For professional investors

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The Investment Engineers

Factor investing versus sector investing

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Intro

- Factor investing uses a rules-based approach to isolate assets with certain characteristics that are expected to deliver superior risk-adjusted returns. Examples are stocks that are inexpensive relative to their fundamentals, stocks with strong recent performance, low-risk stocks, or high-quality stocks. Strategic allocation to such factors has been shown to provide diversification benefits and improve risk-adjusted returns over the more traditional portfolio management approaches that explicitly allocate to countries and/or sectors.
- Interestingly, a recent working paper provides results of a contest between factor-based and sector-based investing. The authors conclude there is no clear winner between the two approaches in the long-only context. We challenge their conclusion and argue that results of the mentioned study are crucially dependent on the choice of factors that they consider. In fact, we show that an explicit allocation to the well-established factor premiums dominates allocation to sectors regardless of the optimization objective that is used.

Motivation

A recent study suggests that sector investing is superior to factor investing in long-only strategies. We oppose this idea.

Brierè and Szafarz (2016; henceforth BS2016) provide an empirical contest between factor-based and sector based investment strategies.[1] They consider the Size, Value, Momentum, and Quality factors and ten sectors, as classified by Kenneth French.[2] While the authors show that factor investing is superior to sector investing within the long-short context, sector investing does as well, or even better than factor investing in the long-only context; i.e. when short-selling is not allowed. More specifically, the authors show that factor investing is the superior approach when evaluated using certain performance metrics, such as attaining the highest return, while sector investing beats factor investing when other performance metrics are used as the relevant evaluation criteria. For example, the paper claims that sector investing has the potential to offer greater downside protection than factor investing as strategies based on certain sector allocations are exposed to lower absolute risk levels than the best possible factor allocation.

We oppose the idea that sector investing can add as much, or even more value than factor investing, even in the long-only context. First, there is no theoretical foundation for sector investing. While certain sectors have historically outperformed other sectors, there is no reason to expect this pattern will continue. Factor investing, on the other hand, is based on a vast amount of academic evidence that shows the existence of several factor premiums, provides reasons to expect these factors to continue to earn a premium in the future, and shows that factor-based strategies have added value in portfolios in practice.[3]

Second, regardless of differences in the theoretical foundations, we argue that the empirical findings of BS2016 crucially depend on their selection of factors, and that conclusions turn in favor of factor investing if a different choice of factors is made. For instance, at Robeco, we believe in four key factor premiums that, next to Value, Momentum, and Quality, also includes the Low-Risk factor. The reason why BS2016 find that sectors have more potential to provide downside protection could well be because they do not include the Low-Risk factor in their selection. Consequently, the sector investing approach can be tilted to defensive sectors like utilities, but in their setting the factor investing approach is restrained from allocating to the defensive segment of the market.

In the next section, we run a horse-race between factor investing and sector investing, but this time also including a Low-Risk factor in the contest. We find that factor investing is superior to sector investing no matter what metric is used for performance evaluation.

[1] Brierè and Szafarz, 2016, “Factor-Based v. Industry-Based Allocation: The Contest”, available on SSRN: http://ssrn.com/abstract=2615703
[2] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_10_ind_port.html
[3] It is beyond the scope of this paper to provide a literature overview on factor investing. We refer the reader to Blitz, 2012, “Strategic Allocation to Premiums in the Equity Market”, and Blitz, 2015, “Factor Investing Revisited”, both published in issues of the Journal of Index Investing, for an introduction on factor investing.

The contest

We run our own horse race between factor and sector investing, also including the Low-Risk factor. Factor investing turns out to beat sector investing for all absolute and risk-adjusted return measures.

Following BS2016, we use publicly available data from the website of Professor Kenneth French.[4] In the empirical analysis of BS2016, ten factor portfolios are included: Small versus Big, Value versus Growth, Winners versus Losers, Robust profitability versus Weak profitability, and Conservative investment versus Aggressive investment. We augment these factor portfolios with low-beta and high-beta portfolios, thus totaling 12 factor portfolios. We match the number of factor portfolios by also using the 12 industry definitions of Kenneth French. The factor portfolios are based on the value-weighted decile sorts of which we use the top and bottom deciles. On average, this means that factor portfolios and sector portfolios have similar concentrations, which makes the comparison a fair one. As a proxy for the market portfolio, we take the value-weighted return of the entire CRSP (Center for Research in Security Prices) universe. RF, the proxy for the risk-free rate, is the return on the one-month T-bill. We use monthly return series from July 1963 to December 2015.

In Table 1, we present the historical performance of the market, the twelve sector portfolios (Panel A) and the twelve factor portfolios (Panel B). Over the full sample period, the market portfolio has a return above the risk-free rate of 4.9% per year and a volatility of 15.4%. The excess returns of the sectors range from a low 3.1% for consumer durables to 7.4% for consumer non-durables. In total, five sectors underperformed the market portfolio and seven sectors showed an outperformance. On a Sharpe ratio basis, only consumer non-durables, shops, and healthcare had a better performance than the market portfolio. The tracking errors of the sector portfolios versus the market portfolio range from 6.8% per year for the manufacturing sector to 14.5% for the energy sector.

The factor portfolios show a much wider dispersion in returns and volatilities. For instance, returns range from as low as -6.6% per year for momentum Losers to 11.6% for momentum Winners. The least volatile factor portfolio is the Safe portfolio with a 12.0% volatility per year. The most volatile portfolio is the Losers portfolio with a volatility of 27.9%. A total of six factor portfolios have a higher return than the market; all the 'attractive' sides of the factors, including Small, Value, Winners, Robust profitability, Conservative investments, and Safe portfolios. The six counterparts, Large, Growth, Losers, Weak profitability, Aggressive investments, and Risky portfolios underperform the market in terms of returns.

[4] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Table 1: Historical performance of sector-based and factor-based portfolios

Panel A: Sectors

	Excess return	Volatility	Sharpe	Outperf.	Tracking error	Information ratio
Market	4.9%	15.4%	0.32			
Consumer non-durables	7.4%	14.8%	0.50	2.5%	8.7%	0.28
Consumer durables	3.1%	21.8%	0.14	-1.8%	13.1%	-0.14
Manufacturing	5.4%	18.3%	0.29	0.5%	6.8%	0.07
Energy	5.6%	18.8%	0.30	0.7%	14.5%	0.05
Chemicals	5.0%	16.1%	0.31	0.1%	8.4%	0.02
Business equipment	4.6%	22.5%	0.20	-0.3%	12.2%	-0.03
Telecom	4.4%	16.1%	0.27	-0.5%	11.1%	-0.05
Utilities	4.1%	13.9%	0.30	-0.8%	13.4%	-0.06
Shops	6.2%	17.9%	0.35	1.3%	9.1%	0.15
Healthcare	7.1%	16.8%	0.42	2.2%	11.1%	0.20
Finance	5.1%	18.8%	0.27	0.2%	9.1%	0.02
Other	3.5%	18.9%	0.18	-1.4%	7.2%	-0.20

Panel B: Factors

	Excess return	Volatility	Sharpe	Outperf.	Tracking error	Information ratio
Small	6.7%	22.0%	0.30	1.8%	14.0%	0.13
Large	4.3%	14.7%	0.29	-0.6%	3.5%	-0.18
Value	9.1%	20.2%	0.45	4.2%	11.8%	0.35
Growth	3.8%	17.7%	0.21	-1.1%	6.6%	-0.17
Winners	11.6%	21.4%	0.54	6.7%	11.7%	0.57
Losers	-6.6%	27.9%	-0.24	-11.5%	18.2%	-0.63
Robust profitability	5.7%	16.0%	0.36	0.8%	5.7%	0.15
Weak profitability	1.7%	22.4%	0.08	-3.2%	10.9%	-0.29
Conservative investment	7.6%	18.6%	0.41	2.8%	7.8%	0.35
Aggressive investment	1.4%	21.1%	0.07	-3.5%	8.5%	-0.41
Safe	5.8%	12.0%	0.49	0.9%	9.4%	0.10
Risky	3.3%	27.4%	0.12	-1.6%	15.0%	-0.10

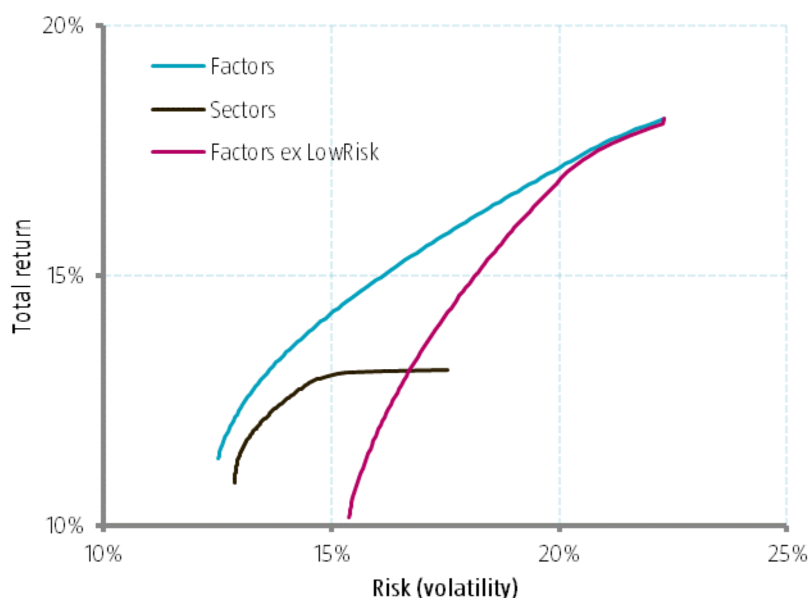
Source: Webpage of Kenneth French and Robeco; time period July 1963 to December 2015.

These results indicate that one can obtain better performance characteristics by allocating to single factors than to single sectors. For instance, Winners have a return of 11.6% while the sector with the highest return historically is consumer non-durables with only 7.4%. The

highest Sharpe of 0.54 is also achieved by investing in the Winner factor portfolio, while the consumer non-durables sector yields the highest Sharpe ratio among sectors.[5] This, however, does not take into account interaction effects and resulting diversification benefits within sectors and within factors. To address this, we construct multi-factor and multi-sector portfolios that meet several optimization objectives and compare their performance characteristics. First, we construct three efficient frontiers comprised of (i) sectors, (ii) factors excluding the Low-Risk factor, and (iii) factor portfolios comprised of all factors; next, we optimize sector investing and factor investing portfolios for several commonly used performance objectives.

Starting with the first part of the contest, Figure 1 below shows the efficient frontiers. Consistently with the findings of BS2016, the factor frontier that excludes the Low-Risk factor does not contain the minimum variance portfolio; however, one can still achieve the highest attainable return using this selection of factors, as the Low-Risk factor has no weight in this portfolio. Once we add the Low-Risk factor to the mix, it is clear from the figure that for any given level of risk, factor investing can achieve a higher level of return. Also, both the minimum variance portfolio, and the portfolio that achieves the highest return are found on the factor frontier. Hence, it can be concluded that factor investing dominates sector investing in the mean-variance optimized risk-return space.

Figure 1 | Efficient frontiers



Source: Webpage of Kenneth French and Robeco; time period July 1963 to December 2015

[5] Note that factor portfolios typically have higher turnover in order to keep their factor tilts. In practice this will negatively impact returns. Unreported results show that conclusions are not materially affected when we control for this.

In the next part, we optimize the two approaches to meet five commonly used performance objectives. These objectives include obtaining the highest return, minimum volatility, maximum Sharpe ratio, highest alpha (i.e. Jensen's alpha[6]), and maximum information ratio. Results can be found in Table 2. Interestingly, for all five measures factor investing beats sector investing. For instance, the factor investing portfolio that maximizes return has more than 4% higher excess return than its sector investing counterpart. Also in terms of Sharpe ratio or alpha, factor investing beats sector investing. Consistently with the results of the mean-variance optimization, factor investing also dominates sector investing if the optimization objective is to achieve the lowest volatility. Finally, looking at a relative return/risk objective the clear winner is factor investing with an information ratio which is almost 40% higher than that of the sector investing portfolio (0.63 versus 0.88).

Table 2: Optimizing towards performance objectives

		Excess return	Volatility	Sharpe	Alpha	Information ratio (I.R.)
Maximizing	*Sector*	**7.4%**	14.6%	0.51	3.4%	0.31
return	*Factor*	**11.6%**	21.4%	0.54	6.3%	0.57
Minimum	*Sector*	5.4%	**12.3%**	0.44	2.0%	0.07
volatility	*Factor*	6.0%	**12.0%**	0.50	2.7%	0.12
Maximum	*Sector*	7.3%	13.9%	**0.53**	3.2%	0.35
Sharpe	*Factor*	9.0%	14.8%	**0.61**	4.3%	0.74
Maximum	*Sector*	7.4%	14.8%	0.50	**3.4%**	0.28
alpha	*Factor*	11.6%	21.4%	0.54	**6.3%**	0.57
Maximum	*Sector*	6.3%	15.2%	0.41	1.4%	**0.63**
I.R.	*Factor*	8.5%	15.4%	0.55	3.6%	**0.88**
Winning approach		**Factor**	**Factor**	**Factor**	**Factor**	**Factor**

Source: Webpage of Kenneth French and Robeco; time period July 1963 to December 2015

It should come as no surprise that the optimal sector and factor allocations depend on the performance objective. How the optimal allocations have been historically can be seen in Table 3. For instance, while consumer non-durables receive a positive weight regardless of which objective is used, as a result of the relatively high historical return for this sector, Utilities only receive a large allocation in the minimum volatility portfolio due to its defensive nature. We find that for the factor investing portfolios, the momentum Winners portfolio has positive allocations in all performance objectives in which return plays a role. For obtaining the maximum information ratio, all but the Small factor portfolio receive a positive weight,

[6] Jensen's alpha is measured as the risk-adjusted return by adjusting the portfolio return for its market beta.

indicating that that there are diversification benefits from combining single factors in a multi-factor portfolio. For the minimum volatility factor portfolio, the Safe portfolio receives a large weight. As we can see from the efficient frontiers, the factor investing portfolio that excludes the Low-Risk factor is unable to achieve a lower risk portfolio than the sector investing portfolio with minimum volatility, confirming the results of BS2016. However, unreported results show that for all other return-based performance objectives, the conclusion that factor investing is superior to sector investing does not rely on the in- or exclusion of the Low-Risk factor.

Table 3: Sector and factor allocations of the optimized portfolios

Panel A: Sector allocations

	Maximum Sharpe	Minimum volatility	Maximum return	Maximum alpha	Maximum IR
Consumer non-durables	61%	11%	70%	100%	17%
Manufacturing	-	-	-	-	12%
Energy	18%	5%	-	-	13%
Chemicals	-	7%	-	-	-
Business equipment	-	-	-	-	20%
Telecom	-	20%	-	-	7%
Utilities	1%	45%	-	-	-
Shops	-	-	-	-	9%
Healthcare	21%	11%	30%	-	10%
Finance	-	-	-	-	12%

Panel B: Factor allocations

	Maximum Sharpe	Minimum volatility	Maximum return	Maximum alpha	Maximum IR
Small	-	4%	-	-	-
Value	12%	-	-	-	16%
Winners	40%	-	100%	100%	27%
Robust profitability	-	-	-	-	20%
Conservative investment	-	-	-	-	10%
Safe	48%	96%	-	-	26%

Source: Webpage of Kenneth French and Robeco; time period July 1963 to December 2015.

While sector investing might lead to better investment performance than investing in the market portfolio, there is no theoretical reason why certain sectors should persistently have higher returns than others. Hence, the portfolios which have historically been optimal with

regards to a certain performance measure, might be far off from the optimal portfolio going forward. We therefore also look at more robust, optimization-agnostic portfolios: an equal-weighted sector allocation, an equal-weighted factor allocation which only includes the six 'attractive' factor portfolios, and a selected factor portfolio comprised of the four key factor premiums identified by Robeco, which includes Value, Momentum, Low-Risk, and Quality and does not include the Size factor. In order to raise the bar for factor investing, we also look at an equal-weighted allocation to the four sectors which, in retrospect, had the highest return. Table 4 presents these results.

Table 4: Non-optimized combinations

	Excess return	Volatility	Sharpe	Alpha	Information ratio
Equal-weighted sector	5.7%	14.8%	0.38	1.0%	0.29
Equal-weighted factor	8.2%	16.3%	0.50	3.2%	0.68
Selected factor	8.7%	15.7%	0.56	3.8%	0.85
High-return sectors	7.0%	14.2%	0.50	2.7%	0.39

Source: Webpage of Kenneth French and Robeco; time period July 1963 to December 2015

The equal-weighted sector portfolio outperforms the market portfolio by 0.8% per year. As such, giving relatively more weight to smaller sectors, which have a more defensive character, results in a reduced volatility for the sector portfolio (14.8% versus 15.4% for the market). The equal-weighted factor portfolio does better by having a return of 8.2%. While this does come at the cost of a higher volatility, the Sharpe ratio of 0.50 is higher than that of the equal-weighted sector portfolio, which has a Sharpe ratio of 0.38. Finally, the Robeco combination of factors does even better; by excluding the Small portfolio, all performance characteristics improve compared with the equal-weighted factor portfolio. Also, if we compare it with the equal-weighted high-return sector portfolio, the Robeco factor portfolio does better. In sum, the factor investing approach beats the sector investing approach for all absolute and risk-adjusted return measures, confirming the findings of the prior analyses.

Final discussion

As small caps can incur higher transaction costs, we also consider factor portfolios that exclude the 40% smallest stocks. This doesn’t change the outcome.

As factor strategies entail higher turnover in order to maintain tilts to desired factors, we also considered factor portfolios which exclude the smallest 40% of stocks. Small stocks can be harder and more expensive to trade, and, consequently, result in bigger performance drags, especially if the turnover of a strategy is substantial.

By excluding these stocks, we ensure that the strategies we describe can be applied on a large scale and that the results are not highly sensitive to market microstructure concerns. Our conclusions do not change if we leave out the small-cap segment of the market for the factor portfolios.

Also, note that the factor portfolios used in this analysis are based on very generic factor definitions. Using more sophisticated factor strategies is likely to give even better results, making the case in favor of factor investing even more compelling.

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