

# Dynamic Multifactor Strategies:

A Macro Regime Approach



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Part 1: Investment rationale, process and performance

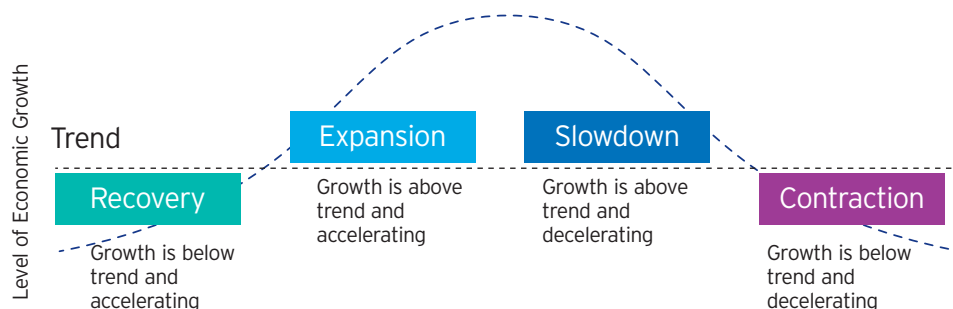


## Executive Summary

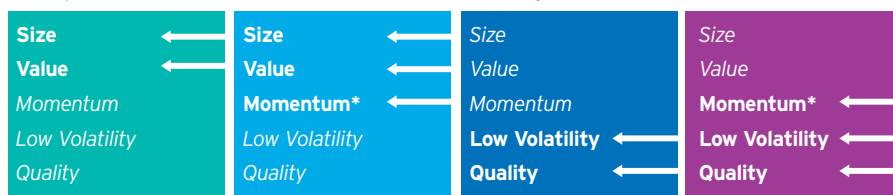
- + Factor portfolios based on quantitative characteristics such as value, momentum, quality, size and low volatility have historically generated attractive excess returns, outperforming market cap benchmarks on a risk-adjusted basis. While single factors have outperformed over the long-term, they have also experienced strong cyclicalities, occasionally leading to extended periods of underperformance driven by changing market environments.
- + Factor cyclicalities can be understood in the context of factor fundamentals and their sensitivity to macroeconomic risks. While size and value tend to be pro-cyclical factors, low volatility and quality tend to be defensive factors. Momentum, a more transient factor, tends to outperform during late cyclical stages.
- + We believe investors can exploit these distinct macro sensitivities among factors, developing dynamic rotation strategies driven by forward-looking macro regime frameworks, with the potential to outperform static multifactor portfolios while maintaining diversification to multiple factors.
- + These dynamic strategies have generated attractive excess returns while reducing portfolio risk in terms of volatility, market beta and drawdowns. Our results are consistent and robust across market cap segments and regions (US, Developed markets ex-US and Emerging markets).
- + In a forthcoming research note, we will provide additional insights into the time-varying exposures and risk characteristics of these strategies, analyzing their downside risks, and which market conditions may provide challenges to performance.

### Exhibit 1: Macro regimes and factor cyclicalities

Factors expected to outperform in each macro regime



Emphasis on each factor is determined by the current environment.



\*Momentum using a bottom-up framework has the potential to act defensively in contractionary periods and pro-cyclically in expansionary periods.

For illustrative purposes only. There is no guarantee these views will come to pass.

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## The evolution of factor investing: A brief summary

How does an investor begin to explain the performance of an investment? Was it a good investment relative to how risky it was? For that level of risk, would it have been better to simply invest in the market and a risk-free asset? There was no consistent answer to these questions before Bill Sharpe's Capital Asset Pricing Model (CAPM) from just 55 years ago (1964). This breakthrough was the start of factor investing; a single factor, the market, could explain most of an individual stock's return.

Graham and Dodd (1934) would argue that the performance of their investment could be explained by how fundamentally sound it was. Decades after Sharpe, Fama and French provided empirical evidence that company valuations were a factor not entirely explained by market performance, and that undervalued companies outperformed overvalued ones over the long run. Along with the Value factor, they also documented that company Size<sup>1</sup> was another statistically significant driver of returns, with smaller companies outperforming larger ones in the same universe over the long-run. These two factors collectively became familiar to investors as investment "styles". Subsequent notable factor discoveries include that of Quality<sup>2</sup>, Momentum<sup>3</sup> and Low Volatility<sup>4</sup>. Industry and academic research documents how these five factors have the potential to deliver excess returns in the long-run, and fulfill key evaluation criteria such as pervasiveness, persistence, intuitiveness, robustness and investability<sup>5</sup>. Collectively, these factors can be used to decompose stock returns into targeted systematic risk exposures, i.e. betas, and idiosyncratic returns, i.e. alpha, and get investors closer to answering this paper's opening question.

In academia, single factors are expressed as long/short, market-neutral exposures, and similar strategies are now ubiquitous in the financial industry and accessible to both retail and institutional investors. In addition, long-only benchmarks that tilt towards these factor exposures by overweighting and underweighting stocks exhibiting desired factors have been developed to track their characteristics and performance versus market cap benchmarks. For the rest of this practitioner-oriented paper, we define our universe of factors and benchmarks in the table below using the FTSE Russell Factor Indices, which reference the five academically supported factors mentioned above (**Exhibit 2**)<sup>6</sup>. These indices satisfy the key factor attributes, with a long history of data and consistent methodology across equity market sectors and regions beyond US large caps, including US Small Caps, Developed Markets ex-USA, and Emerging Markets.

1 The size effect was first shown in Banz (1981), and the book-to-market effect first appeared in Statman (1980) and subsequently in Rosenberg, Reid, and Lanstein (1985).

2 The investment effect was identified by Fairfield, Whisenant, and Yohn (2003), Titman, Wei, and Xie (2004), and Polk and Sapienza (2009). The profitability effect was introduced by Haugen and Baker (1996) and confirmed first in Vuolteenaho (2002) and later in Novy-Marx (2013).

3 Jegadeesh, N. and S. Titman. (1993). "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency." *Journal of Finance*, Vol. 48, No. 1, pp. 65-91.

4 Risk and the Rate of Return on Financial Assets: Some Old Wine in New Bottles, Robert A Haugen and A. James Heins, *The Journal of Financial and Quantitative, Analysis*, December 1975.

5 Evidence of a long-term factor from Swedroe's "Your Complete Guide to Factor-Based Investing":

**Persistence** - does the factor historically deliver returns through market cycles?

**Pervasiveness** - does it, on average, deliver returns in a variety of locales and asset classes?

**Robustness** - it shouldn't be dependent on one specific formulation and fail if other versions are tested

**Intuitiveness** - does it make sense, or is it only based on historical performance?

**Investability** - even if we believe the factor is real, can an investor harvest returns after costs?

6. Additionally, the yield factor (i.e. 12-month dividend yield) is also well-established in the industry and supported by academic research. However, we do not include it in this analysis as it has tended to have high positive correlation with the low volatility factor and value factor.

### Exhibit 2: FTSE Russell factor definitions

Factor	Description	FTSE Russell Factor Definition	FTSE Russell Factor Index
Value	Stocks that appear cheap tend to perform better than stocks that appear expensive.	Equally weighted composite of cash flow yield, earnings yield and price-to- sales ratio	Russell 1000 Value Factor Index
Quality	Higher-quality companies tend to perform better than lower-quality companies.	Equally weighted composite of profitability (return on assets, change in asset turnover, accruals) & leverage ratio	Russell 1000 Quality Factor Index
Size	Smaller companies tend to perform better than larger companies in the same universe.	Inverse of full market capitalization index weights*	Russell 1000 Size Factor Index
Low Volatility	Stocks that exhibit low volatility tend to perform better than stocks with higher volatility.	Standard deviation of 5 years of weekly total returns	Russell 1000 Volatility Factor Index
Momentum	Stocks that rise or fall in price tend to continue rising or falling in price.	Cumulative 11-month return (last 12 months excluding the most recent month)	Russell 1000 Momentum Factor Index

\*Measured as the natural logarithm of the full market capitalization

Source: Invesco, FTSE Russell.

## Multifactor Portfolios: The Case for Dynamic Strategies

While these single factors have delivered outperformance over long periods of time, they have also experienced prolonged phases of underperformance, with returns influenced by macro conditions, valuations and market cycles. Periods like the late 1990s and 2010s for value investors are reminders that factor investing often experiences multi-year periods of dramatic deviations from expected returns. However, given their distinct fundamental characteristics, these five factors have historically exhibited low or even negative excess return correlations, meaning that factors have rarely experienced long periods of simultaneous underperformance. **(Exhibit 3)**. As a result, investors have exploited these features and combined several factors into static multifactor portfolios to harvest diversification benefits and obtain more stable excess returns over time.

### Investment Philosophy

In this paper, we aim to go a step further and explain why factors are cyclical, shedding some light into their fundamental characteristics and how they are influenced by the business cycle. We argue that factors carry structurally different economic exposures, qualifying some as pro-cyclical and others as defensive. We believe these differences provide a strong economic rationale, which can be exploited through a rules-based investment process, to develop factor rotation strategies that aim to tilt the portfolio towards factors expected to outperform in each macro regime, while reducing exposure to factors that are expected to lag the market. However, we believe it is important to maintain an appropriate level of diversification and construct portfolios with exposures to multiple factors, avoiding high concentration to a single factor for long periods of time. Our results indicate dynamic factor strategies have the potential to outperform static multifactor implementations and market cap benchmarks, maintaining a diversified multifactor exposure and delivering attractive risk-adjusted returns.

### Exhibit 3: Motivating the Construction of Multifactor Portfolios

Correlation of Monthly Hypothetical Excess\* Returns: Russell 1000 Factor Indexes  
Jul. 1980 - Dec. 2019

- Greater than 0.70
- 0.30 to 0.70
- Less than 0.30

Factor	Value	Low Vol.	Quality	Size	Mom.
Value	1.00				
Low Volatility	0.29	1.00			
Quality	-0.55	-0.05	1.00		
Size	0.32	-0.42	-0.27	1.00	
Momentum	-0.45	-0.14	0.29	-0.06	1.00

\* Excess returns calculated by subtracting the Factor Indexes returns by the Russell 1000

Source: FTSE Russell, period from Jul. 31, 1980 to Dec. 31, 2019. An investor cannot invest directly in an index. The results shown are hypothetical (not real) and were achieved by means of retroactive application of the statistical model. It may not be possible to replicate the hypothetical results.

## Rationale: Factors, Fundamentals and the Business Cycle

Academic literature has illustrated that the variation in equity market returns can be decomposed into two distinct components, one reflecting news about future discount rates, and one reflecting news about future cash-flows<sup>7</sup>.

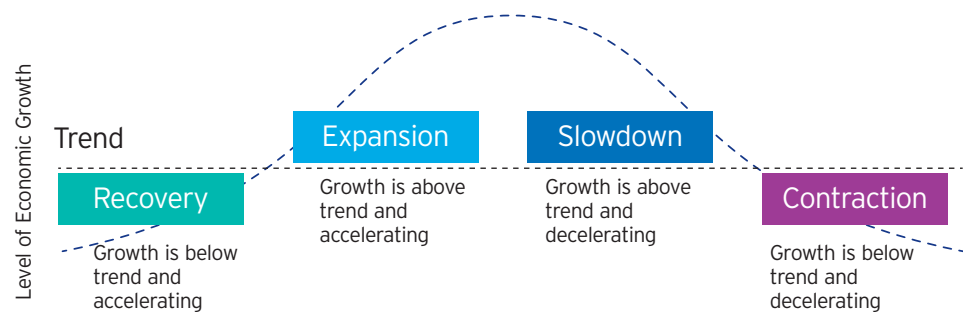
Factor cyclicity can be understood in the context of factor sensitivity to aggregate cashflow news, or news about the overall economy. As discussed in more detail in our paper "Time-Series Variation in Factor Premia: The Influence of the Business Cycle" (Polk, Haghbin and de Longis, 2020, in the *Journal of Investment Management*, Vol. 18, No. 1, (2020), pp. 1-21<sup>8</sup>), factors exhibit distinct sensitivities to macro news, and these differences are economically and statistically significant, helping to explain why factors perform differently in different economic environments.

As illustrated in our previous research, we define the four stages of the business cycle based on the expected level and change in economic growth<sup>9</sup>:

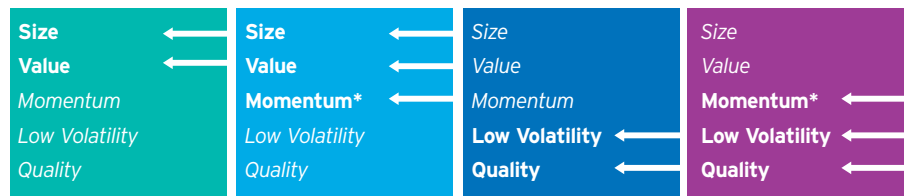
- + Recovery, when growth is below trend and accelerating
- + Expansion, when growth is above trend and accelerating
- + Slowdown, when growth is above trend and decelerating
- + Contraction, when growth is below trend and decelerating

### Exhibit 4: Macro regimes and factor cyclicity

Factors expected to outperform in each macro regime



Emphasis on each factor is determined by the current environment.



\*Momentum using a bottom-up framework has the potential to act defensively in contractionary periods and pro-cyclically in expansionary periods.

For illustrative purposes only. There is no guarantee these views will come to pass.

7 See for example Cambell (1991), "A Variance Decomposition for Stock Returns", *Economic Journal*, 101 (405), 157-179.

8. Polk, Christopher and Haghbin, Mo and de Longis, Alessio, Time-Series Variation in Factor Premia: The Influence of the Business Cycle (April 24, 2019). Can also be found on SSRN.

9. See our white papers "Dynamic Asset Allocation through the Business Cycle" (de Longis, 2019) and "Market Sentiment and the Business Cycle" (de Longis and Ellis, 2019).

In **Exhibit 4**, we map the five equity factors to these four macro regimes, based on our expectations for factor outperformance in each regime.

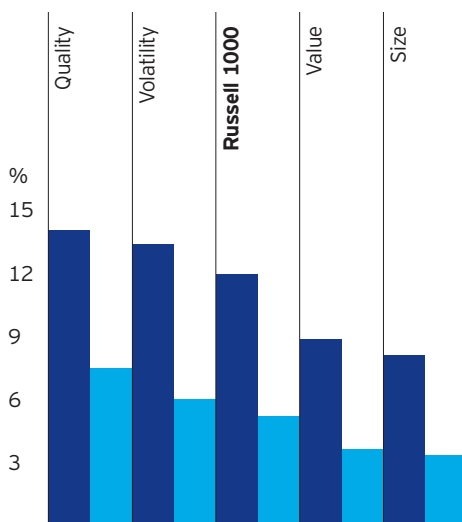
In particular,

- + **Size and value** have historically exhibited higher sensitivity to cash-flow news, leading to procyclical performance characteristics. Hence, we expect size and value to outperform during the *recovery and expansion phase*. This cyclicity can also be related to the higher operating leverage of their underlying stocks, characterized by lower profit margins and return on assets, leading to lower capex and interest coverage ratios (**Exhibit 5**). In other words, given their reduced ability to cover capex expenditures and service debt payments with internal resources, these companies tend to be more reliant on external funding and more exposed to macro and default risk during economic downturns, when earnings come under pressure.
- + **Low volatility and quality** have historically exhibited lower sensitivity to cash-flow news, leading to defensive performance characteristics. Hence, we expect low volatility and quality to outperform during the *slowdown and contraction phase*. This counter-cyclicity can also be related to the lower operating leverage of their underlying stocks, characterized by higher profit margins and higher return on assets, making them less reliant on external funding (**Exhibit 5**). In other words, these companies have a greater ability to navigate through an economic downturn, covering capex expenditures and interest expenses with internal resources. As a result, quality and low volatility companies carry less sensitivity to macro and default risks, on average.
- + Notably, the **momentum** factor is quite different from the others, with less persistent fundamental characteristics, consistent with the transitory nature of its price-based definition. Momentum is behavioral in nature, seeking to harvest the continuation in recent price trends, therefore taking on some of the fundamental characteristics of the factors that have been outperforming in the recent past. As a result, momentum can be expected to outperform in the late stages of cyclical upturns, i.e. *expansion*, and late stages of cyclical downturns, i.e. *contractions*. Similarly, underperformance of momentum can be expected in periods following major turning points in the business cycle, when price trends and fundamentals are likely to reverse.

#### **Exhibit 5: Relating factor cyclicity to fundamentals**

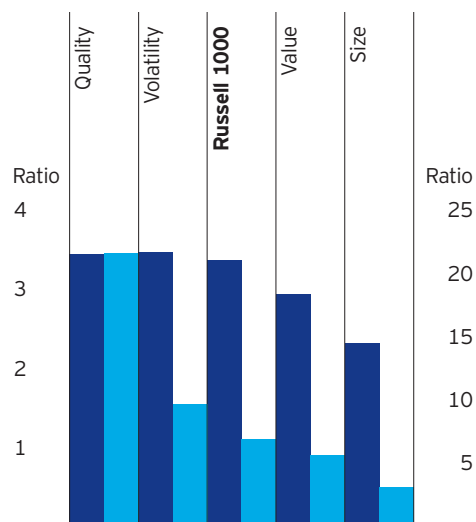
##### **Profitability and Margins**

- Net margin
- ROA



##### **Capex and Interest Coverage Ratios**

- EBITDA/Capex (left)
- EBIT/Interest expense (right)



Source: FactSet 12/31/2018. FTSE Russell single factor indices used as proxies for calculation purposes. Chart shows average ratios between 6/30/2001-12/31/2018.

**There is no guarantee these views will come to pass.**

## Investment Process and Performance Analysis

### Strategy Methodology

For each equity region (i.e. US, Developed Markets ex-US and Emerging Markets), we simulate the performance of a long-only dynamic factor rotation strategy that seeks to reposition factor exposures based on the expected stage of the business cycle. Using our regional leading economic indicators and global risk appetite cycle indicator we estimate macro regimes for each region and tilt the respective portfolios towards the factors we expect to outperform in each macro regime\*, as outlined previously in **Exhibit 4**. Specifically, we follow a two-step process:

\* There is no guarantee these views will come to pass.

- + For each region we construct four separate “regime portfolios”, with factor tilts calibrated to deliver the desired factor exposures for each macro regime. Factor exposures are generated using the FTSE Russell Tilt-Tilt methodology, a bottom-up approach to multifactor portfolio construction in which individual securities are scored and ranked based on their combined factor scores using sequential or “multiplicative” tilts away from market cap weights<sup>10</sup>. This process allows for interaction effects among factors to reward securities that score well on multiple factors. The magnitude of tilts is determined by the expected macro regime, and adjusted for implementation concerns such as liquidity, capacity, diversification and turnover. **Exhibit 6**<sup>11</sup> highlights the tilts for each regime portfolio. In this matrix, a tilt equal to “1” indicates that we multiply a company’s market cap weight by the factor score a single time, and a tilt equal to “2” indicates we multiply by the factor score two times. A tilt equal to “0” indicates that the factor is not targeted. For example, in the Recovery portfolio the strategy will be overweight Size and Value (tilt = 2), and neutral in the other three factors (tilt = 0). For comparison, we include both the Russell 1000 Index, which carries a neutral or “0” tilt to each factor, and the Russell 1000 Comprehensive Factor Index, which represents a static multifactor portfolio with a constant tilt equal to “1” through time for all the five factors<sup>12</sup>.
- + Each month, our proprietary macro signal is used to identify the expected macro regime and rotate the strategy over time into one of these four pre-constructed regime portfolios (see Appendix for more details on macro signal framework).<sup>13</sup>

### Exhibit 6: Constructing regime-specific portfolios

Factor tilts for each macro regime

	Low Volatility	Size	Value	Momentum	Quality
Recovery	0	2	2	0	0
Expansion	0	1	1	2	0
Slowdown	2	0	0	0	2
Contraction	2	0	0	2	2

### Benchmark portfolio factor tilts

Russell 1000	0	0	0	0	0
Static Strategy*	1	1	1	1	1

\* Static Strategy refers to FTSE Comprehensive Factor Total Return Index.

Source: Invesco, FTSE Russell. For illustrative purposes only.

10. FTSE Russell (2017), Multi-factor indexes: The power of tilting

11. The factor tilt matrix in Exhibit 6 is used for the strategy in larger, more liquid markets such as the US and developed markets ex-US. For emerging markets, we use a similar and directionally consistent set of tilts, but with narrower dispersion between regime portfolios to reduce turnover and transaction costs when rotating between portfolios.

12. See Appendix for a brief discussion on the comparison between bottom-up and top-down portfolio construction methodologies.

13. Finally, we let sector and country exposures be a byproduct of targeted factor exposures. However, while the strategies are neither sector-neutral nor country-neutral versus their market cap benchmarks, they are subject to constraints on how large these deviations can be.

14. Our macro regime framework has historically generated two regime changes per year on average, with an approximate annual portfolio turnover of 150% in developed markets and 90% in emerging markets.

### Performance Analysis

Back-tested results are reported in **Exhibit 7** and **Exhibit 8** (see exhibits for sample dates based on data availability). Across geographies (US, DM ex US, and EM), the Dynamic Strategy has delivered attractive performance with excess returns above the market capitalization weighted benchmarks between 4% and 6%, with lower volatility and shallower drawdowns. Significantly lower downside capture and faster recoveries from drawdowns are the strategies’ key features. Information ratios (i.e. excess returns over tracking error) between 0.70 and 1.00 across regions are indicative of the robustness and pervasiveness of the strategy in different markets. Most importantly, the dynamic strategy outperforms a static multifactor implementation represented by portfolios with an equally weighted and constant tilt of 1 to each of the five factors. By lowering drawdowns and increasing upside capture, the Dynamic Strategy improved performance by roughly 2% annualized and information ratios by around 0.25 compared to the Static Strategy in all three regions. Furthermore, our analysis indicates these results are economically significant after accounting for capacity, turnover<sup>14</sup> and transaction costs, making it a practical and realistic application for investors seeking to deploy a dynamic portfolio solution.

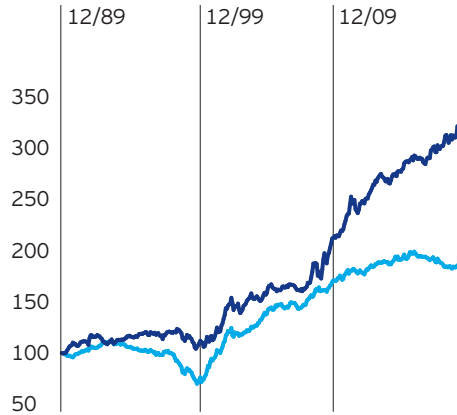
**Exhibit 7: Dynamic Factor Rotation: Backtest graphics across geographies**

**Benchmark:**  
Russell 1000 Index

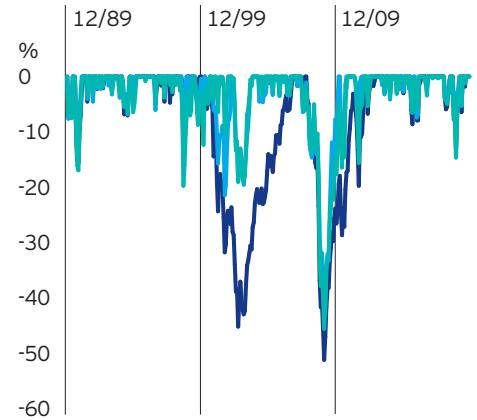
**Full Sample:**  
Dec. 1989 - Dec. 2019

**Cumulative relative growth (indexed at 100)****US Large-cap**

■ Dynamic - Benchmark  
■ Static - Benchmark

**Drawdown**

■ Benchmark Index  
■ Dynamic Strategy

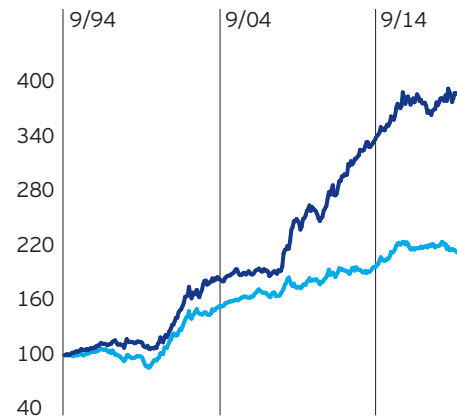


**Benchmark:**  
FTSE Developed ex-US Index

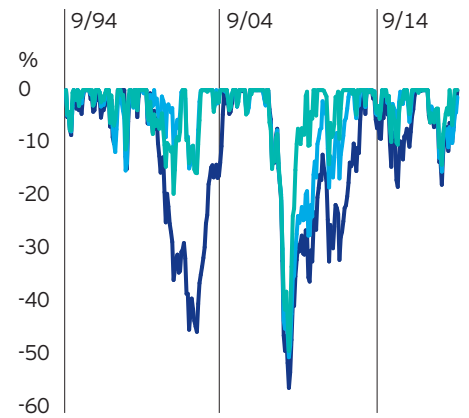
**Full Sample:**  
Sep. 1994 - Dec. 2019

**Developed ex US**

■ Dynamic - Benchmark  
■ Static - Benchmark



■ Benchmark Index  
■ Static Strategy

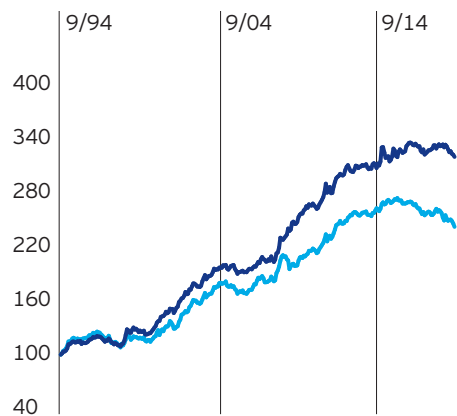


**Benchmark:**  
FTSE Emerging Markets Index

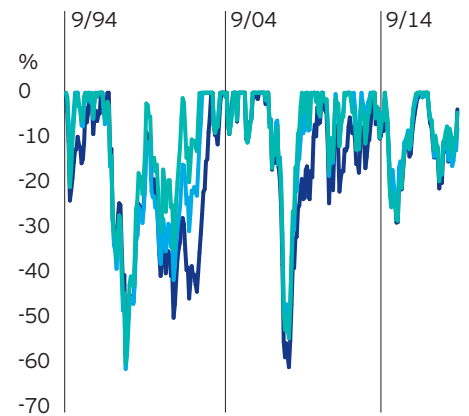
**Full Sample:**  
Sep. 1994 - Dec. 2019

**Emerging Markets**

■ Dynamic - Benchmark  
■ Static - Benchmark



■ Benchmark Index  
■ Static Strategy



\* Static strategy refers to the FTSE Comprehensive Factor version of a region for the respective region.

Source: FTSE, Invesco, as of Dec. 31 2019. For illustrative purposes only. Inception dates for the Russell 1000 Index is January 1, 1984 the FTSE Developed ex-US Index and the FTSE Emerging Markets Index is June 30, 2000, respectively. The back-tests for the non-US strategies begin Sept. 1994 as that is the beginning of FTSE non-US factor data. All information presented prior to the inception dates is back-tested. **Back-tested performance is not actual performance, but is hypothetical.** Although back-tested data may be prepared with the benefit of hindsight, these calculations are based on the same methodology that was in effect when the index was officially launched. Index returns do not reflect payment of any sales charges or fees. An investor cannot invest directly in an index.

**Exhibit 8: Dynamic Factor Rotation: Backtest statistics across geographies**

	Returns %	Standard Deviation %	Sharpe Ratio	Excess Returns	Tracking Error %	Info. Ratio	Max Drawdown %	Skewness	Beta	Up Capture Ratio	Down Capture Ratio
<b>United States (1989)</b>											
Russell 1000 Index	10.7	14.4	0.55	NA	NA	NA	-51.1	-0.7	1.0	100	100
Static Strategy*	12.8	13.6	0.74	2.1	5.2	0.40	-45.5	-0.7	0.9	91.0	82.9
Dynamic Strategy	14.8	13.4	0.90	4.1	5.7	0.71	-43.2	-0.5	0.9	95.0	77.2
<b>Russell 2000 Index</b>											
Russell 2000 Index	9.7	18.5	0.37	NA	NA	NA	-52.9	-0.5	1.0	100	100
Static Strategy*	12.6	15.8	0.62	2.9	6.2	0.47	-50.4	-0.6	0.8	91.4	69.8
Dynamic Strategy	14.4	16.7	0.69	4.7	6.4	0.73	-48.4	-0.3	0.8	96.4	74.2
<b>Developed Markets ex-US (1994)</b>											
FTSE Dev Ex US Index	7.0	15.9	0.29	NA	NA	NA	-56.3	-0.6	1.0	100	100
Static Strategy*	10.1	13.7	0.56	3.1	4.9	0.64	-50.5	-0.7	0.8	90.5	69.5
Dynamic Strategy	12.5	14.3	0.71	5.5	5.7	0.98	-49.3	-0.1	0.8	98.0	66.3
<b>Emerging Markets (1994)</b>											
FTSE EM Index	8.2	22.5	0.26	NA	NA	NA	-61.1	-0.8	1.0	100	100
Static Strategy*	11.9	20.8	0.46	3.6	5.0	0.72	-61.5	-0.7	0.9	97.4	82.2
Dynamic Strategy	13.0	21.5	0.49	4.7	4.8	0.99	-60.3	-0.5	0.9	102.4	84.4

\* Static strategy refers to the FTSE Comprehensive Factor version of a region for the respective region.

Source: FTSE, Invesco, as of Dec. 31 2019. For illustrative purposes only. Inception dates for the Russell 1000 Index is January 1, 1984 the FTSE Developed ex-US Index and the FTSE Emerging Markets Index is June 30, 2000, respectively. The back-tests for the non-US strategies begin Sept. 1994 as that is the beginning of FTSE non-US factor data. All information presented prior to the inception dates is back-tested. **Back-tested performance is not actual performance, but is hypothetical.** Although back-tested data may be prepared with the benefit of hindsight, these calculations are based on the same methodology that was in effect when the index was officially launched. Index returns do not reflect payment of any sales charges or fees. An investor cannot invest directly in an index.

## Conclusion

Factor portfolios based on quantitative characteristics such as value, momentum, quality, size and low volatility have generated attractive excess returns over long time horizons and have outperformed market cap benchmarks on a risk-adjusted basis. However, each factor can experience prolonged periods of underperformance, driven by changing market environments. We argue that understanding the economic drivers of these factors can help investors rotate among these strategies and construct dynamic multifactor portfolios that seek to tilt towards factors expected to outperform in different economic environments. Using our forward-looking macro regime frameworks, we illustrate how dynamic factor strategies have the potential to outperform both market cap benchmarks and static multifactor implementations. Results are statistically significant after accounting for transaction costs, capacity and turnover, and they are robust across market cap segments and geographies. In a forthcoming research note, we plan to provide additional insights into the time-varying exposures and risk characteristics of these strategies, analyzing their downside risks, and which market conditions may provide challenges to their performance.



# Appendix

In practice, **Top Down** can lead to a portfolio with substantially reduced exposure to the intended single factors, and increased exposure to unintended factors.

One caveat of the **Bottom Up** approach resides in its complexity, as many individual investors lack the stock specific factor data and capabilities necessary to construct these multi-factor portfolios on their own.

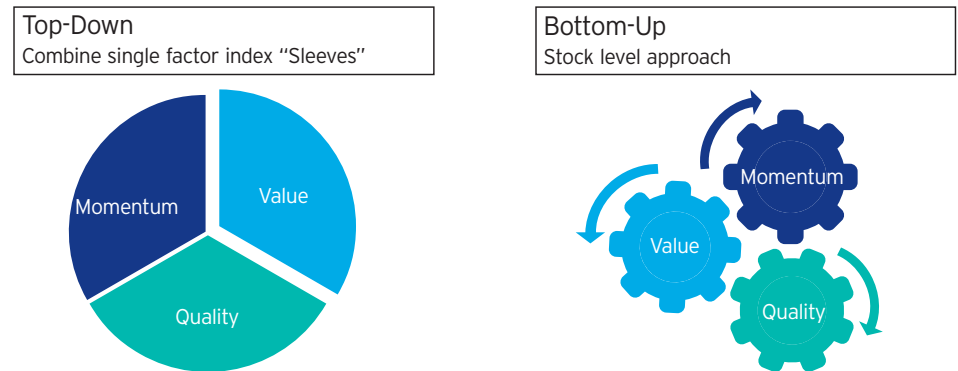
## Constructing Multifactor Portfolios: top-down vs. bottom-up approach

There are two common approaches to combine multiple factors in a portfolio, a top-down and a bottom-up methodology. Both methods have their individual merits and drawbacks, which an investor should take into consideration when deciding how to combine multiple factors in a portfolio (see FTSE-Russell 2015 and 2017)<sup>15</sup>.

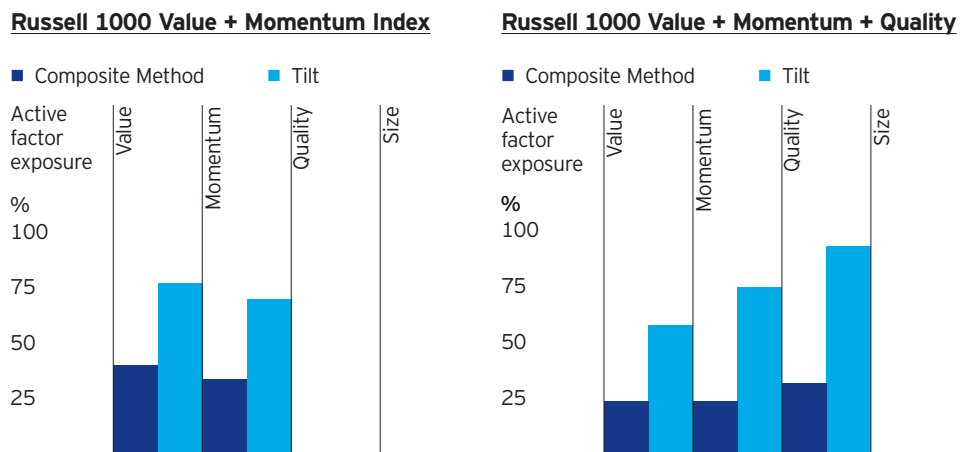
- + Using the top-down, or "composite" method, one allocates capital across individual, stand-alone factor portfolios. An example of this is if an investor allocates 50% of his/her assets to a momentum strategy and 50% to a value strategy, with the resulting portfolio being a capital-weighted average of the two factors. The advantage of this approach is in the simplicity of its implementation, where an investor can target desired individual factor exposures within a portfolio by increasing the allocation to the individual factor sleeves. On average, this results in a portfolio with more stocks and higher diversification. However, this approach can lead to a portfolio with lower factor-exposure and "too much diversification". This dilution effect occurs due to averaging factor sleeves and offsetting factor exposures, particularly for negatively correlated factors.
- + In a bottom-up, or "integrated" approach, individual securities are scored across all their factor exposures and integrated in a portfolio based on the combined exposure to the desired factors. Following the previous example, an investor seeking to combine value and momentum would end up overweighting the individual securities that rank attractively on both a value and momentum score, benefiting from the interaction between the two factors. By enhancing a stock's factor score through this multiplicative effect, the bottom-up approach has the potential to create more targeted and precise factor exposures. Furthermore, factor correlation begins to matter significantly within the portfolio should an investor wish to purposefully amplify or dilute any set of factors (**Exhibit 10**).

**Exhibit 9** and **Exhibit 10** provide a visual representation of these techniques and their resulting hypothetical portfolio outcomes, using momentum, value and quality factors as examples. In constructing dynamic multifactor strategies, we favor a bottom-up approach, leveraging its ability to deliver more precise exposure to targeted factors for each macro regime, and minimize unintended factor exposures.

**Exhibit 9: Factor Combination: Top-Down vs. Bottom-Up**



**Exhibit 10: Bottom-Up Improves Factor Exposure**



15. FTSE Russell (2015), "FTSE Comprehensive Factor Indices, Methodology Overview", and FTSE Russell (2017), "Factor Exposure and Portfolio Concentration".

See our white papers "Dynamic Asset Allocation through the Business Cycle" (de Longis, 2019) and "Market Sentiment and the Business Cycle" (de Longis and Ellis, 2019).

## Forecasting Macro Economic Regimes

As detailed in previous publications, we estimate the prevailing macro regime for each region using our proprietary regional leading economic indicators ("LEI") and global risk appetite cycle indicator ("GRACI"):

- + Our LEIs combine several economic variables from the most cyclical and leading parts of the economy (i.e. housing, manufacturing, etc.) together with variables capturing financial and monetary conditions (i.e. the yield curve, money supply, etc.). For more details, see "Dynamic Asset Allocation and the Business Cycle" (de Longis, 2019). We use our leading economic indicators to predict whether growth will be above or below trend in the medium term.
- + Our global risk appetite indicator measures the incremental return received by investors, on average, for an incremental unit of risk taken in global financial markets on a trailing basis. As described in "Market Sentiment and the Business Cycle" (de Longis and Ellis, 2019), global risk appetite has a strong and statistically significant correlation with the growth cycle and tends to lead turning points in global leading economic indicators by 2-3 months. In other words, we use risk appetite to extract market expectations of future changes in economic growth, i.e. whether growth is likely to accelerate or decelerate, therefore anticipating the occurrence of cyclical peaks and troughs.

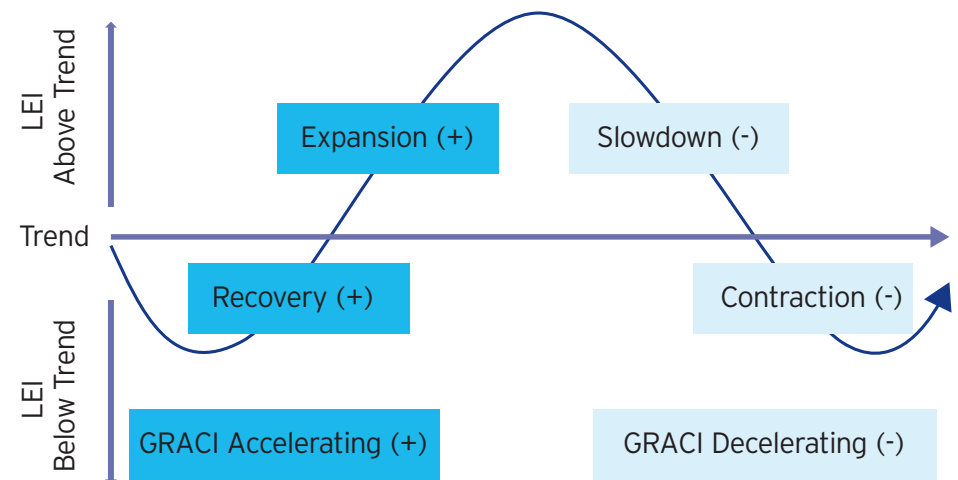
A brief description of these indicators and their constituents is reported in **Exhibit 11**, while **Exhibit 12** provides a visual representation of how these indicators are combined to estimate the occurrence of the four macro regimes recovery, expansion, slowdown and contraction..

### Exhibit 11: Macro regime identification using Invesco Investment Solutions proprietary indicators

Combining regional leading economic indicators and global market sentiment to generate expected economic regimes

Regional Leading Economic Indicator (LEI)	Global Risk Appetite Cycle Indicator (GRACI)
Equally weighted:	Equally weighted:
<ul style="list-style-type: none"> <li>+ Manufacturing business surveys</li> <li>+ Consumer sentiment surveys</li> <li>+ Monetary conditions</li> <li>+ Housing/Construction activity</li> <li>+ Manufacturing activity</li> <li>+ Labor market activity</li> </ul>	<ul style="list-style-type: none"> <li>+ Country-level total return indices across equity, credit and fixed income markets</li> <li>+ Developed and emerging markets</li> <li>+ Global benchmark providers: FTSE, MSCI, Barclays, JPMorgan, Credit Suisse</li> </ul>

### Exhibit 12: Blending LEI and Global Risk Appetite



For illustrative purposes only

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Momentum style of investing is subject to the risk that the securities may be more volatile than the market as a whole or returns on securities that have previously exhibited price momentum are less than returns on other styles of investing.

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