



Thoughts on Multi-Factor Investing

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INTRODUCTION

Over the last several years, there has been increased interest in factor-focused investing. Allocating capital to one or more factor-based strategies has offered investors the potential to improve their overall portfolio results in a variety of different ways. Indeed, investors have used these strategies to potentially increase their portfolio returns, manage volatility, increase diversification, and lower costs.

Recently, asset flows into factor-focused strategies have surged and today investors enjoy many choices as they consider investing in them. With these choices, however, often come questions. One very common question is, “What is the best way to invest in more than one factor-based strategy at the same time”? When exploring the answer to this question, people often consider two approaches:

1. Invest in a **composite model portfolio**, as is done in many traditional quantitative equity strategies
2. Invest in a **multi-factor portfolio**, aggregating stock holdings from distinct single-factor-focused portfolios

In this white paper, we will define these two approaches and detail the potential benefits of each. Importantly, we will see that based on our research and historical tests, both approaches generated positive excess returns over a traditional market-capitalization weighted benchmark. Historically, composite model portfolios tended to perform better than multi-factor portfolios in markets and time periods where there was less efficiency and more pronounced factor and composite model efficacy. Multi-factor portfolios, on the other hand, performed better in more efficient markets with lower factor efficacy and generally had the edge when considering attributes beyond simple total performance. Our research found the multi-factor portfolios offered more consistent positive excess returns, with better downside protection and less turnover.

TERMINOLOGY

In the world of factor investing, there are many different terminologies and people may use the same term differently. Before proceeding further, let us clarify some of the terms as we will use them in this paper:

Factor: a specific characteristic (such as value, yield, quality, and momentum) that historically has been associated with positive excess returns above a traditional market-capitalization weighted benchmark. Factors are defined with individual **metrics** such as book-to-price, dividend yield, return on assets, and intermediate-term price momentum.

Composite Model: a multi-factor model that combines two or more factors (for example, a model that combines value and momentum at equal weights).

Composite Model Portfolio: a portfolio which invests in the stocks that rank best on a composite model.

Factor-Focused Portfolio: a portfolio which invests in stocks that rank best on a single factor.

Multi-Factor Portfolio: a portfolio which allocates capital among the securities in more than one factor-focused portfolio.

WHAT ARE COMPOSITE MODEL AND MULTI-FACTOR PORTFOLIOS?

As previously mentioned, people often wonder how they should go about investing in more than one factor-based portfolio. When doing this, they may consider using composite model or multi-factor portfolios. Let us explain further what we mean by “composite model portfolio” and “multi-factor portfolio”:

- 1. Composite Model Portfolio:** in this approach, investors choose a universe of stocks, rank each stock across two or more individual factors, combine the individual factor ranks into a single composite model rank, and invest in a portfolio of stocks that score best (say, in the top 20%) on that composite model. Many traditional quantitative equity managers employ this type of portfolio approach.
- 2. Multi-Factor Portfolio:** in this approach, investors choose two or more stand-alone factor-focused portfolios and allocate capital to stocks based on their aggregate weight across the chosen stand-alone factor-focused portfolios.

Now, let us make this explanation more concrete and construct sample portfolios using the following parameters (represented in the corresponding table which directly follows):

- Choose a universe of ten stocks, designated with the letters A-J.
- Evaluate the attractiveness of each stock using four factors - - value, yield, quality, and momentum - - ranking each stock from one through ten on each of these factors (with one being “best”).
- Average the ranks across the four factors and from this average calculate a composite model rank for each stock.
- Form a **composite model portfolio** investing in the best 20% of stocks based on the composite model (which we have highlighted in blue in the table below). In this case, our portfolio consists of two stocks: A and C. One could calculate the stocks’ portfolio weights in a variety of different ways, but here we choose to weight the stocks in proportion to their market capitalizations.
- Form four **factor-focused portfolios** comprised of stocks that rank in the best 20% on each factor (which we have highlighted in green in the table below). Each of these portfolios consists of two stocks: value (stocks C and D), yield (stocks A and C), quality (stocks A and I), momentum (stocks J and H). One could calculate the stocks’ portfolio weights in a variety of different ways, but here we choose to weight the stocks in proportion to their market capitalizations.
- Form a **multi-factor portfolio** allocating capital based on stocks’ aggregate weight across the chosen stand-alone factor-focused portfolios. Using this approach, the multi-factor portfolio consists of six stocks: C, D, A, I, J, H.
- Note that in this example, the composite model portfolio invests in fewer underlying stocks than the multi-factor portfolio.

Factor-Focused Portfolios and Ranks								
Stock	Value	Yield	Quality	Momentum	Average Rank Across Factor Focused Portfolios	Composite Model	In Composite Model Portfolio?	In Multi-Factor Portfolio?
A	6	2	2	3	3.25	1	yes	yes
C	1	1	5	8	3.75	2	yes	yes
D	2	3	7	4	4.00	3		yes
B	3	4	4	10	5.25	4		
F	5	6	3	7	5.25	5		
I	8	9	1	6	6.00	6		yes
E	4	10	6	5	6.25	7		
J	7	8	10	1	6.50	8		yes
H	10	7	9	2	7.00	9		yes
G	9	5	8	9	7.75	10		

Exhibit 1: An example of how to form composite model and multi-factor portfolios. For illustrative purposes only.

A COMPARISON OF COMPOSITE MODEL AND MULTI-FACTOR PORTFOLIOS

To assess the potential benefits of composite model and multi-factor portfolios, we performed historical tests using the following parameters:

- We constructed composite model and multi-factor portfolios using the methodology described in the previous section. Instead of using our hypothetical ten stock universe, we performed tests over the Russell 1000 (U.S. Large Cap) and Russell 2000 (U.S. Small Cap) universes.
- Portfolios were rebalanced at each month-end from December 1997 through July 2019 with returns measured over the subsequent one month.

For additional details about the data used, please see the Appendix. In the following sections, we comment on the test results.

Observations on Test Results

In reviewing the results of our historical tests, several interesting observations can be made. First, as can be seen in the charts that directly follow, regarding performance, both the composite model portfolios and the multi-factor portfolios outperformed their traditional market-cap weighted benchmarks through time. Also noteworthy, in U.S. Large Cap the multi-factor portfolio outperformed the composite model portfolio while in U.S. Small Cap the composite model portfolio outperformed.

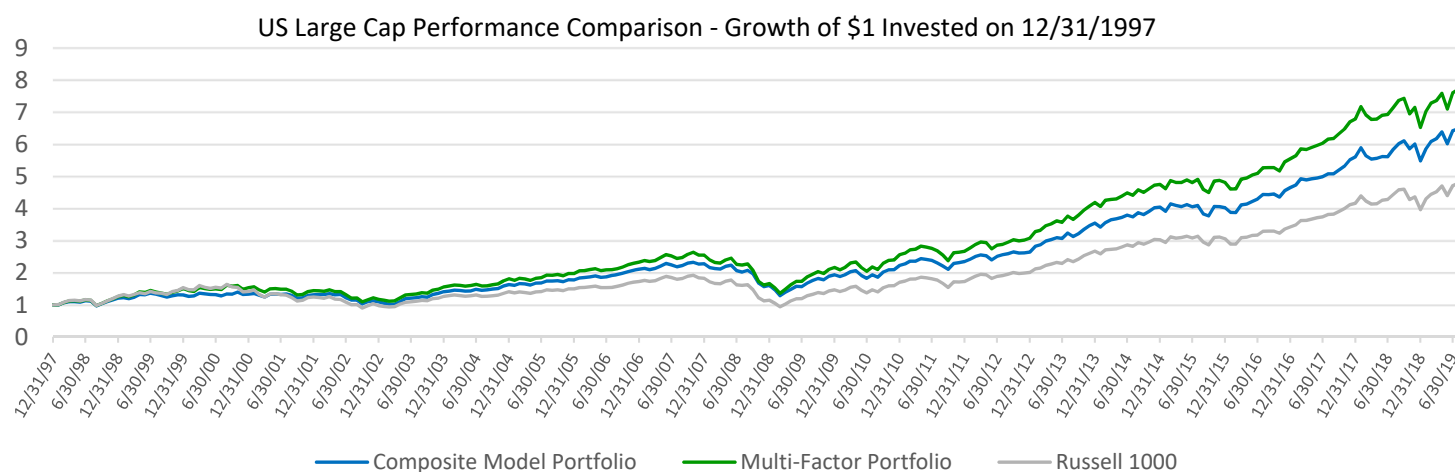


Exhibit 2: U.S. Large Cap performance comparison

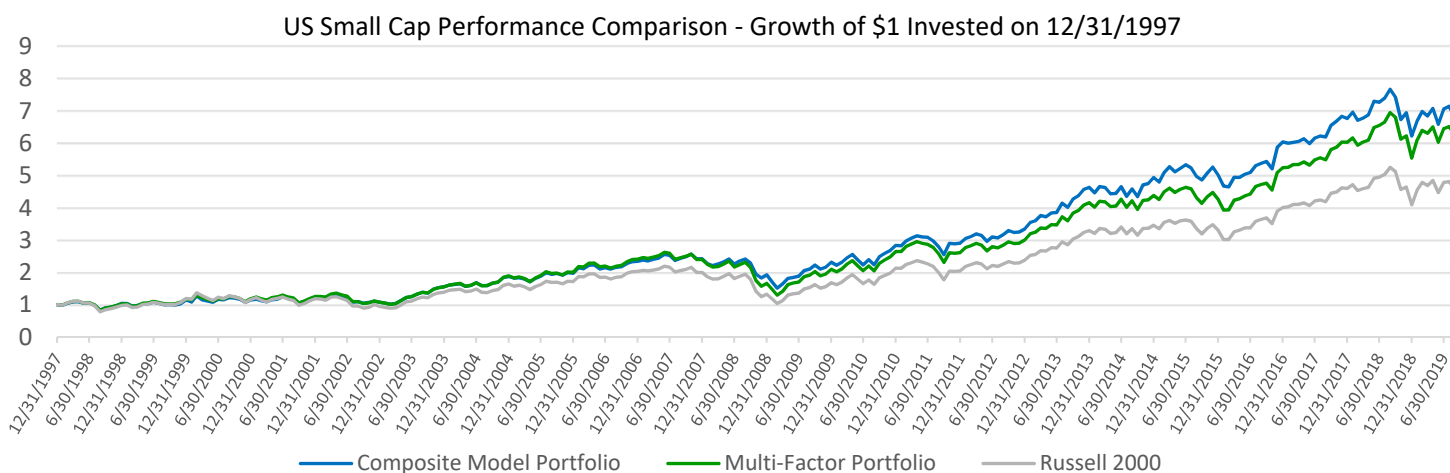


Exhibit 3: U.S. Small Cap performance comparison

Source: Cadence, FactSet. Past performance is no guarantee of future results. Gross performance results do not take into account investment management fees, trading costs, custodial fees, or other fees or charges. Performance results do reflect the reinvestment of dividends and other earnings. Results are in USD. For illustrative purposes only. Please see “Appendix” for methodology details.

Further examining the active returns for the portfolios, the multi-factor portfolios had historically better performance in U.S. Large Cap while the composite model portfolios had better performance in U.S. Small Cap. Meanwhile in both U.S. Large Cap and U.S. Small Cap, and again looking at active returns, the multi-factor portfolios historically had the edge in producing lower return volatility, better monthly performance consistency, and lower downside risk.

PERFORMANCE COMPARISON							
	U.S. Large Cap				U.S. Small Cap		
	Composite Model Portfolio	Multi-Factor Portfolio	Russell 1000		Composite Model Portfolio	Multi-Factor Portfolio	Russell 2000
Annualized Return (%)	8.94	9.79	7.41		9.25	8.82	7.27
Annualized Active Return (%)	1.53	2.38	NA		1.98	1.55	NA
Annualized Realized Tracking Error	4.78	2.59	NA		4.81	2.74	NA
Annualized Standard Deviation	13.23	14.53	15.13		17.28	18.23	19.86
Sharpe Ratio	0.68	0.67	0.49		0.54	0.48	0.37
IR	0.32	0.92	NA		0.41	0.57	NA
Worst Month of Active Performance (%)	-6.57	-2.14	NA		-5.38	-5.07	NA
% of Months with Positive Active Performance	50.4%	59.2%	NA		53.8%	57.7%	NA

Returns from January 1998- August 2019

Exhibit 4: Active Return Comparison

From a performance perspective, a natural question arises when reviewing these results: why did the multi-factor portfolio have a higher annualized return than the composite model portfolio in U.S. Large Cap, but the opposite was true in U.S Small Cap? The answer: We conclude that, historically, the composite model portfolio relative performance advantage over the multi-factor portfolio tended to relate closely with how well the composite model itself performed. When the composite model performance was strong, the composite model portfolio tended to outperform the multi-factor portfolio. During our test period, overall, the composite model had stronger performance in U.S. Small Cap than it did in U.S. Large Cap, leading to better composite model portfolio performance in U.S. Small Cap.

Please see the chart below in which we present equal-weighted, average, monthly quintile returns for the composite model in U.S. Large Cap and U.S. Small Cap. Here, quintile 1 (Q1) is the best (stocks that would be bought in the composite model portfolio), and quintile 5 (Q5) is the worst. On the left-hand side of the chart are the average returns for each quintile; on the right side of the chart are the differences in performance between various quintiles Q1 minus Q5, Q1 minus Q2, Q1 minus Q3.

Notice that the composite model tended to perform more strongly in U.S. Small Cap – the differences in performance among the quintiles were greater here. One would expect to see this type of performance as the smaller capitalization part of the market has historically been less efficient, and the factors and composite models have had larger quintile return spreads in the less efficient parts of the markets and globe.

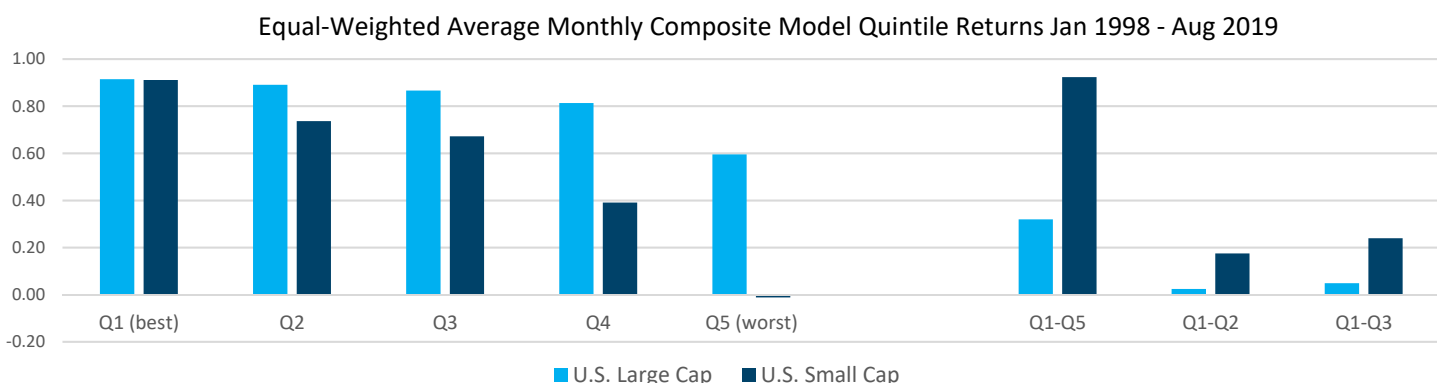


Exhibit 5: Equal-weighted average monthly composite model quintile spreads; January 1998 – February 2017. Russell 1000 and Russell 2000 universes

Source: Cadence, FactSet. Past performance is no guarantee of future results. Gross performance results do not take into account investment management fees, trading costs, custodial fees, or other fees or charges. Performance results do reflect the reinvestment of dividends and other earnings. Results are in USD. For illustrative purposes only. Please see "Appendix" for methodology details.

Recall that we constructed the composite model portfolio by investing in the best quintile of stocks (Q1) of the composite model. This portfolio construction rule means that the composite model portfolio in U.S. Large Cap had about 200 stocks in it in each month, while in U.S. Small Cap, the composite model portfolio had about 400 stocks in it. In the multi-factor portfolios, holding all stocks that appeared in any one of the single factor-focused, resulted in portfolios with more stocks in them: numbering 525 to 625 in U.S. Large Cap and 1100 to 1200 in U.S. Small Cap. The total number of stocks in the multi-factor portfolios was higher because, to be included, a stock only had to rank in the top 20% of any of the four individual factor portfolios; hence the holdings were not concentrated only in Q1 of the composite model. In U.S. Small Cap there was a greater advantage to concentrating holdings in Q1 of the composite model because the model performed better; therefore, the composite model portfolio had better performance in that universe.

To confirm that composite model performance greatly influences the performance differences in the two types of portfolios, we examined the returns to the composite model portfolio and multi-factor portfolios solely *within* both the U.S. Large Cap and U.S. Small Cap universes, conditioned on composite model performance. We observed that *within* each universe, over the test period, the composite model portfolios generally outperformed the multi-factor portfolios when the composite model had the stronger performance.

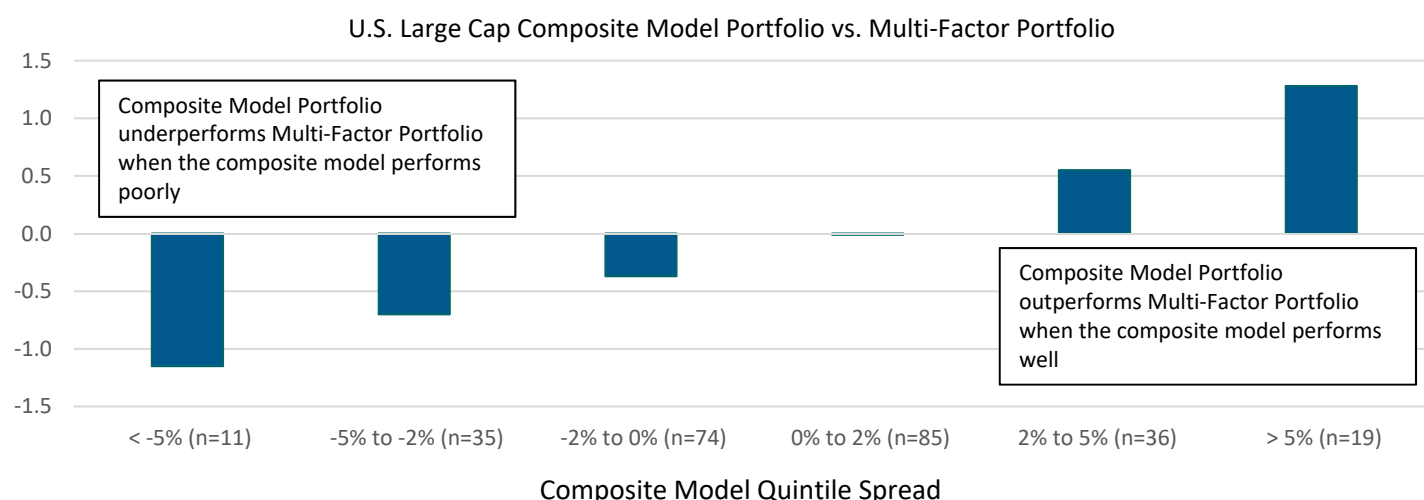


Exhibit 6: Relationship between composite model and portfolio performance, Russell 1000

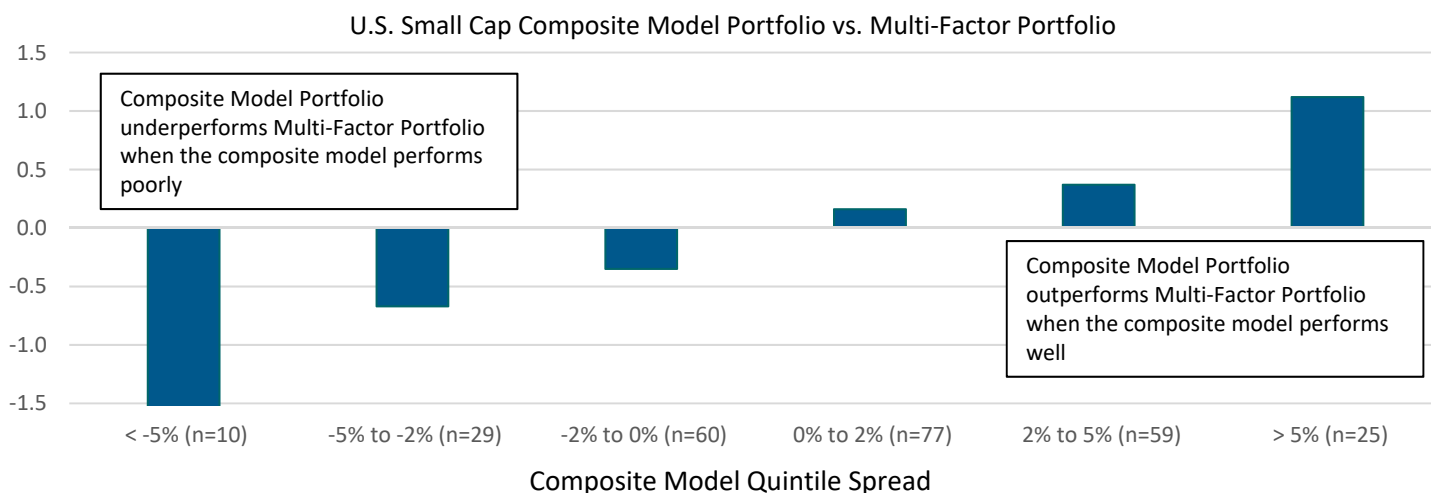


Exhibit 7: Relationship between composite model and portfolio performance, Russell 2000

Source: Cadence, FactSet. Past performance is no guarantee of future results. Gross performance results do not take into account investment management fees, trading costs, custodial fees, or other fees or charges. Performance results do reflect the reinvestment of dividends and other earnings. Results are in USD. For illustrative purposes only. Please see "Appendix" for methodology details.

Observing this relationship between the strength of composite model performance and the relative performance of the composite model portfolio and multi-factor portfolios, one arrives at a key insight: **adopting a one-size fits all approach to multi-factor investing, using only a composite model portfolio or only a multi-factor portfolio might not result in the best outcome. One may want to vary the solution depending on the universe of stocks under consideration.**

Further Observations on Test Results

A few other points on the composite model and multi-factor portfolios are noteworthy. As previously mentioned, the multi-factor portfolios tended to hold more stocks in aggregate than the composite model portfolios. They also tended to have 25-30% lower turnover. With more stocks and lower turnover, the multi-factor portfolios would also therefore generally be able to handle more capacity and have lower transaction costs. These types of transaction cost and turnover considerations are of great importance to many institutional investors who may contend with overseeing larger pools of assets. To get a sense of some of the transaction costs differences between the portfolios we estimated what the market impact and percent of daily volume impacts would be for the large and small cap portfolios.

	US Large Cap		US Small Cap	
	Composite Model Portfolio	Multi-Factor Portfolio	Composite Model Portfolio	Multi-Factor Portfolio
Estimated Market Impact Costs	9.8 bps	8.4 bps	40.8 bps	28.1 bps
Percent of Daily Volume	0.70%	0.33%	9.11%	3.85%

Portfolios are based on estimates from Nomura assuming \$250,000,000 portfolios invested on March 5, 2019

Exhibit 8: Market Impact Cost Comparison

Source: Cadence, Nomura. For illustrative purposes only.

Another less quantifiable potential advantage of the multi-factor approach is that it can be more transparent to the end investor making it easier to manage allocation adjustments among factors. The following table summarizes the benefits of both the composite model and multi-factor portfolios.

	US Large Cap		US Small Cap	
	Composite Model Portfolio	Multi-Factor Portfolio	Composite Model Portfolio	Multi-Factor Portfolio
Test Period	Jan-98 through Aug-19		Jan-98 through Aug-19	
Approximate Number of Stocks in Portfolio	175-200	525-625	350-400	1100-1200
Outperforms Market-Cap Weighted Benchmark	✓	✓	✓	✓
Lower Absolute Volatility than Cap-Weighted Benchmark	✓	✓	✓	✓
Comparing the Multi-Factor vs. the Multi-Beta Portfolios . . .	Composite Model Portfolio	Multi-Beta Portfolio	Composite Model Portfolio	Multi-Beta Portfolio
Higher Active Returns		✓	✓	
Lower Active Return Volatility		✓		✓
Lower Downside Risk		✓		✓
Greater Consistency (number of months with positive active return)		✓		✓
Lower Turnover		✓		✓
Greater Transparency		✓		✓

Exhibit 9: Summary comparison of composite model and multi-factor portfolio benefits

Source: Cadence, FactSet. Past performance is no guarantee of future results. Gross performance results do not take into account investment management fees, trading costs, custodial fees, or other fees or charges. Performance results do reflect the reinvestment of dividends and other earnings. Results are in USD. For illustrative purposes only. Please see "Appendix" for methodology details.

WHAT ABOUT IN NON-US UNIVERSES?

Although not the focus of this paper, our research found the general observations made in the U.S. universes for the composite model and multi-factor portfolios extend to non-U.S. universes as well. Specifically, we found the multi-factor portfolios tended to offer lower active return volatility, lower downside risk, greater consistency, and lower turnover. The differences in composite model and multi-factor portfolios' performance also tended to correlate with composite model efficacy. Please contact us if you would like to discuss these non-US results; we would be happy to do so.

CONCLUSION

What is the better approach, composite model portfolios or multi-factor portfolios? In this paper, we have found that both composite model and multi-factor portfolios generated positive active returns over a traditional market-capitalization weighted benchmark during the test period. Historically, we found composite model portfolios tended to perform better than multi-factor portfolios in markets and time periods where there was less efficiency and more pronounced composite model efficacy. Multi-factor portfolios, on the other hand, were found to generally have the edge when considering attributes beyond simple total performance. They offered a smoother performance experience, with better downside protection and less turnover.

However, as is the case with all factor-focused investing, the details matter. Any number of decisions and details may materially impact the results an investor experiences. For instance, we would expect one to observe different test results if one chose a different mixture of factor-focused portfolios, stock weighting methodology, or factor ranking process.

Since the details are so important with factor-focused investing we believe that an off-the-shelf, one-size-fits-all approach is unlikely to be an ideal solution for most investors. At Cadence, we partner with our clients to help them understand these details and to assist them in developing an allocation to factor-focused strategies that best suits their specific goals and needs. Please contact us to discuss further.

APPENDIX

DATA SPECIFICS

To assess the potential advantages of composite model and multi-factor portfolios, we performed historical tests using the following parameters:

- Composite model and multi-factor portfolios were constructed using the basic methodology described on page 2, but instead of using our hypothetical ten stock universe, we performed the test over a US Large Cap and US Small Cap universe
- Portfolios were rebalanced each month from January 1998 through June 2018 with returns measured over the subsequent one month
- We used four factor themes:
 - Value: equal-weight of book-to-price and earnings to price
 - Yield: dividend yield
 - Quality: earnings stability, return on assets, debt to assets
 - Momentum: intermediate term price momentum
- Within each universe, all factor ranks were done by sector
- We formed a composite model comprised of an equal weight of the four factor themes
- We formed single strategic factor portfolios based on each of these four themes. In each case investing in the top quintile of stock ranks, with weights apportioned by market capitalization.
- For the composite model portfolio, we invested in stocks which fell in the top quintile of the composite model, with weights apportioned by market capitalization
- For the multi-factor portfolio, we formed a portfolio of the aggregate holdings in each factor-focused portfolio with the weight of each stock equal to its combined weight across the four individual factor-focused portfolios, rescaled to equal 100%.
- Analysis was done in Factset
- Data from Factset, MSCI, Compustat

INDEX DESCRIPTIONS

The Russell 1000 Index is an unmanaged index, which measures the performance of the large-cap segment of the U.S. equity universe. It is a subset of the Russell 3000® Index and includes approximately 1000 of the largest securities based on a combination of their market cap and current index membership.

The Russell 2000 Index is an unmanaged index, which measures the performance of the 2000 smallest stocks (on the basis of capitalization) in the Russell 3000 Index.

Investors cannot invest directly in an index. Index results assume the re-investment of all dividends and capital gains.

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