax, smart beta and multi-manager strategies.

Scott has undertaken research on various topics including ESG, equity factors, trading costs, quantitative risk management and performance evaluation, which have been published in several academic journals. In 2010 won the JASSA prize for best paper for his work on Active Share across Australian equity managers.

Scott earned his bachelor's degree in business (economics and finance) with distinction from RMIT University and a master's in finance (applied finance) from the University of New South Wales (UNSW).

'Priced' and 'Unpriced' Risks

Sector
Biases

Idiosyncratic
Risk

Quality/
Profitability

Currency
Exposure

Volatility/
Beta

Size

Economic
Growth
Exposure

Inflation
Exposure

Momentum

Duration/
Interest Rate
Sensitivity

Region
Biases

Value

Leverage

Liquidity

Dividend
Yield

Key Drivers of Returns

Quality

The Quality factor targets companies with efficient management, profitability, and strong cash flows. Quality strategies seek to provide excess returns by investing in companies that are better positioned for short and long term growth.

Value

The Value factor targets companies that trade at low valuations. Value strategies seek to provide excess returns as companies grow and their current valuations become more in line with normalized and prospective valuations.

Low Volatility

The Low Volatility factor targets companies with less price and fundamental volatility. Low Volatility strategies seek to provide excess returns by minimizing losses in recessions while participating in the growth seen in expansionary phases.

Dividend Yield

The Dividend Yield factor targets companies that pay large dividends. Dividend Yield strategies seek to provide excess returns by receiving larger dividends than the benchmark and reinvesting them for long-term capital appreciation.

Momentum

The Momentum factor targets companies that have strong market sentiment and analyst sentiment. Momentum strategies seek to provide excess returns by investing in companies with strong tailwinds for higher growth than the benchmark.

Size

The Size factor targets companies of smaller market capitalization. Size strategies seek to provide excess returns by investing in companies of smaller size that have more room to grow within their industries and geographies.

Factors have been the primary source of excess returns

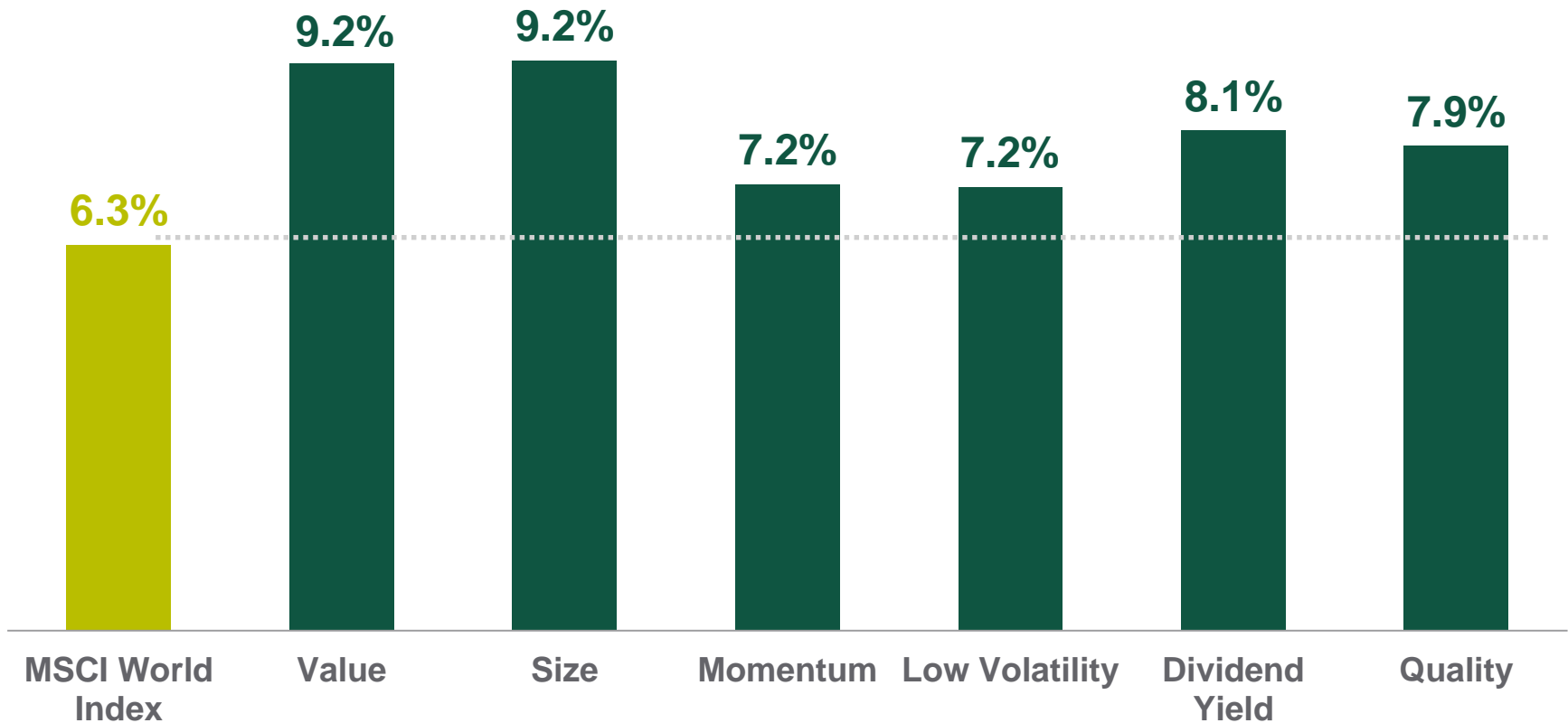
				Factors Driving Excess Returns				
	Type	# Funds	Time Period	Common Style Factor Exposure		Skill "Stock Picking"	=	Monthly Excess Return
Carhart (1997)	Time Series	1,892	1962 – 1993	0.55%	+	-0.13%	=	0.41%
Grinblatt et. al. (2016)	Time Series	589	1998 – 2012	0.23%	+	0.01%	=	0.24%
Grinblatt et. al. (2016)	Cross Sectional	589	1998 – 2012	0.33%	+	-0.03%	=	0.30%

Carhart, Mark M. "On persistence in mutual fund performance." *The Journal of finance* 52.1 (1997): 57-82.

Grinblatt, Mark, et al. "Style and Skill: Hedge Funds, Mutual Funds, and Momentum." *Mutual Funds, and Momentum (January 6, 2016)* (2016).

Factors and Their Risk Premiums

ANNUALISED RETURN OF COMMON FACTORS (1997–2018)

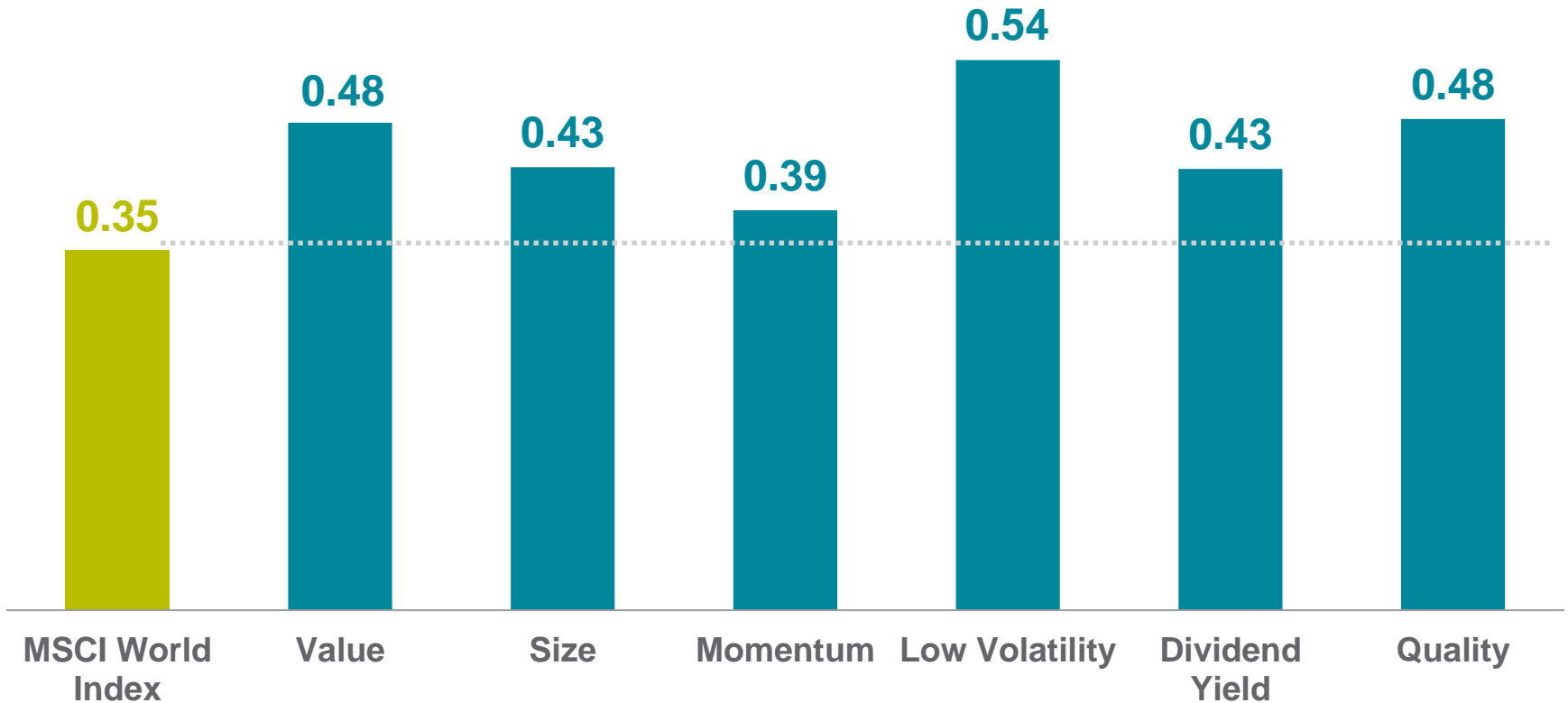


Past performance is no guarantee of future results. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index. Factor returns are defined as the market capitalization weighted top or bottom 20% of the MSCI World Index. Ranking is based on exposure to factor as defined by Barra (Value, Momentum, Volatility, Dividend Yield, Size) and Northern Trust Quality Score.

Source: Northern Trust Quantitative Research, Data as of 12/31/2018

Factors and Their Risk Premiums

SHARPE RATIOS OF COMMON FACTORS (1997–2018)



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Source: Northern Trust Quantitative Research, Data as of 12/31/2018

The cyclical nature of factors

Calendar Year Returns – Last 15 Years

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Annualized 15-Year Return
Highest	VALUE 28.6%	MOMENTUM 13.4%	DIVIDEND YIELD 23.6%	MOMENTUM 13.0%	LOW VOLATILITY -23.3%	VALUE 81.4%	VALUE 30.1%	LOW VOLATILITY 7.6%	VALUE 22.8%	MOMENTUM 47.2%	LOW VOLATILITY 16.4%	LOW VOLATILITY 4.3%	VALUE 33.2%	MOMENTUM 18.0%	LOW VOLATILITY -4.0%	QUALITY 11.0%
	QUALITY 23.5%	QUALITY 10.9%	VALUE 23.3%	LOW VOLATILITY -0.3%	DIVIDEND YIELD -32.2%	SIZE 51.5%	QUALITY 29.3%	DIVIDEND YIELD 1.7%	QUALITY 20.5%	QUALITY 43.7%	DIVIDEND YIELD 13.4%	MOMENTUM 0.6%	DIVIDEND YIELD 30.2%	LOW VOLATILITY 15.3%	MOMENTUM -7.5%	LOW VOLATILITY 10.2%
	LOW VOLATILITY 20.7%	VALUE 6.8%	LOW VOLATILITY 22.0%	QUALITY -0.5%	QUALITY -33.7%	QUALITY 50.3%	SIZE 28.5%	QUALITY -1.0%	DIVIDEND YIELD 17.9%	VALUE 43.7%	QUALITY 10.1%	DIVIDEND YIELD -4.1%	SIZE 21.8%	QUALITY 15.2%	DIVIDEND YIELD -8.4%	VALUE 8.9%
	DIVIDEND YIELD 19.9%	LOW VOLATILITY 5.8%	QUALITY 21.7%	SIZE -5.5%	SIZE -39.2%	DIVIDEND YIELD 34.8%	MOMENTUM 27.1%	MOMENTUM -3.5%	SIZE 16.8%	SIZE 41.5%	VALUE 4.6%	QUALITY -5.4%	LOW VOLATILITY 21.3%	SIZE 14.4%	QUALITY -8.9%	DIVIDEND YIELD 8.3%
	MOMENTUM 19.2%	SIZE 3.8%	SIZE 18.2%	DIVIDEND YIELD -14.6%	MOMENTUM -42.0%	LOW VOLATILITY 15.6%	DIVIDEND YIELD 25.9%	SIZE -7.4%	LOW VOLATILITY 16.8%	DIVIDEND YIELD 29.4%	MOMENTUM 4.5%	SIZE -6.7%	QUALITY 19.5%	VALUE 10.8%	SIZE -12.6%	MOMENTUM 7.8%
Lowest	SIZE 18.6%	DIVIDEND YIELD 3.5%	MOMENTUM 15.6%	VALUE -16.3%	VALUE -44.7%	MOMENTUM 13.8%	LOW VOLATILITY 17.8%	VALUE -7.8%	MOMENTUM 15.8%	LOW VOLATILITY 29.1%	SIZE 3.9%	VALUE -6.7%	MOMENTUM 10.5%	DIVIDEND YIELD 8.6%	VALUE -16.8%	SIZE 7.4%
Russell 3000® Index																
	11.9%	6.1%	15.7%	5.1%	-37.3%	28.3%	16.9%	1.0%	16.4%	33.6%	12.6%	0.5%	12.7%	21.1%	-5.2%	7.9%

Source: Northern Trust Quantitative Research, Compustat, Barra. Data as of December 31, 2018

Factor returns are defined as the equally weighted top or bottom 20% of the Russell 3000 Index. Ranking is based on exposure to factor as defined by Barra (Value, Momentum, Volatility, Dividend Yield, Size) and Northern Trust Quality Score. Factors are winsorized to remove extreme 5% of outliers. **Simulated past performance and actual past performance is no guarantee of future results.** Index performances returns do not reflect any management fees, transaction costs of expenses. It is not possible to invest directly in any index.

Academic vs. practical factor definitions

	Academic Factor Definitions	Practical Factor Definitions
Intent	<p>a) Challenge status quo asset pricing models (e.g., Fama French 1992)</p> <p>b) Prove the existence of a factor anomaly (e.g., Basu 1977)</p>	Extract factor premia in the best possible manner
Approach	<p>Typically single-signal models with no sector/region differentiation</p> <ul style="list-style-type: none"> Value = P/B (Fama French 1992) Quality = Gross Profitability (Novy Marx 2013) Momentum = 12m – 1m (Jegadeesh Titman 1993) Low Volatility = Low beta (Frazzini 2014) 	Multi-dimensional, sector/region specific – where appropriate
Decay Considerations	Usually None	Signal decay must be managed to coincide with trading frequency, turnover and tracking error targets
Risk Considerations	Usually None	Must be risk efficient, sector/region neutral
Liquidity Considerations	Usually None	Stocks with greater liquidity/narrower spreads are preferred
Stability Considerations	Usually None	Factor exposures must be managed for stability and consistency

THE QUESTION OF EFFICIENCY



Capturing “Pure” Factor exposure

Pure factor exposure can reduce the effects of uncompensated risks. In order to minimise uncompensated risks, factor based strategies need to maintain a “pure” exposure to only the targeted factor.

Uncompensated Risks *Commonly Found in Factor-Based Strategies*



Factor-based equity strategies target to generate excess return through exposure to compensated risk factors

Factor Efficiency Ratio (FER)

$$\text{FER} = \frac{\text{Active Risk from Intended Factor Exposures} \text{ (Take Compensated Risks)}}{\text{Total Active Risk} \text{ (Minimise Risk from Uncompensated Risks)}}$$

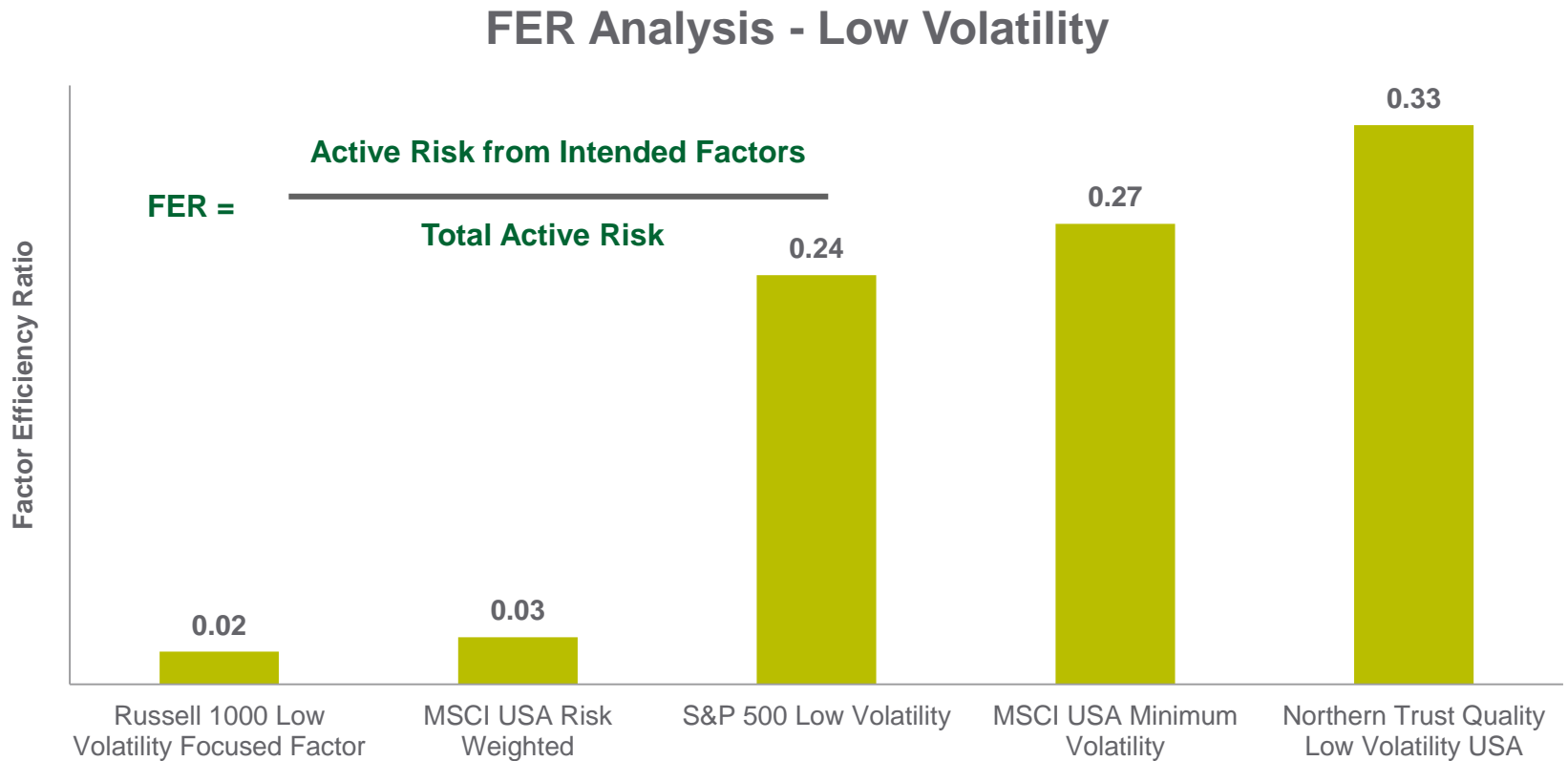
High FER = Pure Factor Exposure

¹Carhart (1997)

²Jacobsen, et. al. (2010)

Factor efficiency ratio: Low Volatility Strategies

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 different strategies.



Source: Northern Trust Quantitative Research. Data as of December 31, 2018.

Removing Unpriced Risks Has Helped Risk-Adjusted Returns

SHARPE RATIOS OF FACTOR PORTFOLIOS – U.S. EQUITIES (JULY 1963 TO JUNE 2018)

■ Standard Factors ■ Sector-Neutral Factors



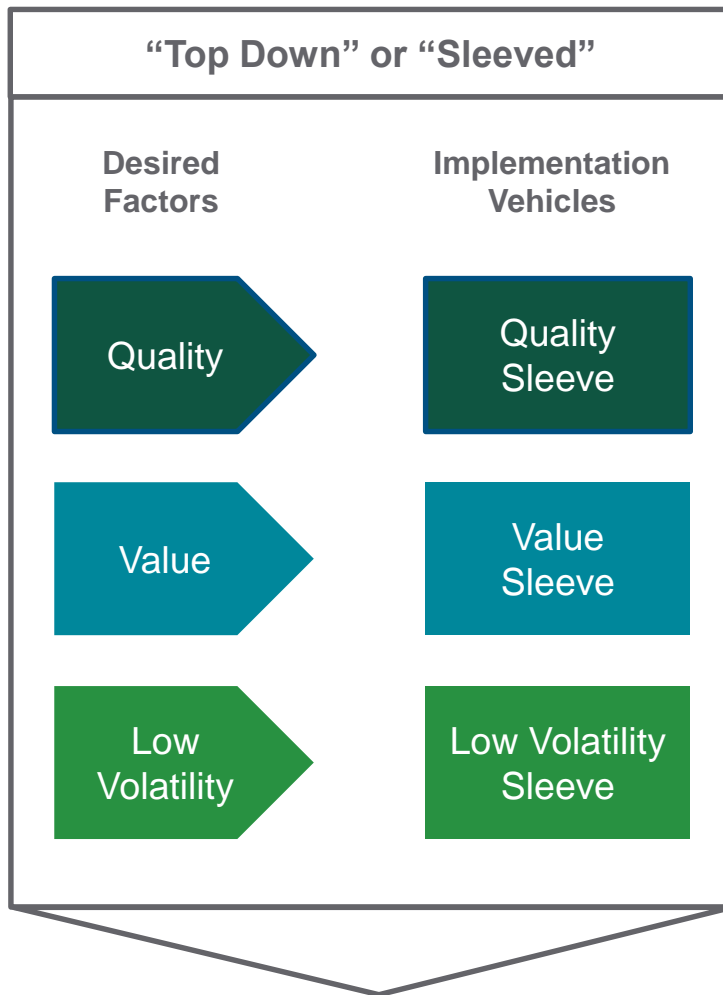
Past performance is no guarantee of future results. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index.

*Investment refers to change in assets over the fiscal year. The Investment factor has a strong correlation to Quality, as Conservative Investment is a signal of greater Management Efficiency. Source: Daniel, Kent D. and Mota, Lira and Rottke, Simon and Santos, Tano, The Cross-Section of Risk and Return (October 31, 2018). Derived from Table 6. Data is from July 1963 to June 2018. Note: The portfolios represented above are derived from the Fama-French model. Value refers to HML (High Minus Low), the average return on two value portfolios minus the average return on two growth portfolios. Investment refers to CMA (Conservative Minus Aggressive), the average return on two conservative investment portfolios minus the average return on two aggressive investment portfolios. Size refers to SMB (Small Minus Big), the average return on nine small stock portfolios minus the average return on nine big stock portfolios. Past performance is no guarantee of future results. See Kenneth French Data Library for details.

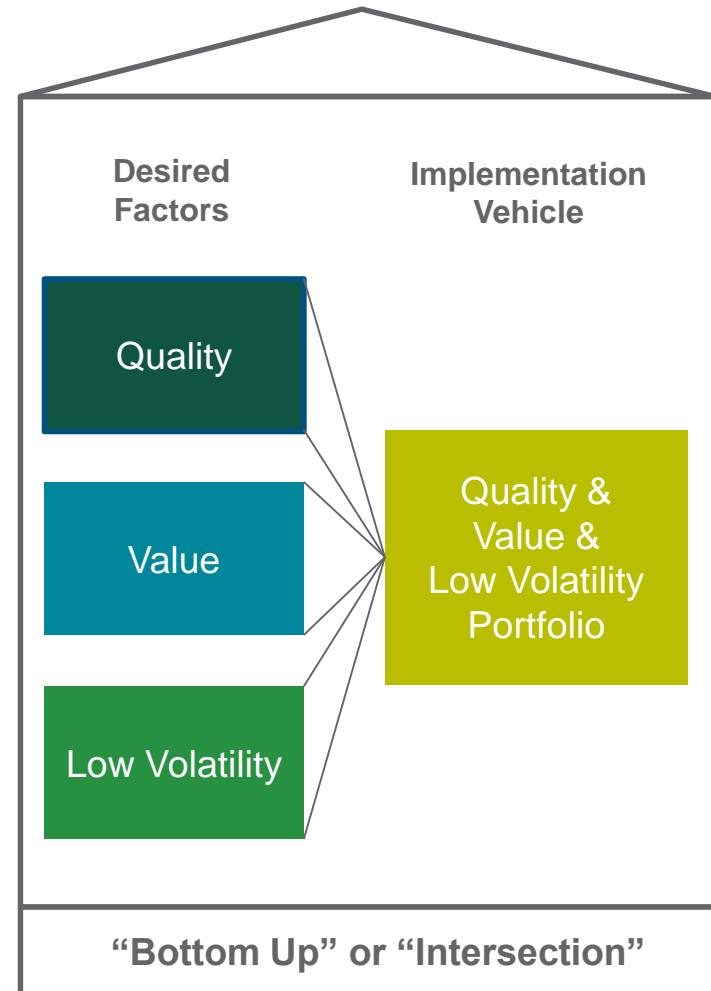
TOP DOWN OR BOTTOM UP?



Multi-Factor Portfolios: Thoughtful Design is Imperative



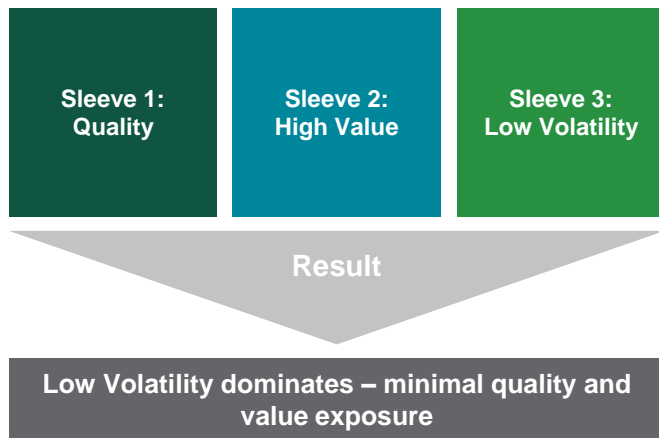
Gain exposure to each factor individually through 3 separate portfolios



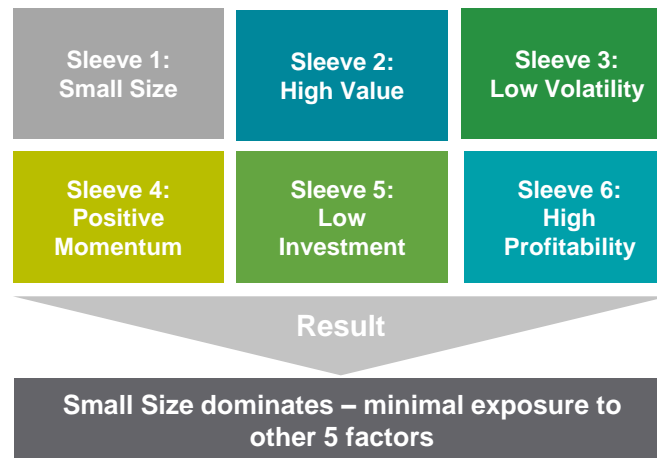
Invest at the intersection of all targeted factors within single portfolio

Approach to Factor Targeting Matters

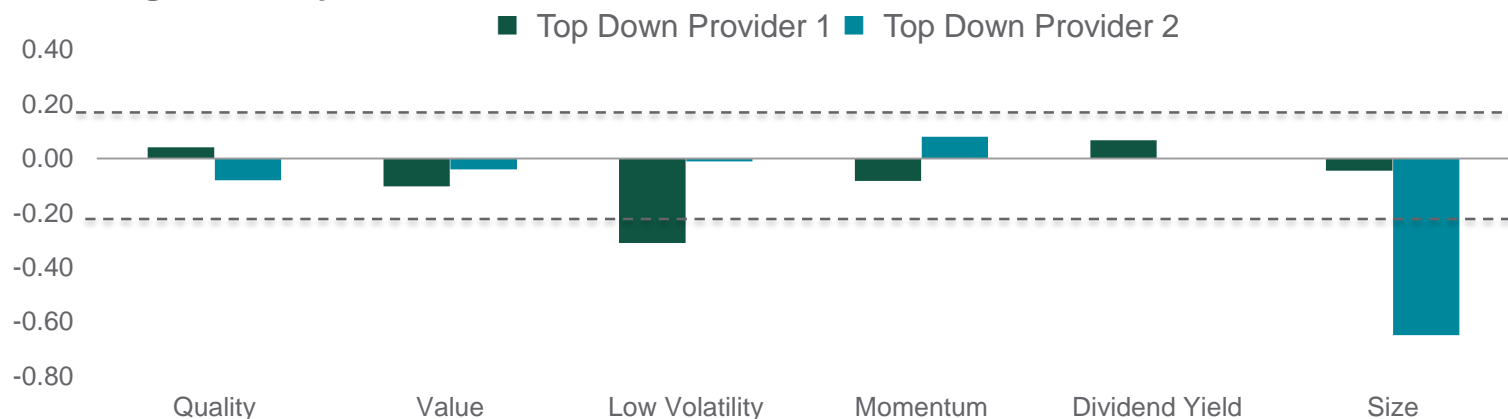
Top Down Index Provider 1 Approach



Top Down Index Provider 2 Approach



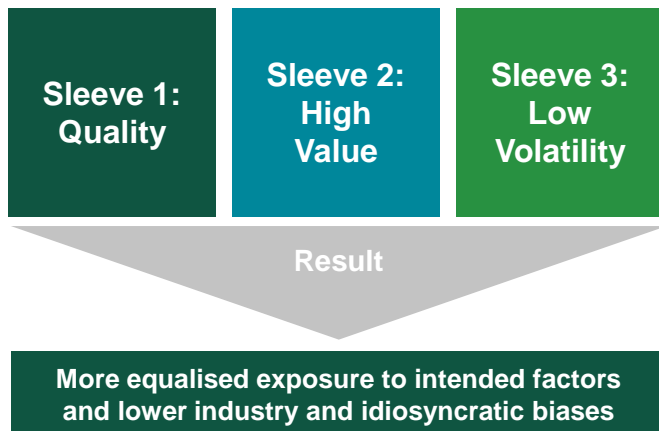
Resulting Factor Exposure



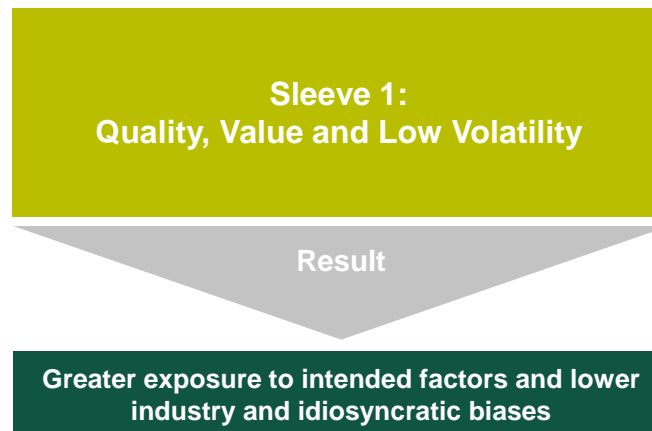
For illustrative purposes only. NT Quantitative Research, Barra. Past performance is no guarantee of future results. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index.

Efficient Outcomes Through Portfolio Construction

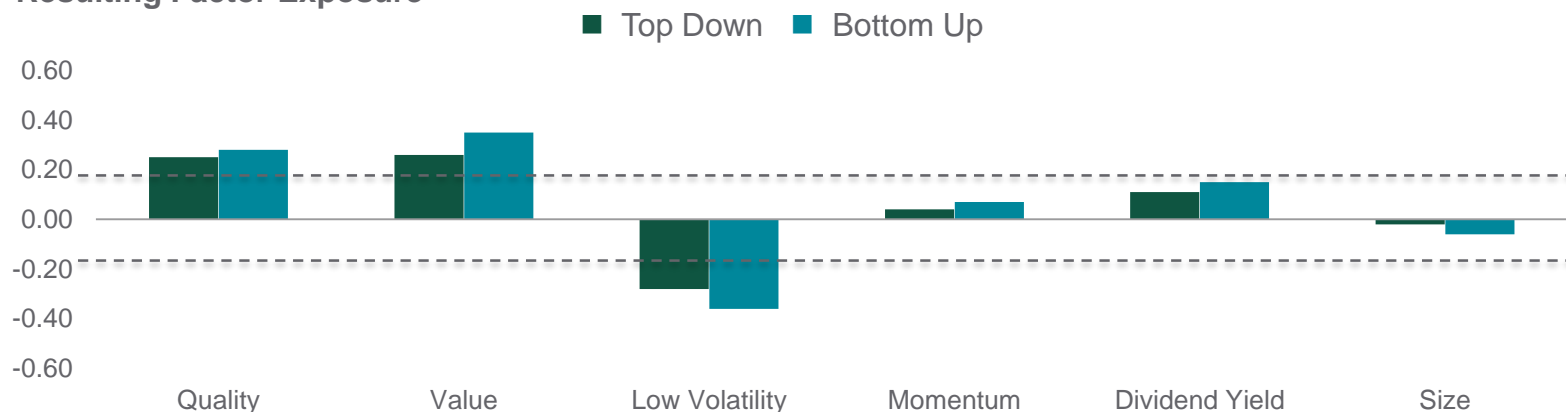
Efficient Top Down Approach



Efficient Bottom Up Approach



Resulting Factor Exposure



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TOP DOWN OR BOTTOM UP?

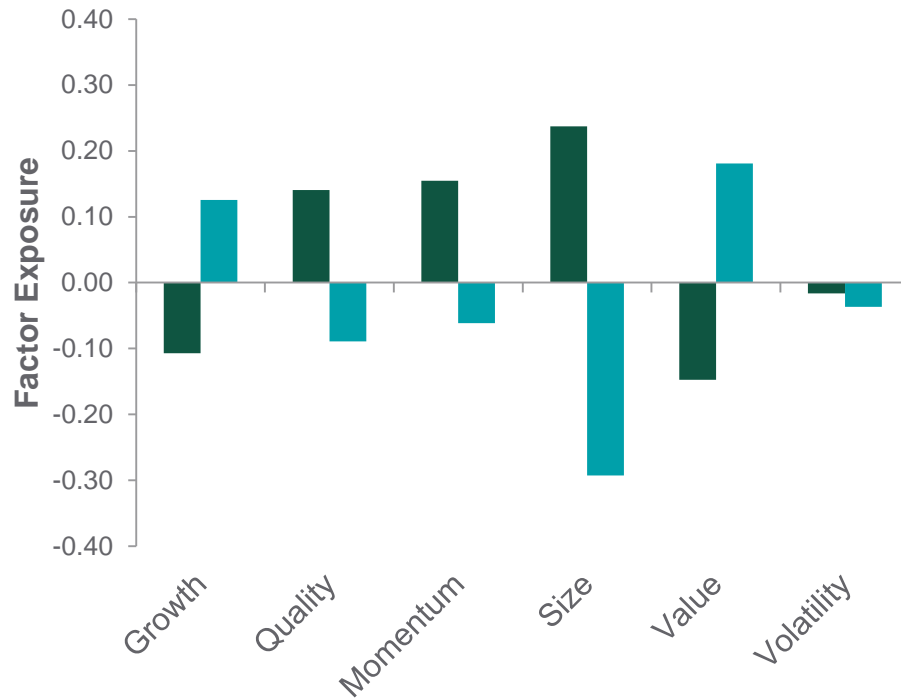


ESG can complement a multi-factor portfolio

- ESG factors highlight genuine risks that are not adequately captured in traditional risk models.
- ESG is related to other factors, but not a proxy
- Sector and Region risks can harm ESG performance

ESG is related to other factors, but not a proxy

PORTFOLIO FACTOR EXPOSURE

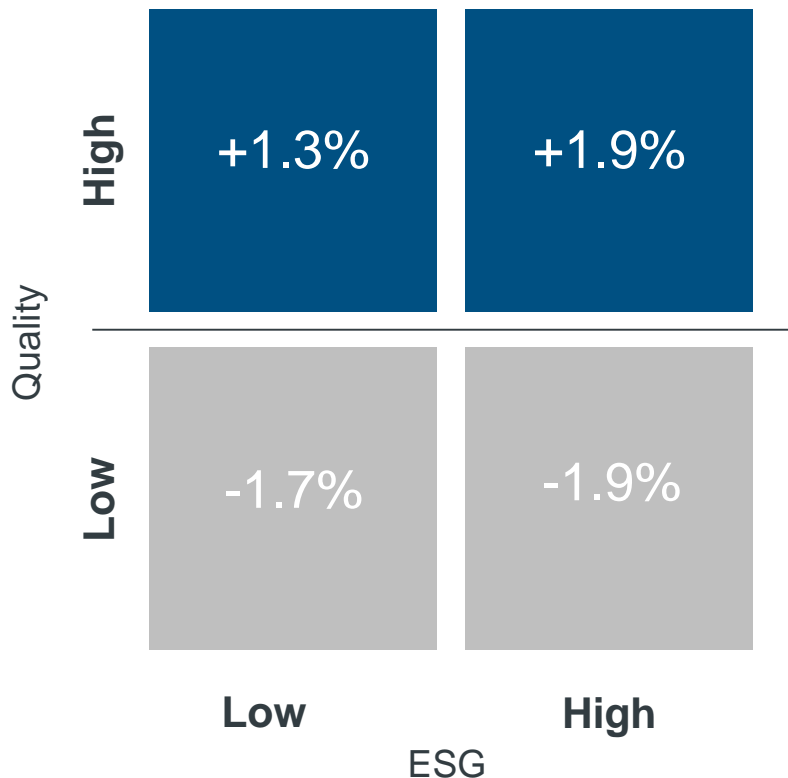


ESG leaders are typically larger and higher Quality companies that trade at a relative premium to the market.

Note: This representative portfolio analysis was selected in order to illustrate how factors have been implemented in this unique equal weighting approach that uses passive, fundamental active, and factor-based management. Source: Northern Trust Quantitative Research, MSCI, Barra GEMLT, Russell. As of March 31, 2019. Please see important information on Hypothetical Returns at the end of this presentation. For illustrative purposes only. **Past performance is not indicative of future results.** Returns reflect the reinvestment of dividends and other earnings and are shown before the deduction of investment management fees. Returns of the indexes also do not typically reflect the deduction of investment management fees, trading costs or other expenses. It is not possible to invest directly in an index. Indexes are the property of their respective owners, all rights reserved. The case study presented is intended to illustrate products and services available at Northern Trust. They do not necessarily represent experiences of other clients nor do they indicate future performance. Individual results may vary.

ESG is related to other factors, but not a proxy

RETURNS VS MSCI WORLD INDEX
(JANUARY 2007 THROUGH MARCH 2019)



Correlations of Quality and ESG Scores

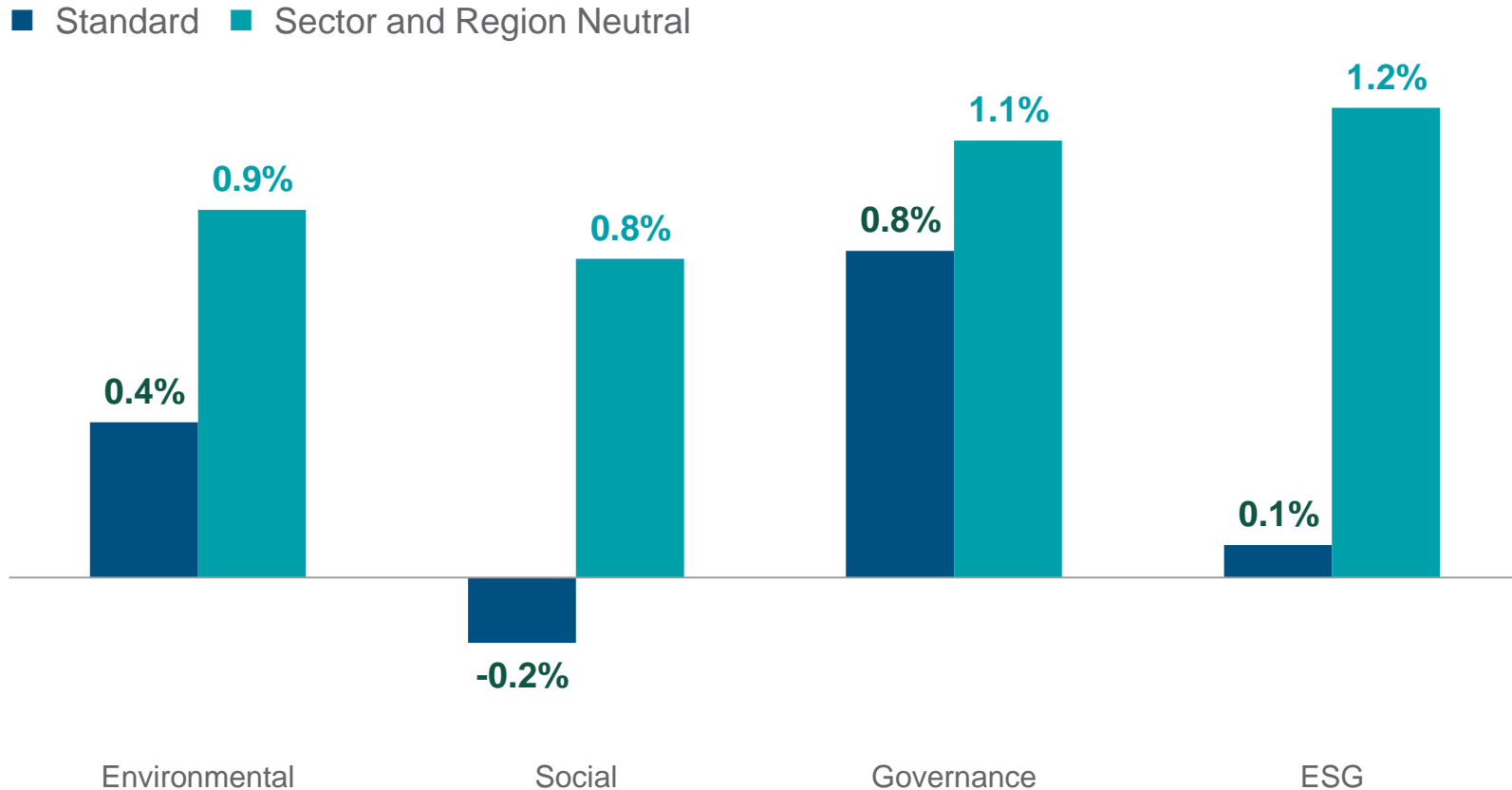


Source: Northern Trust Quantitative Research, MSCI, FactSet. Returns represent annualised average returns of equally weighted portfolios formed as follows. High and Low ESG represent the top and bottom two quintiles of companies based on their Industry Adjusted ESG Scores, respectively. High and Low Quality represent the top and bottom two quintiles of Northern Trust's Quality score, respectively Returns are gross of dividend withholding tax. Returns include backtested performance.

Sources: Northern Trust, MSCI. Represents Spearman Rank Correlations of Industry Adjusted ESG scores and Northern Trust's Quality score. From January 2007 – March 2019.

Sector and Region risks may harm ESG performance

EXCESS RETURNS OF TOP QUINTILE VS. MSCI WORLD INDEX



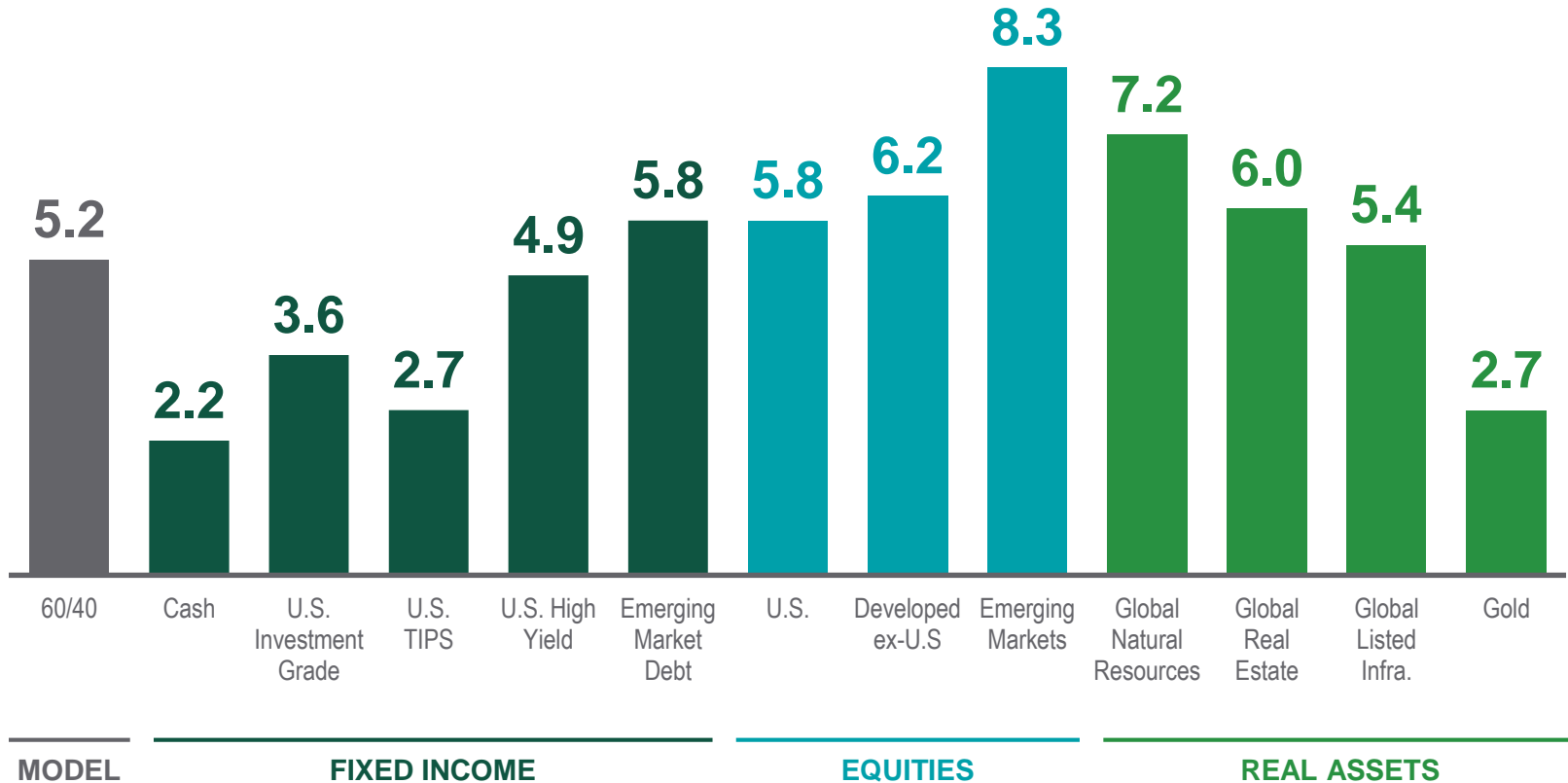
Source: Northern Trust Quantitative Research, MSCI, As of March 31, 2019 from 01/31/2007 – 03/31/2019. Performance reflects the performance of the top quintile of ESG minus the MSCI World benchmark equal weighted. Please see important information on Hypothetical Returns at the end of this presentation. For illustrative purposes only. **Past performance is not indicative of future results.** Returns reflect the reinvestment of dividends and other earnings and are shown before the deduction of investment management fees. Returns of the indexes also do not typically reflect the deduction of investment management fees, trading costs or other expenses. It is not possible to invest directly in an index. Indexes are the property of their respective owners, all rights reserved.

USING FACTORS IN THE CURRENT ENVIRONMENT



Return Forecasts

FIVE-YEAR ASSET CLASS TOTAL RETURN FORECASTS (%)



Source: Northern Trust as of 31/12/2018. Pre-tax strategic, growth and income accredited investor portfolio model. All figures in percentage terms.

Forward-looking statements could differ from actual results. For illustrative purposes only. CMA model expected returns do not show actual performance.

Contraction, Recovery & Growth: How Factors Performed

FACTOR PREMIUMS ACROSS BUSINESS CYCLES*

	ENTIRE PERIOD (1978-2018)	CONTRACTION	RECOVERY	EXPANSION	SLOWDOWN
Size	1.40%	1.55%	15.04%	4.29%	-2.06%
Value	3.22%	6.14%	6.50%	2.38%	1.32%
Momentum	2.24%	-2.45%	-5.39%	3.32%	4.72%
Low Volatility	1.10%	7.84%	-4.97%	-5.79%	2.90%
Dividend Yield	1.35%	4.66%	1.55%	-2.19%	1.50%
Quality	3.77%	6.63%	5.19%	1.83%	2.67%
Number of Observations	480	80	49	156	195

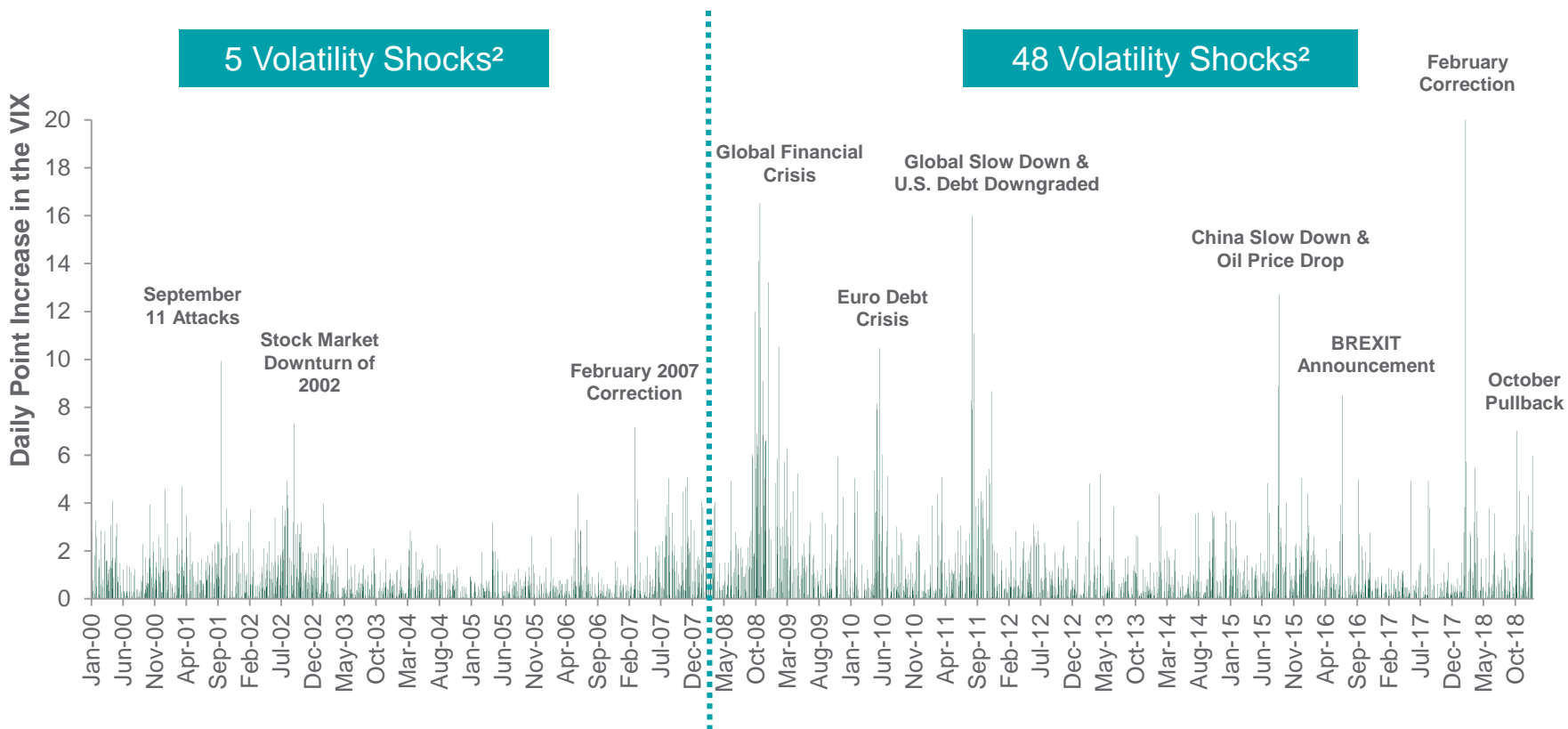
*Green cells are highlighted for emphasis

Past performance is no guarantee of future results. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index.

Source: For illustrative purposes only. NTAM Quantitative Research, Bloomberg. Data as of 12/31/2018. Note: Russell 1000 Index data is shown. Factor returns are excess returns of the top factor quintile of the Russell 1000. Geometric averages used for entire period column. For regime analysis, annual averages are displayed.

Volatility Spikes Are Becoming More Frequent

VOLATILITY INCREASES¹ OVER TIME



¹Volatility increases are represented by any increase in the VIX daily, as of December 31, 2018.

²Volatility shocks any increase in the VIX daily greater than five points.

Source: Northern Trust Asset Management, Bloomberg. Past performance is no guarantee of future results. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index

QUESTIONS



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