Equity factor investing: Historical perspective of recent performance

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Executive summary

We investigate the possible sources of the recent underperformance of multi-factor equity strategies reported by many equity quant managers. We considered the value, quality, low risk and momentum factor styles in mid to large-capitalisation World, USA and European stock universes. When looking at the historical performance of the factors and multi-factor combinations, we find that this is not the first time factor strategies have experienced a period of poor performance. The tech bubble of the late 90s and the great financial crisis of 2008 were other difficult periods for some of the factors and multi-factor combinations. What is different this time around is that poor performance can be mainly attributed to the underperformance of value factors. We also find that long-only portfolios, which tend to be exposed to smaller-capitalisation stocks in their construction, have suffered additionally from that exposure. Not only did the size factor fail to generate a premium in mid to large-capitalisation universes in the long term, but also the recent underperformance of smaller-capitalisation stocks and the consequent increase in the concentration of benchmarks was an additional source of difficulty in long-only benchmarked portfolios. Finally, we discuss the impact of a number of choices available to managers of factor strategies and show that the neutralisation of sectors, neutralisation of beta, control of tracking error and diversification of factors in styles play an important role in improving the performance of equity factor strategies.

1. Introduction

The use of factors in active equity investing can be traced back to the 1970s when academics first showed that US stocks with the lowest risk delivered higher returns than expected from their level of risk. This discovery was followed by empirical evidence that value stocks, i.e. those with the lowest price-to-earnings ratio, also delivered higher returns than expected from their risk. The use of factors to select stocks for active portfolios, giving a preference to low risk and value stocks, has been used since then, not only by quant equity portfolio managers but also by a number of fundamental managers. In the early 1990s, academics added the momentum factors to the list of factor styles that can be used to forecast stock returns. This came after showing that stocks with the strongest past returns, e.g. 12 month returns, tend to outperform stocks with poorer historical performances in the future. Finally, there are quality factors, i.e. factors that measure how profitable and well-managed companies are. These have been used for decades by fund managers to select the most profitable and best managed companies. Academics also acknowledged quality as an important factor style to forecast stock returns. A more controversial factor style is size, with academics defending that smallest-capitalisation stocks are more likely to outperform. This factor has raised controversy and some have questioned the extent to which the size factor really works across the entire spectrum of market capitalisation and after correcting for risk.

Since there is not just one way of measuring how cheap, profitable, risky, trending or small a company is, it should not come as a surprise that the list of factors reported in literature grew large over time. Since the 1970s, many value, quality, low risk, momentum and size factors have been proposed.

Over the last 50 years of factor investing, we have witnessed a number of love and fear cycles for the use of factors to select stocks for portfolios. At present, 2019-2020 seems likely to go down in history as a period of fear, much like 2009-2011 and 1998-2000. These were periods when the most traditional factor combinations used by portfolio managers did not deliver.

In this paper, we argue that there are good reasons to expect the recent underperformance reported by a number of equity quant managers to be temporary. While there have been claims that this time is different, this was also the case in previous episodes of underperformance – it is always different in some way. Indeed, this time around, it is the value factors that explain much of the poor performance, while the quality factors delivered strong performances, momentum factors also delivered good performances, and the performance of low risk was mixed.

Much like value, the performance of size was also poor. Here we show that the size factor applied to mid and large-capitalisation stock benchmarks had rather poor performances, in particular for USA and World stocks and more recently for European stocks too. This was certainly an additional problem for managers who actively allocate to the size factor, i.e. who prefer smaller-capitalisation stocks. But this was also a problem for long-only managers in general, in particular those with higher tracking error who inevitably, because of the long-only constraint, end up overweight smaller-capitalisation stocks to some extent, even if they do not explicitly seek to allocate to the size factor. Indeed, the outperformance of the larger-capitalisation stocks in the USA and World over smaller stocks has been increasing the concentration of the benchmark indices. The market capitalisation of just a very few of the larger stocks has reached historically high levels, significantly reducing the diversification of the indices and leaving little room to fund active positions without underweighting such large outperforming stocks.

In all, multi-factor managers with a preference for quality and momentum styles and/or running lower tracking errors were more likely to deliver better performances in the last two years, perhaps even managing to outperform the index in the period, but at the likely cost of lower longer-term historical performance against the more diversified multi-factor managers running higher tracking errors.

Conversely, multi-factor managers with a higher allocation to value or size and those running higher tracking errors were more likely to deliver poor performances recently despite their long-term outperformance over the less diversified managers or those with lower tracking errors. The fact that most multi-factor managers tend to fall in this second category is the likely explanation of why performances have been poor for so many equity quant managers.

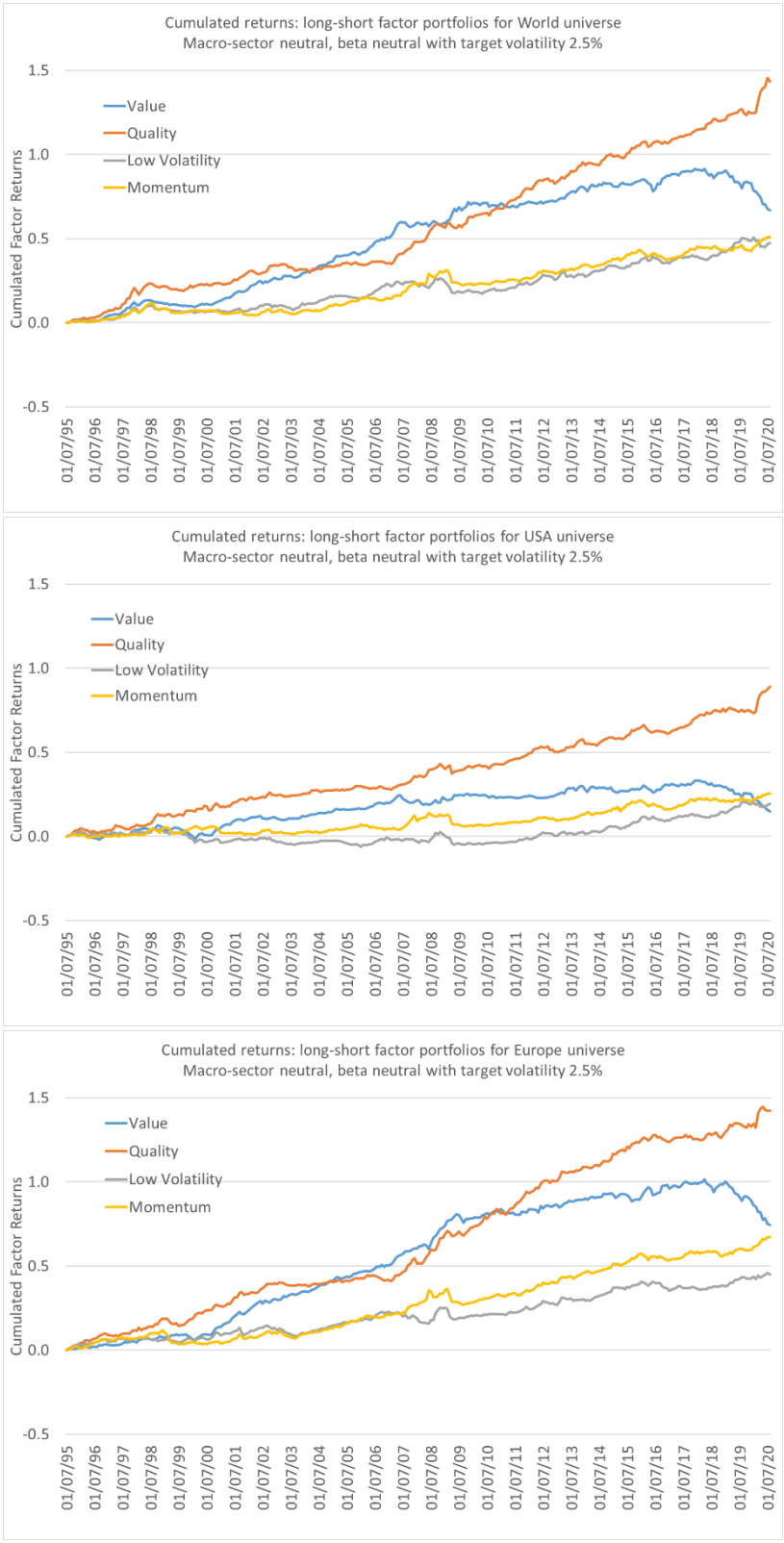
In this paper, we shall answer six important questions investors may be asking themselves at this moment. In the next section, we ask whether equity factor investing is still relevant today. Then we ask if all factors failed. Next, we ask how a simple multi-factor combination behaved recently before applying any portfolio constraints. The next and obvious question is what has been the impact of typical portfolio constraints, e.g. long-only. Finally, we ask about the impact of different factor and multi-factor portfolio construction choices such as: i) the choice to neutralise beta, macro-sectors and to target a constant level of risk; ii) the choice to use a diversified set of factors instead of just the most popular factors in each style; and iii) the choice to include the size factor.

2. Is equity factor investing still relevant?

We firmly believe so.

First, there is the strong financial rational of investing in the cheaper (value) and less risky stocks (low risk) that are outperforming (momentum) and that have the strongest fundamentals when it comes to profitability and quality of management (quality). This is not merely sensible; it has been backed by academics and by empirical evidence for decades, and despite the many changes we have witnessed throughout time in terms of market regimes, in the way stocks are traded, in how technology is used by markets participants and even changes in the actual investors themselves.

Second, it removes human emotion and biases from the equation. In fact, human behavioural biases have been put forward as a key explanation of the long-term performance in factor investing. Value investing is often explained by evidence that investors tend to overreact and over-estimate the returns of growth stocks, leaving value stocks effectively undervalued. Low risk is explained by behavioural biases such as over-confidence, with investors over-estimating their ability to select stocks, and preference for lotteries, with investors attracted to risky stocks that may offer a small change of a disproportionally large reward. Low risk can also be associated with incentives, i.e. investors prepared to overpay for risky stocks because incentives push them to do so, as can be the case for active fund managers. Momentum is often explained by behavioural biases such as investor herding, investor over- and under-reaction, and by the confirmation bias, whereby investors are likely to amplify investment signals that are consistent with their pre-existing beliefs. Quality is associated with the present bias, i.e. investors being more likely to overvalue the potential short-term benefits of less profitable companies over the long-term benefits of investing in better managed and profitable companies that deliver in the longer-term. The focus bias is also often put forward to explain the performance of quality, with investors obsessed by less important things like short-term earnings or with over-estimated rewards from over-indebted companies. Finally, much as with low risk, quality is also explained in terms of incentives and investor overconfidence.



Exhibits 1. Cumulated monthly performances of unconstrained long-short value, quality, low volatility and momentum factor portfolios, monthly rebalanced, beta neutral, macro-sector neutral and targeting 2.5% ex-ante volatility. A- World in USD, B- USA in USD and C- Europe in EUR. No transaction costs. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

Third, factor investing remains a transparent and efficient approach to investing from a cost perspective since it requires much less human input. Once the factor quantitative models are built, they are extremely effective for handling the vast amounts of data used to select the best investment opportunities in any region or sector. Factor investing models rank stocks by the expected risk-adjusted returns derived from the factors and can be used to narrow down large investable universes into a short list of stocks more likely to outperform. It is easy to explain why a stock was short-listed by going back to the data that was used.

Fourth, by relying on a robust approach to construct the factor portfolios – for example by minimising the impact of constraints and neutralising unwanted risk exposures – factor investing remains an efficient, rigorous approach to generate performance above benchmarks, at least on average in the medium to long term.

Finally, there is the question of the recent shorter-term performance. As we shall see in this paper, the current episode of underperformance is not unique and we shall explain why we believe factor investing strategies should go back to delivering returns in line with their long-term promise.

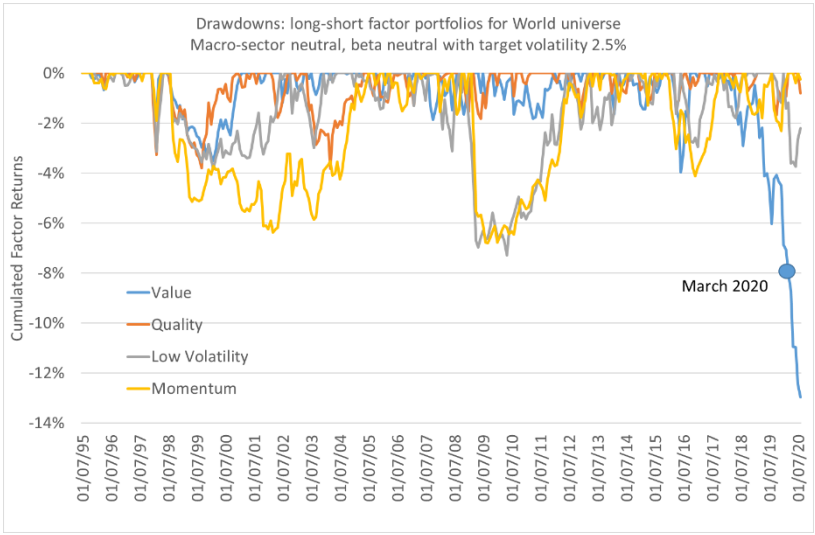
3. Did all factors fail recently?

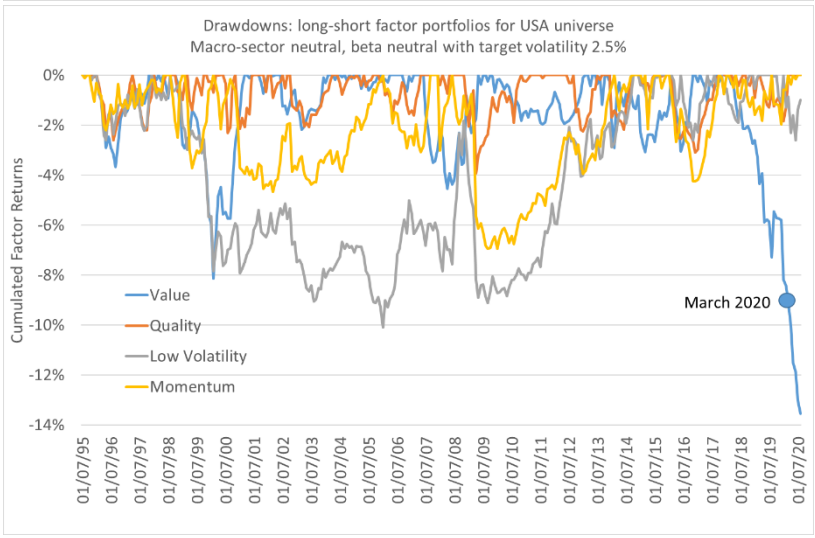
No. Quite the contrary: Quality and momentum worked well. Value was the main culprit.

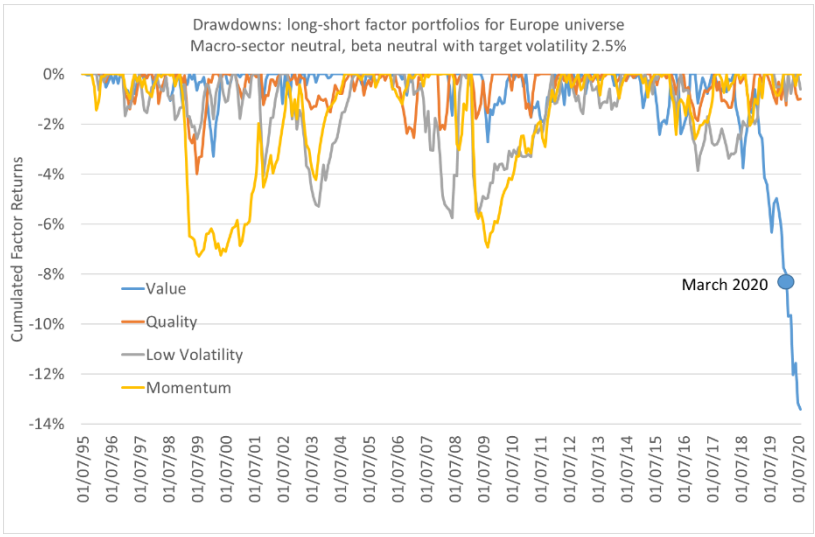
In Exhibits 1, we show the cumulated performance of the value, quality, low volatility and momentum factor styles for the World, USA and Europe. We rely on investment universes equivalent to those from the MSCI World, the S&P 500 and the MSCI Europe index constituents. Each style is a simple combination of some of the most commonly used factors and were chosen based on their diversification effect. For value, we used earnings yield, free cash flow yield and operating cash flow to enterprise value. For quality, we used return on capital employed, free cash flow to assets and a measure of accruals, preferring low accruals. For low risk, we used a measure of the historical volatility of each stock. For momentum, we used a measure of historical stock returns over the medium term and earnings analysts' revisions.

The returns in Exhibits 1 were created by simulating unconstrained strategies based on long-short portfolios constructed from the factors, as is usually done in academic studies. We neutralise macro-sectors and beta, and we set the volatility of the long-short portfolio to 2.5% in ex-ante at each monthly rebalancing. The advantage of this simple long-short approach is that it is informative of the extent the information content of the factors was useful in forecasting the performance of stocks relative to their peers in each macro-sector. The neutralisation of beta and sectors and the targeting of constant volatility are choices we defended in our paper by Leote de Carvalho *et al.* (2017).

What these charts show is that all factors generated positive premiums in the long term, but the quality factors have been doing better than the other factors. We can also see that the value factors performed rather well until recently but have disappointed since about mid-2018, in all three regions. The momentum and the low-volatility styles delivered positive performances in the period that were less strong than those of quality or value.







Exhibits 2. Drawdowns in cumulated monthly performances of unconstrained long-short value, quality, low volatility and momentum factor portfolios, monthly rebalanced, beta neutral, macro-sector neutral and targeting 2.5% ex-ante volatility. A- World in USD, B- USA in USD and C- Europe in EUR. No transaction costs. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

In Exhibits 2, we can also see that these factors have gone through other difficult periods in the past. The run-up to the tech bubble in 1998-99 and the great financial crisis of 2008-09 were periods when some of the factors had choppy performances. The tech bubble in particular was also difficult for all factor styles in the three regions, with only quality in the USA surviving. It is clear that this period was one when many investors asked questions about the ability of factors to generate premiums. The global financial crisis was also difficult, in particular when the markets bottomed in 2009 and there was significant rotation in stock performances. However, 2020 was different as the poor performance was driven mainly by value, which strongly underperformed even by historical standards. In fact, the performance of value factors was still within bounds by March 2020, but was sent into disarray by the Covid-19 crisis and the unusual stock performances that followed from the impact of lockdowns imposed around the world.

In Exhibit 3, we show the factor returns over different periods as well as the information ratios over the long term. All factors delivered over the long term, in all regions. While results are very strong for Europe and the World, information ratios are weaker for the USA, even in the longer term. We can also see that quality factors performed extremely well and did better than the other factors at least in this period.

If we now focus on recent performances in Exhibit 3, we can see that the quality factor had much higher returns than its long-term average; in contrast, value suffered in the last three years and in particular in the last year. Momentum performed in line with long-term expectations in all three regions in both the last three years and more recently, while low risk performed well in the last three years but disappointed in the USA and World in the last year.

World	Annualised returns				Information ratio		Annualised volatility	
	-1Y	-3Y	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95
Value	-7.4%	-4.2%	1.6%	2.1%	0.58	0.82	2.7%	2.5%
Quality	7.2%	4.8%	3.5%	3.6%	1.45	1.44	2.4%	2.5%
Low Vol	-2.1%	1.9%	1.7%	1.6%	0.66	0.62	2.6%	2.5%
Momemtum	3.2%	2.1%	2.0%	1.6%	0.79	0.66	2.6%	2.5%

USA	Annualised returns				Information ratio		Annualised volatility	
	-1Y	-3Y	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95
Value	-6.7%	-4.1%	0.3%	0.6%	0.10	0.22	2.5%	2.5%
Quality	7.8%	4.6%	2.5%	2.6%	1.07	1.03	2.3%	2.5%
Low Vol	-1.0%	2.0%	1.3%	0.7%	0.52	0.28	2.5%	2.5%
Momemtum	2.1%	1.6%	1.2%	0.9%	0.49	0.37	2.5%	2.5%

Europe	Annualised returns				Information ratio		Annualised volatility	
	-1Y	-3Y	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95
Value	-7.6%	-4.5%	1.7%	2.2%	0.65	0.90	2.5%	2.5%
Quality	3.6%	2.0%	3.3%	3.6%	1.32	1.44	2.5%	2.5%
Low Vol	1.2%	2.0%	1.6%	1.5%	0.65	0.60	2.4%	2.5%
Momemtum	4.2%	2.1%	2.5%	2.1%	1.03	0.83	2.5%	2.5%

Exhibit 3. Annualised excess monthly returns, volatility and information ratios of unconstrained long-short value, quality, low volatility and momentum factor portfolios, monthly rebalanced, beta neutral, macro-sector neutral and targeting 2.5% ex-ante volatility for World in USD, USA in USD and Europe in EUR. No transaction costs. 31-Jul-95 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope,

IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

These results show that not everything is failing, but rather that the recent period has been quite extraordinary both positively for quality factors and negatively for value factors. However, there were periods in the past when there were even more styles underperforming than today, in particular in the run-up to the tech bubble and during the global financial crisis.

4. How did a simple unconstrained multi-factor combination perform?

The performance of multi-factor combinations of the factors above depends on the risk budget allocated to each factor style. What is clear from Exhibit 3 is that the larger the weight allocated to value, the more the chances of generating negative returns in the last three years.

Here we considered an equal risk contribution algorithm to allocate risk to each factor style. This algorithm allocates the risk budget required to make sure each factor style contributes equally to the final volatility of the long-short portfolio combining the four factor styles.

In Exhibit 4, we show the returns and the long-term information ratios of the equal risk contribution combination of the factor styles. These multi-factor combinations performed well over time generating a premium of about 3.5% annualised for the World and Europe and a premium of 1.8% for the USA, which reflects the fact that the factors worked less well in the USA, as in Exhibit 3. The information ratios are strong for both the World and Europe and good for the USA. We note that the results include an estimation of transaction costs.

What we also find is that despite the good performance of quality and momentum, the multi-factor combination underperformed in the last year, which was the result of the allocation to value, and, in the World and USA, also to underperforming low volatility.

	Annualised excess returns				Information ratio		Annualised volatility	
	-1Y	-3Y	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95
World	-1.1%	2.6%	3.5%	3.4%	1.59	1.38	2.2%	2.5%
USA	-1.3%	1.4%	2.0%	1.8%	0.89	0.72	2.3%	2.5%
Europe	-0.8%	0.0%	3.4%	3.6%	1.51	1.45	2.3%	2.5%

Exhibit 4. Annualised excess monthly returns, volatility and information ratios of equal risk contribution combinations of beta neutral, macro-sector neutral constant volatility value, quality, low volatility and momentum factor styles as in exhibits 1 for the World in USD, 2 for the USA in USD and 3 for Europe in EUR. No transaction costs. 31-May-03 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

5. What was the impact of the long-only constraint?

We now focus on the impact of applying realistic constraints to a multi-factor portfolio. We shall consider an active benchmarked portfolio with two common constraints: A long-only constraint on the benchmarked portfolio and a constraint on its tracking error set to 2.5%, which is typical of many equity quant managers.

We used a portfolio optimiser to create the long-only constrained benchmarked portfolios at the targeted level of target tracking error. The optimiser is asked to find the portfolio that best replicates the returns

to a portfolio made of the benchmark index plus the equal risk contribution combination of long-short factor portfolios, while respecting the constraints imposed. The performance of the long-short multi-factor portfolio investigated in the previous section is thus our target in terms of excess returns over the benchmark for our long-only portfolio. The result from the optimiser is a long-only multi-factor portfolio that stays as close as possible to the index, plus the long-short multi-factor combination.

This portfolio construction is used in the proprietary multi-factor portfolio strategies managed by the quantitative investment team at BNP Paribas Asset Management and was presented in our papers by Soupé *et al*. (2019) and Leote de Carvalho *et al*. (2014). Our investment team also relies on an equal risk contribution allocation to factor styles and use the same factors proposed in section 2 and only the level of tracking error can be different.

In Exhibit 5, we show the annualised returns in different periods and the information ratio and tracking error in the entire period for the long-only portfolios. Here we focus on the period May-03 through Aug-20 because of our licencing agreement for the constituents of the MSCI World and MSCI Europe benchmark indices.

	Annualised excess returns			Information ratio	Tracking error
	-1Y	-3Y	Since 31-May-03	Since 31-May-03	Since 31-May-03
World	-4.6%	-0.8%	2.7%	1.11	2.5%
USA	-2.3%	0.4%	2.6%	1.01	2.6%
Europe	-4.0%	-0.5%	2.6%	1.00	2.6%

Exhibit 5: Annualised monthly returns, tracking error risk and information ratio of monthly rebalanced long-only multi-factor portfolio strategies based on an equal risk contribution allocation to the value, quality, low volatility and momentum factor styles. The target ex-ante tracking error is 2.5%. An estimation of transaction costs were included in the calculations. World in USD, USA in USD and Europe in EUR. 31-May-03 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

We can see from Exhibit 5 that the ex-post tracking error of the strategies is well in line with the ex-ante target. This is a good result, particularly if we take into account that the strategies are rebalanced only once a month. We can also see that the information ratios are positive and significant in the period. They are nevertheless smaller than the corresponding information ratios for the long-short multi-factor corresponding combinations in Exhibit 4. The difference illustrates the almost inevitable loss to constraints. Finally, while the excess returns are smaller for the long-only strategy than the returns for the long-short strategies in Exhibit 4, they remain large and significant.

Finally, when comparing Exhibits 4 and 5 we can see that recent returns have been poorer for the long-only portfolios. These recent returns are in fact poorer than we could perhaps expect from the average long-term impact of the constraints. This suggests that the impact of the long-only constraints was more significant in the recent period than on average in the entire period.

To put the recent performance into historical context, in Exhibit 6 we show the drawdowns in the cumulated active returns of the long-only multi-factor portfolio strategies relative to the respective benchmarks. What we can see is that while the drawdowns were significant in the long-only multi-factor strategies, they are comparable in size to those experienced during the great financial crisis. Should we

have extended the simulations back to the tech bubble period, we are sure we would have found another similar drawdown in these multi-factor strategies.

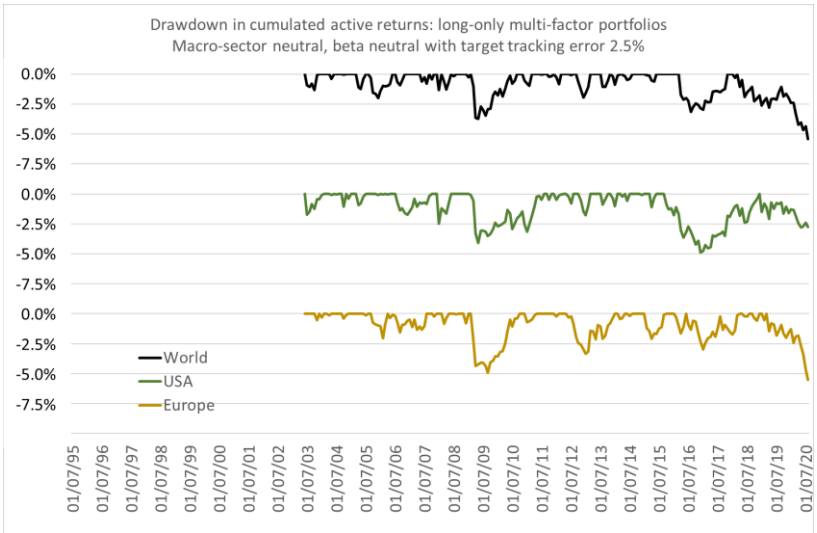


Exhibit 6: Drawdown in cumulated active returns against the benchmark of the long-only multi-factor portfolios of Exhibit 4. World and USA in USA and Europe in EUR. Transaction costs included. Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

We have so far demonstrated that the levels of underperformance of long-only multi-factor strategies relative to their benchmarks in the current period is not exceptional. This should be the case at least when relying on our choice of factors for each style, imposing the rules that factors are beta neutral, macro-sector neutral and that they target a constant active risk over time, and finally when using an optimiser to minimise the impact of the long-only constraint in portfolios and target a constant level of tracking error throughout time. It is important to say that these choices were not made by chance: They reflect the choices that were made for our proprietary multi-factor strategies and that have been proposed in a number of papers we published over the years, some of which have already been cited. What if other choices had been made? We consider this question in the next section.

6. What was the impact of our choices for multi-factor strategies?

In this section, we investigate the impact of making different choices when it comes to constructing multi-factor strategies. First, we shall look at the impact of simplifying the strategies by relaxing the neutrality of beta and macro-sectors, and by replacing the targeting of constant risk by a simpler approach. Second, we consider a less diversified strategy relying only on the most common factor for each style. For this, we replace the factors that we have so far been using in this paper by just one of the factors most commonly found in academic studies. Finally, we look at the impact of voluntarily adding an exposure to the size factor in the multi-factor combination and the consequent tilt towards smaller-capitalisation stocks in portfolios.

6.1. Was it helpful to neutralise beta, macro-sectors and target constant risk?

Yes, indeed, such choices have been extremely helpful over time!

In Exhibit 7, we compare information ratios of the long-short multi-factor combination from Exhibit 4, where all factors are beta neutral, macro-sector neutral and target a constant volatility at each rebalancing with similar strategies that differ only by not imposing beta and sector neutrality and by replacing the targeting of constant volatility by a constant level of leverage. We call the first *Neutralised* and the second *Raw*. Both neutralised and raw strategies rely on an equal risk contribution allocation to the factor styles and use the same factors in each style, as described in section 2.

		Information ratio		
		World	USA	Europe
Value	Neutralised	0.82	0.22	0.90
	Raw	0.73	0.30	0.60
Quality	Neutralised	1.45	1.03	1.44
	Raw	0.98	0.72	0.74
Low Vol	Neutralised	0.62	0.28	0.59
	Raw	0.17	0.00	0.15
Momemtum	Neutralised	0.66	0.36	0.83
	Raw	0.28	0.14	0.46
Composite	Neutralised	1.42	0.80	1.48
	Raw	0.74	0.43	0.73

Exhibit 7. Information ratios of unconstrained long-short value, quality, low volatility and momentum factor portfolios, monthly rebalanced. Neutralised refers to the beta neutral, macro-sector neutral factor strategies targeting ex-ante 2.5% volatility at each rebalancing. Raw refers to the equivalent strategies where beta is not neutralised, macro-sectors are not neutralised and the leverage is constant over time. World and USA in USA and Europe in EUR. No transaction costs. 31-Jul-95 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

The results in Exhibit 7 show very clearly that the risk-adjusted returns tend to be significantly higher for the neutralised factors than for the raw factors. The only exception is value in the USA, which also has the lowest information ratio in the table. In the case of low volatility, the raw factors even have information ratios close to zero, which arises from the fact that, without neutralising beta, the raw factors have a negative beta and are penalised by a negative exposure to the equity risk premium.

It is remarkable how the impact of being more sophisticated but sensible, almost doubles the risk-adjusted returns of the multi-factor combinations over the long term. The conclusion is that the neutralisation of beta and macro-sectors and the targeting of constant volatility does help quite significantly over the long-term. The reasons why neutralised factors deliver superior risk-adjusted returns were the focus of one of our previous papers, e.g. Leote de Carvalho *et al.* (2017).

6.2. Was it helpful to diversify the number of factors in each factor style?

Yes! Diversifying the factors used in each style does significantly increase the risk-adjusted returns.

In Exhibit 8, we compare the information ratios of the long-short multi-factor combination from Exhibit 4, which uses the factors described in section 2, with similar strategies that differ only by using price-to-book as value, return on capital employed (ROCE) as quality, 12-month returns minus 1-month returns as momentum and historical volatility as low risk. These are found in many academic research papers about equity factors. Other than that, both strategies rely on an equal risk contribution allocation to the factor styles, and both are also beta neutral, macro-sector neutral and target a constant volatility.

The results show significantly higher risk-adjusted returns across regions for the more diversified strategies, in particularly for the USA and World. In Europe, the benefits were smaller in the period considered.

	Information ratio	
	One factor per style	Diversified
World	1.12	1.38
USA	0.47	0.72
Europe	1.37	1.45

Exhibit 8. Information ratios of unconstrained long-short value, quality, low volatility and momentum factor portfolios, monthly rebalanced, beta neutral, macro-sector neutral and targeting 2.5% ex-ante volatility. Diversified use of several factors in value, quality and momentum styles as described in section 2. One factor per style uses price-to-book for value, ROCE for quality, 12-month returns minus 1-month return for momentum and historical volatility for low risk. World and USA in USA and Europe in EUR. No transaction costs. 31-Jul-95 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

6.3. Would an allocation to the size factor help?

No, particularly not in the last few years.

We do not allocate to the size factor. One reason for this is that the true size factor would require investing in small-capitalisation stocks which are typically outside the mid to large-capitalisation benchmarks we use, such as the MSCI World, S&P 500 or MSCI Europe indices. These benchmarks are not sufficiently deep to include such small capitalisation stocks. However, we do not wish to extend the coverage of the benchmarks to smaller capitalisation stocks because that would reduce significantly the capacity of the strategies and would likely pose liquidity issues.

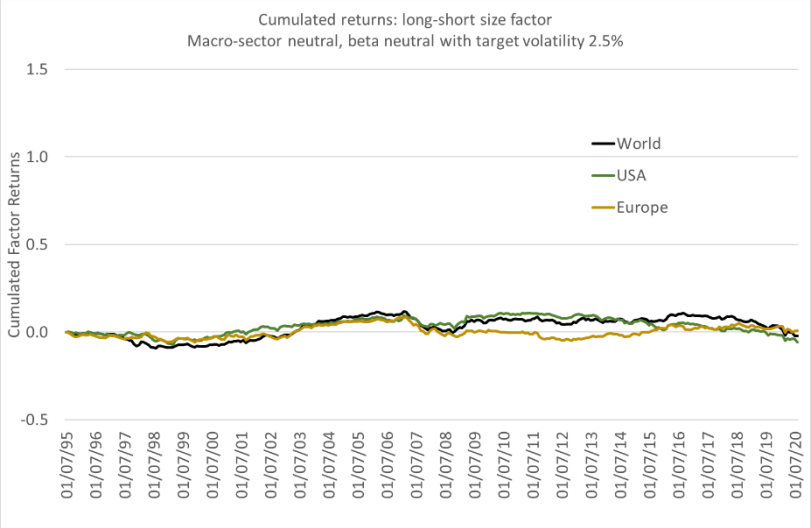


Exhibit 9. Cumulated performances of unconstrained long-short size factor portfolios, monthly rebalanced, beta neutral, macro-sector neutral and targeting 2.5% ex-ante volatility. World and USA in USA and Europe in EUR. No transaction costs. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

Moreover, we do not create even a voluntary preference towards the smaller capitalisation stocks in our indices, e.g. mid cap stocks, because our research does not suggest the existence of a premium to be earned from this tilt. To illustrate this point, we calculated the performance of a size factor constructed from the stocks in our large-mid capitalisation universes. We used the logarithm of the market cap of stocks as a factor to construct a long-short strategy that invests in the smallest capitalisation stocks and shorts the largest. The portfolio is constructed is a similar way to those for the value, quality, low risk and momentum factors in section 2, i.e. we also neutralise beta and macro-sectors, and target a constant volatility at 2.5% annualised. The performance of these long-short portfolios rebalanced on a monthly basis is shown in Exhibit 9.

The scale of the vertical axis in Exhibit 9 compares with that in Exhibit 1. Unlike the factors in Exhibit 1, this factor failed to generate a positive and significant premium in the period considered. Investors with a preference for mid over larger-capitalisation stocks would have underperformed from 1995 through 1998, then outperformed until 2007, then underperformed again during the great financial crisis and until the market trough of 2009. While the behaviour of mid versus large capitalisation across regions was comparable until then, we see subsequent divergent behaviour. The large capitalisation stocks have been outperforming since 2013 in the USA and since 2016 in the World universe. The trend in Europe was less correlated with the USA and World: Only in 2018 did we see large capitalisation stocks outperforming.

	Annualised returns				Information ratio		Annualised volatility	
	-1Y	-3Y	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95	Since 31-May-03	Since 31-Jul-95
World	-3.8%	-3.4%	-0.2%	-0.1%	-0.07	-0.04	2.6%	2.5%
USA	-4.1%	-2.6%	-0.6%	-0.2%	-0.22	-0.10	2.5%	2.5%
Europe	-1.0%	-0.4%	0.0%	0.0%	0.01	0.01	2.5%	2.5%

Exhibit 10. Annualised excess returns, volatility and information ratios of a beta neutral, macro-sector neutral constant volatility size factor. World and USA in USA and Europe in EUR. No transaction costs. 31-May-03 through 31-Aug-20. Source: Bloomberg, FactSet, Worldscope, IBES, Exshare-ICE, BNP Paribas Asset Management. For illustration only. Past performance is not indicative of future performance.

In Exhibit 10 we show the returns, information ratios and volatility of the long-short size factor portfolios, beta and macro-sector neutral, and targeting 2.5% volatility at each monthly rebalancing. We can see that returns average close to zero in the full period. The returns in the last year and in the last three years were rather poor, penalising portfolios that were more exposed to mid-capitalisation stocks than to the larger-capitalisation stocks of these indices.

We do not voluntarily seek a preference for mid-cap over larger-capitalisation stocks through an allocation to a factor size. However, we know that long-only constraints in benchmarked portfolios cause some almost inevitable exposure to the smaller-capitalisation stocks, in particular as the concentration of benchmark indices grows. That arises because as concentration increases, it becomes increasingly difficult to avoid underweighting the largest market-capitalization stocks to fund other active overweight positions in long-only portfolios. Similarly, because shorting stocks is not possible, the increasing concentration also makes it increasingly difficult to underweight unwanted stocks if their market capitalisation is increasingly smaller. This is what has been happening in particular in the USA and World benchmark indices. For example, the market capitalisation of the five largest stocks in the S&P 500 index just reached 22% in Aug-20 when compared to just 10% in Sep-13. In Aug-20, just 4% of the stocks in the S&P 500, i.e. 20 stocks, accounted for 39% of the index market capitalisation. For the

MSCI World index, the five largest capitalisation stocks accounted for 14% of the index market capitalisation in Aug-20 versus just 5% in Mar-10. This effect explains in part why the recent returns in Exhibit 4 to the long-only multi-factor portfolios were worse than to the long-short portfolios as in Exhibit 3.

7. Key takeaways

This paper was motivated by the recent poor performance of those approaches as found in reports from a number of quant equity managers and in the financial press. Thus, we investigated the performance of equity factors and multi-factor portfolios in the World, USA and Europe and looked at recent performances from a historical point of view.

The main conclusions of this paper are that the recent poor performance is not unusual in multi-factor approaches as it is not the first time these strategies have experienced difficult times. Other difficult periods have included the run-up to the tech bubble in 1998-00 and the great financial crisis period of 2009-11. However, there are some differences between now and then. In the tech bubble of the period 1998-00, almost all factors failed across the three regions. The performance of factors eventually came back as the tech bubble burst. Similarly, in the great financial crisis, in particular at the time of the market rebound in 2009, a large number of factors failed, also resulting in a drawdown.

However, the recent period of poor performance is somewhat more subtle. The main culprit was without doubt the value factor, which performed poorly across regions. Low risk also performed poorly but mainly in 2020 and only in the World and USA, not in Europe. On the contrary, momentum and in particular quality had good performances across regions. Nevertheless, a multi-factor combination that relies on diversification, i.e. based on equal risk contribution to the factor styles, would not have escaped some underperformance despite the good performances of quality and momentum. The second culprit was the size factor. Managers voluntarily allocating to the size factor, creating a preference to smaller-capitalisation stocks in their portfolios, would have likely increased the extent of their recent underperformance. Long-only managers would have also suffered from a side impact of the long-only constraints, which forces some exposure to smaller-capitalisation stocks in their benchmarked portfolios.

The results here are not likely to be a worst-case scenario. In fact, we would expect a number of equity quant managers to have performed worse than shown here. First, because we know that most equity quant managers tend to rely even more on value than on other factors, as recently mentioned in the report by Harmsworth (2020). Second, because we also know that a number of equity quant managers voluntarily allocate to the size factor, which should have made their performances even worse. Finally, the fact that long-only portfolios are almost inevitably exposed to the size factor, and that this exposure likely increases with tracking error, we would expect poorer performances for the managers offering long-only multi-factor strategies with higher tracking error.

Additional reasons for expecting poorer performances than reported here include the fact that our simulations are based on a number of choices we made when it comes to factor and portfolio construction. Those choices include an equal risk contribution allocation to the value, quality, low volatility and momentum factor styles, the used of a diversified set of factors in each style, the neutralisation of beta and macro-sectors, the targeting of a pre-selected level of tracking error, and the application of long-only constraints to the final strategies. These reflect the choices in our proprietary multi-factor strategies but are not the standard in the industry. Managers that take the more conventional choice of not neutralising beta, not neutralising sectors, not targeting a constant level of risk or just relying on a less diversified set of factors in each style or relying on the most common factors used by academics were more likely to deliver poorer performances.

One last important question is: What should we expect now? While we can never say for sure, it is clear that some of the recent trends seem largely overstretched. Both value and size underperformance is significant from a historical point of view. The valuation gap between the cheap and the expensive stocks in sectors is at historically high levels, and the level of concentration in the market capitalisation benchmark indices has also reached historical highs. We would find it surprising should the trends seen in both value and size continue much further. We thus think that the multi-factor strategies are now likely to start coming back as factor performances re-normalise to their long-term trends, even if this may take time to fall more firmly into place.

8. References

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9. Disclaimer

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