Research

Factor behavior through the cycle

Lessons from the Russell 1000 Index

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Introduction

Understanding when factors pay off is essential to effective factor investing.

Factors have become an influential force in investors' decision-making processes, buttressed by a growing body of academic and financial industry research that has affirmed the effectiveness of factors in driving risk and returns.

But to get the most value from factor investing strategies, investors should first gain a more comprehensive understanding of how and why factors behave the way they do. Insights into the complexities of factor behavior can help investors to better anticipate how their portfolios might perform in the future. It can also help them to capitalize more effectively on the potential benefits of factors − either by strategically or tactically taking factor exposures to express specific economic or market views in their portfolios, or by investing in a static multifactor portfolio that takes advantage of the inherent interplay among factors.

This paper seeks to provide a nuanced framework to help investors form more realistic expectations of how factors perform over full economic cycles. First, we cover the standard characteristics from an unconditional standpoint, meaning we examine how the factors behave on average over the entire time period. Next, we look more deeply at each factor's conditional behavior − that is, how they have performed depending on the stage of the market or economic cycle. Lastly, we examine these same unconditional and conditional behaviors within a multifactor context.

How we approached this research

For this paper, we examined the five core FTSE Russell single factors − Value, Size, Momentum, (low) Volatility and (small) Size − as well as the hybrid (dividend) Yield, using back-tested Russell 1000 Index data for the 21-year period ended December 2018. Data draws on the performance of all six single factors using the FTSE Russell Tilt methodology that applies an exponent of 1 to each factor (see [1]), and then we combine the five core factors using a static factor combination to understand the behavior of a baseline multifactor index.

One caveat: As is typical with any analysis using historical financial data, we only have one history and we cannot recreate a new history. Thus, it is important not to place too much emphasis on absolute performance or to make gross generalizations based on these findings. For that reason, we have endeavored to tie our observations of each factor's conditional behavior back to its underlying rationale. It is also worth noting that no forecasting was involved in the back-tests and that we went to great lengths to ensure that the data used at any point in time in the back-test construction process would have been known at that point in time.

2. Unconditional vs. conditional behaviors

Investors should be cautious when drawing on past factor behavior to help form expectations of future behavior. Under the simplest assumptions, some investors may have heard that factors outperform the cap-weighted market index, and so expect the factor index to outperform in all periods. Those investors will be disappointed frequently.

Others may expect factors to outperform over extended periods of, perhaps, three to five years. But even this more reasonable view is inaccurate. Factors behave differently at different stages of the market cycle. The three- to five-year rule of thumb assumes that a market cycle is three to five years long. But that rule of thumb is based on averages; it is not always true. Investors need to understand how factors behave conditional on macro conditions. Doing so should enable them to form more realistic expectations of future factor performance that conform with their outlook for the economy and the market.

It is also important to consider that factors do not all behave the same. Under certain conditions, we would expect some factors to outperform the market and others to underperform it, based on their historical behaviors. It is these differences in behavior that allow investors to take advantage of the potential factor premia in a multifactor context.

In our analysis, we were frequently able to tie the specific factor behavior back to the underlying market or economic conditions and then apply these insights to form interpretations − and expectations − of future factor behavior. By using this conditional approach to analyze and interpret factor performance, we gained a much more comprehensive understanding of what has occurred in the past.

Not only do factors behave differently from each other, but they also behave differently over time.

3. Defensive vs. Cyclical

The cyclical and defensive categories provide a useful framework for understanding factor behavior.

In an earlier paper [2], we divided factors into two general categories: cyclical and defensive.

Cyclical factors have historically outperformed broad market indexes in rising markets, while defensive factors have generally outperformed in falling markets. Cyclical factors are considered riskier because they have tended to perform best in up markets, when investors need the extra return least, and to lose more than the market in downturns. Defensive factors are viewed as less risky because they can help protect portfolios in market downturns, when investors need the extra performance most. These characterizations also align with the overall volatility of the factor returns as well as with the correlations with the cap-weighted benchmark.

Cyclical factors

The three cyclical factors are Value, Size and Momentum. One of the earliest factors to be identified and studied was Value, which refers to the tendency of stocks with lower prices relative to some fundamental value to outperform the average over time (see references in [3]). The Size factor refers to the tendency of smaller capitalization stocks to outperform larger capitalization stocks over time, while the Momentum factor explains the tendency of stocks that have been performing well to continue performing relatively well.

While all three of these factors are considered cyclical, the degree of their cyclicality − and, thus, how they behave − varies. For example, Value typically performs well when markets are rising, and when investors are confident enough in the macro outlook to invest in undervalued stocks. But Value stocks do not always do well in rising markets, especially when markets are rising because of excessive investor crowding into high-profile, expensive stocks. The dotcom bubble of the late 1990s is the quintessential case in point.

Smaller stocks (Size) tend to have less diversified business models than their larger peers. They also receive far less research coverage, which means that there is greater uncertainty surrounding their earnings prospects. Interest in small caps is typically highest when investors are confident in the stability of the economic backdrop.

Momentum, on the other hand, is more technical than the other two factors. The Momentum effect is the tendency of stocks that are trending in one direction to continue doing so, a phenomenon attributable to the cognitive biases that drive performance chasing. Because it is a technical factor, the specific movement of the market can have a strong impact on the behavior of Momentum.

Defensive factors

The two defensive factors are Quality and (Low) Volatility, both of which have characteristics sought by investors when markets are volatile or under stress. The Quality factor is defined by various measures of balance-sheet strength and cash-flow sustainability − attributes that offer more confidence that a company can survive tougher economic times (See references in [4]).

The Volatility factor focuses on a stock's volatility relative to that of the average stock. Empirical research has found that less volatile stocks tend to produce higher risk-adjusted returns than more volatile stocks. There can be both

behavioral and structural reasons why this would be the case. While there is typically considerable overlap between Quality and low Volatility stocks, the rationales for their premia are different and we expect them to behave differently in different environments.

Finally, while the (Dividend) Yield factor has defensive characteristics, it is best considered a hybrid, meaning that it contains elements of the more cyclical Value effect during most periods but exhibits a risk-on/risk-off behavior in times of market stress. Because many investors specifically favor the income generation of high-yield portfolios, we have included this factor in our analysis.

4. Unconditional factor behavior

Returns and volatility

Exhibit 1 shows standard "unconditional" statistics of six single factor indexes and the capitalization-weighted Russell 1000 (R1000) benchmark. The top half shows absolute performance statistics, and the bottom half shows statistics relative to the Russell 1000.

Unconditional measures help characterize factors as cyclical or defensive.

Exhibit 1. Performance statistics − six factors vs. the Russell 1000 Index

	Russell 1000	Value	Size	Momentum	Volatility	Quality	Yield
Absolute							
Arithmetic Return % p.a.	8.12	8.98	10.27	8.46	7.98	8.80	8.36
Volatility % p.a.	17.30	17.27	19.32	17.29	15.76	16.17	15.89
Geo. Return % p.a.	6.77	7.70	8.65	7.14	6.90	7.71	7.29
Return/Risk Ratio	0.39	0.45	0.45	0.41	0.44	0.48	0.46
Max Drawdown %	-47.6	-48.9	-53.4	-45.5	-44.5	-41.9	-49.0
Turnover % p.a.	12.5	39.3	37.3	81.2	14.6	34.9	23.4
Relative to Benchmark							
Arithmetic Excess Return % p.a.	--	0.87	2.16	0.35	-0.14	0.68	0.25
Geometric Excess Return % p.a.	--	0.87	1.76	0.35	0.12	0.88	0.49
Volatility Reduction % p.a.	--	0.17	-11.68	0.06	8.90	6.53	8.15
Tracking Error % p.a.	--	2.89	5.12	2.89	2.98	2.37	5.65
Information Ratio	--	0.30	0.34	0.12	0.04	0.37	0.09

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

First, let's consider the arithmetic returns, which are frequently ignored in financial analysis but can still be informative. These are simply the means of the return distributions and so can also be interpreted as unconditional expectations. The returns of the cyclical factors (the first three columns) tend to be higher than that of the benchmark, while those of the defensive factors are mixed.

Intuition tells us that cyclical factors should exhibit higher unconditional returns because they pay off when everything else is paying off, which means that investors should be rewarded for holding them with higher expected returns. Defensive factors, on the other hand, should have a lower unconditional payoff because they provide protection in tougher market environments. While that is generally the case, we note that Quality performed well during the entire period examined, despite being a defensive factor.

During this period, the volatilities of the cyclical Value and Momentum factors were roughly in line with that of the benchmark but considerably higher for Size. The volatilities of the two defensive factors and Yield were somewhat lower than that of the benchmark.

Financial analysis often uses geometric or compounded returns to summarize a time-series of returns because it does a good job of explaining the realized effect of holding the asset over time. In the table above, we include the arithmetic

average to point out that the geometric mean is influence by both the arithmetic average and volatility, or standard deviation. If we use the approximation that

$$ret_{Geo} = ret_{Arith} - \frac{\sigma^2}{2} \ (where \ \ \sigma \quad is \ the \ standard \ deviation)$$

we can see that return volatility reduces the geometric return for a given arithmetic average return. So, a high average return is good, but a lower volatility also improves the long-term cumulative return.

For example, the (low) Volatility factor has lower average arithmetic returns than the other factors, but it also has lower volatility, which lifts its geometric return. The volatility comes into play again when we divide the geometric average by volatility to obtain the return/risk ratio. As shown, the Volatility factor has delivered a respectable return/risk ratio despite starting with a relatively low arithmetic mean return.

Drawdowns, turnover and tracking error

Unconditional metrics generally support the rationales underlying factor behaviors.

Maximum drawdown measures the defensive characteristics of each factor, which in this analysis occurred for all factors during the Lehman collapse in 2008, when the R1000 fell 47.6%. As shown, Quality offered the best protection during this episode, with a drawdown of 41.9%. Size was the most cyclical, with a drawdown of 53.4%.

Factor turnover is also an important characteristic. It is sometimes missing from expected performance calculations because most performance numbers are calculated before transaction costs. The turnover numbers shown above are all annualized, two-way turnovers. To make these comparable, factor indexes are all assumed to be rebalanced semi-annually. Unsurprisingly, Momentum has the highest turnover since there is significant information decay with a technical signal like Momentum. On the other end of the range is Volatility, which is slower-moving because it is calculated here over a five-year window.

The rest of the relative metrics show similar performance information. The only new information is tracking error. Many investors are concerned not only with returns relative to a benchmark but also with risk relative to a benchmark. As Table 1 shows, four of the factors have moderate tracking errors, while they are high for Size and Yield. In the case of Size, tracking error is elevated because the capitalization of the Size factor index is tilted far from the cap-weighted benchmark. And, because the Yield factor index excludes the many stocks that do not pay a dividend, its tracking error is high relative to the cap-weighted benchmark.

Co-movement

The above statistics present an unconditional description of each factor taken in isolation. But we were also interested in how the factors co-move with other assets. The exhibit below shows that the correlations of factor index returns with benchmark returns are all quite high. We also combined these correlations with the volatilities from the table above to calculate the betas.[1] As shown, the betas of Value and Momentum have been close to that of the market (of one), quite high (cyclical) for Size, and relatively low for Volatility, Quality and Yield.

[1] Beta is the covariance of the factor with the market over the variance of the market. Since the covariance is the correlation of the factor with the market times the standard deviation of each of them, the beta can also be calculated as the standard deviation of the factor times the correlation divided by the standard deviation of the market.

In examining the correlations of the factor indexes' excess returns with that of the R1000 absolute return, we see that Value and Momentum have been nearly uncorrelated to the benchmark over the 21-year period, Size was the only positively correlated factor, while Volatility, Quality and Yield were all strongly negatively correlated.

Exhibit 2. Co-movements of factor indexes with the Russell 1000 Index

	R1000	Value	Size	Momentum	Volatility	Quality	Yield
Correlation with R1000	1.00	0.99	0.97	0.99	0.99	0.99	0.95
Volatility	17.30	17.27	19.32	17.29	15.76	16.17	15.89
Beta	1.00	0.98	1.08	0.99	0.90	0.93	0.87
Correlation of Excess Return with R1000		-0.09	0.27	-0.09	-0.58	-0.53	-0.40

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Correlations and relative volatilities contribute to beta. Value has a high correlation to the benchmark but a slightly lower volatility, which results in a beta below 1.0. Size, by contrast, has a lower correlation to the benchmark than Value but a much higher volatility, which gives it the highest beta, at 1.08.

We also looked at how the excess returns of factors relate to each other (see Exhibit 3). Many of the correlations are intuitive:

Correlations among factor excess returns are intuitive.

- Value has had a strongly negative correlation with Momentum and a positive correlation with Yield, which is also a valuation-based ratio. The positive correlation with Size reflects that the smaller stocks tend to be cheaper.[2] However, Value's positive correlation with Volatility is somewhat odd, although it was likely influenced by the dotcom bubble, when expensive stocks were very volatile.
- Size's negative correlation with Volatility and Quality is understandable, as (low) Volatility and Quality stocks are usually large caps.
- Volatility has had high correlations with Quality and Yield.
- Quality has had a positive correlation with Yield.

[2] It should be remembered that these are correlations of return time-series and not based on cross-sectional correlations of the characteristics themselves.

Exhibit 3. Correlations of factor excess returns

	Value	Size	Momentum	Volatility	Quality	Yield
Value	**1.00**	0.49	-0.64	0.47	-0.02	0.77
Size	0.49	**1.00**	-0.32	-0.24	-0.37	0.10
Mom	-0.64	-0.32	**1.00**	-0.21	0.26	-0.46
Vol	0.47	-0.24	-0.21	**1.00**	0.59	0.84
Quality	-0.02	-0.37	0.26	0.59	**1.00**	0.29
Yield	0.77	0.10	-0.46	0.84	0.29	**1.00**

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

5. Conditional factor behavior

Conditional on market returns

Looking at performance in varying economic environments provides a useful understanding of what factors can do.

It is also important to understand how factors behave within the context of prevailing market conditions. A useful framework is to look at how much of the market movement each factor has captured when the market is either rising or falling.

Measures of beta assume that the co-movement is symmetric. Participation (or capture) ratios, on the other hand, calculate the effect separately and so allow for asymmetry. As shown in Exhibit 4, Value and Momentum have had participation ratios of close to one, Size above one, and Volatility, Quality and Yield below one.

The average participation ratio gives us an indication of the defensiveness or cyclicality of the factor index, with averages below one more defensive. By this measure, Value and Momentum are neutral, Size is cyclical, while Volatility, Quality and Yield are defensive.

The average participation ratio conveys information similar to that of beta. However, the participation ratio difference allows for asymmetries in co-movements. This metric tells us how a factor would have performed relative to the market over a full market (up and down) cycle if that factor had followed its participation ratio pattern. Over the examined period, most of the factors indicated quite a bit of symmetry, with only Size showing considerably more participation on the upside than on the downside.

Exhibit 4. Participation ratios − six factor indexes vs Russell 1000 Index

	R1000	Value	Size	Momentum	Volatility	Quality	Yield
Up	1.00	0.99	1.10	1.02	0.89	0.96	0.85
Down	1.00	0.96	1.01	1.00	0.90	0.93	0.84
Average	1.00	0.97	1.05	1.01	0.90	0.95	0.84
Difference	0.00	0.03	0.09	0.02	-0.01	0.03	0.01

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Conditional on the economic backdrop

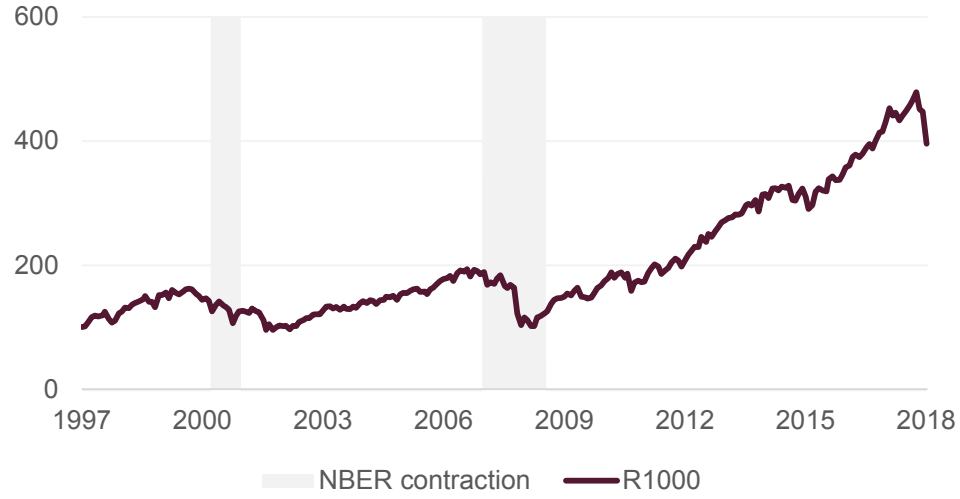
The statistics above focus on the performance of factor indexes during individual months when the market (as represented by the Russell 1000 benchmark) rose or fell. An intuitive extension of this is to compare how the factors performed under different economic conditions.

A commonly used indicator of the economic environment comes from the National Bureau of Economic Research (NBER). The NBER provides dates of economic troughs and peaks, which divide the economic cycle into expansions and contractions (or recessions). The chart below shows the cumulative performance of the Russell 1000 since 1998, along with the two NBER-defined contractions over that time frame. As would be expected, the market has dropped around the time of the contractions.[3] As also shown, the contractions

[3] We include both the start and end month of the contraction in the contraction period.

have been much shorter in length than the periods of expansion. Other views of the economic cycle take a more nuanced view of expansions by, for example, dividing the stylized economic cycle up into contractions, recovery, expansion and slowdown. Conceptually, this emphasizes the transitions between the two extremes of contraction and expansion.

Exhibit 5. Russell 1000 Index cumulative returns (%)



Source: FTSE Russell and Refinitiv. Data through December 2018. Past performance is no guarantee of future results. Please see end for important legal disclosures.

To illustrate the differing behavior of factors in different economic environments, the six charts in Exhibits 6−12 show the excess cumulative returns for each factor. Cyclical factors − such as Size − have tended to underperform during contractions. Defensive factors − such as (low) Volatility − have typically outperformed during contractions. However, these performance patterns have not been consistent across the two NBER contraction periods. There also seems to be some issue of timing, given the large swings in excess returns outside of the official NBER contraction periods.

Exhibit 6. Value factor index − excess cumulative returns (%)

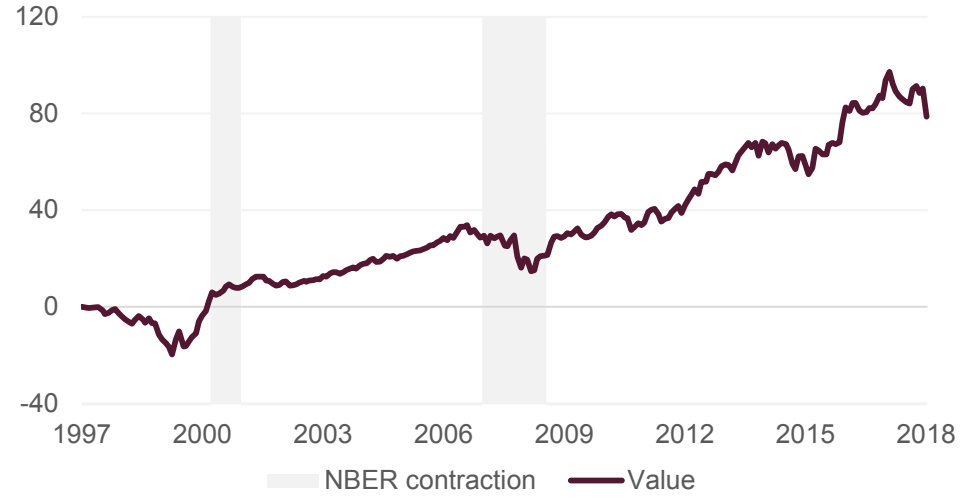


Exhibit 7. Size factor index − excess cumulative returns (%)

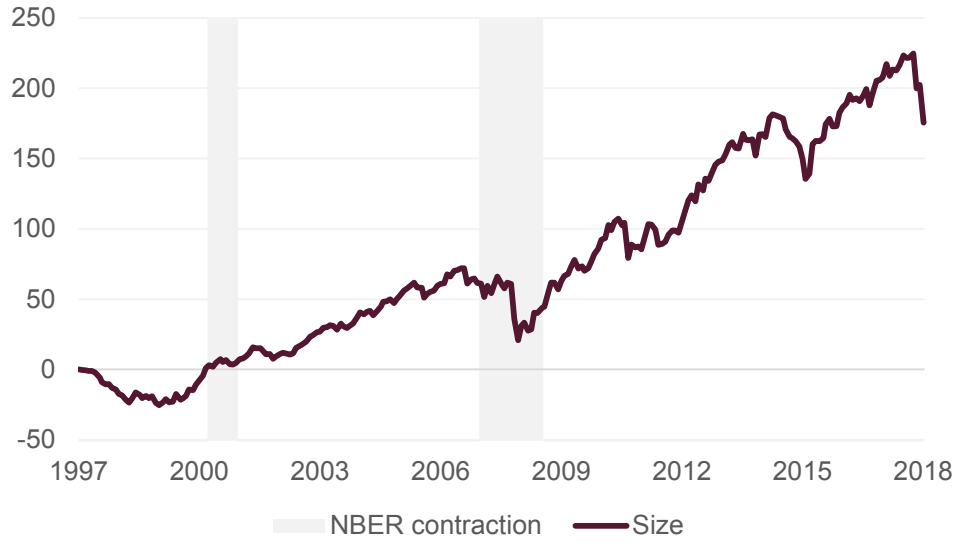


Exhibit 8. Momentum factor index − excess cumulative returns (%)

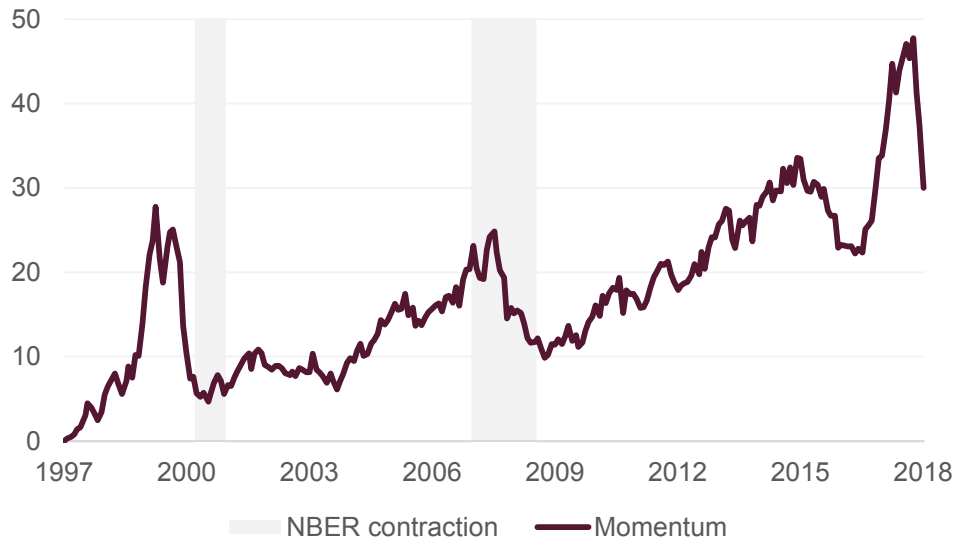


Exhibit 9. Volatility factor index − excess cumulative returns (%)

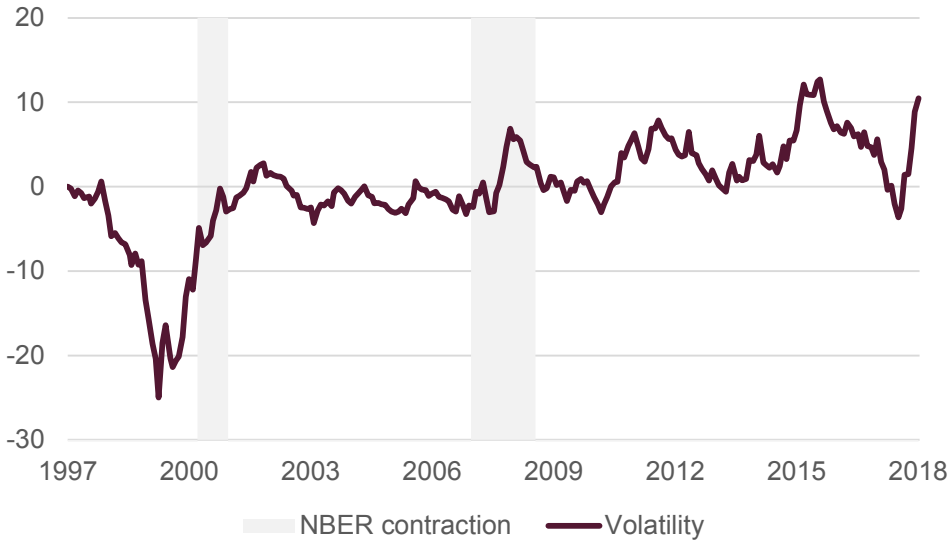


Exhibit 10. Quality factor index − excess cumulative returns (%)

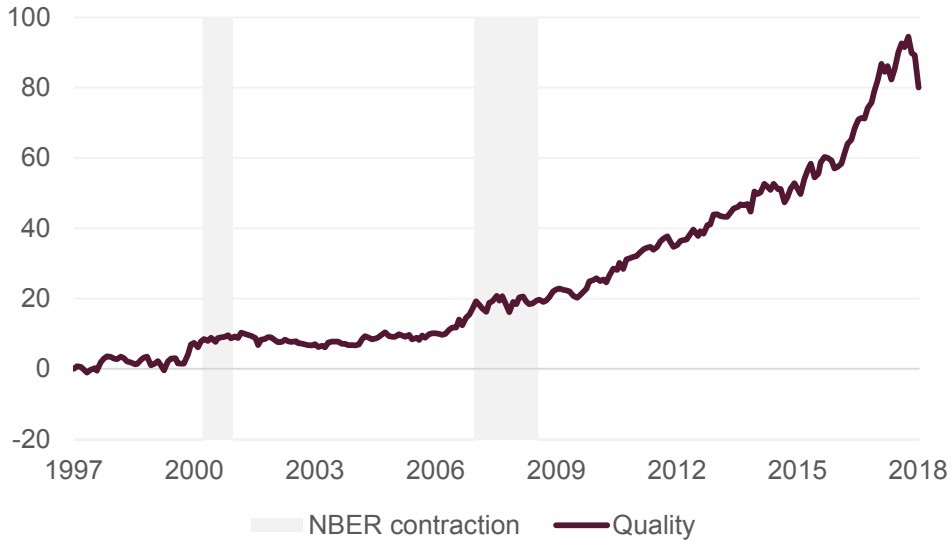
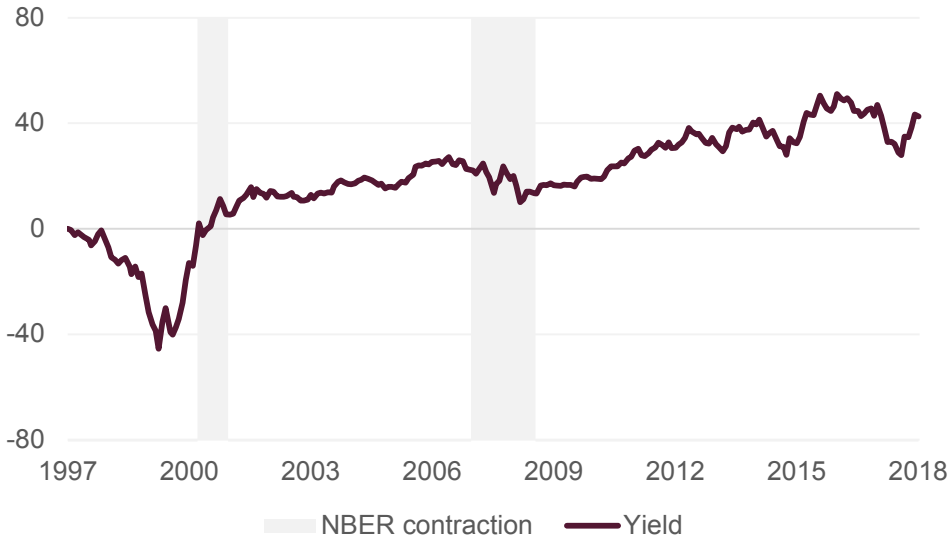


Exhibit 11. Yield factor index − excess cumulative returns (%)



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Our conditional analysis also examined factor performance before, during and after recessions.

One complicating issue with these analyses is the timing of the contraction periods. NBER recessions indicate real economic shrinkage and so may occur at some point after an economic or financial shock. Moreover, stock prices incorporate collective investor expectations and are commonly considered a leading indicator of economic growth. It is important to consider not only periods of contraction and expansion but also the periods of transition between the two, so we can better understand how factors behaved leading up to and following the official period of contraction.

To do this, we examined factor returns before, during and after the NBER contraction periods. Because there were only two recessions over the 21-year period, and because they were quite different, it was difficult to make any strong conclusions. Still, we did uncover some interesting timing patterns that paralleled historical defensive/cyclical patterns.

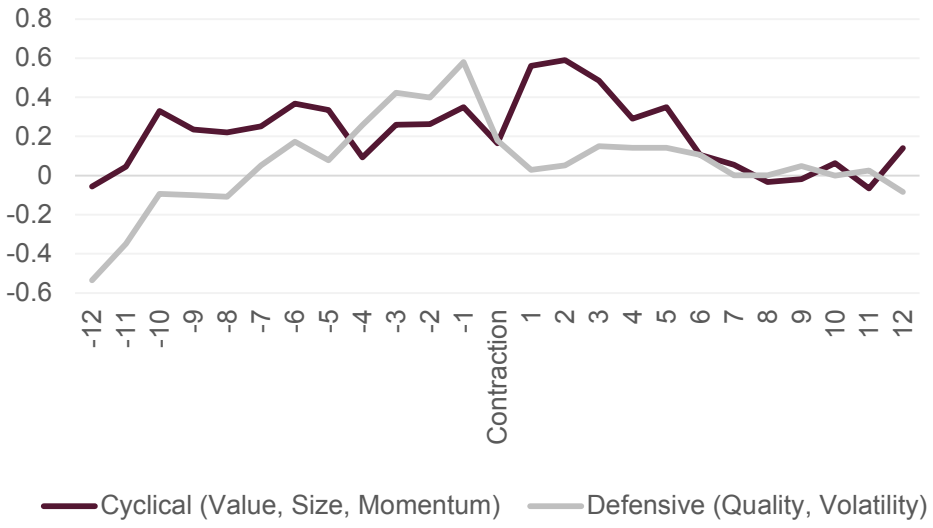
Exhibit 12 shows the average monthly excess returns during the two official NBER contractions since 1998. The numbers to the left of the contraction label represent the average excess returns over a six-month period ending in a given month before the contraction. For example, the value for “-1” is the six-month return ending in the last month before the contraction.

The numbers to the right of the contraction label represent the average excess returns over a six-month period starting in a given month after the contraction. For example, “+1” is the average of monthly returns for the six-month period starting the month after the end of the contraction. The contraction periods are overlapping so each result shows the average for each six-month interval.

As shown, in the period leading up to the contraction, cyclical factor performance diminished slightly, and defensive factor performance took the lead. After the end

of the contraction, defensive factor outperformance waned, and Cyclical factors gained traction.

Exhibit 12. Average excess returns (%) during NBER contraction and six-month intervals before and after contraction



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Cyclical and defensive factors performed as generally expected in the run-up and aftermath of the past two recessions.

In general, these results conform to the historical relationships of factors with both market movements and economic conditions. However, as this analysis also illustrates, the timing of the interaction between factors and the economic backdrop is more complicated. We address this issue in the next section.

6. Performance variability over time

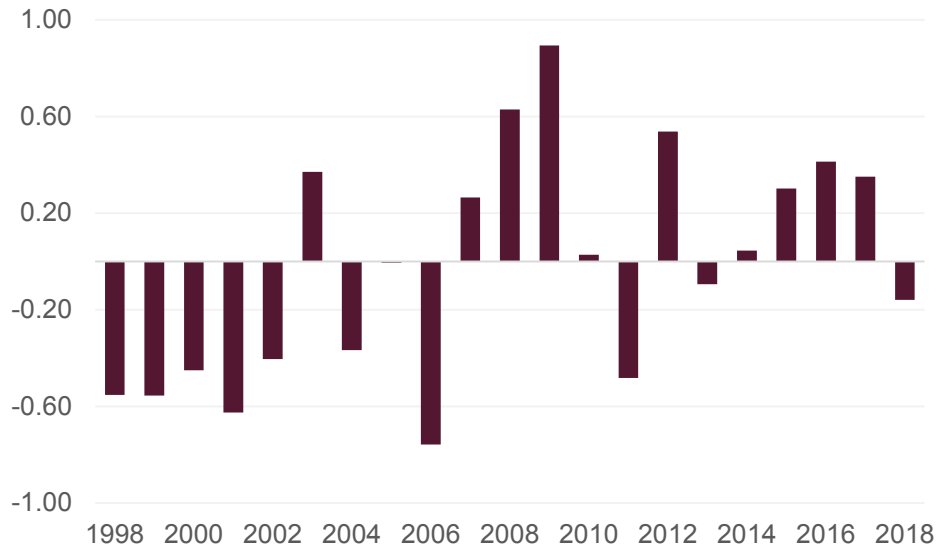
The stability of co-relationships

A year-by-year look at factor excess returns uncovered interesting patterns and explained some inconsistencies.

In Exhibit 2 above, we reviewed the unconditional correlations of absolute market returns (as represented by the Russell 1000) with the excess returns of each factor index. In this section, we look more closely at the variability of this relationship over time by calculating correlations year by year.

As would be expected, since there are only 12 observations for each year, the results were somewhat noisy. Nonetheless, some interesting patterns emerged when viewed over the entire 21-year period

Exhibit 13. Yearly correlations − Value excess returns to Russell 1000 returns

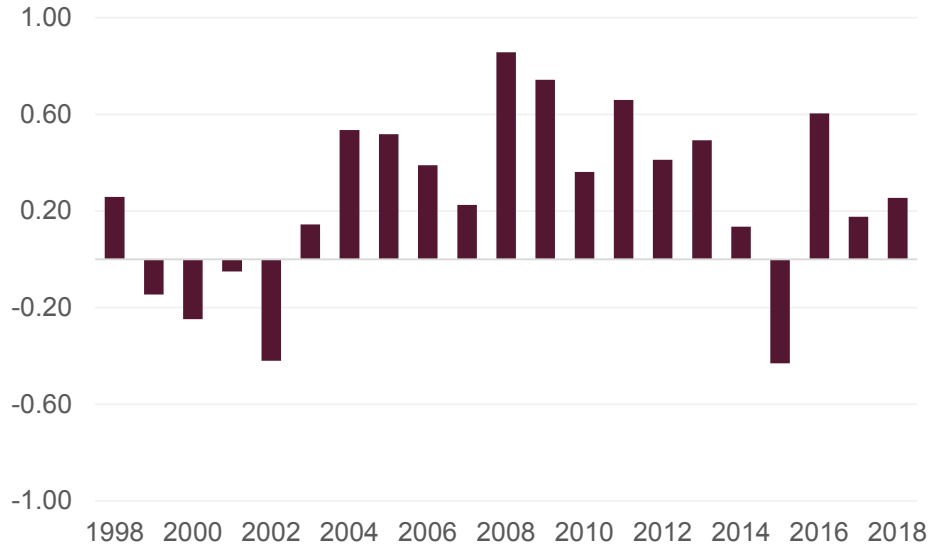


Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The unconditional correlation for Value, at -0.09 (from Exhibit 2), is slightly negative. As noted earlier, this conflicts with our expectations: Given that Value is commonly viewed as a cyclical factor, we would expect a positive reading. The annual correlations shed some light on this puzzle.

While there are quite a few observations of positive correlations in the latter half of the 21-year period, the earlier period is dominated by the run-up and collapse of the dotcom bubble from 1998 through 2002. During the period, expensive technology, media and telecom stocks led a narrowly driven market run-up, and Value stocks underperformed. As the bubble deflated, Value stocks rebounded but the market fell, so the correlation again was negative. If we omit those years, the unconditional correlation for Value excess return was a healthy +0.30. All told, though Value is normally considered a cyclical factor, a more nuanced view would omit frothy periods like the dotcom bubble.

Exhibit 14. Yearly correlations − Size excess returns to Russell 1000 returns



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

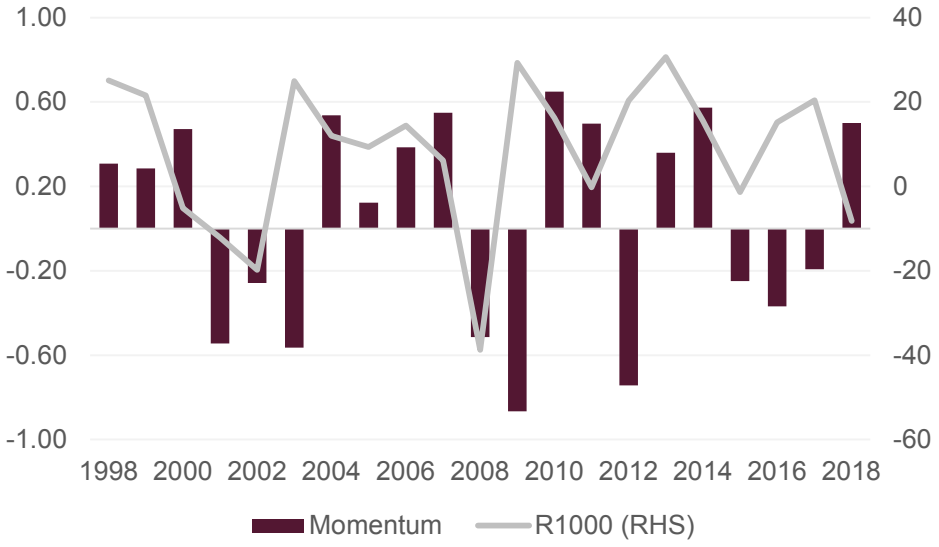
The dotcom bubble had a distortive effect on Value and Size performance.

The unconditional correlation (from Exhibit 2) of Size excess returns to the Russell 1000, at +0.27, supports the factor's status as a cyclical factor. While the annual Size correlations are fairly steady, their weakening in the early 2000s also illustrates the influence of the dotcom bubble, which was led by larger stocks. Thus, even though the market was up strongly during that period, smaller cap stocks did not rise as much. As the bubble deflated, smaller caps outperformed. If we omit the 1998-2002 period, the correlation more than doubles to +0.56.

The Momentum correlations appear to be very unstable. However, some of that is understandable given that Momentum is defined by returns over the past year (omitting the most recent month). Market reversals are likely to have a large effect on Momentum.

In the Exhibit below, we added the annual returns (shown by the gray line, right-hand scale). While it does not explain the correlations perfectly, the pattern reveals that when markets undergo a major shift (i.e., positive to negative or negative to positive), the correlation between market returns and Momentum excess returns is often negative; if market returns are stable, then momentum tends to have the expected positive correlation.

Exhibit 15. Yearly correlations of Momentum excess returns to Russell 1000 returns (LHS) and Russell 1000 returns (RHS)

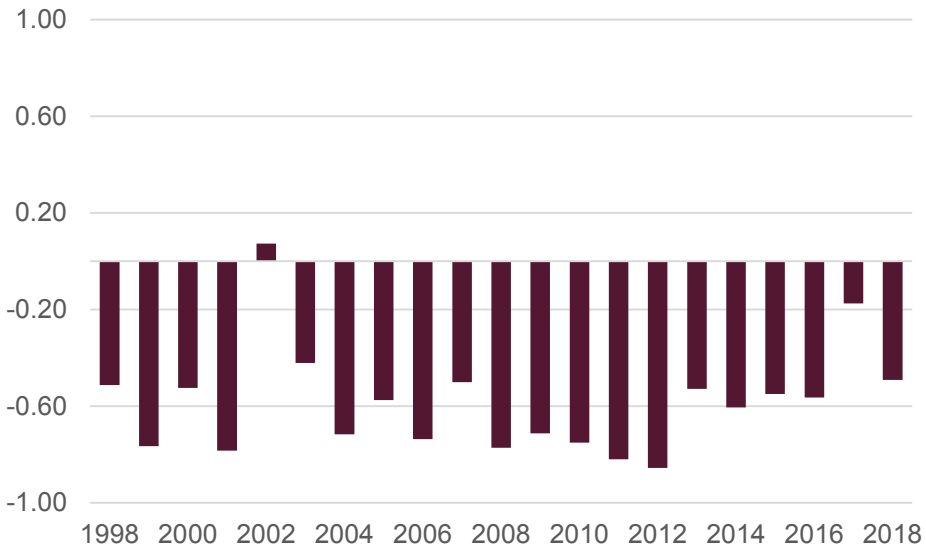


Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The correlations for the Volatility factor exhibit impressive stability, with negative correlations in all but one year, reflecting its defensive characteristics.

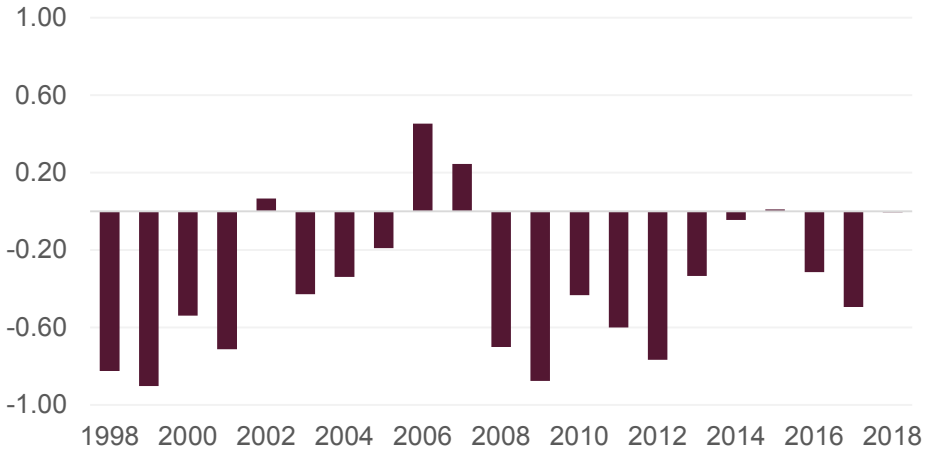
Volatility's stable, negative correlations reflect its defensive characteristics.

Exhibit 16. Yearly correlations − Volatility excess returns to Russell 1000 returns



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

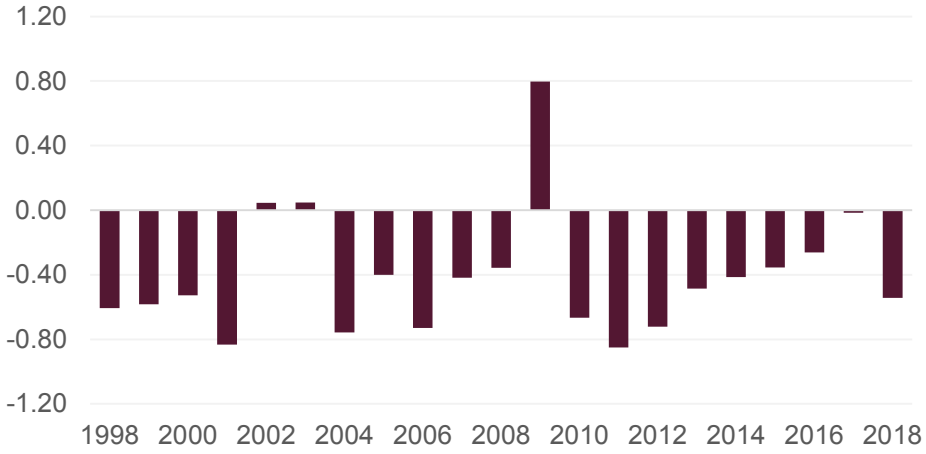
Exhibit 17. Yearly correlations − Quality excess returns to Russell 1000 returns



Source: FTSE Russell. Data from September 2003 to October 2018. Data based on the FTSE Developed Index Universe. Min Var, ERC and LVF results are based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The correlations for Quality excess returns are mostly negative, also highlighting the factor's defensive nature.

Exhibit 18. Yearly correlations − Yield excess returns to Russell 1000 returns



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The correlations for the hybrid Yield factor are also mostly negative, with a significant exception of 2009, when markets strongly rallied.

As the analyses above reveals, the behavior of these six factors has generally corresponded with the rationale of their cyclicality or defensiveness during shifting market and economic conditions. It also highlights important qualitative differences in how some factors behaved in the two contractions.

7. A multifactor view

In the sections above, we highlighted the differences among single factor behaviors. While these factors can be implemented as single-factor portfolios, the fact that they behave differently means that combining them into a single multifactor portfolio offers some important advantages.

Combining single factors into a multifactor portfolio takes advantage of factor diversification benefits.

A baseline method for building a multifactor portfolio using the FTSE Russell Tilt methodology is to apply a constant exponent of one to each of the factors. This differs from a top-down averaging of the single factor indexes (see [1] for details on the Tilt methodology). In this section, we examine the performance of a baseline multifactor index that combines the five core factors − Value, Size, Momentum, Quality and Volatility (omitting the hybrid Yield factor).

In the Exhibit below, we show the standard performance statistics comparing the multifactor index with the Russell 1000 and the averages of the five core single factors shown in Exhibit 1 (excluding Yield). The results underscore the benefits of diversification, as the multifactor index's volatility is almost as low as that of the defensive Quality factor (see Exhibit 1) and its returns are higher than any of the single factor indexes − translating to a return/risk ratio considerably higher than any of the single factor indexes.

The relative performance benefits show up in the multifactor index's information ratio, which is higher than that of any of the single factor indexes despite a relatively high tracking error.

Exhibit 19. Multifactor performance statistics vs. Russell 1000 and factor average

	Russell 1000	Factor Average	Multifactor Index
Absolute			
Arithmetic Return % p.a.	8.12	8.90	11.38
Volatility % p.a.	17.30	17.16	16.21
Geo. Return % p.a.	6.77	7.62	10.49
Return/Risk Ratio	0.39	0.45	0.65
Max Drawdown %	-47.56	-46.83	-43.36
Turnover % p.a.	12.50	41.46	99.55
Relative to Benchmark			
Arithmetic Excess Return % p.a.	--	0.78	3.26
Geo. Excess Return % p.a.	--	0.80	3.48
Vol. Reduction % p.a.	--	0.80	6.30
Tracking Error % p.a.	--	3.25	6.58
Information Ratio	--	0.23	0.53

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The correlations of multifactor excess returns with single factor indexes are all positive, except for Momentum, which is slightly negative.

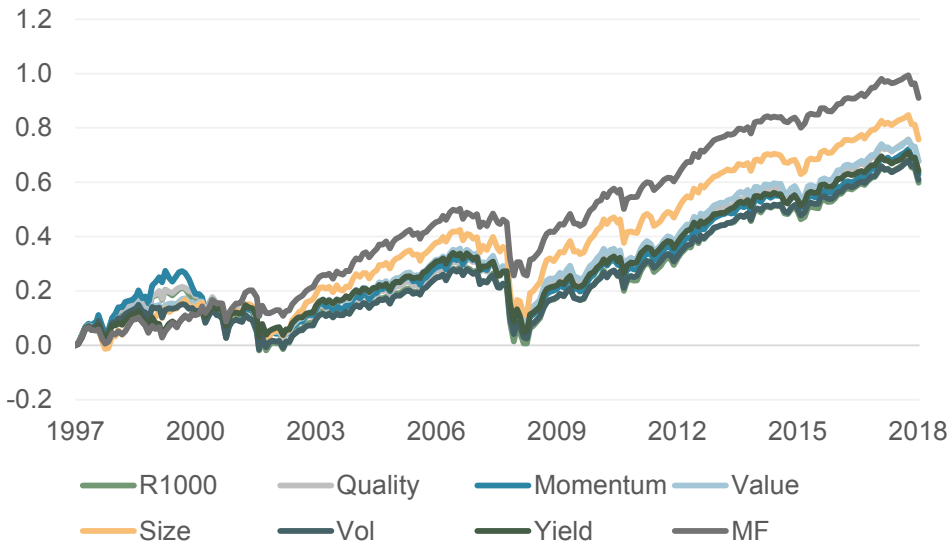
Exhibit 20. Multifactor Index vs single factors − Excess return correlations

Quality	Momentum	Value	Size	Volatility	Yield
0.37	-0.17	0.69	0.52	0.60	0.69

Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

The long-term performance advantage is also apparent in the Exhibit below, which shows the log of cumulative returns for the Russell 1000, the five core factor indexes and the static multifactor index. The top gray line shows the results for the static multifactor index, which takes advantage of the natural correlations among the single factors.

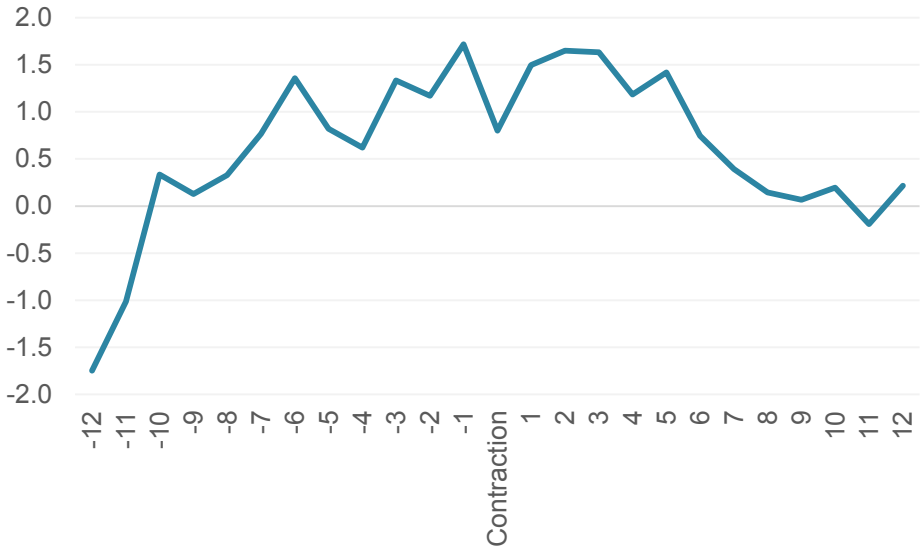
Exhibit 21. Single factor and multifactor (MF) indexes − cumulative returns (%) (log scale)



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Exhibit 22 shows the lead-lag relationship with the NBER contraction dates. Combining the factors does a good job of stabilizing the returns in the period leading up to and following the contraction.

Exhibit 22. Multifactor index − average excess returns (%) during NBER contraction and six-month intervals before and after contraction



Source: FTSE Russell. Data from December 1997 to December 2018. Data based on the Russell 1000 Index Universe. All results based on back-tested data. Past performance is no guarantee of future results. Please see end for important legal disclosures.

Summary

This paper provided a descriptive framework for understanding equity factor behavior within the Russell 1000 universe. Our analysis emphasized not only the differences among factors but also how factors behave differently over time. We did this by examining factor performance behavior within the conditional context of shifting market and economic cycles.

Although this analysis confirmed the usefulness of considering factor behavior by their cyclical and defensive characteristics, it also pointed out that there are important differences between factors even within the cyclical and defensive groups. These differences provide investors with an opportunity to use single factor exposures strategically or tactically to express their market and economic views. Even absent specific views, however, a FTSE Russell Tilt multifactor index can take advantage of the factor correlations to potentially improve returns and reduce volatility beyond a simple average of the single-factor indexes.

References

[1] Ground Rules: FTSE Global Factor Index Series. November 2018.

[2] Implementation considerations for factor investing. FTSE Russell. March 2018.

[3] Factor exposure indexes: Value factor. FTSE Russell. August 2014.

[4] Factor exposure indexes: Quality factor. FTSE Russell. August 2014.

About FTSE Russell

FTSE Russell is a leading global provider of benchmarks, analytics and data solutions with multi-asset capabilities, offering a precise view of the markets relevant to any investment process. For over 30 years, leading asset owners, asset managers, ETF providers and investment banks have chosen FTSE Russell indices to benchmark their investment performance and create investment funds, ETFs, structured products and index-based derivatives. FTSE Russell indexes also provide clients with tools for performance benchmarking, asset allocation, investment strategy analysis and risk management.

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