

## Factor investing: building balanced factor portfolios



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We examine a sample of US equities over the past 24 years and find that a simple, balanced factor portfolio of value and momentum outperformed a cap-weighted benchmark. This is true whether the balanced factor portfolio is formed from a combination of two individual factor portfolios or implemented via a single portfolio built from a multi-factor model (the “multi-factor portfolio”). We also find that, relative to a combination of single factor portfolios, the multi-factor portfolio more effectively accounts for the relationship between factors. As a result, it tends to have higher exposure to the intended factors so that, ultimately, the multi-factor portfolio outperformed the combination. Importantly, we find that there are ways to construct single factor portfolios such that their combination delivers both factor exposure and performance that is similar in magnitude to that of the multi-factor approach.



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As factors become an increasingly more important part of the way in which we invest, there are many critical questions to be considered. Based on the premise that factors are investments with risk and return properties, the relevant decision is how to allocate between factors to appropriately trade-off risk and return. Specifically, what are the factors in which to invest? What is the appropriate balance between these factors? And, what is the best method for implementing the balanced approach?

In recent years, we have observed growing demand for factor-based approaches to investing. According to the Invesco Global Factor Investing Study (2016) conducted by NMG consulting, 70% of the investors surveyed currently use factors in portfolio construction, and 71% of respondents expect to increase factor product allocations in the future. Several drivers have likely led to this growth. Among these is an increased awareness of factor investing thanks to a well-established and growing body of research on factors such as value, size, momentum, volatility and quality. Another contributor to this growth is better access to factor-based products via quantitative asset managers and exchange traded funds (ETFs) focused on smart beta. Perhaps most importantly, the growth in factor investing stems from an increasing appreciation by members of the investment community that a meaningful proportion of their portfolios' performance is explained by exposure to factors as systematic drivers of risk and return.

Investment managers have responded to the growth in demand. For decades, quantitative asset managers have been creating multi-factor portfolios that take into account the relationship between various factors, from both a risk and return perspective. In recent years, we have also seen the introduction of single-factor “smart beta” portfolios (often in the form of ETFs) offering exposure to individual factors. These single-factor portfolios can be combined to produce a balanced factor allocation as well. While both multi-factor portfolios and combinations of single-factor portfolios generate balanced exposure to multiple factors, the portfolios can differ in fundamental ways.

In this article, we consider both approaches. First, we combine two individual portfolios where each is formed from a single factor only. We compare this combination to a single portfolio built from a multi-factor model, “the multi-factor portfolio”. Intuitively, if all information on the factors is applied simultaneously, as is the case with the multi-factor portfolio, the decision-making process tends to be more informed and outcomes are improved. As a result, the multi-factor portfolio outperformed the combination of single factors. This finding is consistent with Bender and Wang (2016), Fitzgibbons, Friedman, Pomorski and Serban (2016), and Clarke, de Silva and Thorley (2016), all of whom find that “the whole is worth more than the sum of the parts.” But, unlike these studies, this article also shows that there are ways to construct single factor portfolios in such a way that their combination delivers both factor exposure and performance that is similar in magnitude to that of the multi-factor portfolio.

“The whole is worth more than the sum of the parts.”

## Factors and models

In the first section, we consider two commonly used factors: value and momentum. Both factors are used by practitioners and have been shown in academic literature to have forecasting power in the cross-section. High value stocks tend to outperform low value (or expensive) stocks, and high momentum stocks, or stocks with high positive returns in the past, tend to outperform low momentum stocks. A large body of literature follows the early work on value by Basu (1977) and momentum by Jegadeesh and Titman (1993).

We consider simple, easy to understand, and commonly used definitions of value and momentum. Momentum is computed as the cumulative return over the past 12 months excluding the most recent month. Value is measured using earnings yield, or earnings over price, where earnings is the average over the past four quarters. Each month, both factors are computed and standardized over a large/midcap universe of approximately 1,300 US equities. Finally, we define a model as an equally weighted combination of momentum and value. The factors and the model are estimated over the 25-year period beginning April 1991 and ending October 2016.

<b>Table 1: Factor and model performance</b>			
<b>1-month information coefficients</b>	<b>Value</b>	<b>Momentum</b>	<b>Model</b>
Average	0.021	0.031	0.040
Standard error	0.008	0.011	0.009
t-statistic	2.72	2.87	4.65

Source: Invesco calculations.

Table 1 reports the performance of each factor and the overall model. Factor performance is measured using one-month information coefficients, or the correlation of factor readings with realized returns over the subsequent month. Both momentum and value factors are significantly positively correlated with subsequent returns. The information coefficients of momentum and value are 3.1% (t-statistic = 2.9) and 2.1% (t-statistic = 2.7), respectively.

Stocks with strong model readings tend to possess the properties of both value and momentum stocks. These are stocks that have been increasing in price over the past year and are still trading at attractive multiples. As might be expected, this is not especially common. All other things being equal, stocks that tend to increase in price are not necessarily those that look most attractive from a valuation perspective. In fact, the cross-sectional correlation between momentum and value is consistently negative, at -13% on average over the sample period. Combining drivers of return that are uncorrelated with one another to create balanced factor exposures is a key to successful factor investing. In table 1, we see that the combination of momentum and value outperformed each factor individually, with an information coefficient of 4% (t-statistic = 4.7). As we will now discuss, not all methods of building balanced factor portfolios take advantage of these correlation structures as effectively as others.

The momentum portfolio has consistently negative exposure to value, and the value portfolio has consistently negative exposure to momentum.

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## Multi-factor portfolios versus combinations of single-factor portfolios

In this second section, we explore different ways of achieving balanced exposure to multiple factors in tradable portfolios. We consider two common approaches to building balanced factor portfolios. First, we build a single portfolio using the multi-factor model described in the previous section. This approach is a common one that has been used by quantitative asset managers for decades. The multi-factor forecast simultaneously considers the information contained in both the momentum and value factors, and the portfolio formed from this joint forecast incorporates the inverse relationship between the two factors.

We also consider a portfolio of momentum and value formed from two single-factor portfolios, a momentum portfolio and a value portfolio. This is a very practical approach. There are a large and increasing number of single-factor portfolios available in the marketplace that can be used as potential building blocks for this type of exercise. These smart beta portfolios offer the consumer a wide array of choices regarding provider, factor definition and portfolio construction methodology. They provide the ability to combine factors at customized weightings, and all of this flexibility often comes at highly competitive prices. One potential drawback of using combinations of independently formed, single-factor portfolios is that the approach may be less effective at capturing relationships between factors.

We simulate equal investments in separate momentum and value portfolios, and compare the properties and performance of a combined portfolio to that of a multi-factor momentum-value portfolio of equal total value over the same period. Each of the portfolios has been built using a mean-variance optimization framework, in which return forecasts are either one of the single-factor forecasts or the multi-factor forecast described earlier. Risk is estimated using a fundamental risk model that includes value and momentum factors, as previously defined. We constrain active exposure to all style factors other than value or momentum. Since we use a large/midcap U.S. investment universe, we optimize against the Russell 1000 Index. The maximum active weight in any individual security is constrained to be within two percent of the benchmark, and GICS industries and sectors are limited to be within three percent of the benchmark. The active risk level is calibrated to be approximately three percent for both the combination of single-factor portfolios and the multi-factor portfolio.<sup>1</sup>

Importantly, in this article we do not address the issue of which portfolio construction methodology to use when building factor portfolios. Instead, we attempt to compare combinations of single factor portfolios with a multi-factor portfolio where the portfolio construction methodology is held constant. For convenience, we choose mean variance optimization against a benchmark.

Figure 1 shows the active exposure to momentum and value through time in the single-factor portfolios. Panel A describes the momentum portfolio, and panel B describes the value portfolio. We observe that the momentum portfolio and the value portfolio each have high positive exposure to their respective factors. However, we also note that the momentum portfolio has consistently negative exposure to value, and the value portfolio has consistently negative exposure to momentum. This second finding is critical. It follows from the fact that momentum and value are negatively correlated with one another, and the fact that each of the single-factor portfolios was constructed with the intention of capitalizing exclusively on the factor of relevance.

1 None of the calculations in this article takes into account trading costs, management charges and other fees.

Multi-factor portfolios outperformed combinations of single factors.

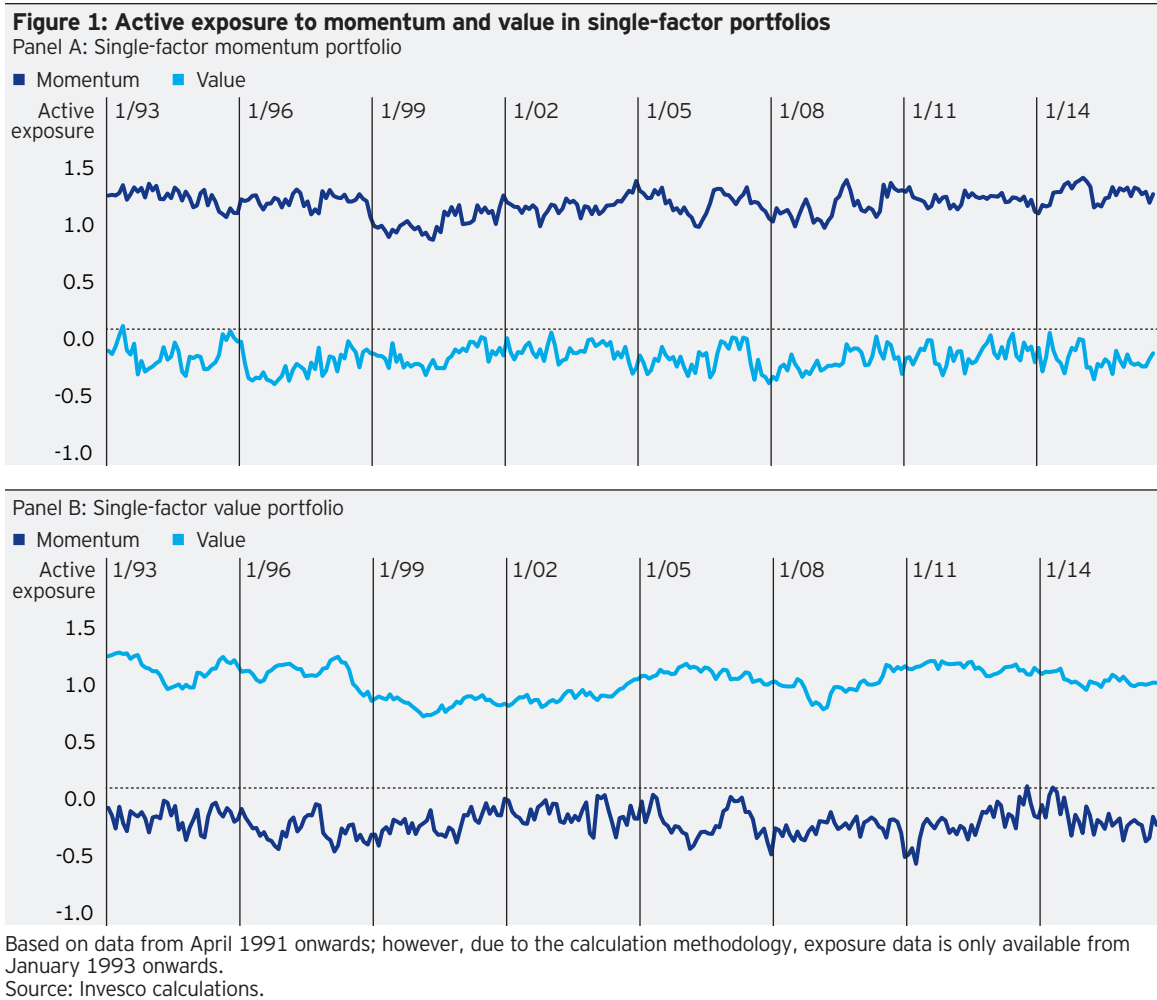
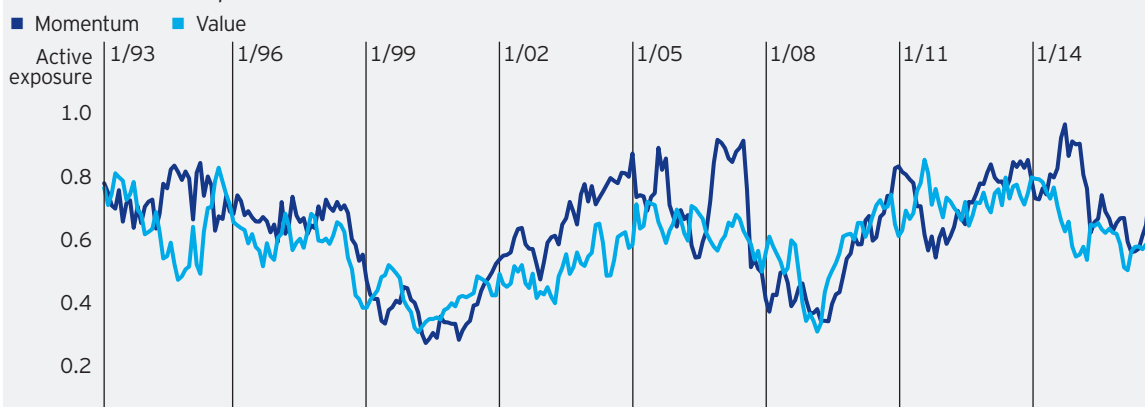


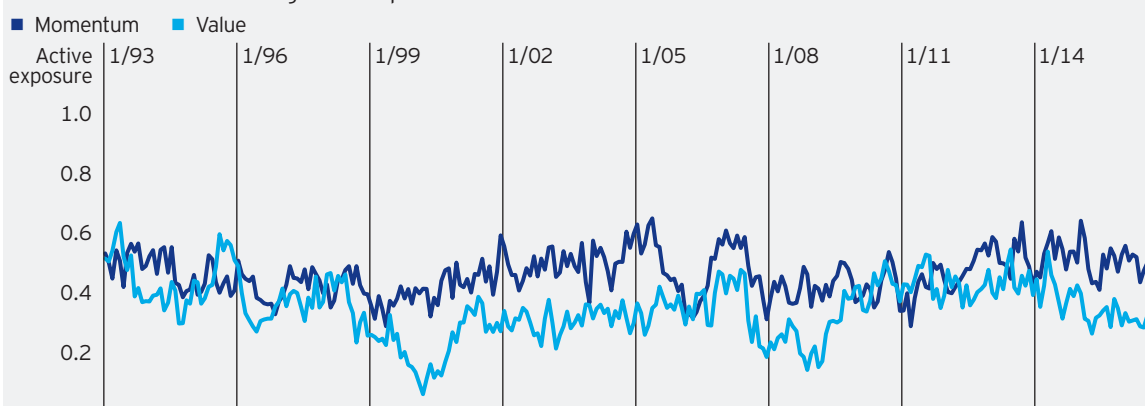
Figure 2 shows the active exposure to momentum and value through time in the multi-factor portfolio (panel A) and in the combined single-factor portfolios (panel B). In these graphs, active exposure to both momentum and value are positive through time. This follows from the fact that in both cases we are building portfolios that allocate to assets with high exposure to each of the factors individually. Importantly, we observe that the level of active exposure for both momentum and value is substantially higher for the multi-factor portfolio than for the combination of single-factor portfolios. This is because the multi-factor portfolio is not building a portfolio of assets merely having high individual exposure to momentum and value - the assets also have high exposure to momentum and value jointly. The combination of single-factor portfolios, on the other hand, has its positive momentum exposure offset by the negative exposure in the value portfolio, and has its positive value exposure reduced by the negative exposure in the momentum portfolio.

**Figure 2: Active exposure to momentum and value in balanced factor portfolios**

Panel A: Multi-factor portfolio



Panel B: Combination of single-factor portfolio



Based on data from April 1991 onwards; however, due to the calculation methodology, exposure data is only available from January 1993 onwards.

Source: Invesco calculations.

The increased exposure to factors with the ability to forecast return translates directly into portfolio performance. The first two columns of table 2 report the active performance of the multi-factor portfolio and the combination of two single-factor portfolios, respectively. By construction, both portfolios have approximately 280bp of active risk, but the multi-factor portfolio offers an annual return of 222bp. This is almost 70bp more per year than the 154bp of active return delivered by the portfolio formed from a combination of single factors. Ultimately, the information ratios for both portfolios are positive and significant, but the multi-factor portfolio is notably stronger (0.78 vs. 0.55).

### Portfolio construction matters

Consistent with Bender and Wang (2016), Fitzgibbons, Friedman, Pomorski and Serban (2016), and Clarke, de Silva and Thorley (2016), we find that multi-factor portfolios outperformed combinations of single factors. This occurs because the multi-factor portfolios are built to more effectively account for the correlation between factors and, as a result, relevant exposures in the multi-factor portfolio are higher than those in the equivalent combination of single factors. Given the ubiquity of single-factor options for delivering factor exposures, it might be worthwhile to construct combinations of single-factor portfolios that offer benefits similar to the multi-factor return forecast. Let us explore this possibility next.

Recall that our single-factor momentum portfolio has negative value exposure, and our single-factor value portfolio has negative momentum exposure – both of which lead to diminished exposures in the combined portfolio. As a practical matter, if we were able to create single-factor portfolios based on factors that were negatively correlated with one another but were not negatively exposed to the complementary factor, we might be able to mitigate the issue and generate a combined portfolio of single factors that performs similarly to the multi-factor portfolio.

We build the single-factor portfolios identical to those in the second section, except for the additional requirement that the momentum portfolio has zero value exposure, and the value portfolio has zero momentum exposure. In this way, we avoid creating single-factor portfolios that have deleterious effects on the contributions of other factors when held in combination. Column 3 of table 2 shows the performance of the combination of these “enhanced” single-factor portfolios.

<b>Table 2: Portfolio performance</b>			
	<b>Multi-factor portfolio</b>	<b>Combination of single factors</b>	<b>Enhanced combination of single factors</b>
Active return	2.22%	1.54%	2.12%
Active risk	2.83%	2.80%	2.88%
Information ratio	0.78	0.55	0.73
t-statistic	3.81	2.68	3.57

Source: Invesco calculations in USD.

The average value exposure (not tabulated) in the combination of single-factor portfolios increases by 32%, from 0.32 to 0.42, and the average momentum exposure increases by 29%, from 0.43 to 0.55. These increases in exposure to factors with positive returns lead to increases in portfolio return at similar levels of risk. The combination of single-factor portfolios now has an information ratio of 0.73, an increase of 33% over the 0.55 information ratio for the previous combination of single factors. This risk-adjusted return is hardly distinguishable from the 0.78 information ratio associated with the multi-factor portfolio.

## Conclusion

We have provided empirical evidence for two well-established factors: value and momentum. We have demonstrated the efficacy of each factor for forecasting US equity returns and shown that a multi-factor model capturing a balanced combination of uncorrelated factors has been beneficial. The main focus of this article is on how to implement the model as a portfolio of balanced factor exposures. We examined implementations via combinations of single-factor portfolios and via one multi-factor portfolio. Regardless of the approach chosen, we found that a simple, balanced factor portfolio of value and momentum outperformed a cap-weighted benchmark. Similar to other research, we also found that single-factor portfolios, when combined, have lower exposures to the intended factors, and, as a result, inferior performance compared to an analogous multi-factor implementation. However, we also found that, if single-factor portfolios are built in specific ways, it is possible to combine them to achieve many of the benefits of the multi-factor approach. Ultimately, the way in which a balanced portfolio of factors is constructed should reflect the preceding points, but it should also take into account practical concerns, including, but not limited to, existing factor exposures in a portfolio and intended factor allocations. Such considerations would likely lead to use cases for both single factor and multi-factor portfolios.

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