



RESEARCH COMPENDIUM 2018

By FactorResearch

Abstract

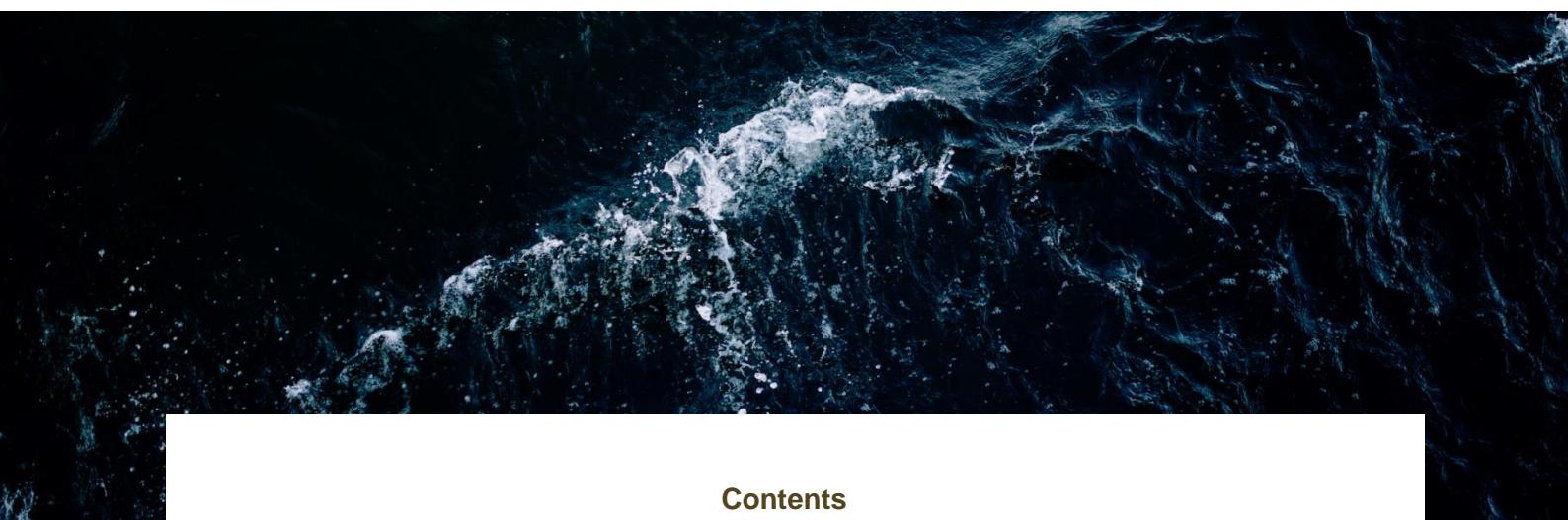
The Research Compendium 2018 includes 50 research notes and 4 white papers that were published on FactorResearch.com and other media in 2018.

The objective of these research reports is to analyse factor investing and quantitative strategies from a practical perspective and highlight issues that may not be significant for more rigid academic papers. They are kept brief, as simple as possible, and will hopefully stimulate debate.



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FACTOR INVESTING MADE IN CHINA

Harvesting Factor Returns in the Middle Kingdom

December 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CAIA Association's AllAboutAlpha blog.

SUMMARY

- Common equity factors generated attractive risk-adjusted returns in the Chinese stock market
- Factor performance in China often mirrors global factor performance
- Indicates common factor drivers that permeate even emerging and isolated markets

INTRODUCTION

Economic news like changes in GDP growth are frequently used by financial commentators to explain the daily ups and downs of the stock market. However, research by Dimson et al (2002) revealed that there is a modest negative correlation between long-run equity returns and economic growth by analysing multiple countries over a century. China is a prime example of this unusual relationship as the economy has been growing at a steady 7% per annum in recent years while its stock market had anything but a steady performance.

Until recently investors were fortunate enough to be able to ignore Chinese stocks as these had a low weight in global benchmarks. However, in 2018 MSCI increased the number of Chinese A shares in its global emerging market index, which is followed by \$1.6 trillion of assets. Although Chinese stocks still have a relatively low weight in global benchmarks, emerging market investors are forced to spend more time analysing these stocks and contemplate what kind of strategies work in the Chinese stock market. In this short research note, we will investigate applying classic factor investing strategies to Chinese stocks.

METHODOLOGY

We focus on all A shares traded in Chinese stock markets in the period from 2008 to 2018. The factor performance is calculated by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks ranked by the factor definitions. Only stocks with a minimum market capitalization of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points. It is worth noting that there are few data points available for historical transaction costs for Chinese stocks.

THE NON-PERFORMING CHINESE STOCK MARKET

The Chinese stock market comprised of A shares, which are companies from mainland China that are traded in Shanghai and Shenzhen, has not been attractive for investors in the last two decades. There have been two major boom and bust cycles since 2000, which featured drawdowns of larger than 70%. The Chinese government tried to control the last crash in 2016 by forcing state-related entities to buy declining stocks and introducing



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maximum daily price changes, but unsurprisingly these measures failed to stop the stampede of exiting investors.

The poor performance of the Chinese stock market is frequently explained by that the composition does not reflect the dynamic nature of the economy appropriately. Many of the largest A shares companies are state-owned entities that are managed inefficiently while most of the highly successful Chinese companies like Alibaba are listed in Hong Kong, London or New York.



Source: FactorResearch

FACTOR INVESTING IN CHINESE STOCKS

We focus on three factors namely Value, Momentum and Quality. It is worth noting that shorting Chinese stocks has historically been prohibited or exceedingly difficult, therefore we show factor performance for portfolios that short stocks as well as short the index, which is somewhat easier. In addition, we contrast the performance of factors in Chinese stocks to the global factor performance.

Chinese stock markets are dominated by retail investors, which are less analytical than institutional investors. Therefore we would expect a Value strategy that requires investors to analyse fundamentals to perform less well. We define the Value factor by a combination of price-to-book and price-to-earnings multiples.

In contrast to our expectations, the long-short Value factor in Chinese stocks generated positive excess returns since 2008, albeit with little consistency. Comparing Chinese to global factor performance does not indicate a strong relationship.

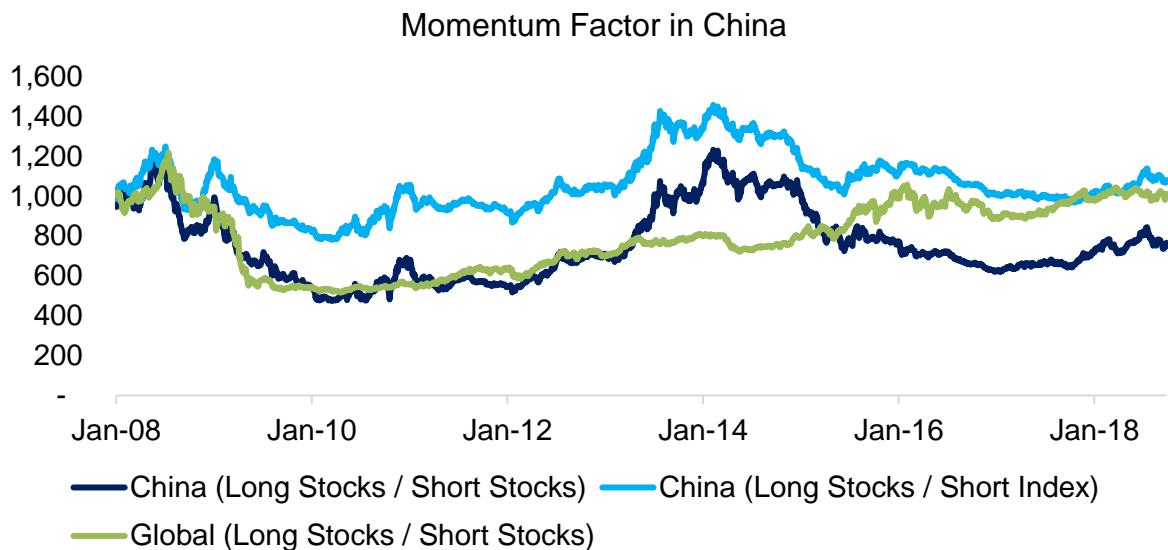


Source: FactorResearch

Retail investors tend to chase performance. Investors might therefore expect the Momentum factor, which is defined as buying winners and shorting losers as measured over the stock performance of the last 12 months, excluding the most recent month, to perform strongly.

However, the Momentum factor in China generated relatively flat returns since 2008. More interesting and contrasting to Value, comparing the Chinese and global Momentum factor shows shared trends.

We observe that the Momentum crash of 2009 is clearly visible in the Chinese stock market, which would indicate that Chinese investors behave similarly to global investors. However, the analysis also highlights that between 2013 and 2015 the Momentum performance in Chinese stocks was significantly different to the global factor performance.



Source: FactorResearch

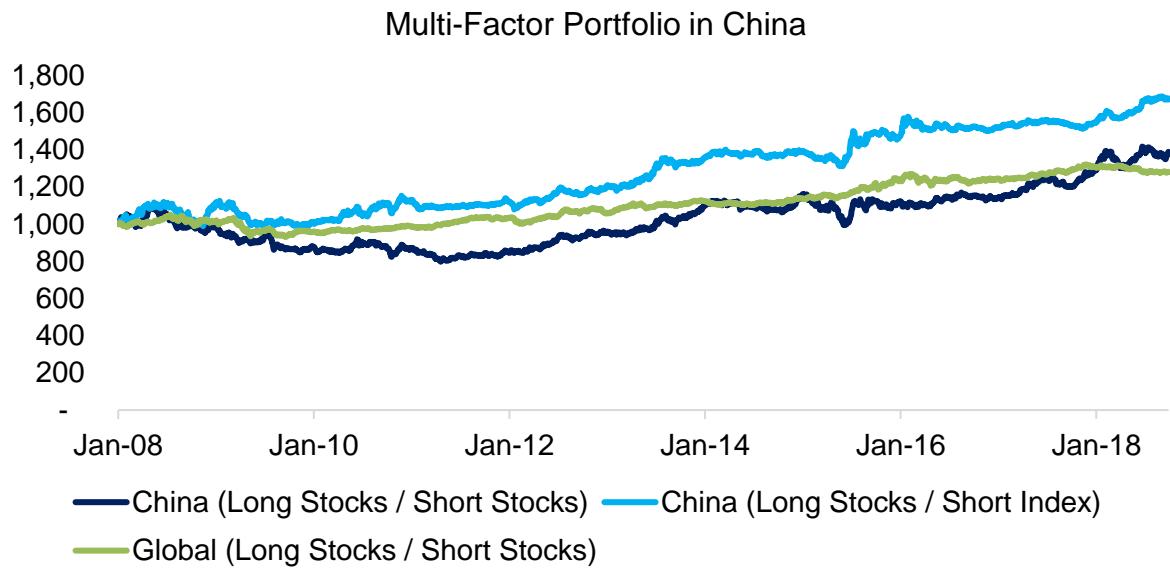
Chinese stock markets feature a large number of companies where the government is the majority owner. These are typically diversified companies that exhibit low profit margins and high levels of debt. The Quality factor represents the strategy of shorting low-quality and buying high-quality stocks, which generated attractive returns in Chinese and global stock markets since 2008. Similar to the Momentum factor, there seem to be shared trends across markets, indicating common drivers of factor performance.



Source: FactorResearch

Next, we create classic multi-factor portfolios by equally allocating to the Value, Momentum, and Quality factors. The performance is relatively consistent across time and therefore attractive for investors. The performance of the multi-factor portfolios in Chinese and global

stock markets are comparable, which is to be expected given that the single factors share trends.

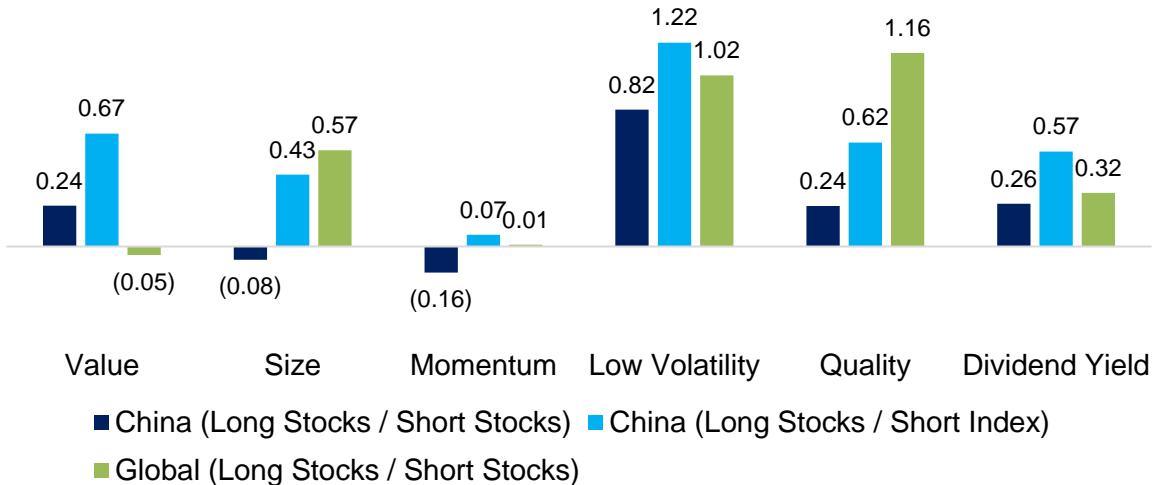


Source: FactorResearch

Finally, we analyse the risk-return ratios of six common equity factors in the Chinese stock market. A few observations:

- Factor investing in Chinese stocks generated attractive risk-adjusted returns
- Shorting the index was more attractive than shorting stocks
- Chinese factor performance mirrors approximately global factor performance
- Low Volatility and Quality were most while Size and Momentum factors were least attractive

Risk-Return Ratios of Factors in China (2008 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

The short research note highlights that factor investing in Chinese stocks was attractive, albeit mirrors global factor performance, which is somewhat surprising as investors might have expected completely alien factor performance. Given that trading Chinese stocks has been difficult for foreign investors, the factor performance is explained by the behaviour of local investors. It is another indication that factors have common drivers across sectors and markets, even if emerging and isolated.

RELATED RESEARCH

[Equity Factors in Japan](#)

FACTOR OPTIMISATION (WHITE PAPER)

Pure versus Dirty Factors

December 2018. Reading Time: 15 Minutes. Author: Nicolas Rabener.

SUMMARY

- Equity factors exhibit sector biases and exposures to other common factors
- A factor optimisation process allows investors to create pure factors
- Risk-adjusted returns do not increase, but pure factors are attractive from analytical, risk and allocation perspectives

INTRODUCTION

When large quantities of organisms like zooplankton and algae are buried underneath sedimentary rock and subjected to intense heat and pressure, petroleum is created. It is a substance that is usually brown or black and contains a mixture of gas, liquids and solid hydrocarbons.

The Chinese were the first to start refining petroleum into fuel about 2,000 years ago. Being able to refine petroleum into oil and gasoline has been instrumental in accelerating the growth of human civilization as these have become primary energy sources.

In factor investing, single factor portfolios can be considered the equivalent of petroleum as they are essentially unrefined. Creating a Value factor portfolio consists of ranking stocks on single or multiple valuation metrics like price-to-book or price-to-earnings multiples. However, the resulting portfolio will by nature feature biases to certain sectors and exposure to other common equity factors.

In this white paper, we will introduce a factor optimization process that maximises the exposure to a target factor and minimises the exposure to non-target factors. We will initially focus on the Value factor in the US, then expand to other common equity factors in the US, and finally conclude with multi-factor portfolios across markets.

METHODOLOGY

We focus on five factors namely Value, Size, Momentum, Low Volatility, and Quality in the US, European, and Japanese stock markets. The factor definitions are in line with industry standards and the factor performance is calculated by constructing beta-neutral long-short portfolios by taking the top and bottom 10% of the stock universe ranked by the factor. Only stocks with market capitalisations of larger than \$1 billion are considered. Portfolios are rebalanced monthly and 10 basis points of costs per transaction are included. The analysis covers the period from 2001 to 2018.

MODEL OBJECTIVE

The objective of the optimisation process is to maximise the exposure to a single target factor and minimise the exposure to defined non-target factors. The optimisation process



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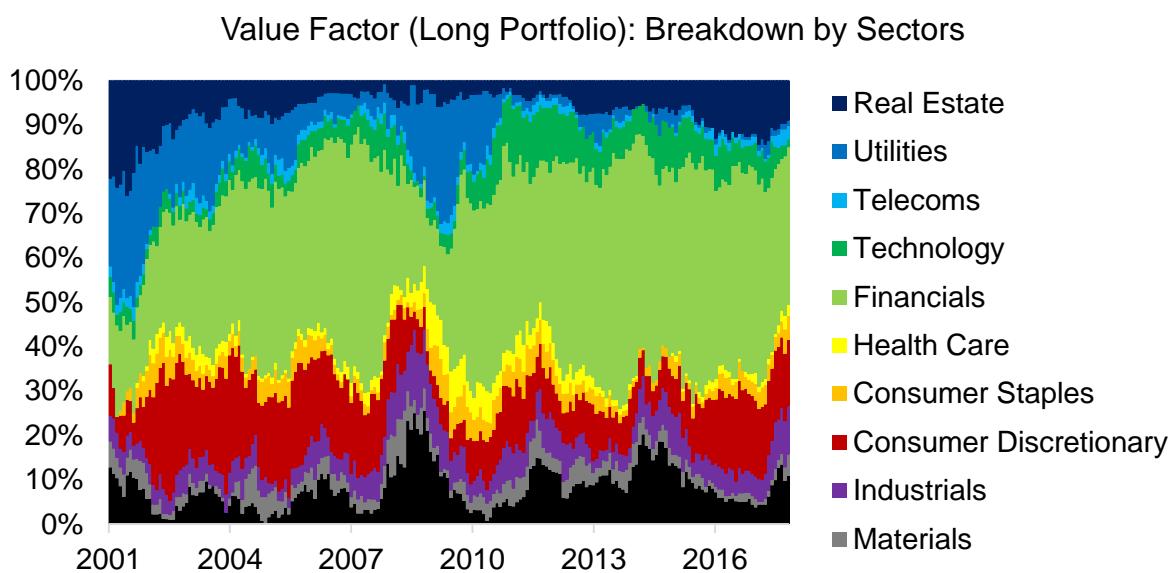
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impacts the stock selection process and leads to different portfolio composition, which may have positive or negative consequences on factor performance.

RAW VERSUS PURE VALUE FACTOR IN THE US

The long-short Value factor is defined as buying cheap and shorting expensive stocks. Specifically, we use a combination of price-to-book and price-to-earnings multiples for the stock selection process.

The analysis below highlights that the resulting long portfolio of the Value factor in the US had strong sector biases over time. We observe that most cheap stocks were contributed by the financial sector, which implies that the returns of the Value factor were strongly influenced by the performance of the financial sector.



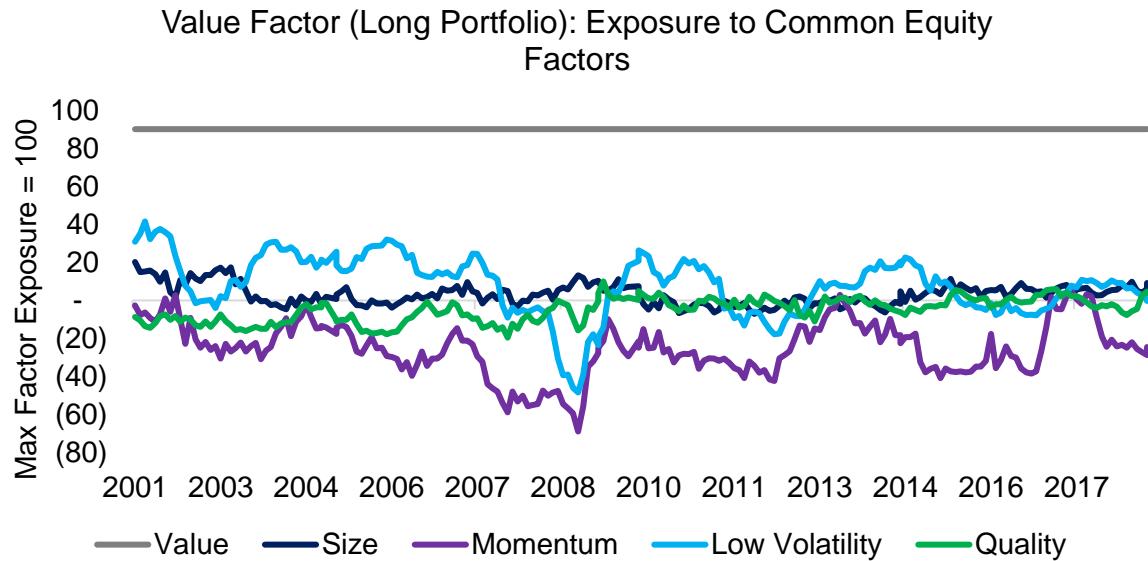
Source: FactorResearch

Factor investing aims at systematically harvesting factor returns that exist due to behavioural biases or other reasons. Betting on certain sectors can be considered risky as it is a different game. Fortunately, long-short factor portfolios can be constructed sector-neutral, which eliminates any sector biases and allows investors to harvest factor returns independent of sector trends.

However, a Value portfolio also exhibits exposure to other common equity factors, even if structured sector-neutral. For example, cheap stocks typically have small market capitalisations, rank low on quality metrics, and feature declining stock prices as these companies are characterised by temporary or structural issues.

A factor exposure analysis reveals that the long portfolio of the Value factor had slightly positive exposure to the Size and Low Volatility factors while negative exposure to the Momentum and Quality factors. The analysis below highlights that a Value investor has

indirectly been shorting the Momentum factor, which may be considered unintended and undesirable.

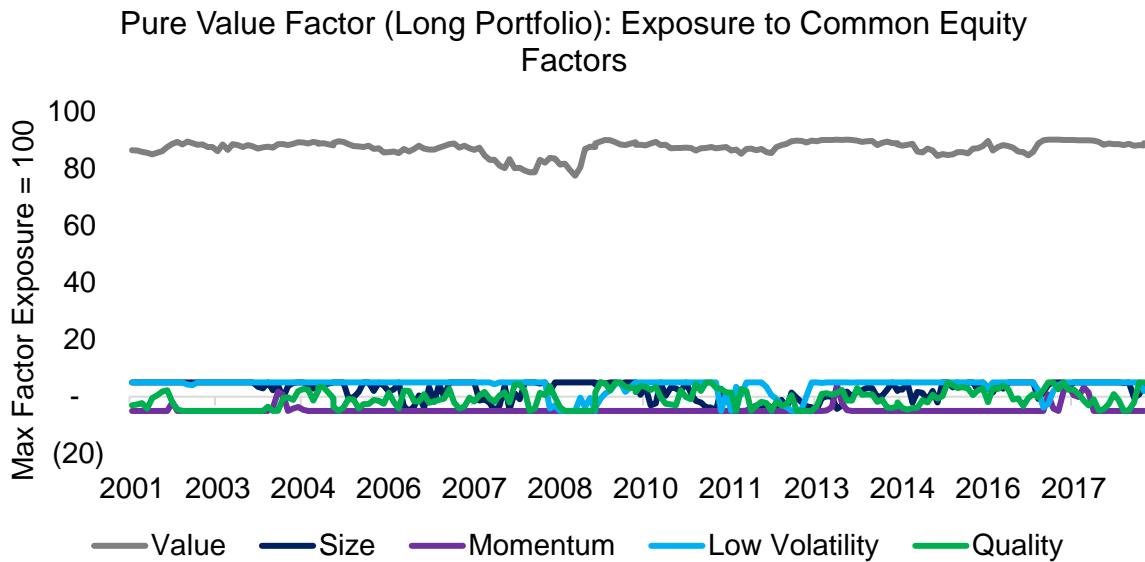


Source: FactorResearch

We can utilize an optimisation process during the stock selection process that maximises the exposure to the Value factor while minimising the exposure to other common equity factors. As a result, the optimised portfolio will feature slightly different stocks and weights compared to the original portfolio. The algorithm underlying the optimisation process will consider the factor scores of each stock at the rebalancing date and then provide the optimal weights to achieve the defined objectives.

Although we are only considering common equity factors, the optimisation process can be applied to any financial variable, e.g. foreign exchange or interest rates. Investors can use such a process to create highly tailored portfolios that provide specific exposures.

A factor exposure analysis of the long portfolio of the Value factor post the optimisation process, which therefore is labelled Pure Value factor, shows high exposure to the Value factor and minimal exposure to other factors.

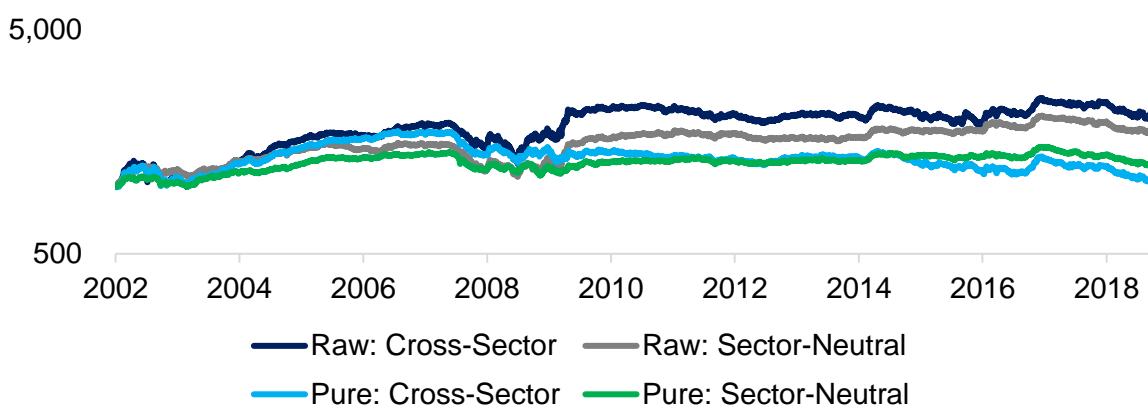


Source: FactorResearch

The optimisation process therefore allows investors to harvest the returns of the Value factor with limited risk to other factors. However, the stock portfolios of the raw and pure factor are different, which will impact factor performance.

The analysis below shows the performance of the cross-sector and sector-neutral Raw and Pure Value factors. The cross-sector Raw Value factor, which is the most unconstrained portfolio, generated the highest returns. The sector-neutral Pure Value factor, which is the most constrained version of the Value factor, was similar in trend but was effectively flat since 2002.

Value Factor in US: Raw versus Pure Factor Performance



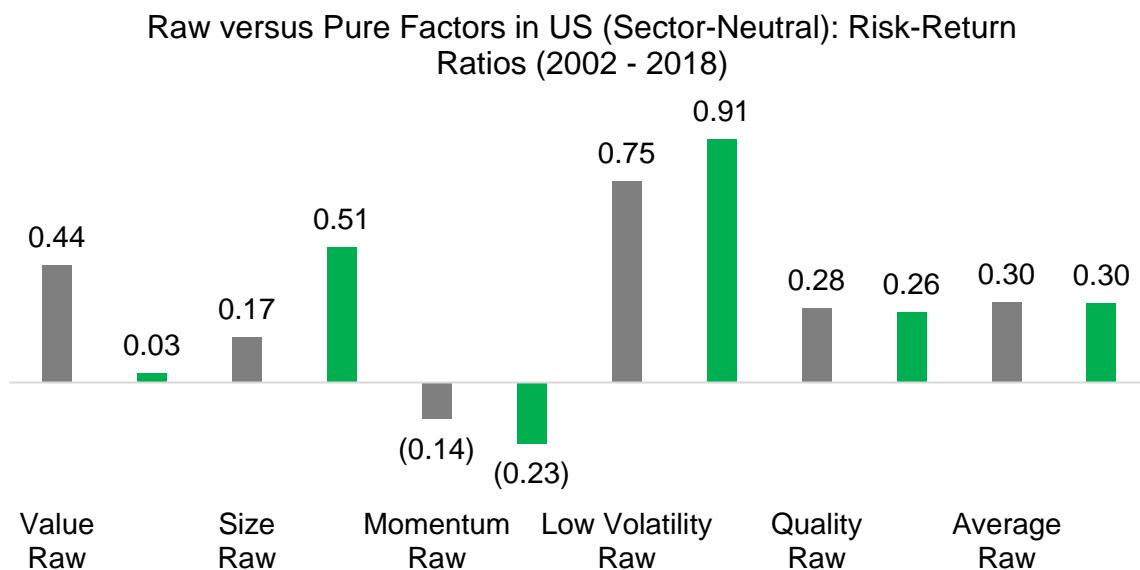
Source: FactorResearch

It is worth noting that the objective of the optimisation process is to remove undesired risk, not to increase returns. The results therefore simply highlight the contribution of other factors to the performance of the Value factor.

RAW VERSUS PURE FACTORS IN THE US

Next, we expand the analysis to other common equity factors in the US stock market and focus on risk-adjusted returns. Raw and pure factors are both constructed sector-neutral to show the impact of the optimisation process. Each of the pure factors has been optimised to maximise the exposure to the target factor and minimise the exposure to non-target factors.

We observe in the analysis below that the risk-return ratios improved for some factors and deteriorated for others. Investors might have expected that the optimisation process reduces risk by eliminating exposures to other factors and therefore leads to higher risk-return ratios, but factor purification is more alike to crystallising than to reducing risk.



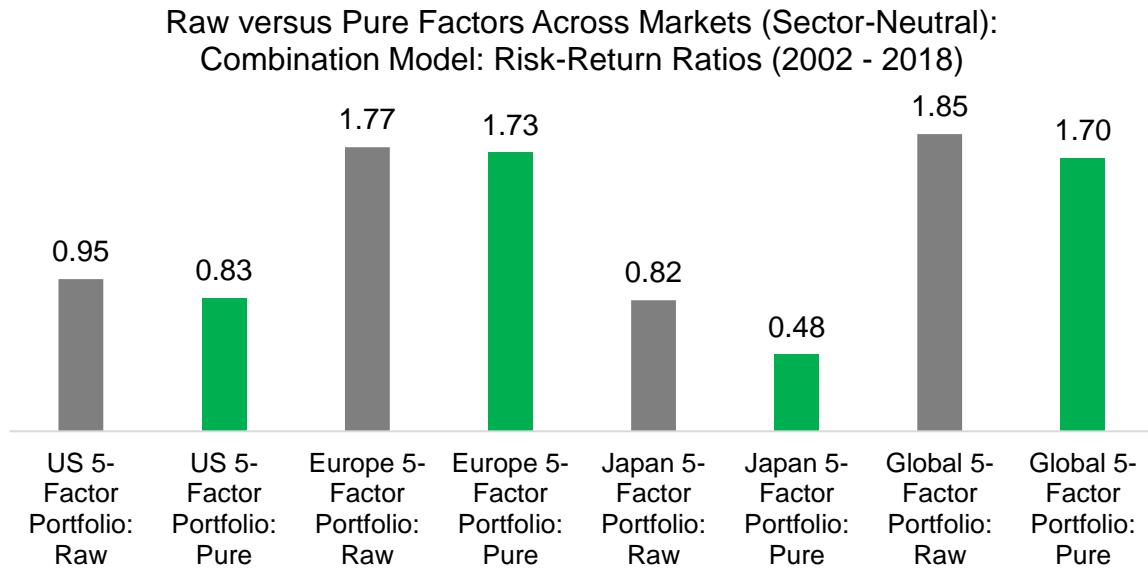
Source: FactorResearch

RAW VERSUS PURE FACTORS ACROSS MARKETS

Finally, we optimise factors in US, European, and Japanese stock markets and create multi-factor portfolios, which allocate equally to five factors that are all created sector-neutral. These are the Value, Size, Momentum, Low Volatility, and Quality factors. Specifically, we use two methodologies to create multi-factor portfolios:

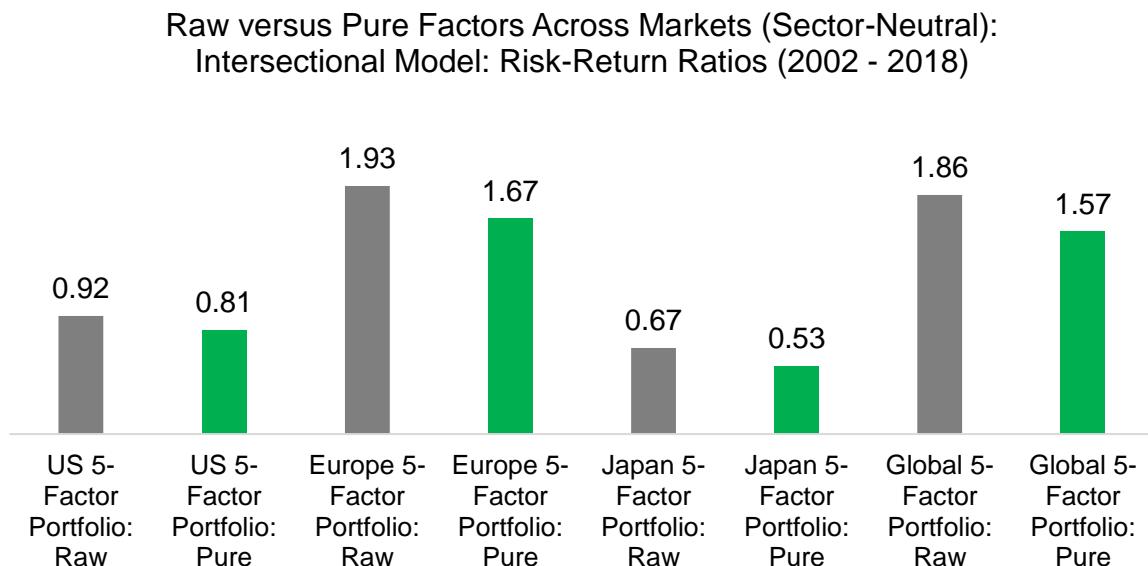
- Combination model: This approach calculates single-factor performance and then combines these in one multi-factor portfolio
- Intersectional model: This model ranks stocks by several factors simultaneously and then derives one multi-factor portfolio

The multi-factor portfolios created via the combination model exhibit slightly lower risk-return ratios across markets after applying the optimisation process. The differences are not meaningful in the US and Europe, but significant in Japan.



Source: FactorResearch

Similarly, the risk-return ratios of multi-factor portfolios created via the intersectional model also decreased compared to raw multi-factor portfolios. It is worth noting that the results of the combination and intersectional models are relatively comparable. Please see our other white paper [Multi-factor Models 101](#) for further details.



Source: FactorResearch

RESULTS DISCUSSION

The analysis highlights that constraining factors via an optimisation process has consequences for performance. The risk-adjusted returns were slightly lower for pure factors across markets. Investors might therefore argue that the raw factors are more attractive.

However, pure factors have desirable features from the following perspectives:

- Refined analytics: Pure factors empower investors to improve their understanding of factor performance, i.e. how much of the factor performance can be explained by other factors.
- Higher diversification benefits: Raw factors exhibit sector biases and exposure to other factors, therefore may represent duplicate risk exposure for a portfolio. Sector-neutral pure factors are less correlated and therefore provide higher diversification benefits for a portfolio.
- Tailored factor portfolios: Investors often focus on specific factors from a philosophical perspective, but will indirectly have exposure to other factors. Pure factors feature minimal exposure to other equity factors and allow investors to create portfolios that are tailored to their investment philosophies.
- Improved factor allocation:
 - Risk parity: Investors using risk parity models to allocate to factors require volatility as an input for calculating allocation weights. Pure factors provide less diluted factor volatility and likely improve the allocation process.
 - Tactical models: Investors who tactically allocate to factors typically want to avoid exposure to other factors as they have specific reasons for allocating to a target factor. For example, some factors might be considered crowded and therefore unattractive for an allocation. Pure factors allow to minimise the exposure to non-target factors.

Raw factors require fewer calculations than pure factors, but effectively resemble multi-factor portfolios with sector biases. Conversely, sector-neutral pure factors provide an undiluted perspective on factor performance.

FURTHER THOUGHTS

Two decades ago the outperformance of a fund manager was called alpha. Supported by better data and new technologies investors today realise that there is very little alpha and that most excess returns can be explained by exposure to sectors or systematic factors.

In factor investing the next frontier is to isolate the pure factors returns and identify the underlying factor drivers, which then can be used to create better allocation models. Ultimately it is a search for truth, which may not be pleasant, but will make us better investors.

RELATED RESEARCH

White paper: [Factor Allocation Models](#)

White paper: [Multi-factor Models 101](#)



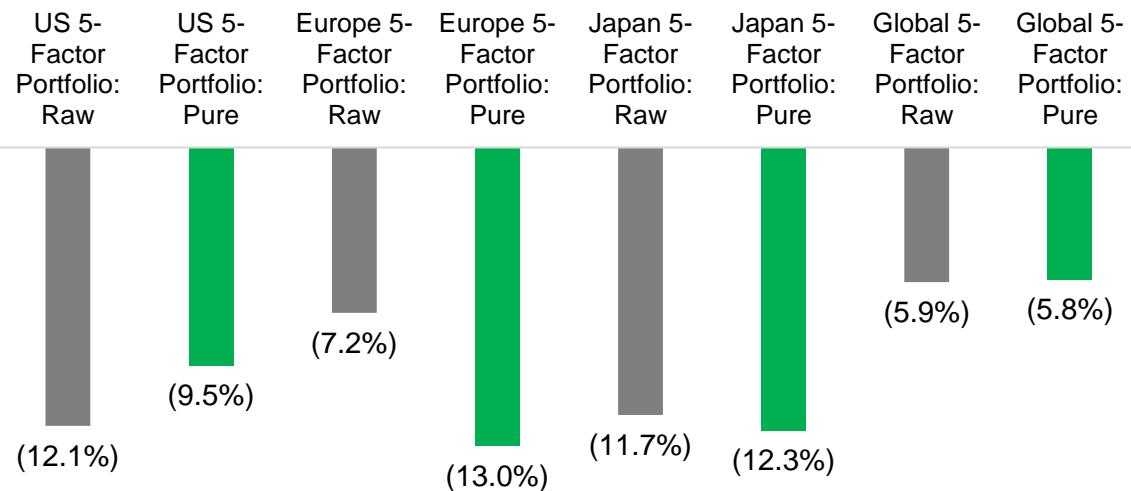
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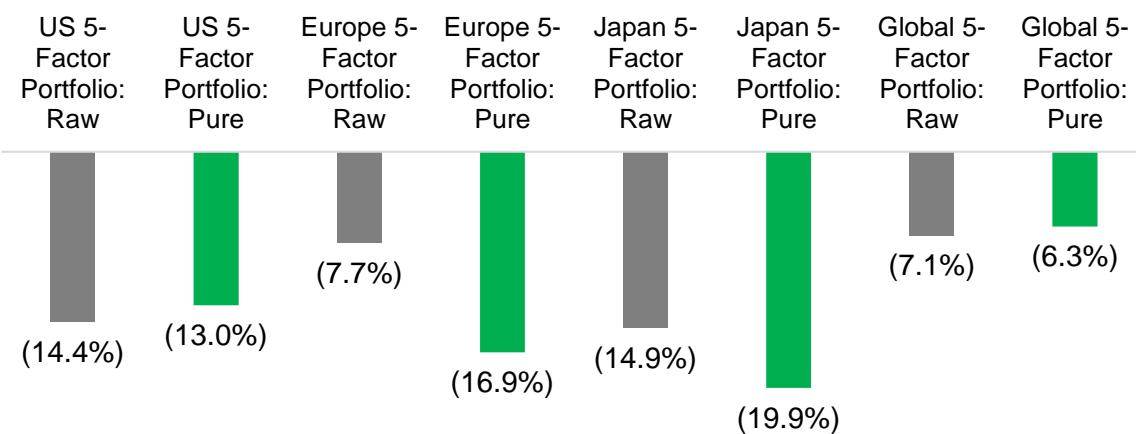
APPENDIX

Investors might also be interested in the maximum drawdowns, which are shown for multi-factor portfolios for the period from 2002 to 2018. The maximum drawdowns reached were comparable when using sector-neutral raw and pure factors, regardless if the combination or intersectional model was employed for creating the multi-factor portfolios.

**Raw versus Pure Factors Across Markets (Sector-Neutral):
Combination Model: Max Drawdowns (2002 - 2018)**



**Raw versus Pure Factors Across Markets (Sector-Neutral):
Intersectional Model: Max Drawdowns (2002 - 2018)**



Source: FactorResearch

PRIVATE EQUITY: THE EMPEROR HAS NO CLOTHES

Replicating Private Equity with Public Equities

December 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Private equity returns can be replicated with small cap equities
- Small, cheap and levered stocks would have achieved higher returns since 1988
- Valuation and debt multiples are at all-time-highs, lowering expected returns

FROM BUST TO BOOM

The private equity industry had an abysmal outlook in 2008 and many portfolio companies were at the brink of collapse. Carlyle Capital, a listed affiliate of the US buyout giant The Carlyle Group, defaulted on its debt.

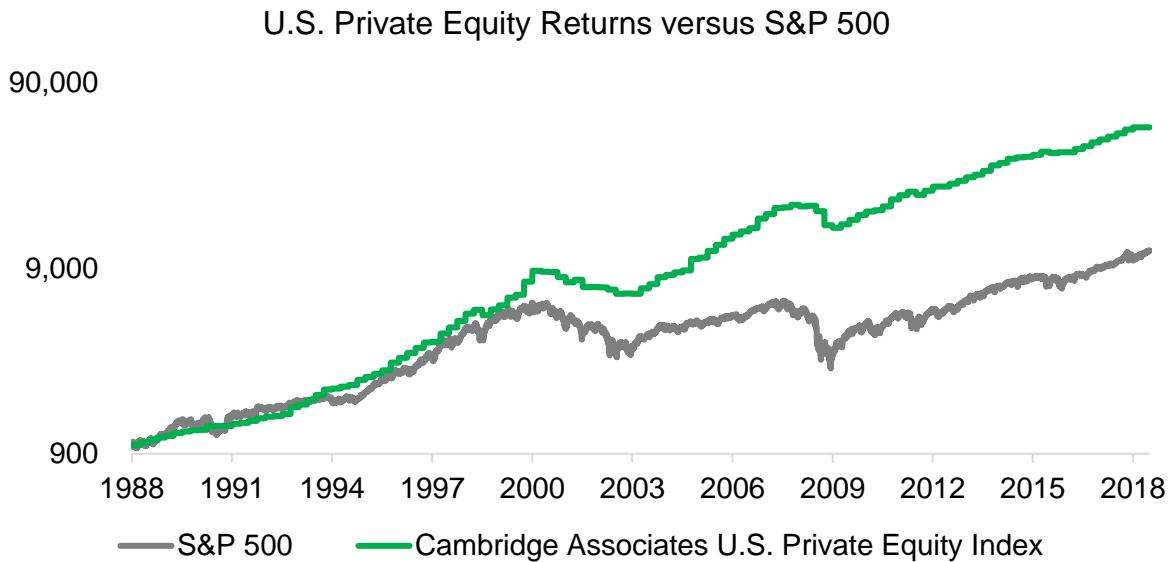
Fast-forward to 2018 and such global financial crisis-related difficulties seem almost forgotten and private equity is flourishing. Indeed, alternative investment firms have \$1.8 trillion in "dry powder" waiting in reserve and more than half of that is held by private equity funds.

The fondness for private equity among institutional investors is easy to explain: It comes down to high returns, low volatility, and a lack of correlation to traditional asset classes. Of course, such attributes also evoke some skepticism: Don't they sound just too good to be true?

To explore that question, we set out to replicate private equity returns with public stocks.

PRIVATE EQUITY RETURNS VERSUS THE S&P 500

Private equity returns in the United States have outperformed various equity and bond benchmarks over the long term, according to data from Cambridge Associates. Private equity returns are compiled from 1,481 US private equity funds and are available net of fees on a quarterly basis. Using this data, we construct a U.S. Private Equity Index that has outperformed the S&P 500 by a significant margin since 2000.



Source: Cambridge Associates, FactorResearch. Private equity returns are only available as IRRs and not CAGRs, so should be viewed as an approximation when comparing to public equity returns.

Not only has it outperformed, the U.S. Private Equity Index also has much lower volatility than the S&P 500. This no doubt has an appeal for institutional investors. Unfortunately, it is more illusion than reality. After all, private equity portfolio companies are typically valued on a quarterly basis so lack a daily time series. In addition, most portfolio company valuations are smoothed as they are conducted by external appraisers using business plans from the private equity firms.

If private equity firms valued their portfolio companies on a daily basis using public market multiples, volatility would be much higher and more reminiscent of the S&P 500.

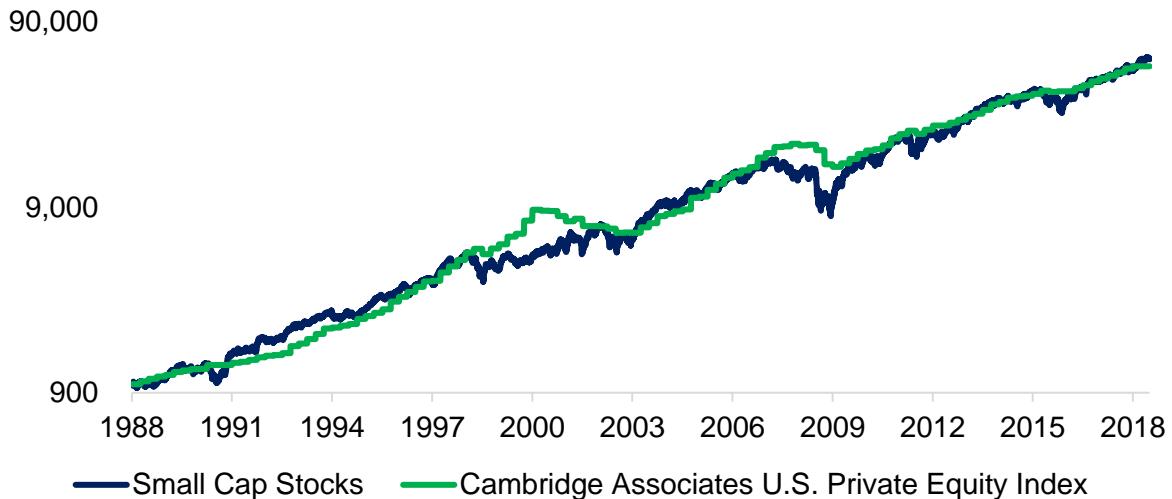
EXPLAINING PRIVATE EQUITY RETURNS

Bryan Burrough and John Helyar immortalized the private equity industry in “Barbarians at the Gates”, their account of the 1988 buyout of RJR Nabisco. The deal, which involved many prominent Wall Street characters, was valued at a then-unprecedented \$25 billion.

Although private equity today is renowned for enormous buyouts, take-over targets historically were much smaller simply because private equity funds held much less capital. The average transaction size was much more in line with small-cap equities.

Based on this data point, we create an index of the 30% of the smallest US public companies with market capitalizations over \$500 million. As it turns out, the small-cap equity index and the U.S. Private Equity Index have almost identical returns. The performance profiles also demonstrate that private equity returns are not as uncorrelated to public equities as institutional investors might like them to be.

Replicating Private Equity Returns with Small Cap Equities



Source: FactorResearch

Maybe the U.S. Private Equity Index only represents average returns and not those of the top-performing funds. But ample academic research shows that fund selection is challenging across all asset classes. Choosing the funds with the best historical returns is rarely a winning strategy. Therefore, average returns are likely reflective of the actual returns that investors should expect from private equity allocations.

LIQUID PRIVATE EQUITY ALTERNATIVES

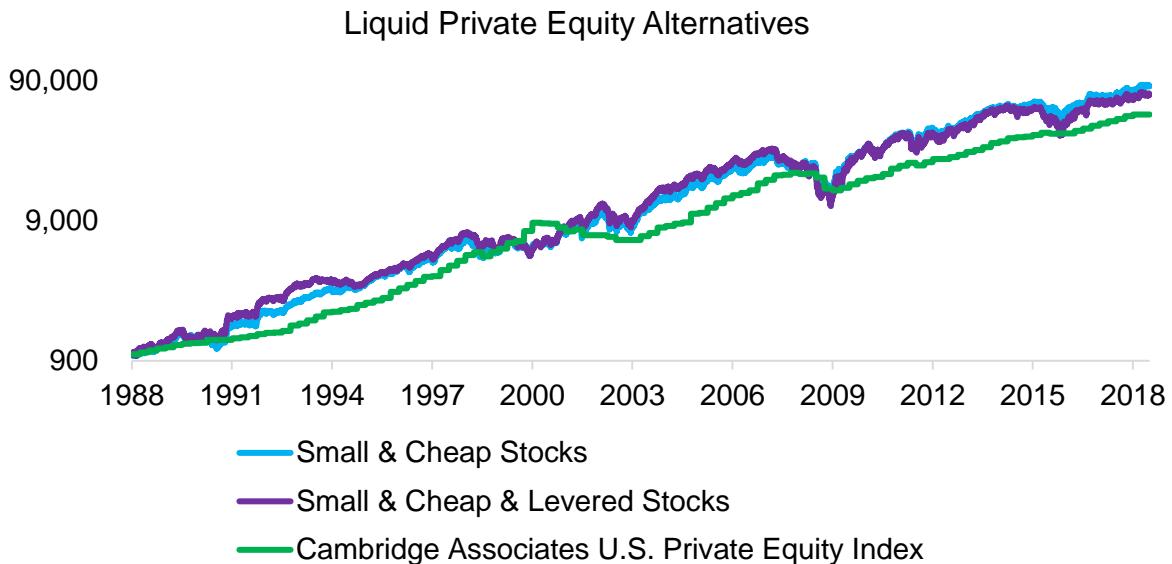
In addition to their smaller size, private equity target companies have also tended to share other characteristics, among them lower valuation multiples and the ability to carry debt.

Companies trading at lower valuations often have temporary or structural issues that private equity firms see as opportunities. By swooping in and addressing them, the private equity firm can unlock value.

Although much less leverage is applied in private transactions today than when the sector got rolling in the 1980s, recouping the initial equity investment quickly through a dividend recap financed by additional debt remains a popular strategy. Companies with proven cash flows and the ability to take on debt are still popular targets.

So we create two portfolios: one with small and cheap stocks and another with small, cheap, and levered US stocks. Cheap stocks have low EV-to-EBITDA multiples and levered stocks high debt-to-EBITDA multiples.

What did we find? From 1988 to 2018, the liquid private equity alternatives portfolios outperformed the U.S. Private Equity Index. They provide daily liquidity and require minimal initial due diligence and ongoing monitoring. They can also be rebalanced quarterly and managed internally or outsourced to any asset manager for a few basis points.



Source: Cambridge Associates, FactorResearch

FURTHER THOUGHTS

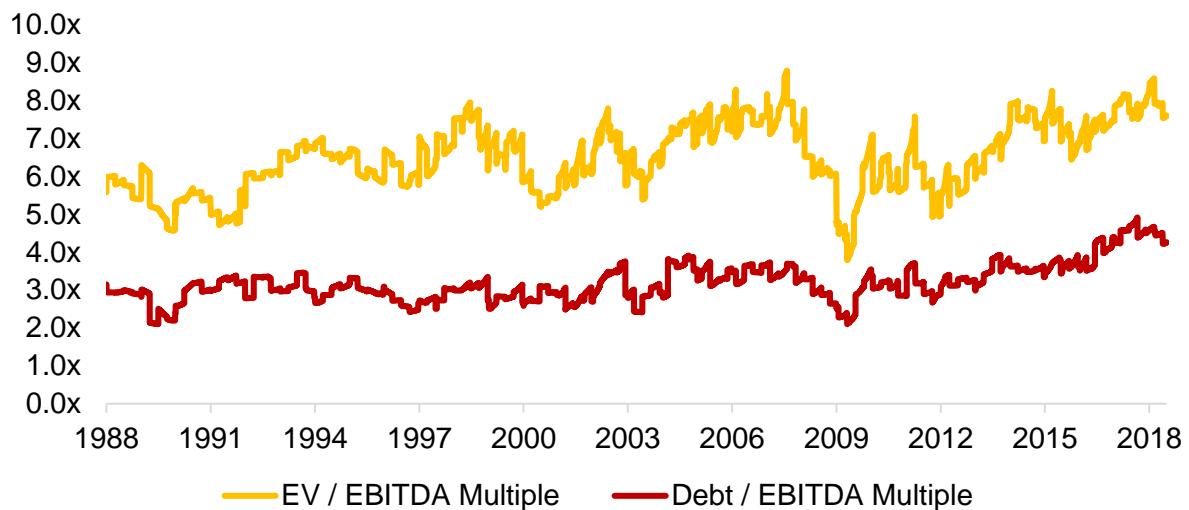
Exposure to small caps likely explains private equity returns. Liquid alternatives to private equity can be created simply by buying small, cheap, and levered stocks.

Some have reached similar conclusions and proposed that the nature of locked-up capital is what makes private equity so advantageous. It keeps investors from redeeming their funds at market lows and helps private equity firms weather storms like the global financial crisis. But the same fund structure can be replicated through public equities at a fraction of private equity fees.

Furthermore, with \$1.8 trillion sitting on the sidelines, too much money may end up chasing too few deals, creating high acquisition multiples that don't augur well for expected returns.

Of course, high valuations are now the rule in both private and public markets. And corporate debt levels are at all-time highs.

Small, Cheap and Levered Stocks: Valuation and Debt Multiples



Source: FactorResearch

Neither of these developments bode well for expected returns. So investors might be wise to reconsider direct private equity allocations and their liquid alternatives altogether.

RELATED RESEARCH

[Chasing Mutual Fund Performance](#)

TACTICAL STATISTICAL ARBITRAGE

Tactical versus Strategic Exposure

November 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Statistical arbitrage behaves similarly across markets
- Volatility is the main performance driver
- Attractive strategy for diversifying an equity portfolio

INTRODUCTION

Strategies like Value or Momentum are like staples that deserve a permanent allocation in investors portfolios. In contrast, other strategies are more like sunscreen, which is mainly used tactically to minimize the risk of getting a sunburn when going to the beach. Statistical arbitrage is a strategy that is likely more interesting on a tactical than strategic basis as returns are only attractive when volatility is high. In this short research note we will investigate statistical arbitrage across markets and the utilization as a tactical strategy for hedging equity portfolios.

METHODOLOGY

We focus on all stocks in the US, European and Asian markets with a market capitalization of larger than \$1 billion. The strategy is to create a diversified portfolio of pair trades, which will be dollar-neutral. Each pair consists of one long and one short position in stocks. In addition, the two stocks of a pair need to be cointegrated, which is measured with a one-year lookback and a maximum p-value of 0.3. A trade in a pair is entered when the z-score of the stock price ratio breaches +/- 2.0 and exited when the z-score reaches 0 subsequently. The z-score is calculated with a 21-day lookback. Each transaction incurs 10 basis points of costs. The portfolio is created sector-neutral in the US while cross-sector in other stock markets.

It is worth noting that statistical arbitrage is a sophisticated strategy that comes in all kind of forms and requires many assumptions. Our methodology is in line with academic research and relatively simple.

STATISTICAL ARBITRAGE ACROSS MARKETS

Peter Muller's proprietary trading team at Morgan Stanley is often accredited for pioneering statistical arbitrage in the US stock market in the 1980s, although hedge fund managers like Edward Thorpe had also been employing the strategy at the same time. Since then the strategy has been explored by academics and rolled out to other markets by practitioners.

The analysis below highlights that the performance of the statistical arbitrage strategy is relatively comparable across markets. The market-neutral strategy generated attractive returns between 2000 and 2004 and then again during the global financial crisis between

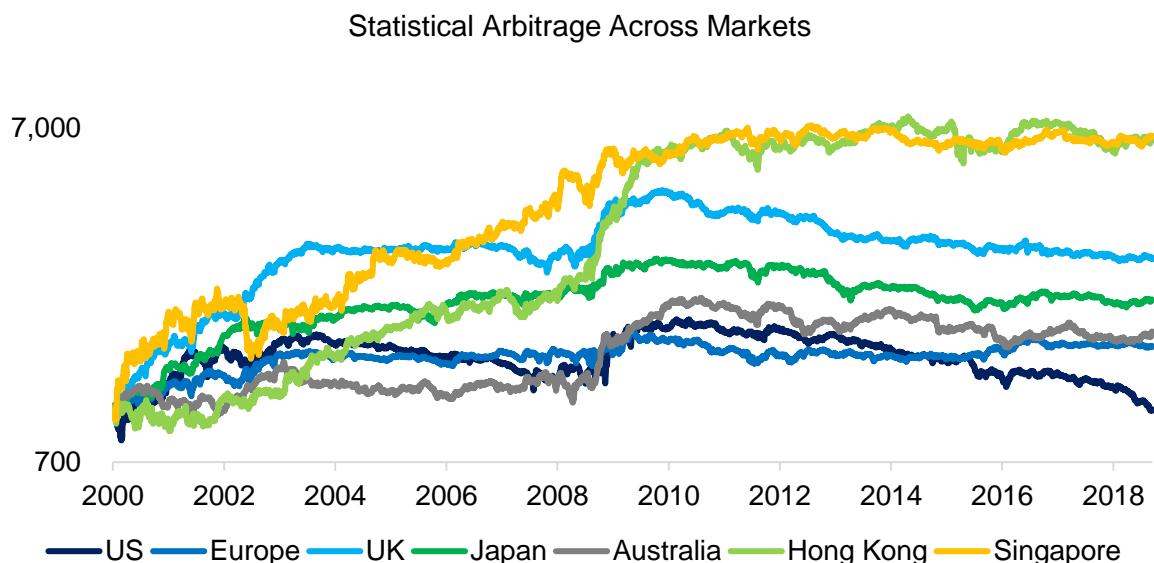


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2008 and 2010. However, the last few years seem to be evolving into a lost decade as most markets show a declining or flat performance.

The markets with most consistent returns appear to be Hong Kong and Singapore, although the performance needs to be discounted. We assume the same 10 basis points of cost per transaction across all markets, but trading stocks in these two markets is more expensive in reality, especially given that they feature stamp duty transaction taxes. Stocks are only held for a number of days, which makes statistical arbitrage a high-turnover strategy that is extremely sensitive to transaction cost assumptions.

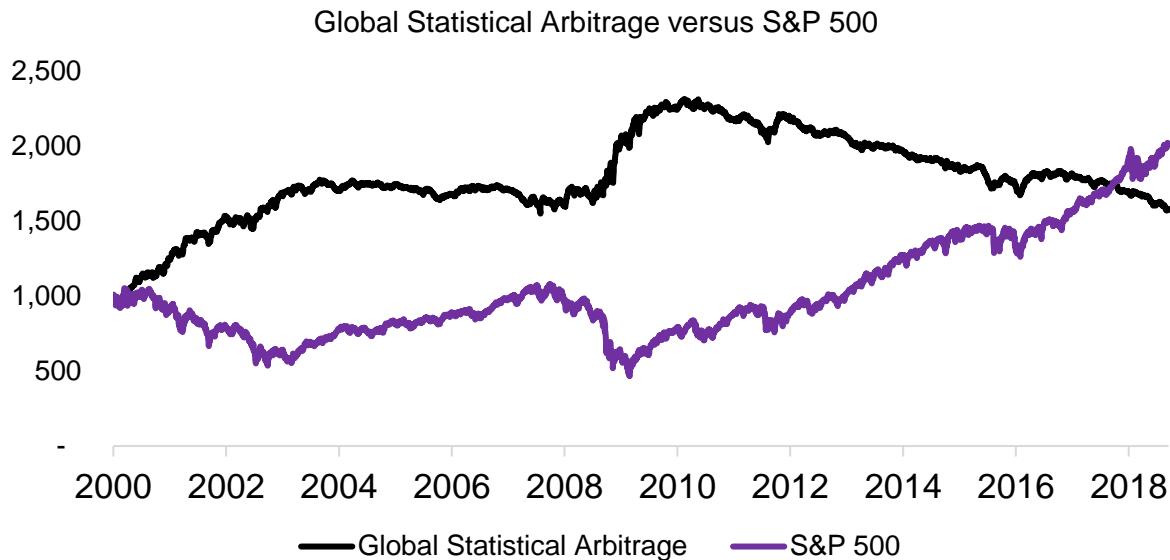


Source: FactorResearch

GLOBAL STATISTICAL ARBITRAGE

Next, we create a global statistical arbitrage portfolio by combining the country portfolios and weighting them according to their market capitalizations, which gives the US the largest weight with approximately 50%.

The analysis highlights that before 2010 the strategy was attractive as it was either flat or increasing, but experienced hardly any drawdowns. However, since the global financial crisis, the returns have been consistently negative. We also observe that statistical arbitrage performed best when the S&P 500 was declining, which typically coincides with high levels of market volatility. The poor performance since 2010 can likely be explained by increased competition and low market volatility.

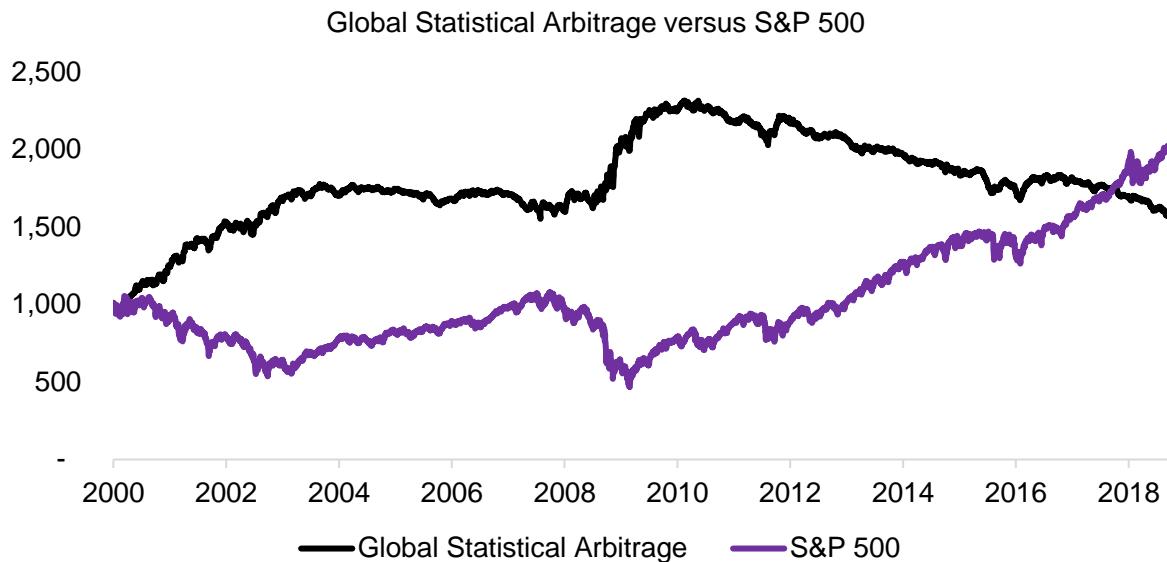


Source: FactorResearch

TACTICAL GLOBAL STATISTICAL ARBITRAGE

Statistical arbitrage can be characterized as a liquidity-providing strategy as it takes the opposite direction of the current trend. For example, the long position in a statistical arbitrage trade is a stock that has been decreasing rapidly on a relative basis to another stock. The strategy is to offer liquidity to any investor who wants to sell the stock. Naturally this is more likely to be a profitable strategy when investors are reacting less rational, i.e. buying or selling aggressively, which tends to occur when market volatility is high.

We can differentiate market volatility by VIX quartiles. Given that the VIX is mean-reversionary in nature, there is no significant look-ahead bias in this analysis. We observe that statistical arbitrage generated only positive returns when the VIX was above 17, which represents high levels of market volatility.



Source: FactorResearch

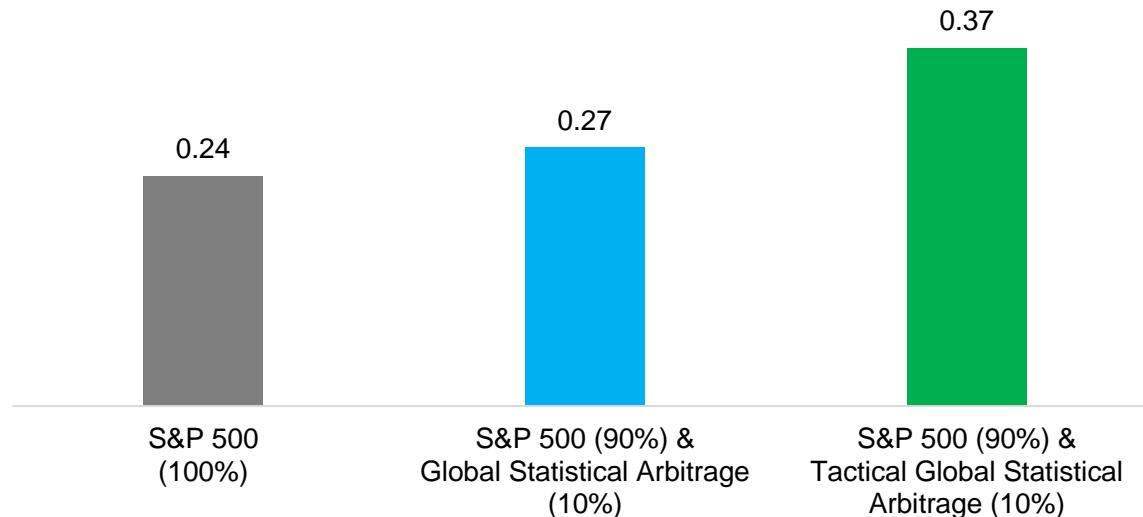
The analysis can be challenged by the assumption of constant transaction costs of 10 basis points throughout the observation period. Investors might argue that bid-and-ask spreads are going to be wider in periods of high market volatility.

HEDGING EQUITY PORTFOLIOS WITH TACTICAL STATISTICAL ARBITRAGE

Given that statistical arbitrage tends to perform best when markets are declining and volatility is high, it might be an attractive strategy for diversifying an equity portfolio. We create two portfolios that allocate 90% to the S&P 500 and 10% to the statistical arbitrage strategy, once with continuous exposure and the other with tactical exposure when the VIX is in the top quartile, i.e. above 23.

We observe that adding a 10% allocation to statistical arbitrage improves the risk-return ratios, especially if it represents a tactical rather than strategic allocation. Investors might be concerned that a tactical allocation requires frequent changes in the portfolio composition, but allocations rarely change as stock market volatility tends to cluster.

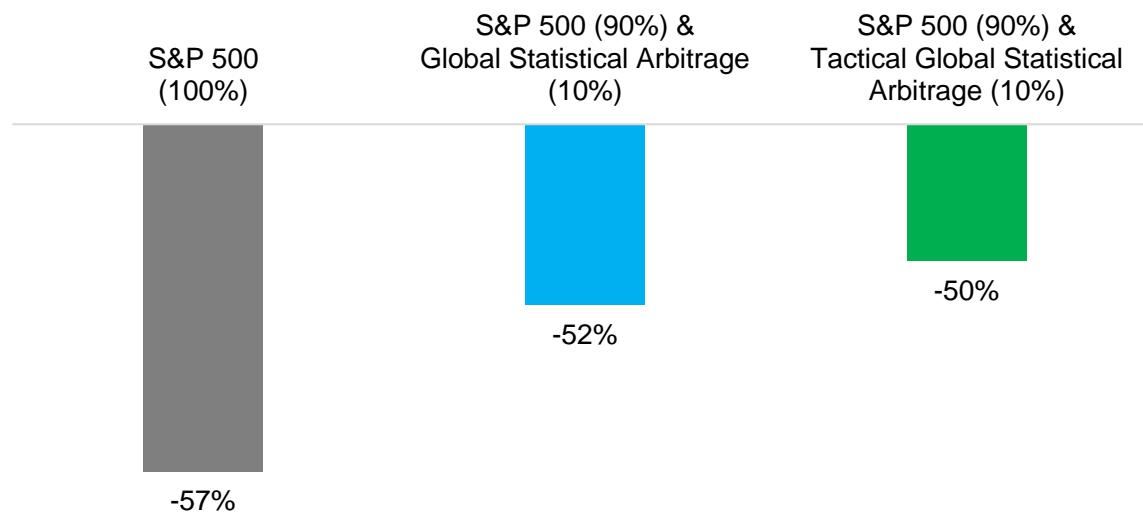
Hedging Equity Portfolios: Risk-Return Ratios (2001 - 2018)



Source: FactorResearch

It is also worth highlighting a significant decrease in maximum drawdowns when adding an allocation to statistical arbitrage to an equity portfolio. Common equity factors like Quality or Low Volatility can also be used to hedge equity risk when structured as beta-neutral long-short portfolios, but the link to market volatility is less clear, which makes statistical arbitrage particularly attractive.

Hedging Equity Portfolios: Max Drawdowns (2001 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that statistical arbitrage might be an attractive diversifier for an equity portfolio. Historically statistical arbitrage was only available to institutional investors via hedge funds, but more recently there have been attempts in the US to make the strategy available as a liquid alternative fund in the mutual fund format.

However, it is somewhat questionable if strategies like this are suitable for a wider investor audience given the complexity. It is also worth considering that the ongoing automation of financial markets likely reduces the expected returns, even when volatility will be high.

RELATED RESEARCH

[Statistical Arbitrage in the US](#)

[Mean-Reversion Across Markets](#)

[Tactical Mean-Reversion](#)

[Mean-Reversion on Equity Index Level](#)

THE RISE OF ZOMBIE STOCKS

The Dead versus the Living

November 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CAIA Association's AllAboutAlpha blog.

SUMMARY

- Zombie firms, where interest payments exceed operating profits, are on the rise
- Zombie stocks perform surprisingly well
- They are expensive, volatile stocks from diverse sectors

INTRODUCTION

The Bank for International Settlements (BIS) recently published research on the rise of zombie companies, which are firms where operating profits are below interest rate payments. The research highlights that the number of these companies is proportionally increasing and that these are less productive than other firms. They also crowd out investment in and reduce employment at healthier companies. Like zombies in literature and the movies, these firms seem to have a negative impact on society. In this short research, we will analyze the performance and characteristics of zombie companies in the US stock market.

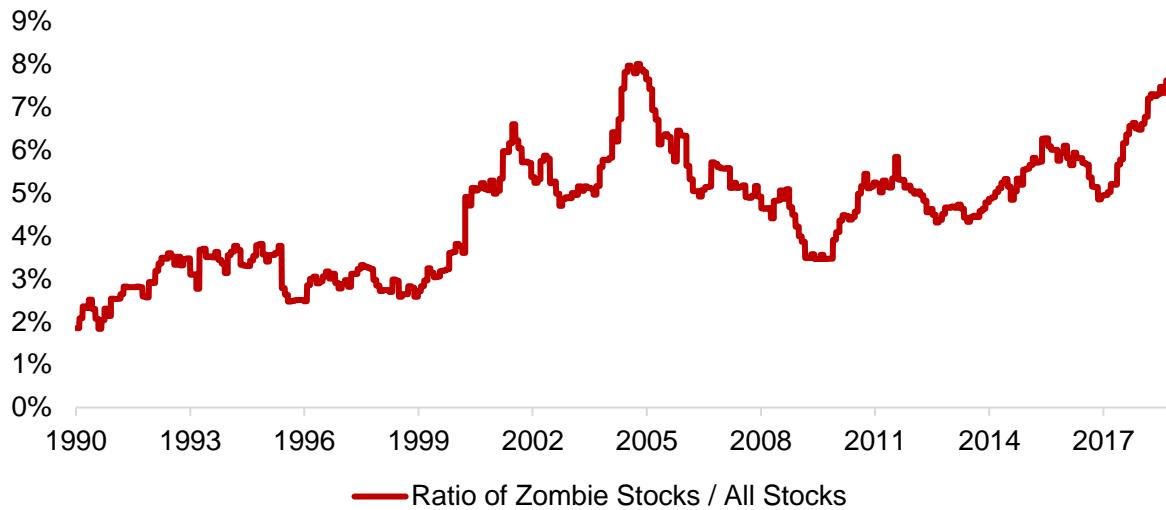
METHODOLOGY

We define zombie companies by having EBITDA-to-interest ratios below one measured over a three-year period. All stocks in the US with a market capitalization above \$500 million are considered. The performance of the zombie stock index is calculated via equal-weight allocations to all zombie stocks with monthly rebalancing and 10 basis points of transaction costs.

THE RISE OF THE ZOMBIE STOCKS

The number of zombie companies in the US stock market has been proportionally increasing since 1990. The current level of 8% was previously only reached in 2004. The rise and fall of zombie companies can perhaps be explained by the interest rate cycle. When interest rates are decreasing, then highly levered companies have more room to survive and are increasing in numbers, which we observe between 2000 and 2005. When the US Fed started raising interest rates thereafter, financial conditions tightened and companies were forced to restructure or declare bankruptcy, therefore decreasing the number of zombie firms.

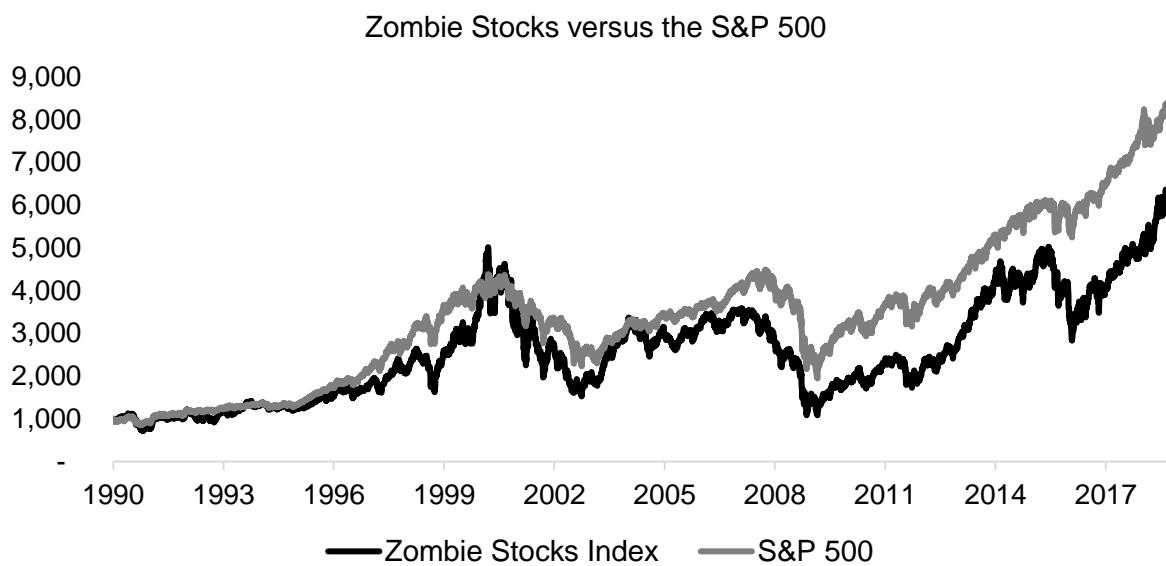
The Rise of the Zombie Stocks



Source: FactorResearch

ZOMBIE STOCKS VERSUS THE S&P 500

Investors might assume that zombie stocks underperform the market dramatically, but they do surprisingly well. The performance since 1990 of an equal-weighted index of zombie stocks almost matches the performance of the S&P 500, albeit with higher volatility and larger drawdowns. Zombie stocks, like human zombies, are still remarkably close to the living.



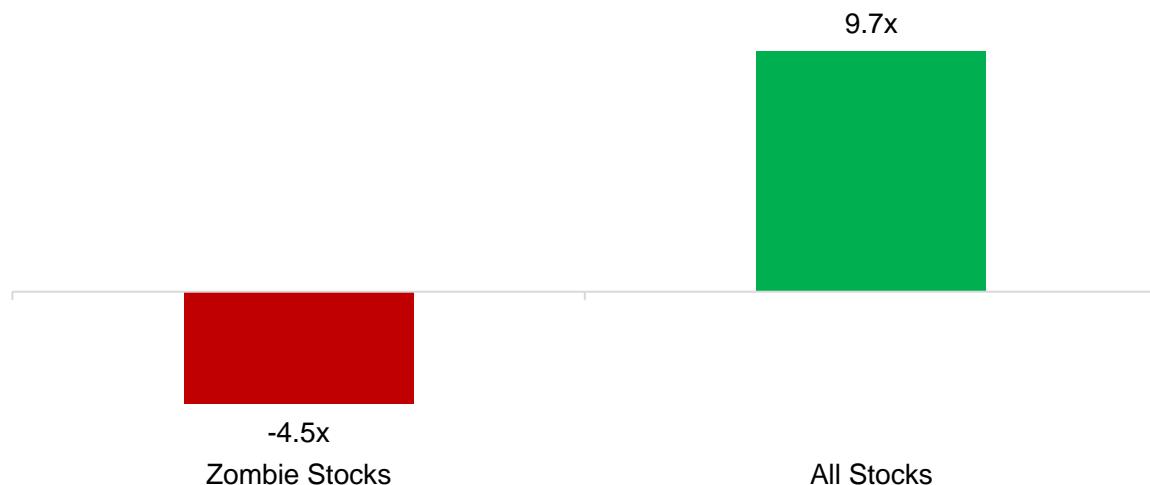
Source: FactorResearch

ANALYSING THE UNDEAD

Next, we analyze some key metrics to get a better understanding of the nature of the zombie stocks. The average market capitalization of zombie companies is \$1.9 billion, compared to \$2.4 billion for all stocks in the US with a market capitalization above \$500 million.

The average EBITDA-to-interest ratio for zombie companies is negative while positive for all companies. Negative interest coverage ratios are mainly explained by companies having more costs than revenues, which results in negative EBITDA. Although this might be considered acceptable for startups, it indicates too much debt for mature companies.

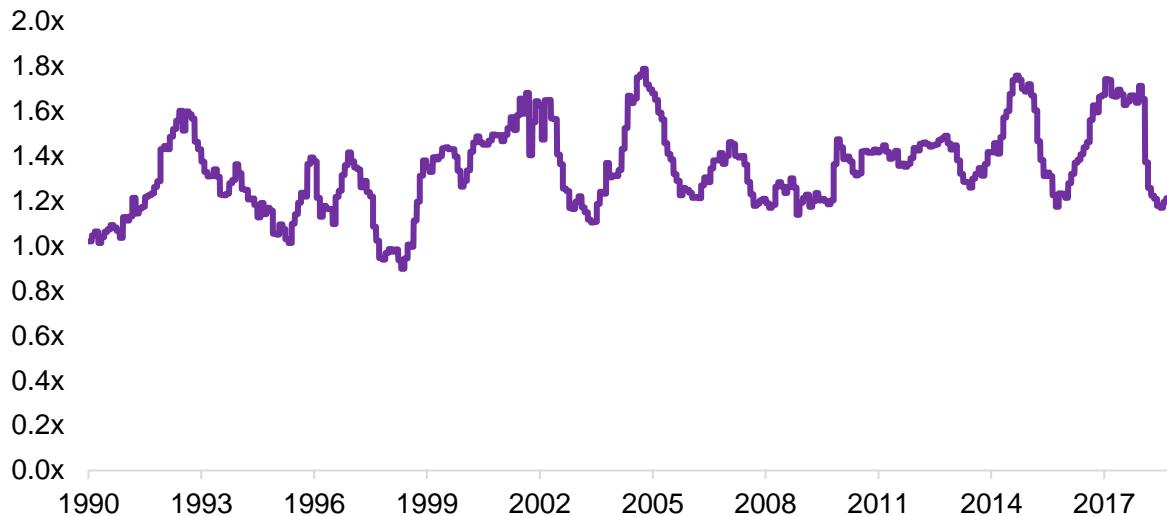
EBITDA-Interest Coverage of Zombie Stocks (1990 - 2018)



Source: FactorResearch

Zombie stocks exhibit higher betas than the market, indicating that they are volatile stocks. Naturally this is to be expected as zombie companies are likely in a state of financial distress. Given the high betas, these stocks likely feature in the short portfolio of the Low Volatility factor.

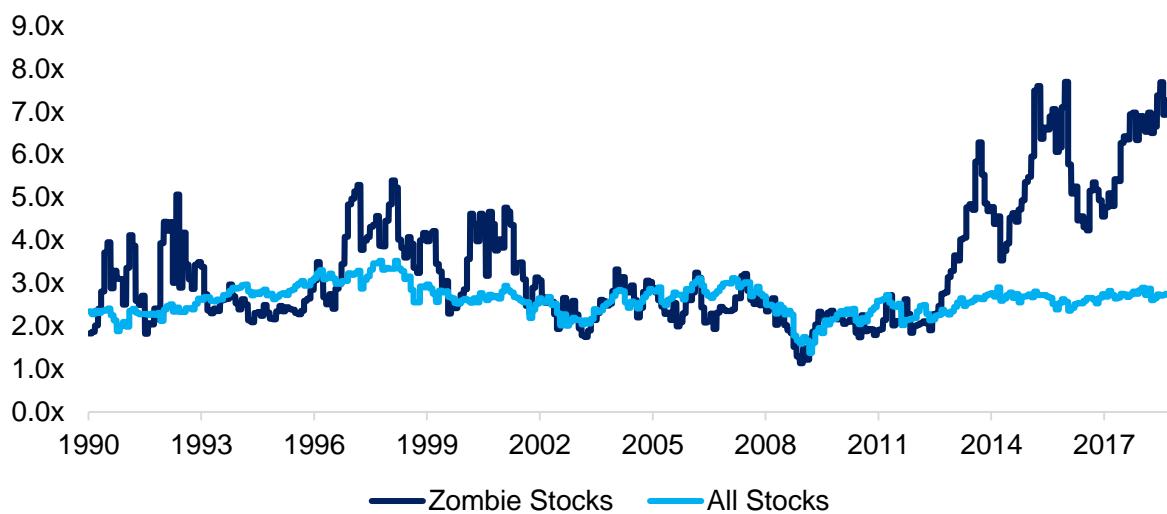
Betas of Zombie Stocks



Source: FactorResearch

Investors might expect that zombie stocks trade at low valuations given the unhealthy financial metrics. Interestingly zombie companies are trading on higher price-to-book multiples than the average stock and have been especially expensive since 2012. It is somewhat challenging to explain why investors are paying high multiples for volatile stocks in poor financial health.

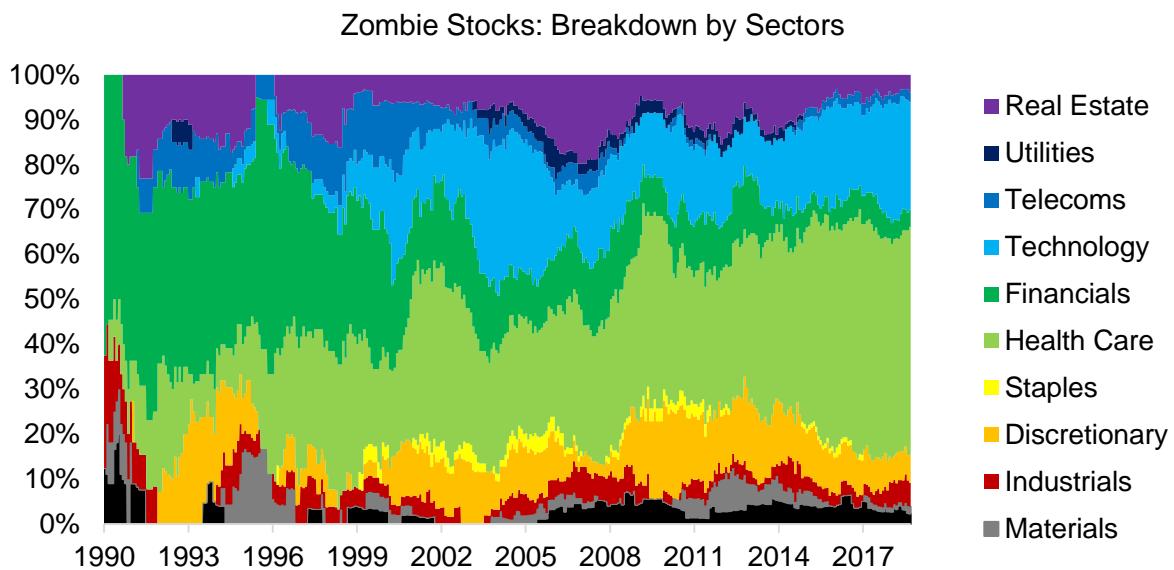
Valuation of Zombie Stocks: Price-to-Book Multiples



Source: FactorResearch

Finally, we analyze zombie companies by sectors. We observe that before 2000 the financial sector, which excludes banks and insurance companies as interest coverage ratios are

meaningless for these, contributed most zombie stocks. After 2000 the health care and technology sectors were most plagued by firms in poor financial health. Major pharmaceutical companies tend to normal interest coverage ratios, but there are many biotechnology companies with little to no revenues. Similarly, there are many technology companies that are more focused on growth than profitability. The increase in valuation multiples of zombie stocks after 2012 can likely be explained by a larger proportion of stocks from these two sectors, which feature high multiples in general.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that the number of zombie stocks in the US has been increasing steadily and is close to an all-time high. Given that interest rates in the US are rising, this will require these companies to restructure their balance sheets or face bankruptcy. Although cleansing the corporate world of zombies is a natural and healthy process, it will result in companies laying off employees.

However, the alternative that the US central bank keeps interest rates artificially low to allow these companies to survive, is not advisable. The last three decades in Japan highlight that letting zombie companies roam freely is likely detrimental for economic growth and society, much like in literature and in the movies.

REFERENCED RESEARCH

BIS: [The Rise of Zombie Firms: Cause and Consequences](#)

EQUITY FACTORS: REDUCING PORTFOLIO TURNOVER

Less Churn, More Returns?

November 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Portfolio turnover of equity factors can be reduced significantly by trading more conservatively
- However, reducing turnover does not necessarily increase risk-return ratios
- It all depends on transaction costs

INTRODUCTION

Turnover in business tends to be positive or negative, depending on the context. Investors prefer businesses with high turnover in inventory to similar businesses with low turnover as it implies higher revenue growth. Inversely, investors prefer low to high turnover in staff as hiring and training new people tends to be expensive.

Turnover in stock portfolios is almost always seen as negative as each transaction incurs costs. Some factor-based strategies like Momentum exhibit high turnover ratios as significant amounts of the portfolio are rotated at each rebalancing date. However, new stocks are often just slightly more attractive than the old stocks from a factor perspective, which raises the question if the transaction was necessary. In this short research note, we will investigate the impact of reducing the turnover on common equity factor portfolios across markets.

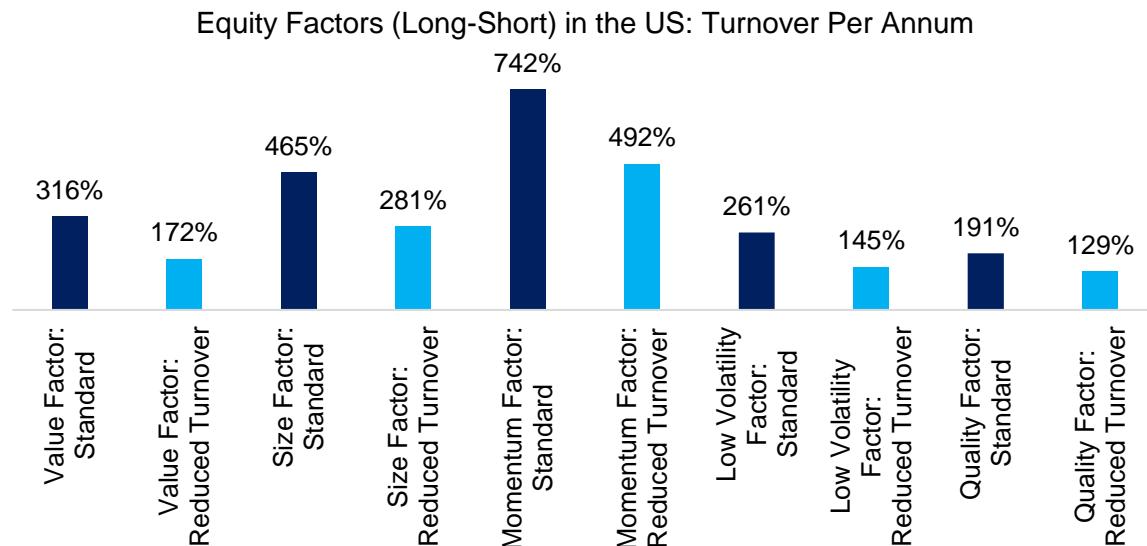
METHODOLOGY

We focus on a universe of five factors namely Value, Size, Momentum, Low Volatility and Quality in the US, European and Japanese stock markets. The factor performance is calculated by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks ranked by the factor definitions, which are in line with academic and industry standards (please see our [Factor Guide](#) for the factor definitions). Only stocks with a minimum market capitalization of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

REDUCING TURNOVER IN FACTOR PORTFOLIOS

Our universe in the US contains approximately 1,800 stocks as of 2018, which implies 180 stocks in the long and 180 stocks in the short portfolio. At each monthly rebalancing date, existing stock positions that no longer fulfill the criteria are replaced with new stocks. However, if a stock only slightly changed its factor rank, e.g. moved from rank 180 to 181, it likely has the same factor potency as before. In order to reduce turnover, we therefore only replace stocks that are no longer in the top or bottom 15% of the stocks ranked by the factor. New stocks are still derived from the top and bottom 10%, we just exit slightly more conservatively.

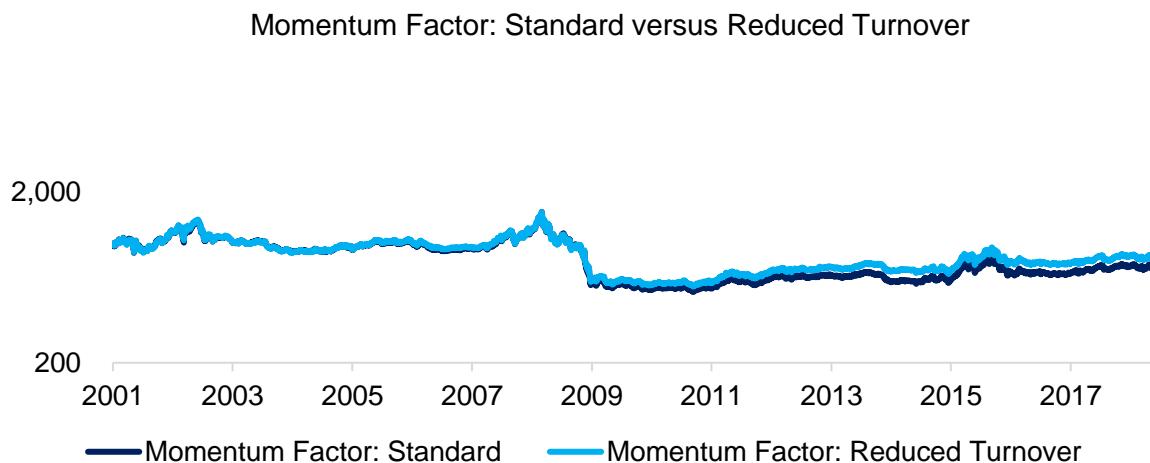
The chart below shows the turnover per annum of common equity factors in the US, which is the lowest for the Quality and highest for the Momentum factor. We observe that applying a more conservative stock replacement methodology reduces the turnover significantly.



Source: FactorResearch

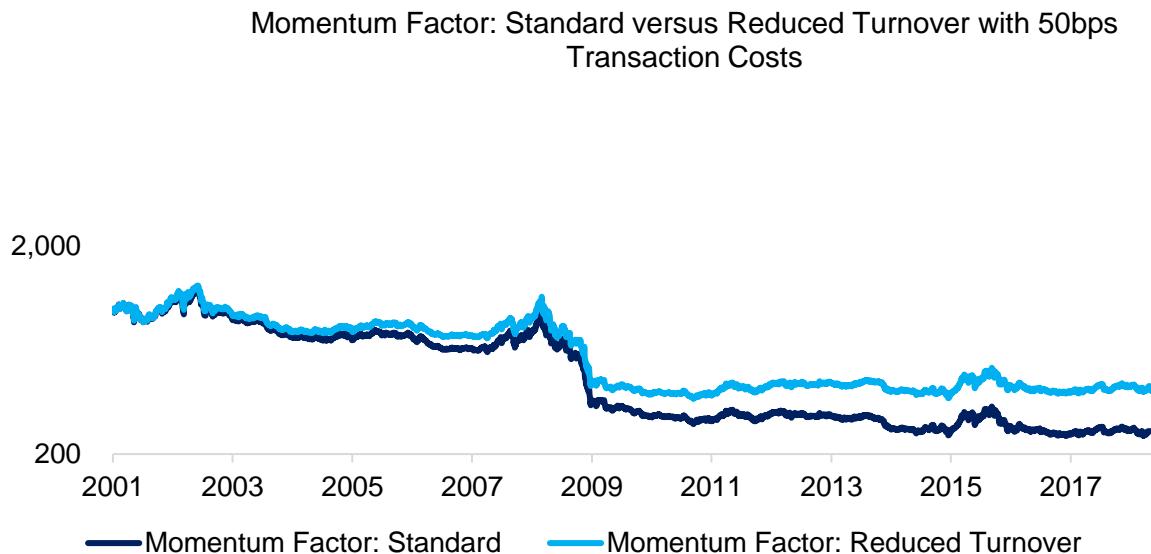
MOMENTUM FACTOR: REDUCING TURNOVER

Given that the long-short Momentum factor exhibits the highest turnover, we will focus on this factor for analyzing the impact of reducing the portfolio turnover on its performance. The chart below highlights that reducing the portfolio turnover generated only slightly higher returns. Given that the annual turnover was reduced from 742% to 492%, this may be somewhat surprising.



Source: FactorResearch

The lack of positive impact on the factor performance is likely explained by the transaction cost assumptions, which are 10 basis points per trade. Commissions for institutional investors are typically 2 basis points or less and market impact costs for medium to large capitalization stocks in the US range between 5 and 10 basis points. Naturally we can simulate the impact of higher transaction costs, e.g. 50 basis points, which then highlights a clear benefit of reducing portfolio turnover. The chart below highlights that a high turnover strategy like Momentum should only be pursued with low transaction costs.

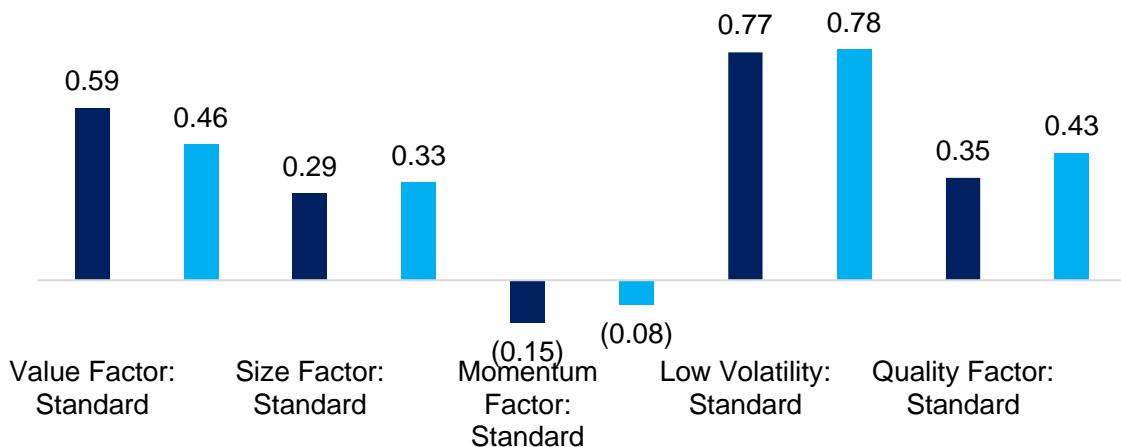


Source: FactorResearch

EQUITY FACTORS IN THE US: STANDARD VERSUS REDUCED TURNOVER

Next we expand the analysis to other common equity factors in the US and focus on the risk-return ratios in the period from 2000 to 2018. We observe that reducing the turnover was slightly accretive for the ratios of all factors, except for Value. There is no particular reason why reducing the turnover should be negative for the Value factor, so we attribute this result to randomness.

Equity Factors in the US: Risk-Return Ratios (2000 - 2018): Standard versus Reduced Turnover

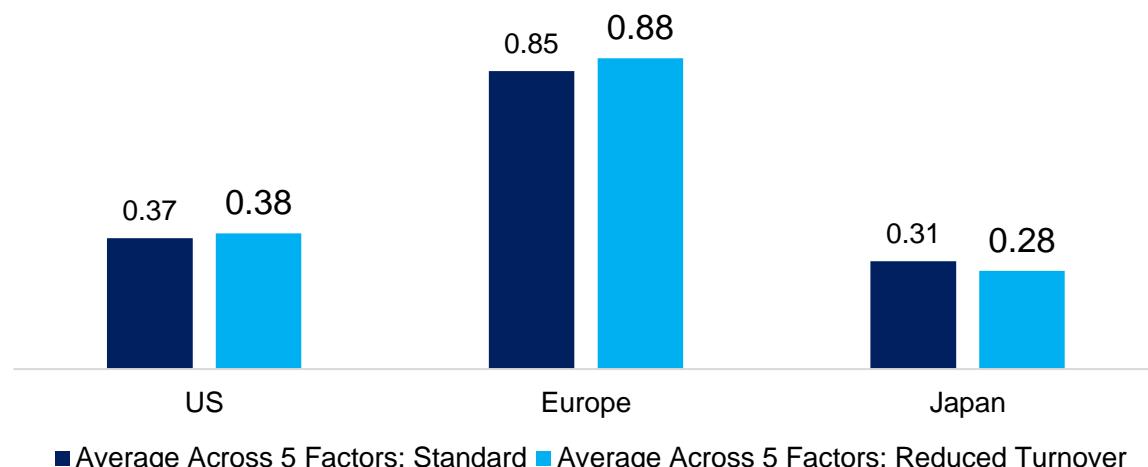


Source: FactorResearch

EQUITY FACTORS ACROSS MARKETS: STANDARD VERSUS REDUCED TURNOVER

We further expand the analysis to European and Japanese stock markets, which highlights mixed results. The average risk-return ratios across five factors are almost identical across markets. However, transaction costs are slightly higher in Europe and Japan compared to the US. Some countries, e.g. Italy, feature stamp duty, which would imply transaction costs of more than 10 basis points. Lower turnover therefore becomes more desirable.

Equity Factors Across Markets: Risk-Return Ratios (2000 - 2018): Standard vs Reduced Turnover



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that reducing turnover in factor portfolio does not significantly increase risk-adjusted returns, although it strongly depends on transaction costs. Reducing turnover seems intuitively beneficial, but it also implies that new stocks are not being added to the portfolio, which may have an adverse impact on factor performance.

RELATED RESEARCH

[Factor Construction: Portfolio Rebalancing](#)

[Factor Portfolios: Turnover Analysis](#)

THE ODD FACTORS: PROFITABILITY & INVESTMENT

Odd, but attractive?

November 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Profitability factor generated attractive returns in the US and Europe since 1990
- It is difficult to explain why investors should be compensated for holding highly profitable companies
- The Investment factor was less attractive and is unusual from a financial analyst's perspective

INTRODUCTION

Discretionary and systematic investors tend to have different perspectives on what works in the stock market. On the topic of factor investing, both types of investors tend to agree that Value is an attractive strategy. It is intuitively appealing to discretionary investors given that everyone likes bargains while systematic traders can rely on a significant amount of academic research. Views diverge on the Momentum factor, which is too simple for most discretionary investors while being a favorite amongst systematic investors. Finally, there the Profitability and Investment factors from 5-factor model of Fama-French and the Q-factor model from Zhang, which are challenging for both types of investors. In this short research note, we will analyze these two factors – Profitability and Investment – across markets.

METHODOLOGY

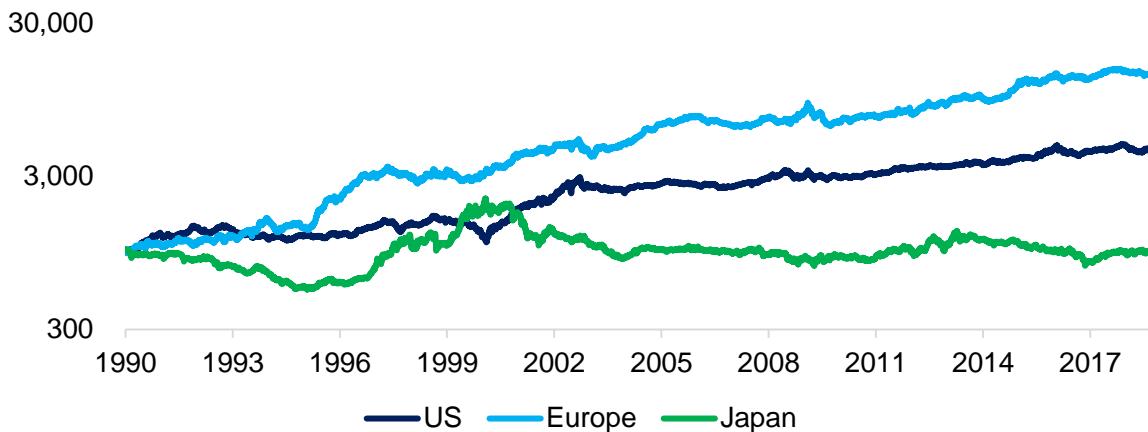
We focus on the Profitability and Investment factors in the US, European and Japanese stock markets. Profitability is defined as return-on-equity and investment as the one-year change in total assets. Factor performance is calculated by creating long-short beta-neutral portfolios comprised of the top and bottom 10% of the stocks ranked by the factor. Only stocks with a market capitalization of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

THE PROFITABILITY FACTOR ACROSS MARKETS

Profitability is a subset of the Quality factor and may be attractive in times of market stress as these stocks should outperform weaker ones. However, it is questionable if the Profitability factor should generate positive returns across time. It is challenging to derive a theory of why investors should be compensated for holding highly profitable companies.

However, in contrast to our expectations, the long-short Profitability factor generated consistently positive returns in the US and Europe since 1990. The performance in Japan is flat, but not negative.

Profitability Factor in US, Europe and Japan



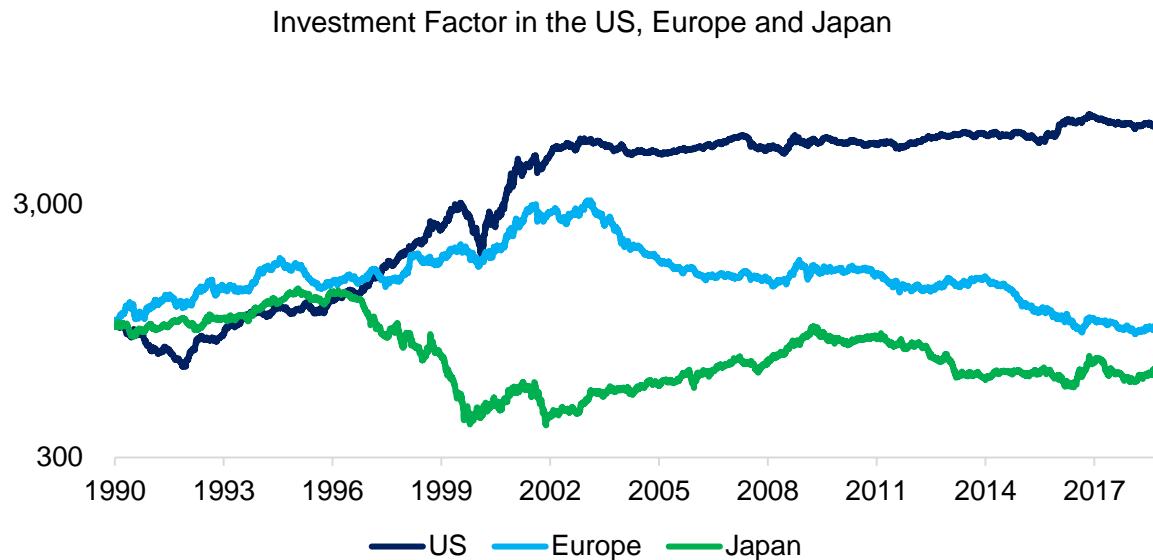
Source: FactorResearch

THE INVESTMENT FACTOR ACROSS MARKETS

Although it is theoretically challenging to argue why the Profitability factor should generate positive returns, the metric is widely accepted by financial analysts for evaluating stocks. Conversely, the Investment factor, which is defined as the annual asset growth, can be considered much more unusual when analyzing companies.

Assets might increase because of organic growth or acquisitions. They might decrease due to divestments of non-core assets or write-downs of goodwill. However, the fundamental link to the valuation of a company is much more opaque than with other financial metrics such as sales, profits, cashflow, margins or leverage. Although the factor might be interesting from an academic perspective for explaining returns, we see a limited relevance for financial analysts.

Analyzing the long-short performance of the Investment factor highlights divergent returns across regions. The performance in the US and Europe was attractive from 1990 to 2000, but flat in the US and declining in Europe thereafter. The factor in Japan occasionally exhibited similar trends as the other markets, but traded differently more often than not.



Source: FactorResearch

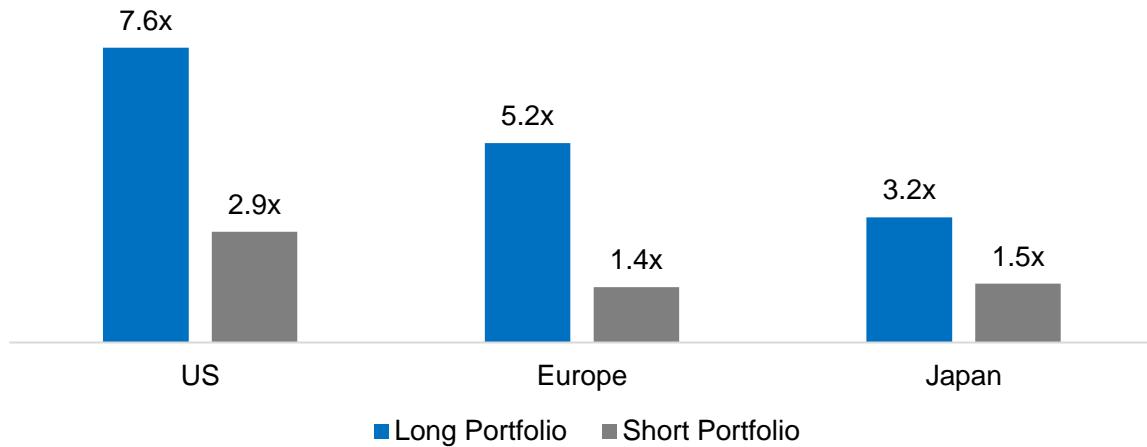
ANALYSING THE PROFITABILITY FACTOR

Given that we are challenged by the relevance of the Investment factor for practical purposes, we focus on analyzing the Profitability factor. The results highlighted attractive returns in the US and Europe since 1990, which can be considered unusual.

Companies that are more profitable than others should be trading at higher valuations. The analysis below displays the price-to-book multiples for the long and short portfolios of the Profitability factor, which confirms the expectation. The Profitability factor could therefore be regarded as the opposite of the Value factor.

The Value factor generated negative returns since 2010 while the Profitability factor showed a strong performance, indeed indicating an inverse relationship. However, both factors generated significantly positive returns between 2000 and 2006, therefore the inverse relationship was not consistent across time.

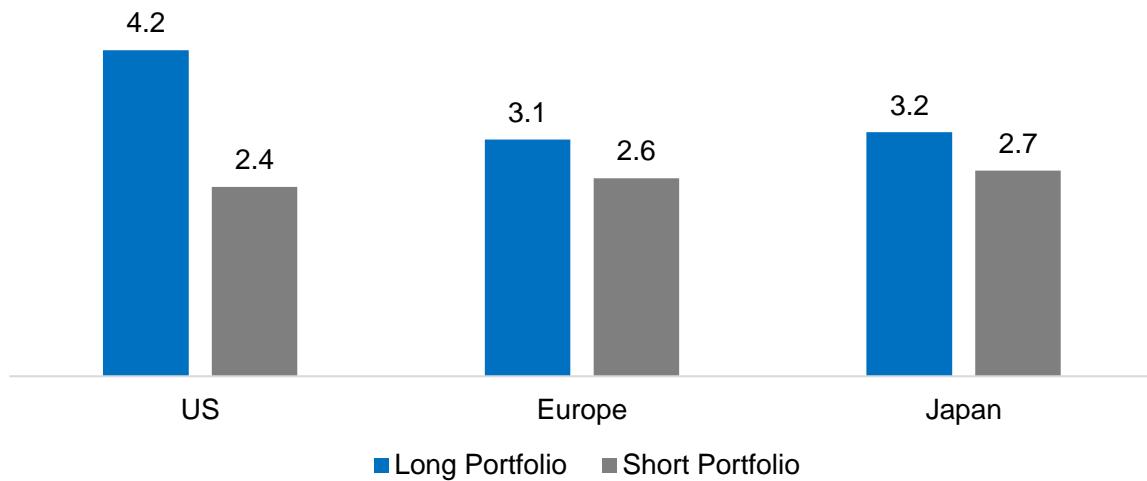
Profitability Factor: Average Price-to-Book Multiples (1990 - 2018)



Source: FactorResearch

Next, we analyze the market capitalizations of the long and short portfolios of the Profitability factor, which indicate that highly profitable companies in the US featured almost twice the market capitalization of companies with low levels of profitability. There is less differentiation in European and Japanese stock markets.

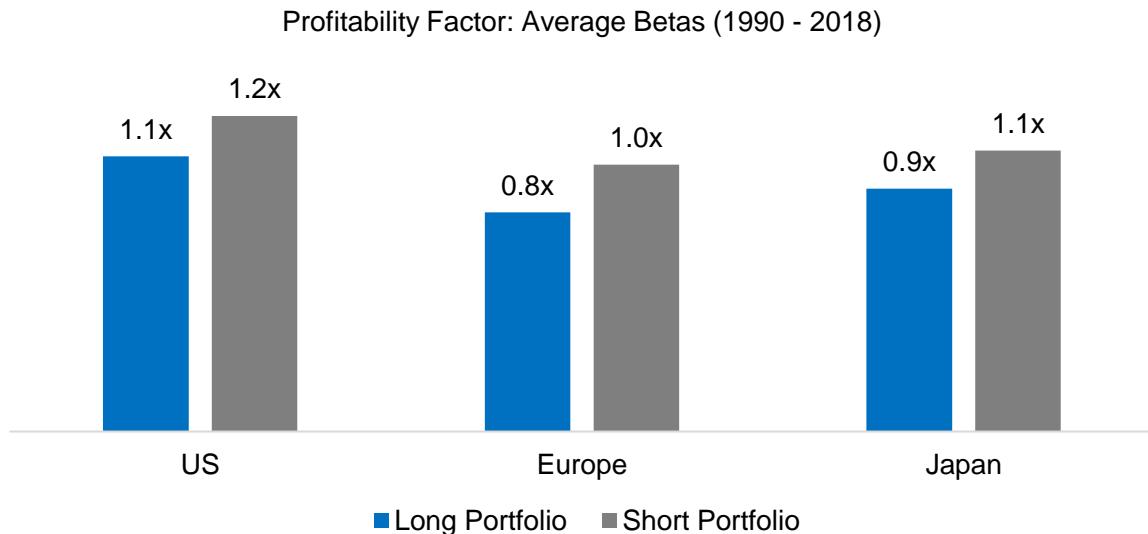
Profitability Factor: Average Market Capitalizations (1990 - 2018) (\$bn)



Source: FactorResearch

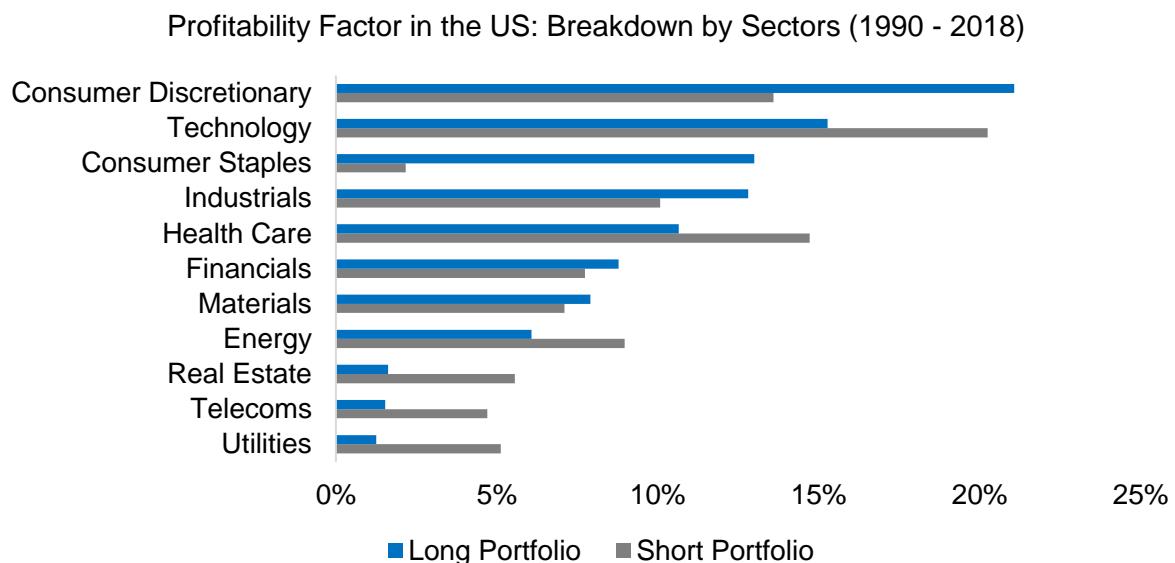
Some academic research indicates a relationship between the Profitability and Low Volatility factors. The analysis below shows that highly profitable companies feature lower betas than stocks with low profitability. However, the net betas, i.e. the difference between the betas of

the long and short portfolios, average 0.2 for Profitability compared to more than 1 for the Low Volatility factor, implying different underlying portfolios.



Source: FactorResearch

Finally, we analyze the sectoral composition of the Profitability factor from 1990 to 2018. It is worth noting that the sector exposures are structural and do not change significantly across time. We observe overweights in the consumer discretionary and staples sectors and underweights in the technology, healthcare, energy, and asset-heavy sectors. The net short exposure to the real estate, telecoms, and utilities further highlights that the Profitability and Low Volatility factors are different, as the later has net long exposure in these.



Source: FactorResearch

FURTHER THOUGHTS

This short research note investigates the Profitability and Investment factors across markets. The Investment factor is unusual from a financial analyst's perspective, which likely explains why there are almost no investment products like smart beta ETFs that offer exposure to the factor.

In contrast, profitability is a common metric in financial analysis and features prominently in most quality-focused portfolios. The analysis highlights that highly profitable companies feature expensive valuations, large market capitalizations, and low betas. However, these stock characteristics are more likely to result in negative than positive excess returns, therefore we continue to be mystified by the impressive performance of the Profitability factor.

THE DARK SIDE OF LOW-VOLATILITY STOCKS

Long Bonds?

October 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Low-volatility stocks have outperformed the market over the last 25 years
- The strategy has reduced equity drawdowns in the US, Europe, and Japan significantly
- However, low-volatility stocks have partially been bond-proxies, which poses risk when rates rise

MARKETING INGENUITY IN FINANCE

Smart beta may be the best marketing concept ever invented in finance. Buying something labeled “smart beta” makes you intuitively feel both smart and good about the investment. But if smart beta is the best investment product label ever, low volatility is a strong contender for second place. It isn’t hard to see why.

After the global financial crisis, risk was front of mind for investors, so buying stocks with lower volatility, perhaps even bond-like characteristics, had obvious appeal. Since then, low-volatility strategies have rapidly gathered assets and today low-volatility exchange-traded funds (ETFs) in the United States account for about \$46 billion in assets under management (AUM).

But the strategy isn’t immune to criticism. Some contend the underlying stocks are effectively bond proxies that have benefited from the declining interest rates over the last few decades. So just how does this low-volatility strategy perform across markets? And does it really suffer from interest-rate exposure as its critics claim?

LOW-VOLATILITY STRATEGIES IN THE UNITED STATES

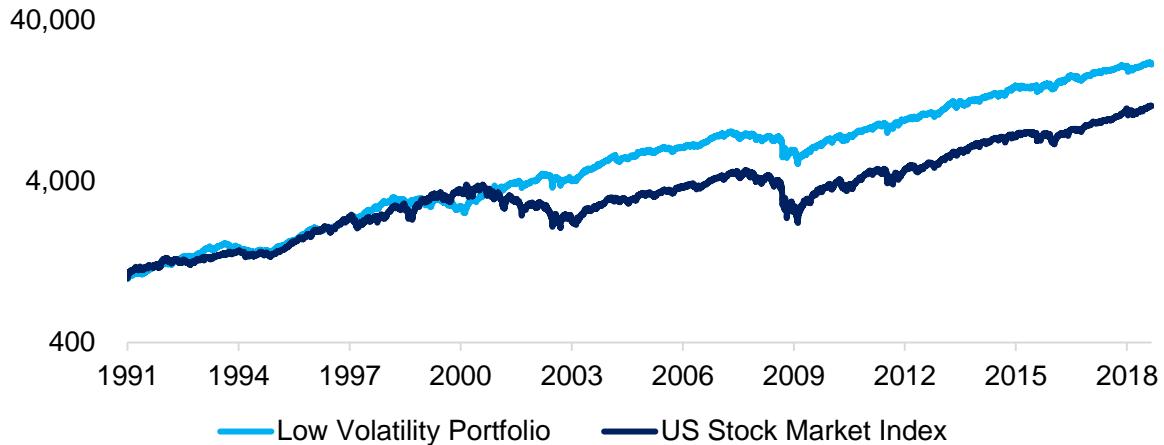
To answer these questions, we created a long-only portfolio composed of the top 10% of US equities ranked by price volatility over the last 12 months with monthly rebalancing. We then compared it to the US stock market. We found that the low-volatility portfolio outperformed the stock market since 1991. While there was a period of slight underperformance during the tech bubble, the portfolio outpaced the stock market during both the subsequent crash and the global financial crisis from 2007 to 2009. These initial results make a strong case for low-volatility stocks.



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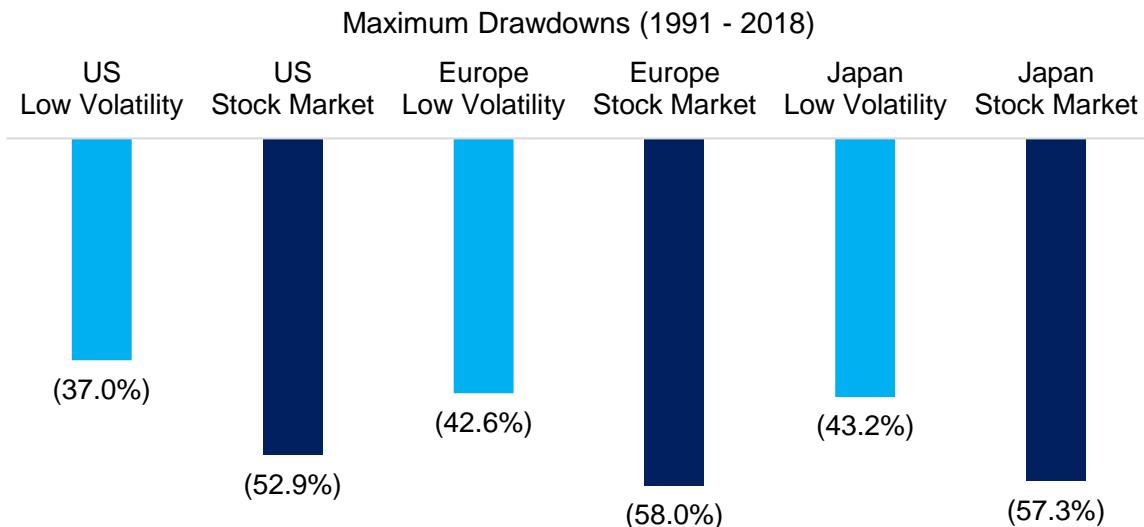
Low Volatility Strategy in the US Stock Market



Source: FactorResearch

LOW-VOLATILITY STRATEGIES ACROSS MARKETS

Expanding our analysis to the European and Japanese stock markets, we shifted the focus to maximum drawdowns, since low-volatility funds are generally bought to reduce risk. Over the last 25-plus years, the low-volatility portfolios had much lower maximum drawdowns than their corresponding stock market indices. So, again, what's not to like?

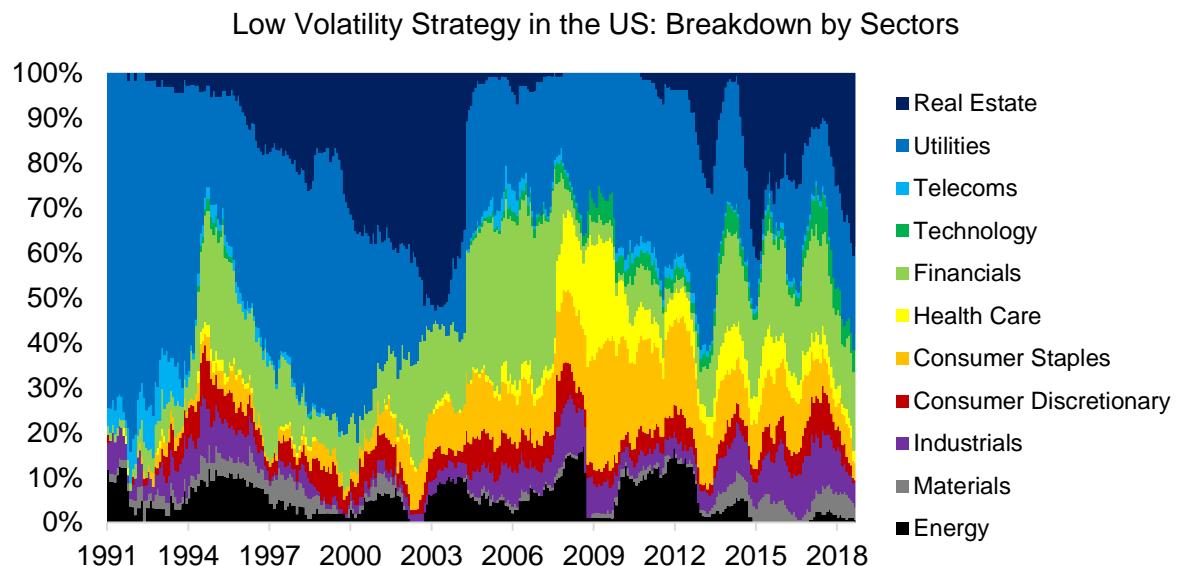


Source: FactorResearch

BREAKDOWN BY SECTOR

Thus far, low-volatility stocks seem to have highly attractive risk-return characteristics. However, a breakdown of the underlying US portfolio shows that the strategy was largely a bet on two sectors: real estate and utilities. Together, these accounted for more than 50% of the stocks across the time period.

Sectoral biases are to be expected since low-volatility stocks are typically mature businesses with stable cash flows. In fact, investors might find them a bit staid compared to Tesla or the FAANG companies.

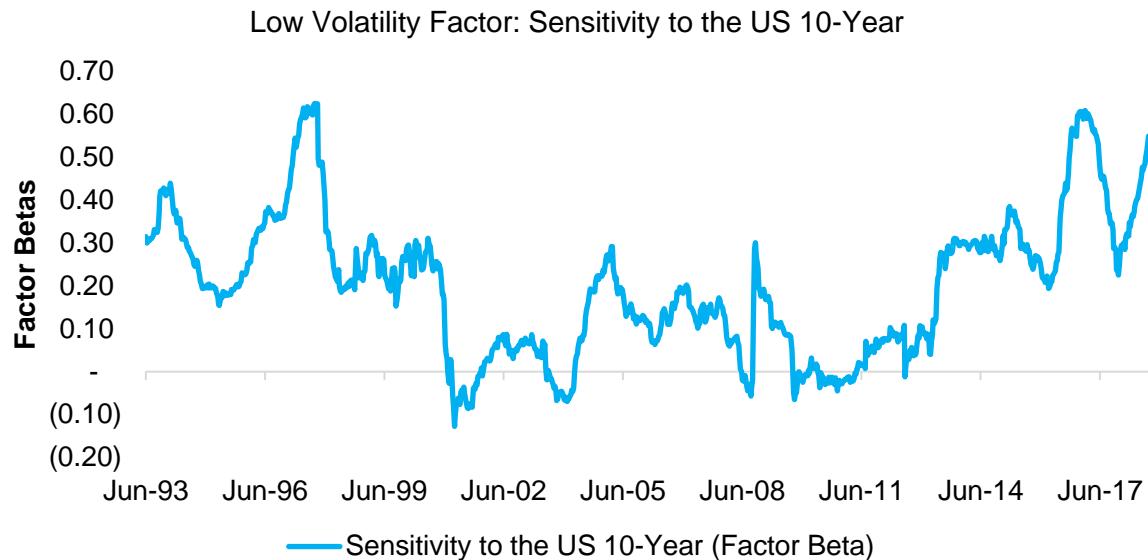


Source: FactorResearch

BETTING ON BONDS?

But stable businesses like these tend to be more levered. Given their debt levels, they are more sensitive to changes in interest rates. Comparing the US low-volatility portfolio to the 10-year US Treasury bond, we found periods of elevated sensitivity in the 1990s and since 2013.

The degree of sensitivity is partially explained by sectoral exposure. For example, from 2005 onward, the volatility of real estate stocks increased, a symptom of the boom-and-bust nature of the real estate cycle. Thus the portfolio's exposure to the sector decreased in favor of financial stocks, which are not as responsive to interest rates.

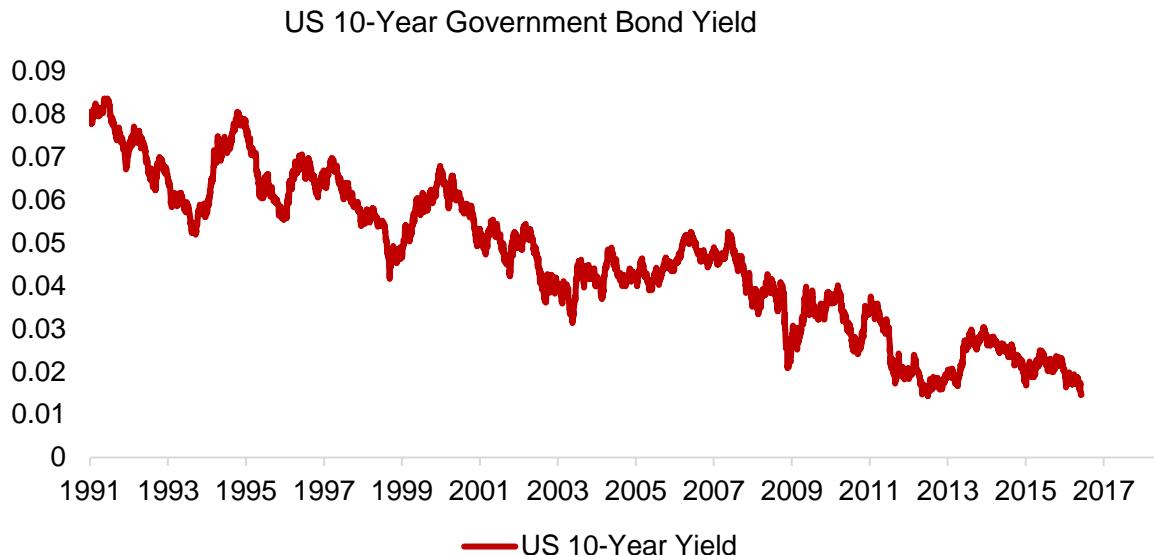


Source: FactorResearch, Newfound Research for 10-year data

So is interest rate-sensitivity the reason for the low-volatility strategy's stellar performance?

It certainly is a major component. After all, interest rates in the United States have been heading steadily downward for the last 30 years. This enabled levered companies to increase their earnings by continuously refinancing existing debt at lower rates.

But the outlook is changing and US interest rates are on the rise. So low-volatility stocks are becoming riskier bets. Moreover, it is an open question whether investors should hold indirect bond exposure in their equity portfolios when most diversified portfolios have direct exposure.



Source: FactorResearch

FURTHER THOUGHTS

Declining interest rates likely explain most of the low-volatility strategy's attractive risk-adjusted returns. If the strategy is constructed long-short, creating a sector-neutral portfolio can reduce interest rate-sensitivity. However, this isn't feasible in the long-only format — the structure available to most investors through ETFs and funds.

Low-volatility stocks were great for risk reduction over the last few decades, protecting capital during equity market downturns. But the long US bond bull market may have run its course, and if bond and equity markets correct simultaneously, low-volatility stocks may not provide so safe a haven.

RELATED RESEARCH

[Low Volatility, Low Beta & Low Correlation](#)

[Low Volatility: Interest-Rate Sensitivity & Sector-Neutrality](#)

[Low Volatility: High Valuation](#)

STATISTICAL ARBITRAGE IN THE US

Arbitraged Away?

October 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Statistical arbitrage has attractive strategy characteristics
- However, the returns are highly dependent on transaction costs
- Best used as a tactical strategy when volatility is high

INTRODUCTION

Equity markets in 2018 can be characterized by divergence. There is the US, showing strong returns, versus most other developed and emerging markets, which are generating lower or negative returns. A common trade is therefore shorting the US and going long the rest of the world. The supporting thesis is that mean-reversion will set in as the US is fully integrated into the global economy.

However, most investors are likely to be cautious as there is no certainty when the outperformance of the US will cease. Investors can speculate on mean-reversion on index as well as stock level. On the latter, the opportunity set is much larger as there are thousands of individual stocks, which allows the creation of a diversified portfolio of pair trades. Furthermore, the strategy can be enhanced by using statistical measures to improve the pair selection process. In this short research note we will investigate statistical arbitrage in the US stock market.

METHODOLOGY

We focus on all stocks in the US with a market capitalization of larger than \$1 billion. The strategy is to create a diversified portfolio of pair trades, which will be dollar-neutral. Each pair consists of a long and a short position of stocks from the same sector. In addition, the two stocks of a pair need to be cointegrated, which is measured with a one-year lookback and a maximum p-value of 0.3. A trade in a pair is entered when the z-score of the stock price ratio breaches +/- 2.0 and exited when the z-score reaches 0 subsequently. The z-score is calculated with a 21-day lookback.

It is worth noting that statistical arbitrage is a sophisticated strategy that comes in all kind of forms and requires many assumptions. Our methodology is in line with academic research and relatively simple.

CASE STUDY: STATISTICAL ARBITRAGE IN THE US REAL ESTATE SECTOR

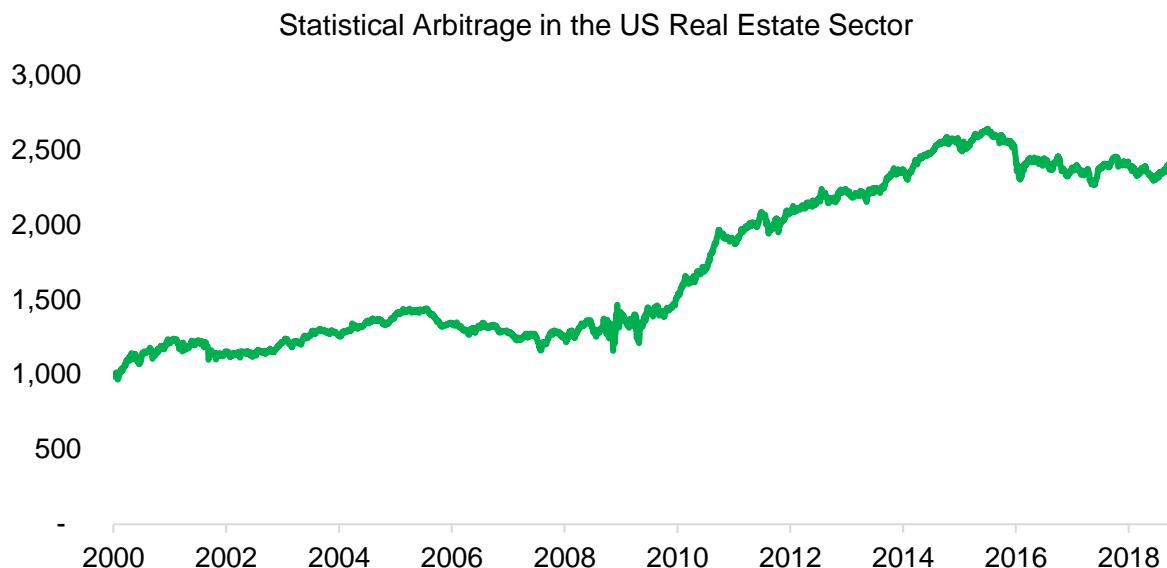
Considering the nature of mean-reversion, some sectors should offer better opportunities than others. If the stock price of a biotech company jumps due to a drug approval from the US FDA, then it is not necessarily sound to short the stock and hedge it with a long position in another healthcare company. Sectors with high firm-risks are theoretically less attractive than sectors where stocks trade similarly due to the nature of their businesses.



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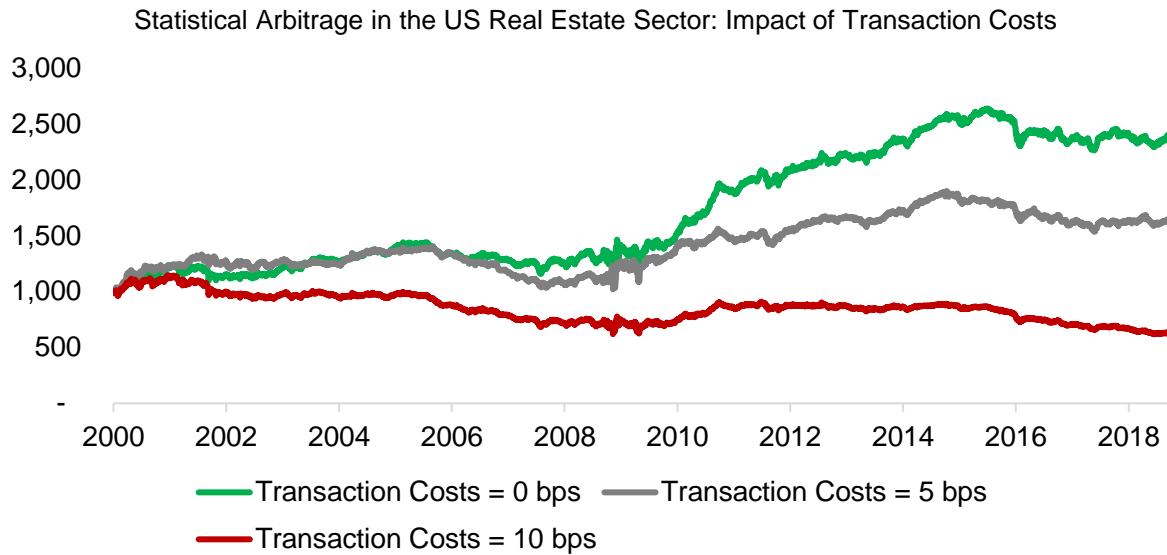
The chart below shows the performance of the statistical arbitrage strategy in the US real estate sector. Stocks from this sector feature low firm-risks as they are mainly driven by three macro variables: inflation, real GDP growth, and interest rates, which affect all companies in a similar fashion. For example, if a large shopping centre company reports an earnings surprise, then other shopping centre stocks are likely to follow given common corporate drivers, which implies high mean-reversion potential.



Source: FactorResearch

The performance of the statistical arbitrage strategy in the US real estate sector exhibits highly desirable features: consistent returns, low volatility and hardly any drawdowns. However, the returns are highly dependent on transaction cost assumptions. The analysis below highlights the impact of transaction costs on the performance of statistical arbitrage in the US real estate sector.

Commissions are less than 1 basis points (bps) for institutional investors, but there are also market impact costs, which typically range between 3 and 7 basis points. Some stock exchanges offer rebates for strategies like statistical arbitrage that provide liquidity, which makes transaction cost analysis challenging.



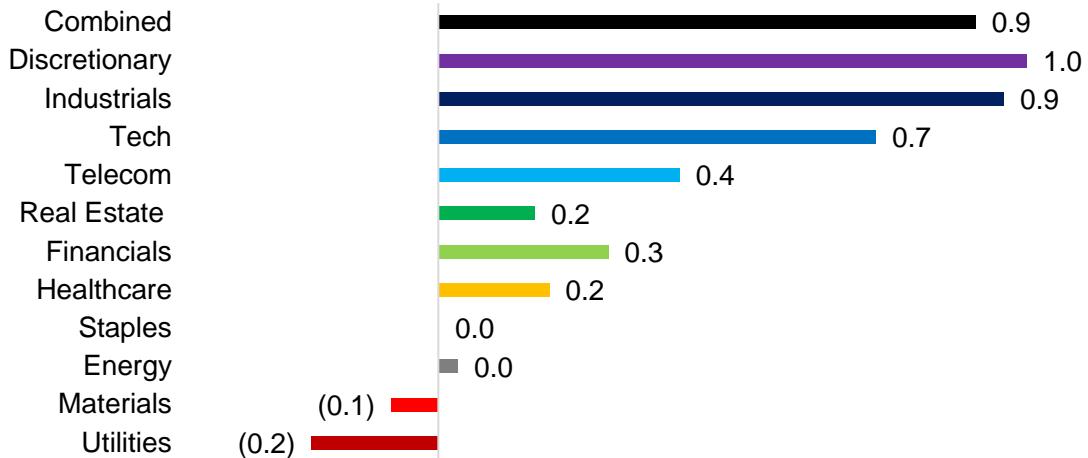
Source: FactorResearch

STATISTICAL ARBITRAGE ACROSS SECTORS IN THE US

We can expand the analysis to include all sectors of the US stock market. The chart below shows the risk-return ratios assuming transaction costs of 5 basis points and includes a market-capitalization weighted combination portfolio of all sectors.

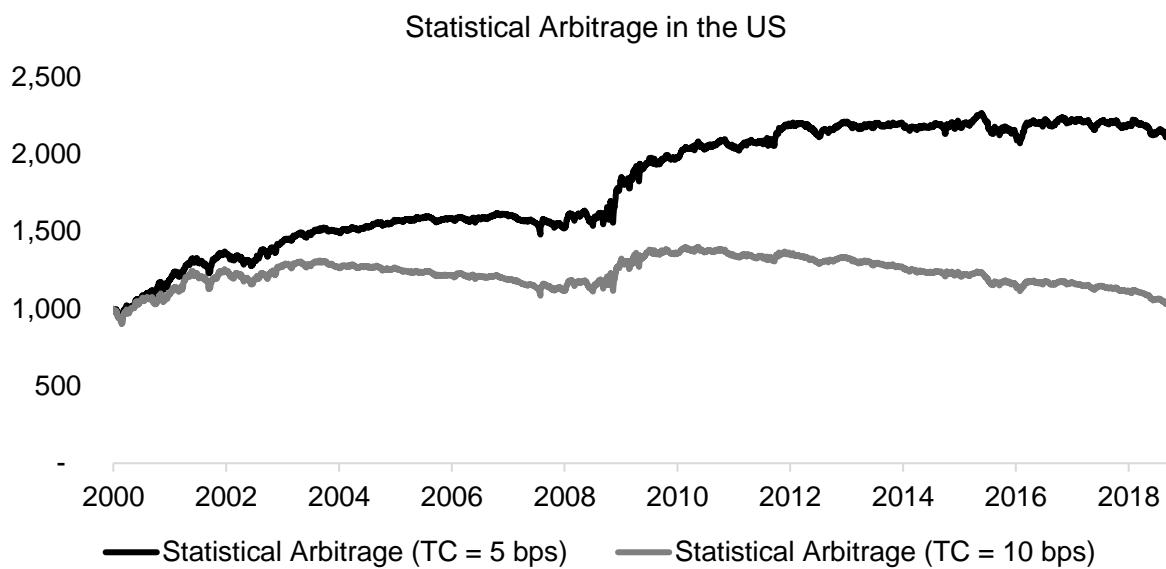
An investor might expect that sectors with low firm-risks offer higher risk-return ratios, but the results show a somewhat mixed picture. Utilities, which likely exhibit the highest systematic risks, generated the worst risk-return ratio, while real estate and telecom stocks are only moderately attractive. The consumer discretionary and industrial sectors, which have average firm-risks, featured the highest risk-adjusted returns. The results are likely impacted by the number of stocks in each sector as some, e.g. telecom, have only a few constituents, which leads to a less diversified portfolio of bets on mean-reversion.

Statistical Arbitrage Across Sectors: Risk-Return Ratios (2000 - 2018)



Source: FactorResearch

Next, we show the performance of the combined statistical arbitrage portfolio in the US, which is completely sector-neutral. The performance is attractive, albeit depending on transaction costs. We observe that the portfolio assuming transaction costs of 5 basis points exhibits hardly any drawdowns, albeit multi-year periods of flat performance. Higher costs make the strategy unattractive.

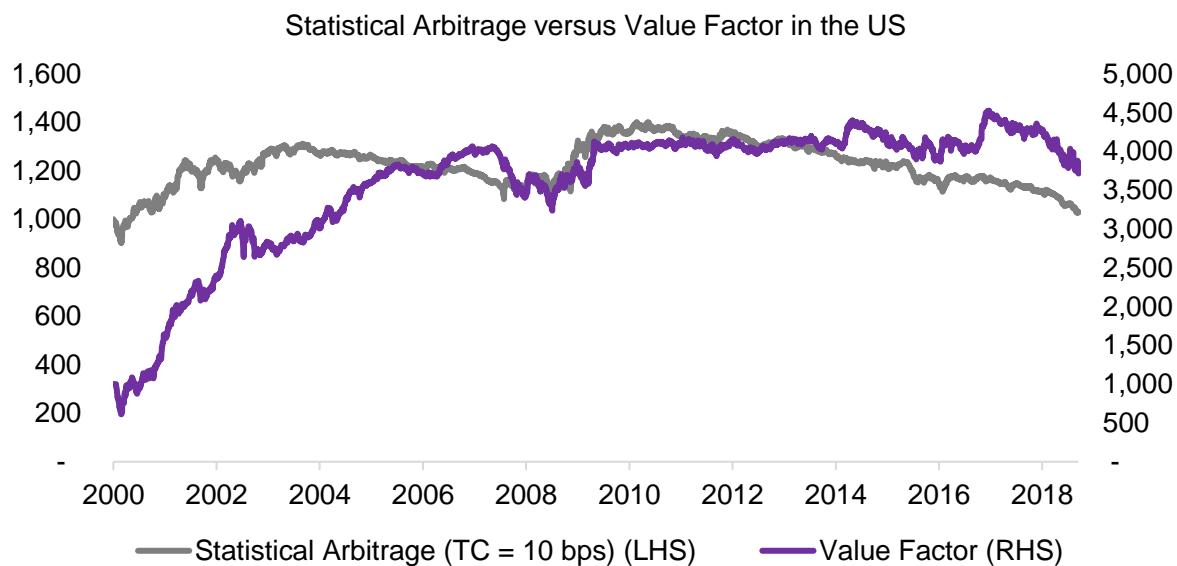


Source: FactorResearch

STATISTICAL ARBITRAGE AND THE VALUE FACTOR

Investors familiar with factor investing might have noticed that the shape of the statistical arbitrage performance is comparable to that of the long-short Value factor. Both strategies showed a strong increase between 2000 and 2004, a rebound in the Global Financial Crisis in 2009, and a declining performance since 2010.

Value is also a mean-reversion strategy as investors speculate that cheap companies will increase in valuations and expensive companies will become more reasonably priced. However, beyond this, establishing a clear relationship between both is challenging. Statistical arbitrage returns are higher when volatility is elevated as it is a strategy that benefits from the mistakes of other investors that are buying or selling too quickly. The drivers of Value are less clear, but volatility is not one that is frequently cited.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that statistical arbitrage is an attractive strategy, albeit depending on transaction costs. Given that the strategy does not correlate with equities and features hardly any drawdowns, it may serve as an interesting diversifying strategy for an equity portfolio, especially when volatility is high. However, given the ongoing automation of financial markets, future returns for simple versions of this strategy are likely much lower than the backtesting results indicate.

RELATED RESEARCH

[Mean-Reversion Across Markets](#)

[Tactical Mean-Reversion](#)

IMPROVING THE ODDS OF VALUE

Tactical versus Strategic Allocations to Value

October 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Value investors earn a premium for holding undesirable stocks
- Market skewness may identify periods where the premium is more attractive
- The returns from the Value factor since 1926 were zero when market skewness was negative

INTRODUCTION

Although buying cheap stocks is intuitively appealing, holding them is highly unappealing for most investors. Value stocks tend to be companies that lack growth, require balance sheet restructuring, feature incompetent management, need a new corporate strategy, are rated “Sell” by brokers, or have some other issue. Effectively Value investors provide a service to the market by holding undesirable stocks.

Historically Value investors were compensated for this service, although with moderate consistency across time. It would be highly desirable to identify the type of environment that is more favorable for harvesting the premium from buying cheap and selling expensive stocks. In this short research note, we will explore using market skewness for improving allocations to the Value factor.

METHODOLOGY

We focus on the Value factor in the US stock market and source data from the library of Kenneth R. French. The performance of the Value factor is derived from a dollar-neutral long-short portfolio of the top and bottom stocks in the US ranked by price-to-book multiples. The data is available from 1926 to 2018, includes companies with small market capitalizations, and excludes transaction costs.

THE VALUE FACTOR & MARKET SKEWNESS

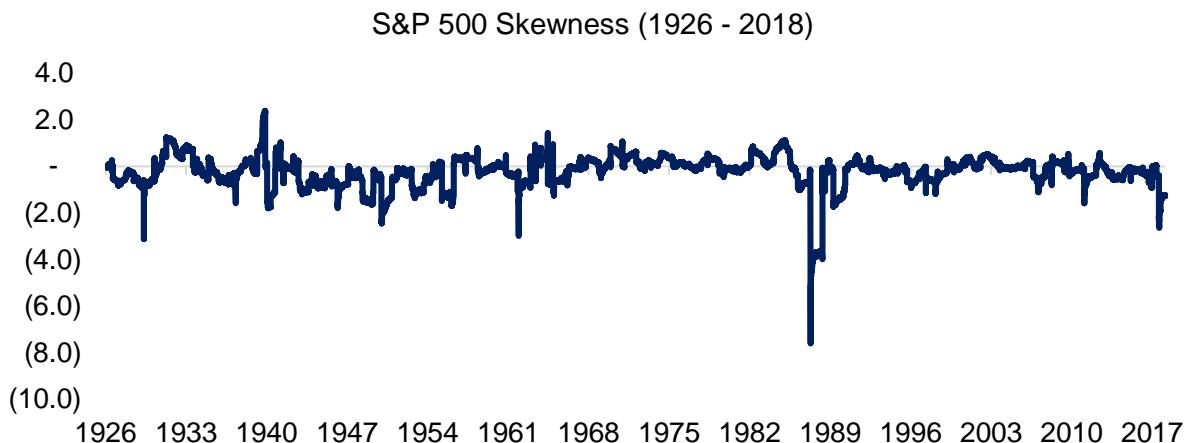
The chart below shows the skewness of the S&P 500 from 1926 to 2018 measured with a 12-month lookback. Positive skewness describes a return distribution where frequent small losses and a few extreme gains are common while negative skewness highlights frequent small gains and a few extreme losses.

The S&P 500's skewness was slightly negative (-0.2) over the 90-year period. The chart below highlights some of the significant moments in stock market history, e.g. the stock market crash of 1987. We can see that the most recent skewness in 2018 was more extreme than during the Global Financial Crisis, which is explained by the strong returns coupled with the exceptionally low volatility that preceded the market losses of the first quarter of 2018.



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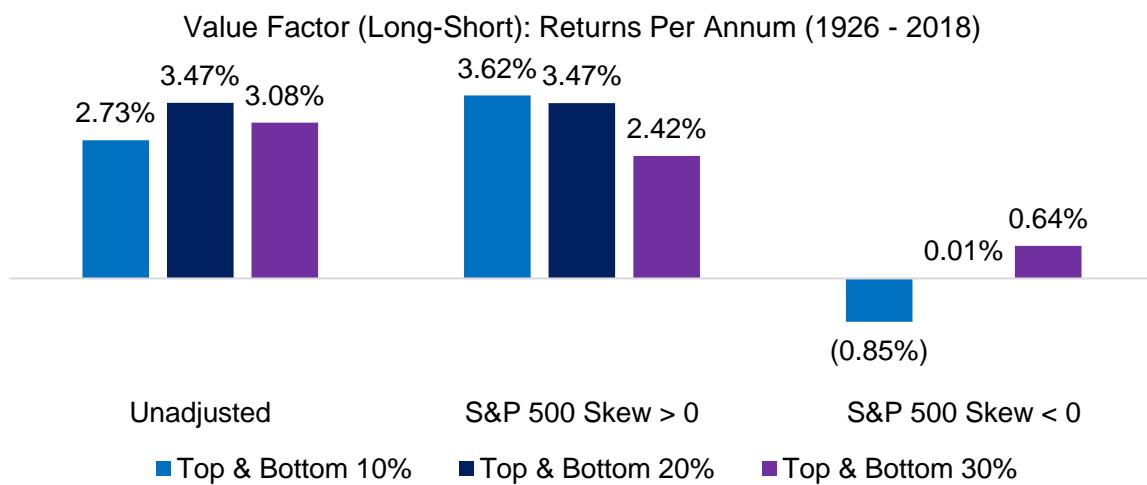


Source: FactorResearch, Stooq.com

If the stock market exhibits negative skewness, then the recent history features some days with large losses. Investors are likely to be risk averse when the skewness of the stock market is negative, which should create more demand for quality stocks than for cheap, but typically problematic companies.

The analysis below shows the returns per annum of the long-short Value factor from 1926 to 2018 for three portfolios, which were created based on the top and bottom 10%, 20% and 30% of US stocks ranked by price-to-book multiples.

We observe that the Value factor generated significantly higher returns per annum when the market skewness was positive than when negative. It is worth noting that the more concentrated the Value portfolio, e.g. the top and bottom 10% versus 30%, the larger the impact of skewness on the returns.



Source: FactorResearch, Kenneth R. French

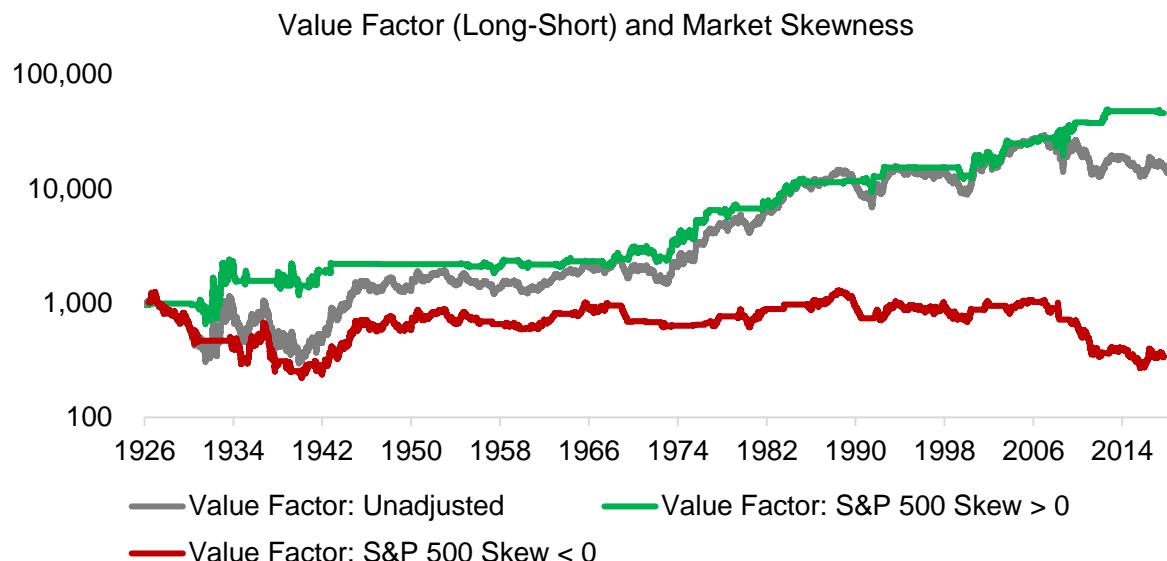
TACTICAL VERSUS STRATEGIC VALUE FACTOR EXPOSURE

We can apply the insight on the relationship between the Value factor and market skewness by developing a systematic allocation framework, which only invests in the Value factor when market skewness is positive, otherwise into cash. Allocation changes are implemented with one day delay to create a more realistic trading strategy. Given the 12-month lookback for calculating skewness, allocations change on average only three times per annum, which makes this framework attractive for implementation.

The chart below compares the performance of the Value factor to when market skewness was positive or negative. We focus on the most extreme Value portfolio comprised of the top and bottom 10% of the stocks. We observe the following:

Positive market skewness: The framework captures most of the returns generated by the Value factor with lower volatility and drawdowns, especially during the Great Depression and the most recent decade

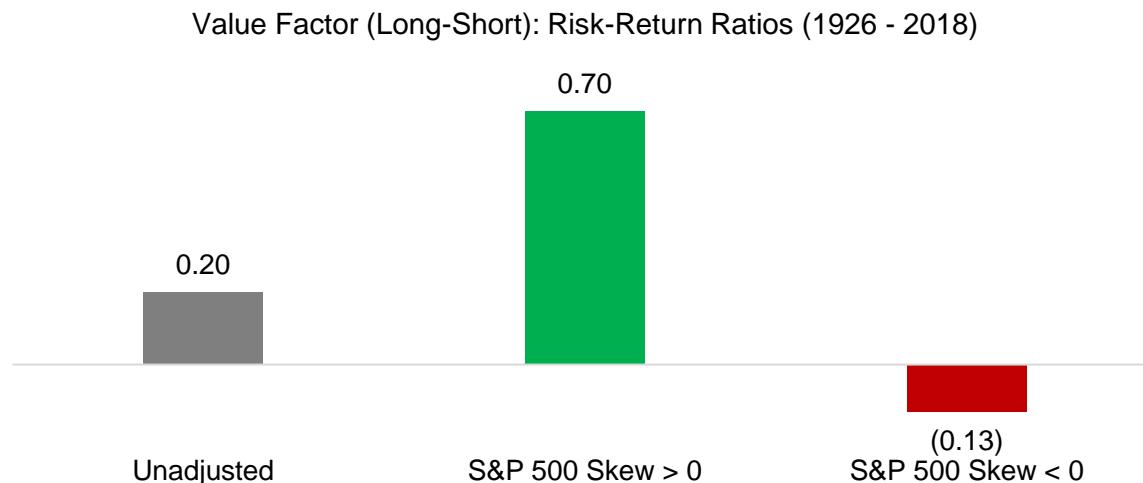
Negative market skewness: Post 1946 the Value factor did not generate any significant positive returns when market skewness was negative



Source: FactorResearch

Next, we normalize the return data by creating risk-return ratios, which highlight that allocating to the Value factor was not attractive when the skewness of the stock market was negative.

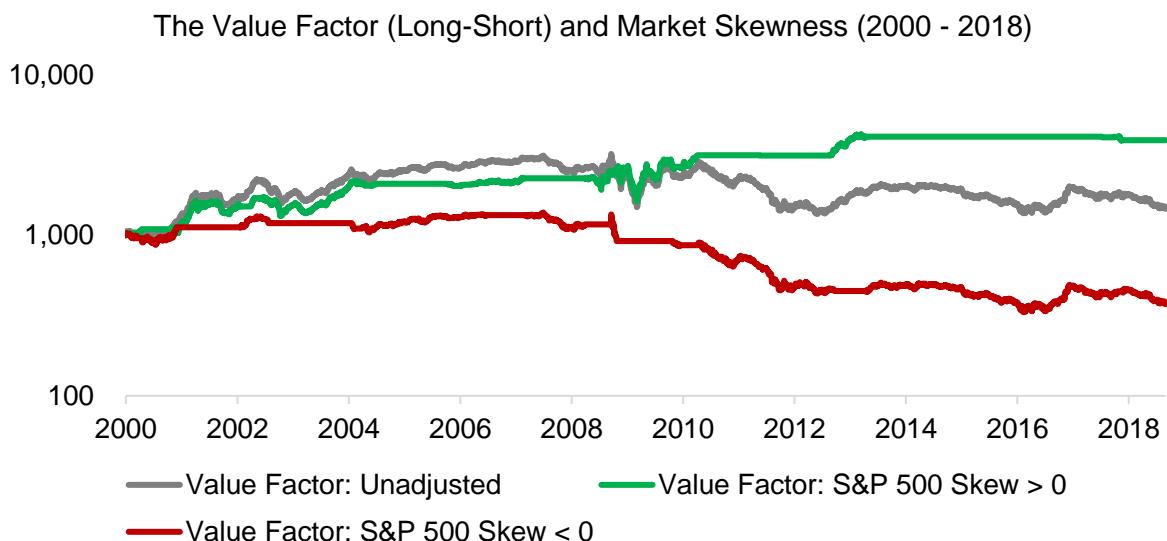
Given that the market is skewed positively only 35% of the time, it implies a 65% allocation to cash for the portfolio that allocates to the Value factor when skewness is positive. Investors could reallocate cash into short-term bonds or other strategies, which would further increase the risk-return ratio.



Source: FactorResearch

Most investors are likely to be more interested in the recent past, therefore we rebase the portfolios to 2000. We observe the Value rebound after the Tech bubble implosion between 2000 and 2003, but losses in the last decade and a total return of close to zero, which is before transaction costs.

Although the chart below emphasizes the attractiveness of only allocating to Value when market skewness is positive, it also highlights the difficulty of implementing the strategy in practice – years of a zero allocation to the Value factor. Given that Value is the most widely pursued strategy, it likely would challenge even highly disciplined investors to follow the framework.



Source: FactorResearch, Kenneth R. French

FURTHER THOUGHTS

This short research report introduces a novel, systematic framework for allocating to the Value factor. Allocating tactically based on the market skewness might be considered unusual given the abstract nature of skewness. However, the skewness of the stock market can perhaps be understood as a measurement for the risk sentiment of investors. If risk aversion prevails, then investors are less likely to be interested in cheap, but problematic stocks and Value investors will not get compensated for holding undesirable stocks.

The analysis can be challenged in many ways, amongst these are:

- Skewness lookback of 12 months; however, 6 and 24 months work equally well
- Price-to-book multiple as Value definition; however, Value portfolios show similar trends, regardless of how they are defined
- Excludes transaction costs; however, these would be minimal given that there are only three allocation changes per annum on average

The next step is to conduct the same analysis in other stock markets, which can serve as an out-of-sample test for the framework and will be the subject of another research note.

RELATED RESEARCH

[Skewness as a Factor](#)

[Factor Allocation Models](#)

FACTOR INVESTING IN MICRO & SMALL CAPS

Treasure Hunting in the Wild West of Equity Markets

October 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Micro caps are commonly perceived as highly risky, but potentially also highly rewarding
- Smalls caps generate more attractive risk-return ratios than micro caps on index level
- Focusing on factors improves risk-adjusted returns across market cap segments

INTRODUCTION

FAANG stocks like Apple (AAPL) are covered by dozens of highly trained financial analysts. Galaxy Gaming (GLXZ), on the other hand, is followed by exactly zero analysts.

Galaxy Gaming who?

Galaxy Gaming, which produces table games and betting platforms for the casino industry, has a market capitalization of \$50 million and trades over the counter (OTC). Unfortunately for such companies, analyst coverage of US stocks has been steadily decreasing since the 2000s due to tighter Wall Street regulations, among other factors.

But the lack of analyst coverage might offer alpha-generating opportunities. Could the less-covered areas of the equity markets be worth an extra look?

Although analyzing thousands of micro- and small-cap stocks by hand is not a sensible strategy, investors can apply systematic frameworks to uncover hidden gems. So does factor investing in micro- and small-cap stocks in the United States offer any additional alpha?

METHODOLOGY

To find out, we divided the US equity market into three segments based on market capitalization. Together these three segments approximate the Russell 3000 universe:

- Micro caps include about 800 stocks, each with \$100 million to \$500 million in market capitalization.
- Small caps feature about 400 stocks with \$500 million to \$1 billion in market capitalization.
- Mid and large caps have market capitalizations in excess of \$1 billion and number about 1,800 stocks in total

We created market cap-weighted and equal-weighted indices as well as three equal-weighted factor portfolios composed of the top 10% of stocks ranked by each factor. We



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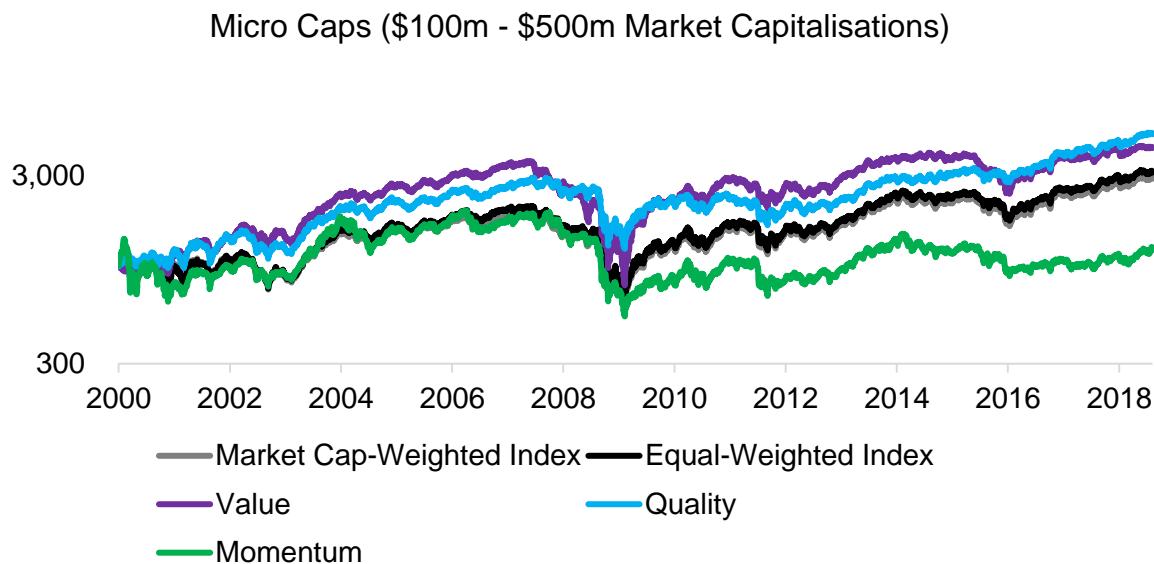
define Value as a combination of price-to-book and price-to-earnings multiples and Quality as a combination of return-on-equity and debt-over-equity. Momentum is measured by the performance over the last 12 months, excluding the most recent month. The indices are rebalanced quarterly and the factor portfolios monthly.

Transaction costs are 1% for micro caps, 0.5% for small caps, and 0.1% for mid and large caps. Since shorting micro- and small-cap stocks is expensive and frequently impossible, we focused on long-only portfolios.

FACTOR INVESTING IN MICRO CAPS

The small-cap companies generally come in two varieties: a small number of firms that recently went public and a large cohort whose businesses are in decline.

The characteristics of the universe are reflected by the performance of the Quality portfolio, which successfully reduces exposure to less healthy companies by focusing on profitable and lowly levered stocks. Cheap companies also outperformed the indices, while the Momentum portfolio underperformed post-2009, reflecting the severe Momentum crash that followed the financial crisis.

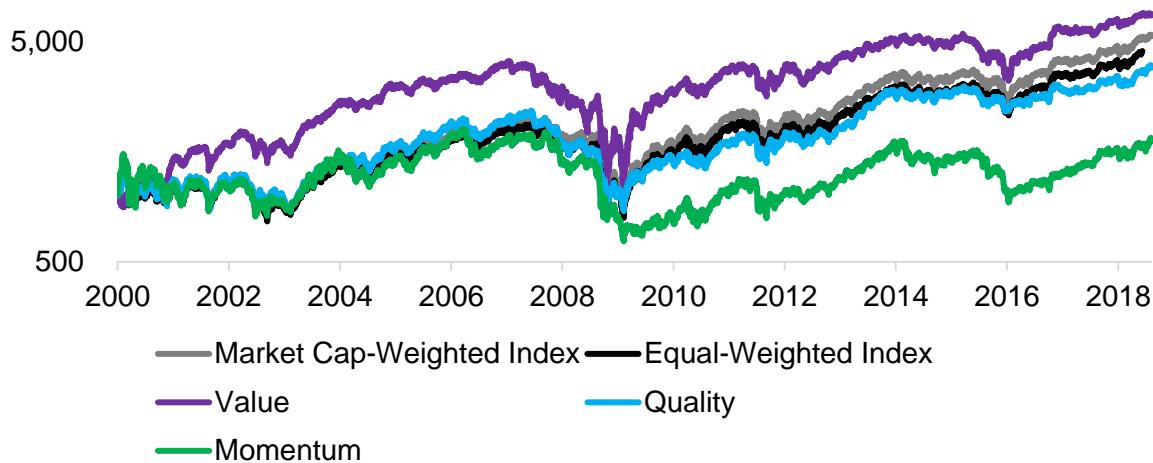


Source: FactorResearch

FACTOR INVESTING IN SMALL CAPS

Small caps generated more attractive returns than micro caps from 2000 to 2018. Only the Value portfolio outperformed the indices, with most of the outperformance coming between 2000 and 2003, when the tech bubble imploded. Cheap stocks were unpopular during the tech bubble but rebounded significantly thereafter.

Small Caps (\$500m - \$1,000m Market Capitalisations)

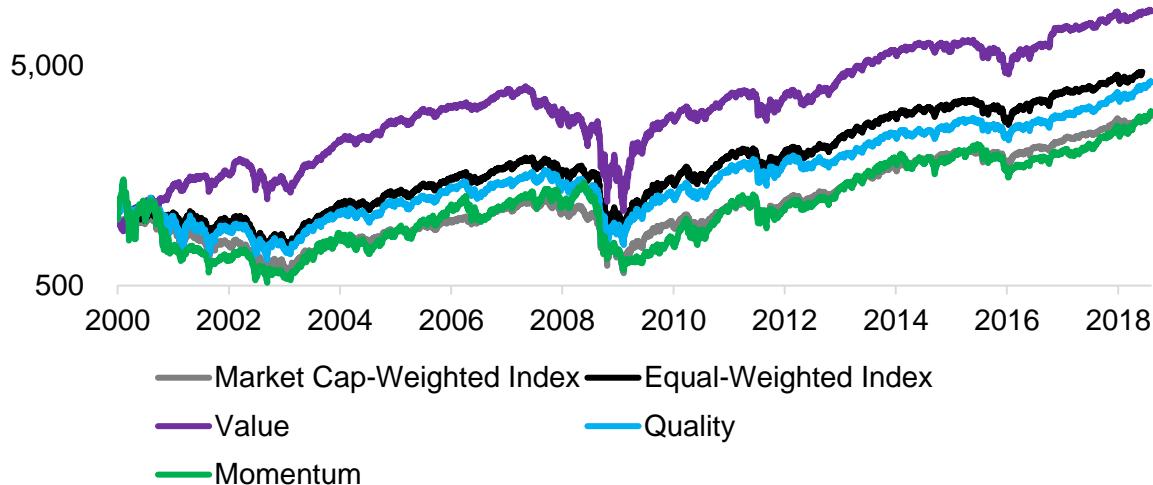


Source: FactorResearch

FACTOR INVESTING IN MID & LARGE CAPS

The mid-and large-cap universe is composed of mostly successful companies. As with micro and small caps, only cheap companies outperformed the indices. It is worth noting that the factor performance across market caps is relatively homogenous, which partially depends on the starting point of the analysis.

Mid & Large Caps (>\$1,000m Market Capitalisations)

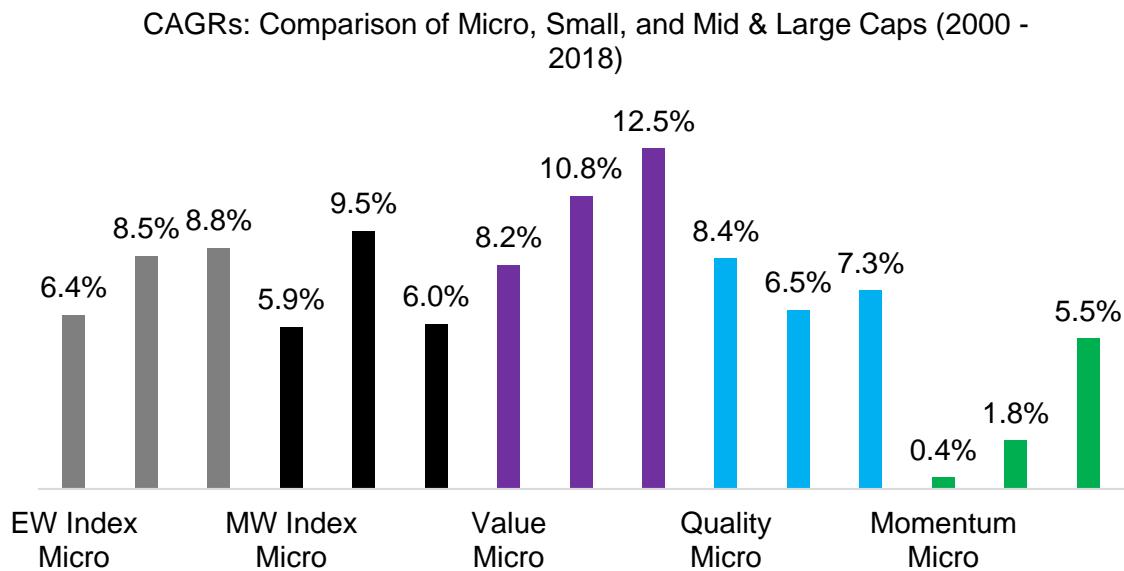


Source: FactorResearch

COMPARISON ACROSS MARKET CAP SEGMENTS

Analyzing the returns across the different market-cap segments yields the following takeaways:

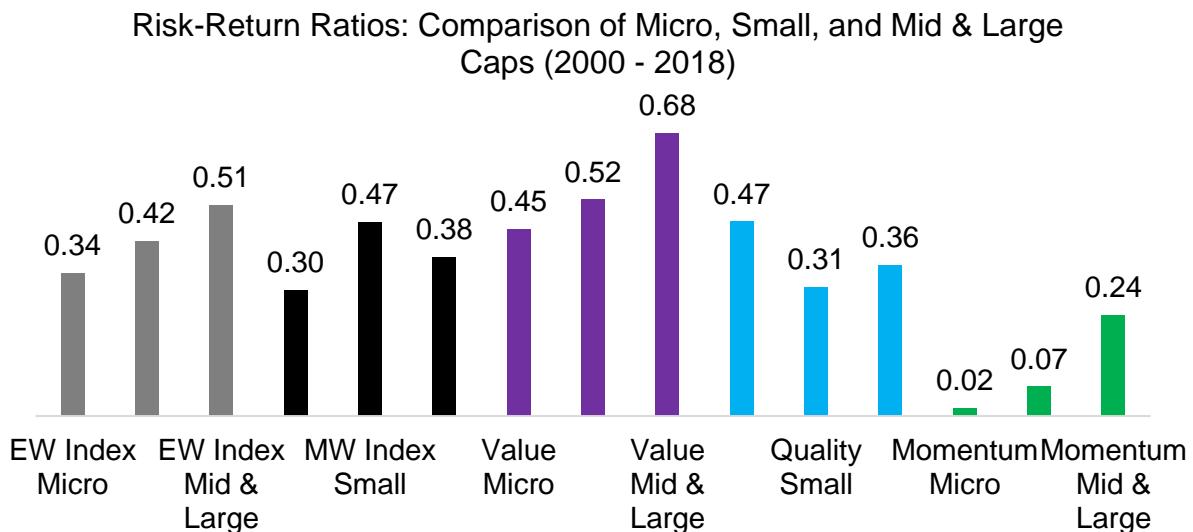
- Index returns were highest for mid and large caps when weighted equally (EW), but highest for small caps when weighted by market cap (MW).
- Micro caps did not generate attractive returns at the index level regardless of the weighting methodology.
- CAGRs from the Value factor portfolio increased linearly with market capitalization. This is likely because the Value rebound after the tech bubble was stronger in mid and large caps.
- The Quality factor is most effective in micro caps, successfully screening out the deteriorating businesses.
- Momentum was impacted by the Momentum crash of 2009 across market cap segments.



Source: FactorResearch

Returns can be normalized by transforming them into risk-return ratios. This demonstrates factor investing works just as well with mid and large caps as it does with small stocks.

Other researchers have shown that small caps generate the largest factor returns. Why do our results differ? Probably because we have different definitions of the market-cap segments, lookback periods, and transaction cost assumptions.



Source: FactorResearch

FURTHER THOUGHTS

Fortunately for most investors, our results demonstrate that factor returns are not exclusive to smaller companies.

So as alluring as they may be, US micro-caps — the Galaxy Gamings of the world — can safely be ignored.

RELATED RESEARCH

[Factor Returns: Small versus Large Caps](#)

FACTOR OLYMPICS Q3 2018

And the Winner is...

October 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Global factor performance in the first three quarters of 2018 is comparable to 2017
- However, regional factor performance diverges, reflecting changes in monetary and trade policies
- Low Volatility leads and Value lags

INTRODUCTION

We present the performance of seven well-known factors on an annual basis for the last 10 years and the first three quarters of 2018. It is worth mentioning that not all factors have strong academic support, e.g. Growth lacks a long-term track record of positive excess returns; however, is still a widely-followed investment style.

METHODOLOGY

The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks in the US, Europe and Japan and 20% in smaller markets. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios rebalance monthly and transactions incur 10 basis points of costs. Please see our [Factor Guide](#) for the factor definitions.

FACTOR OLYMPICS (LONG / SHORT): GLOBAL

The table below shows the factor performance for the last 10 years ranked top to bottom. The global series is comprised of all developed markets in Asia, Europe and the US. Aside from displaying the factor performance the analysis highlights the significant factor rotation in terms of profitability from one year to the next.

The first three quarters of 2018 shows largely a continuation of 2017, i.e. Low Volatility, Quality, Momentum and Growth generated positive returns while Size, Dividend Yield and Value were negative. Factors often exhibit the same trends across markets, but 2018 can be characterized by asynchronous factor performance, which is explained by divergent central bank policies and geopolitical risks.

Factor Olympics (Long / Short): Global												
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 Q1-Q3	
Positive Returns	Dividend Yield 9.0%	Value 28.2%	Quality 7.4%	Low Volatility 24.4%	Low Volatility 17.5%	Low Volatility 20.4%	Low Volatility 29.4%	Momentum 26.9%	Dividend Yield 14.3%	Quality 15.5%	Low Volatility 3.5%	
	Low Volatility 6.7%	Size 16.1%	Low Volatility 6.5%	Momentum 14.9%	Momentum 11.0%	Momentum 14.1%	Value 4.3%	Low Volatility 18.7%	Value 13.9%	Growth 14.8%	Quality 3.4%	
	Value 5.5%	Dividend Yield 11.8%	Size 6.3%	Growth 14.1%	Multi-Factor 5.2%	Quality 3.8%	Multi-Factor 9.7%	Growth 4.2%	Size 8.3%	Momentum 10.5%	Momentum 3.0%	
	Quality 3.7%	Growth 10.9%	Growth 5.2%	Quality 10.6%	Size 2.9%	Multi-Factor 6.5%	Dividend Yield 3.5%	Quality 0.5%	Low Volatility 8.1%	Low Volatility 7.3%	Growth 1.2%	
	Size 1.8%	Quality 6.0%	Multi-Factor 4.4%	Multi-Factor 7.4%	Dividend Yield 1.1%	Dividend Yield 3.5%	Quality 0.5%	Multi-Factor 12.4%	Multi-Factor 5.2%	Multi-Factor 3.3%	Multi-Factor 4.6%	
	Multi-Factor 1.7%	Multi-Factor 2.3%	Dividend Yield 4.3%	Dividend Yield 2.5%	Quality 0.0%	Size 2.7%	Momentum 0.1%	Size 4.7%	Quality 0.2%			
Negative Returns	Momentum (4.6%)	Low Volatility (15.2%)	Value (2.4%)	Size (3.6%)	Value (0.9%)	Growth (0.2%)	Size (3.2%)	Dividend Yield (10.4%)	Growth (8.6%)	Size (0.5%)	Size (0.3%)	
	Growth (10.5%)	Momentum (41.4%)	Value (11.0%)	Growth (4.9%)	Value (4.9%)	Growth (4.9%)	Growth (4.5%)	Value (10.9%)	Momentum (10.2%)	Dividend Yield (6.3%)	Multi-Factor (0.6%)	
	Market (38.2%)	28.7%	9.8%	(6.2%)	17.6%	32.2%	9.7%	3.8%	7.9%	18.3%	4.5%	
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 1H	

Source: FactorResearch

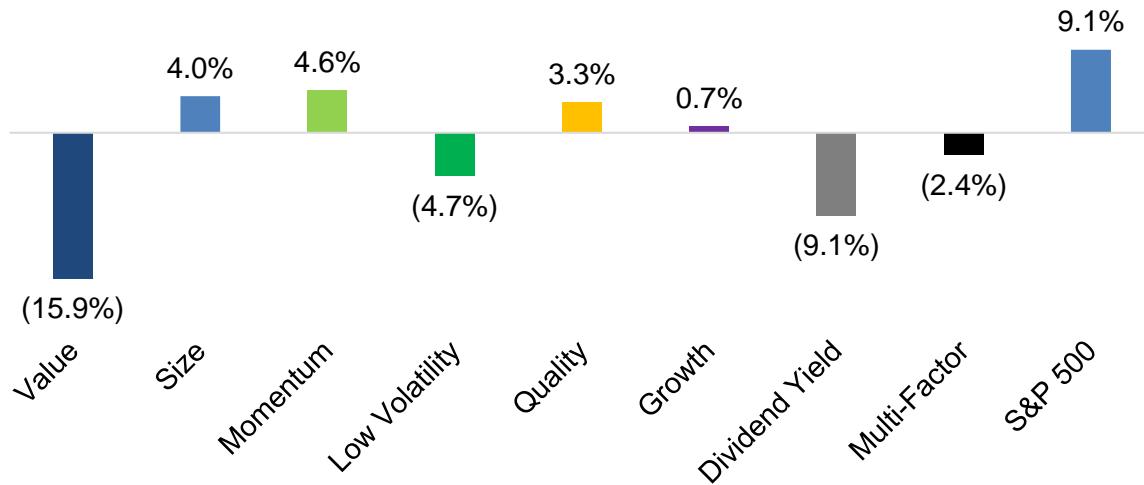
FACTOR PERFORMANCE Q1-Q3 2018: US

The table above reflects the global factor performance and it is interesting to analyse how homogeneous the performance is across regions. The global performance is significantly weighted towards the US, so it is not surprising that factor performance in the US is comparable to the global returns.

The factor performance in the first three quarters of 2018 can be partially explained as follows:

- Value: Similar to 2017, investors continue to show a strong preference for growing companies, especially in the Technology sector, and seem to place less emphasis on valuation. The negative performance of the Value factors is reflected in the positive performance of Momentum, Quality and Growth.
- Size: The trade tariffs introduced by the US government have favoured small caps as investors expect these companies to be less affected by a global trade war.
- Low Volatility: The US economy continues to show strong economic growth and low unemployment, which has led to changes in monetary policy and rising interest rates. The Low Volatility factor exhibits interest rate-sensitivity and has therefore been negatively impacted.

Factor Performance Q1 - Q3 2018 (Long / Short): US



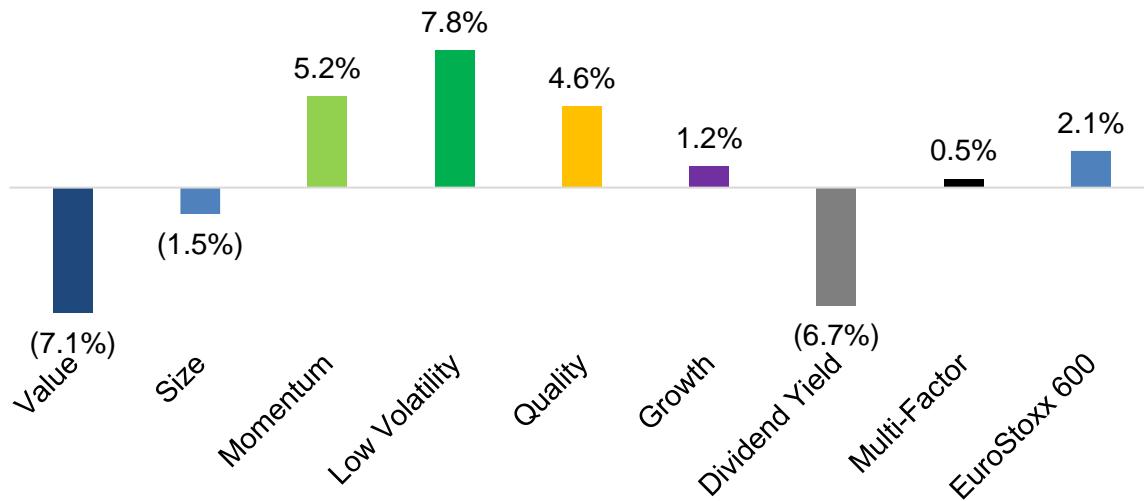
Source: FactorResearch

FACTOR PERFORMANCE Q1-Q3 2018: EUROPE

In most years the factor performance in Europe mirrors the US; however, in 2018 there are some divergent trends. The key differences are the following:

- Size: Small cap stocks did not outperform large caps in Europe, which implies that investors anticipate the trade tariffs to have a larger impact on US than on European stocks.
- Low Volatility: While the Low Volatility factor was negative in the US, it was the best performing factor in Europe. The US central bank has started raising interest rates, while the ECB is only moderately changing its monetary policy, which likely explains the difference in performance.

Factor Performance Q1 - Q3 2018 (Long / Short): Europe



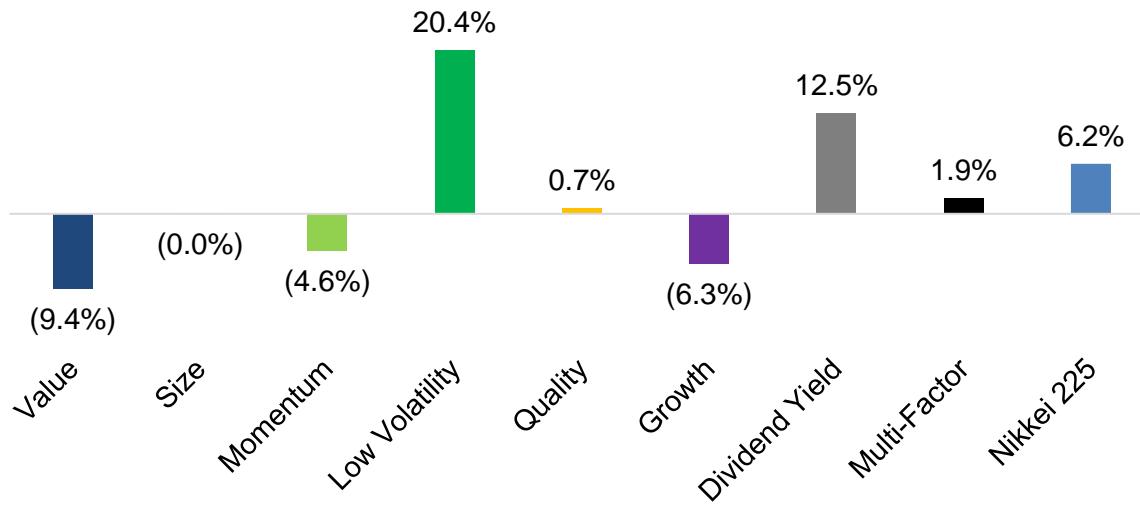
Source: FactorResearch

FACTOR PERFORMANCE Q1-Q3 2018: JAPAN

The factor performance in Japan shows even stronger divergent trends to the US performance than Europe. The key differences to both other regions are the following:

- Momentum & Growth: There seems to be less enthusiasm for growing companies, which is reflected in the negative performance of these two factors. However, it is worth noting that the Momentum factor in Japan has historically generated lower returns than in other markets. Japanese investors tend to prefer Mean-Reversion over Momentum strategies.
- Dividend Yield: Cheap companies tend to pay high dividends, which makes Value and Dividend Yield related factors. While Value was negative across all three regions, Dividend Yield was positive in Japan, which might be explained by the negative performance of the carry factor in foreign exchange. Japanese investors are well-known for pursuing carry strategies, which were unattractive in 2018 given the steep declines in emerging market currencies. Perhaps the strong performance of the Dividend Yield factor reflects Japanese investors reallocating capital from riskier emerging market currencies to high yielding local stocks.

Factor Performance Q1 - Q3 2018 (Long / Short): Japan

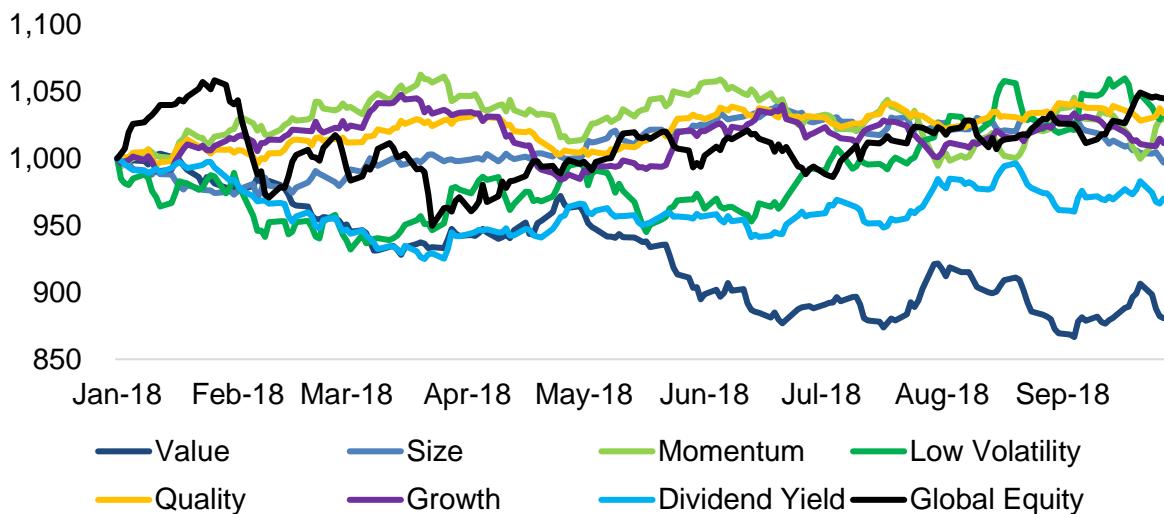


Source: FactorResearch

FACTOR PERFORMANCE 2018: PERFORMANCE CHART

The chart below shows the factor performance in the first three quarters of 2018 and we can identify one cluster of correlated factors, which comprises Growth, Quality and Momentum. The Technology sector currently contributes a significant amount of stocks to these three factors as Tech companies have shown strong growth in sales and earnings (Growth) and also feature high profitability and low levels of debt (Quality), which has led these stocks to outperform others (Momentum). It is worth highlighting the divergence of cheap (Value) and high yielding stocks (Dividend Yield) from May onwards.

Factor Performance Q1 - Q3 2018 (Long / Short): Global



Source: FactorResearchThe correlation matrix below highlights the global one-year factor correlations. We can observe strong relationships between Momentum and Growth, Quality and Growth, and Low Volatility and Dividend Yield. Some of these are structural, e.g. Quality and Growth in the US have been correlated for many years. Low Volatility and Dividend Yield do not tend to be correlated, but both currently exhibit interest rate-sensitivity. Some factors show low or negative correlations, which can be accretive for creating diversified multi-factor portfolios.

Global Factor Correlations (Long / Short): Last 12 Months

	Value	Size	Momentum	Low Volatility	Quality	Growth	Dividend Yield	Global Equity
Value	1	(0.15)	(0.71)	0.27	(0.39)	(0.54)	0.64	0.01
Size	(0.15)	1	0.06	(0.33)	0.03	0.04	(0.09)	(0.22)
Momentum	(0.71)	0.06	1	(0.23)	0.49	0.54	(0.66)	0.02
Low Volatility	0.27	(0.33)	(0.23)	1	0.12	0.11	0.59	0.06
Quality	(0.39)	0.03	0.49	0.12	1	0.68	(0.33)	0.08
Growth	(0.54)	0.04	0.54	0.11	0.68	1	(0.35)	(0.01)
Dividend Yield	0.64	(0.09)	(0.66)	0.59	(0.33)	(0.35)	1	0.02
Global Equity	0.01	(0.22)	0.02	0.06	0.08	(0.01)	0.02	1

Source: FactorResearch

FURTHER THOUGHTS

Most multi-factor products feature Value as a core factor and the strongly negative performance of Value was not offset by other factors, implying that 2018 is not shaping up as a great year for factor-focused investors. Given that our factor returns are post transaction costs, but before fund expenses, realized returns from investible products will be even less attractive.

LIQUID ALTERNATIVES: ALTERNATIVE ENOUGH?

Fake Alternatives?

September 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Liquid alternatives offer hedge fund strategies in mutual fund format
- The correlations to the S&P 500 have been high, even of market neutral funds
- Diversification benefits have therefore been limited

DISRUPTING THE HEDGE FUND INDUSTRY

Liquid alternatives have been heralded as hedge funds for Main Street as these investment vehicles offer typical hedge fund strategies in mutual fund format with daily liquidity. While they have higher management fees than plain vanilla mutual funds, liquid alternatives charge less than hedge funds and don't charge performance fees.

Given their lower fees and greater transparency, liquid alternatives were expected to disrupt the hedge fund industry in much the same way that exchange-traded funds (ETFs) disrupted the mutual fund space. However, ETFs have enjoyed continuous growth in assets under management (AUM), while liquid alternatives have stalled at around \$350 billion in AUM since 2013, according to data from Wilshire.

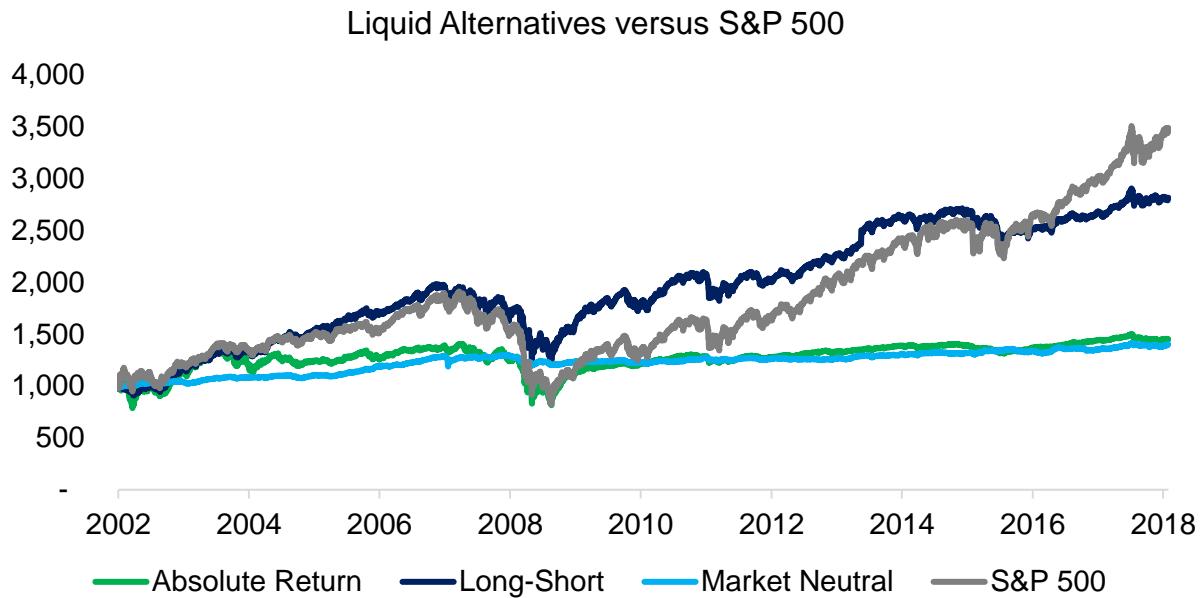
Hedge funds have experienced a similar stall, hovering at around \$3 trillion in AUM over the last five years. Given strong equity markets, investors likely were less inclined to hedge their portfolios. Moreover, hedge funds also failed to generate meaningful alpha.

So how do liquid alternatives perform from a risk-and-return perspective in the context of an equity portfolio, particularly the three largest groups in the liquid alternative mutual fund space — absolute return, long-short, and market-neutral strategies?

LIQUID ALTERNATIVES PERFORMANCE

Long-short and long-only strategies are not comparable, so hedge funds and liquid alternatives shouldn't be benchmarked to the S&P 500. But the S&P 500 can illustrate the different phases of the market cycle.

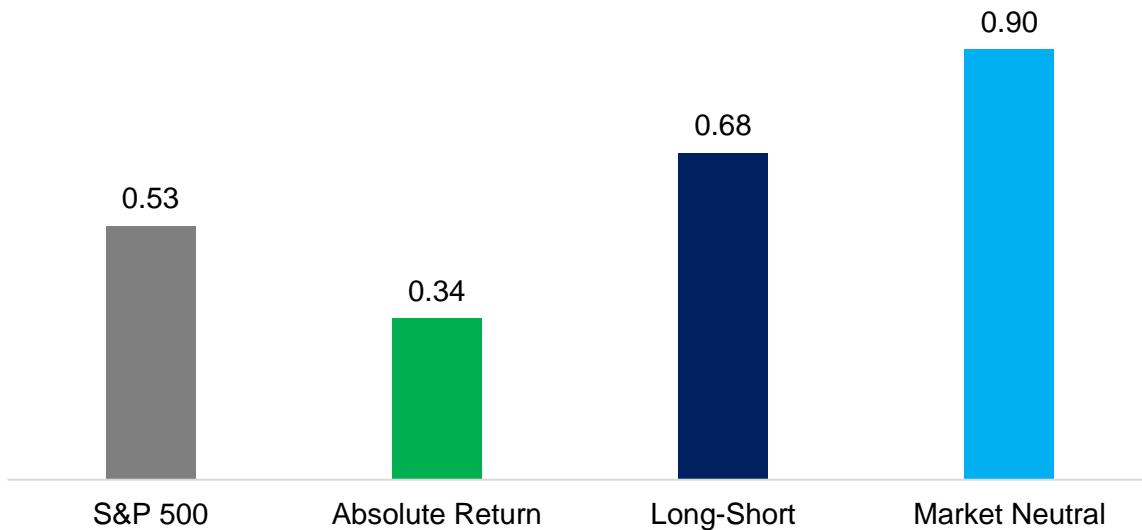
The chart below highlights the similarity between the S&P 500 and an equal-weighted index of long-short liquid alternative mutual funds. This is to be expected since long-short funds essentially offer equity exposure with lower volatility. In contrast, market-neutral funds are typically fully hedged and absolute return funds allocate across asset classes, which results in much lower return profiles.



Source: FactorResearch

When it comes to risk-adjusted returns, long-short and market-neutral funds perform well. Absolute return funds generated less attractive risk-return ratios, which is surprising since absolute return portfolio managers have the flexibility to create well-diversified portfolios. Perhaps this reflects the challenges of tactically timing allocations to different asset classes like equities, bonds, or commodities.

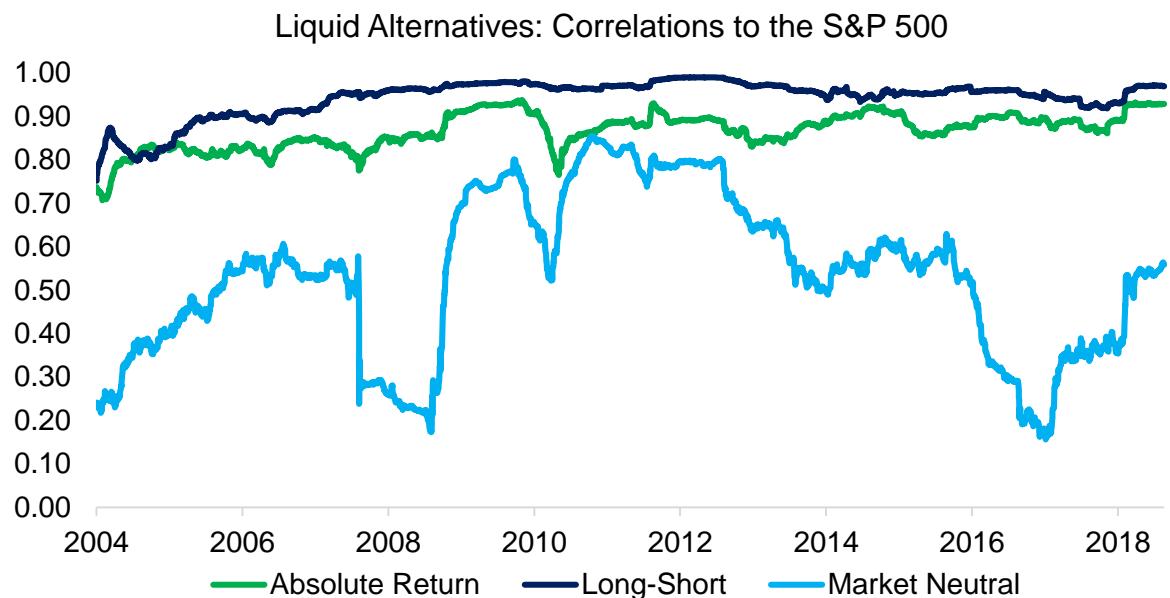
Liquid Alternatives: Risk-Return Ratios (2002 - 2018)



Source: FactorResearch

UNCORRELATED RETURNS?

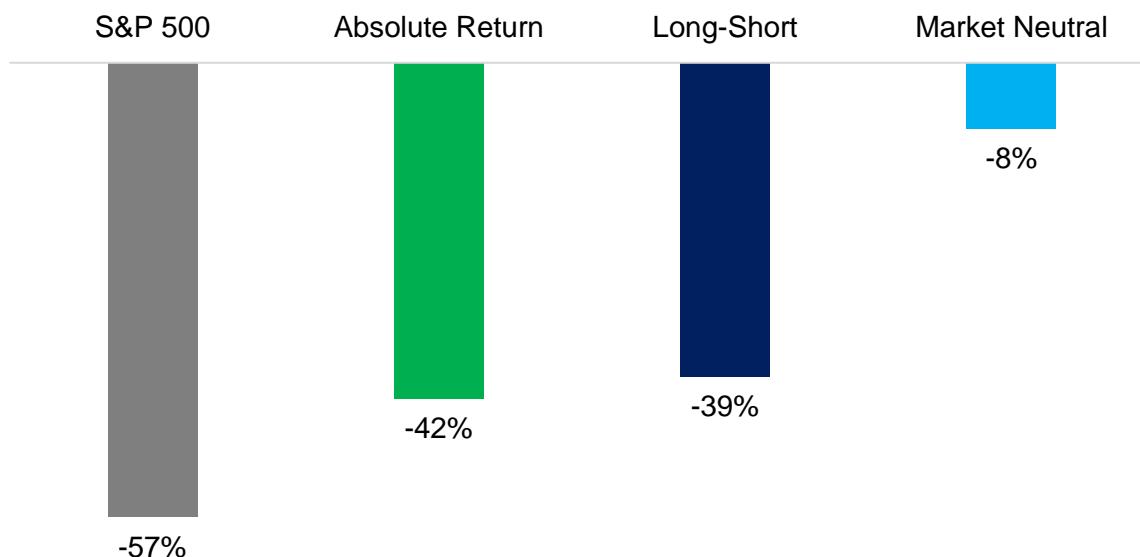
As their name implies, hedge funds short stocks in order to preserve capital. Similarly, liquid alternatives aim to provide returns that don't correlate to traditional asset classes. However, the analysis below shows that liquid absolute return and long-short funds are highly correlated to the S&P 500. That means they offer little protection in a potential stock market crash. Market-neutral funds should have close to zero correlation to the S&P 500, but frequently have correlations above 0.5.



Source: FactorResearch. Geeks might recognize the Quant Crash in August 2007.

This high correlation to the S&P 500 resulted in significant drawdowns in liquid alternatives during the global financial crisis in 2008 to 2009. Although the maximum drawdowns were less than those of the S&P 500, an investor in an absolute return fund would hardly have been pleased with a 42% drawdown. Market-neutral funds had a significantly lower drawdown, making them slightly more interesting for diversification purposes.

Liquid Alternatives: Max Drawdowns (2002 - 2018)



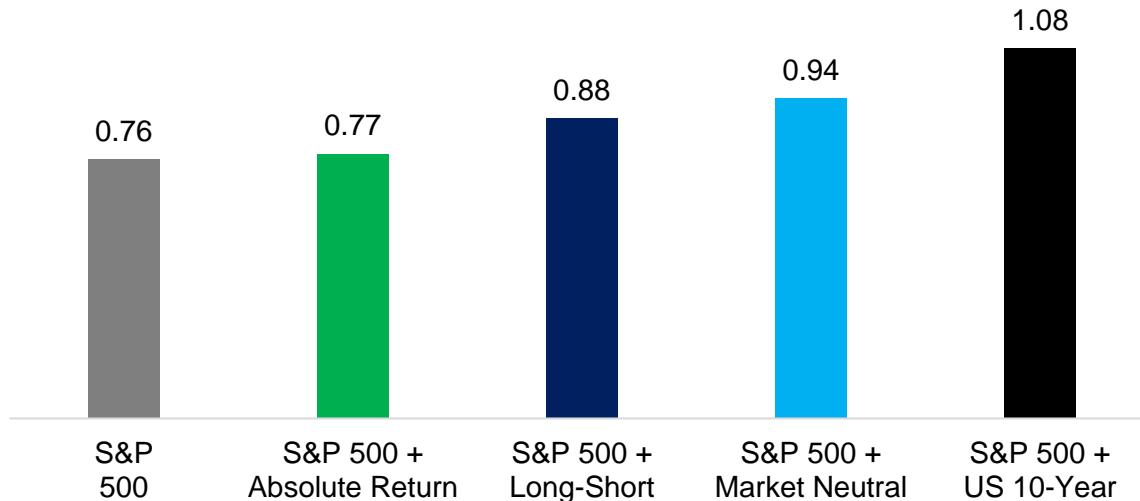
Source: FactorResearch

LIQUID ALTERNATIVES FROM A PORTFOLIO PERSPECTIVE

An investor currently concerned about high valuations, record levels of debt, and geopolitical instability might consider adding liquid alternatives to protect their portfolio. We can simulate this on a historical basis by adding a 20% allocation of liquid alternatives to a portfolio consisting exclusively of the S&P 500 with quarterly rebalancing.

In this case, the risk-return ratios would have improved in all three scenarios compared to the S&P 500 on a stand-alone basis, demonstrating the benefits of diversification. However, adding an equivalent allocation to 10-year US Treasury bonds would have meant better risk-adjusted returns.

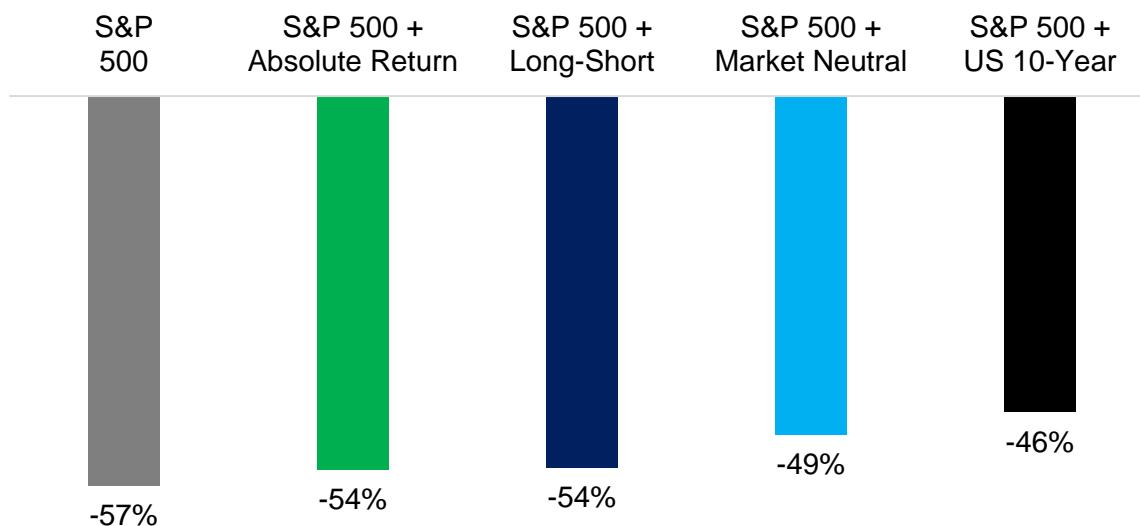
S&P 500 (80%) + Liquid Alternatives (20%): Risk-Return Ratios
(2002 - 2018)



Source: FactorResearch

Similarly, the maximum drawdowns of the combined portfolios would have fallen only slightly and less than they would have with exposure to bonds. That means liquid alternatives do not generate returns sufficiently uncorrelated to an equity portfolio. Put another way: They are not alternative enough.

S&P 500 (80%) + Liquid Alternatives (20%): Max Drawdowns
(2002 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

Liquid alternatives are useful investment products that give all sorts of investors access to typical hedge fund strategies and exert pressure on the hedge fund industry to reduce its fees. But investors should be wary of liquid alternative funds that offer equity exposure at high fees and effectively represent fake alternatives.

RELATED RESEARCH

[Hedge Fund Factor Exposure & Alternatives](#)

[Factor ETFs & Futures](#)

SHORT-TERM MOMENTUM IN EQUITY FACTORS

Does Short-Term Performance Chasing Work?

September 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Short-term momentum persists in common equity factors
- The persistence is strong in Value and Dividend Yield
- However, these results conflict with short-term mean-reversion on equity index level

INTRODUCTION

When Trump won the US presidential election in November 2016, small and cheap stocks started rallying, which surprised most investors as the consensus was a risk-off positioning. As new trends emerge, a frequent question is if these trends will sustain. Momentum, which is a trend following strategy, works when measured over longer time periods, but some investors might be more intrigued by chasing performance on a shorter time frame. In this short research note, we will evaluate short-term momentum in common equity factors across markets.

METHODOLOGY

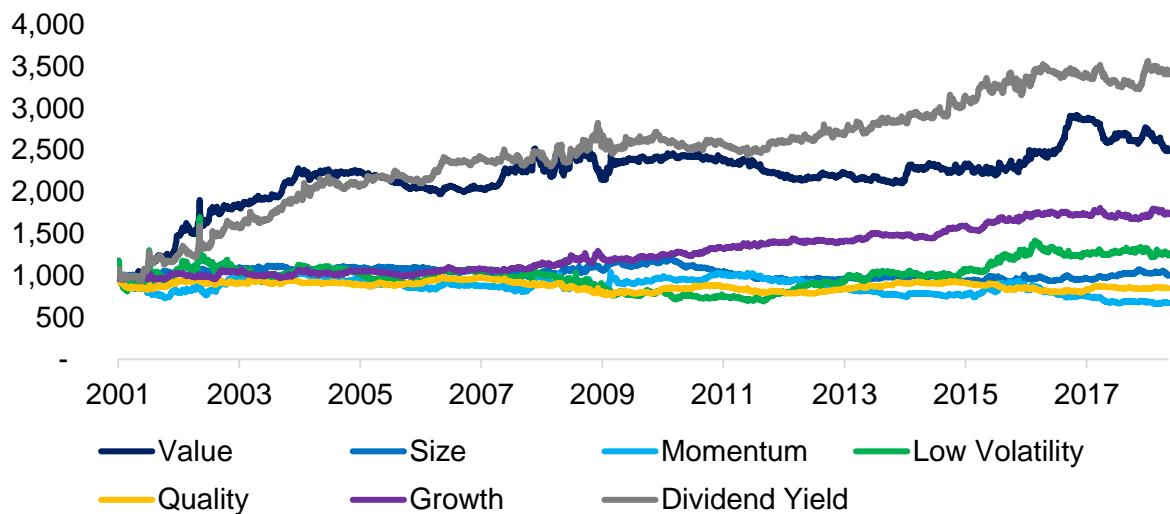
We focus on a universe of seven factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield in the US, European, UK and Japanese stock markets. The factor performance is calculated by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks ranked by the factor definitions, which are in line with academic and industry standards. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

Short-term momentum is defined as a time series momentum strategy, i.e. we buy the factor if last week's performance was positive and short the factor if the performance was negative. A trade is entered each day and held for a week. The portfolio can therefore be theoretically 100% net long or short a factor. Transaction costs are ignored, which makes this analysis more interesting from a theoretical than practical perspective.

SHORT-TERM MOMENTUM IN US EQUITY FACTORS

The chart below shows the performance of the short-term momentum strategy applied to common equity factors in the US. We can observe that most factors do not exhibit performance persistence, except for Value, Growth and Dividend Yield. Growth generated a lower return than Value or Dividend Yield, but has been highly consistent since 2009.

Short-Term Momentum in Equity Factors in the US

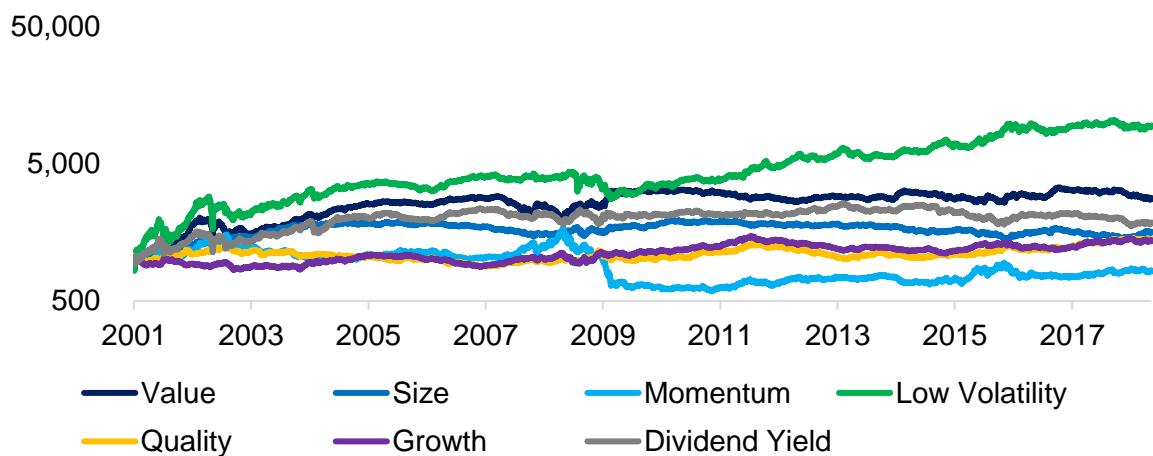


Source: FactorResearch

US EQUITY FACTOR PERFORMANCE

Investors might expect that there is a relationship between the persistence of performance and factor performance. Interestingly, the three factors that exhibited strong short-term momentum, i.e. Value, Growth and Dividend Yield, do not distinguish themselves from other factors in terms of underlying performance, at least not from a subjective perspective gained by viewing the chart below. The Low Volatility factor generated the strongest performance since 2001, but does not exhibit any persistence, indicating frequent short-term reversals.

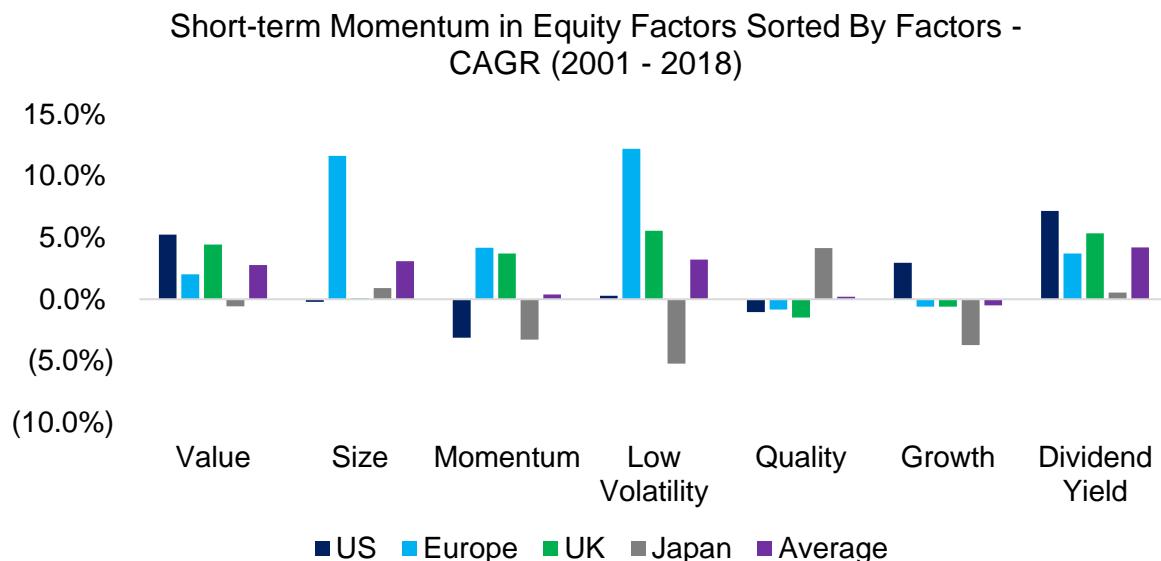
US Equity Factor Performance (Long-Short)



Source: FactorResearch

SHORT-TERM MOMENTUM IN EQUITY FACTORS SORTED BY FACTORS

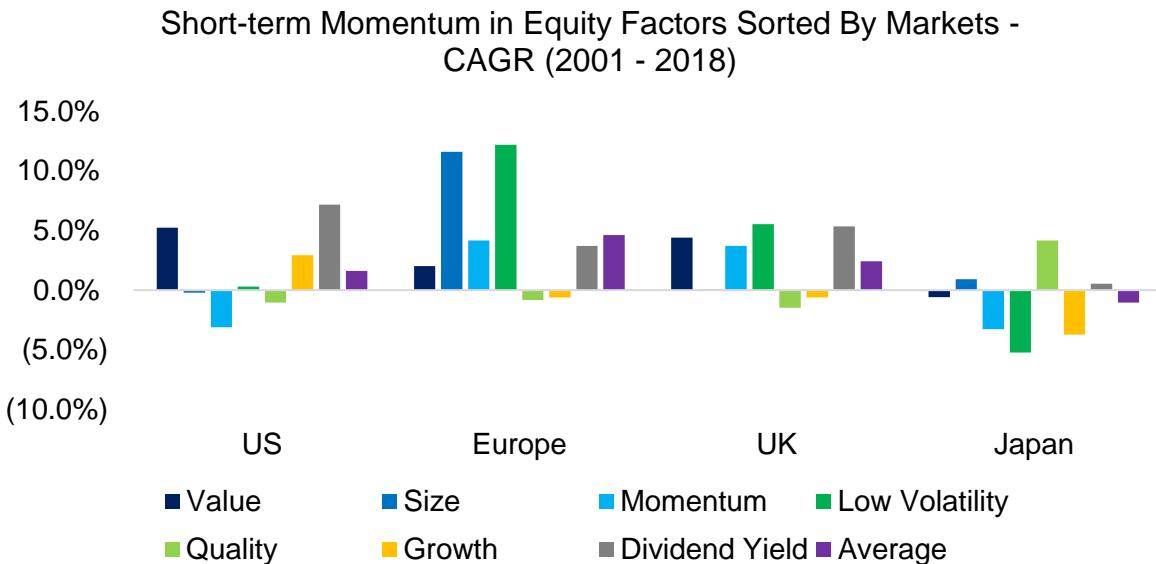
We can expand the analysis to other markets to investigate if the performance persistence found in the Value, Growth and Dividend Yield factors in the US can be validated elsewhere. The chart below highlights that Value and Dividend Yield, which are related factors, exhibited short-term momentum across markets, although this does not hold for Growth. It is worth noting that the average performance of the short-term momentum strategy is positive for six out of seven factors, highlighting that chasing short-term factor performance has merit, at least theoretically when excluding transaction costs.



Source: FactorResearch

SHORT-TERM MOMENTUM IN EQUITY FACTORS SORTED BY MARKETS

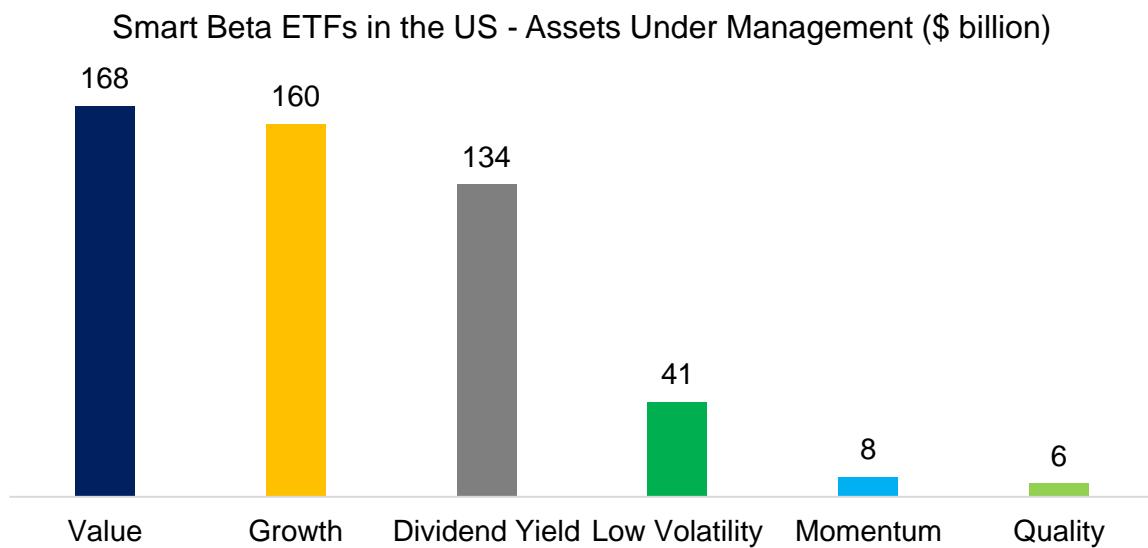
We can change the perspective by displaying the short-term momentum strategy by markets, which reveals that factors exhibit performance persistence across markets, except for Japan. Other researchers have similarly concluded in studies of quantitative strategies that Japan's stock market is driven more by mean-reversion than by momentum.



Source: FactorResearch

PERFORMANCE PERSISTENCE REQUIRES PRODUCTS

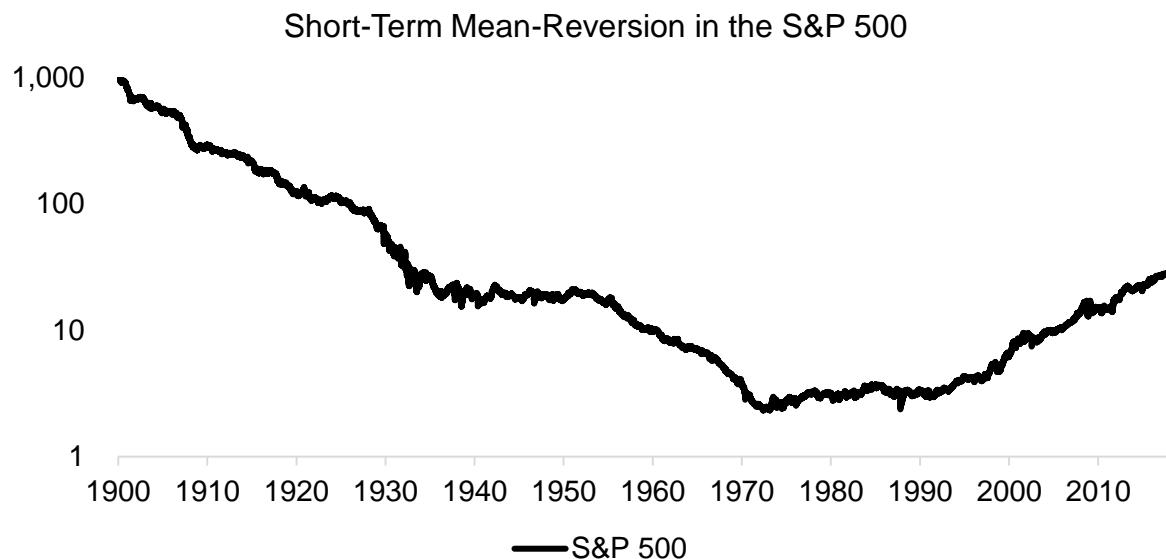
Value and Growth represent the most widely-followed investment styles and factors with the largest assets under management. Using smart beta ETFs in the US as a proxy, we can visualize the assets allocated to these two styles as well as to Dividend Yield. All three exhibited performance persistence, which likely is stronger the more products are available that allow performance chasing. ETFs are naturally highly suitable for this given low transaction costs and daily liquidity.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that common equity factors exhibit performance persistence in most markets. However, these results conflict with investor behaviour on equity index level, which is dominated by short-term mean-reversion, i.e. the inverse of short-term momentum. The chart below shows that the S&P 500 exhibited short-term momentum from 1900 to the 1970s, but has been dominated by short-term mean-reversion since then.



Source: FactorResearch

RELATED RESEARCH

[Mean-Reversion on Equity Index Level](#)

[Chasing Mutual Fund Performance](#)

[Factor Momentum](#)

VOLATILITY, DISPERSION & CORRELATION – FRIENDS OR FOES?

Reading Stock Market Tea Leaves.

September 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Higher volatility & dispersion imply higher stock market risks
- The relationship between correlation and risk is not linear
- However, these market technicals do not behave consistently across time

INTRODUCTION

Financial reporters frequently comment on stock market technicals like volatility and correlation, although most investors struggle to process this information adequately. The VIX jumping by 20% sounds concerning until compared to the historical volatility of the index, where increases or decreases of similar magnitude were frequent. In recent years, higher stock market volatility was typically associated with falling stock prices and a potential harbinger of a stock market crash. However, in the years leading up to 2000, volatility was high and stock prices were increasing. The implications of changes in stock market technicals on returns and risks are complicated. In this short research note we will investigate volatility, dispersion and correlation of the US stock market.

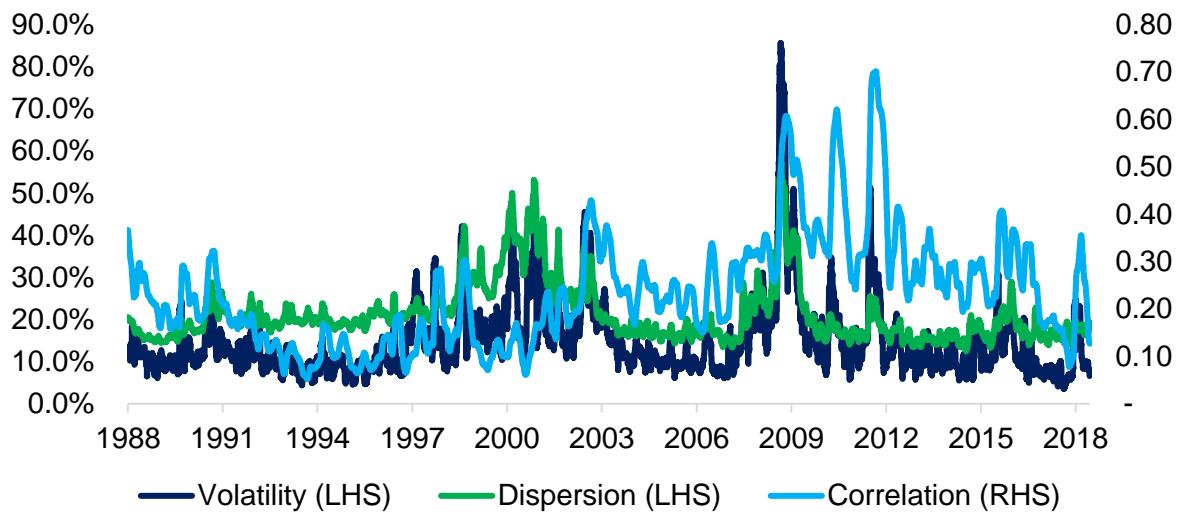
METHODOLOGY

We focus on volatility, dispersion and correlation of the US stock market for the period from 1988 to 2018. Volatility is measured by realized returns of the stock market with a one-month lookback. Dispersion is calculated as the absolute differences between stock prices and the market average on a daily basis, which is then averaged over a one-month period. Correlation is derived from the pairwise correlations of all stocks in the universe measured over a three-month lookback.

VOLATILITY, DISPERSION & CORRELATION IN THE US

The chart below highlights the volatility, annualised dispersion and correlation of the US stock market from 1988 to 2018. Bull markets can broadly be categorized by exhibiting low volatility and dispersion. Stock correlations appear to have structurally increased since the 2000s, perhaps reflecting more integrated capital markets. Some investors are concerned that ETFs lead to higher stock correlations, but 2017 and 2018, where passive investments reached a new record in terms of market share, exhibited exceptionally low levels of correlation.

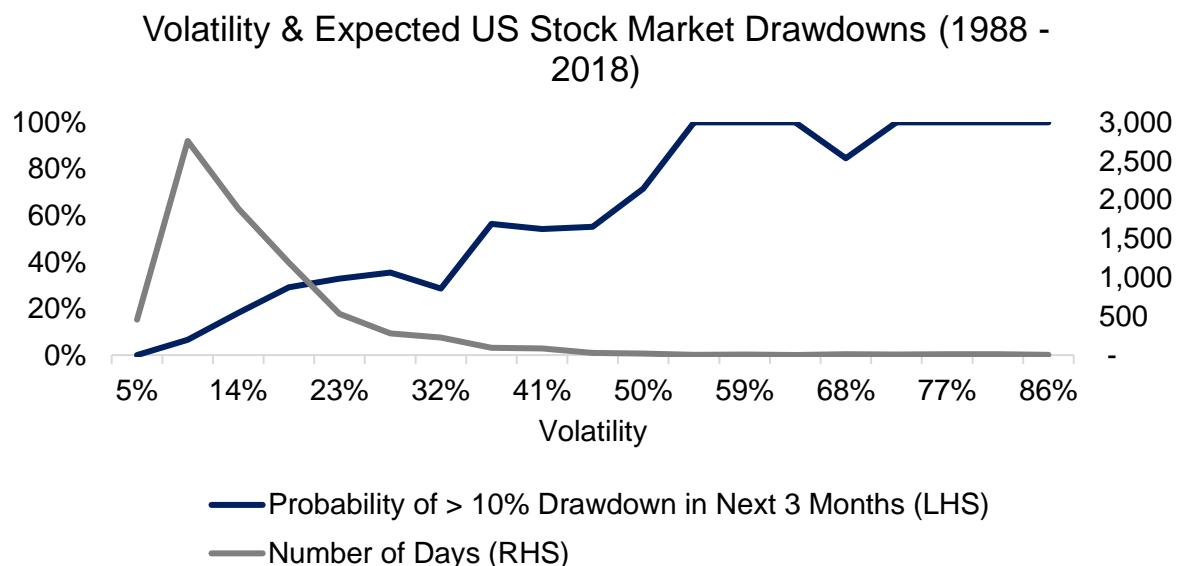
US Stock Market: Volatility, Dispersion and Correlation



Source: FactorResearch

VOLATILITY & STOCK MARKET DRAWDOWNS

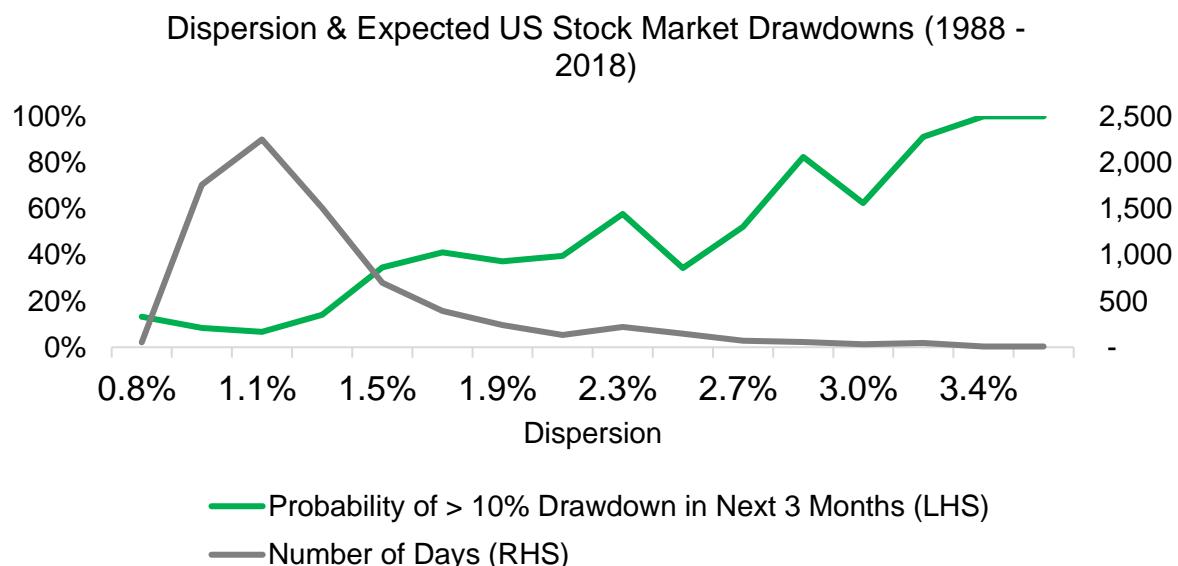
We analyse the relationship between stock market volatility and risk by measuring subsequent drawdowns, which investors are typically concerned about. The chart below highlights the probability of a 10% or larger drawdown in the next three months at various levels of volatility, which is an almost linear relationship as expected. The analysis also shows that there are few days with extreme levels of volatility.



Source: FactorResearch

DISPERSION & STOCK MARKET DRAWDOWNS

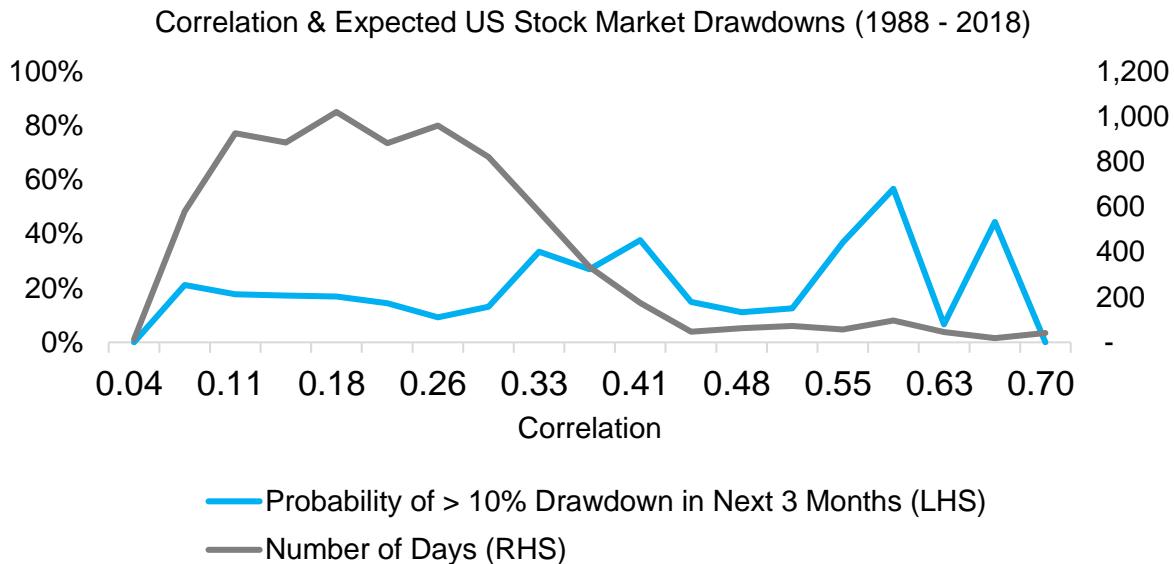
Stock dispersion is similar to volatility, but not the same. There are periods when stocks exhibit high dispersion, but not necessarily high volatility, e.g. when companies report earnings. Inversely, there are periods when dispersion is low, but volatility is high, e.g. during a market sell-off. However, most often dispersion and volatility are correlated. Daily dispersion, similar to volatility, exhibits a strong positive relationship to the probability of drawdowns.



Source: FactorResearch

CORRELATION & STOCK MARKET DRAWDOWNS

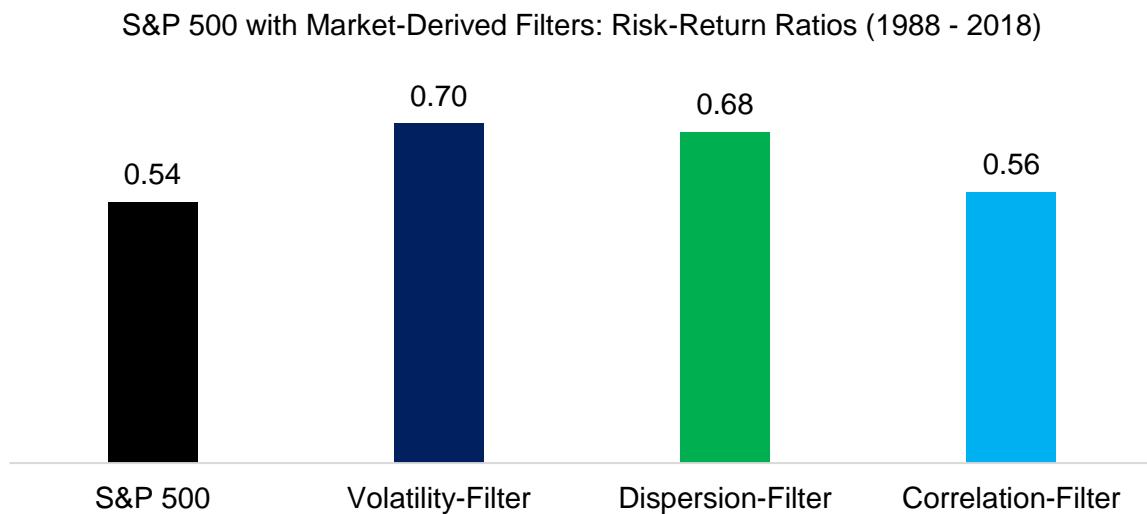
Investors might expect that stock correlations increase when markets crash as investors tend to sell-off indiscriminately. Although this was the case in the Global Financial Crisis in 2008 and 2009, the correlations were relatively low during the implosion of the Tech bubble from 2000 to 2002. During the latter sell-off, there was much greater sector differentiation than in the former. The chart below highlights that the relationship between correlation and the probability of drawdowns is not consistent.



Source: FactorResearch

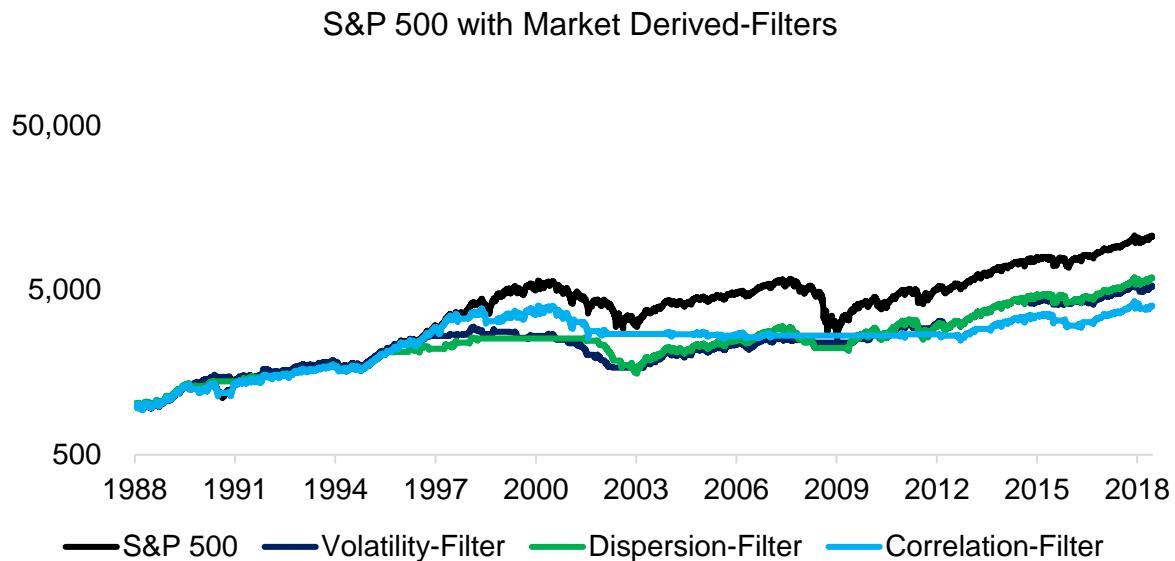
USING MARKET TECHNICALS FOR RISK MANAGEMENT OVERLAYS

Given the almost linear relationships between volatility and dispersion and subsequent drawdowns, investors may consider using these as signals for a risk management overlay for an equity portfolio. The analysis below compares a buy-and-hold versus risk-managed strategies for a portfolio consisting of the S&P 500. The equity exposure is reduced to 0% when the market technicals are in the fourth quartile, measured on a rolling-forward basis and with a time-delayed signal. We observe that the risk-return ratios improve by exiting the market when market technicals are extreme.



Source: FactorResearch

In addition to analysing the risk-return ratios, we compare the performance of the buy-and-hold versus risk-managed strategies, which exhibit lower total returns. The risk management overlays significantly reduced the drawdowns during the Global Financial Crisis in 2008 and 2009, but not during the implosion of the Tech bubble. The results reflect that the behaviour of the market technicals is not consistent across time.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that market technicals, which are frequently commented on by financial media, do not behave consistently in bull and bear markets across time. Investors should therefore be cautious about using these on a stand-alone basis, although they might be more effective when combining them. Even more attractive is likely a combination with less related signals, e.g. trend following.

RELATED RESEARCH

[Market Timing with Multiples, Momentum & Volatility](#)

[Market Timing versus Risk Management](#)

CHASING MUTUAL FUND PERFORMANCE

Follow the Momentum?

September 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Mutual funds exhibit momentum when measured by their one-year performance
- Momentum disappears when more reasonable fund selection criteria are applied
- Performance does not seem effective for fund selection for a full market cycle

CHASING PERFORMANCE

Chasing mutual fund performance suffers from a bad reputation these days. Of course, perspectives change all the time in finance. What was once considered poor form often becomes best practice and vice versa. Leveraged buyouts and activist investors, for instance, were once looked down on by much of the sector, but today their milder incarnations are staples of pension fund portfolios and are perceived as forces of good, not evil.

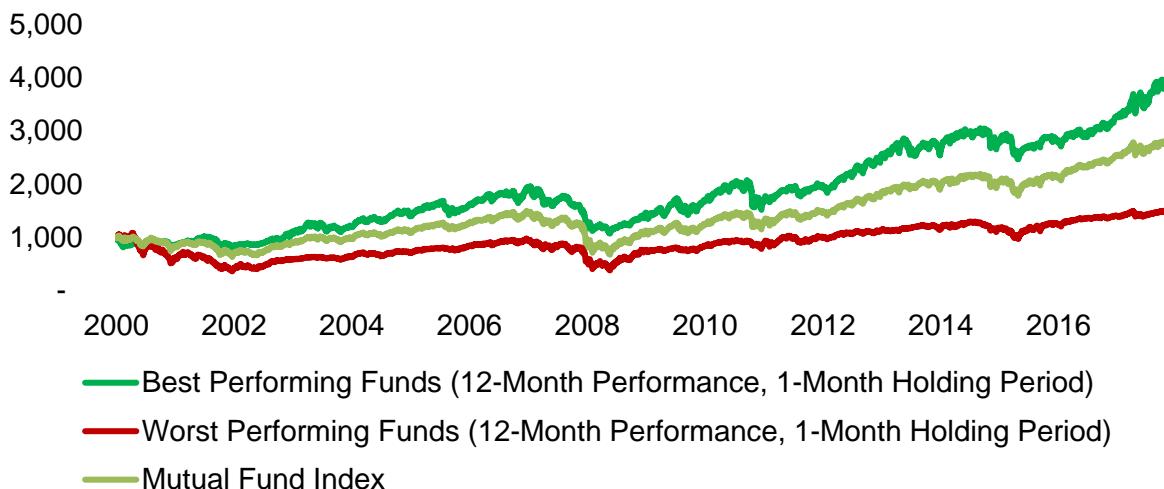
So maybe investing in the best-performing mutual funds isn't a bad strategy. It is certainly a popular one. The question is, how does mutual fund momentum chasing play out in the US market?

CLASSIC MOMENTUM

To answer that, we looked at US equity mutual funds from 2000 to 2018 and created long-only portfolios composed of the top and bottom 10% of funds. We then replicated classic equity momentum strategies, selecting mutual funds based on their performance over the previous 12-months and rebalancing the portfolio on a monthly basis.

We found the best-performing funds beat an equal-weight index of all equity mutual funds as well as the worst-performing funds by a handsome margin. Put another way: Performance chasing works.

Momentum in Mutual Funds

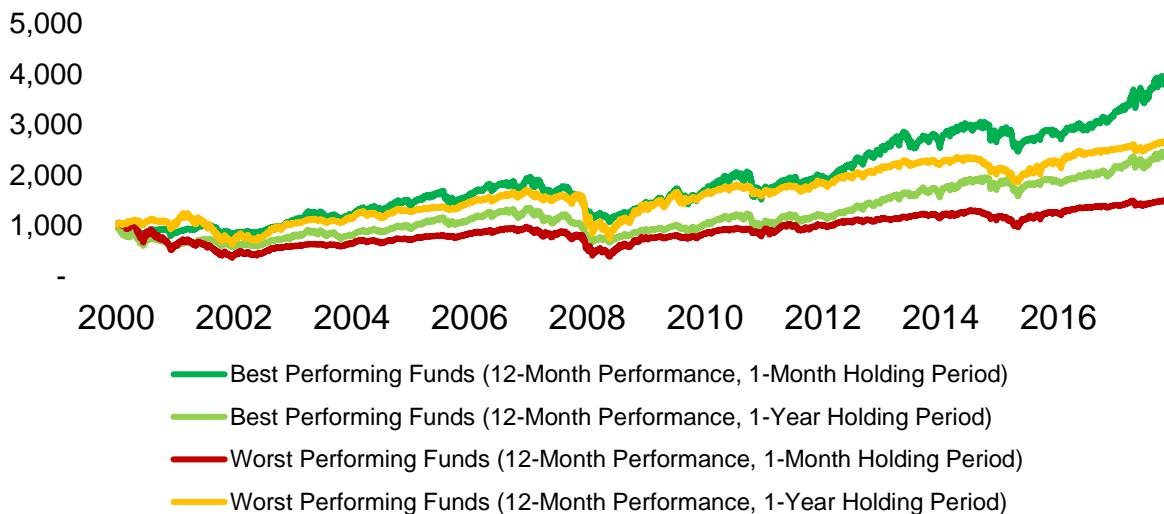


Source: FactorResearch

Of course, most mutual fund investors won't be willing to rebalance their portfolios every month. Moreover, our calculations did not include transaction costs, which are likely in excess of 1%. As a consequence, these results are more theoretical than practical.

And, if we impose a minimum holding period of one year, performance chasing looks far less appealing. The best- and worst-performing funds with one-year holding periods generated similar returns from 2000 to 2018, albeit with significant differences in performance at different times.

Momentum in Mutual Funds: Different Holding Periods



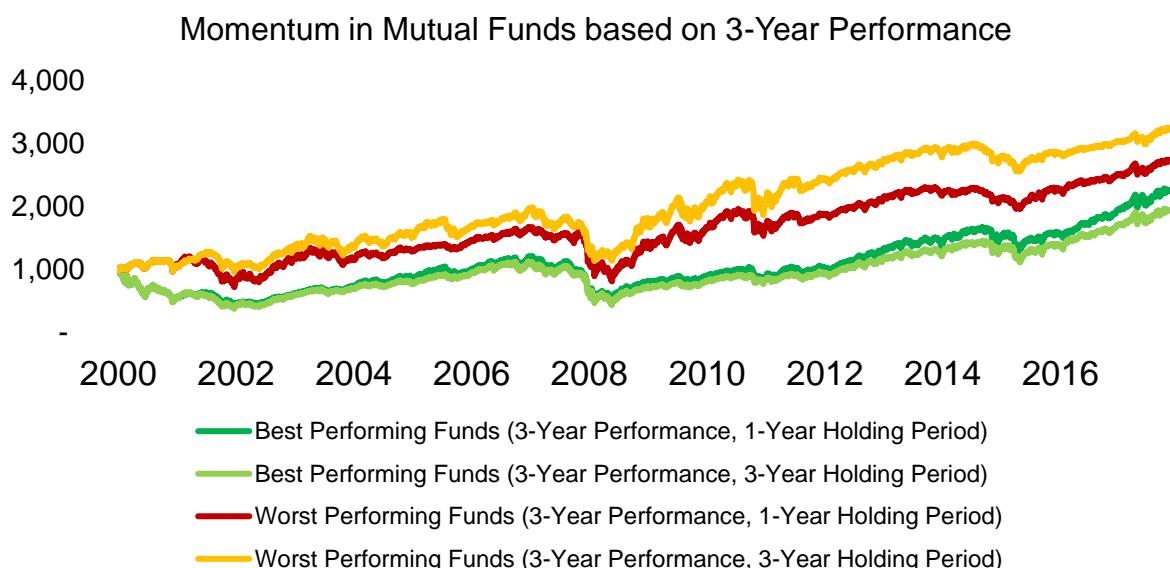
Source: FactorResearch

CLASSIC MUTUAL FUND SELECTION

Although buying winners and selling losers in equities is typically based on a 12-month lookback period, such a time frame is rather short for most mutual fund allocators. Since investors seek to distinguish the skilled managers from the lucky, they usually analyze fund manager performance over several years.

Three years is considered the bare minimum for evaluating mutual funds, which hopefully includes some ups and downs in stock markets. Applying this momentum strategy, we selected funds based on their three-year performance and held them for one and three years, respectively.

The results suggest that mutual fund chasing deserves its bad reputation. The worst-performing funds outperformed the best-performing, regardless of the holding period. This indicates that mean-reversion, not momentum, dominates fund returns when measuring funds on longer-term performance.



Source: FactorResearch

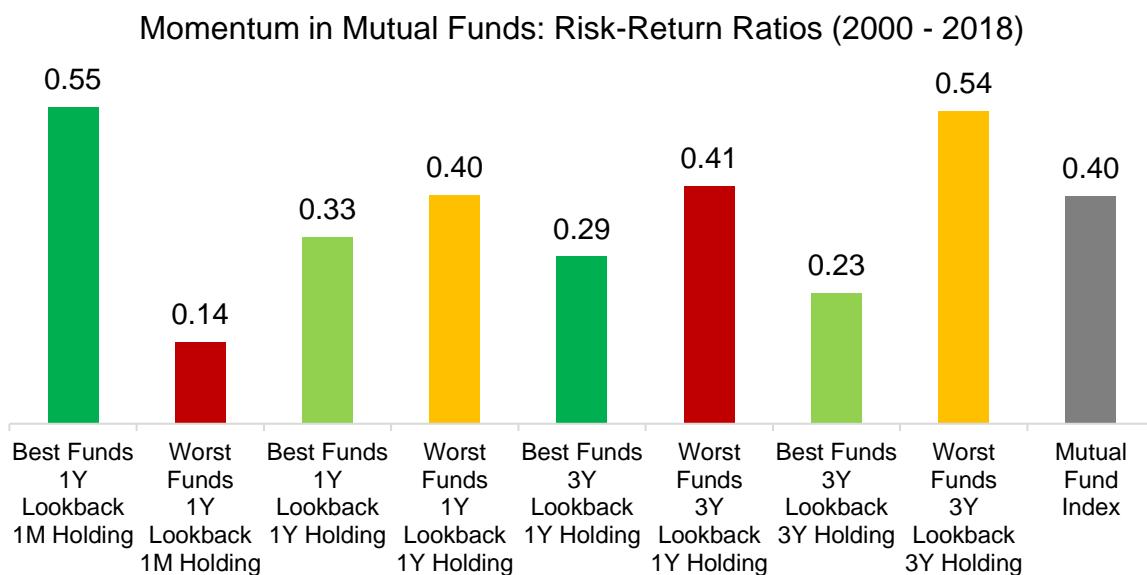
That said, when the analysis begins has a significant influence on the outcome. For example, the worst-performing funds generated the best returns between 2000 and 2002, but fell back to earth thereafter. Why the initial outperformance? The implosion of the dot-com bubble: The worst-performing funds probably held far fewer technology stocks than their counterparts.

The same calculus applies to the global financial crisis in 2008 and 2009: The drawdowns of the best-performing funds are significantly higher than those of the worst performers, presumably because the latter had less exposure to the sectors — banks and real estate, for example — that underperformed during the crisis.

These results suggest the best-performing funds lose more during crashes, giving up all the outperformance they achieved in the stable years. Therefore, past performance does not seem meaningful for selecting funds for a full market cycle.

RISK-METRICS COMPARISON

So do the worst funds yield less attractive risk-adjusted returns than their better-performing peers. We found the dismal performers generated higher risk-return ratios than the standout funds in all scenarios except for one: when momentum is measured with a 12-month lookback and one-month holding period. And that scenario would likely be different were trading costs factored in.



Source: FactorResearch

FURTHER THOUGHTS

So does performance chasing in the mutual fund universe deserve its less-than-stellar reputation? It depends. If the momentum strategy is systematically implemented, frequently rebalanced, and has low transaction costs, it can generate excess returns.

But as a rule, performance chasing is best avoided. Our analysis indicates that investors would be better off betting on mean-reversion.

RELATED RESEARCH

[Factor Momentum](#)

[Sector versus Country Momentum](#)

FACTOR MOMENTUM

Chasing Factor Performance

August 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Momentum strategy can be applied to stocks, sectors, countries and factors
- Factor momentum shows positive excess returns across regions
- However, single-stock Momentum performance is comparable and less complex to implement

INTRODUCTION

We recently investigated applying the long-short Momentum strategy to sectors and countries in Europe, which revealed positive excess returns ("[Sector versus Country Momentum](#)"). Effectively, this simply means that performance chasing works, at least if implemented systematically. In addition to allocating to the best performing sectors or countries, investors also tend to chase the best performing investment strategies like Value or Growth. In this short research note we will investigate the application of the long-short Momentum strategy to factors, which we refer to as factor momentum.

METHODOLOGY

We focus on the Momentum strategy, which is defined as buying the winning and selling the losing factors, as measured by their performance over the last 12 months, excluding the most recent month. The strategy is applied to a universe of 25 factors in the US, Europe and Japan. The factors can be broadly categorised into Value, Quality, Size, Growth and price-based metrics. The factor performance is calculated by creating beta-neutral long-short portfolios that select the top and bottom 10% of each stock market ranked by each factor. Only companies with a market capitalisation of larger than \$1 billion are included. The portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points. The graphic below summaries the factor universe.

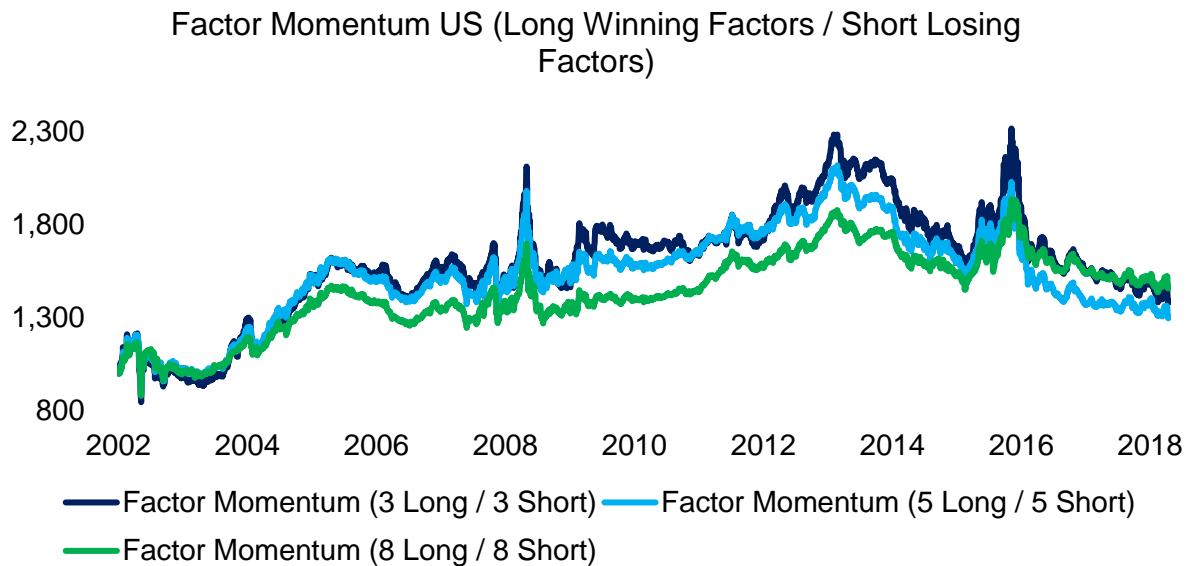


Source: FactorResearch

It is worth mentioning that not all factors have strong academic support, e.g. Growth lacks a long-term track record of positive excess returns; however, is still a widely-followed investment strategy.

FACTOR MOMENTUM IN THE US

We initially focus on the US and analyse the performance of three factor momentum portfolios, which differ only by the number of factors included in the long and short portfolios. The chart below shows that the performance was positive from 2002 to 2018, but features high volatility and extreme peaks in 2008, 2013 and 2016. Although the number of factors in the portfolios vary, the trends in all three are almost identical, which likely indicates that a few factors dominate in terms of performance contribution.

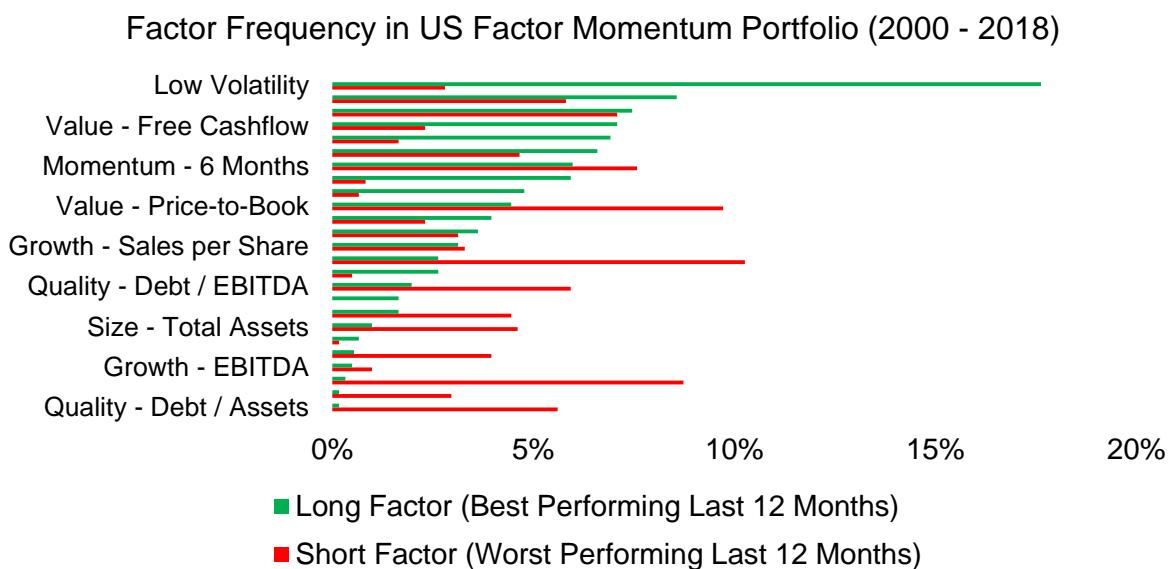


Source: FactorResearch

FACTOR MOMENTUM PORTFOLIO ANALYSIS

In addition to highlighting the performance, we can also analyse the portfolios over time. The chart below shows the allocation to factors in the US from 2000 to 2018, sorted highest to lowest for the long portfolio. We can observe that the Low Volatility factor was selected most frequently, which simply implies that the factor most often showed the strongest performance of all factors over a 12-month horizon and was therefore included in the long portfolio. Value factors also frequently appeared in the long portfolio while the short portfolio was mostly comprised of Quality, Growth and Size factors.

Although this perspective reflects that Value generated positive performance, in line with long-term academic research, it does depend on the observation window, e.g if measured from 2010 to 2018 Value factors would more frequently appear in the short portfolio as the performance was flat to negative.

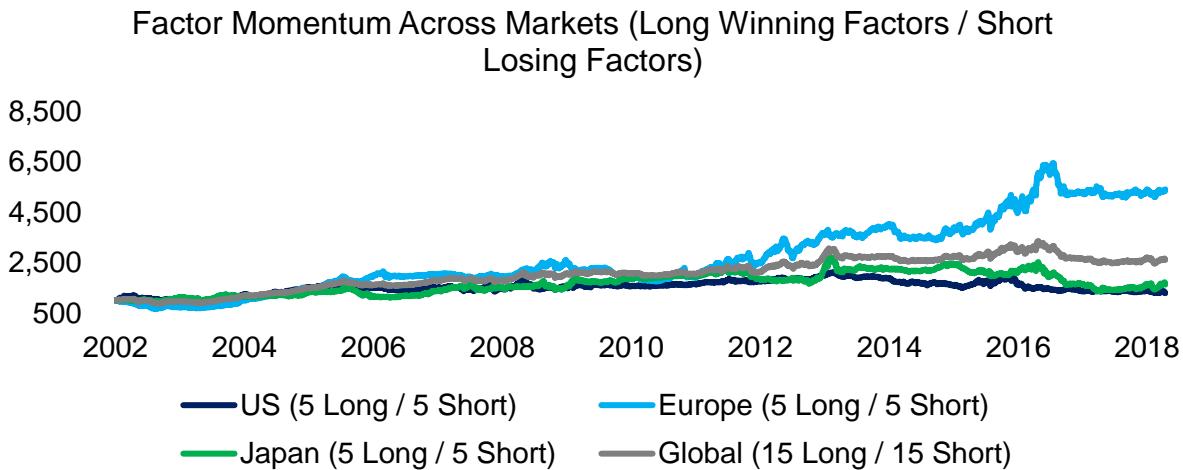


Source: FactorResearch

FACTOR MOMENTUM ACROSS MARKETS

We can expand the analysis to other markets, which reveals that factor momentum was particularly strong in Europe. It is interesting to note that the performance across markets shares some trends, which reflects similar underlying stock portfolios and global drivers of factor performance.

For example, all three factor momentum portfolios showed comparable performance between 2002 and 2006. During that period the Value factor, regardless how measured, performed strongly across markets for several years, which warranted its inclusion in the long side of the portfolio and resulted in a similar performance of factor momentum across regions. Identifying the global drivers of factor performance is a research area worth exploring.

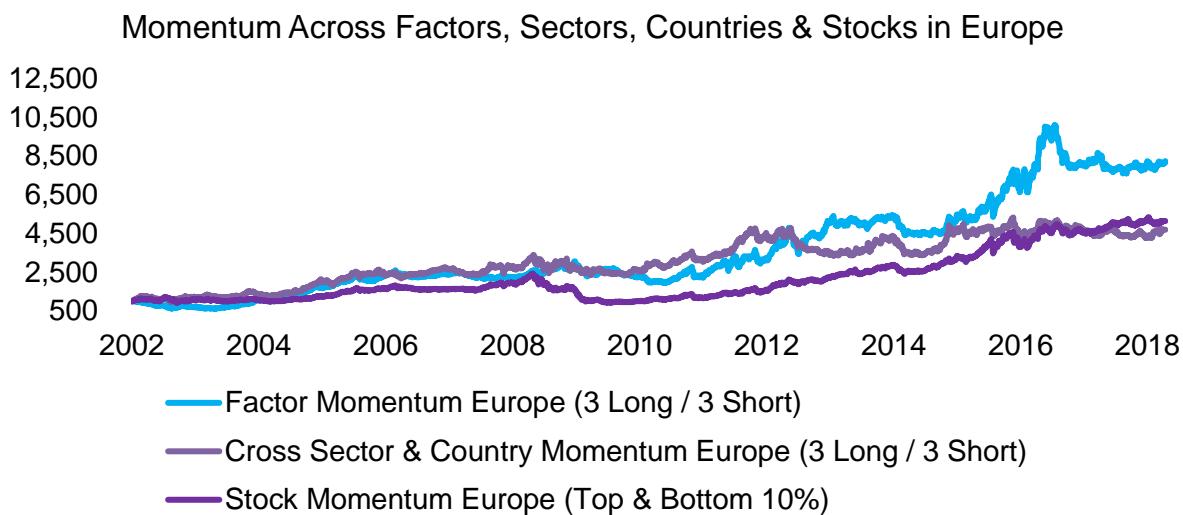


Source: FactorResearch

MOMENTUM ACROSS FACTORS, SECTORS, COUNTRIES AND STOCKS IN EUROPE

Finally, we compare factor momentum to the same strategy in two other universes in Europe: cross sector & countries and single stocks. All three universes ultimately comprise the same pool of approximately 600 European stocks and represent just different perspectives.

It might not be intuitive to compare factor momentum to single-stock momentum as factor momentum buys the winning and sells the losing factors while single-stock momentum buys the winning and sells the losing stocks. However, often the winning stocks represent a factor with strong positive performance and the losing stocks a factor with negative performance, therefore the performance profiles are roughly comparable.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that applying the Momentum strategy to factors would have generated positive excess returns, which is another confirmation of how effective Momentum is as a strategy. This version of Momentum cannot be implemented directly as there are only a few long-short factors that are traded on exchanges, but the factors can be efficiently replicated via stock portfolios. However, the single-stock based Momentum factor coupled with a sound risk management framework to reduce Momentum crashes is likely more attractive and less complex to implement.

HOW CROWDED ARE TECH STOCKS?

A Systematic Approach to Measuring Peak Investor Interest

August 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

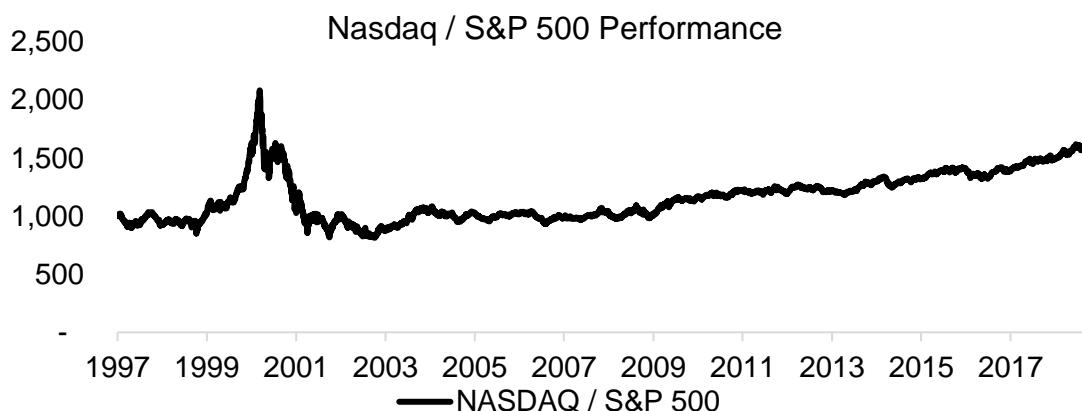
SUMMARY

- Equity crowding models can be applied to factors and sectors
- Crowding leads to more frequent drawdowns
- Tech sector was crowded over the last 12 months

DOT-COM REDUX

Many investors are wary of technology stocks despite their strong performance over the last several years. The implosion of the dot-com bubble back in the early 2000s casts a long shadow.

Such fears may be overblown. The gains of the technology-heavy Nasdaq and the S&P 500 in recent years are more moderate than the rapid jumps seen at the turn of the millennium. That gives some reassurance that the situations are not quite analogous.



Source: FactorResearch

But if history doesn't repeat, it still may rhyme. So just how crowded are technology stocks today, especially the powerful FAANG quintet of Facebook, Amazon, Apple, Netflix, and Google? After all, among its other lessons, the dot-com bubble illustrates the risks of crowded stocks. A sudden change in market sentiment can lead many investors to try and unload the same equities simultaneously. With few natural buyers left in the market, the losses can become amplified.

CROWDING METRICS

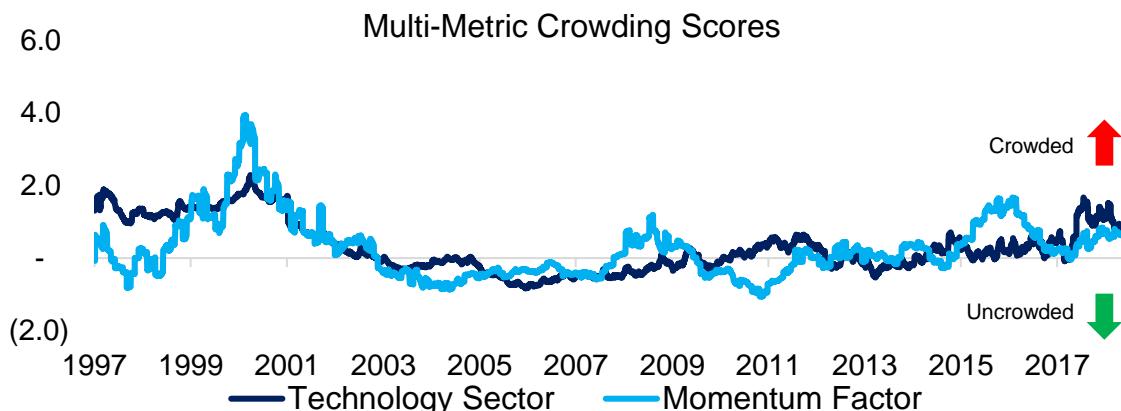
To measure crowding across the entire technology sector, we borrow a model that gauges the crowding of equity factors. Given the strong performance of technology stocks in recent years, many are currently included in the long momentum factor portfolio, which buys the winning and shorts the losing stocks. At certain times, the present among them, the momentum factor exhibits significant exposure to the technology sector and provides a useful means of comparison. The crowding model aims to identify when the technology sector or momentum factor is crowded, which is characterized by exhibiting more subsequent drawdowns than an uncrowded sector or factor.

Various methodologies measure crowding. Our approach focuses on market-derived metrics that are available daily or even intra-day. We combine five measures that indirectly reflect changes in the sector or factor and often indicate when significant inflows or outflows are occurring. They are:

- Residual Volatility
- Residual Correlation
- Residual Dispersion
- Valuation Difference to the Market
- Performance

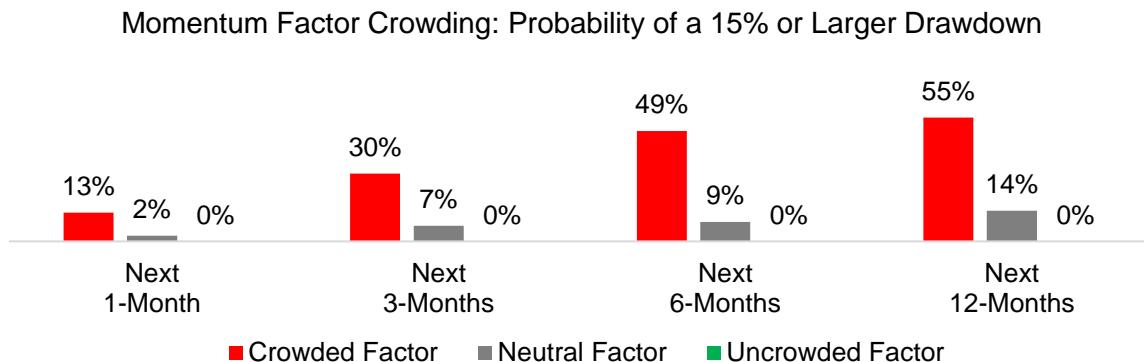
All of these metrics correlate positively to crowding. That is, the higher the residual volatility or the larger the valuation difference to the market, the greater the likelihood that crowding is taking place.

We standardize the five metrics and combine them into one score. According to the model below, the technology sector was crowded in 2000 and in 2018. The momentum factor was also crowded in 2000, when it exhibited a significant exposure to the technology sector. It was crowded as well during the financial crisis in 2008 and in 2016.



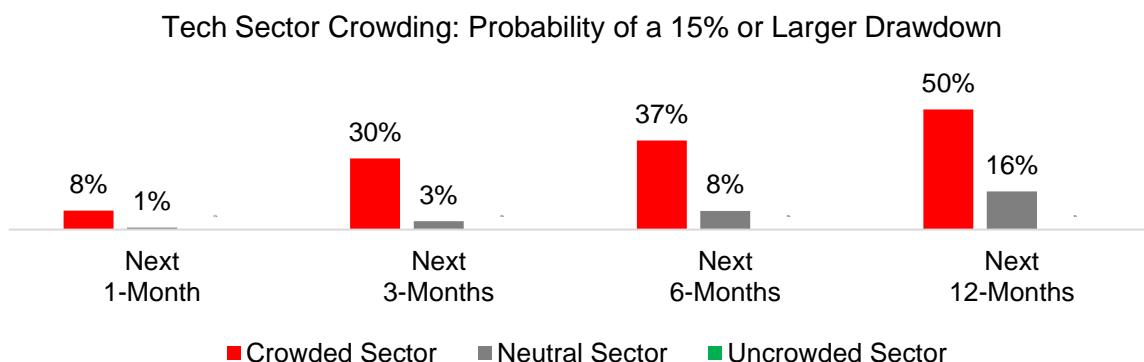
Source: FactorResearch

We can investigate the effectiveness of this approach by analyzing the drawdowns of the momentum factor after measuring the crowding score. The analysis below demonstrates that a crowded factor is associated with higher subsequent drawdowns.



Source: FactorResearch

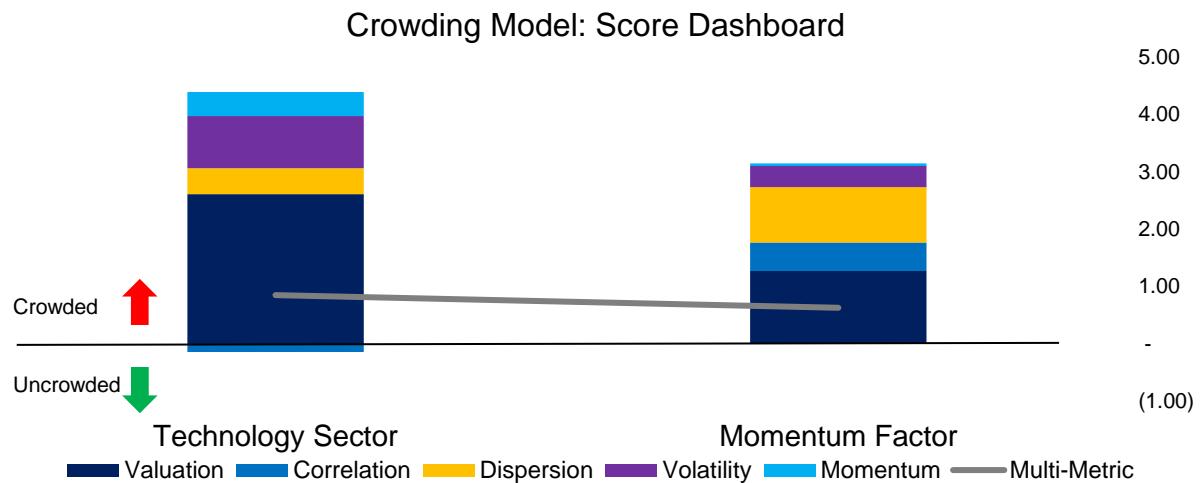
Applying the same methodology to the technology sector works too: A crowded sector exhibits more frequent subsequent drawdowns than an uncrowded one. These drawdowns are measured on a relative basis to the market.



Source: FactorResearch

CURRENT CROWDING SNAPSHOT

The score dashboard below provides a recent snapshot of all the summarized metrics and shows that both the technology sector and momentum factor were crowded, with positive scores on all metrics except for the correlation of technology stocks. The sector and factor appeared especially crowded on valuations, which may not be too surprising, while technology stocks were more volatile than usual. Momentum factor stocks also displayed higher dispersion than the norm.



Source: FactorResearch

Crowding is not negative for the performance of a factor or sector per se. After all, every investment needs some interest to generate performance. An uncrowded sector or factor demonstrates a lack of investor interest and thus is not especially attractive. The optimal state is between crowded and uncrowded, not too hot and not too cold.

FURTHER THOUGHTS

The recent sell-off in technology, especially among FAANG stocks, led to renewed comparisons of the tech sector today versus 2000. But the sector has matured and contains many highly profitable, stable businesses, so it is far less risky than two decades ago.

Current relative valuations are high but gauging sector risk with valuations is not a perfect science. Valuations can be elevated for long time periods, often much longer than most investors' time horizons.

Investors are better off listening to multiple signals to measure portfolio risks.

LOW VOLATILITY, LOW BETA & LOW CORRELATION

There is Magic in Leverage

August 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Low Volatility, Low Beta and Low Correlation factors are interrelated
- Low-risk factors generate attractive risk-adjusted returns, but require beta-neutrality
- Currently they feature moderate to high interest-rate sensitivity

INTRODUCTION

Coca-Cola versus Bitcoin Investment Trust, Mattel versus Groupon, Ventas versus Facebook. Which stocks would you prefer? These stock pairs represent low versus high volatility, low versus high beta, and low versus high correlation to the market. Most traditional stocks pickers likely consider these metrics exotic compared to evaluating stocks on their valuation or quality characteristics. Aside from the quantitative nature of these metrics, the theory that stocks with low risks outperform stocks with high risks is counterintuitive and in conflict with a classic finance education. However, given a strong performance of low-risk factors over the last two decades, these are becoming more common in portfolios. In this short research note we will investigate and contrast the Low Volatility, Low Beta and Low Correlation factors.

METHODOLOGY

We focus on the Low Volatility, Low Beta and Low Correlation factors in the US, European and Japanese stock markets. The factor performance is calculated by constructing long-short portfolios of the top and bottom 30% of stocks ranked by the factor definitions. Low Volatility ranks stocks by their volatility, low beta by their beta to the market, and low correlation by their correlation to the market, all measured with a 12-month lookback period. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

NET BETAS OF THE LOW VOLATILITY, NET BETA & LOW CORRELATION FACTORS

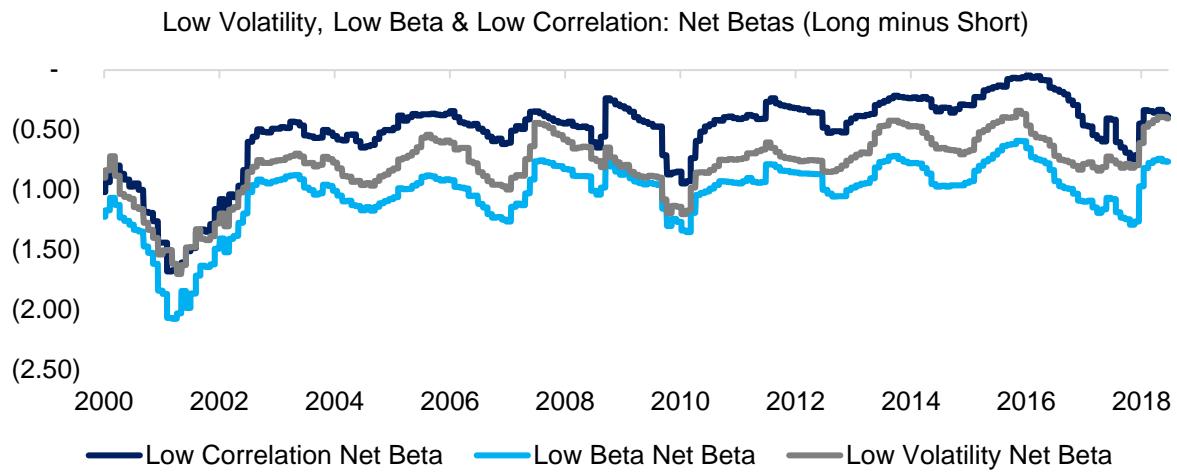
Investors musing about Coca-Cola (KO) versus the Bitcoin Investment Trust (GBTC) are naturally aware of the different risk profiles. Coca-Cola is a stable, mature business selling flavoured drinks in over 100 countries and counts Warren Buffett as a shareholder. The Bitcoin Investment Trust provides investors exposure to Bitcoin, which is highly volatile, and has a much younger shareholder base. The long portfolio of the Low Volatility factor, which contains stocks like KO, has a much lower beta than the short portfolio.

The chart below exhibits the net betas, which represent the difference between the betas of the long and short portfolios, of the Low Volatility, Low Beta and Low Correlation factors in the US. We can observe consistently negative net betas, which were especially extreme during the Tech bubble in 2000 when investors were aggressively chasing speculative technology stocks and ignoring “old economy” companies.



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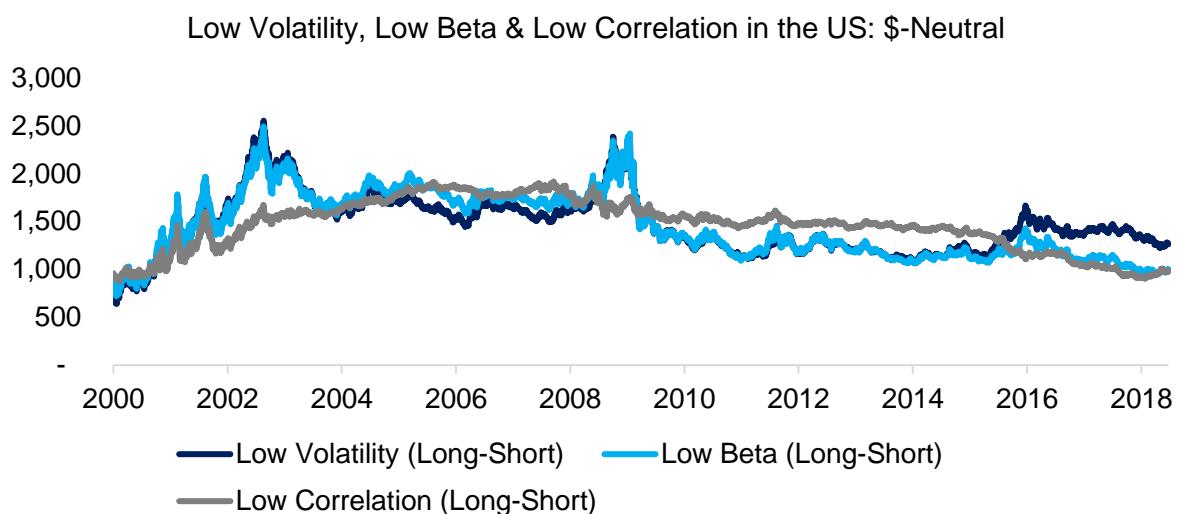
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Source: FactorResearch

PERFORMANCE OF THE LOW VOLATILITY, LOW BETA & LOW CORRELATION FACTORS

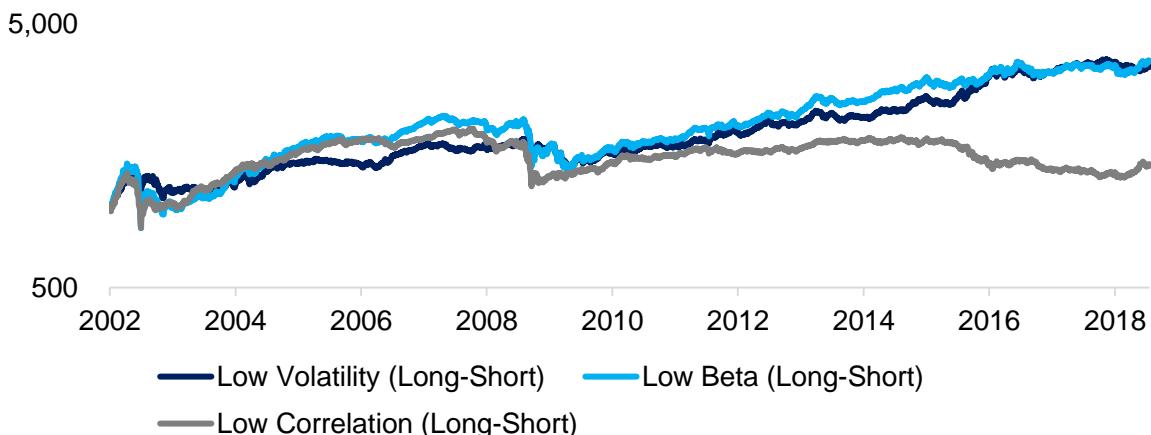
The two common theories supporting positive excess returns from low-risk factors are investors' aversion to leverage and preference for lottery stocks. The chart below shows the performance of the three factors in the US structured as dollar-neutral portfolios, i.e. every \$100 long position is matched with a \$100 short position to achieve market-neutrality. We can observe a stellar performance from 2000 to 2003, which represents the implosion of the Tech bubble. The forgotten, unexciting stocks featuring low volatility, low beta or low correlation significantly outperformed the former stars of the stock market. However, post the Global Financial Crisis the performance of all three factors has been consistently negative, which is expected given the structural negative net beta and rising stock markets since 2010.



Source: FactorResearch

Given the negative net beta, the portfolios need to be beta-adjusted as stocks with lower risks only outperform stocks with higher risks on a risk-adjusted basis. The chart below highlights the beta-neutral performance, which shows attractive returns for the Low Volatility and Low Beta factor and lower returns for Low Correlation. It is worth noting that the three factors experience rare, but significant drawdowns, similar to the crashes of the Momentum factor, e.g. in 2002 and 2009. Investors should be aware that the low-risk factors exhibit higher average volatility than the Value, Quality or Size factors. The high factor volatility is partially a result of leverage, but this analysis highlights there are no positive excess returns without applying leverage to achieve beta-neutrality.

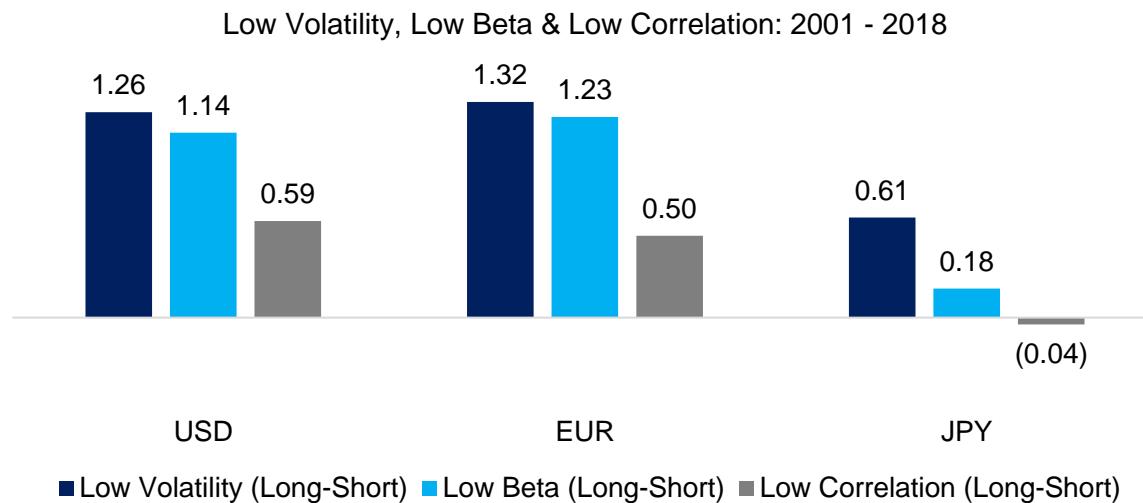
Low Volatility, Low Beta & Low Correlation in the US



Source: FactorResearch

RISK-RETURN RATIOS OF THE LOW VOLATILITY, LOW BETA & LOW CORRELATION FACTORS

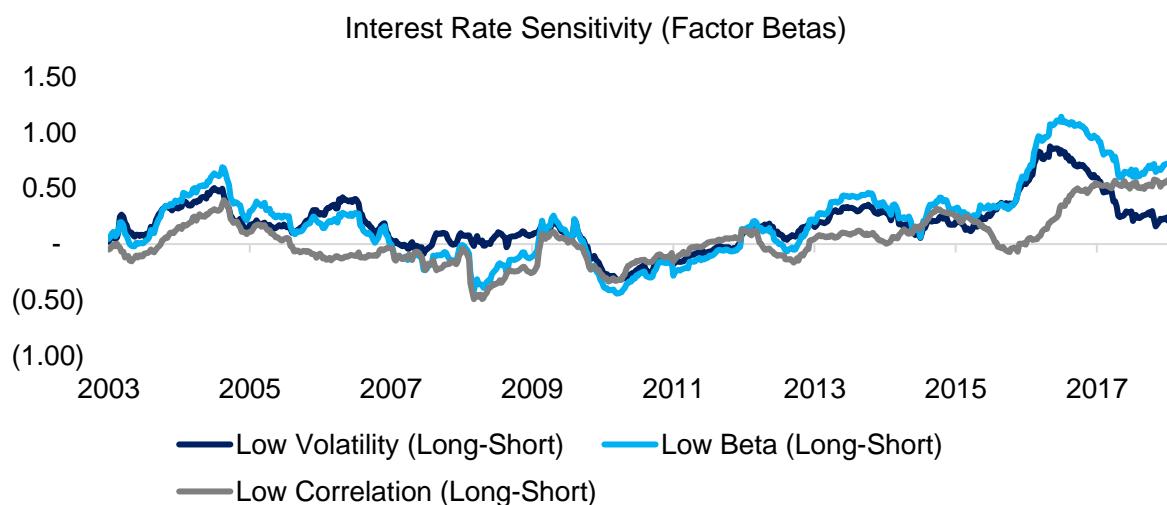
In addition to showing the performance, we can analyse the risk-return ratios and include European and Japanese stock markets. The analysis highlights attractive ratios in the US and Europe and slightly less attractive ratios in Japan. It is worth highlighting that the Low Volatility and Low Beta factors generated the highest risk-return ratios in the last two decades compared to other common equity factors.



Source: FactorResearch

INTEREST RATE-SENSITIVITY OF THE LOW VOLATILITY, LOW BETA & LOW CORRELATION FACTORS

The long portfolios of the three factors typically contain mature companies with stable cashflows like real estate, telecommunications and utility stocks, which tend to feature significant amounts of debt on their balance sheets. In contrast, the short portfolio is typically comprised of high growth stocks from the technology and biotech sectors, which have low to moderate amounts of debt. Given this imbalance, the three factors frequently exhibit an interest rate-sensitivity as shown by the factor beta to the 10-year US treasury yield in the chart below. Investors concerned about the interest rate-sensitivity can reduce the risk by constructing the factor portfolios sector-neutral (please see our report [Low Volatility Factor: Interest Rate-Sensitivity and Sector-Neutrality](#)).



Source: FactorResearch

FURTHER THOUGHTS

The attractive risk-adjusted returns of the low-risk factors over the last two decades should be considered carefully given that they require beta-neutrality, which requires leverage, and are likely partially explained by interest rates. Although the factor drawdowns are rare, they are significant in magnitude, highlighting that low-risk factors can be quite risky.

FACTOR EXPOSURE: SMART BETA ETFS VS MUTUAL FUNDS

Do Active Managers Provide Higher Factor Exposure than ETFs?

August 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Investors can express factor views via smart beta ETFs or mutual funds
- Some mutual funds offer higher factor exposure than smart beta ETFs
- Given higher fees, strong views on expected factor performance are required

INTRODUCTION

Similar to wind and water eroding the strongest mountains over time, passive fund management has been gradually capturing market share from active managers globally. The recent announcement of Fidelity, which a decade ago represented the symbolic leader of active fund managers, to launch two index funds with zero fees, highlights the dramatic changes in the fund management industry. However, at the same time, some providers of passive products like WisdomTree are enhancing their product suite by adding actively managed ETFs. It seems that both worlds are partially integrating and that active management will continue to play an important role in the future.

We previously analysed the factor exposure of smart beta ETFs (please see [ETFs, Smart Beta & Factor Exposure](#)) and noted their relatively low exposure to common equity factors. In this short research note we will compare the factor exposure of smart beta ETFs and mutual funds, initially by focusing on the Value factor and then expanding to other common equity factors.

METHODOLOGY

We focus on six factors namely Value, Momentum, Low Volatility, Quality, Growth and Dividend Yield in the US stock market. The factor performance is calculated by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks ranked by the factor definitions, which are in line with academic and industry standards. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

Factor exposure is measured by factor betas derived from a one-year regression analysis utilising daily data and the six equity factors as well as the market as independent variables.

SMART BETA VALUE ETFS VS VALUE MUTUAL FUNDS

Mutual funds were less popular in recent years as investors became more aware of the perpetual underperformance of funds against their benchmarks. Research such the S&P SPIVA Scorecards highlights that across markets and time periods only a small fraction of active managers outperform their benchmarks, which is typically explained by high fees and a low active share.



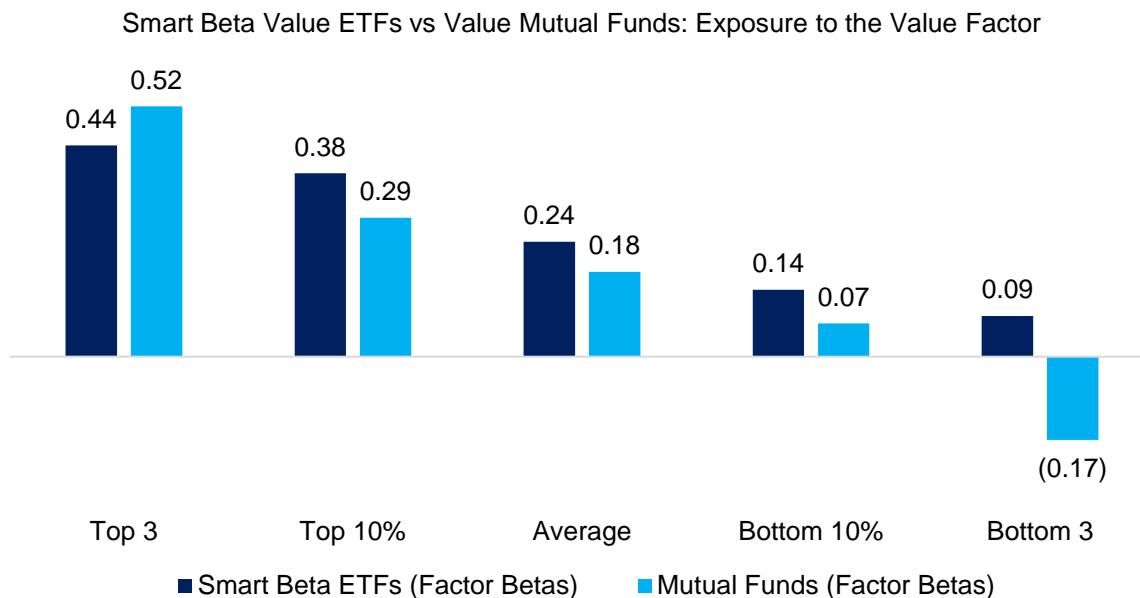
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Although active managers can not compete on fees with ETFs, they do have flexibility in stock selection and portfolio construction as they are not tracking rules-based indices. Naturally this comes with some career risk, but the free lunch of closet indexing is rapidly disappearing. Given that passive fund management is steadily gaining market share, active managers need to differentiate themselves to survive.

The chart below compares the exposure of smart beta Value ETFs and Value-focused mutual funds to the long-short Value factor. The metrics shown are the factor betas that represent the sensitivity to the factor, i.e. the closer the beta to 1, the more the ETF or fund approximates the behaviour of the factor.

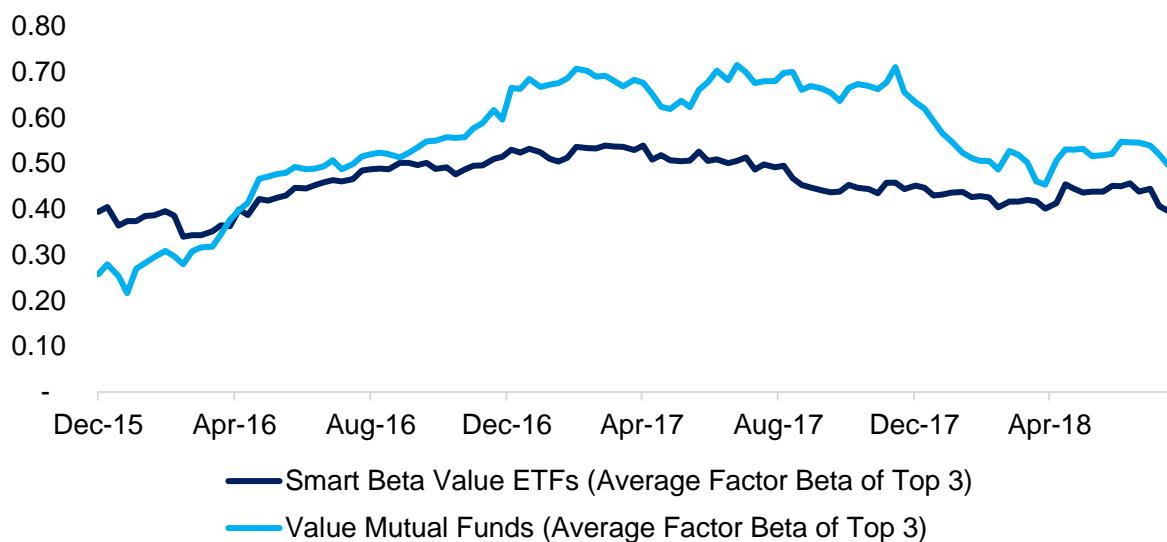
We observe that investors seeking exposure to the Value factor are in general better served with smart beta ETFs as these offer higher factor exposure on average, except when comparing the three ETFs or funds with the highest exposure. It is worth noting that the number of mutual funds with a Value focus vastly exceeds the number of smart beta Value ETFs, therefore these results have to be taken with caution.



Source: FactorResearch

The analysis might be challenged by arguing that the factor betas of the top three mutual funds are random and not consistently higher than those of smart beta ETFs. The chart below compares the average factor betas of the top three smart beta ETFs and mutual funds from 2015 to 2018. We can observe that the factor betas of the smart beta ETFs seem less volatile, which is to be expected given that these follow a systematic portfolio construction process. The factor exposure of the mutual funds has been consistently high, except for the end of 2015, which might indicate style drift and warrants further investigation.

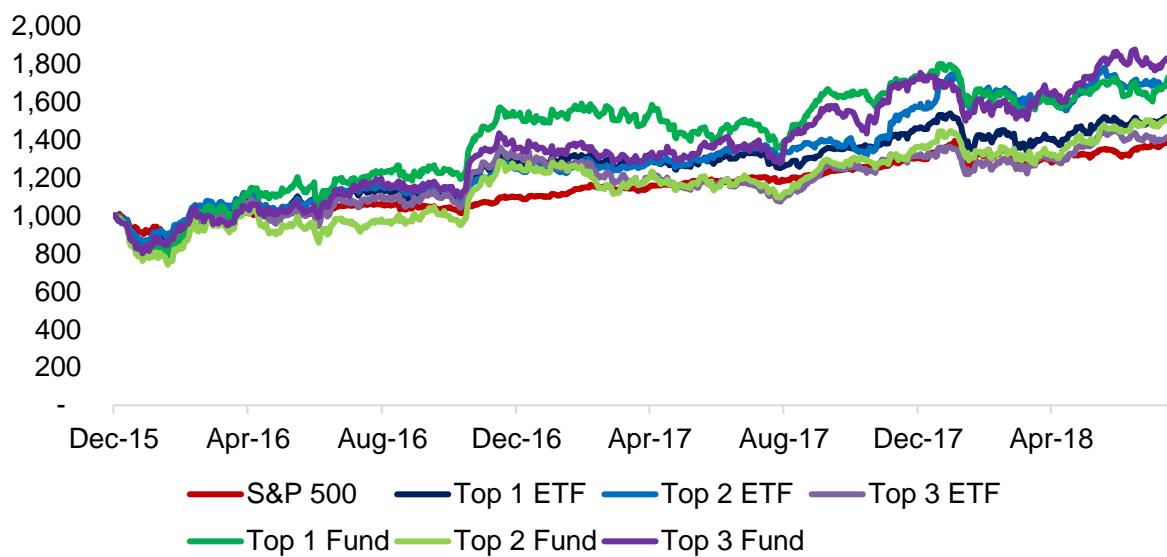
Factor Betas: Smart Beta Value ETFs vs Value Mutual Funds



Source: FactorResearch

Finally, we compare the performance of the same top 3 smart beta Value ETFs and mutual funds, which we benchmark against the Russell 3000. We observe similar trends, albeit with meaningful differences in performance. Some ETFs and funds exhibit higher volatility than others, which likely indicates more concentrated portfolios. The significant increase in performance in November 2016 can be attributed to the US election, which led to a change in market sentiment and rally in the Value and Size factors.

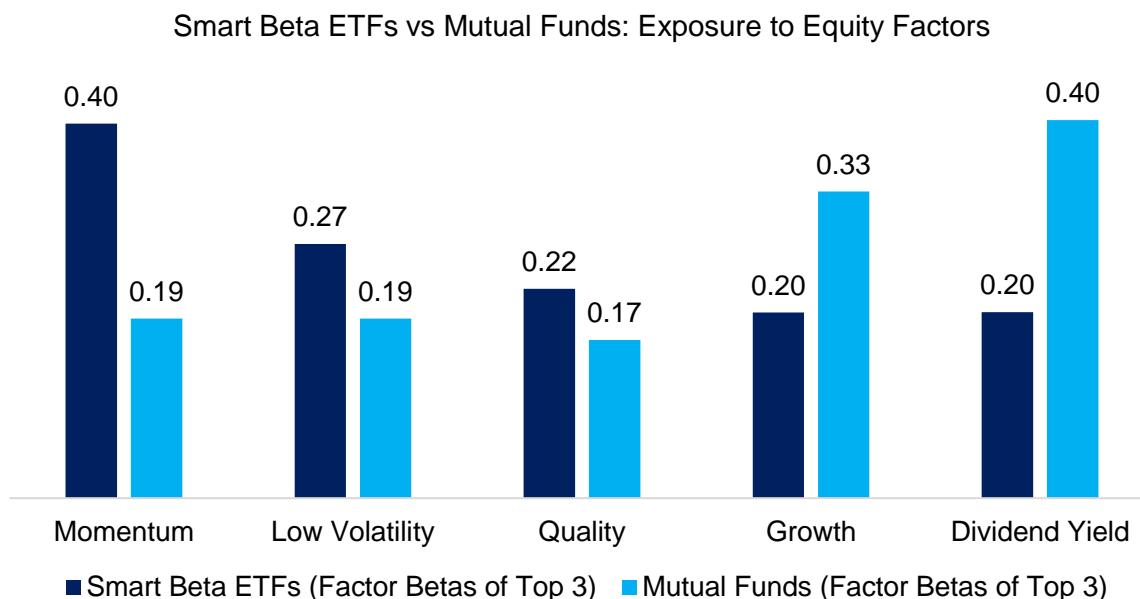
Smart Beta Value ETFs vs Value Mutual Funds: Performance



Source: FactorResearch

SMART BETA ETFS VS MUTUAL FUNDS: FACTOR EXPOSURE

We expand the analysis to other common equity factors and continue to focus on the top three ETFs and funds. The chart below highlights large differences in exposure across the various factors. It is worth noting that there are relatively few mutual funds focused on Momentum and Low Volatility as these represent quantitative strategies where active managers are less likely to create value. In contrast, there are many funds focused on Value, Growth and Quality as these provide more opportunities for fundamental analysis, which is the core skillset of most active managers.

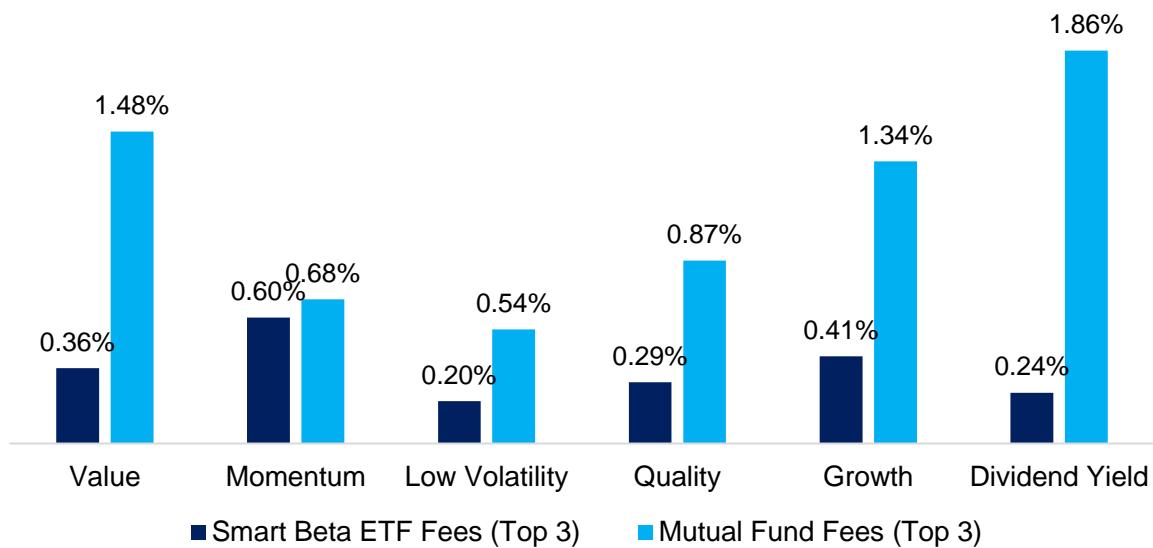


Source: FactorResearch

SMART BETA ETFS VS MUTUAL FUNDS: FEES

The comparison indicates that the choice between smart beta ETFs and mutual funds somewhat depends on the factor. However, the analysis would be incomplete if we would not highlight the fees for both product families, which are significantly lower for ETFs. Investors can select mutual funds based on high factor exposure, but need to consider the price they are paying for it.

Smart Beta ETFs vs Mutual Funds: Fees



Source: FactorResearch

FURTHER THOUGHTS

This short research note contrasts the factor exposure of smart beta ETFs and mutual funds. Despite active managers being in the defensive in recent years, investors may utilise mutual funds to capture higher exposure to certain factors than with ETFs. However, given the higher costs associated with funds, investors need strong views on the expected factor performance to justify these.

MOMENTUM VARIATIONS

Does Complexity Beat Simplicity?

August 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The simplicity of the Momentum factor can be intellectually challenging
- Various alternative Momentum versions highlight remarkable similar return profiles
- The robustness is an attractive characteristic of the investment strategy

INTRODUCTION

What do selfies, the Kardashians, Crocs, blue cheese, and Boris Johnson have in common? They all rank within the top 50 things that split the opinion of modern British people according to a recent survey. An equivalent list in finance likely includes cryptocurrencies, the valuation of the S&P 500, the direction of interest rates, the future of the Euro, and the Momentum factor. The latter is a slightly more unusual component as there is a significant amount of academic research that has shown that Momentum, both time series and cross-sectional, works within various asset classes, across different markets and time periods.

However, especially long-short Momentum in equities tends to be either favoured, mostly by quants, or actively disliked, usually by discretionary investors. It is reasonable that investors who create detailed fundamental models, regularly meet corporate CEOs, and often studied hundreds of hours after work for the chartered financial analyst (CFA) designation struggle with an investment strategy that can be replicated by high school students. In this short research note, we will therefore investigate more complex variations of the Momentum factor, which might intellectually be more satisfying and potentially result in higher risk-adjusted returns.

METHODOLOGY

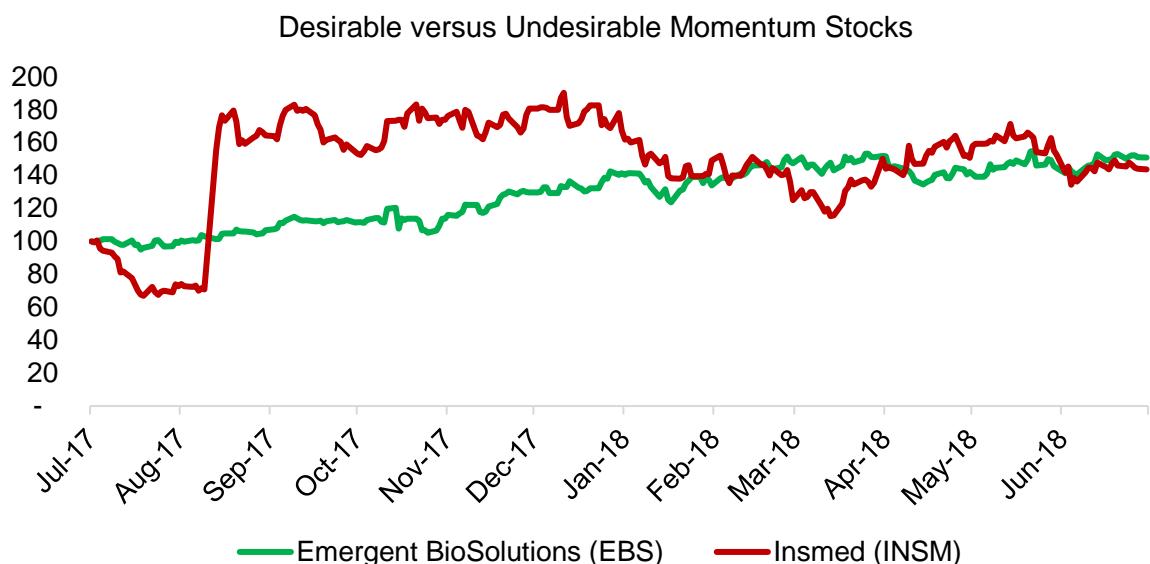
We focus on the Momentum factor in the US, Europe and Japan, which is defined as buying the winning and shorting the losing stocks. The factor performance is calculated by constructing a long-short beta-neutral portfolio of the top and bottom 10% of stocks ranked by the factor definition. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points. We investigate the following Momentum variations:

- Classic (Fama-French): Sorting stocks by their performance over the last 12 months, excluding the most recent month
- Sharpe Ratio: Sorting stocks by their Sharpe ratio of the last 12 months
- Gain / Loss Ratio: Sorting simultaneously by performance (Classic) and the ratio of winning days over losing days, weighted equally
- Slope: Sorting simultaneously by performance (Classic) and the slope, which is calculated as the absolute difference between the 12-month return today and one-year ago, weighted equally

- Alpha: Sorting stocks by their alpha, which is defined as the residual between the 12-month stock return and the sum of seven common equity factor contributions to the stock return
- Ex. – Skew on Long: Removing all stocks in the long portfolio with negative skewness, then ranking by performance (Classic)
- Ex. + Skew on Long: Removing all stocks in the long portfolio with positive skewness, then ranking by performance (Classic)
- Ex. – Skew on Short: Removing all stocks in the short portfolio with negative skewness, then ranking by performance (Classic)
- Ex. + Skew on Short: Removing all stocks in the short portfolio with positive skewness, then ranking by performance (Classic)

DESIRABLE VERSUS UNDESIRABLE MOMENTUM STOCKS

Momentum is a trend-following strategy, but defining a trend is as much art as science. The chart below shows the indexed stock performance of two biotech companies. Emergent BioSolutions (EBS), which develops medical countermeasures for biological and chemical threats as well as for infectious diseases, showed a consistent upward trend over the last 12 months. In contrast, Insmed (INSM), which develops drugs for rare diseases, shows a flat performance over the same time period, except for September 2017, where the stock price doubled in one day after the company announced a successful drug trial. Investors typically prefer consistent upward trends versus sporadic jumps in stock prices as these might not be repeated in the future. The objective of some of the Momentum variations is to identify stocks with higher trend consistency.

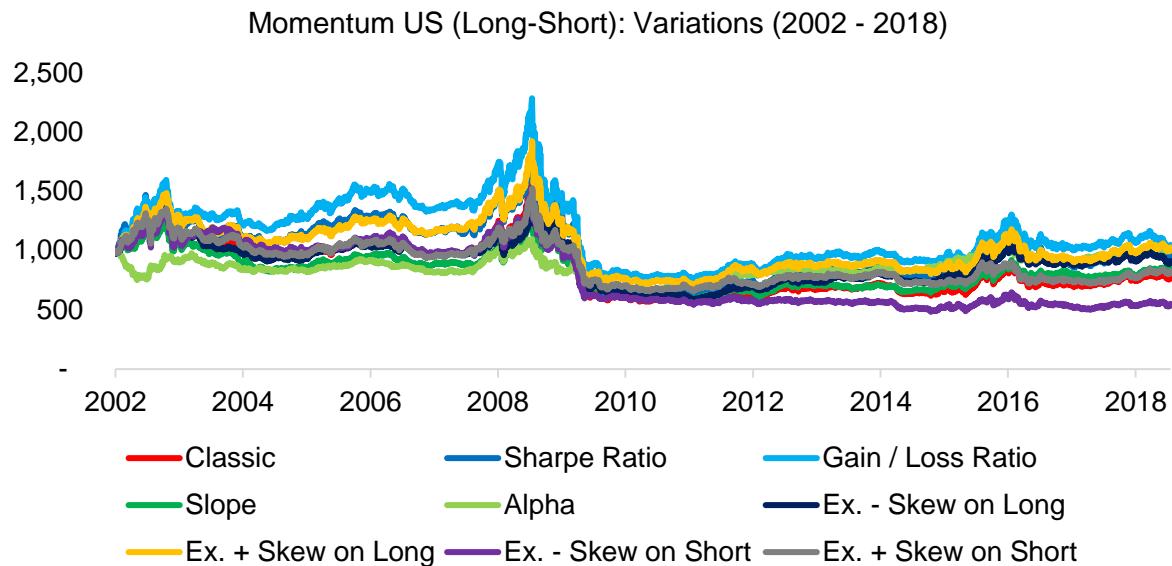


Source: FactorResearch

MOMENTUM VARIATIONS IN THE US

The chart below highlights the long-short Momentum variations from 2002 to 2018. We can observe that in general the trends in the various profiles are very similar, despite quite

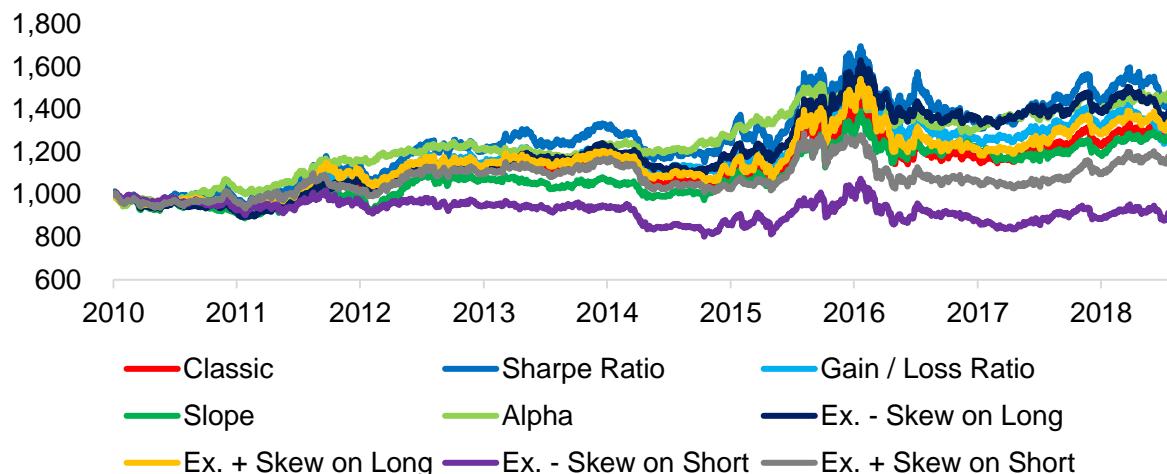
different factor definitions, which reflects the robustness of the strategy. Alpha Momentum showed the inverse performance of all other variations in the first years of the analysis but performed in line thereafter. Excluding negatively skewed stocks, i.e. stocks that exhibited sharp stock price decreases, in the short portfolio, led to a lower performance compared to the Classic Momentum factor. Interestingly, excluding negatively skewed stocks in the long portfolio increased performance, which implies that investors dislike sharp drawdowns when stocks are increasing or decreasing.



Source: FactorResearch

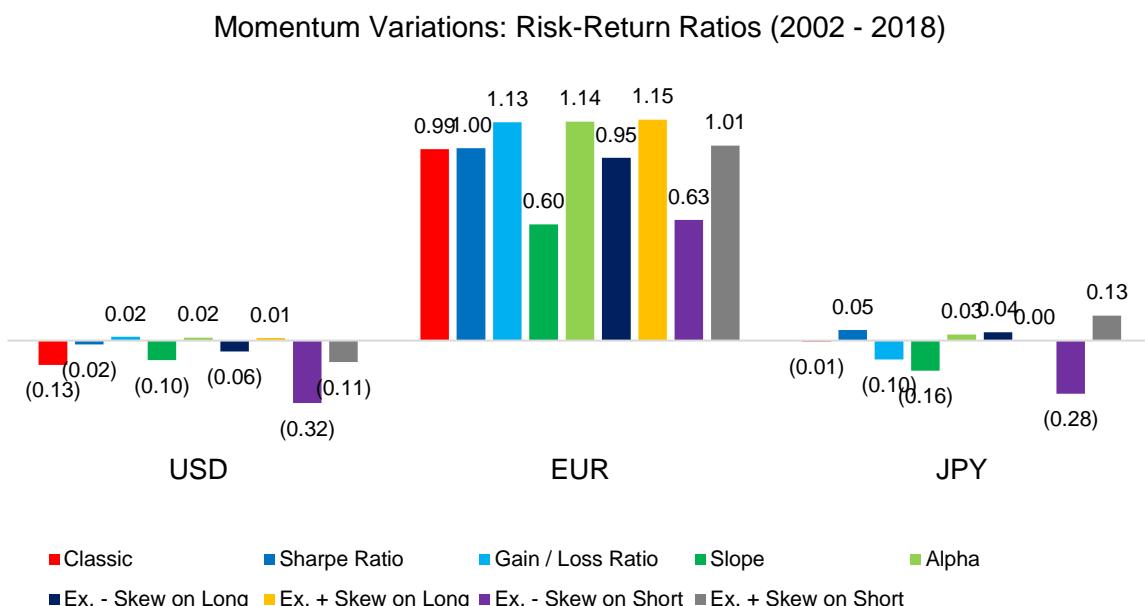
The previous analysis included the Global Financial Crisis and the well-documented Momentum crash in 2009, which makes it somewhat difficult to analyse the trends. The chart below shows the performance since 2010, which highlights again the similarity of return profiles. Although excluding the negatively skewed stocks in the short portfolio decreased the performance, it is challenging to identify any variation that represents a significant improvement to the Classic Momentum factor.

Momentum US (Long-Short): Variations (2010 - 2018)

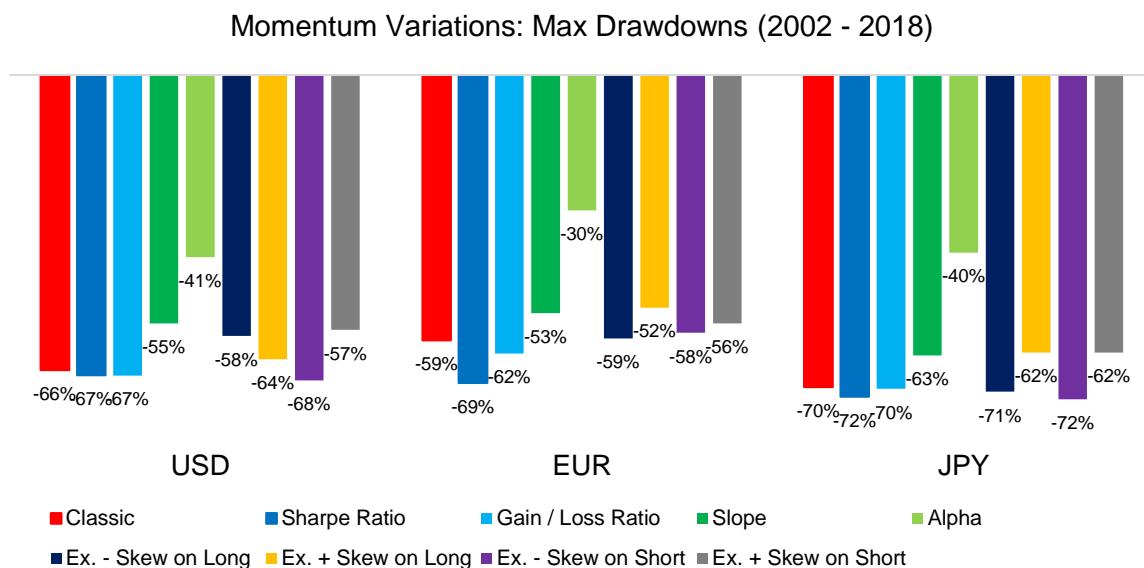


MOMENTUM VARIATIONS ACROSS MARKETS

In order to investigate the Momentum variations further, we expand the analysis to Europe and Japan and focus on risk-adjusted returns. The chart below shows that in the period from 2002 to 2018 Momentum only generated attractive risk-return ratios in Europe. The analysis fails to highlight any Momentum variations that are consistently and significantly better than the Classic Momentum strategy, although Slope and excluding negatively skewed stocks in the short portfolio exhibit lower ratios across the three markets.



Finally, we analyse the maximum drawdowns of the Momentum variations, which highlights that Slope and Alpha Momentum exhibit consistently reduced drawdowns. Slope Momentum is not particularly attractive given below average risk-return ratios, but Alpha Momentum offers higher risk-adjusted returns. The severe drawdowns represent the Momentum crash in 2009, which occurred when the sentiment changed and financial markets recovered. Classic Momentum and most other variations had significant negative exposure to other factors, e.g. Value, which generated negative returns when markets and these factors recovered. Alpha Momentum exhibits significantly less factor exposure as it represents residual or idiosyncratic Momentum, therefore was less affected by the recovery (please see our report [Alpha Momentum](#)).



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights variations of the long-short Momentum factor in equities, which results in relatively comparable return profiles, despite different factor definitions. There are many assumptions in the factor and portfolio construction process that can be evaluated, but the similarity of the results of this analysis reflects an attractive robustness of the strategy. Although the more complex variations do not show significantly higher risk-adjusted returns than the Classic Momentum factor, they might be combined into a multi-metric Momentum portfolio, which is a research topic worth exploring further.

FACTORS: SHORTING STOCKS VS THE INDEX

Do Short Stock Positions Contribute to Factor Returns?

July 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research was originally published in the Beyond Beta magazine.

SUMMARY

- Most factor investing research is based on long-short stock portfolios
- Investible risk premia strategies often feature a short index position
- Trade-off between theoretical alpha and implementation costs & efficiency

INTRODUCTION

Amundi, a French asset manager, was the first institution to launch a European multi-factor ETF that was market neutral, the Amundi ETF iSTOXX Europe Multi-Factor Market Neutral UCITS ETF (MKTN:FP). MKTN harvests factor returns from European equities and achieves market-neutrality by buying exchange-traded factor futures while shorting the Stoxx Europe 600 index future. This portfolio construction not only differs from competing funds, but also from academic research, which created the foundation of factor investing. This article investigates the difference between constructing a factor portfolio by shorting stocks on the one hand, and constructing a factor portfolio that shorts an index on the other. It proceeds as follows. First, it outlines the key differences between shorting stocks versus an index. Second, it analyses the impact of replacing stocks with the index for one factor in detail, specifically the value factor in the US. Finally, it highlights the impact for various factors in the US, Europe and Japan.

SHORTING STOCKS VERSUS SHORTING AN INDEX

Factor investing has its origin in the work of Fama and French (1993) who explained stock returns by the market risk and the value and size factors. In academic research factor portfolios are created by ranking the top and bottom stocks of a stock market by a factor and then rebalancing these on a regular basis. Nearly all academic research is based on selecting single stocks for the long and short portfolios and indices are rarely featured.

However, when undertaking fund management in practice, shorting a portfolio of stocks is much more complex and expensive than shorting an index. In order to short stocks, stocks first must be available for shorting, which requires confirmation from a broker as naked shorting is banned in most countries. Shorting an index can be done efficiently via futures or ETFs, which requires little up-front work and portfolio maintenance thereafter, aside from occasionally rolling the future forward at expiry and adjusting the trade size. The transaction and impact costs when executing trades are significantly lower when shorting an index as futures and ETFs are amongst the most liquid products traded on financial markets.

There is also the risk of short stock positions being recalled, which is at the lenders discretion and often occurs at inopportune moments for the short-seller, e.g. during a short squeeze. The ultimate owners of shares need to be compensated for lending the stocks to



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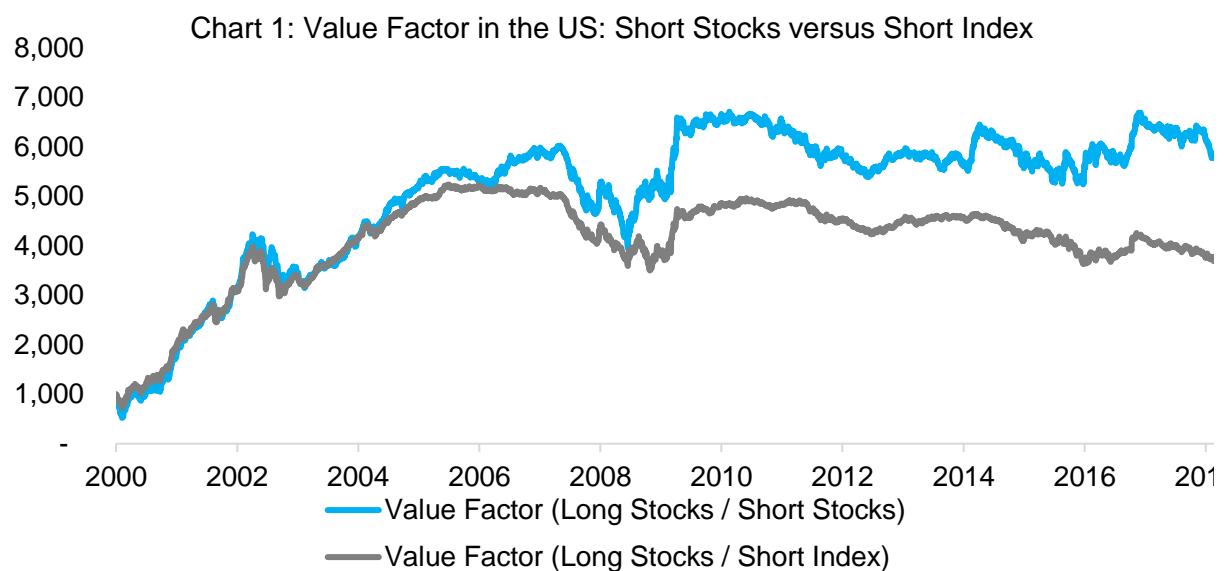
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short-sellers, which results in annual borrowing fees of 30 to 40 basis points for liquid stocks to much higher rates for less liquid stocks. Shorting an index incurs a fraction of these costs.

VALUE FACTOR IN THE US: SHORTING STOCKS VERSUS SHORTING AN INDEX

From an operational and cost perspective, it is far more efficient to short an index than a portfolio of stocks. But choosing to short an index will likely have an impact on the factor performance. An index typically represents the free-float market capitalisation-weighted average of all constituents of a stock market, which is fundamentally different from a portfolio of stocks ranked by a factor.

Chart 1 shows the performance for the value factor in the US, which is defined by an equal-weight combination of price-to-earnings and price-to-book multiples. The blue line shorts the most expensive 10% of stocks, while the grey line takes a short position in the index (the S&P 1500). The long portfolio is the same for both: selecting the cheapest 10% of stocks. The stock universe is defined as all US stocks with a market capitalisation of larger than \$1 billion, which currently comprises approximately 1700 stocks. Portfolios are rebalanced monthly, reflect borrowing fees and include transaction costs of 10 basis points.



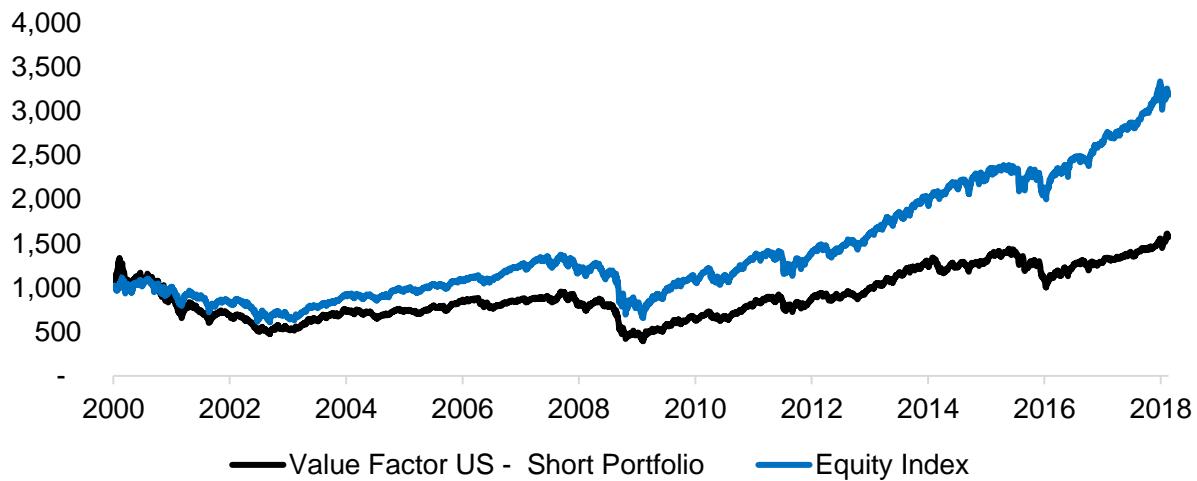
Source: FactorResearch

The performance of the long-short value factor was strong from 2000 to 2008, but has effectively been flat since then, causing difficult years for Value-oriented fund managers. The analysis also highlights that the performance of short-stocks value factor is almost identical to the short-index factor from 2000 to 2006, but superior thereafter.

Given that the short-index value factor underperformed the short-stocks factor during the period from 2000 to 2018, this would imply that the index has outperformed the portfolio of expensive stocks. This is in evidence in Chart 2.

The black line in Chart 2 compares the performance of the short value portfolio (i.e. long the most expensive 10% of stocks) with the index, which is the blue line. The chart shows that the portfolio of expensive stocks indeed underperformed the index, which benefited the short-stocks value factor in terms of returns.

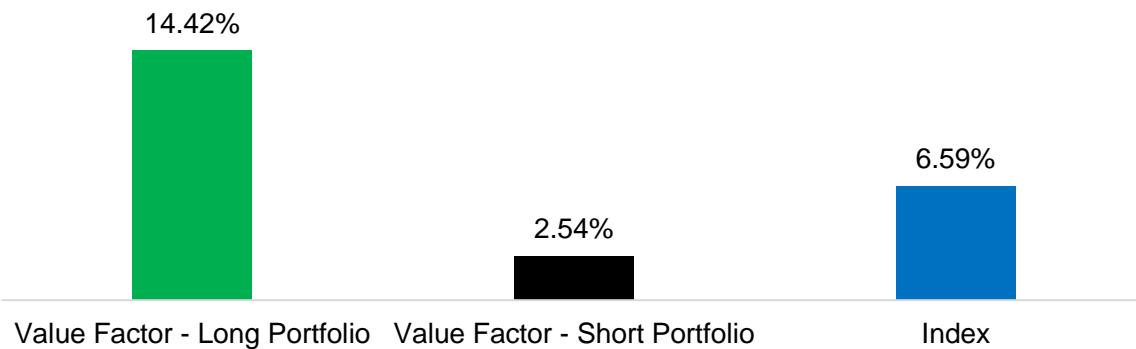
Chart 2: Value Factor in the US - Short Portfolio (Expensive Stocks) versus Index



Source: FactorResearch

The US equity market has generated attractive returns over the last two decades, despite two severe market crashes (2000 tech bubble and the 2008 financial crisis). However, the long portfolio of the value factor, i.e. the cheapest stocks, has generated significantly higher returns than the index as can be seen in Chart 3.

Chart 3: CAGRS: Value Factor (Long & Short Portfolios) and Index (2000 - 2018)



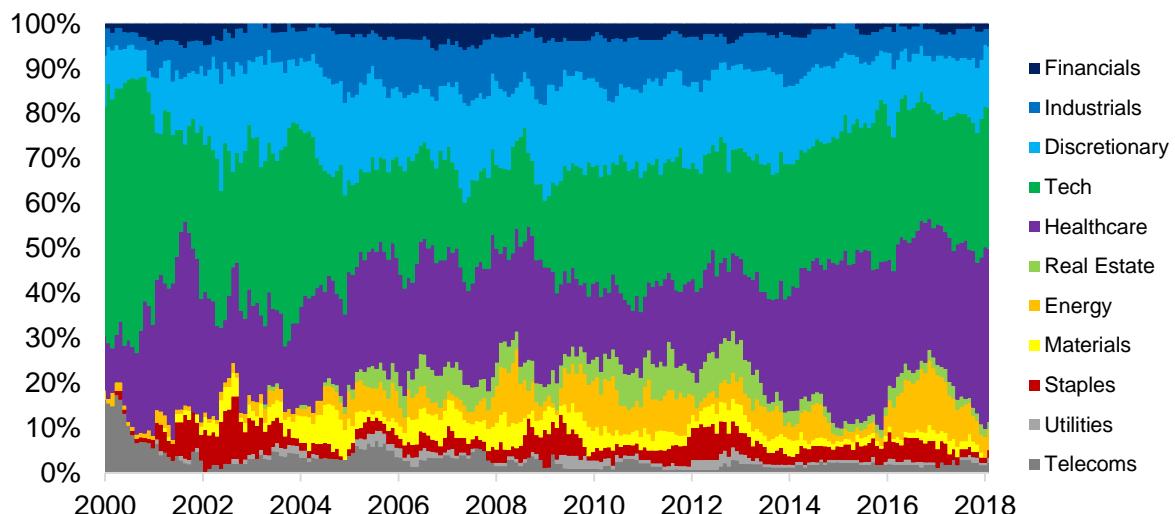
Source: FactorResearch

It is worth noting that the value factor in the US and globally experienced a large drawdown during the tech bubble as investors disregarded fundamental valuations when buying exciting technology stocks between 1996 and 2000, therefore the high returns of the long portfolio of the value factor include a significant recovery of the factor performance.

WHAT THE VALUE SHORT PORTFOLIO IS MADE OF

In addition to showing performance data, it is interesting to analyse what the short portfolio of the value factor is comprised of, which can be highlighted by a breakdown by sectors. The analysis in Chart 4 highlights the sectoral composition of that portfolio from 2000 to 2018. We can observe that there were significant biases toward the technology and healthcare sectors, which currently contribute approximately 70% of the short positions. It seems that these two sectors are structurally expensive compared to other sectors when measured on a combination of price-to-earnings and price-to-book multiples. The index is naturally more diversified across sectors, which explains the difference in performance when replacing the stocks with an index in the short portfolio of the value factor.

Chart 4: Value Factor in the US - Short Portfolio: Breakdown by Sectors



Source: FactorResearch

It is worth noting that the long portfolio of the value factor has similar sectoral biases, specifically toward financial and consumer discretionary stocks, which are structurally cheap and currently make up approximately 50% of the portfolio.

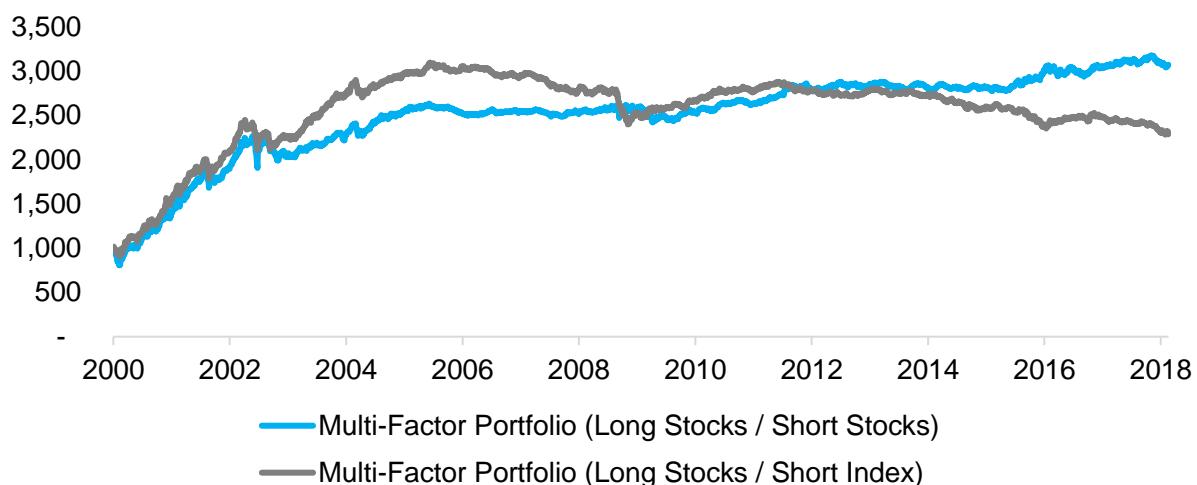
MULTI-FACTOR PORTFOLIOS: SHORT STOCKS VERSUS SHORTING THE INDEX

The case study of the value factor has highlighted that there is a significant difference when constructing a factor by shorting stocks versus an index. Naturally these results are for one factor in a single market and therefore not sufficient for a sound conclusion on this research question.

Therefore we construct a multi-factor portfolio, which comprises seven factors. They are: value, size, momentum, low volatility, quality, growth and dividend yield. The factors are defined in line with academic and industry standards, receive equal allocations and are rebalanced monthly.

Chart 5 displays the performance of a multi-factor portfolio in the US, once with stocks and alternatively with an index for the short portfolio. We can observe a strong performance between 2000 and 2006, which can be explained primarily by the performance of the value, size and dividend yield factors, and then flat returns thereafter. The analysis highlights that in the first few years the short-index portfolio generated a higher return, but over the entire observation period the short-stocks portfolio was more consistent in performance generation.

Chart 5: Multi-Factor Portfolio in the US: Short Stocks versus Short Index

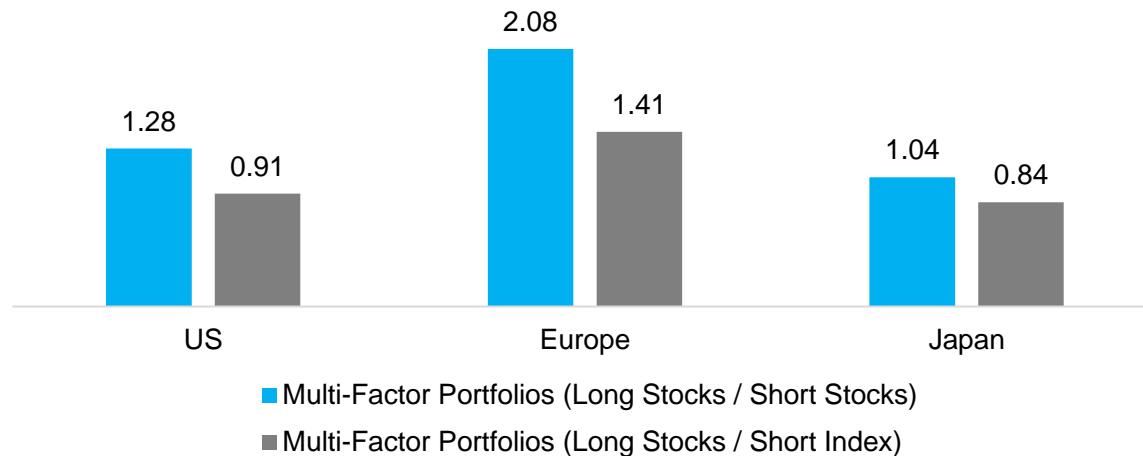


Source: FactorResearch

Analysing the outperformance of the multi-factor portfolios in the US reveals that this can be attributed to all seven factors and that there is not one of the seven factors where the short-index portfolio generated consistently higher returns. Over some years shorting the index did lead to a superior performance; however, over the full observation period from 2000 to 2018 the performance was higher for each factor when constructed with stocks in the short portfolio.

The analysis can be extended to Europe and Japan and highlight the difference in terms of risk-adjusted returns. Chart 6 shows that in each of the three regions the Sharpe ratios of the long-short multi-factor portfolios are higher when shorting stocks instead of the index.

Chart 6: Multi-Factor Portfolios (Long-Short): Sharpe Ratios (2000 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

This article highlights that factor portfolios can be constructed by shorting stocks or an index. The latter has significant benefits from an operational and cost perspective; however, leads to lower risk-adjusted returns across factors and regions.

The analysis can be challenged that it is entirely based on backtesting, as is nearly all research in factor investing, which should be viewed with caution. From this perspective the short-index portfolio can be seen as slightly advantageous as there is likely to be a smaller difference between backtested and realised returns. Stocks selected for the short portfolio might not be available for shorting or only at significant borrowing costs, which are not issues when considering shorting an index as this will always be available with relatively low fees. Naturally none of these risks of real life fund management are reflected in the backtesting.

In summary, factor investing is based on academic research that uses stocks for the construction of the long and short portfolios while some investible products replace the stocks with a short position in an index. Although the results presented in this article highlight that using stocks is significantly more attractive, the difference is likely smaller in realised compared to theoretical returns.

FURTHER THOUGHTS

Although replacing the stocks with an index in the short portfolio did lead to lower returns in this article, the performance profiles are still comparable, which indicates that a large part of the returns were contributed by the long portfolio. The distribution of returns by long and short portfolios across factors and geographies represents another interesting research topic.

ETFS, SMART BETA & FACTOR EXPOSURE

Do Smart Beta ETFs Provide the Desired Factor Exposure?

July 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor exposure analysis can be used to derive factor themes
- Smart beta ETFs offer relatively low factor exposure
- It is all about how factors are defined

INTRODUCTION

The Austrian energy drinks company Red Bull advertised for almost two decades that Red Bull “gives you wings” and improves a consumer’s concentration and reaction speed. Consumers in the US sued the company successfully in 2014 as they had not developed flying capabilities or improved their mental powers. Red Bull was forced to pay a fine of \$13 million and reimburse \$10 to every consumer who bought the drink since 2002. Unfortunately false advertisement is not limited to consumer products, but also widespread within the financial industry. Investors frequently discover that the names of financial products are not accurate descriptions for the underlying portfolios. In this short research note we will investigate the factor exposure of smart beta ETFs, initially by focusing on the Value factor and then expanding to other factors.

METHODOLOGY

We focus on seven factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield in the US stock market. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks ranked by the factor. The factor definitions are in line with academic and industry standards. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

Factor exposure is measured by factor betas derived from a one-year regression analysis utilising daily data and the seven equity factors as well as the market as independent variables.

ETFS WITH VALUE FACTOR EXPOSURE

As a first step, we measure the exposure to the long-short Value factor of all tradable ETFs in the US. Interestingly, the resulting list of ETFs with the highest Value factor exposure as measured by the factor beta does not contain any smart beta Value ETFs, but represents a rather diverse universe. The chart below shows the top and bottom 10 funds and we can identify ETFs for different equity sectors, both long (“Bull”) and short (“Bear”), the VIX, and even commodities.



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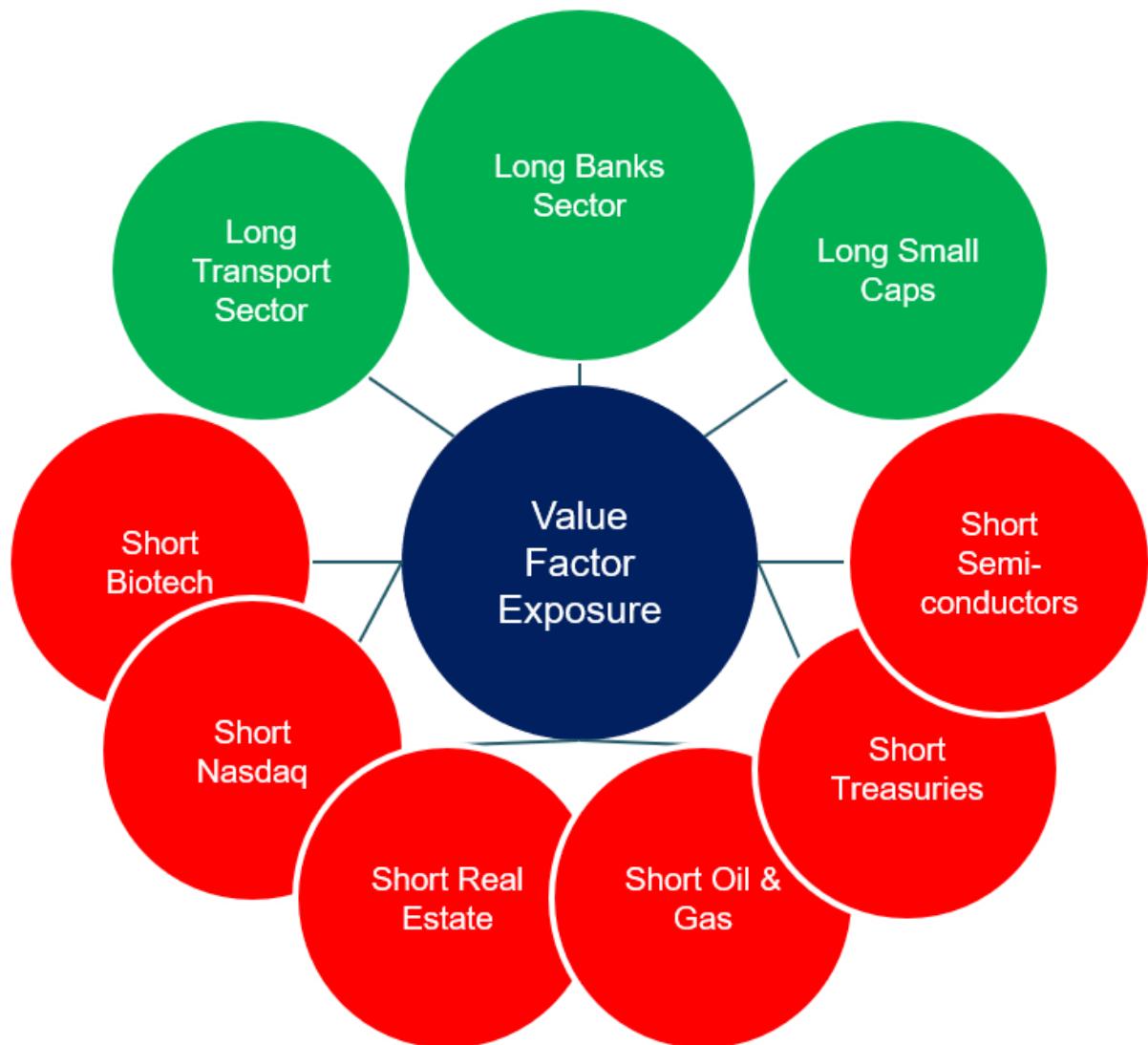
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All ETFs: Exposure to the Value Factor

Top 10 ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
Ticker	Name			
DPST	Direxion Daily Regional Banks Bull 3X Shares	3.56	10.13	0.75
LABD	Direxion Daily S&P Biotech Bear 3X Shares	3.50	7.59	0.72
FINU	ProShares UltraPro Financial Select Sector	2.61	10.40	0.83
ZBIO	ProShares UltraPro Short Nasdaq Biotechnology	1.89	5.01	0.72
DRV	Direxion Daily Real Estate Bear 3x Shares	1.66	6.65	0.71
SZO	DB Crude Oil Short ETN	1.39	2.25	0.05
FAS	Direxion Daily Financial Bull 3x Shares	1.39	8.97	0.90
BIS	ProShares UltraShort Nasdaq Biotechnology	1.34	5.68	0.75
KBWR	Invesco KBW Regional Banking ETF	1.20	9.50	0.72
GASX	Direxion Daily Natural Gas Related Bear 3X Shares	1.17	2.98	0.81
Average		1.97	6.92	0.69
Bottom 10 ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
Ticker	Name			
BBC	Virtus LifeSci Biotech Clinical Trials ETF	(1.31)	(6.11)	0.61
FAZ	Direxion Daily Financial Bear 3X Shares	(1.35)	(8.56)	0.89
BIB	ProShares Ultra Nasdaq Biotechnology	(1.37)	(5.77)	0.75
DRN	Direxion Daily Real Estate Bull 3x Shares	(1.54)	(6.19)	0.71
UVXY	ProShares Ultra VIX Short-Term Futures ETF	(1.62)	(1.74)	0.71
TVIX	VelocityShares Daily 2x VIX Short-Term ETN	(1.69)	(1.79)	0.73
UBIO	ProShares UltraPro Nasdaq Biotechnology	(2.05)	(5.80)	0.75
FINZ	ProShares UltraPro Short Financial Select Sector	(2.71)	(7.24)	0.67
LABU	Direxion Daily S&P Biotech Bull 3X Shares	(3.60)	(7.82)	0.72
WDRW	Direxion Daily Regional Banks Bear 3X Shares	(3.69)	(8.55)	0.59
Average		(2.09)	(5.96)	0.71

Source: FactorResearch

Although the top 10 ETFs might not be appealing for investors seeking exposure to the Value factor, the analysis highlights the thematic exposure of the factor, which is displayed in the graphic below. We can observe that the Value factor is long the transport sector, banks and small caps, while being short biotech, the Nasdaq, real estate, oil & gas, treasuries and semiconductors. The Value factor is defined as a combination of price-to-book and price-earnings multiples, which explains some of the exposure, e.g. banks are structurally cheap on price-to-book ratios while real estate stocks are consistently expensive on price-earnings multiples.



Source: FactorResearch

SMART BETA ETFS WITH VALUE FACTOR EXPOSURE

Next we reduce the universe of tradable ETFs in the US to include only smart beta ETFs. The chart below highlights the top and bottom smart beta ETFs with the highest and lowest exposure to the Value factor. The analysis reveals several Value smart beta ETFs with high factor exposure as well a few dividend and shareholder yield strategies. The bottom 10 smart beta ETFs, i.e. with the least Value factor exposure, are exclusively Growth-focused funds.

Smart Beta ETFs: Exposure to the Value Factor

Top 10 Smart Beta ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
Ticker	Name			
SPVU	Invesco S&P 500 Enhanced Value ETF	0.53	5.62	0.72
WBIY	WBI Power Factor High Dividend ETF	0.45	4.51	0.64
SYLD	Cambria Shareholder Yield ETF	0.44	7.47	0.86
CSML	IQ Chaikin U.S. Small Cap ETF	0.43	6.75	0.87
RPV	Invesco S&P 500 Pure Value ETF	0.40	8.32	0.91
RFV	Invesco S&P MidCap 400 Pure Value ETF	0.40	4.57	0.78
PY	Principal Shareholder Yield Index ETF	0.39	3.11	0.56
CSA	VictoryShares U.S. Small Cap Volatility Wtd Index ETF	0.38	4.11	0.68
FAB	First Trust Multi Cap Value AlphaDEX Fund	0.36	4.44	0.71
NULV	NuShares ESG Large-Cap Value ETF	0.35	2.99	0.49
Average		0.41	5.19	0.72
Bottom 10 Smart Beta ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
Ticker	Name			
VBK	Vanguard Small-Cap Growth ETF	(0.20)	(5.18)	0.94
IWY	iShares Russell Top 200 Growth ETF	(0.20)	(5.90)	0.96
SPYG	SPDR Portfolio S&P 500 Growth ETF	(0.21)	(8.05)	0.98
RPG	Invesco S&P 500 Pure Growth ETF	(0.21)	(5.88)	0.96
VONG	Vanguard Russell 1000 Growth ETF	(0.21)	(8.49)	0.98
PXMG	Invesco Russell MidCap Pure Growth ETF	(0.21)	(2.96)	0.85
VUG	Vanguard Growth ETF	(0.22)	(7.94)	0.97
MGK	Vanguard Mega Cap Growth ETF	(0.23)	(6.80)	0.96
PWB	Invesco Dynamic Large Cap Growth ETF	(0.24)	(5.26)	0.93
PXLG	Invesco Russell Top 200 Pure Growth ETF	(0.35)	(6.32)	0.90
Average		(0.23)	(6.28)	0.94

Source: FactorResearch

VALUE SMART BETA ETFS WITH VALUE FACTOR EXPOSURE

As a third step, we limit the analysis to include only smart beta ETFs that include “Value” in the product name. The ETF with the highest exposure is the Invesco S&P 500 Enhanced Value ETF (SPVU), which might be explained by Invesco using a definition of the Value factor that is similar to the one used for this analysis. However, the ETF with the lowest Value factor exposure is from the same provider, namely the Invesco Russell MidCap Pure Value ETF (PXMV). This result is somewhat perplexing as we would have expected the provider to use the same or at least similar methodology for defining the factor, which should result in both ETFs to exhibit similar exposure levels, regardless of focusing on different market capitalisations. An analysis of the index replicated by PXMV reveals a factor-weighting, which oddly results in the ETF exhibiting higher exposure to the Low Volatility than to the Value factor. The implication is that investors should conduct a thorough due diligence on ETFs as product names may be misleading.



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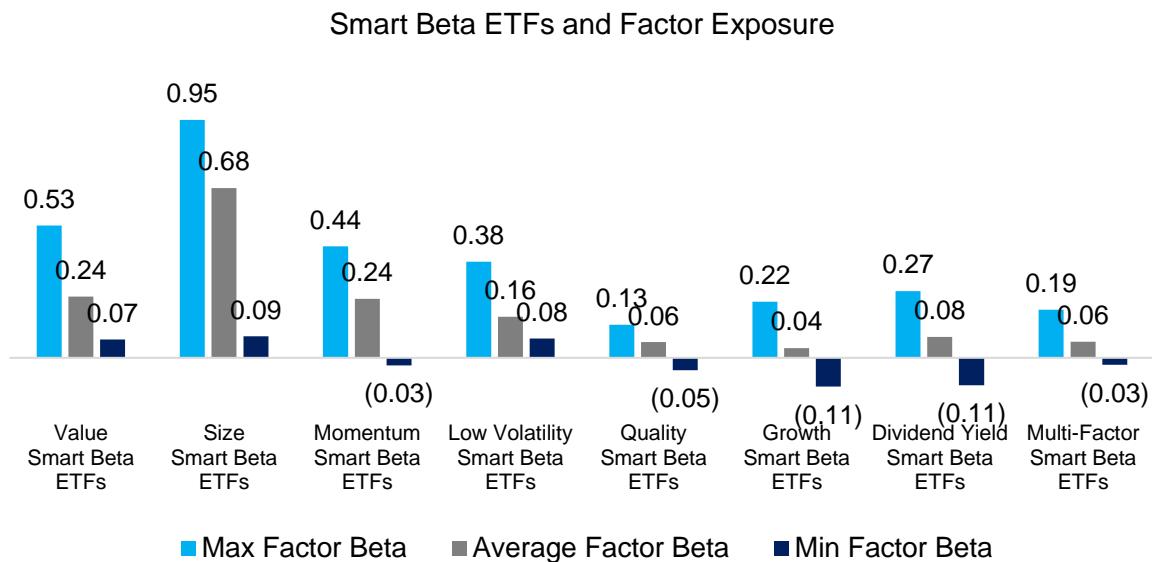
Smart Beta Value ETFs: Exposure to the Value Factor

Top 10 Smart Beta ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
SPVU	Invesco S&P 500 Enhanced Value ETF	0.53	5.62	0.72
RPV	Invesco S&P 500 Pure Value ETF	0.40	8.32	0.91
RFV	Invesco S&P MidCap 400 Pure Value ETF	0.40	4.57	0.78
FAB	First Trust Multi Cap Value AlphaDEX Fund	0.36	4.44	0.71
NULV	NuShares ESG Large-Cap Value ETF	0.35	2.99	0.49
JKL	iShares Morningstar Small Cap Value ETF	0.34	5.57	0.85
PXLV	Invesco Russell Top 200 Pure Value ETF	0.32	5.20	0.84
VTWV	Vanguard Russell 2000 Value ETF	0.32	4.72	0.83
PWV	Invesco Dynamic Large Cap Value ETF	0.31	7.17	0.91
PXSV	Invesco Russell 2000 Pure Value ETF	0.31	3.79	0.73
Average		0.36	5.24	0.78
Bottom 10 Smart Beta ETFs Sorted by Factor Beta		Factor Beta	T-Stat	R2
IJS	iShares S&P Small-Cap 600 Value ETF	0.19	4.14	0.92
VBR	Vanguard Small-Cap Value ETF	0.19	5.12	0.94
DVP	Deep Value ETF	0.18	1.46	0.65
JKI	iShares Morningstar Mid-Cap Value ETF	0.18	3.61	0.88
NUMV	NuShares ESG Mid-Cap Value ETF	0.18	1.75	0.44
FVAL	Fidelity Value Factor ETF	0.17	3.97	0.93
RZV	Invesco S&P SmallCap 600 Pure Value ETF	0.16	1.80	0.80
SCHV	Schwab U.S. Large-Cap Value ETF	0.12	5.23	0.97
IWS	iShares Russell Mid-Cap Value ETF	0.10	3.52	0.95
PXMV	Invesco Russell MidCap Pure Value ETF	0.07	1.23	0.77
Average		0.15	3.18	0.83

Source: FactorResearch

SMART BETA ETFS AND FACTOR EXPOSURE

Finally, we expand the exposure analysis to other factors and respective smart beta ETFs, which highlights a relatively low average factor exposure for most ETFs. One of the reasons for the low factor exposure is that smart beta ETFs represent long-only funds with factor tilts that are mostly market cap-weighted while factors are created as long-short portfolios of the top and bottom stocks, which are equally-weighted. Investors should be aware that expected returns and risks of smart beta ETFs are not comparable with factors seen in academic research (please see our report [Smart Beta or Smart Marketing?](#)).



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the factor exposure of smart beta ETFs, which is relatively low across various different categories. The results of this analysis need to be taken with caution as they highly depend on the factor definitions, which can vary significantly for some factors, e.g. surveying 10 investors on how to define Quality stocks likely results in 10 different responses. However, there is much less flexibility in defining Dividend Yield, which also reflects low factor exposure. Like consumers, investors beware.

STOCK PORTFOLIO OPTIMISATION

Measuring and Tuning Factor Exposure

July 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Portfolios frequently contain stocks representing duplicate factor risks or insignificant weights
- An optimisation process focused on factor exposure can increase the portfolio efficiency
- Increasing or decreasing factor exposure requires a view on expected factor performance and risks

INTRODUCTION

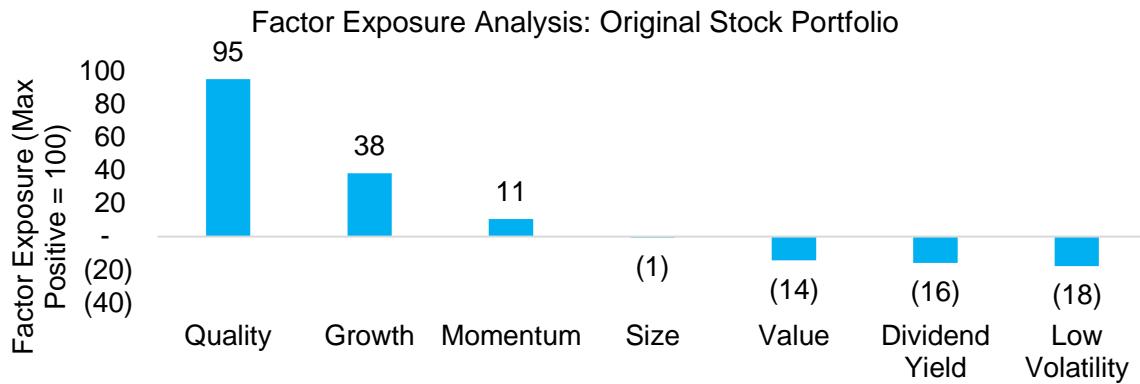
Gardens tend to lose their curated design quickly, if not cared for constantly, as grass, bushes and trees grow according to nature's will. Stock portfolios share this feature as they can look dramatically different, if left unattended for a period of time. Some stocks might dominate in size, others become insignificant and some just represent duplicate risks. However, investors have a variety of tools at hand to keep portfolios in shape. In this short research note we will investigate the application of an optimisation process for an investor targeting to increase the Value factor exposure of a stock portfolio with a Quality focus while improving the overall portfolio efficiency.

METHODOLOGY

We measure the exposure of the stock portfolio to seven common equity factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield in the US stock market. The factor definitions are in line with industry standards and the factor exposure is measured ranking-based, i.e. each stock is ranked on each factor relative to all other stocks and then assigned a ranking score, which is then aggregated on portfolio level for each factor.

FACTOR EXPOSURE ANALYSIS

As a first step we conduct a factor exposure analysis of the current portfolio, which can be seen in the chart below. Unsurprisingly, the analysis reveals high exposure to the Quality factor, which is defined as a combination of return-on-equity and debt-to-equity metrics. We can also observe positive exposure to Growth and Momentum as well as negative exposure to Value, Dividend Yield and Low Volatility. It is quite typical that portfolios with specific factor tilts exhibit significant exposure to other factors, which can be considered as desirable or undesirable.



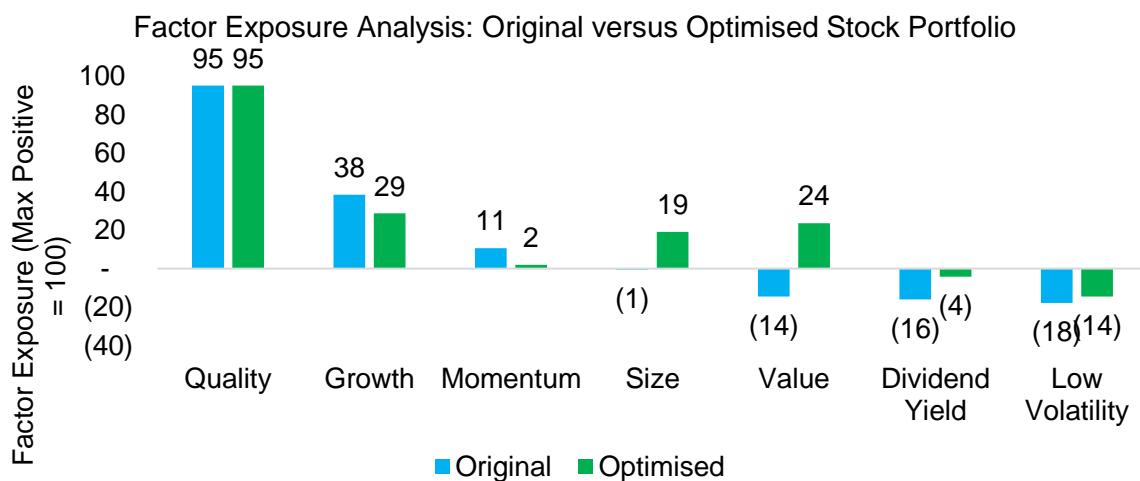
Source: FactorResearch

OPTIMISATION PROCESS

An optimisation process can be applied to the stock portfolio with the following objectives:

- Maintain the high Quality factor exposure
- Increase the Value factor exposure
- Sell stocks with duplicate factor exposure
- Sell stocks with insignificant portfolio weights

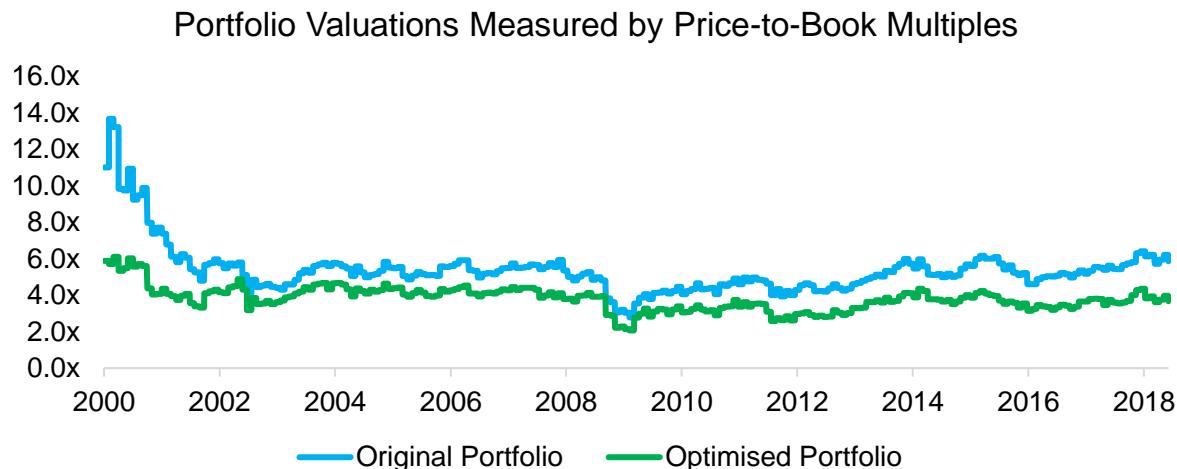
Naturally investors can define many more objectives and constraints; however, the more rules, the narrower the outcome. The analysis below shows the factor exposure of the original and optimised portfolios. We can observe that the optimisation process was effective in maintaining the high Quality exposure while increasing the Value exposure. The exposure to other factors also changed, e.g. to the Size factor, which implies the average market capitalisation decreased.



Source: FactorResearch

IMPACT ON PORTFOLIO VALUATIONS

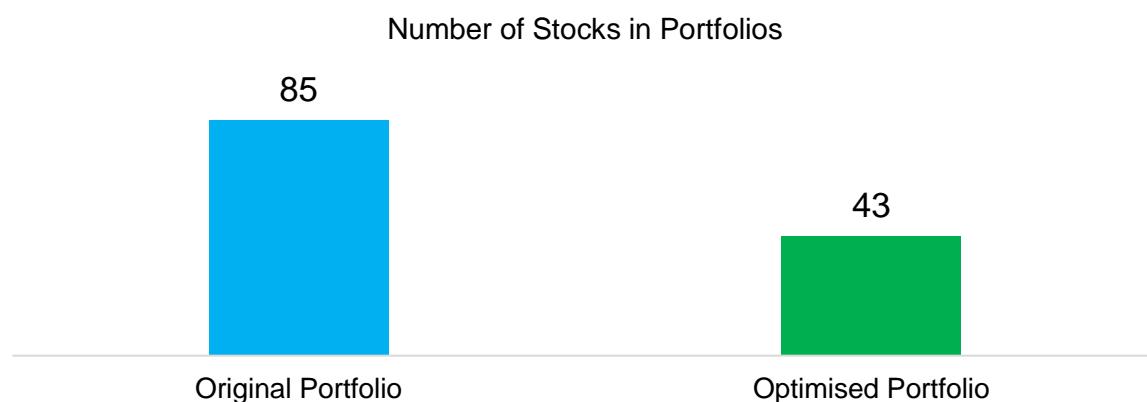
We can highlight the increased exposure to the Value factor by analysing the average portfolio valuations via price-to-book multiples. The analysis below shows that the average price-to-book multiple was reduced significantly, i.e. the portfolio has become cheaper. Given that the Quality exposure has been maintained, it implies an improvement in the attractiveness of the portfolio as investors typically prefer cheap to expensive valuations.



Source: FactorResearch

PORTFOLIO CHARACTERISTICS

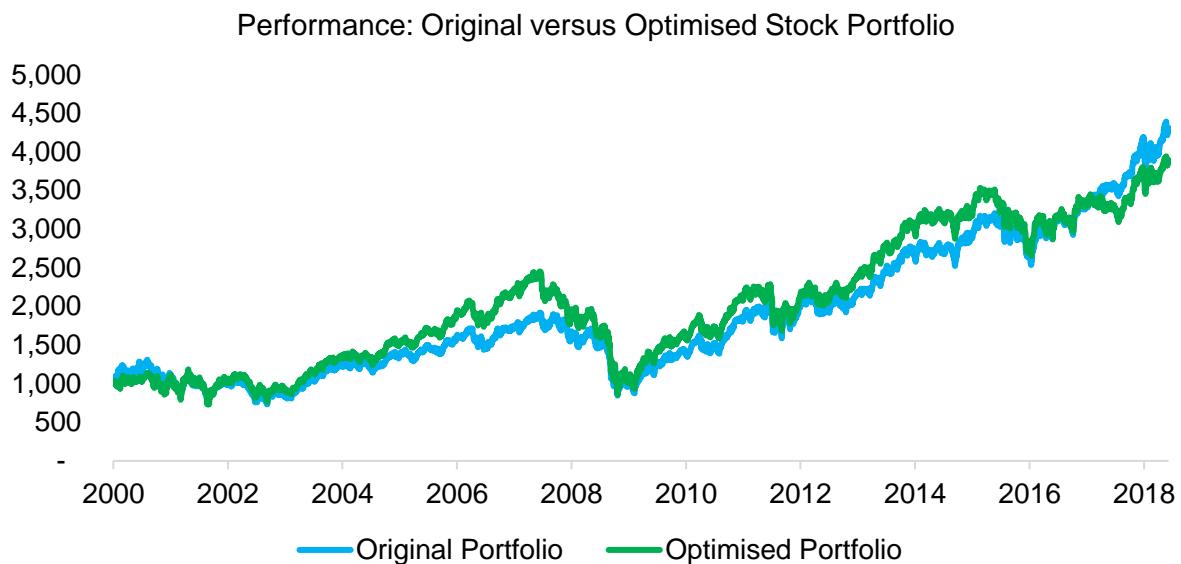
In addition to the objective of changing the factor exposure, the optimisation process targeted to improve the portfolio efficiency by reducing positions with insignificant weights, which often consume an over-proportional amount of the investor's time, and duplicate factor exposure. The analysis below highlights that the number of stocks decreased from 85 to 43, which still can be considered a well-diversified portfolio.



Source: FactorResearch

PERFORMANCE COMPARISON

The change in portfolio composition resulted in the optimised portfolio outperforming the original portfolio most of the time, except in the most recent years, which can be explained by the poor performance of the Value factor. The Quality factor has been performing strongly and was highly correlated to the Growth factor as both were driven by the Technology stocks, which feature low debt, high margins as well as strong sales and earnings growth. The objective of the optimisation process does not need to be higher performance, it may be an equivalent performance with higher portfolio efficiency, a more defensive profile or more diversified factor exposure.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights how an optimisation process empowers investors to improve the efficiency of a stock portfolio. However, although the portfolio may be more efficient, it does not necessarily imply higher performance. The optimisation process requires inputs like desired and undesired factor exposure, which require a view on expected factor performance and risk contribution.

IMPACT OF SINGLE STOCKS ON FACTOR RETURNS

Do Single Stocks Matter for Factor Investors?

July 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Factor portfolios are typically created by equal weighting stocks
- The impact of single stocks is therefore reduced compared to market-cap weighted indices
- The FAANG stocks impacted factors differently

INTRODUCTION

The famous FAANG quintet of Facebook, Amazon, Apple, Netflix, and Google has driven much of the performance of the Nasdaq 100 in 2018 and currently accounts for approximately 35% of the index.

Such a large contribution from a handful of stocks might seem extreme, but a select few stocks have historically accounted for a disproportionate share of stock market returns. Although it may seem counterintuitive, most stocks underperform their index because of the non-normal distribution of stock returns and the nature of market capitalization indexation, which rewards winners and punishes losers.

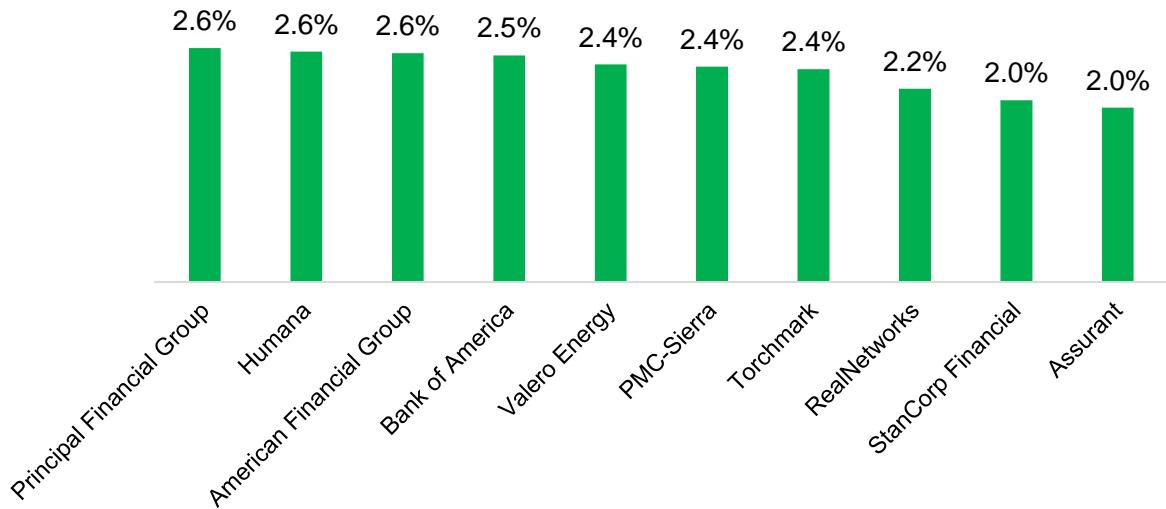
Factor portfolios are less affected by single stocks since they are usually constructed equal weight. Nevertheless, the relationship is worth exploring. Using the Value factor as a case study, how do single stocks influence factor returns? And how do the FAANG stocks influence six common equity factors?

IMPACT OF SINGLE STOCKS ON THE VALUE FACTOR IN THE US

We define the Value factor as buying cheap and selling expensive stocks as determined by a combination of price-to-book and price-to-earnings ratios. The portfolio is constructed beta-neutral and selects the top and bottom 10% of stocks with a US market capitalization of over \$1 billion. This results in a diversified portfolio of approximately 170 stocks each on the long and short sides.

Since the positions are equally weighted, single stocks should have a limited influence. The following chart highlights the 10 stocks that contributed most to positive Value factor performance in the United States from 2000 to 2018. These equities represent a diverse array of industries, with a tilt toward the financial sector.

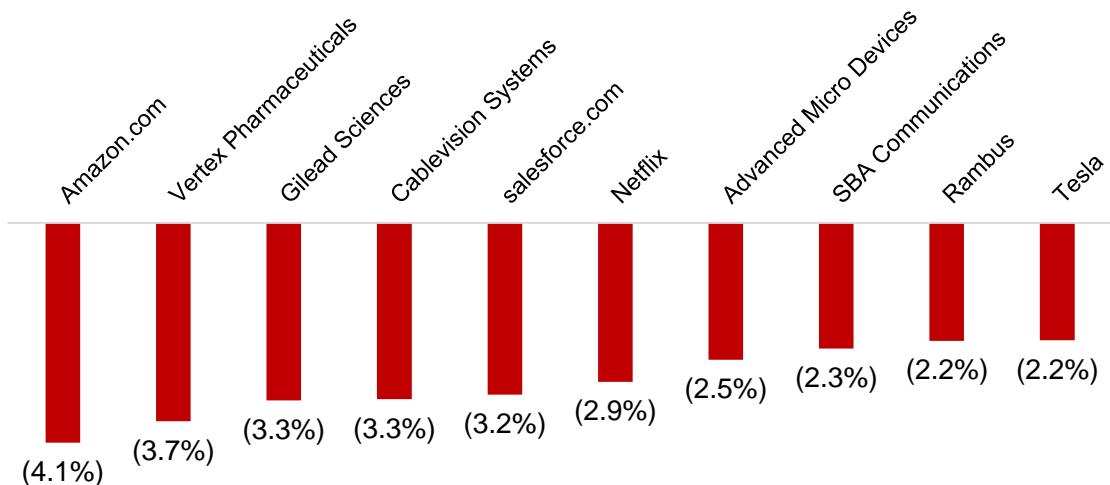
Value Factor US (Long-Short) (2000 - 2018): Top 10 Return Contributors



Source: FactorResearch

The stocks that most negatively influenced Value factor performance skewed toward technology companies. Amazon and Netflix stock, for example, has been expensive for years and so were featured in the short portfolio. But since they generated strong stock returns, they dragged down factor performance.

Value Factor US (Long-Short) (2000 - 2018): Bottom 10 Return Contributors

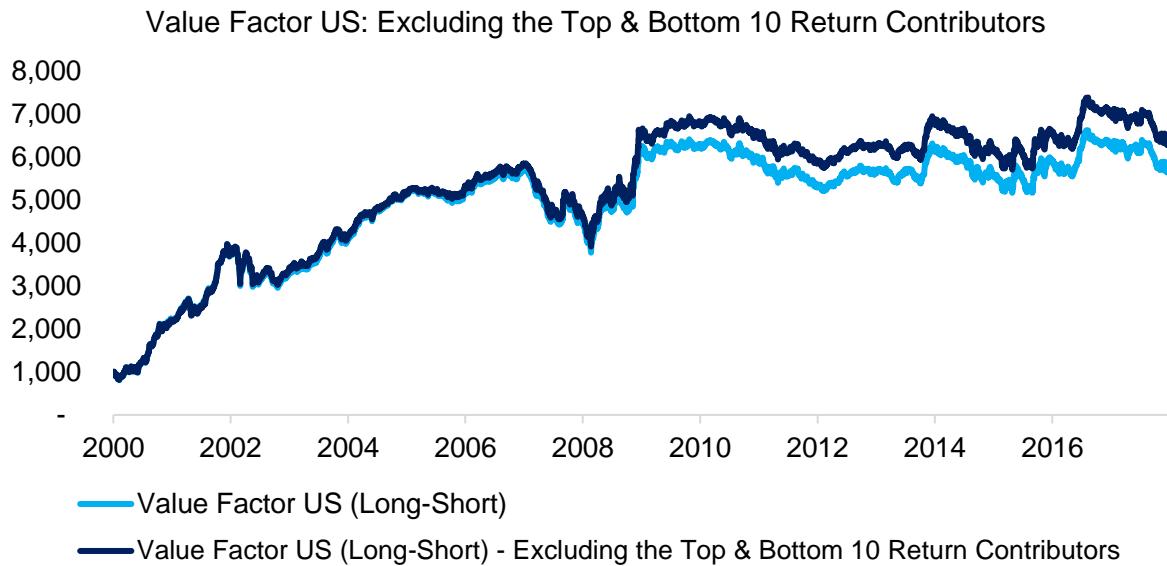


Source: FactorResearch

The top and bottom 10 contributors are not necessarily the cheapest or most expensive companies. Rather, they are those with the largest influence on factor performance, either

positive or negative. Investors therefore could have not avoided these stocks and their contribution only becomes obvious in hindsight.

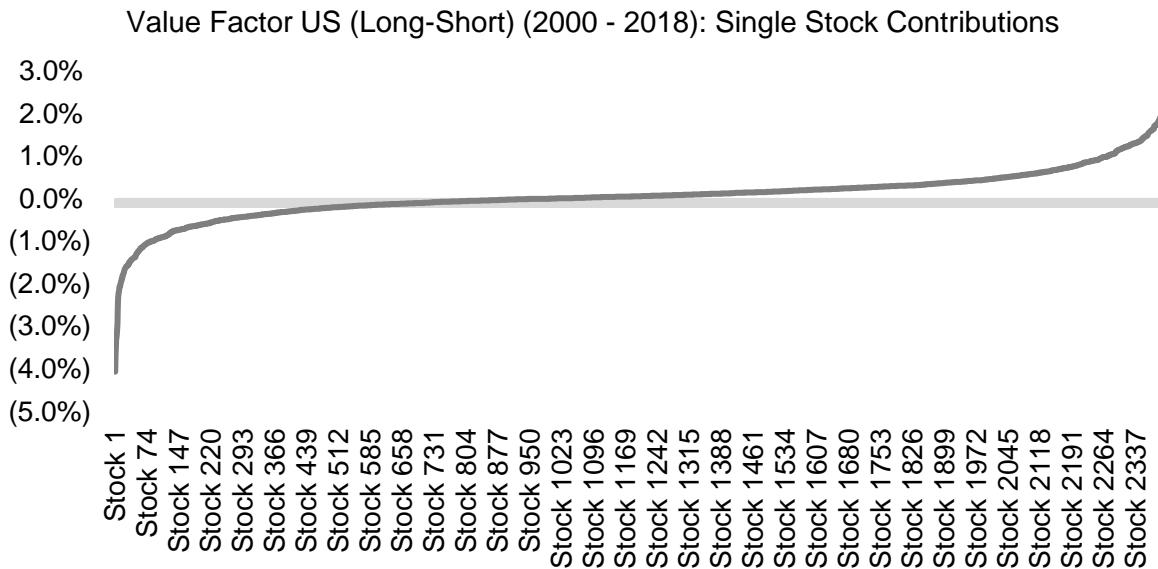
That said, with perfect foresight, we could exclude these 20 stocks. The chart below demonstrates the results: Removing those stocks would have a marginal effect on the performance of the long-short Value factor.



Source: FactorResearch

The reason for the lack of impact on the factor performance? The Value factor portfolio traded 2386 stocks from 2000 to 2018, so 20 stocks, especially given the equal weighting, have only a small influence overall.

The chart below shows the return contribution of all equities. It looks roughly symmetrical. Excluding the top and bottom 10 may remove the extreme outliers but effectively nets them. Therefore, it should have no significant influence on factor performance. The maximum positive distribution to the factor performance was below 3% while the most negative contributions were below -4%.



Source: FactorResearch

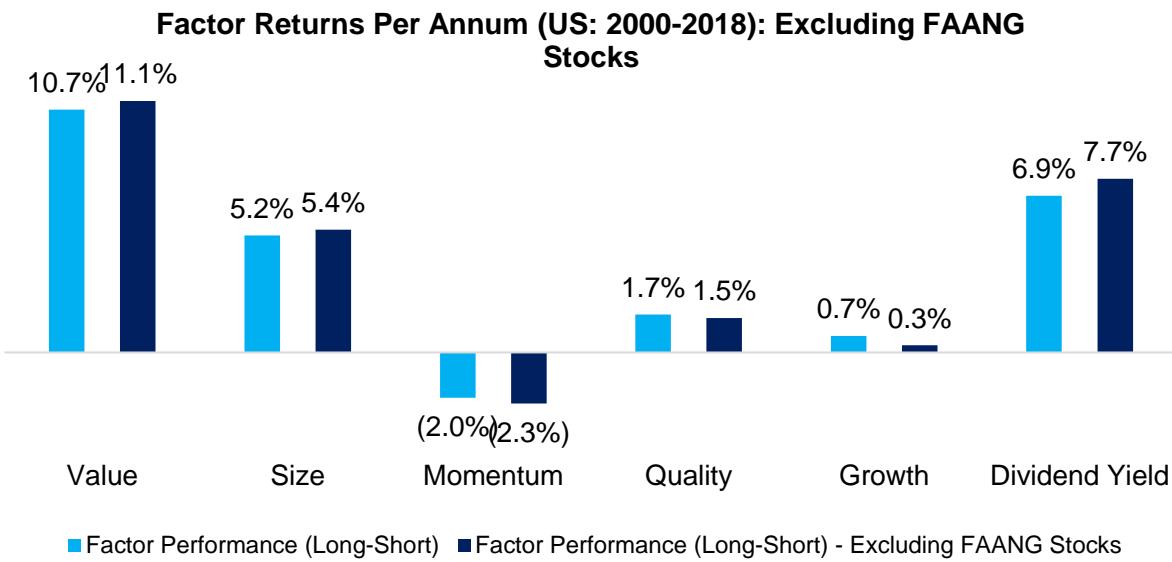
IMPACT OF FAANG STOCKS ON US FACTOR RETURNS

Three of the five FAANG stocks only had their initial public offering (IPOs) over the last two decades, which makes their impact on stock markets and the world all the more remarkable.

Their effect on common equity factors is not negligible either, as the chart below demonstrates. These factors are created via beta-neutral long-short portfolios based on the top and bottom 10% of the US stock markets. The factor definitions are in line with academic and industry standards.

Investors may expect FAANG stocks to demonstrate certain qualities: to be expensive and to outperform, to feature large market caps, high quality, strong growth, and to pay no dividends. Interestingly, the performance of the factor portfolios that excluded these five stocks reflects these company characteristics. Excluding the FAANG stocks was positive for the Value, Size, and Dividend Yield factors as they were featured in the short portfolios and negative for the Momentum, Quality and Growth factors as they were featured in the long portfolios.

The impact on the factor performance was larger than removing the top and bottom 10 stocks as the FAANG stocks were either in the top or bottom portfolios, depending on the factor.



Source: FactorResearch

FURTHER THOUGHTS

Factor investors face many issues, that of factor selection, among them, so it is somewhat comforting that the common approach to equal weight stocks in factor portfolios limits the impact of single stocks, which is one less risk to be concerned about.

Naturally, the FAANG stocks had a significant influence, but it is impossible to predict what stock will follow the path of the FAANG stocks. Considering removing certain stocks is therefore a somewhat theoretical discussion, unfortunately like many discussions about factor investing.

FACTOR CROWDING MODEL (WHITE PAPER)

Mob Management Measures

July 2018. Reading Time: 15 Minutes. Author: Nicolas Rabener.

SUMMARY

- Crowded factors exhibit higher drawdowns than uncrowded factors
- A multi-metric approach can be successfully applied to measure factor crowding
- Effective in reducing factor drawdowns and volatility, but less meaningful for returns

INTRODUCTION

Architects devoted to creating large public facilities like sports stadiums are tasked with finding a good balance between aesthetics, commercialism and safety. The latter mainly focuses on crowd control management as stampedes, crushes and riots can have tragic consequences. Crowds are the lifeblood of public arenas as well as one of the key risk factors.

In investing, crowds have the same characteristics as they are required to make an investment popular and drive its performance, but also represent risk if the trade is widely owned. Given the significant inflows into smart beta ETFs and risk premia strategies in recent years, a frequent investor concern is the crowding of common equity factors like value or momentum.

There are various approaches for measuring factor crowding and these can broadly be differentiated between being based on funds flows, stock ownership, short interest or market-derived indicators. The first three data sets are only available with weeks or months delay while market-derived indicators can be measured daily or even intra-day. In this white paper we introduce a factor crowding model based on market-derived indicators.

Monitoring factor risks is relevant for systematic investors dedicated to factor investing as well as for discretionary portfolio managers. Factor investors are naturally interested in improving the risk-return ratios of their portfolios while discretionary portfolio managers are likely inclined to reduce any systematic risks not associated with their investment thesis.

MODEL OBJECTIVES

Crowding typically refers to periods of investments like equity factors that have received significant inflows and are held by a large part of the investment community. The risk of owning a popular factor is that a sudden change in market sentiment may result in many investors simultaneously reducing their factor exposure, which might be realised via selling smart beta ETFs or portfolios of stocks, with few natural buyers left in the market. The resulting negative short-term performance typically reflects in more selling, creating a negative feedback loop and potentially a significant drawdown. Crowded factors are therefore characterized by experiencing more frequent drawdowns in subsequent periods than uncrowded factors. The objective of the factor crowding model is to identify when factors are crowded, neutral or uncrowded.

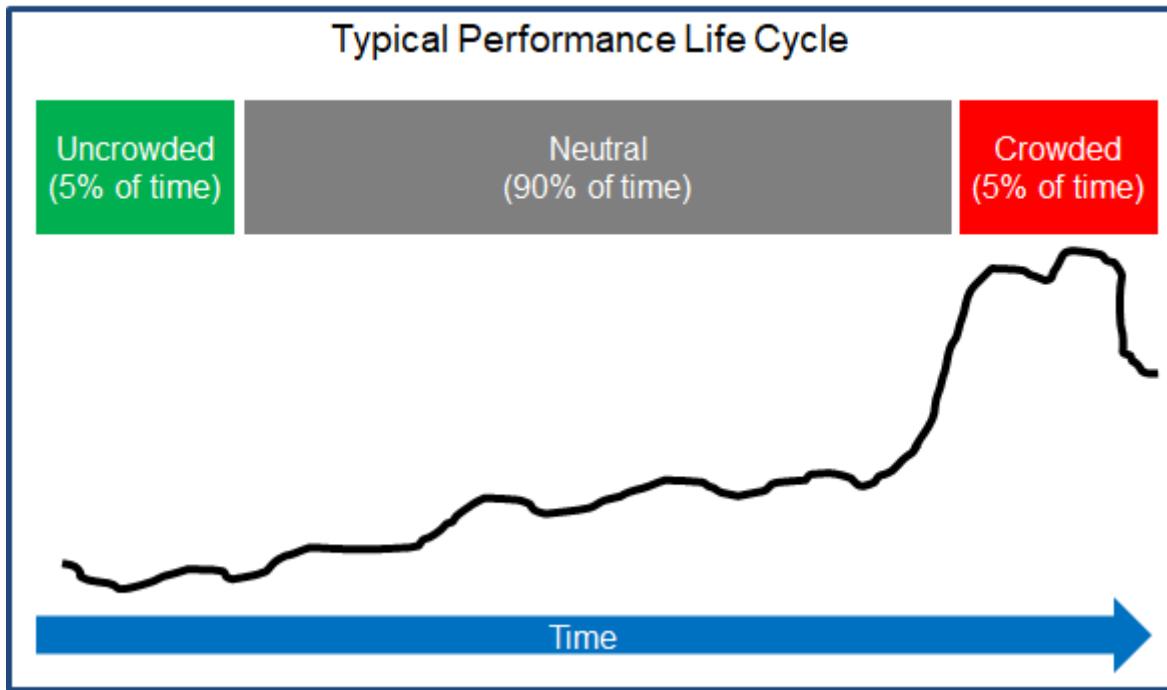


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THOUGHTS ON CROWDING

Crowding is not negative per se as every investment requires capital inflows to generate positive performance. It is only during certain periods of too much interest where factors can be considered crowded and inversely uncrowded when there has been too little interest. The graphic below highlights a typical performance life cycle of an investment.



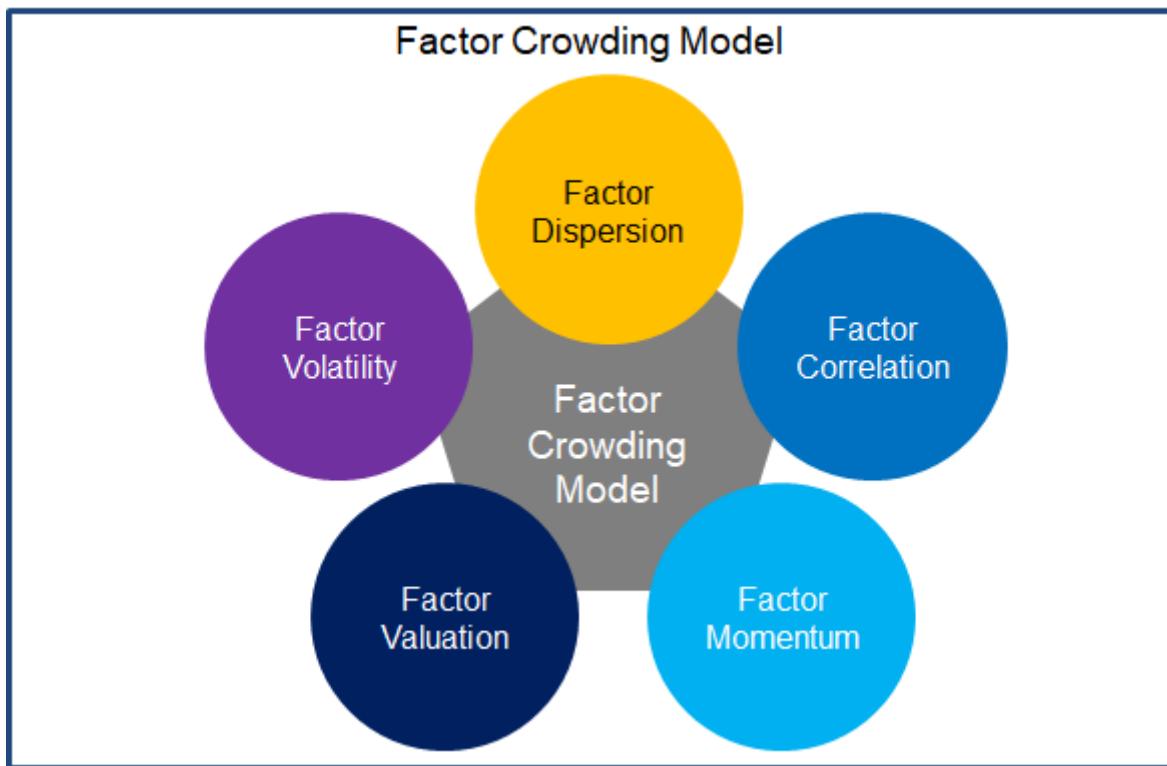
Source: FactorResearch

It is worth highlighting that factors can experience significant drawdowns without being crowded, e.g. the long-short value factor lost more than 50% during the Tech bubble in 2000 as investors exhibited a strong preference for technology stocks at absurdly high multiples over cheaply priced companies, but the factor was not crowded prior to that.

METHODOLOGY

We focus on measuring the degree of crowding for seven factors namely value, size, momentum, low volatility, quality, growth and dividend yield in the US stock market. The factor definitions are in line with industry standards and the factors are constructed as beta-neutral long-short portfolios by taking the top and bottom 10% of the stock universe. Only stocks with market capitalisations larger than \$1 billion are considered. Portfolios are rebalanced monthly and 10 basis points of costs per transaction are included. The analysis covers the period from 1992 to 2018.

The factor crowding model is based on measuring five metrics: volatility, dispersion, correlation, momentum and valuations. Each metric is calculated for each factor on a daily basis, which are then normalised and combined in a multi-metric score by equally weighting them. The graphic below summarises the components of the factor crowding model.



Source: FactorResearch

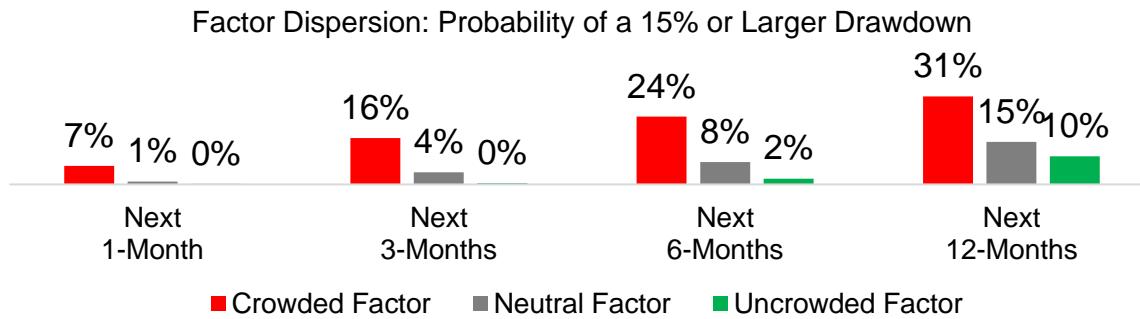
We will demonstrate the effectiveness of each metric as well as of the multi-metric score in the remaining paper by highlighting that high factor crowding scores are associated with a higher probability of drawdowns in the subsequent period than low factor crowding scores.

It is important to note that the individual components of the factor crowding model have different characteristics and some are less effective than others on a stand-alone basis. However, the single metrics complement each other and lead to a highly effective score in the multi-metric factor crowding model.

FACTOR DISPERSION

Factor dispersion measures how similar individual stocks of factor portfolios are trading on a daily basis. We measure the dispersion of the stocks in the long and short portfolios of the factor after accounting for the market beta and then average the time series. A high degree of residual factor dispersion typically indicates a significant change in the factor portfolio, which may be caused sudden in- or outflows, and more likely indicates a crowded than an uncrowded factor.

The chart below shows the probability of experiencing a drawdown of 15% or larger over multiple time frames on a going forward basis from the date of measuring the degree of factor crowding. The results are calculated as the average frequencies of drawdowns across the seven factors covering the period from 1992 to 2018.

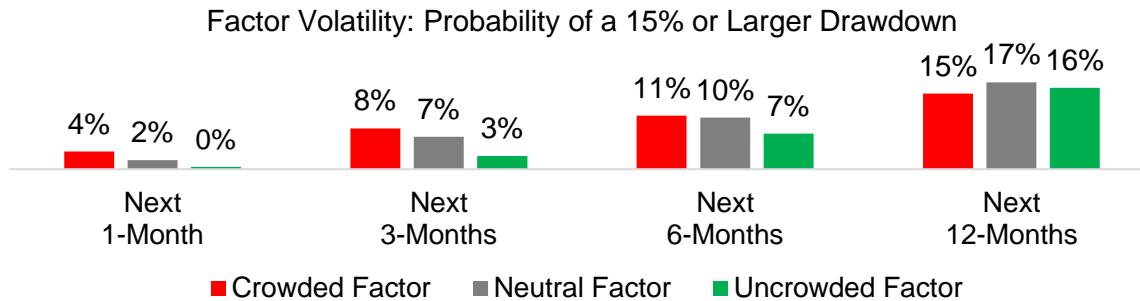


Source: FactorResearch

We can observe that the metric measures factor crowding effectively as drawdowns occur consistently more frequently with crowded than uncrowded factors. It is worth noting that factors are neutral approximately 90% of the time and therefore are only rarely crowded or uncrowded.

FACTOR VOLATILITY

Factor volatility can be explained by market volatility in general, but there are certain periods where these deviate. The residual factor volatility, which is defined as factor volatility in excess of market volatility, is caused by abnormal trading of the stocks in the factor portfolio. High residual factor volatility would be considered as a sign of crowding while low residual factor volatility would indicate an uncrowded factor. The chart below shows the drawdown probabilities and the metric identifies factor crowding across the different time periods.



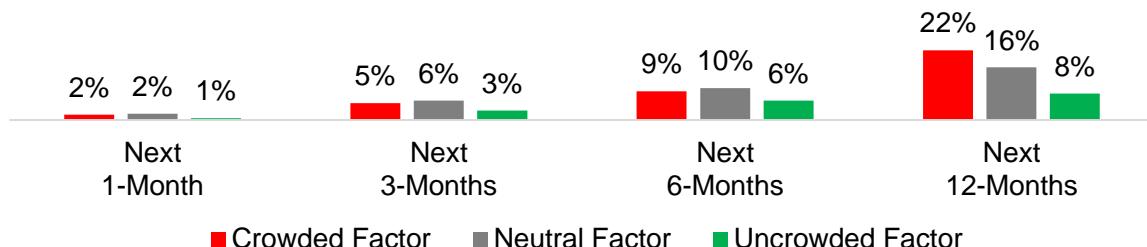
Source: FactorResearch

FACTOR CORRELATION

Factor correlation is derived from calculating the pairwise correlations of the stocks in the long and short portfolio, after adjusting for the market beta. The correlations of the long and short portfolio are then averaged. The pairwise correlation is commonly used for measuring factor crowding as high correlations reflect that the stocks in the long and short portfolios exhibit strong relationships, which is likely caused by in- or outflows and common stock ownership.

The chart below shows that this metric is less effective for identifying factor crowding on a stand-alone basis, but is highly accretive to the multi-metric factor crowding model, which warrants its inclusion.

Factor Correlation: Probability of a 15% or Larger Drawdown

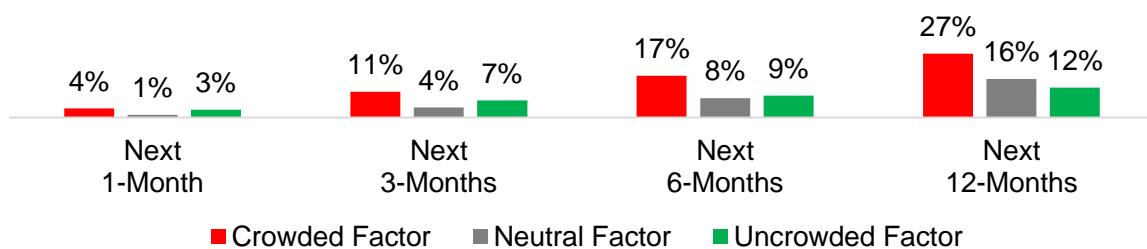


Source: FactorResearch

FACTOR MOMENTUM

A factor that generated strong returns will attract more inflows than a poorly performing factor given that many investors are performance chasing. Therefore, the stronger the performance, the more likely the factor will become crowded. Factor momentum is defined as the three-year performance, which is in line with the three-year track record typically required by institutional investors, and the chart below highlights the effectiveness of the metric for measuring factor crowding.

Factor Momentum: Probability of a 15% or Larger Drawdown

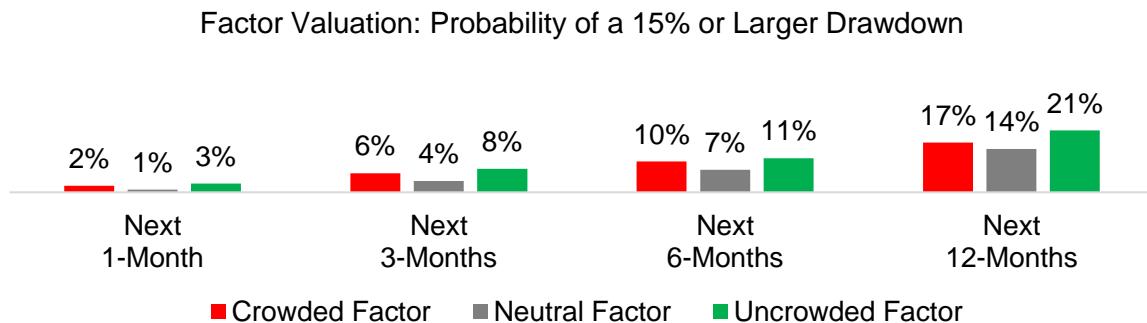


Source: FactorResearch

FACTOR VALUATION

Factors can be valued like stocks by determining their fundamental valuation multiples. The metric is calculated by measuring the ratio of the price-to-book multiple of the long portfolio divided by the price-to-book multiple of the short portfolio. The smaller the ratio, the higher the difference in multiples and the cheaper the factor is from a fundamental valuation perspective. Cheap factors are likely less crowded than expensive factors.

Similar to factor correlation this metric is less effective for identifying factor crowding on a stand-alone basis, but adds value to the multi-metric model.

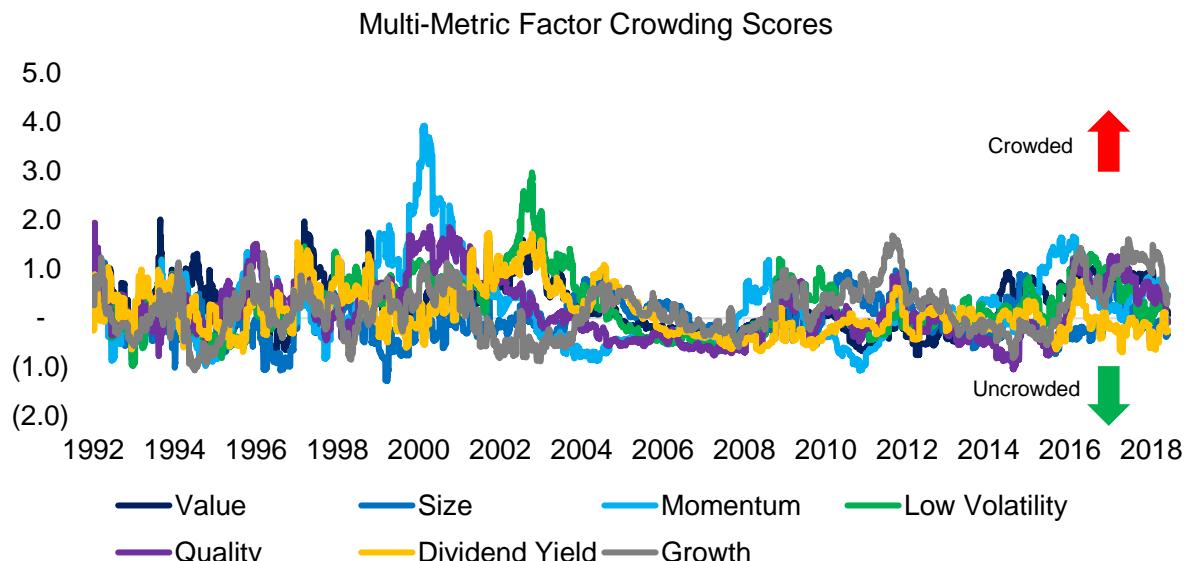


Source: FactorResearch

MULTI-METRIC FACTOR CROWDING MODEL

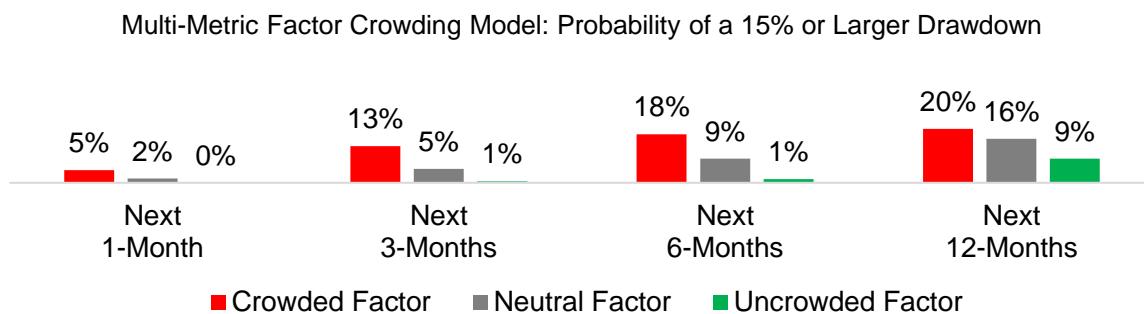
The five metrics are standardised and combined into a multi-metric score by equally weighting them. The calculation of the standardised score utilises a 10-year lookback in order to capture a full market cycle with different market regimes.

The chart below displays the multi-metric crowding scores for the seven equity factors from 1992 to 2018. Positive scores indicate crowding while negative scores suggest uncrowded factors. We can observe that in the first decade of the analysis the crowding scores exhibited significantly higher volatility, which can be explained by a different market structure, e.g. decimalisation became mandatory for US equities in 2001, which led to tighter trading spreads thereafter.



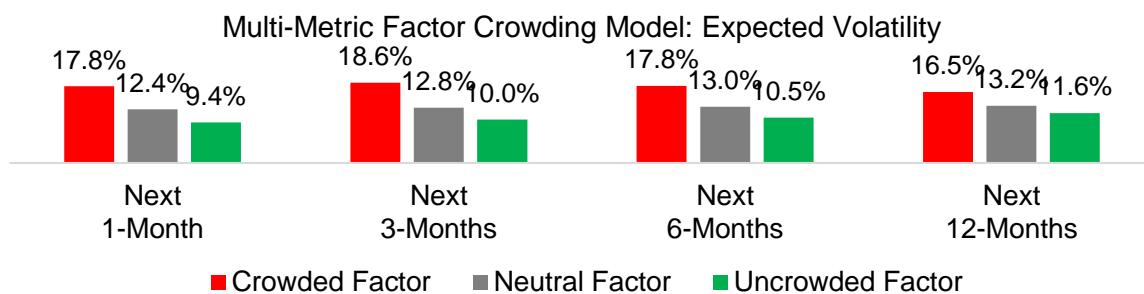
Source: FactorResearch

Combining the single metrics creates a highly effective crowding score as highlighted by the summary chart below. The probability of drawdowns increases linearly from uncrowded to crowded across all periods. It is to be expected that the crowding score is more meaningful for shorter than longer time periods given natural information decay.



Source: FactorResearch

In addition to the drawdown probabilities we can also analyse the expected factor volatility in the same framework. The chart below highlights that expected volatility is highest for crowded and lowest for uncrowded factors.

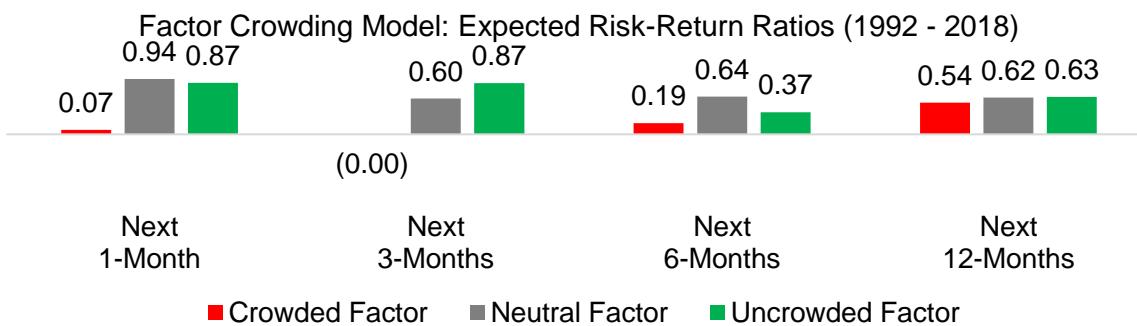


Source: FactorResearch

The analysis so far has focused on factor risks, but ignored returns. Investors applying a value-perspective might expect that uncrowded factors generate the highest returns while crowded factors yield the lowest returns.

However, our research indicates a more complicated relationship between crowding and expected returns. Crowded factors often continue to follow their long-term trend after experiencing a drawdown while uncrowded factors typically generate lower returns, albeit with low volatility, as investor interest in required for positive performance.

The chart below highlights the risk-return ratios and we can observe that crowded factors exhibit the lowest ratios over time, which is partially explained by higher volatility. After 12-months all ratios are approximately comparable.



Source: FactorResearch

The factor crowding model therefore is most useful for factor risk management as the model is highly effective in identifying factor risk, which can be expected given that three out of the five metrics measure risk directly or indirectly. Academic research supports that stock volatility exhibits short-term auto-correlation, i.e. clusters, while this does not apply to returns.

The optimal implementation period for the factor crowding scores is from zero to six months given natural information decay. Naturally the crowding scores are generated daily and therefore allow a continuous monitoring and updating of expected factor risks.

CONCLUSION

This white paper introduces a factor crowding model based on five metrics that are available on a daily or even intra-day basis. The model can be implemented by systematic investors aiming to improve the risk-return ratios of factor portfolios as well as by discretionary portfolio managers interested in avoiding systematic factor risks.

The model shows strong characteristics in assessing factor crowding as measured by the probability of drawdowns across different time periods. An investor can expect a drawdown of 15% or larger over the next six months with a 18% probability for a crowded factor compared to a 1% probability for an uncrowded factor.

The optimal implementation window based on minimal information decay is up to six months, which implies a moderate amount of turnover and further adds to the attractiveness of the model.

FURTHER THOUGHTS

The factor crowding model empowers investors to anticipate and consider reducing expected factor drawdowns, but is less relevant for future returns. Investors not concerned with volatility and drawdowns could therefore choose to ignore factor crowding; however, a buy-and-hold strategy is much more challenging to execute than to contemplate theoretically. Factors are as cyclical as equity markets and the maximum drawdowns reached between 1992 and 2018 are significantly larger than 15%. Risk management matters.

FACTOR OLYMPICS 1H 2018

And the Winner is...

July 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor performance in 1H 2018 is comparable to 2017
- The Size factor has taken the lead, likely reflecting the threat of global trade wars
- Value has generated the most negative returns across regions

INTRODUCTION

We present the performance of seven well-known factors on an annual basis for the last 10 years and the first half of 2018. It is worth mentioning that not all factors have strong academic support, e.g. Growth lacks a long-term track record of positive excess returns; however, is still a widely-followed investment style.

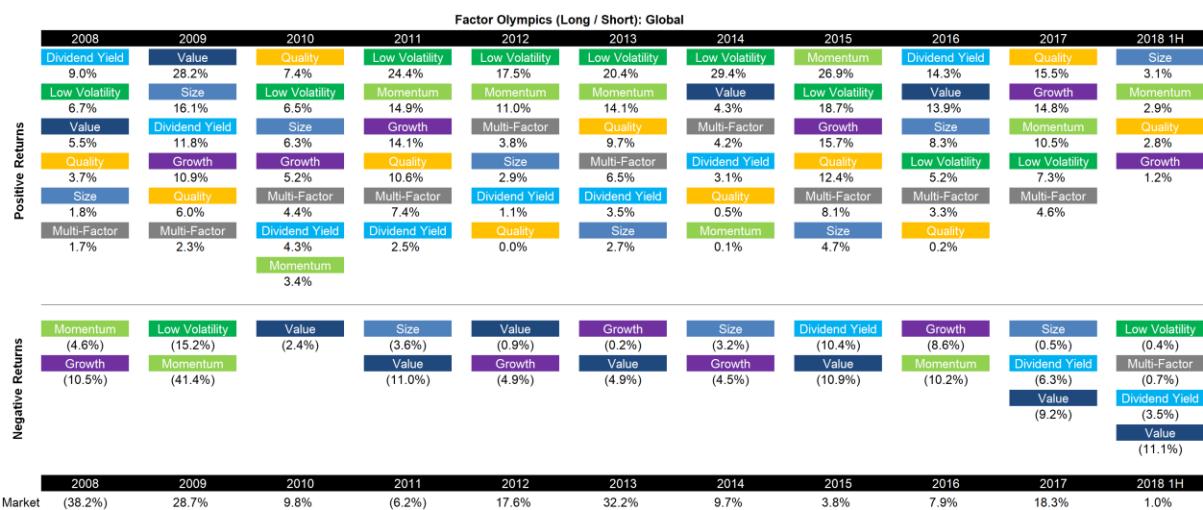
METHODOLOGY

The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks in the US, Europe and Japan and 20% in smaller markets. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios rebalance monthly and transactions incur 10 basis points of costs. Please see our [Factor Guide](#) for the factor definitions.

FACTOR OLYMPICS (LONG / SHORT): GLOBAL

The table below shows the factor performance for the last 10 years ranked top to bottom. The global series is comprised of all developed markets in Asia, Europe and the US. Aside from displaying the factor performance the analysis highlights the significant factor rotation in terms of profitability from one year to the next.

The first half of 2018 shows largely a continuation of 2017, i.e. Growth, Momentum and Quality generated positive returns while Value and Dividend Yield were negative. The Size factor generated the strongest returns in Q2 as the performance was flat in Q1 and has taken performance leadership since then. The strong performance of small caps can likely be explained by the threat of global trade wars, which are based on policy changes of the US government. Investors anticipate that smaller companies will be less negatively impacted by trade tariffs than larger companies.



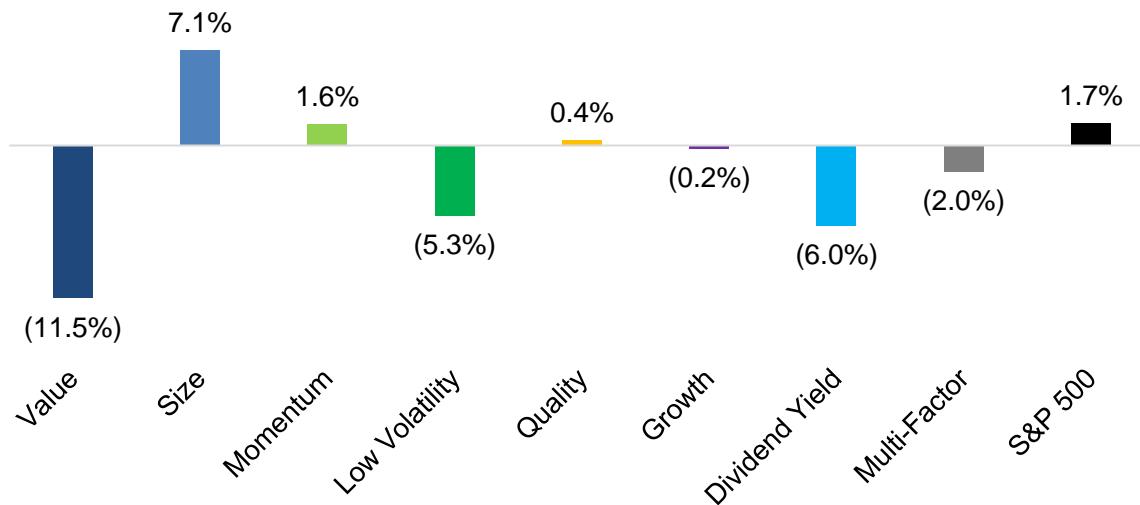
Source: FactorResearch

FACTOR PERFORMANCE 1H 2018: US

The table above reflects the global factor performance and it is interesting to analyse how homogeneous the performance is across regions. The global performance is significantly weighted towards the US, so it is not surprising that factor performance in the US is very similar to the global returns.

In H1 2018 the US economy showed strong growth and low unemployment, which has led to rising interest rates. The Low Volatility factor exhibits interest rate-sensitivity and has therefore been negatively impacted, which can partially also explain the performance of the Dividend Yield factor as higher bond yields make high-yielding stocks less attractive. The Dividend Yield factor is also short the Technology sector as these pay low or zero dividends and Tech companies outperformed in H1 2018.

Factor Performance 1H 2018 (Long / Short): US

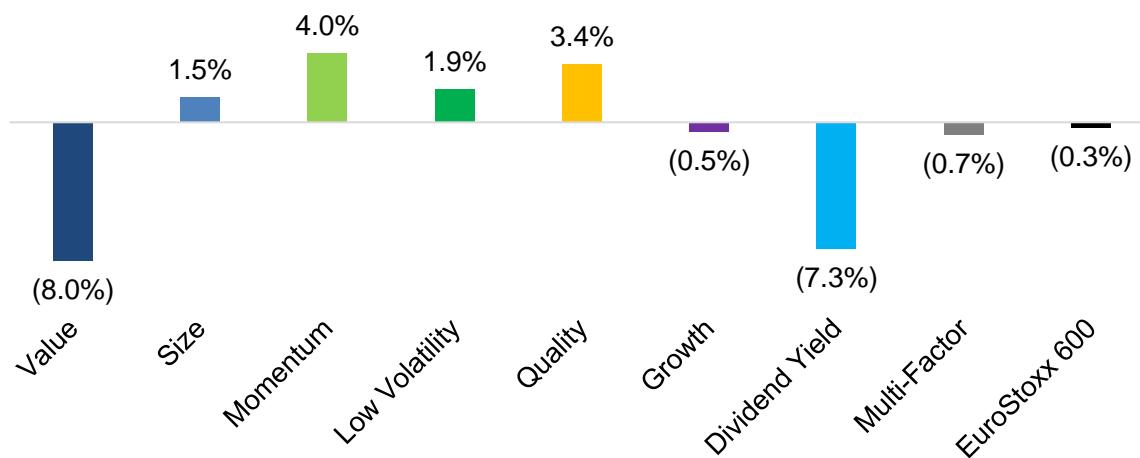


Source: FactorResearch

FACTOR PERFORMANCE 1H 2018: EUROPE

The factor performance in Europe is similar to the US. A key discrepancy remains the performance of the Low Volatility factor, which is negative in the US while positive in Europe. Perhaps this reflects investors expectations of interest rates rising faster in the US compared to Europe. Momentum generated the highest returns in Europe, which has diversified long and short portfolios from a sector perspective, especially compared to the US, where Momentum has a significant long exposure to the Technology sector. A shift in sentiment toward Tech stocks would impact Momentum in the US far more than in Europe.

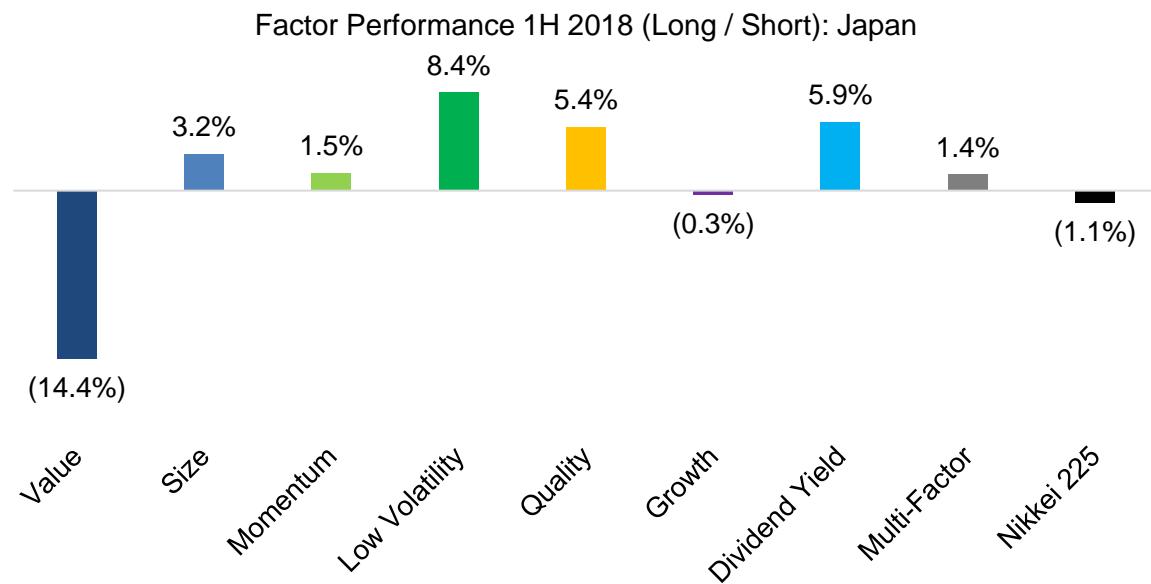
Factor Performance 1H 2018 (Long / Short): Europe



Source: FactorResearch

FACTOR PERFORMANCE 1H 2018: JAPAN

Factor performance in Japan is comparable to the US and Europe and especially pronounced for the Value factor, which performed worst in all three regions by a wide margin. The similar trends in factor performance highlight that some factors seem to have the same drivers that permeate borders and are global in nature, despite the economies having different growth rates and interest rate regimes.

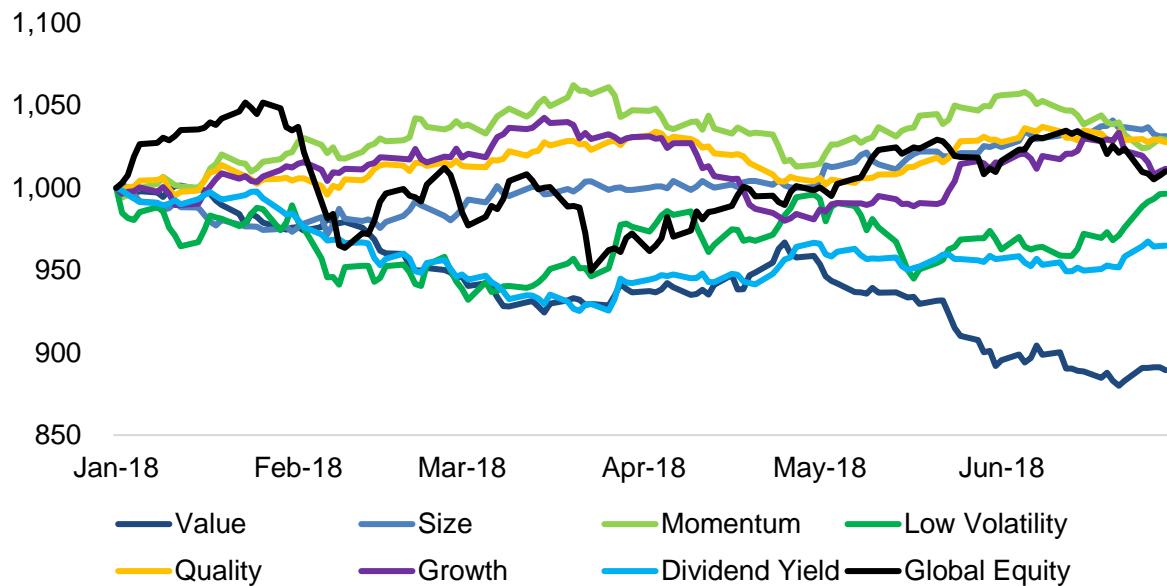


Source: FactorResearch

FACTOR PERFORMANCE 2018: PERFORMANCE CHART

The chart below shows the factor performance in 1H 2018 and we can identify one cluster of correlated factors, which comprises Growth, Quality and Momentum. The Technology sector currently contributes a significant amount of stocks to these three factors as Tech companies have shown strong growth in sales and earnings (Growth) and also feature high profitability and low levels of debt (Quality), which has led these stocks to outperform others (Momentum).

Factor Performance 1H 2018 (Long / Short): Global



Source: FactorResearch

The correlation matrix below highlights the global one-year factor correlations. We can observe strong relationships between Momentum and Growth, Quality and Growth, and Low Volatility and Dividend Yield. Some of these are structural, e.g. Quality and Growth in the US have been correlated for many years. Low Volatility and Dividend Yield do not tend to be correlated, but both currently exhibit interest rate-sensitivity. Some factors show low or negative correlations, which can be used for creating diversified multi-factor portfolios.

Global Factor Correlations (Long / Short): Last 12 Months

	Value	Size	Momentum	Low Volatility	Quality	Growth	Dividend Yield	Global Equity
Value	1	(0.11)	(0.54)	0.21	(0.31)	(0.50)	0.49	(0.06)
Size	(0.11)	1	(0.03)	(0.34)	(0.01)	0.00	(0.05)	(0.25)
Momentum	(0.54)	(0.03)	1	(0.13)	0.41	0.56	(0.60)	0.10
Low Volatility	0.21	(0.34)	(0.13)	1	0.24	0.18	0.54	0.15
Quality	(0.31)	(0.01)	0.41	0.24	1	0.65	(0.24)	0.20
Growth	(0.50)	0.00	0.56	0.18	0.65	1	(0.30)	0.09
Dividend Yield	0.49	(0.05)	(0.60)	0.54	(0.24)	(0.30)	1	(0.00)
Global Equity	(0.06)	(0.25)	0.10	0.15	0.20	0.09	(0.00)	1

Source: FactorResearch

FURTHER THOUGHTS

The factor performance in 1H 2018 reflects largely a continuation of 2017, which can be regarded as factor momentum. However, the strong performance of the Size factor in Q2 highlights how quickly the leaderboard can change. Empirical evidence from mutual funds, which directly or indirectly tend to replicate factors, indicates that the best performing funds over a three-year track record underperform thereafter while the worst performing funds outperform. Investors speculating on the mean-reversion of factors might find that Value is becoming more interesting.

MEASURING FACTOR CROWDING VIA VALUATIONS

Investigating Crowd Control Measures for Factor Investing

June 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Fundamental factor valuations can be used to identify factor crowding
- However, the approach does not improve risk metrics
- A multi-metric approach for identifying factor crowding is likely more successful

INTRODUCTION

The Value factor has generated flat returns over the last decade, which has been challenging for the most dedicated Value investors. Given that the average mutual fund holding period is three years, investors might question if the Value factor has become a contrarian call, which arguably makes it less risky compared to investing in the growth-oriented FAANG stocks. Factors, from a Value perspective, should be more attractive if they are cheaper and uncrowded and more risky if they are expensive and crowded. In this short research note we will analyse factor crowding from a fundamental valuation perspective using price-to-book multiples, starting with the Value factor as a case study and then expanding the analysis to other common equity factors.

METHODOLOGY

We focus on seven factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield in the US. The factor definitions are in line with industry standards and the factors are created via long-short beta-neutral portfolios based on the top and bottom 10% of the US stock market. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

VALUE FACTOR: FUNDAMENTAL FACTOR VALUATION

The concept of valuing a security with fundamental multiples can be applied to single stocks as well as to factors. In the case of factors, the valuation can be determined by measuring the price-to-book multiple spread, which is derived by subtracting the multiple of the short portfolio from the multiple of the long portfolio. For example, if the long portfolio has a price-to-book multiple of 1.0x and the short portfolio of 5.0x, then the spread is -4.0x. If assets are flowing into the factor, then the long portfolio will become more expensive as investors are buying the cheap stocks and the short portfolio will become cheaper as investors are selling the expensive stocks, which will result in a more positive spread. Stated from a Value perspective, the higher the price-to-book spread, the more expensive and crowded the factor.

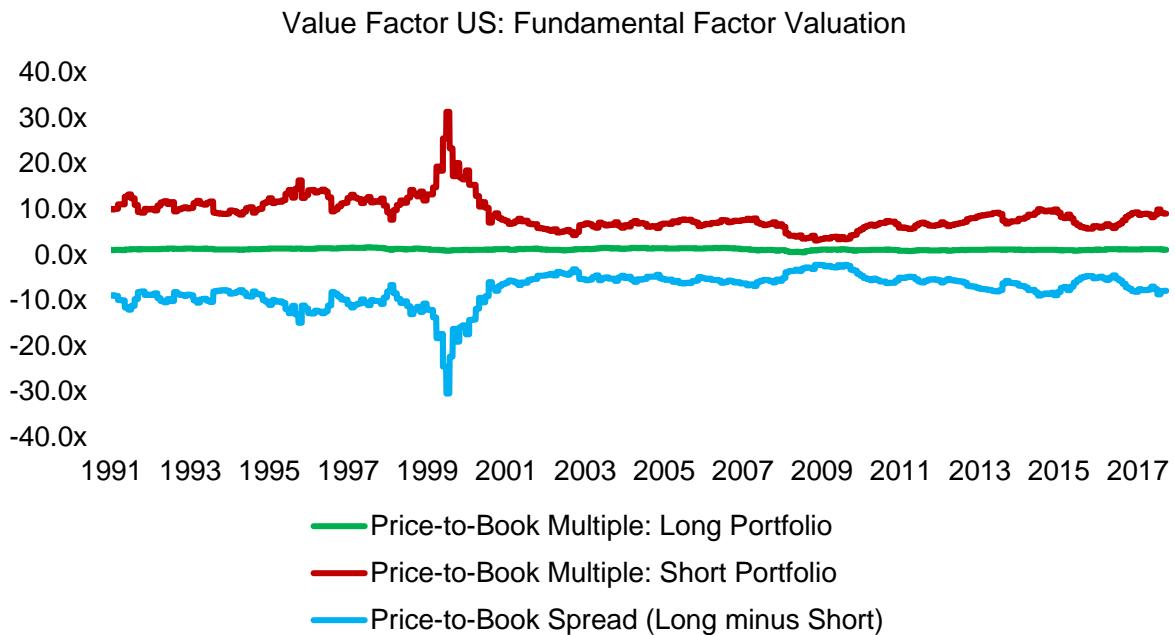
The chart below shows the price-to-book multiples of the long and short portfolios as well as the spread of the Value factor in the US. We can observe that the multiple of the long portfolio is almost constant at around 1.0x over time, while the multiple of the short portfolio



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varies significantly. The peak in 2000 represents the Tech bubble, where Technology stocks were trading at absurdly high multiples. During that period the Value factor was trading at an extremely attractive level compared to its history and was uncrowded as investors were not interested in cheap stocks. However, it is somewhat difficult to identify periods where the factor was expensive and crowded.



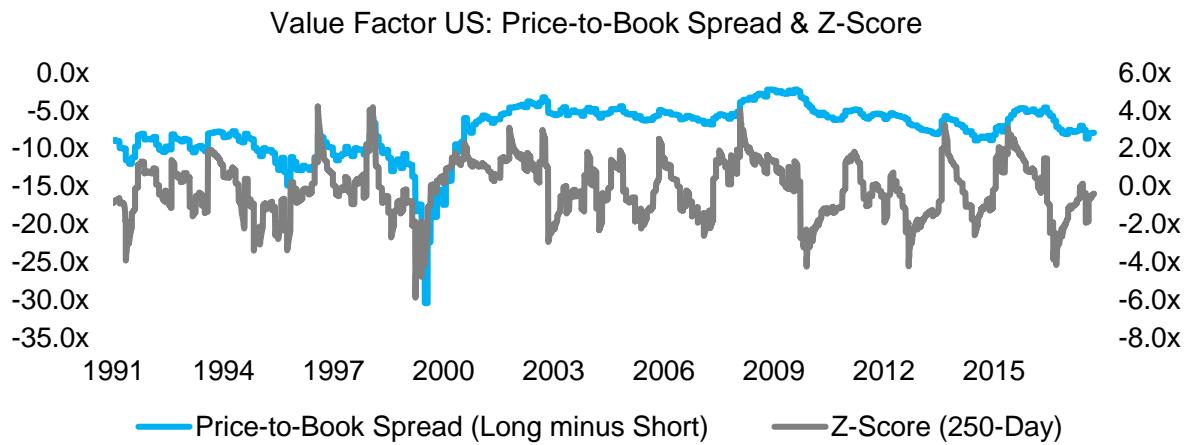
Source: FactorResearch

It is worth highlighting the following regarding the price-to-book spread:

- From a quantitative perspective the price-to-book spread data is difficult to work with given the magnitude of the increase in multiples in the short portfolio during the Tech bubble. The absolute spread is somewhat meaningless post 2000 as these levels were never reached again, although theoretically they could be reached again at any time. Investors could choose to ignore that period, but that is alike to ignoring the Global Financial Crisis and debatable.
- The Tech bubble valuation distortion affects all factors, although in different directions. For example, the Value and Size factors became cheap and uncrowded based on their price-to-book spreads while the Growth and Momentum factors became expensive and crowded.
- Price-to-book can be challenged as a metric for valuing stocks, but the Tech bubble is also reflected in other measures such as price-to-earnings or cashflow-based multiples.

One solution for mitigating this data issue is to normalise the price-to-book spread data by calculating z-scores, which can be used to identify periods where the price-to-book spread is increasing or decreasing significantly. Positive z-scores indicate that the spread has become more positive, i.e. the short portfolio slightly less expensive as the long portfolio does not vary much over time, while negative z-scores indicate that the spread has become more

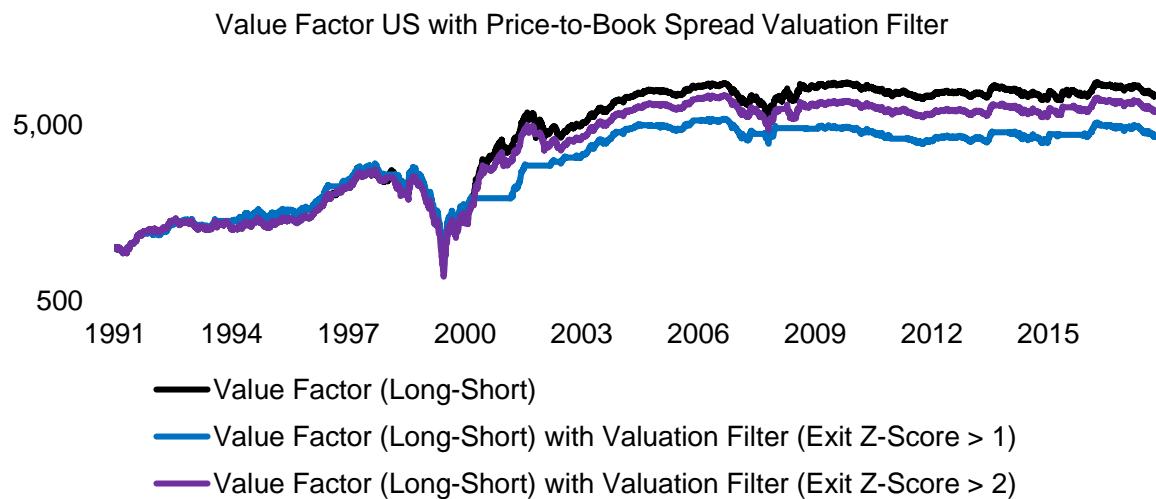
negative, i.e. the short portfolio more expensive. From a Value perspective an investor might argue that positive z-scores represent a period where the factor is less attractive and crowded.



Source: FactorResearch

VALUE FACTOR WITH VALUATION FILTERS

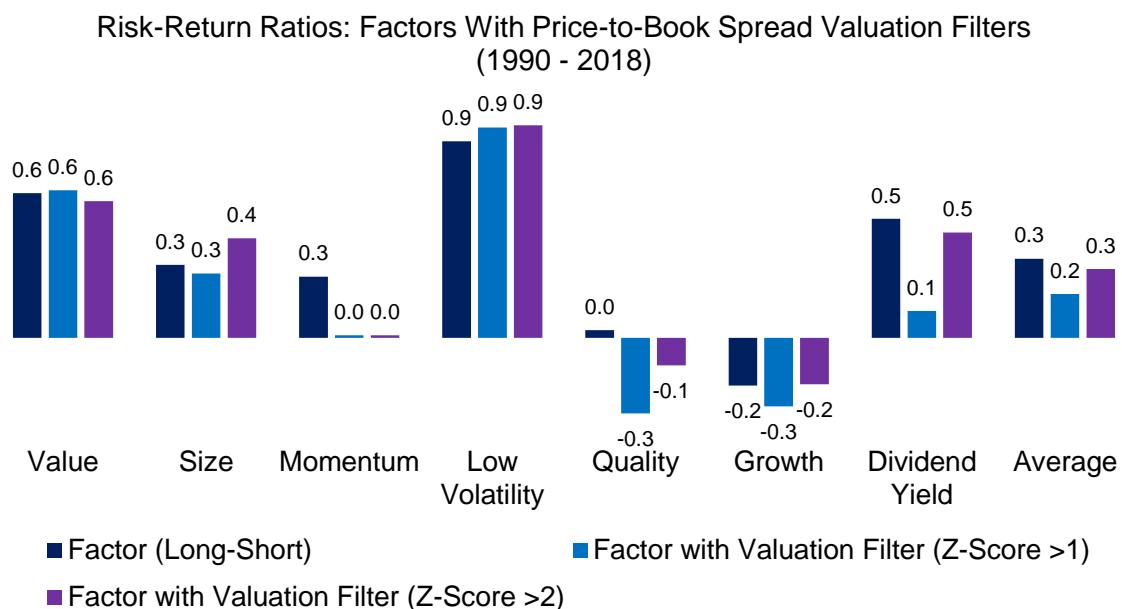
Investors concerned about factor crowding can use the z-score-based fundamental valuation approach to reduce factor exposure when valuations are unattractive. The analysis below highlights this approach applied to the Value factor, one scenario where the exposure is reduced to zero if the z-score is above 1, which occurs 25% of the time, and above 2, which occurs only 5% of the time. We can observe that both scenarios generate a similar profile to the unadjusted long-short Value factor. The significant drawdown during the Tech bubble in 2000 is not reduced, which is expected as the Value factor was not particularly expensive or crowded prior to that period.



Source: FactorResearch

EQUITY FACTORS WITH VALUATION FILTERS

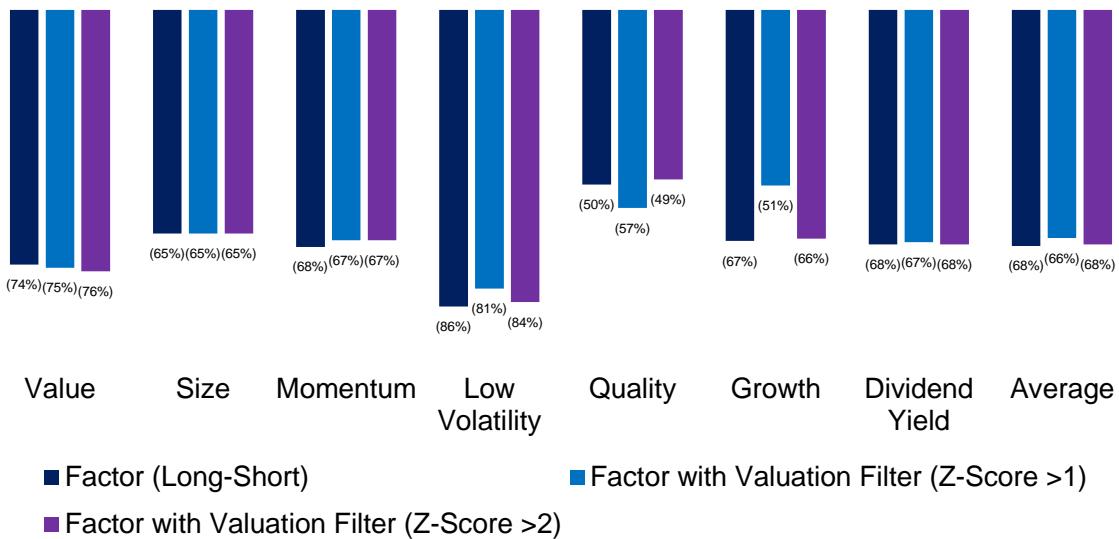
Given that applying a fundamental valuation filter to identify crowding in the Value factor did not generate attractive results, it is worth testing this approach on other factors. The analysis below highlights the risk-return ratios of common equity factors in the US and scenarios where the same valuation filters have been applied. We can observe that on average applying a valuation filter to avoid periods of crowded factors did not improve the risk-return ratios.



Source: FactorResearch

The chart below highlights the maximum drawdowns of common equity factors from 1990 to 2018 and clearly shows that beta-neutral long-short factors require a sound risk management framework given the magnitude of drawdowns. Measuring factor crowding should be a component of such a framework, which has the general objective of improving risk-return ratios and reducing drawdowns. However, as the analysis shows the approach to use fundamental valuation filters did not achieve that objective.

Maximum Drawdowns: Factors With Price-to-Book Spread Valuation Filters (1990 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that applying a fundamental valuation filter to avoid factor crowding does not improve the risk metrics of common equity factors in the US. There are several thoughts and follow-on research areas:

- Factors do require inflows as otherwise there is no positive performance, so crowding per se is not negative.
- Factor drawdowns are not necessarily associated with crowding and can occur when the factor is uncrowded.
- Identifying periods where the factor is uncrowded and attractive is challenging, e.g. as highlighted by the Value factor in 2000, which reached levels of cheapness not seen in the prior decade.
- We applied a tactical approach and a more long-term, strategic approach for identifying crowded or uncrowded factors might be more successful. However, analysing factor valuations from a strategic perspective is as difficult as analysing stock markets from a valuation perspective, e.g. they might be expensive for years and not revert to long-term valuation means.
- A multi-metric approach to measure factor crowding is likely more successful than using a single metric like fundamental valuations.

SECTOR VERSUS COUNTRY MOMENTUM

Does Performance Chasing Work?

June 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Momentum strategy can be applied to stocks, sectors and countries
- Sector and country Momentum portfolios generate positive excess returns
- However, cross sector & country and single stock Momentum portfolios generate higher risk-return ratios

INTRODUCTION

When a graduate joins the M&A division of an investment bank in Europe he or she often has to decide between a country or sector focus. Both have advantages and disadvantages, but are difficult to evaluate at the start of a career as an investment banker. Joining the Technology team was highly desirable in 1999, but much less attractive in 2002. Focusing on M&A transactions in Russia tends to be more interesting when oil and gas prices are high, but energy prices are volatile and difficult to predict.

Investors analysing European stocks often face a similar choice: should they focus on all of Europe, on certain countries or sectors? Many investors decide to simply chase performance and allocate to whatever country or sector has recently performed best, which is often criticised as an investment philosophy. Naturally this strategy can be evaluated quantitatively as it represents the Momentum factor. In this short research note we compare Momentum in sectors versus countries in the European stock market.

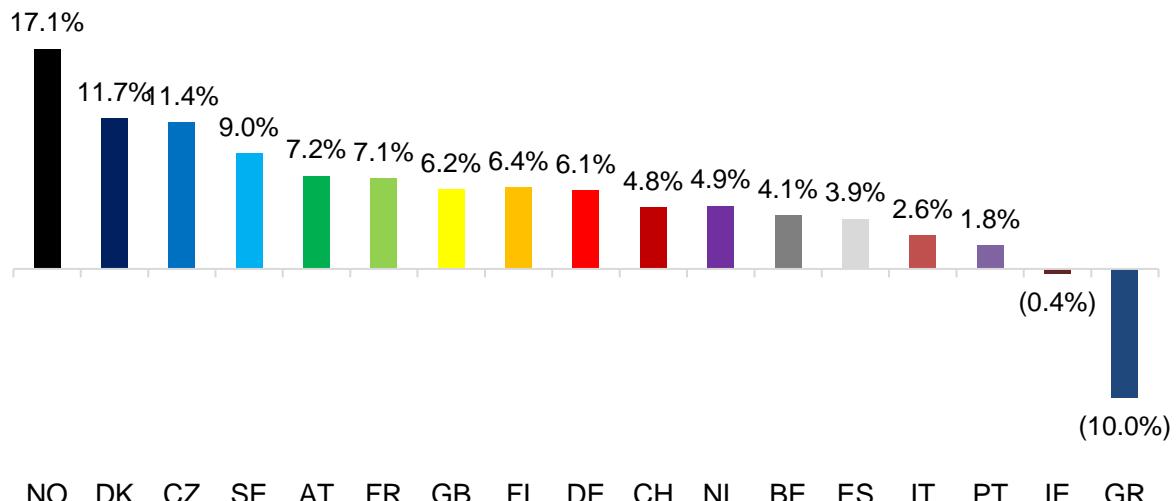
METHODOLOGY

We focus on the Momentum factor across sectors and countries in Europe, which comprises 11 sectors and 17 countries that are available as market capitalisation-weighted indices. The Momentum factor is created via a long-short beta-neutral portfolio based on the top and bottom 3 sectors or countries ranked by the returns over the last 12 months excluding the last month. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

SECTORS VERSUS COUNTRIES

Analysing the performance of various European stock markets from 2000 to 2018 reveals quite divergent returns. The compounded annual returns highlighted in the chart below display an almost perfect geographical split: northern countries like Norway, which mostly have not adopted the Euro, generated the highest returns, central core Euro countries like Germany had average returns, while southern countries like Greece generated the lowest returns.

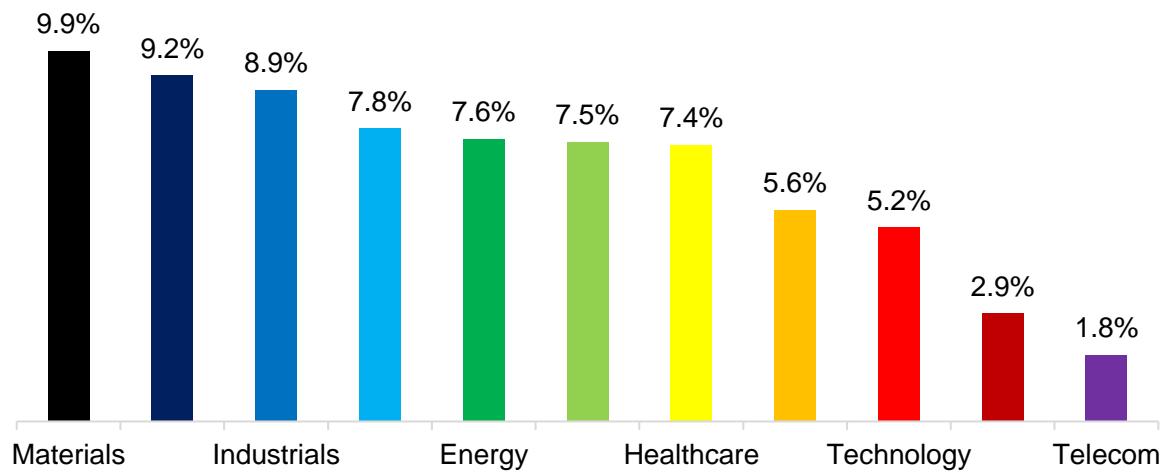
European Stock Market by Countries: CAGRs (2000-2018)



Source: FactorResearch

The performance of sectors is slightly less divergent than the performance of countries, but this can be explained by that there are only 11 sectors compared to 17 countries. Perhaps the most surprising performance is that of the Technology sector in Europe, which is below the average of all sectors. The performance is measured from 2000 onward, i.e. captures the implosion of the Technology bubble and the downfall of Nokia, which used to have a large weight in the sector index. There are also no European equivalents of the FAANG stocks, which have been driving the performance of the Technology sector in the US.

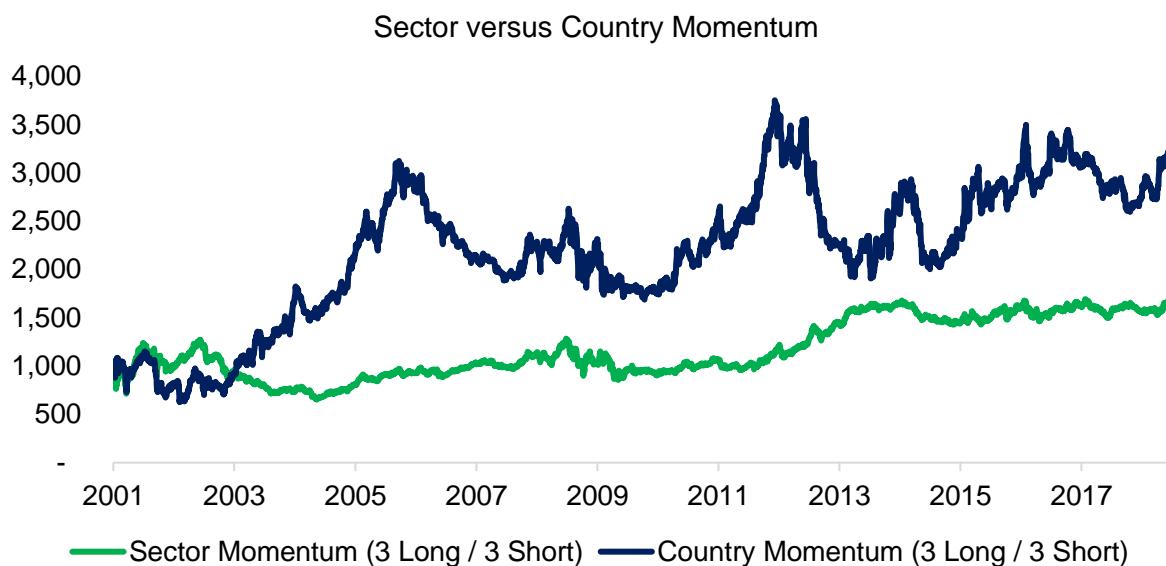
European Stock Market by Sectors: CAGRs (2000-2018)



Source: FactorResearch

SECTOR VERSUS COUNTRY MOMENTUM

The Momentum factor is well documented on single stock level, where the strategy consists of buying the best performing and shorting the worst performing stocks. The same concept can be applied to sector and country indices and the results are shown below. We can observe that the performance of both long-short portfolios was positive, indicating that simple performance chasing with frequent rebalancing was an effective strategy. The performance of Momentum on country level is higher, but also more volatile than on sector level, which can be explained by that there are more countries than sectors. The Momentum factor benefits from a more diversified universe as the positions in the portfolio will be less correlated.

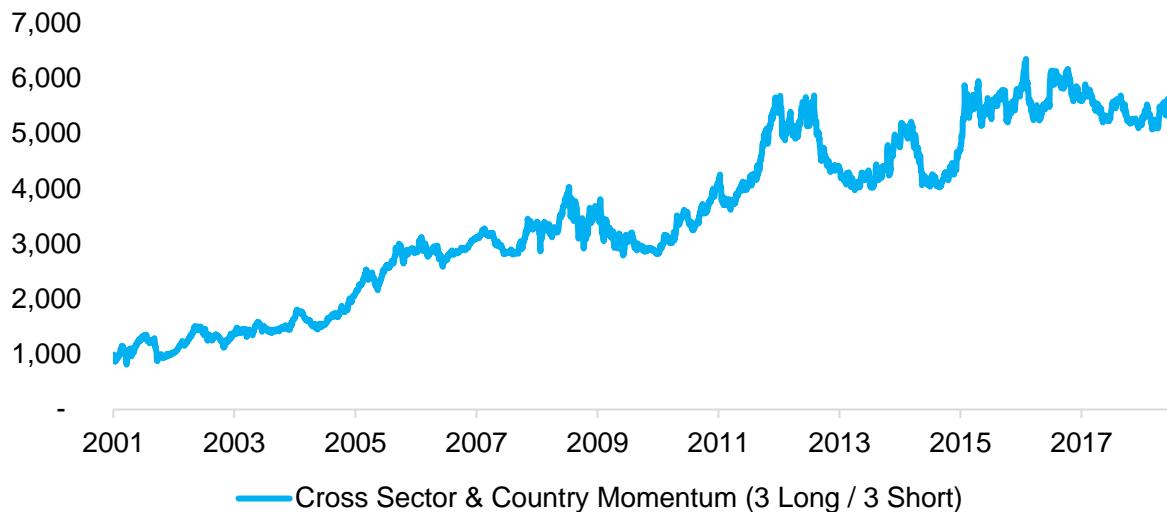


Source: FactorResearch

CROSS SECTOR & COUNTRY MOMENTUM

Given that the Momentum factor benefits from a larger number of securities, we can combine countries and sectors into one universe. The chart below shows the performance of the cross sector and country Momentum portfolio, which highlights a relatively consistent performance over time, albeit with high volatility. The performance achieved is significantly above the sector or country-only portfolios.

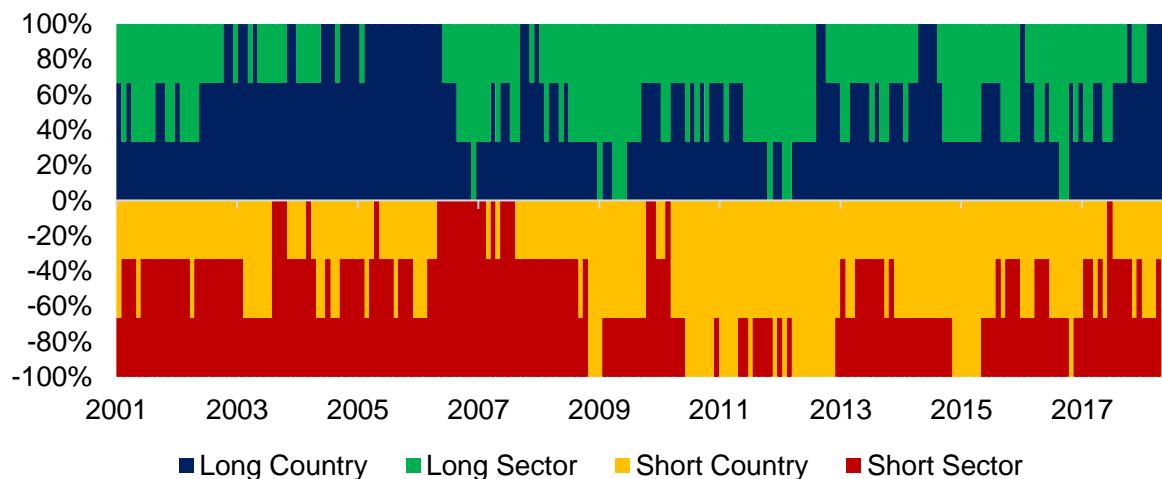
Cross Sector & Country Momentum



Source: FactorResearch

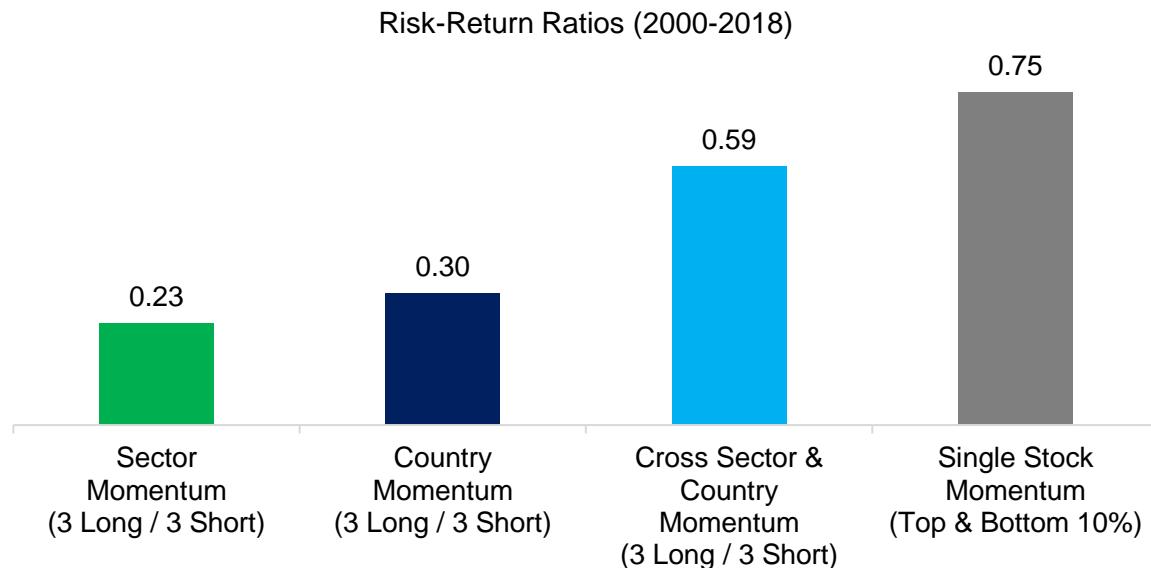
The analysis below highlights the portfolio composition over time, which reveals a diverse portfolio. There were few times where the long or short portfolio was exclusively allocated to sectors or countries. The latest portfolio consists of long positions in the energy sector, the Czech and Norwegian stock markets, and short positions in the healthcare and staples sectors as well as the Belgian stock market. The latest portfolio does highlight related positions, e.g. Norway's economy is driven by oil, which is also driving the energy sector.

Cross Sector & Country Momentum: Breakdown of Long & Short Portfolio



Source: FactorResearch

The cross sector and country Momentum portfolio generated the highest absolute and risk-adjusted returns compared to sector or country-only portfolios. However, the risk-return ratio of a Momentum portfolio created from single stocks is even more attractive, which perhaps can be explained by a much more diversified portfolio given the universe of approximately 600 European stocks with a minimum market capitalisation of \$1 billion.



Source: FactorResearch

FURTHER THOUGHTS

This short research note shows that long-short Momentum portfolios of sectors or countries in European stock markets generated positive excess returns over the last two decades. However, there is solid empirical evidence that buying the mutual funds with the best recent performance is not an effective strategy, which may seem at odds with this analysis. These opposing views can potentially be explained by different portfolio construction. The Momentum factor requires frequent rebalancing to generate positive returns as the top and bottom sectors, countries or stocks change constantly. Less frequent rebalancing leads to a significant decay in returns. Performance chasing works, under certain assumptions.

SKEWNESS AS A FACTOR

Analysing Punchy Stocks

June 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Skewness is a feature of stocks with high firm-risks
- Stocks with positive or negative skewness outperform the market
- Can partially be explained by the Size factor

INTRODUCTION

Many investors started their investment career at an early age, typically buying a stock that showed an enticing performance chart, was featured somewhere or recommended by a family member. Moving to a professional investment career often required a change in mentality by progressing from returns to risk-adjusted returns. Investors can continue this education by adding skewness and kurtosis as further layers of analysing potential investments; however, this often becomes challenging as these are somewhat more abstract concepts. Both provide insights into the distribution of returns, which unlike often assumed in financial theory, are not normally distributed.

Investors rank stocks by returns (Momentum) and volatility (Low Volatility) and could also use skewness and kurtosis as sorting variables. We will explore using skewness as a measure for ranking stocks, although we have no theory or expectation that this will result in anything but random returns, so this research note should be considered only for satisfying intellectual curiosity.

METHODOLOGY

We focus on the US stock market and measure the skewness of stocks over the last 12 months. Portfolios are created by selecting the top 10% of most skewed stocks, which results in a portfolio with the most positively and a portfolio with the most negatively skewed stocks. We also construct beta-neutral factor portfolios by buying the portfolios of skewed stocks and shorting the index. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

SKEWNESS OF THE S&P 500

In advance of the analysis of skewness on single stock level it is interesting to highlight the skewness of the entire stock market. Positive skewness describes a return distribution where frequent small losses and a few extreme gains are common while negative skewness highlights frequent small gains and a few extreme losses.

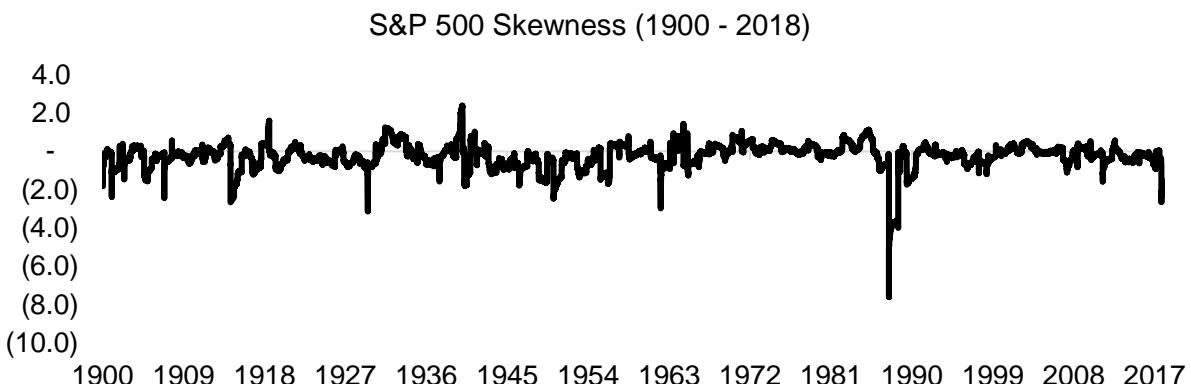
The chart below shows the skewness of the S&P 500 from 1900 to 2018. We can observe that the skewness was slightly negative (-0.2) on average. The analysis highlights some of the significant moments in stock market history, e.g. the stock market crash of 1987. We can



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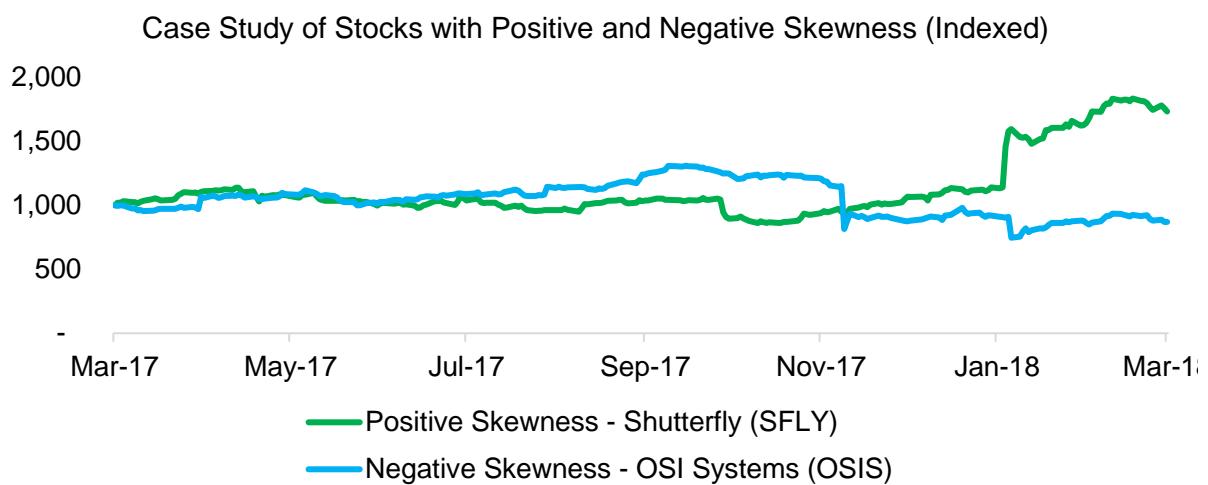
see that the skewness currently is more extreme than during the Global Financial Crisis, which can be explained by the strong returns coupled with exceptionally low volatility that preceded the market losses of early 2018.



Source: Stooq.com, FactorResearch

CASE STUDY OF STOCKS WITH POSITIVE AND NEGATIVE SKEWNESS

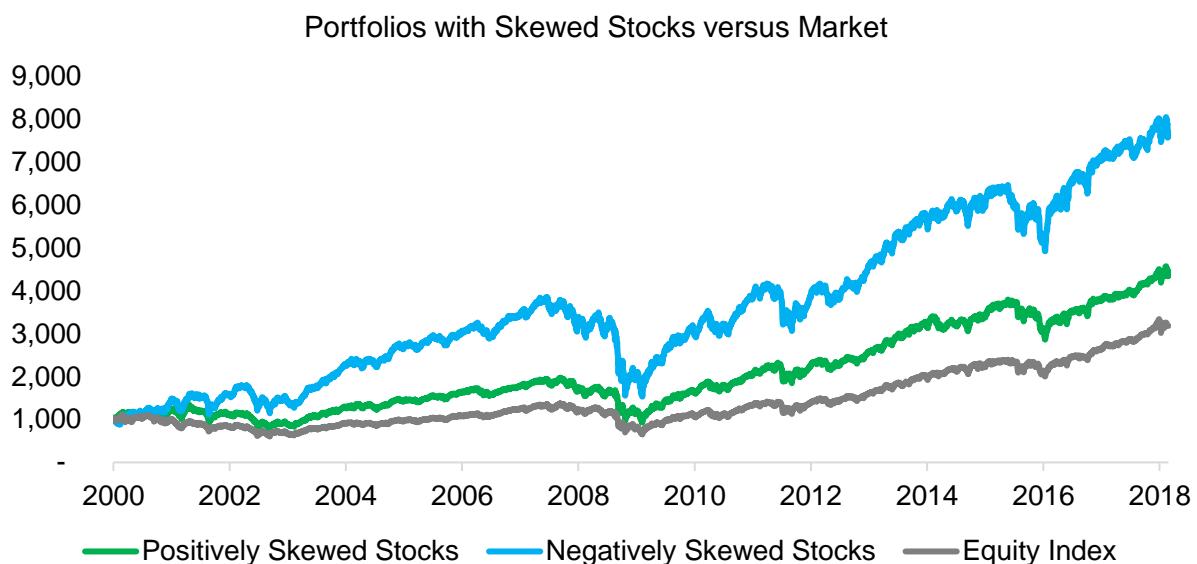
The chart below shows the performance of two stocks, Shutterfly (SFLY), a retail photobook company, and OSI Systems (OSIS), a security systems company, that serve as examples of positive and negative skewness (6.0 and -5.7 respectively). SFLY's stock price exhibited moderate volatility in 2017, but then experienced a significant share price gain in early 2018 based on better-than-expected earnings and an accretive acquisition. OSIS's share price generated a consistent performance throughout 2017 until it was accused of fraudulent and corrupt activity by Muddy Waters, a firm known for identifying short-selling targets, which led to a steep decline in the share price. Most stocks that exhibit skewness experienced events that had a strongly positive or negative impact on the companies.



Source: FactorResearch

STOCK PORTFOLIOS WITH SKEWNESS VERSUS MARKET

Next we create stock portfolios with positive and negative skewness and contrast these with the market. We can observe that both portfolios outperformed the market for the period from 2000 to 2018. The portfolio comprised of the top 10% of the most negatively skewed stocks, i.e. stocks that experienced violent share price decreases in the last 12 months, generated the highest returns. Perhaps the performance reflects some degree of mean-reversion as the stock selling might have been too aggressive.

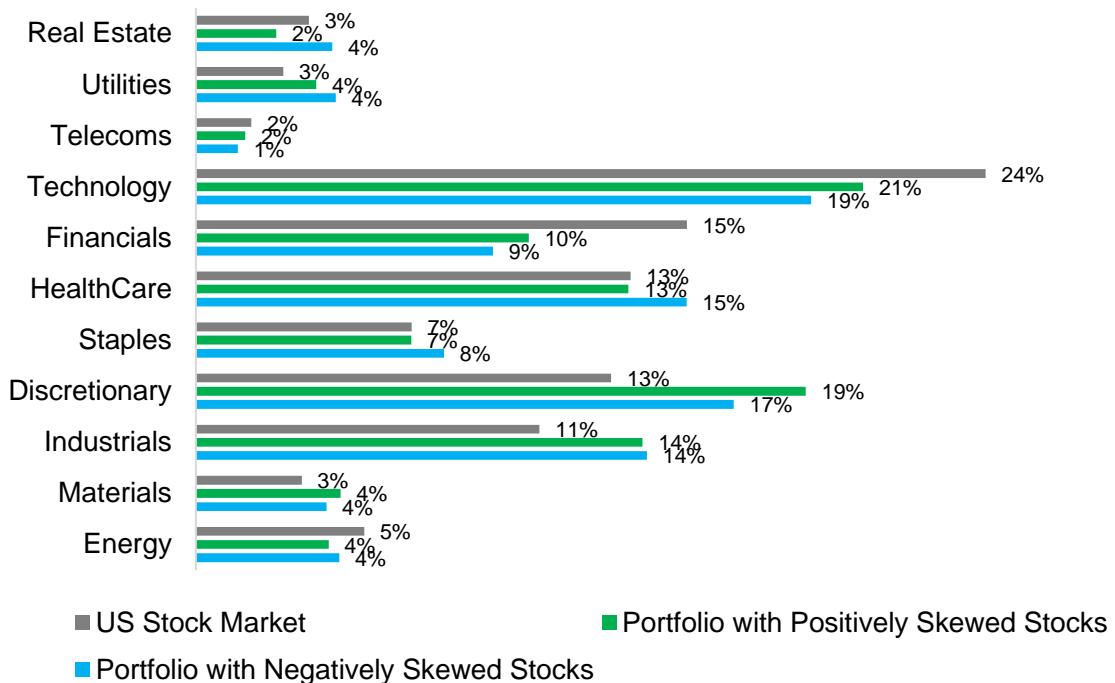


Source: FactorResearch

ANALYSIS OF THE PORTFOLIOS WITH SKEWED STOCKS

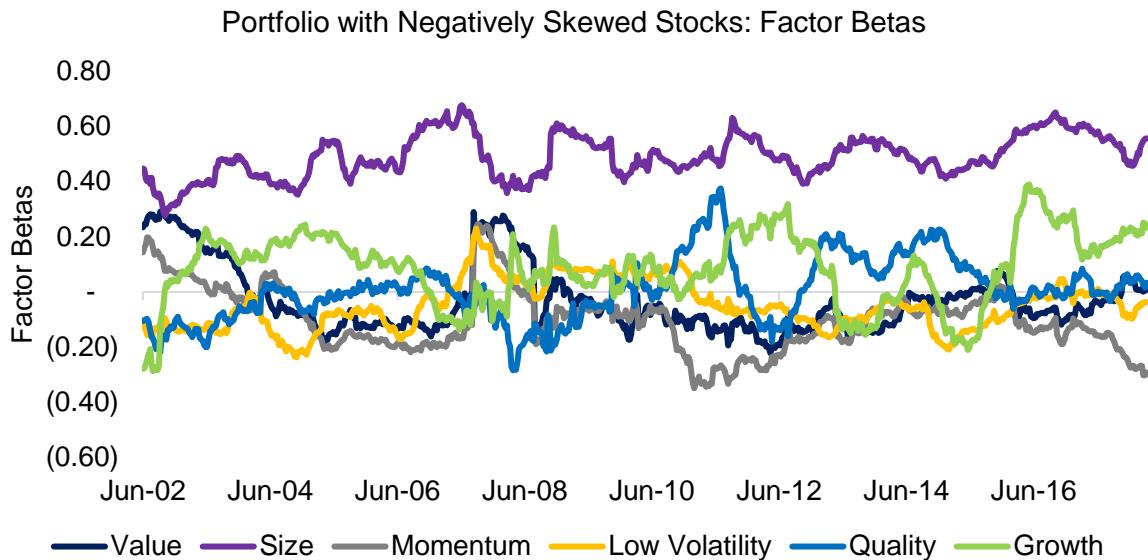
Investors might assume that some sectors are more prone to violent stock moves, e.g. biotech companies that are waiting for an approval for one of their pipeline drugs from the US Food and Drug Administration (FDA). However, the analysis below highlights that all sectors feature stocks with positive and negative skewness. However, the Technology and Financials sectors contribute less stocks to the skewness portfolios than their representation in the market while Discretionary and Industrials stocks contribute more. Tech and Financials stocks are likely more volatile than Discretionary and Industrial stocks, therefore less likely to exhibit skewness.

Portfolio with Positively & Negatively Skewed Stocks: Breakdown by Sectors (2000 - 2018)



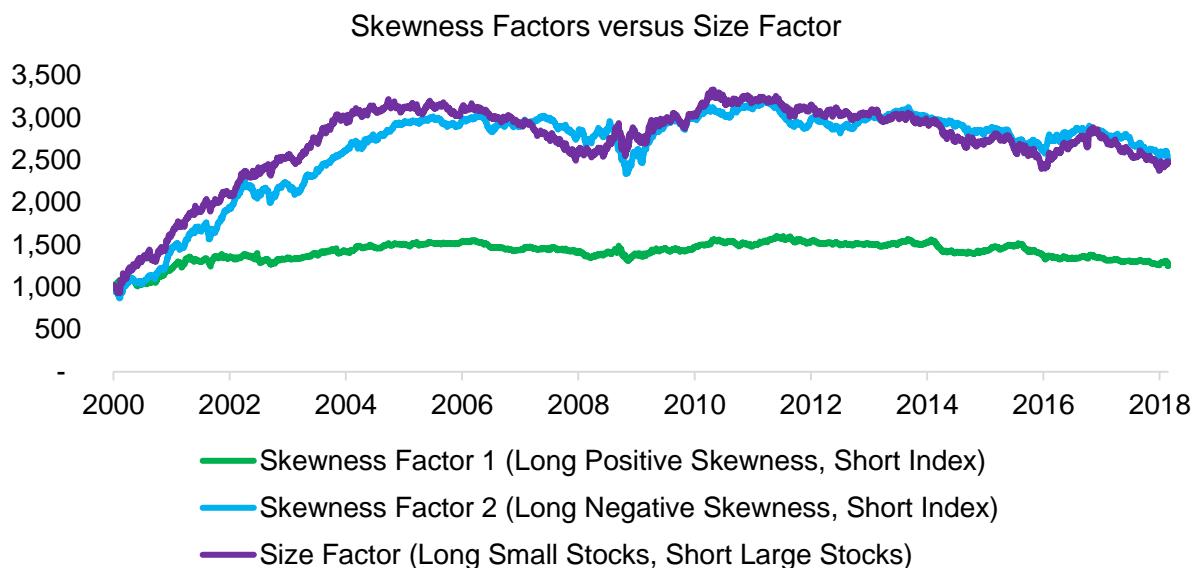
Source: FactorResearch

Given that the skewness strategies outperformed the market, we can attempt to explain the returns by common factors. A factor exposure analysis of the portfolio with negative skewness highlights mixed factor exposure in general, but strong exposure towards the Size factor. This exposure can be explained that skewness is much more likely to occur with companies with a smaller market capitalisations as they exhibit higher firm-risks than larger companies.



Source: FactorResearch

Given that the factor exposure analysis highlighted exposure to the Size factor, we can create long-short skewness portfolios by shorting the market. The analysis below highlights that the portfolio with negative skewness generated positive returns, albeit is a proxy for the Size factor. The portfolio with positive skewness has similar trends, but with much lower total returns. The difference in performance may suggest that the overreaction of investors to negative news is stronger than the underreaction to positive news.



Source: FactorResearch

FURTHER THOUGHTS

This short research note analyses portfolios created by ranking stocks for positive and negative skewness, which outperformed the market, but can partially be explained by the Size factor. The analysis is somewhat flawed from the beginning as a quantitative researcher should first define a sound theory and then perform the backtesting. Randomly backtesting strategies without a sound theory in place is likely to result in data mining. As often in financial markets, the enemy is us.

MARKET TIMING WITH MULTIPLES, MOMENTUM & VOLATILITY

Getting Comfortable with High Equity Multiples

June 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Equity multiples have been elevated in recent years
- Using valuation multiples for allocation decisions is a challenging strategy
- Momentum and volatility-based strategies are more attractive

INTRODUCTION

In recent years the stock market in the US has been expensive on a variety of valuation multiples, which is often cited for why investing has become more difficult. However, in 2009 valuation multiples were much lower, but investing was not regarded as particularly easy as most market participants were concerned about a second Great Depression. A rational observer might conclude that investing is challenging regardless if stocks are expensive or cheap. The same observer might question if valuations are meaningful for future stock returns and can be used to make investing less difficult. In this short research note we will evaluate using valuation multiples for market timing and also assess alternative methods.

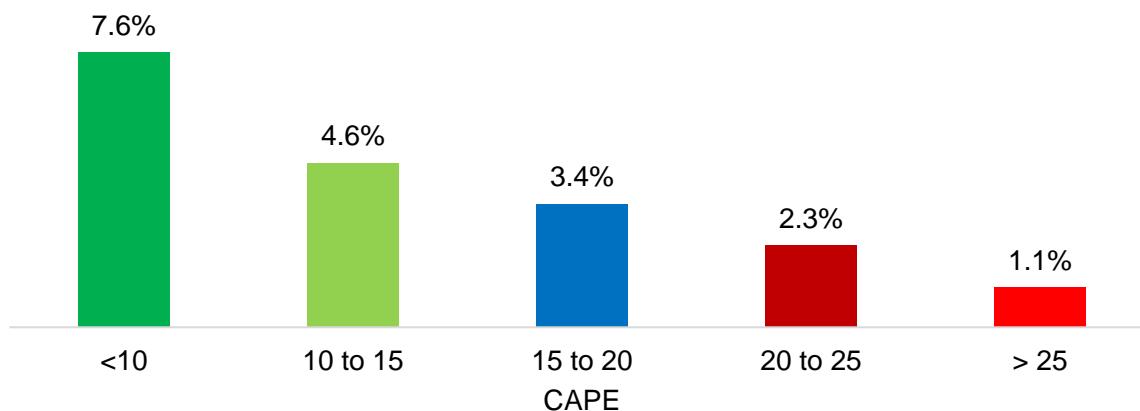
METHODOLOGY

We focus on the US stock market, where price and valuation multiple data is available from 1881 to 2016 from Robert Shiller. The analysis utilises the cyclically adjusted price earnings ratio ("CAPE"), which uses real earnings per share over a 10-year period to smooth out fluctuations in corporate profits that occur over a normal business cycle. The results do not include transaction costs, but turnover is infrequent and therefore costs are not significant.

VALUATION MULTIPLES AND FORWARD RETURNS

Academic research has shown that buying cheap and selling expensive stocks generates excess returns across time and markets, which is typically referred to as the cross-sectional long-short value factor. The same concept can be applied to stock markets from a time series perspective, i.e. invest in the market when valuations are low and do not invest when valuations are high. The chart below shows the 10-year forward returns per annum for the S&P 500 based on different CAPE ranges. The analysis highlights that the lower the entry valuation multiple, the higher the annual return for the 10 years thereafter.

CAPE versus 10-Year Forward Returns Per Annum for the S&P 500
(1881 - 2007)

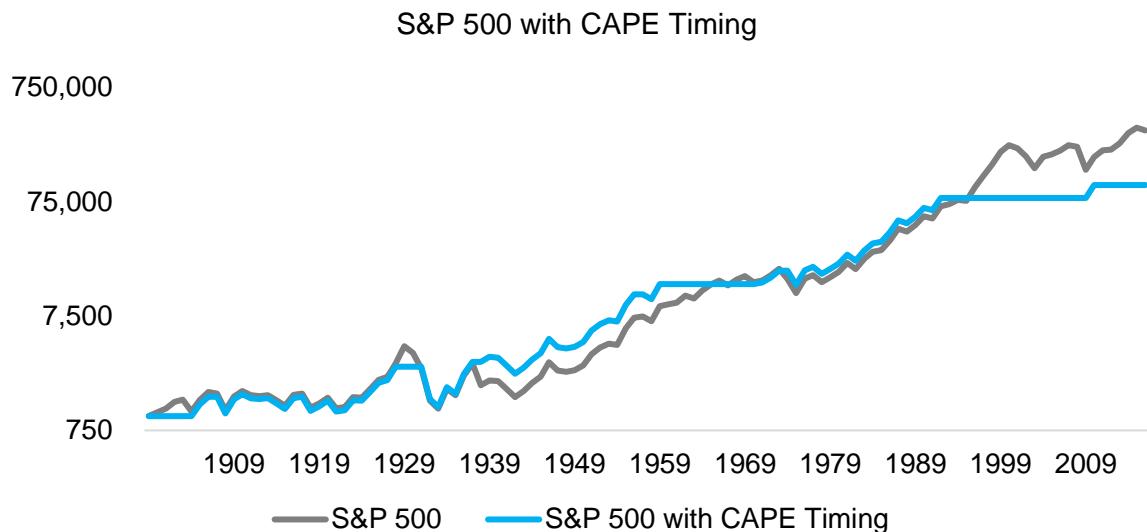


Source: Robert Shiller, FactorResearch

S&P 500 WITH CAPE TIMING

Given the linear relationship between CAPE multiples and expected returns, investors might not want to invest in the stock market when multiples are too high as expected returns would be too low. The chart below shows the performance of the S&P 500 from 1900 to 2016 as well as a tactical strategy, which only allocates when CAPE multiples are below the top quartile, which is measured on a rolling-forward basis to avoid any hindsight bias and to reflect the evolution of the US from an emerging to a developed country. Transactions are executed on an annual basis, which results in a low turnover.

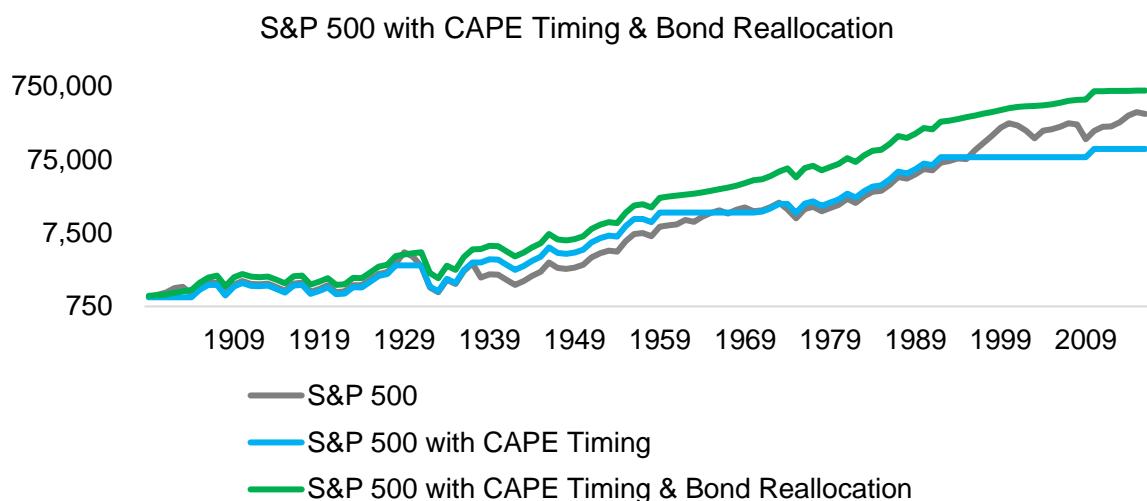
We can observe that the tactical strategy approximates the performance of the S&P 500, but features multi-decade periods where CAPE multiples were too high and investors would have been out of the market. The results highlight that this strategy was not significantly more attractive over the 126-year time period, but more importantly, show that this strategy would have been difficult to implement. Having to wait on the sideline for years or decades when valuations are too high would be emotionally challenging for most investors.



Source: Robert Shiller, FactorResearch

S&P 500 WITH CAPE TIMING AND BOND REALLOCATION

Using valuation multiples like the CAPE would have led investors to be in cash for long periods, especially over the last 30 years. Some investors have the flexibility to reallocate capital to other asset classes, which would make this strategy more implementable. The chart below shows a scenario where investors reallocated to short-term bonds when CAPE multiples were too high, which results in a performance significantly higher than that of the S&P 500. Unfortunately bond yields in recent years have been a fraction of historical yields, which makes this strategy currently less attractive.

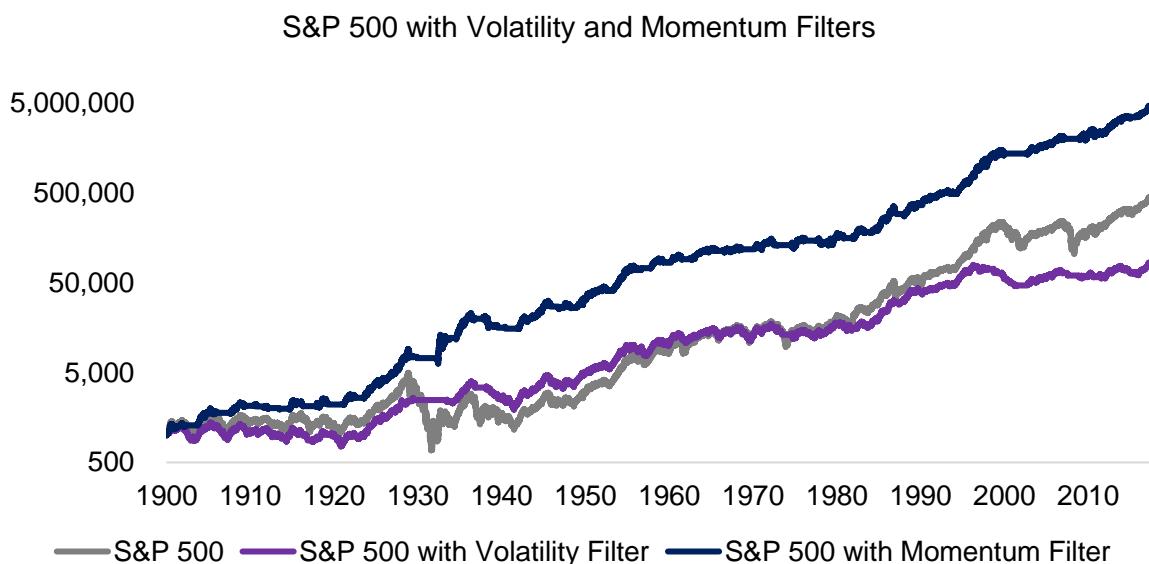


Source: Robert Shiller, FactorResearch

S&P 500 WITH MOMENTUM AND VOLATILITY FILTERS

Given that interest rates are currently low and a reallocation to bonds might not feasible for all investors, we can consider two additional frameworks for allocating to the stock market. Investors can use a simple momentum strategy, which allocates only to the S&P 500 when the last 12-month return was positive, and a volatility-based strategy, which allocates only when the realised 12-month volatility of the S&P 500 is below the top quartile, measured on a rolling-forward basis.

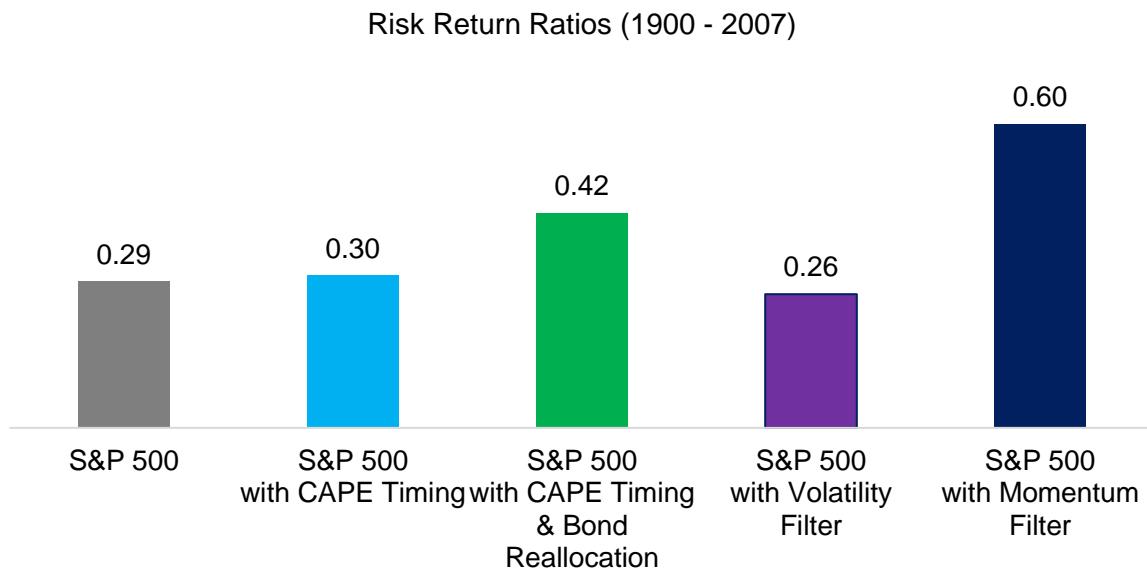
The chart below compares the performance of these two frameworks with the S&P 500 for the period from 1900 to 2018 and we can observe that the momentum strategy generated a higher performance while the volatility-based strategy produced a lower return. However, both strategies lead to significant lower drawdowns during the Great Depression in the 1930s and the Global Financial Crisis in 2008 to 2009. Compared to using valuation multiples for market timing, the advantage of either of these frameworks is that they are less dependent on noisy fundamental data and lead to less time out of the market, which makes these more implementable. Naturally investors could also be less concerned with high multiples.



Source: Stooq, FactorResearch

COMPARISON OF RISK-RETURN RATIOS

The chart below compares the risk-return ratios of the various strategies from 1900 to 2007. We can observe that the ratios are roughly comparable, except for the momentum-based strategy, which shows a significant improvement. Unfortunately momentum, despite significant empirical support, is often ignored and actively disliked by investors, likely due the simplicity. For most active managers complexity is intellectually more interesting as well as more attractive from a career perspective.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that valuation multiples can be used for market timing, but result in an emotionally challenging strategy. Momentum or volatility-based strategies are attractive alternatives. Naturally investors can question why market timing is relevant at all and why not simply buy and hold the market via a low cost ETF.

We believe the viewpoint should be changed from market timing to risk management as buy and hold is not a feasible strategy for most investors. Drawdowns of more than 50% occur on a regular basis on equity markets and evidence shows that investors tend to sell at the bottom and buy at market peaks.

It is also worth highlighting that only looking at the US stock market is a form of survivorship bias. Argentina used to be wealthier and further developed than the US. Venezuela was the richest country in South America in 2001. Japan's Nikkei still trades below the 1989 peak. Risk management matters.

TACTICAL MEAN-REVERSION

Hedging Tail Risks of Equity Portfolios Efficiently

May 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Mean-Reversion factor is driven by volatility
- Allocating tactically when volatility is high generates an attractive payoff profile
- The strategy can be considered as a tail risk hedge for equity portfolios

INTRODUCTION

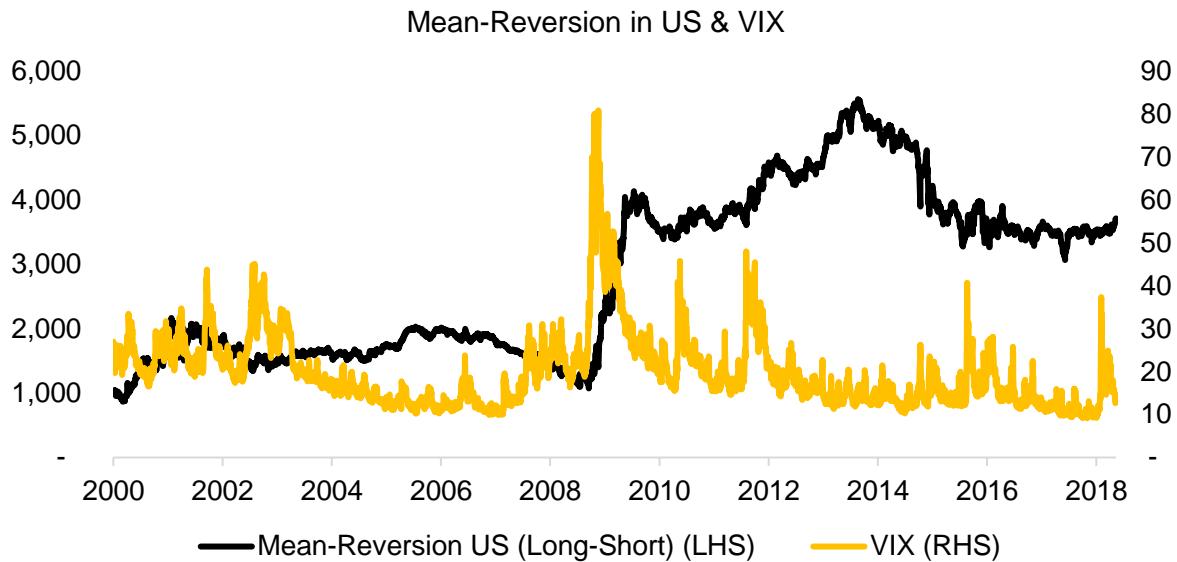
Our most recent research note focused on the Mean-Reversion factor (please see the report [Mean-Reversion Across Markets](#)), which highlighted performance and strategy characteristics. We noted that the strategy is attractive as a diversifier for equity portfolios; however, is difficult to hold given positive skewness, which implies long periods of flat or declining returns with infrequent, but significant positive returns. In this research note we will explore allocating tactically versus strategically in the context of viewing Mean-Reversion as a hedge against equity tail risks.

METHODOLOGY

We focus on the Mean-Reversion factor in the US, which is created via dollar-neutral long-short portfolios buying the stocks with the worst weekly returns and shorting the stocks with the highest weekly returns. The portfolios are created daily and rebalanced weekly, which results in a strategy with an exceptionally high turnover. The top and bottom 2.5% of the stock universe are selected in portfolio construction and only stocks with a market capitalisation of larger than \$1 billion are included. Each transaction incurs costs of 5 basis points.

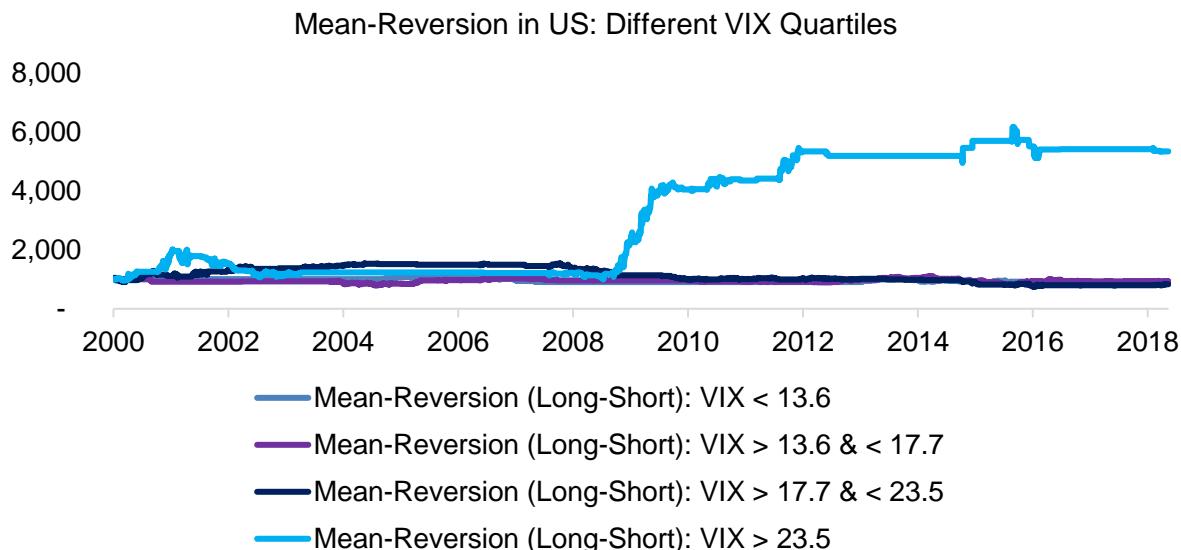
MEAN-REVERSION AND VOLATILITY

Mean-Reversion is the inverse of short-term Momentum as the strategy consists of buying the worst performing and selling the best performing stocks, measured over very short time frames. These stocks have significantly under- or outperformed the market, which is due to stock-specific news. When volatility is low, then markets are likely to reflect news accurately; however, when volatility is high, then mispricings occur more frequently. The Mean-Reversion factor represents a liquidity-providing strategy and the compensation for providing liquidity is highest when markets are in turmoil and investors panic. The chart below compares the performance of the Mean-Reversion factor in the US to the VIX and highlights that more than 50% of the returns can be attributed to a few months during the Global Financial Crisis in 2008 and 2009, when implied volatility was at record levels.



Source: CBOE, FactorResearch

Given that volatility is the key driver of Mean-Reversion returns, we can analyse the returns by splitting the performance into quartiles of implied volatility. The chart below highlights that effectively all positive returns of the Mean-Reversion factor during the last two decades can be contributed to periods when volatility was extremely high, which mainly occurred during the Global Financial Crisis. One conclusion from this analysis is that under normal markets conditions new information is processed efficiently and almost zero alpha can be captured from what investors might perceive as short-term over- and underreaction on single stock level.

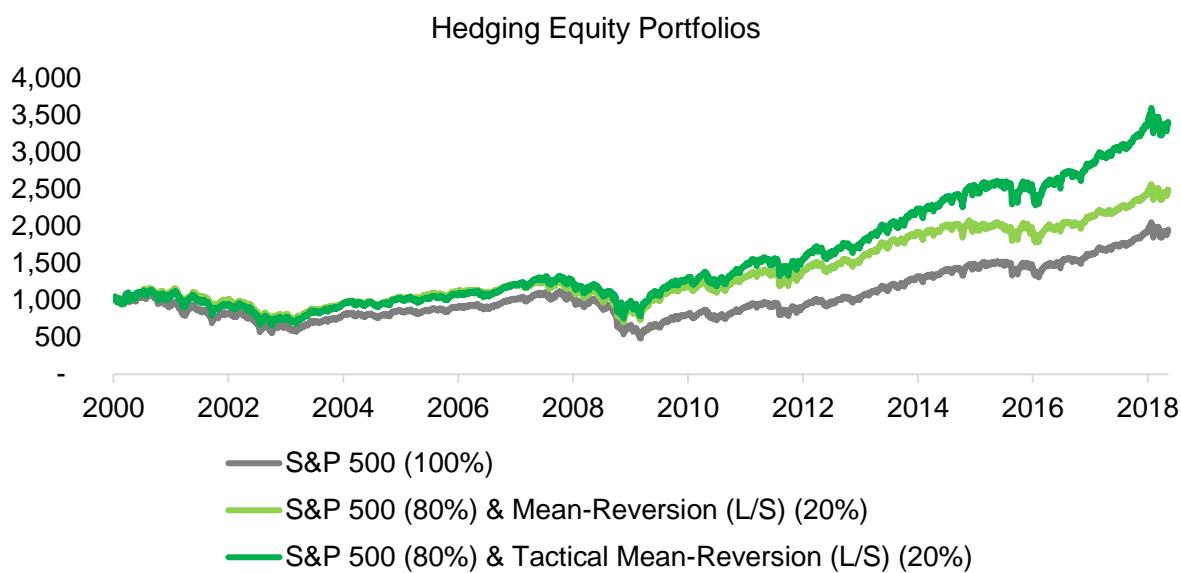


Source: FactorResearch

HEDGING TAIL RISKS OF EQUITY PORTFOLIOS

Investors have many choices when considering hedging tail risks of equity portfolios and these can broadly be differentiated between internal risk management frameworks and allocations to external strategies. The most common external products are trend following funds (CTAs) and option-based strategies. Most of these, like Mean-Reversion, exhibit positive skewness, which implies frequent multi-year periods of flat or negative returns before significant payoffs, which makes these investments emotionally challenging to hold.

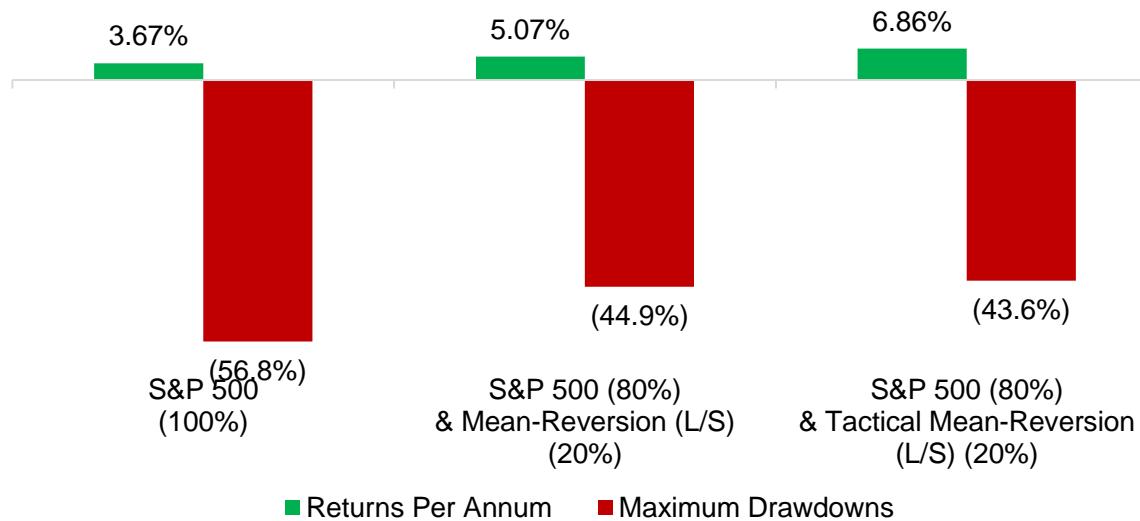
However, an allocation to Mean-Reversion can be structured tactically by only providing liquidity to markets when compensation is likely attractive, which occurs at higher levels of volatility. The chart below compares the performance of the S&P 500 and two combinations with exposure to long-short Mean-Reversion, one strategic and one tactical. The tactical portfolio allocates 20% to the Mean-Reversion factor when implied volatility is in the highest quartile and otherwise 100% into the S&P 500.



Source: FactorResearch

The analysis below shows the impact of adding exposure to the long-short Mean-Reversion factor for an equity portfolio. As expected the maximum drawdown is reduced significantly and returns increase, especially when considering the tactical allocation, which only invests into Mean-Reversion when volatility is extreme.

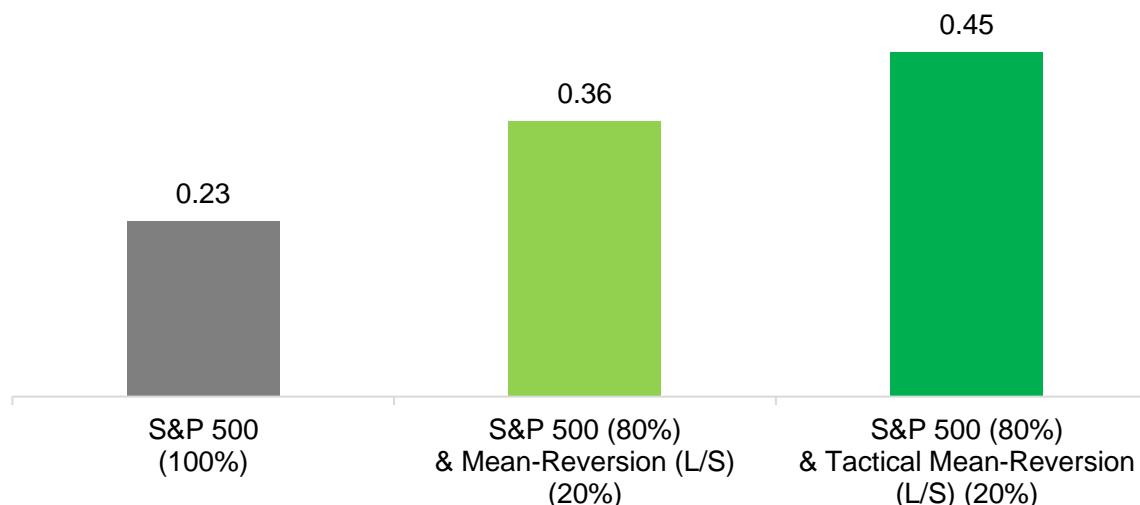
Equity Portfolio Combinations (2000 - 2018): Returns Per Annum & Max Drawdowns



Source: FactorResearch

The risk-return ratio of an equity portfolio can be increased significantly by adding exposure to the long-short Mean-Reversion factor, especially if structured tactically. The factor characteristics make the strategy attractive from a diversification perspective as higher volatility is not associated with higher equity returns. Tactical Mean-Reversion is also cheaper than other tail risk hedges as the exposure is limited, although the capacity is smaller and execution risks are higher, especially when compared to CTAs.

Equity Portfolio Combinations (2000 - 2018): Risk-Return Ratios



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that allocating tactically to the Mean-Reversion factor can improve the performance and risk metrics of an equity portfolio significantly. It is worth highlighting that this strategy has an exceptionally high turnover and therefore requires very low commission rates and an excellent operational infrastructure. Investors considering this strategy might be better suited to find an external party, e.g. an index provider and an investment bank that offers the factor exposure via a total return swap, versus managing it internally. Naturally it also requires a thoughtful and systematic framework for defining when volatility is attractive enough for deploying the strategy, which is likely the biggest challenge.

MEAN-REVERSION ACROSS MARKETS

Hedging Tail Risks of Equity Portfolios

May 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The Mean-Reversion factor shows the same trends across markets
- The strategy differentiates itself from other factors by exhibiting strong positive skewness
- Mean-Reversion is an attractive diversifier for an equity-centric portfolio

INTRODUCTION

Volatility spiked in the first quarter of 2018 when global stock markets declined, which was mainly due to concerns on proposed tariffs by the US government and rising interest rates. Since then markets recovered and volatility declined again, but higher interest rates are likely to have a negative impact on the global economy given record levels of public, corporate and consumer debt. Higher rates probably result in lower corporate earnings and decreased consumer spending, which would lead to markets performing less well than in recent years and volatility to increase. Although this scenario would be a concern for most investors with traditional equity-bond portfolios, there are some strategies like Mean-Reversion that benefit from higher levels of volatility. In this short research note we will analyse the performance and characteristics of the Mean-Reversion factor and its potential utilisation in an equity-centric portfolio.

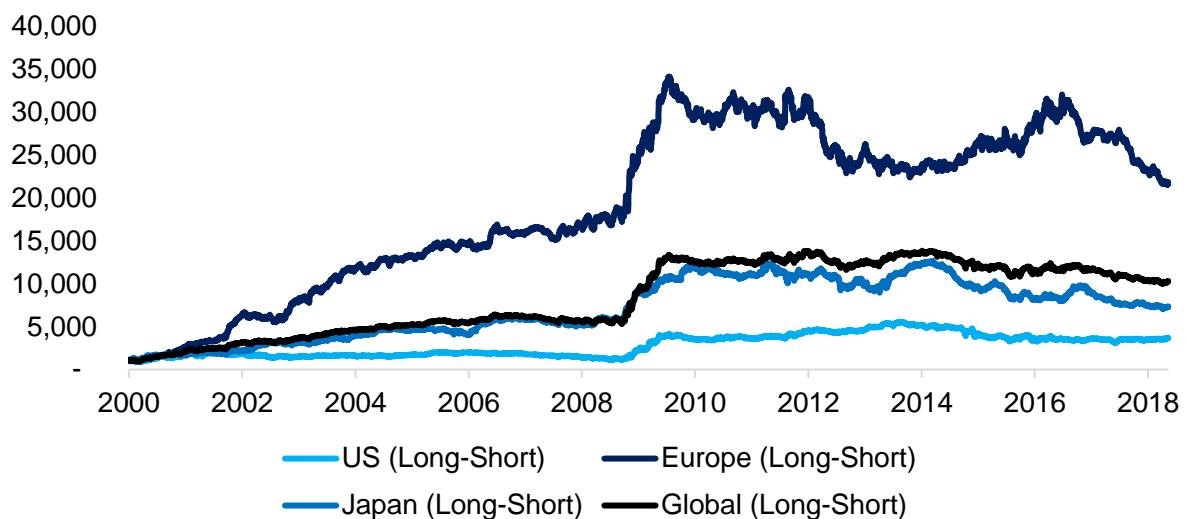
METHODOLOGY

We focus on the Mean-Reversion factor in the US, Europe and Japan. The factor is created via dollar-neutral long-short portfolios buying stocks with the worst weekly returns and shorting stocks with the highest weekly returns. The portfolios are created daily and rebalanced weekly, which results in a strategy with an exceptionally high turnover. In the US the top and bottom 2.5% of the stock universe are selected for the portfolio construction compared to the top and bottom 5% in Europe and Japan. Only stocks with a market capitalisation of larger than \$1 billion are included. Transaction costs of 5 basis points are assumed for the US and 10 basis points for Europe and Japan.

MEAN-REVERSION ACROSS REGIONS

The chart below shows the performance of the Mean-Reversion factor in the US, Europe, Japan and globally, which equally allocates to these three markets, from 2000 to 2018. Overall the profiles are quite similar, which highlights that the factor likely has the same underlying drivers. The factor performance has been significantly higher in Europe and Japan than in the US, which might be explained by less competition or by the backtesting assumptions. The strategy is highly sensitive to transaction costs given high turnover, so the results should be regarded with caution. Compared to other factor strategies, investors can expect a higher discrepancy between theoretical and realised returns.

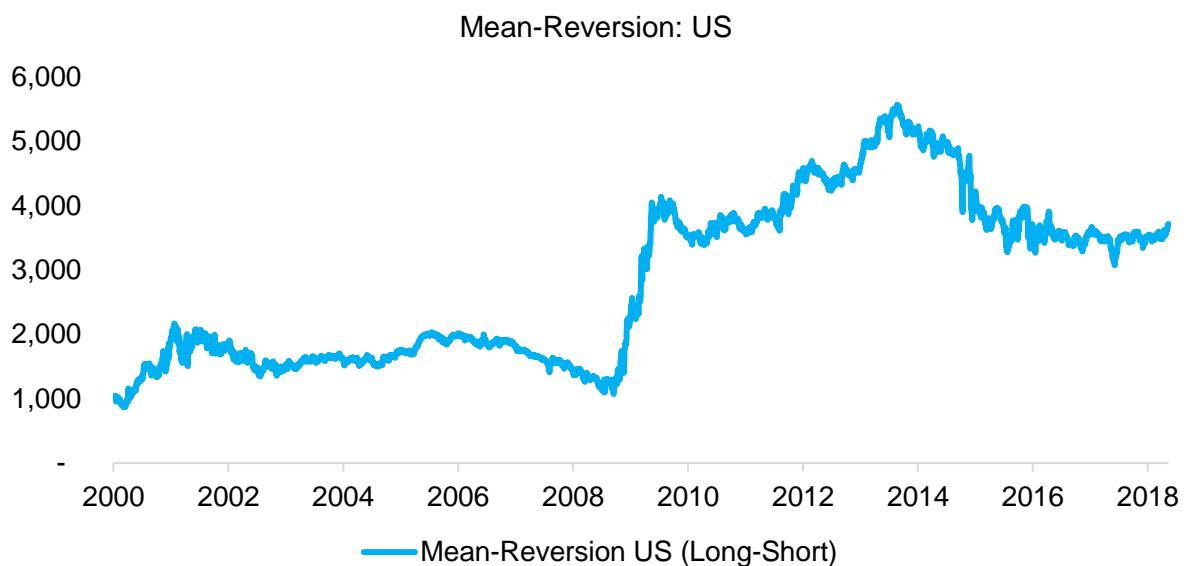
Mean-Reversion: Across Regions



Source: FactorResearch

MEAN-REVERSION IN THE US

The performance of Mean-Reversion in the US seemed somewhat flat compared to Europe and Japan, but was positive since 2000 as highlighted by the chart below. However, almost 50% of the performance can be attributed to a few months in 2008 and 2009 and there were multiple years of flat and declining returns, which makes this strategy challenging for fund managers and capital allocators.



Source: FactorResearch

It is interesting to analyse the performance of the Mean-Reversion factor in 2008 and 2009, given that this period contributed almost the majority of the returns over the last two decades. Naturally this period represents the Global Financial Crisis, where the S&P 500 experienced a drawdown of more than 50%. The chart below compares the performance of the factor and the S&P 500 and we can observe that both declined consistently from 2007 to the middle of 2008. However, in September 2008 the performance started diverging with Mean-Reversion generating substantial gains while the S&P 500 deteriorated further. The analysis highlights that a declining market does not necessarily lead to positive returns from the Mean-Reversion factor.



Source: FactorResearch

In addition to comparing the performance of the Mean-Reversion factor to the S&P 500, we can also display the VIX, which represents implied volatility. The chart below highlights that the Mean-Reversion factor started generating substantial returns above a VIX level of 20, which was reached in September 2008 after Lehman Brothers declared bankruptcy and investors started questioning the financial health of most major banks. During that period investors likely overreacted and mispriced stocks frequently, which is the main source of profits for a liquidity-providing strategy like Mean-Reversion. The analysis also shows that the factor performance deteriorated once volatility started declining when stock markets recovered in 2009.

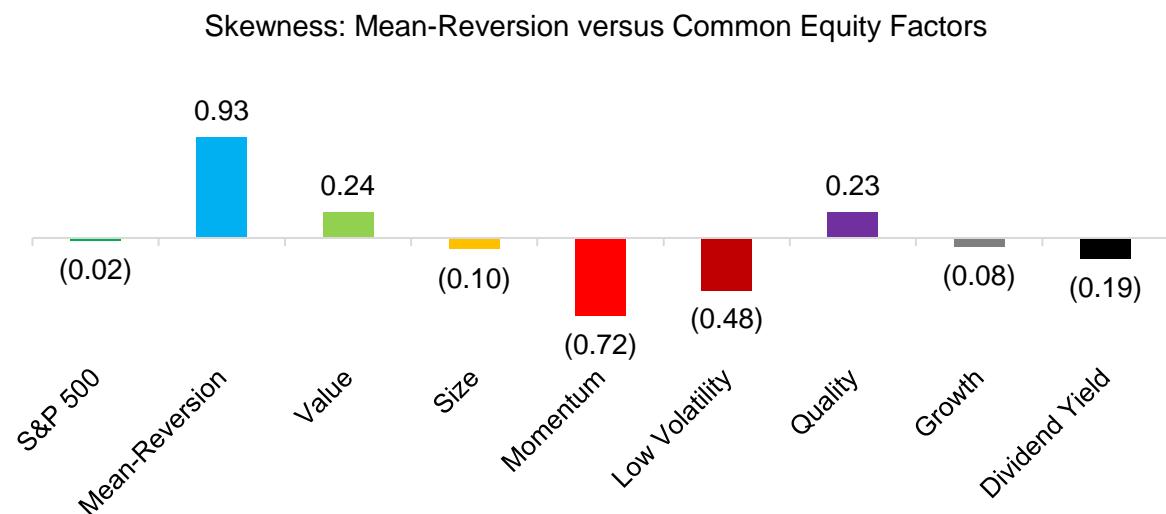
Mean-Reversion versus the VIX in the Global Financial Crisis



Source: FactorResearch

CHARACTERISTICS OF THE MEAN-REVERSION FACTOR

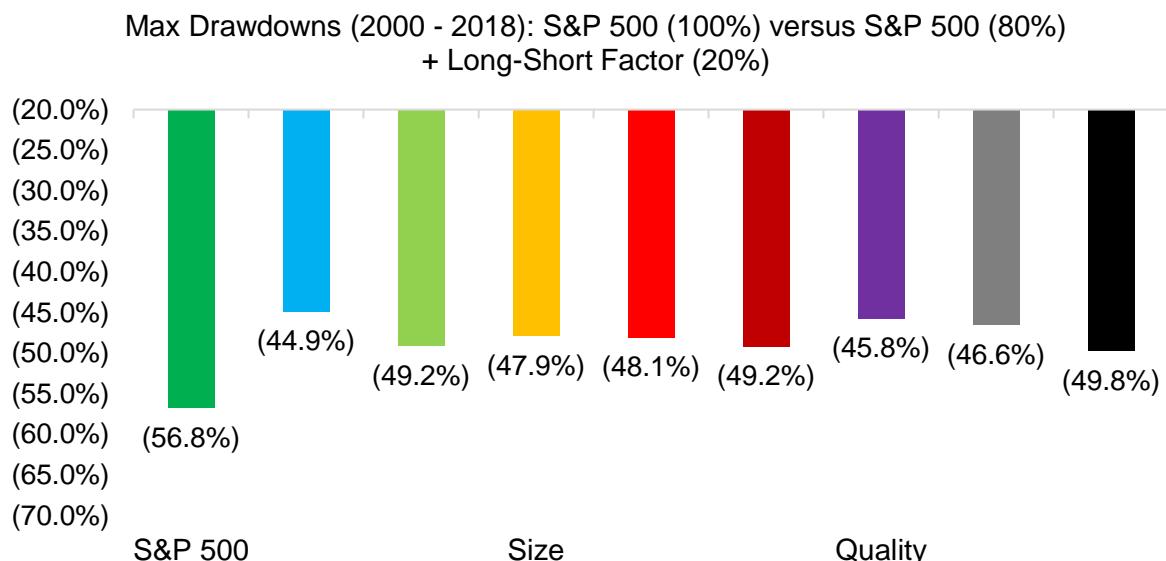
The Mean-Reversion factor differentiates itself from most other common equity factors by exhibiting significantly positive skewness, which describes that the return distribution includes some extreme positive gains. The chart below highlights that the returns of the S&P 500 were not skewed for the period from 2000 to 2018, while the Momentum factor (long-short) exhibited significantly negative skewness. It is worth highlighting that holding a portfolio with negative skewness is emotionally difficult as it implies long periods with flat or slightly declining performance. Therefore strategies like Mean-Reversion or cross-asset class trend following, which also exhibits positive skewness, should be considered as satellite strategies within a larger portfolio and acknowledged for their rare, but useful contributions to the portfolio.



Source: FactorResearch

MEAN-REVERSION IN AN EQUITY-CENTRIC PORTFOLIO

Given that the Mean-Reversion factor exhibits positive skewness and tends to generate substantial profits when markets decline and volatility is high, it should be an interesting addition to an equity-centric portfolio. The analysis below displays the maximum drawdowns of portfolios that consist of the S&P 500 (80% allocation) and a variety of long-short factors (20% allocation). As expected all combination portfolios show a reduced maximum drawdown compared to the S&P 500 on a stand-alone basis, but the portfolio that includes Mean-Reversion results the highest reduction.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the performance and characteristics of the Mean-Reversion factor, which is an attractive addition for an equity-centric portfolio. Unfortunately the unique nature of this strategy makes it less attractive for most investors as high turnover is often considered a negative for investment strategies and positive skewness implies long periods of flat or declining returns. Given that the factor is mainly driven by volatility, investors could consider a tactical versus strategic allocation, although that would require either discretionary or systematic timing skills.

ALPHA MOMENTUM

Improving the Momentum Factor

May 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Stocks can be ranked by alpha instead of stock returns
- Alpha Momentum generates a higher and more consistent performance than Price Momentum
- Momentum crashes are reduced significantly and risk-return ratios increase

INTRODUCTION

Alpha in finance is shrinking continuously as investors are getting better at analysing returns. When a fund manager beat his benchmark 30 years ago, investors likely attributed this to skill. Today a large portion of the outperformance can be explained by exposure to certain factors like Value or Momentum.

The concept of analysing fund manager returns can also be applied to single stocks, which allows investors to decompose stock returns into contributions from certain factors. As with fund managers, not all stock returns can be explained as some companies intrinsically create while others destroy value. Investors can create portfolios by ranking stocks by their alpha generation, speculating that companies with high alphas will continue to generate positive unexplained returns while stocks with low alphas will continue to produce negative unexplained returns. In this short research note we will analyse Alpha Momentum, which is sometimes referred to as Idiosyncratic or Residual Momentum, and contrast the strategy with Price Momentum.

METHODOLOGY

We focus on the Alpha and Price Momentum factors in the US, Europe and Japan. Alpha is defined as the residual between the stock return and the sum of all factor contributions to the stock returns. The factors used to explain stock returns are the market, Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield. The factor contributions are derived via a regression analysis with a two-year lookback and monthly factor data. Price Momentum is based on the absolute stock performance over the last 12 months, excluding the most recent month. The Alpha and Price Momentum factors are created via a long-short beta-neutral portfolios based on the top and bottom 10% stocks in the US, Europe and Japan. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

STOCK ALPHA CASE STUDIES: AMAZON & SNAP

Amazon (AMZN), the online retailer, generated a return of close to 70% over the last 12 months. The return can be partially contributed to the market, which had also a positive performance, and exposure to certain factors. However, a large part of Amazon's performance is unexplained and can be considered alpha or idiosyncratic return. The

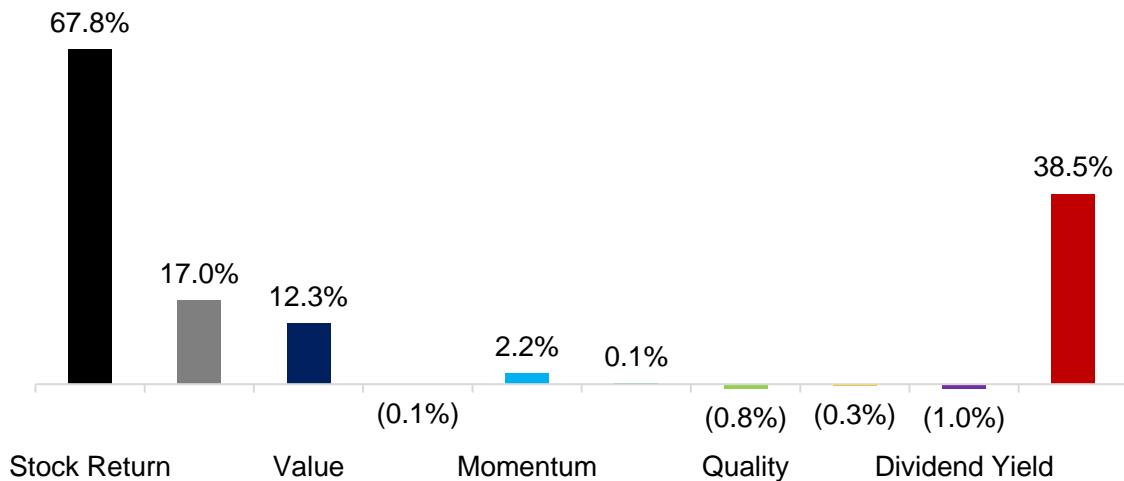


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analysis below highlights the stock return, factor contributions and alpha generated over the last 12 months. Naturally other factors such as sector classification, interest rates or currencies could be included, which would provide additional information and further reduce the alpha.

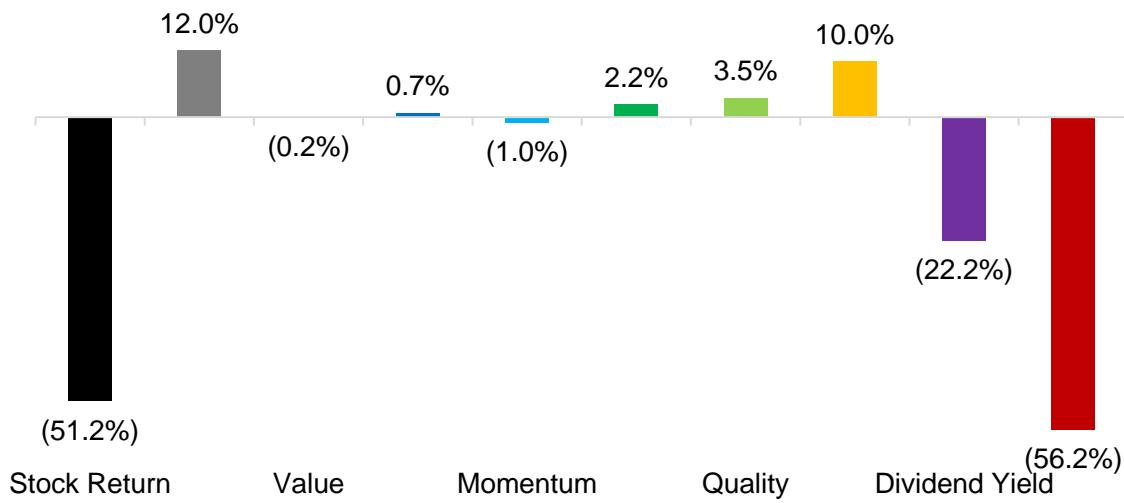
Factor Contribution Analysis (Last 12-Months): Amazon (AMZN)



Source: FactorResearch

In contrast to Amazon, Snap (SNAP), the camera company, generated a significant amount of negative alpha over the last 12 months. The Alpha Momentum portfolio would therefore include Amazon in the long portfolio and Snap in the short portfolio.

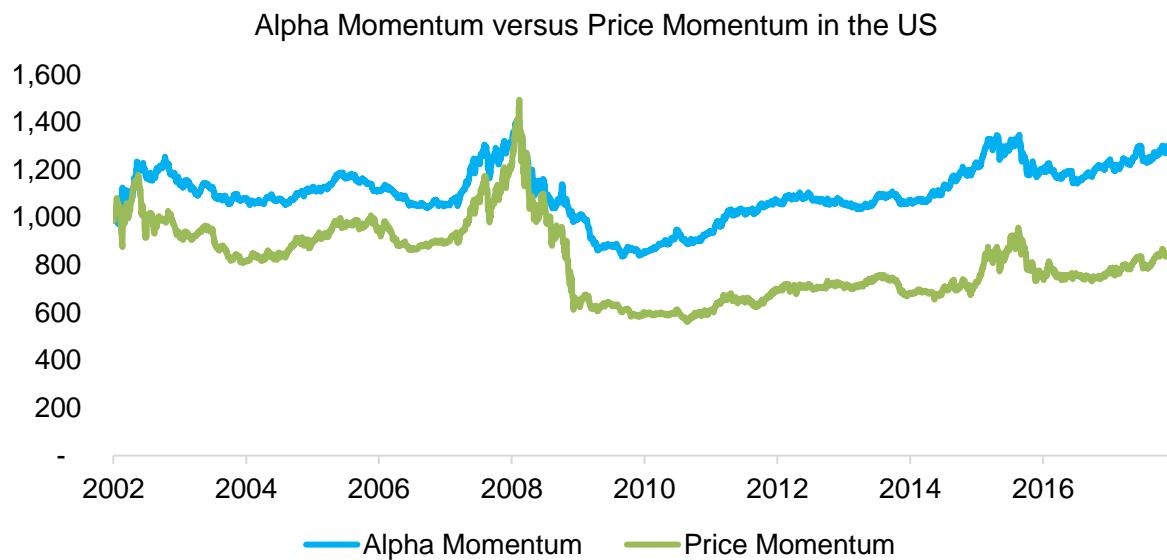
Factor Contribution Analysis (Last 12-Months): Snap Inc (SNAP)



Source: FactorResearch

ALPHA MOMENTUM VERSUS PRICE MOMENTUM: US

The chart below compares the performance of Alpha and Price Momentum in the US from 2002 to 2018. We can observe similar trends, but a slightly reduced Momentum crash in 2009 and a less volatile performance by the Alpha Momentum factor. It is not necessarily intuitive that these profiles are so similar, given Alpha Momentum is derived from a regression analysis that includes Price Momentum as a factor and may seem a rather abstract concept altogether. However, the portfolio is created by buying the stocks with the highest alpha and short the stocks with the lowest alpha, which often represents the stocks with highest and lowest total returns.

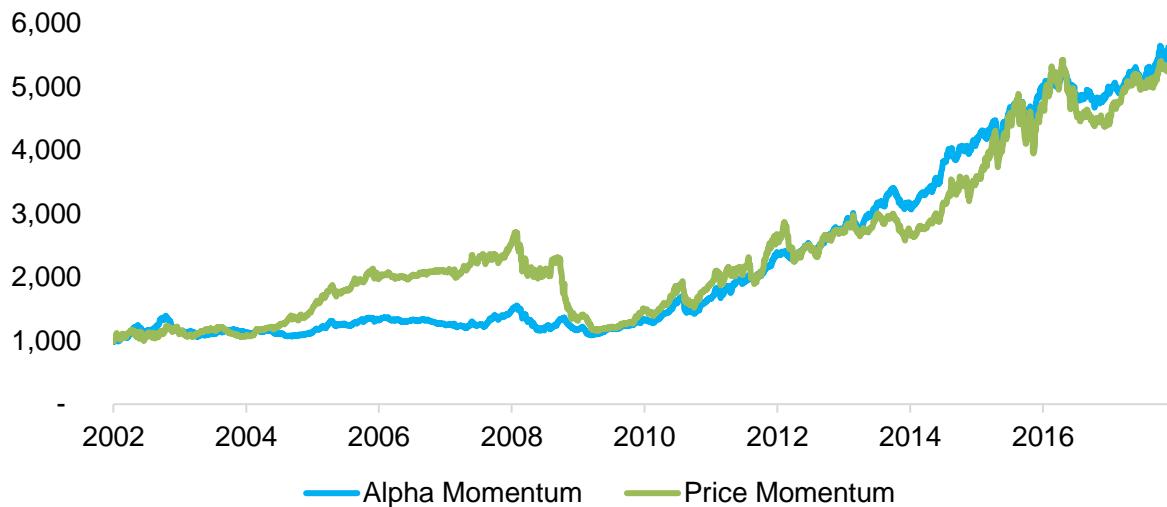


Source: FactorResearch

ALPHA MOMENTUM VERSUS PRICE MOMENTUM: EUROPE

The performance of Alpha and Price Momentum from 2002 has been much more attractive in Europe than the US. The chart below highlights that Alpha Momentum has generated a more consistent and less volatile performance than Price Momentum in Europe. It is worth highlighting that Alpha Momentum does not exhibit a momentum crash in 2009, albeit it also lacks the strongly positive performance of Price Momentum from 2005 to 2008.

Alpha Momentum versus Price Momentum in Europe

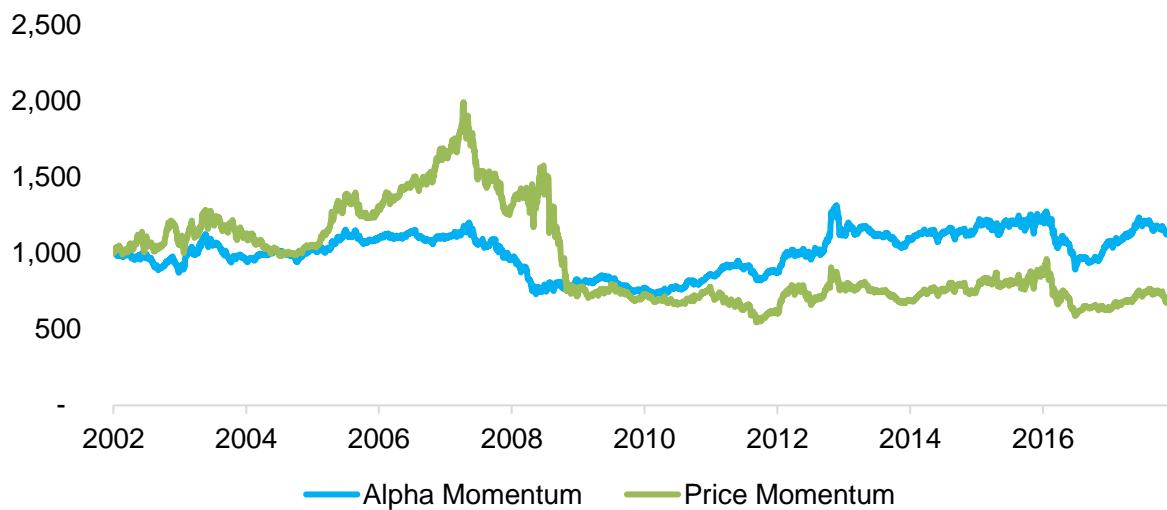


Source: FactorResearch

ALPHA MOMENTUM VERSUS PRICE MOMENTUM: JAPAN

The performance of Alpha and Price Momentum in Japan has been almost zero since 2000. Price Momentum generated strong returns heading into the Global Financial Crisis in 2007, but then crashed thereafter. The performance of Alpha Momentum is not particularly attractive, but less volatile than Price Momentum.

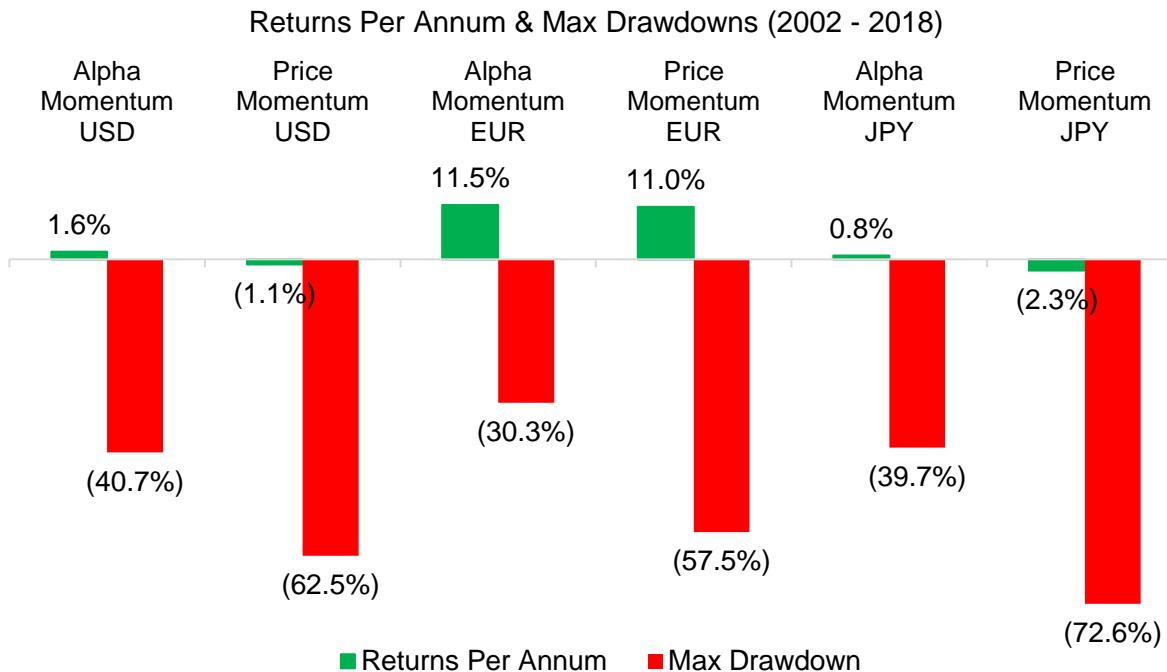
Alpha Momentum versus Price Momentum in Japan



Source: FactorResearch

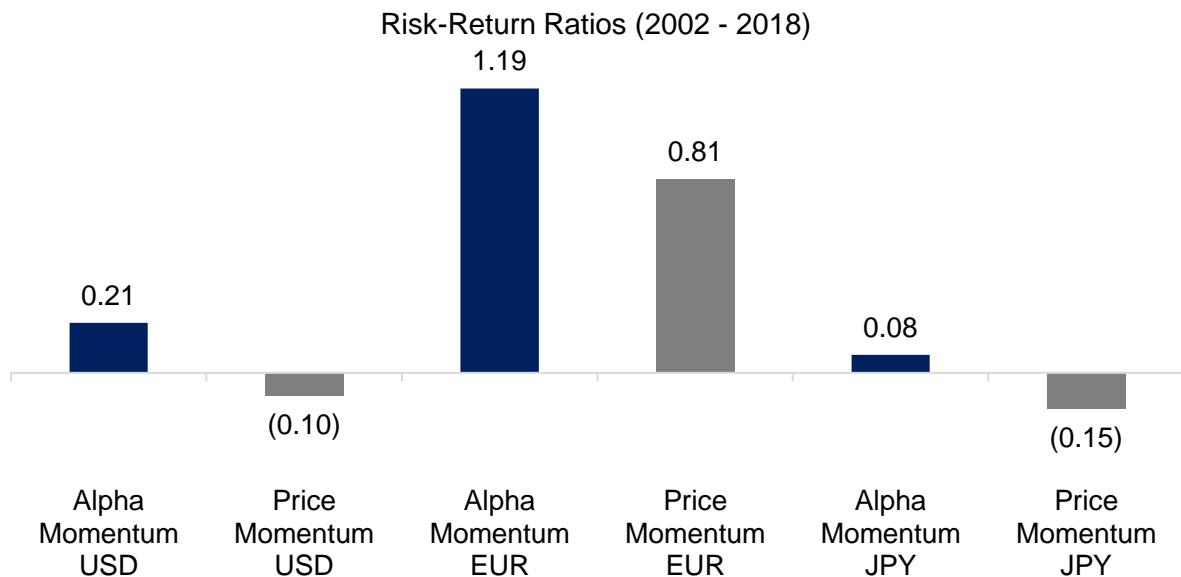
ALPHA MOMENTUM VERSUS PRICE MOMENTUM: RISK METRICS

In addition to observing the performance we can also analyse the returns per annum and maximum drawdowns. Alpha Momentum generated positive returns in all three regions while Price Momentum was only positive in Europe. The analysis highlights that Alpha Momentum reduces the drawdowns of Price Momentum by almost 50%.



Source: FactorResearch

The risk-return ratios highlight that since 20000 Momentum has only been an attractive factor in Europe. However, Alpha Momentum improves the ratios in the US and Japan and can be considered an improvement compared to Price Momentum.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that stock alpha, similar to stock returns, can be used to predict the direction of stock returns, at least if measured over a one-year horizon. Alpha Momentum can be considered an attractive alternative to Price Momentum as performance and risk metrics improve. However, from a computational perspective Alpha Momentum is much more complex to derive than Price Momentum, which likely implies a larger difference between theoretical and realised returns. It would also be interesting to analyse if stock alpha measured on shorter time frames can be used for a short-term Mean Reversion strategy, which is a topic for another research note.

ADDITIONAL RESOURCES

Readers interested in further exploring Alpha Momentum, sometimes also referred to as Residual or Idiosyncratic Momentum, can review additional research [here](#), summarised by Quantpedia.

VALUE FACTOR: COMPARISON OF VALUATION METRICS

Searching for Superior Valuation Metrics

May 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published at Alpha Architect.

INTRODUCTION

Mirror, mirror, on the wall – which is the fairest of them all?

Recent commentary (to include a recent Barron's article) seems to suggest that value is dead and may never come back. Of course, most of these comments revolve around the price-to-book valuation metric, which, as the Barron's article points out, might have some issues:

But there's a problem with price/book: today's economy. Price/book, perhaps the most conventional measure of value, evaluates stock prices based on a company's book value—the worth of all tangible assets but no intangible ones...Today's service economy is filled with companies whose biggest assets are their brands, intellectual property, or customer loyalty, which don't show up on the balance sheet.

But as Wes highlighted not that long ago in a WSJ piece, determining if value investing is dead, really hinges on how one measures "value investing."

In this piece, we look at the performance of various value investing screens from 2000 to 2018 across the globe to garner some more insight on how value investing has fared in recent memory. The results suggest a mixed view on value. There is no conclusive evidence that value is dead, but there is also no clear case that value has done well.

VALUATION HORSE RACE METHODOLOGY

Systematic value investors face a lot of options when deciding which value metric they should utilize when constructing their portfolios. Historically, investors have focused on the price-to-book ratio, which is still the preferred metric in some sectors, e.g. REIT specialists in Europe and Asia continue to focus on premium and discount to book values as it is a very intuitive measure for identifying value in the real estate sector. However, in most sectors investors tend to focus on earnings or cashflow-based metrics. In this short research note, we will compare different value metrics across the globe and evaluate utilizing a multi-metric approach. Wes and Jack have done a similar analysis for the US market over a 40-year period, which can be contrasted with the results below.

We focus on value portfolios in the US, Europe and Japan and the following four valuation metrics: price-to-book (P / B), price-to-earnings (P / E), price-to-free cashflow (P / FCF) and enterprise value-to-EBITDA (EV / EBITDA). The portfolios are constructed by taking the top 10% of the stock universes and are rebalanced monthly. Only stocks with market capitalizations of larger than \$1 billion are considered and 10 basis points of costs per transaction are included.



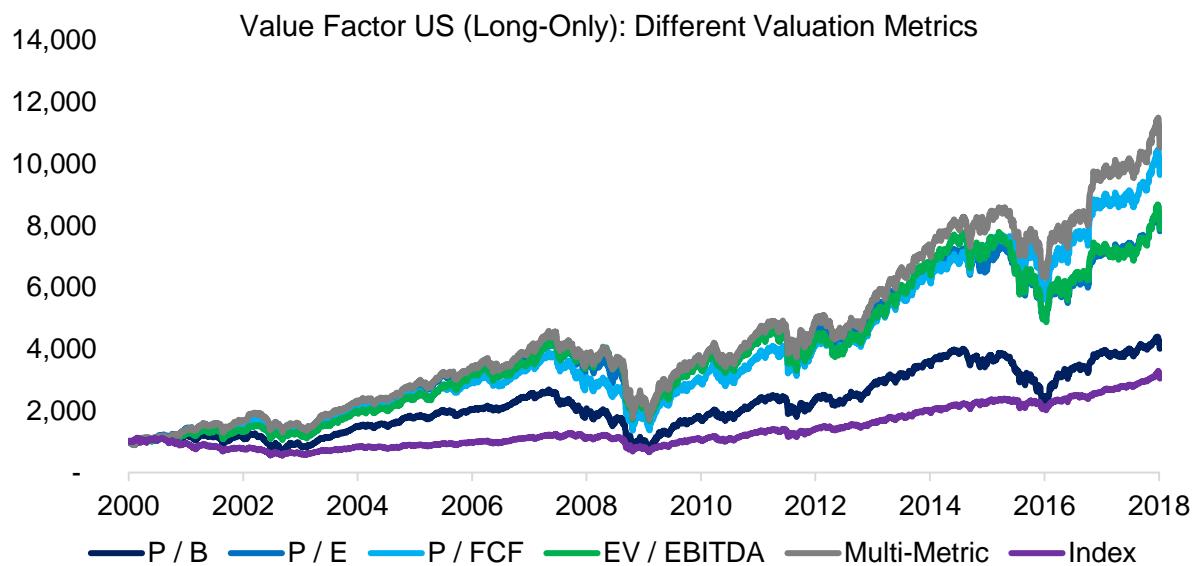
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US VALUE PORTFOLIOS: METRIC COMPARISON

The chart below shows the comparison of different metrics for value portfolios in the US for the period from 2000 to 2018. We can observe that all portfolios outperformed the market over that time period, which can be explained by the period from 2000 to 2003, where the Tech bubble imploded and cheap stocks significantly outperformed the index.

The analysis highlights that the price-to-book portfolio generated the lowest performance, which likely indicates that in the US this metric has been inferior for identifying cheap companies compared to others. Modern finance focuses more on earnings and cashflow than book values, which rarely reflect the intrinsic value of company, e.g. technology companies tend to have few tangible assets. The multi-metric portfolio, which ranks stocks for all four metrics simultaneously, generated the strongest performance.



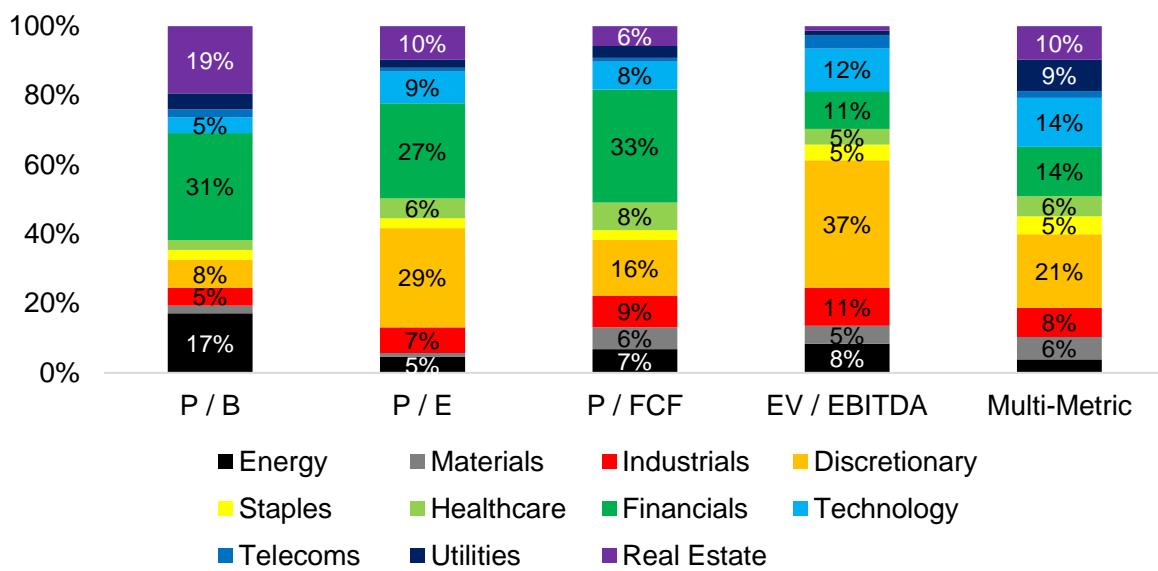
Source: FactorResearch

It is worth highlighting that the valuation metrics lead to different portfolios from a sector perspective. For example, EBITDA (earnings before interest, depreciation and amortization) is not a meaningful measure for banks, as their major source of income is interest, which means they are excluded from the EV / EBITDA portfolio (other financial companies, like asset managers, which have fee income are included).

US VALUE PORTFOLIOS: BREAKDOWN BY SECTORS

The chart below shows the long portfolio for the different valuation metrics and we can observe that there are sectoral biases towards the Financial and Consumer Discretionary sectors, i.e. these sectors are cheap across metrics. Interestingly, the multi-metric portfolio is most diversified across sectors.

Value Metrics - Long Portfolio: Breakdown by Sectors

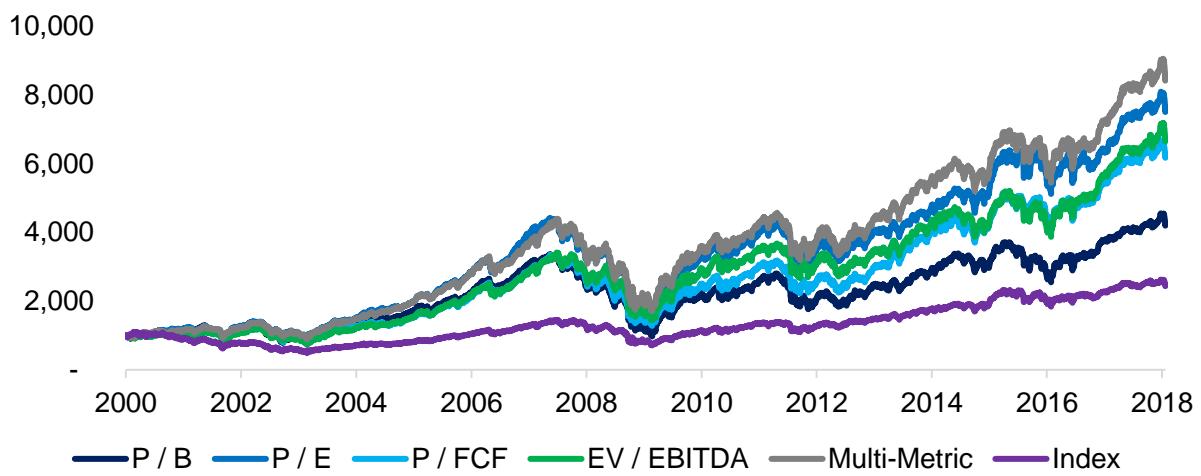


Source: FactorResearch

EUROPEAN VALUE PORTFOLIOS: METRIC COMPARISON

Similar to the US, value portfolios in Europe outperformed the market since 2000, but also due to the strong performance of cheap stocks after the Tech bubble implosion. If the data was rebalanced at a later date, then the outperformance would be far less significant. Price-to-book has also been a less effective value metric in Europe while the multi-metric approach generated the strongest performance.

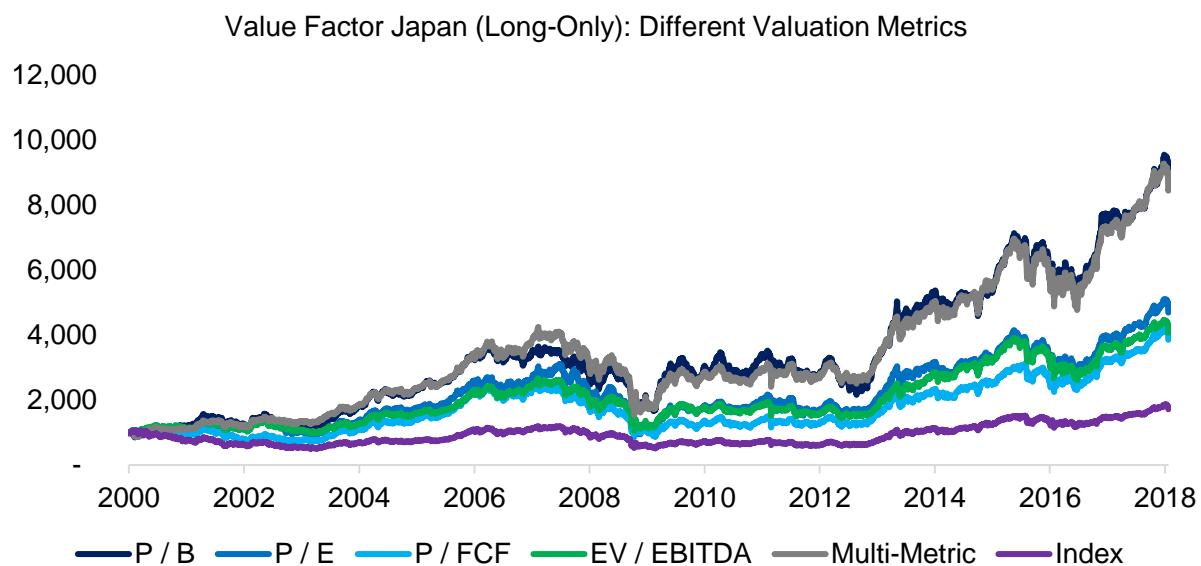
Value Factor Europe (Long-Only): Different Valuation Metrics



Source: FactorResearch

JAPANESE VALUE PORTFOLIOS: METRIC COMPARISON

Japan is often considered an anomaly for quantitative strategies (especially momentum), but the value factor overall mirrors the performance of the global value factor. Similar to the US and Europe, cheap stocks outperformed the market; however, in contrast, the price-to-book portfolio generated the highest returns. It is somewhat challenging to explain, from an accounting perspective, why price-to-book would be a superior metric in Japan, as many listed companies have adopted IFRS and Japanese GAAP is relatively comparable to global accounting standards. Perhaps this reflects historical preferences of the investor and analyst community, although this might change given the continuous integration of global capital markets.



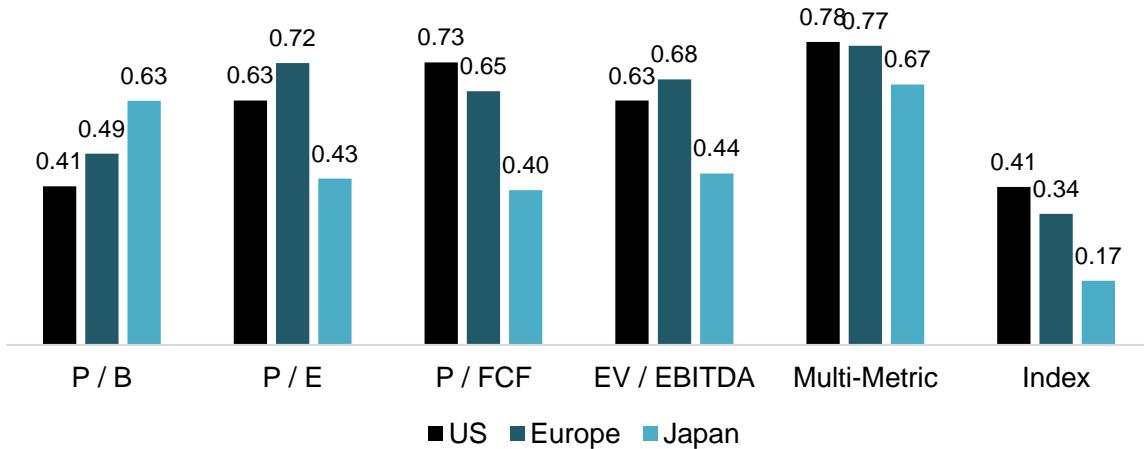
Source: FactorResearch

VALUE PORTFOLIO METRICS: RISK-RETURN RATIOS

In addition to showing the raw performance of the various metrics, we can also analyze the risk-return ratios, which are displayed in the chart below. Overall there does not seem to be one metric that is consistently superior across regions. Selecting the best performing metric for each region could be challenged as optimization, unless there is a sound economic explanation, e.g. unique investor behavior in certain markets. Given similar accounting rules and a global financial community, this is unlikely (although there are arguments for the “single-factor” value metric when it comes to enterprise multiples).

However, investors can mitigate value metric selection risk by combining different metrics. One possible explanation for the superior results of the multi-metric approach is that it avoids false positives, e.g. stocks that appear as value stocks on a single metric for accounting reasons but would not be considered value stocks on other valuation metrics. This ensemble approach shows attractive risk-return ratios across regions.

Value Factor Valuation Metrics: Risk-Return Ratios (2000 - 2018)



Source: FactorResearch

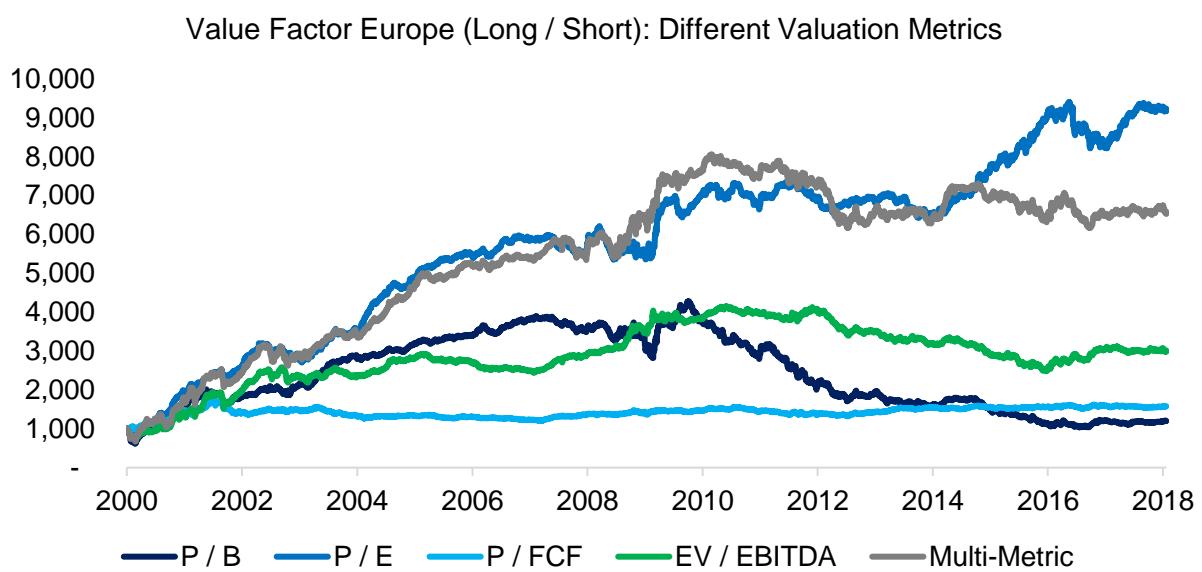
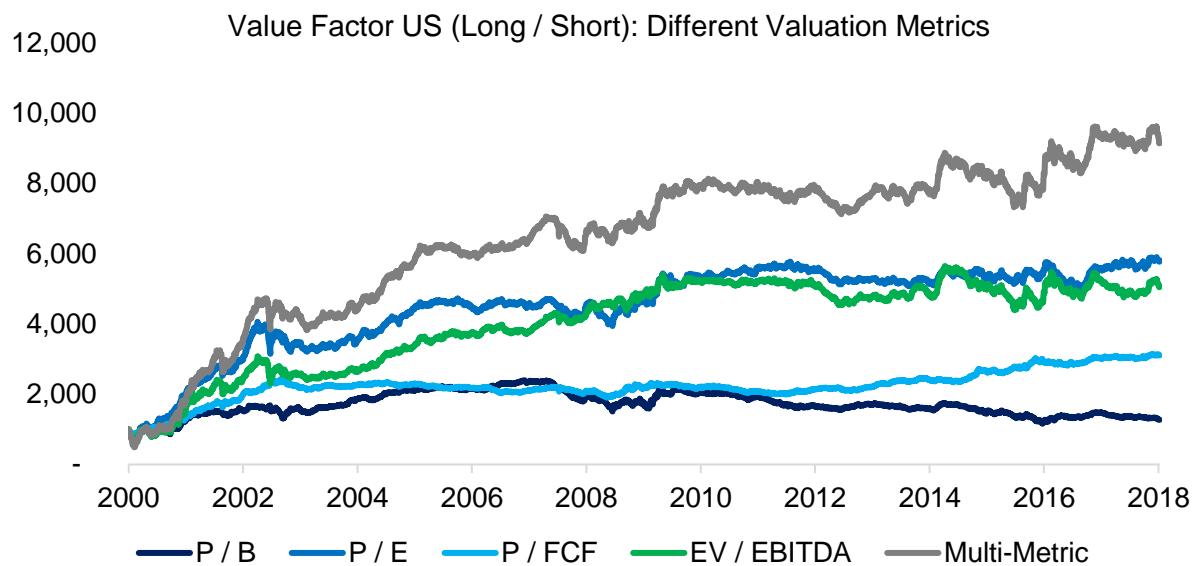
FURTHER THOUGHTS

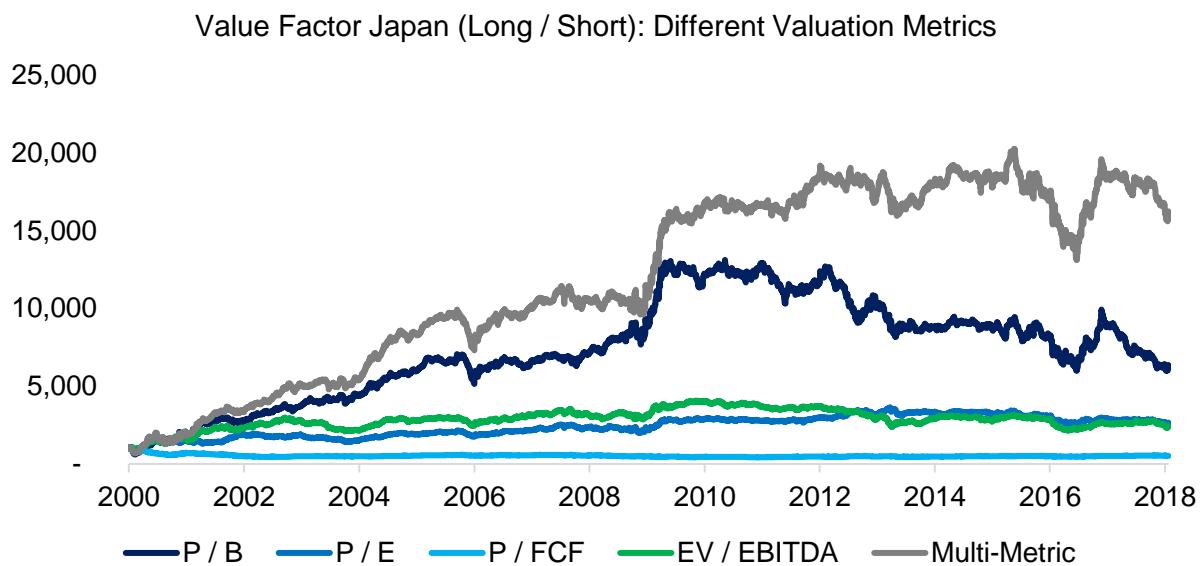
This research note highlights some of the choices investors have when defining value stocks. Value isn't necessarily dead — it all depends on how you measure it, when and where it is measured. This inconsistency suggests that value is merely "noisy," which is well-established. Moreover, the inconsistent performance of the valuation metrics across regions is somewhat surprising, but might be mitigated via a multi-metric approach. However, although combining multiple valuation metrics has generated relatively more attractive results across regions, the value factor performance was flat over the last 10 years. Naturally, investors can diversify across factors by creating multi-factor portfolios, allowing them to harvest returns from a variety of risk premia sources (please see our report: [Intersectional Model: Sorting by 7 Factors](#)).

LONG-SHORT RESULTS

A few key highlights between the long-only and the long/short analysis:

- Multi-metric is the most effective approach across the board.
- Price-to-book has been a poor performer for at least a decade
- Long-only and long-shorts results sometimes diverge





Source: FactorResearch

EQUITY FACTORS & INFLATION

Should Factor Investors Prefer Inflation or Deflation?

April 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor performance is impacted by inflation and deflation
- An inflationary environment is more attractive for most factors
- The change in inflation has been most meaningful for the Size factor

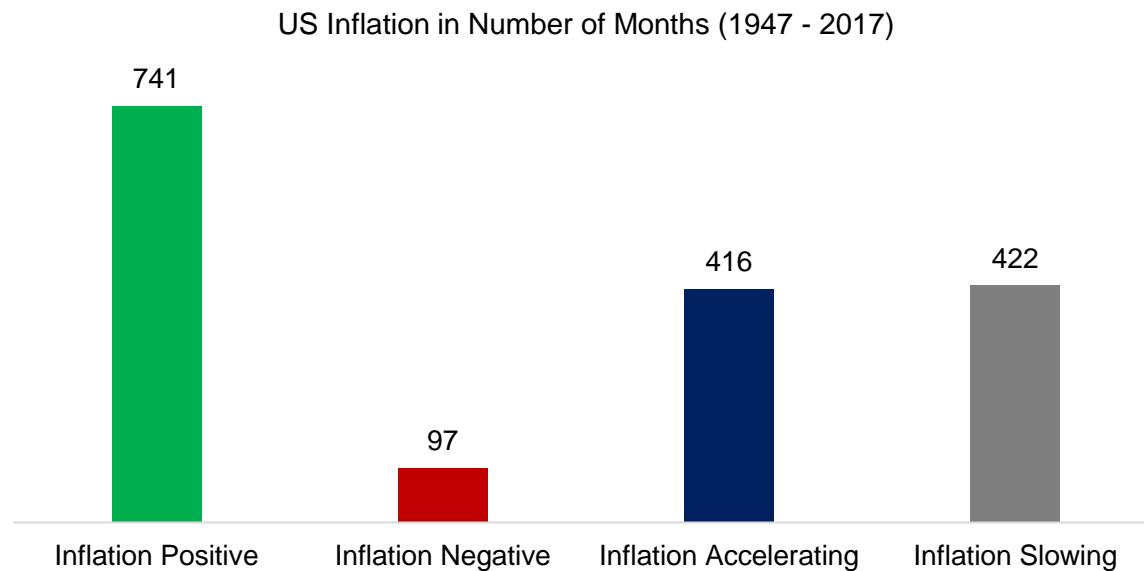
INTRODUCTION

We recently published a research note on the relationship between factor returns and real GDP growth ([Equity Factors & GDP Growth](#)), which highlighted that some factors exhibit pro-cyclical while others have anti-cyclical characteristics. The Value and Size factors showed strong returns when economic growth was high while the Quality and Growth factors performed best when real GDP declined. In another research note ([Factors & Interest Rates](#)) we observed that there are no consistent relationships between factor performance and interest rates. Given that we covered real GDP and interest rates, we are only missing inflation in terms of analysing the most important macroeconomic variables and their impact on factor performance. This short research note evaluates the relationship between equity factor returns and inflation in the US.

METHODOLOGY

We initially focus on the Value, Size and Momentum factors from Fama-French, which are constructed as dollar-neutral long-short portfolios based on the top and bottom 10% of the US stock market. The data includes companies with small market capitalisations, excludes transaction costs and is available since 1926. We expand the factor set by the Low Volatility, Quality, Growth and Dividend Yield factors based on our own data, which is available since 2000. These are created via long-short beta-neutral portfolios and only include stocks with a market capitalisation of larger than \$1 billion. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

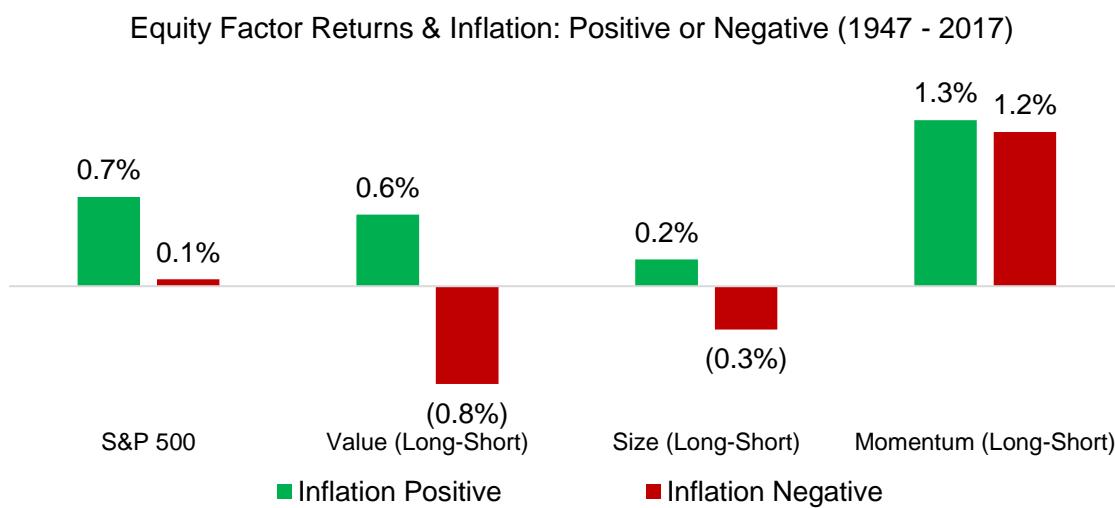
Inflation data is sourced from the Federal Reserve Bank of St. Louis and available since 1947. The chart below shows the number of months with positive and negative inflation as well as accelerating and decelerating inflation, which is defined as the last month divided by the average inflation of the previous 12 months. We can observe that more than 88% of the months showed positive inflation, likely reflecting the healthy economy and demographics of the US, and that the split between acceleration and slowdown was almost equal.



Source: Federal Reserve Bank of St. Louis, FactorResearch

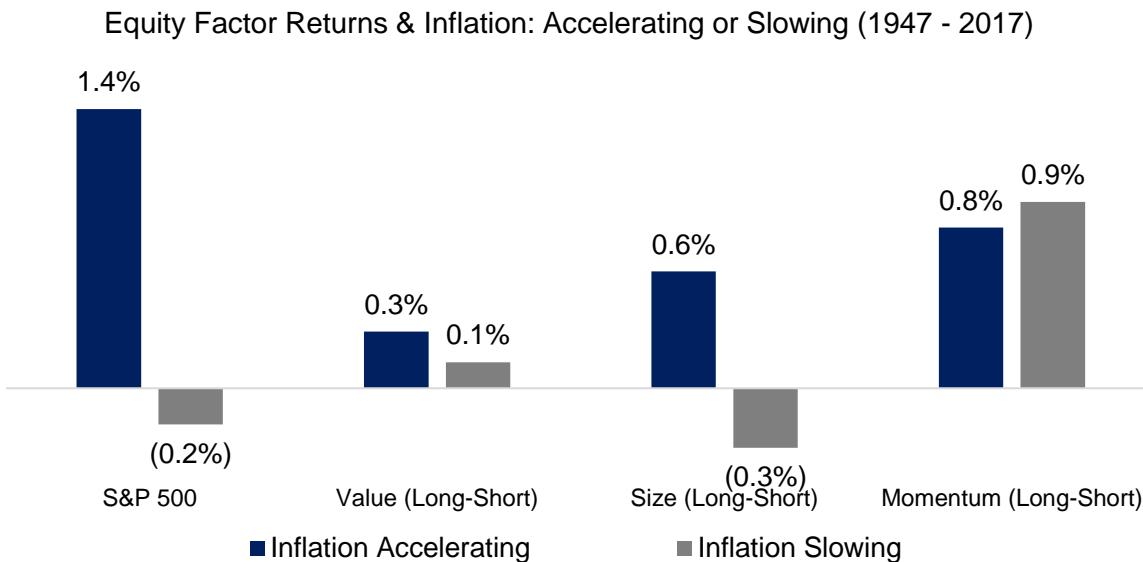
EQUITY FACTORS & INFLATION: 1947 – 2017

The chart below shows the returns of the S&P 500 and three factors (long-short) since 1947 sorted by positive and negative months of inflation. We can observe that equity markets as well as the Value and Size factors generated positive returns in periods of positive inflation, however, negative inflation led to negative returns for the two factors. Deflation likely occurs when the economy is slowing down or in a recession, which highlights the pro-cyclical characteristics of the Value and Size factors. The Momentum factor generated similar positive returns in inflationary and deflationary environments.



Source: Fama-French, Federal Reserve Bank of St. Louis, FactorResearch

Since 1947 the US had a long period of consistently rising inflation, which peaked above 10% per annum in the 1970s, and then declined slowly to the current levels of approximately 2%, supported by an inflation-targeting central bank. The chart below highlights the factor performance when the growth of inflation was accelerating and slowing down. We can observe that a slowdown in inflation generated negative returns for the Size factor as well as for the S&P 500.



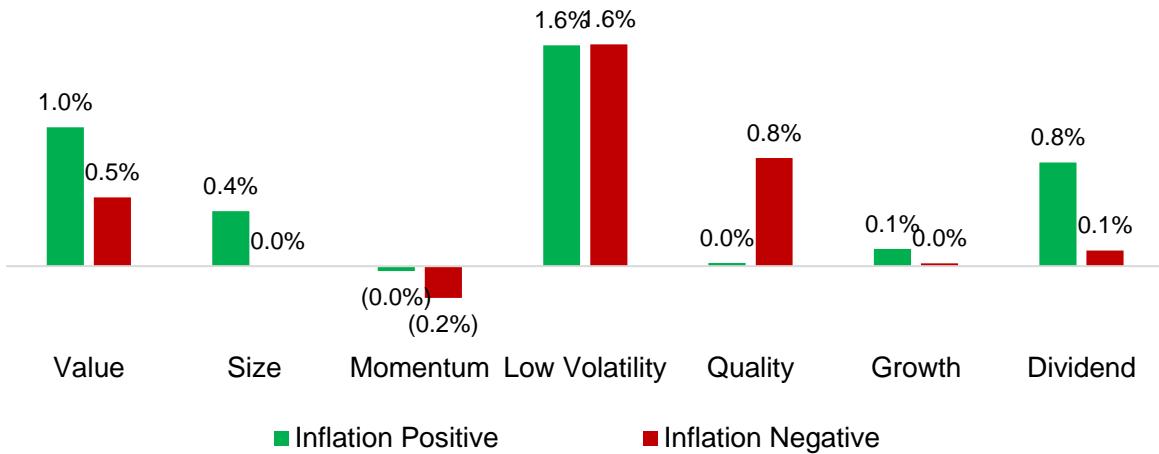
Source: Federal Reserve Bank of St. Louis, FactorResearch

The Size factor, i.e long small and short large caps, approximately mirrors the long upward and downtrend of inflation from 1963 to 2000. It is somewhat challenging to explain this relationship and there are multiple possible reasons, e.g. smaller companies might have been less affected by the dramatic changes in the oil price during that period compared to larger companies or might be better at adjusting to rapidly rising inflation from a revenue and cost perspective.

EQUITY FACTORS & INFLATION: 2000 – 2017

We can extend the analysis by adding additional factors, where data is available since 2000. The chart below shows the performance for seven factors from 2000 to 2017, which was quite heterogeneous when divided into periods of positive and negative inflation. Investors might have expected that the Low Volatility factor would generate higher returns in periods of deflation versus inflation as then interest rates would more likely to be decreasing than increasing, which is beneficial for the factor given its bond-proxy characteristics. However, the US central bank policy post the Global Financial Crisis has been unusual given quantitative easing and the link between inflation and interest rates has likely been weaker than historically.

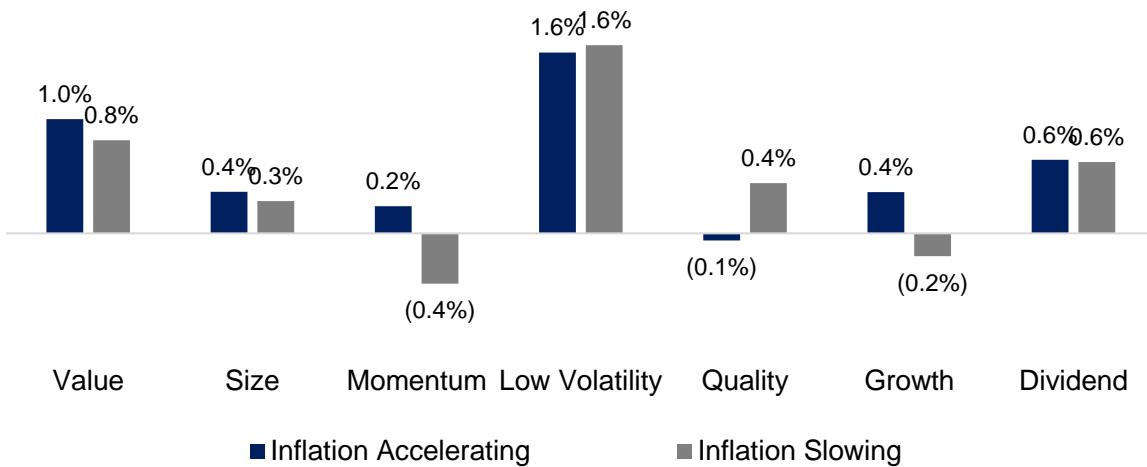
Equity Factor Returns (Long-Short) & Inflation: Positive or Negative (2000 - 2017)



Source: Federal Reserve Bank of St. Louis, FactorResearch

The chart below shows the factor performance in periods of acceleration and slowdown in inflation and no clear relationship emerges, which contrasts to the relationship with real GDP, which highlighted pro-cyclical and anti-cyclical characteristics.

Equity Factor Returns (Long-Short) & Inflation: Accelerating or Slowing (2000 - 2017)

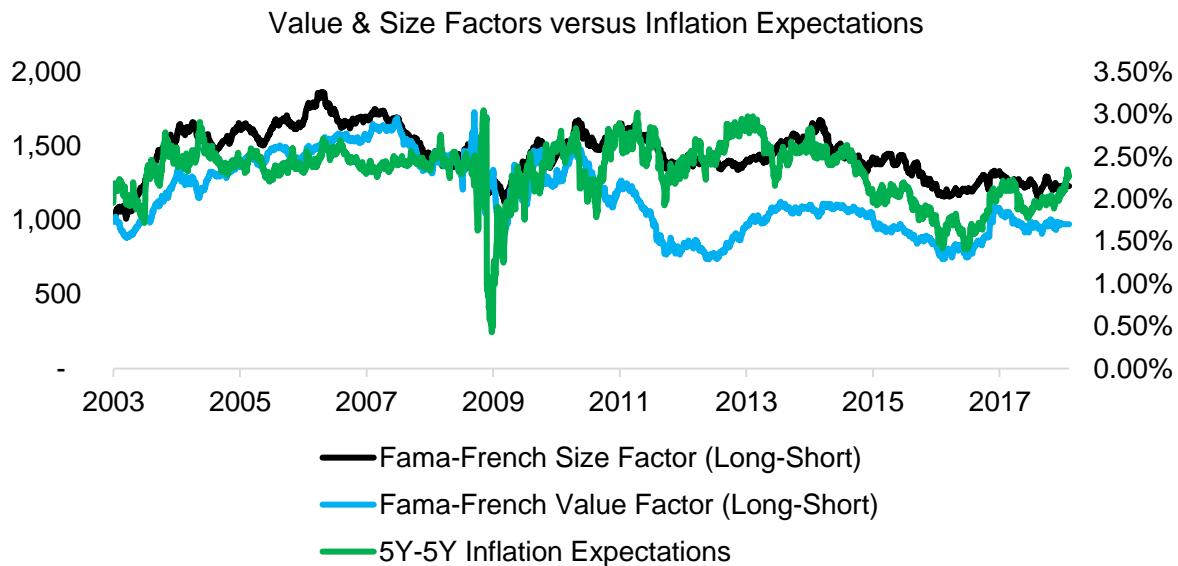


Source: Federal Reserve Bank of St. Louis, FactorResearch

INFLATION EXPECTATIONS

Economic data tends to get published long after the observation period and is often revised thereafter, which makes it less attractive for investment analysis. However, there are a few

forward-looking data sets like the 5 year-5 year inflation expectations, which highlights the expected average level of inflation over 5 years 5 years from today and is available on a daily basis. The chart below shows the Value and Size factors and inflation expectations and we can identify some similar trends. However, we can also observe that inflation expectations is not a leading, but more likely a coincident indicator of factor performance.



Source: Fama-French, Federal Reserve Bank of St. Louis, FactorResearch

FURTHER THOUGHTS

This short research notes highlights the performance of common factors in different periods of inflation, which shows that equity and factor investors should have a preference for inflation over deflation. Although inflation has increased recently across the global economy, deflation might be more likely in many countries given record of levels of debt and poor demographics. Naturally central banks will fight deflation, but it is challenging fighting a declining population with monetary policy as the experience in Japan shows.

VALUE FACTOR: IMPROVING THE TAX EFFICIENCY

Do Value Stocks Need to be Dividend-Yielding?

April 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The tax efficiency of the Value factor can be improved by reducing exposure to dividend-yielding stocks
- Improving the tax efficiency reduces the performance in Europe and Japan, but not in the US
- Reducing turnover can be considered for minimising capital gains and stamp duty taxes

INTRODUCTION

Tax is not a particular exciting dinner party topic, but is highly relevant for net investor returns. A UK-based investor buying Swiss quality stocks like the food company Nestle or the pharmaceutical company Novartis has to pay a 35% tax on dividends, which reduces the post-tax return significantly. Then there are also capital gains taxes and special taxes like stamp duty in countries like Hong Kong and Singapore, which incentivize investors to minimise portfolio turnover.

In factor investing, some strategies are more affected by taxes than others. Value stocks are often also high-yielding stocks, which makes them unattractive from a dividend tax perspective. In this short research note we aim to improve the tax-efficiency of the Value factor by decreasing the exposure to dividend-yielding stocks.

METHODOLOGY

We focus on the Value factor, which selects stocks based on a combination of price-to-book and price-to-earnings ratios, and the Dividend Yield factor, which ranks stocks by the current dividend yield. The factors are created via long-short beta-neutral portfolios based on the top and bottom 10% stocks in the US, Europe and Japan. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

Although this research note focuses on improving the tax efficiency of the Value factor, all returns are shown pre-tax as taxes tend to be different for institutional and retail investors, dependent where the dividend was incurred and where the investor is domiciled.

VALUE VERSUS DIVIDEND YIELD FACTOR

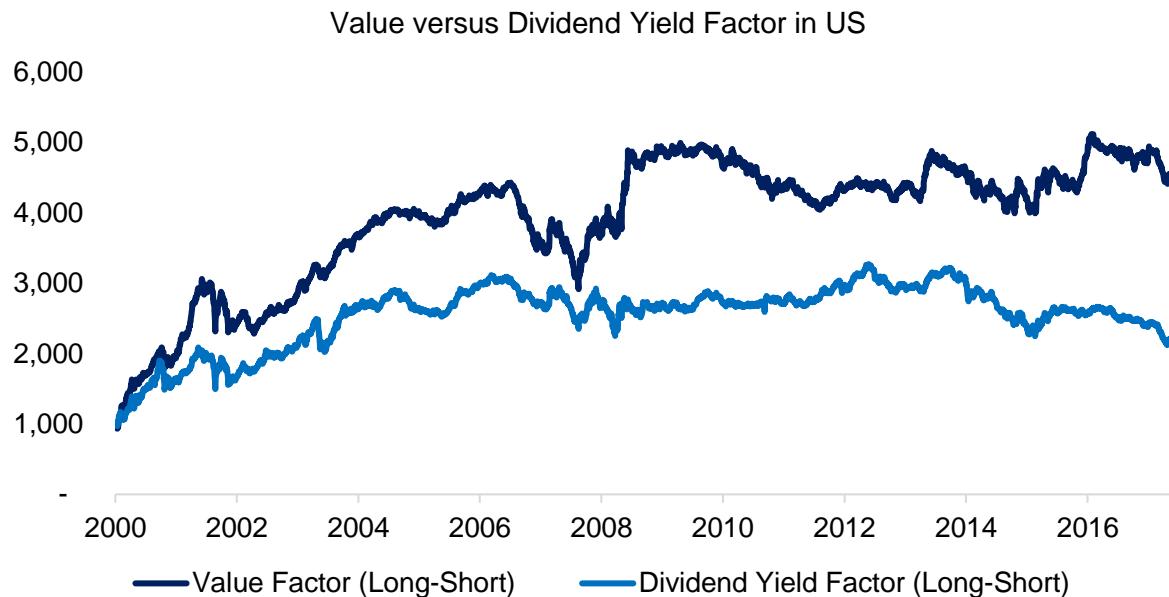
There are various ways of defining Value stocks and the most common metrics are likely price-to-book, price-to-earnings, price-to-cashflow and enterprise value-to-EBITDA. Dividend Yield is an alternative method for sorting cheap and expensive stocks, although it can be challenged as it is not a particularly precise reflection of a company's cashflow generation. The dividend depends on a company's payout ratio, which is typically below 100% of



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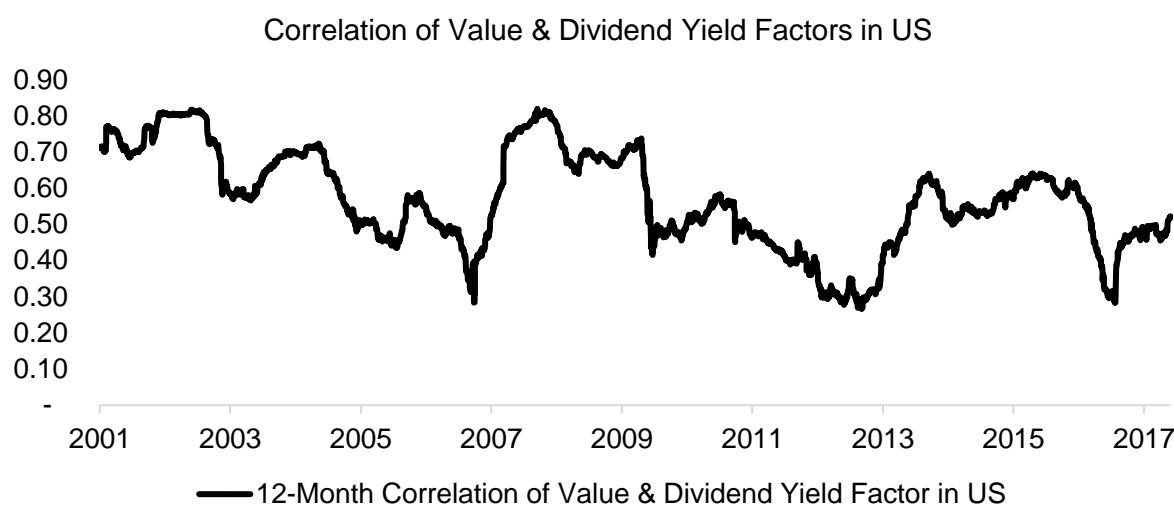
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earnings. However, there is still a strong relationship between the Value and Dividend Yield factors, which is highlighted in the chart below.



Source: FactorResearch

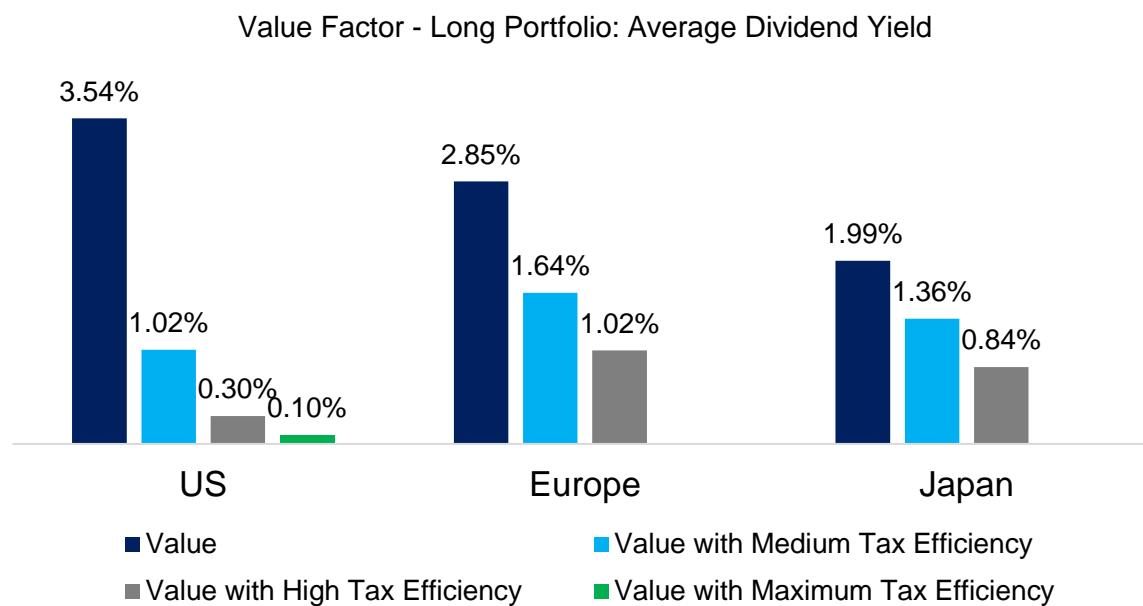
The chart below shows the correlation of the Value and Dividend Yield factors in the US, which highlights that the correlation is high on average, but has been decreasing since the turn of the century. Dividend Yield has likely become a less effective valuation metric in recent years as companies have increasingly used stock buybacks to return profits to shareholders.



Source: FactorResearch

VALUE FACTOR AND DIVIDEND YIELDS

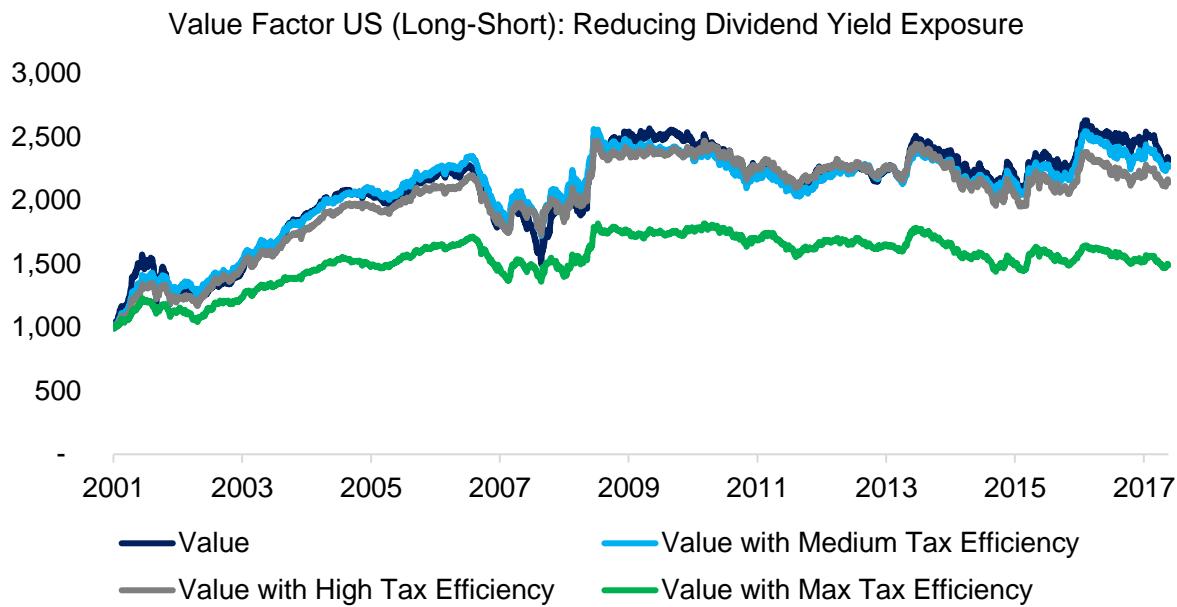
In order to improve the tax efficiency of the Value factor the exposure to dividend yielding stocks is reduced. The chart below shows the average dividend yield of the long portfolio of the Value factor and scenarios with higher tax efficiency, i.e. lower dividend yields, which results in higher post-tax returns. The scenario referenced as medium tax efficiency excludes the top 25% of highest yielding stocks, high tax efficiency the top 50% and maximum tax efficiency the top 75%. It is worth highlighting that excluding all stocks that pay dividends is challenging as there are few stocks that are cheap and pay no dividend, especially in Europe and Japan, which is why there is no maximum tax efficiency scenario for these two regions. There is no taxation of dividends derived from the short portfolio of the factor, which need to be paid to the lender of shares.



Source: FactorResearch

VALUE FACTOR IN US: IMPROVING THE TAX EFFICIENCY

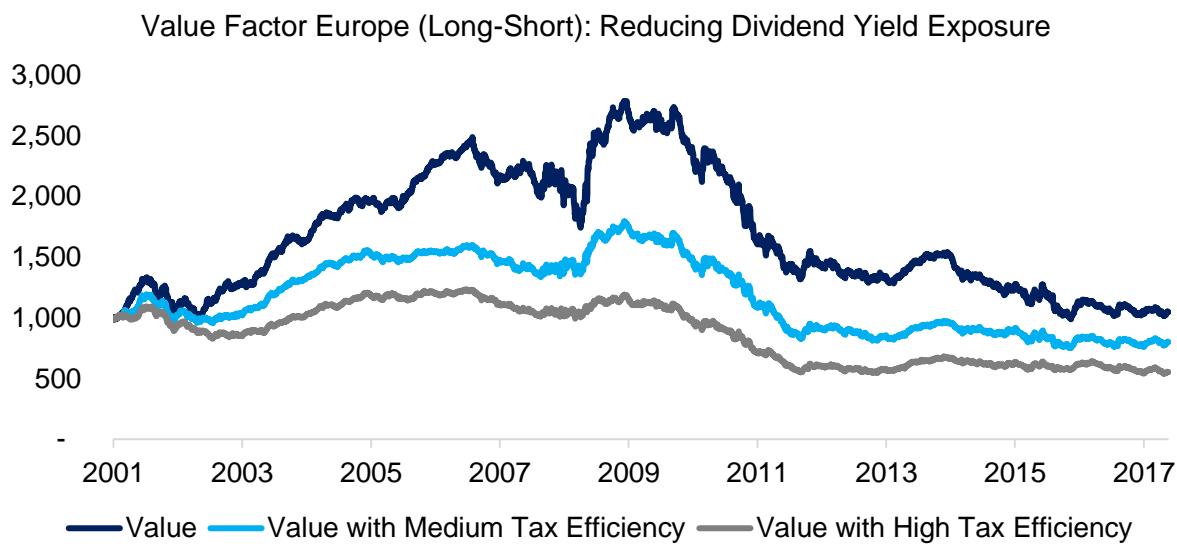
The chart below shows the performance of the Value factor and scenarios with improved tax efficiency. We can observe that the scenarios with medium and high tax efficiency are almost identical to the base case, which implies that there are sufficient stocks that are cheap and feature a low or zero dividend yield. However, the maximum tax efficiency scenario, which features mostly stocks with no dividends, e.g. Berkshire Hathaway, is significantly lower. It is worth highlighting that the performance of the scenarios with improved tax efficiency is understated as they are shown pre-tax, i.e. the performance post-tax would be higher. Naturally this depends on the taxation of the investor.



Source: FactorResearch

VALUE FACTOR IN EUROPE: IMPROVING THE TAX EFFICIENCY

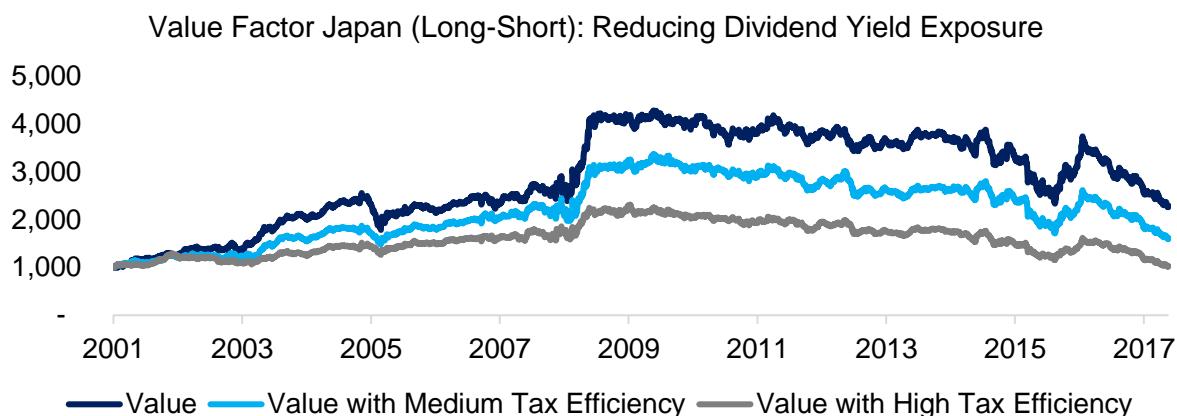
The performance of the Value factor scenarios in Europe are more heterogeneous compared to the US. The results highlight that reducing the exposure to dividend-yielding stocks in Europe has a negative impact on performance, which implies that cheap stocks tend to feature high dividend yields. The universe of stocks in Europe is approximately 30% of the US, therefore there is less choice in stock selection.



Source: FactorResearch

VALUE FACTOR JAPAN: IMPROVING TAX EFFICIENCY

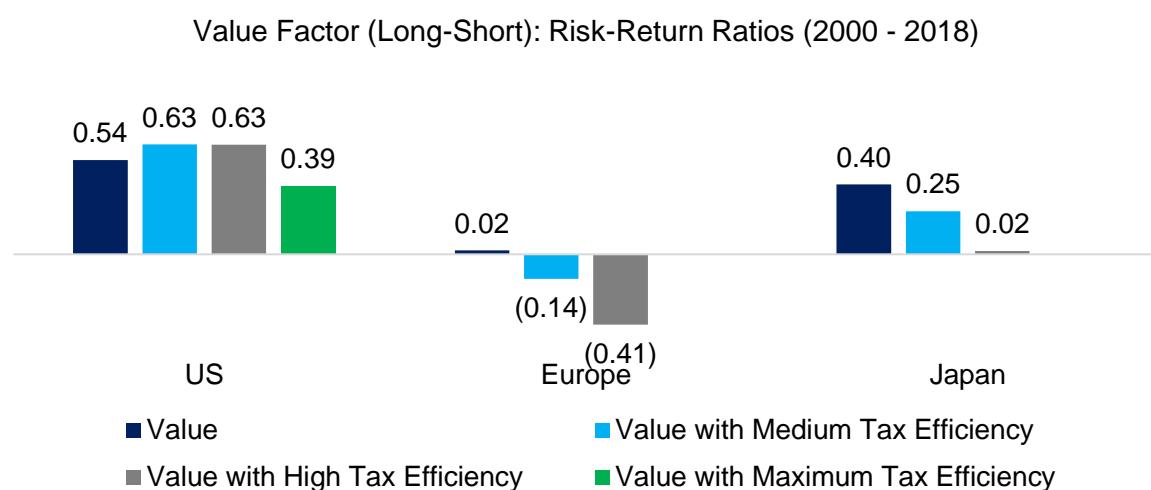
The results in Japan are comparable to Europe, i.e. reducing the exposure to dividend-yielding stocks decreases the performance of the Value factor significantly. It is worth highlighting that most companies in Japan and Europe pay dividends while in the US a significant portion of the stock universe does not, which can be partially explained by the large amount of Technology stocks in the US.



Source: FactorResearch

RISK-RETURN RATIOS

In addition to analysing the performance of the Value factor scenarios we can show the risk-return ratios, which improve with higher tax efficiency in the US and decrease in Europe and Japan. On a post-tax basis the ratios of the scenarios with improved tax efficiency would be higher, but unlikely more attractive than the base case in Europe or Japan.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights that the Value factor can be improved by reducing the exposure to dividend-yielding stocks, albeit not in every region. Investors can also contemplate reducing capital gains or stamp duty taxes by decreasing the portfolio turnover, which may be achieved by rebalancing less frequently (please see our report [Factor Portfolios: Turnover Analysis](#)) or changing factor definitions. Tax-optimisation is a complex subject, but worth pursuing as the gains can be substantial.

LOW VOLATILITY FACTOR: INTEREST RATE-SENSITIVITY & SECTOR-NEUTRALITY

Are Low Vol Stocks Bond Proxies?

April 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The interest rate-sensitivity of the Low Volatility factor has increased in recent years
- Mainly due to the sectoral biases from the long portfolio
- Sector-neutrality reduces the interest rate-sensitivity, albeit at the cost of performance

INTRODUCTION

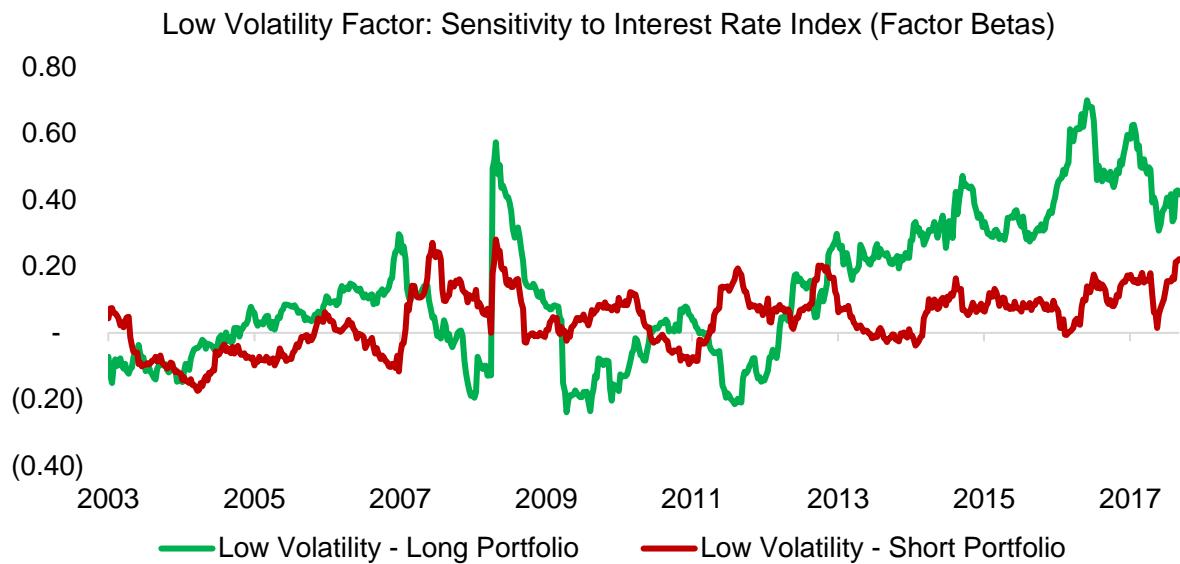
Low Volatility strategies have become popular over recent years and become a staple in factor portfolios. From a classic financial theory perspective the strategy is somewhat problematic as it undermines the expectation that higher risks are rewarded by higher returns. However, academics and investors have provided a theoretical foundation by explaining the positive excess returns with investor lottery preferences and restrictions on leverage. One frequent criticism is that low volatility stocks are bond proxies as these stocks tend to be stable businesses with significant amounts of leverage. In this short research note we will analyse the interest rate sensitivity of the Low Volatility factor in the US and evaluate a sector-neutral approach.

METHODOLOGY

We focus on the Low Volatility factor, which selects stocks based on their volatility over the last 12 months. The long portfolio includes stocks that exhibit low volatility while the short portfolio is comprised of highly volatile stocks. The factor is created by constructing a long-short beta-neutral portfolio of the top and bottom 10% of stocks of the US stock market. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction incurs costs of 10 basis points.

INTEREST RATE SENSITIVITY OF THE LOW VOLATILITY FACTOR

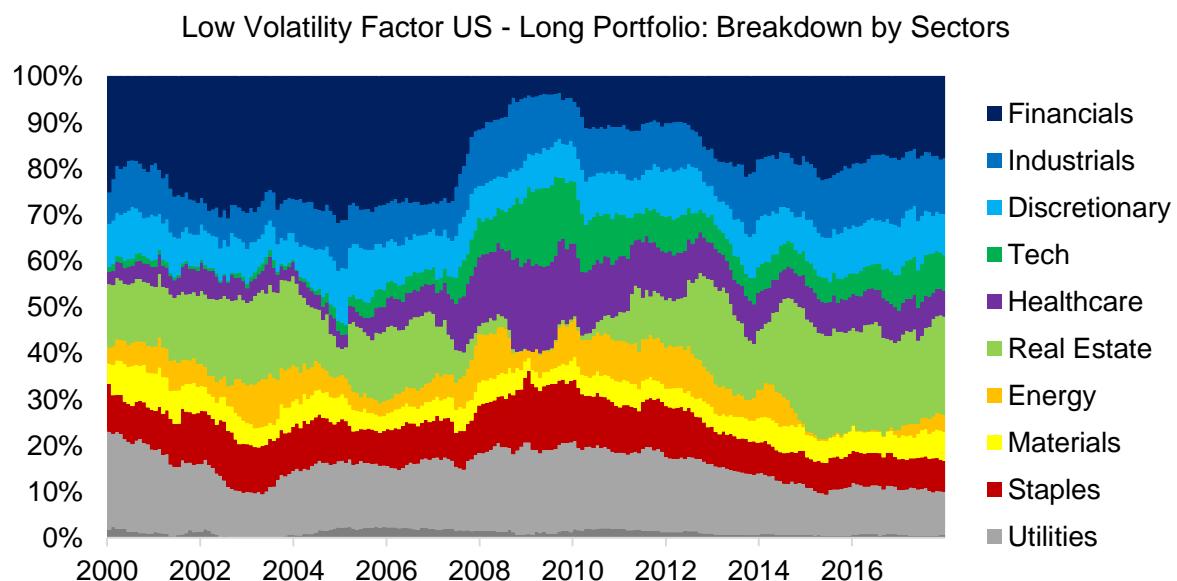
The chart below highlights the factor betas of the long and short portfolios of the Low Volatility factor to an interest rate index, specifically the iShares 7-10 Year Treasury Bond ETF, which were derived from a regression analysis with a one-year lookback. We can observe that the factor betas of the long portfolio have been zero on average from 2003 to 2011 and since then been gradually rising, which highlights that the performance of the long portfolio in recent years can be partially explained by changes in interest rates. Naturally this period is characterised by decreasing interest rates due to quantitative easing of central banks, which likely explains the stellar performance of the Low Volatility factor in the period. The short portfolio does not highlight any sensitivity to interest rates.



Source: Ishares, FactorResearch

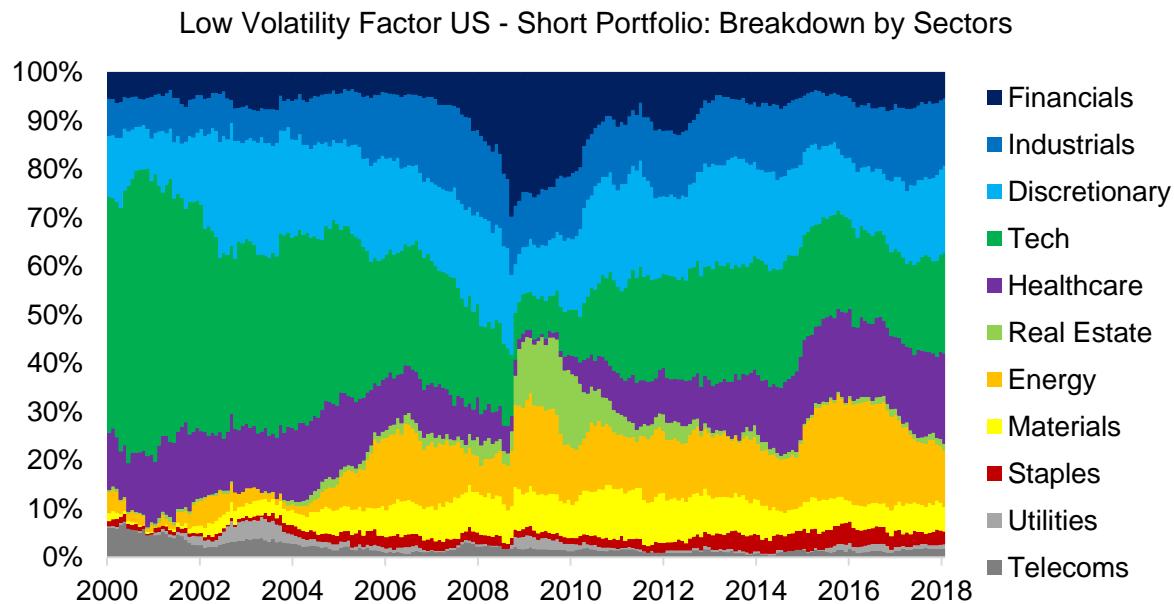
LOW VOLATILITY FACTOR: BREAKDOWN BY SECTORS

Given that the long portfolio of the Low Volatility factor highlighted a sensitivity towards interest rates it is interesting to analyse the sectoral composition. We can observe a relatively diversified portfolio with Financials, Real Estate and Utilities being the largest sectors. The latter two are highly interest rate-sensitive sectors as these contain companies with significant amounts of debt, i.e. decreasing interest rates increase earnings and vice versa.



Source: FactorResearch

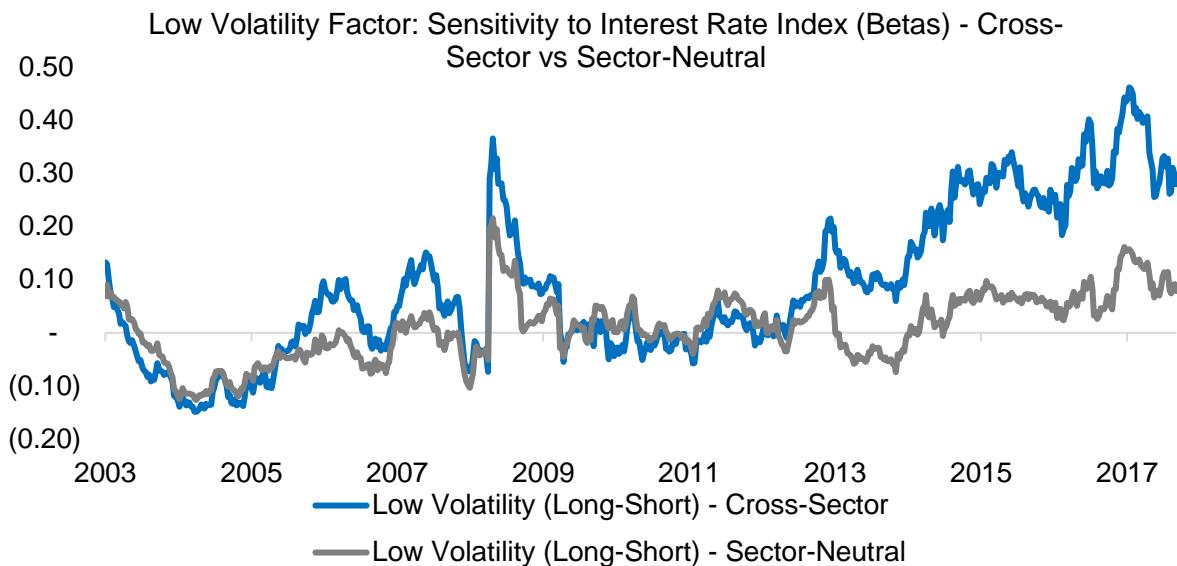
The short portfolio also highlights a relatively diversified portfolio with the Industrials, Discretionary, Technology and Healthcare sectors contributing most stocks. None of these sectors is particular interest rate-sensitive, e.g. Technology stocks tend to have low leverage and Healthcare stocks are more impacted by their product pipeline and changes in regulations.



Source: FactorResearch

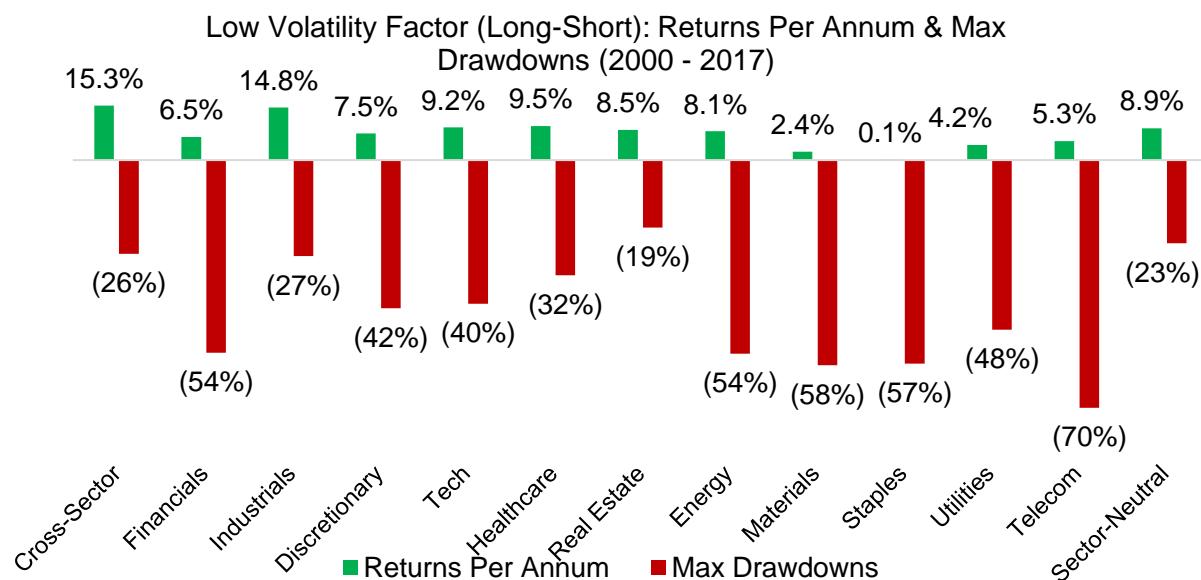
LOW VOLATILITY FACTOR: CROSS-SECTOR VERSUS SECTOR-NEUTRAL

Some research suggests that the interest rate-sensitivity is mainly due to the large sector biases in the long and short portfolios, which could be mitigated by creating a sector neutral-portfolio. The chart below shows the factor betas of the cross-sector and sector-neutral Low Volatility factors. We can observe that sector-neutrality indeed lowers the interest rate-sensitivity, which can be considered an undesired risk exposure from a portfolio perspective.



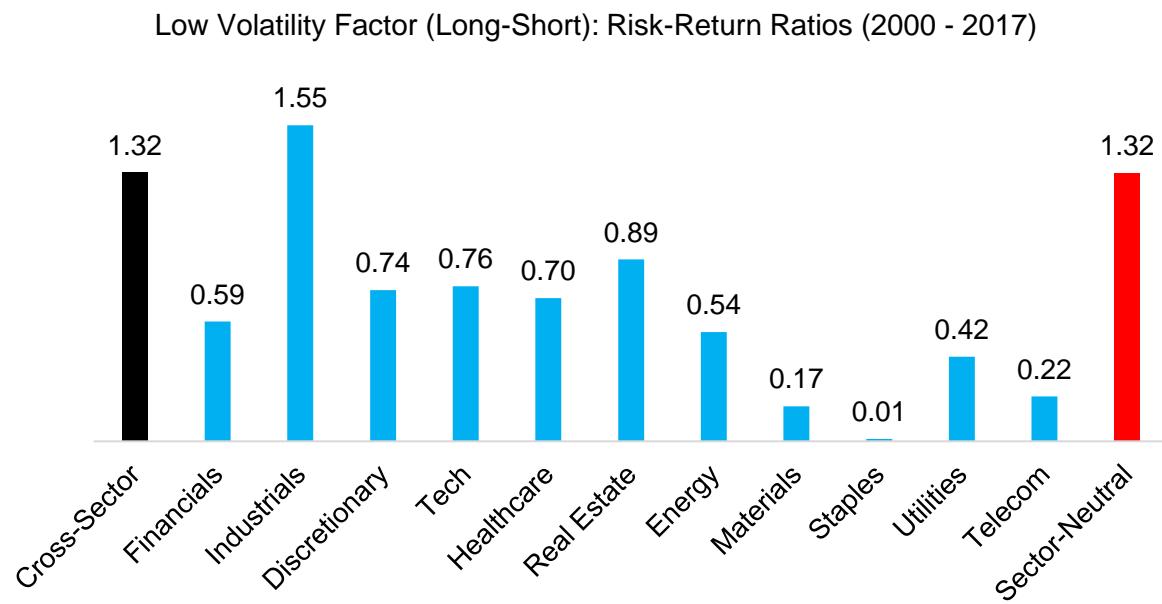
Source: FactorResearch

However, there are few free lunches in finance and introducing sector-neutrality may impact the performance and risk-metrics of the Low Volatility factor. The analysis below highlights the returns per annum and maximum drawdowns of the cross-sector, intra-sector and sector-neutral Low Volatility factors (long-short) from 2000 to 2017. We can observe that the maximum drawdowns of the intra-sector portfolios were much larger than those of the cross-sector and sector-neutral portfolios. The returns per annum of the sector-neutral portfolio were also significantly lower than that of the cross-sector portfolio, despite having comparable maximum drawdowns.



Source: FactorResearch

Finally we can compare the risk-return ratios, which highlights similar ratios for the cross-sector and sector-neutral portfolios. The ratios for the intra-sector portfolios are quite diverse and should be regarded with caution as some sectors, e.g. Telecoms, contain few constituents, which implies more firm-risk than factor exposure due to small portfolios.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the interest rate-sensitivity of the Low Volatility factor and shows how a sector-neutral portfolio reduces that sensitivity, albeit at the cost of lower performance. Investors should regard the interest rate-sensitivity as undesirable risk as otherwise the factor exposure becomes a partial speculation on the direction of interest rates, which is an area where few investors succeed.

SMART BETA OR SMART MARKETING?

The Unusual Choices of Evidence-based Investors.

April 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This article was originally published at Investments & Pensions Europe (IPE).

SUMMARY

- Smart beta ETF investors seem to ignore empirical evidence
- Excess returns from smart beta are substantially different from factor returns
- Smart beta ETFs offer little diversification for an equity-centric portfolio

INTRODUCTION

Assets under management in smart beta products surpassed \$1 trillion in 2017, according to Morningstar. That was three years earlier than predicted by BlackRock, the single largest issuer of smart-beta exchange-traded funds (ETFs).

Investors have not only embraced smart-beta products, which are long-only portfolios with factor tilts, but also allocated billions to long-short factor products. However, despite the enthusiasm shown for smart-beta ETFs, several concerns remain about the products and how investors are using them.

This article addresses four key challenges of smart-beta products:

- First, the difference between investor interests and empirical evidence
- Second, the gulf between simplicity and complexity
- Third, the gap between realised versus expected returns
- Finally, the difference between investors' objectives and product characteristics

INVESTOR INTERESTS VERSUS EMPIRICAL EVIDENCE

Smart beta is based on factor investing, which has its foundation in the work of Eugene Fama and Kenneth French. In a seminal 1993 paper they explained equity returns in terms of market risk in combination with the Value and Size factors. Since then, their work has been replicated across time, countries and various asset classes. Other factors such as Momentum and Low Volatility have also gained support from academic researchers and finance professionals.

However, if the assets under management in smart-beta ETFs are analysed it becomes apparent that allocations are spread among both the well-established factors and factors that are less, if at all, supported by empirical evidence.

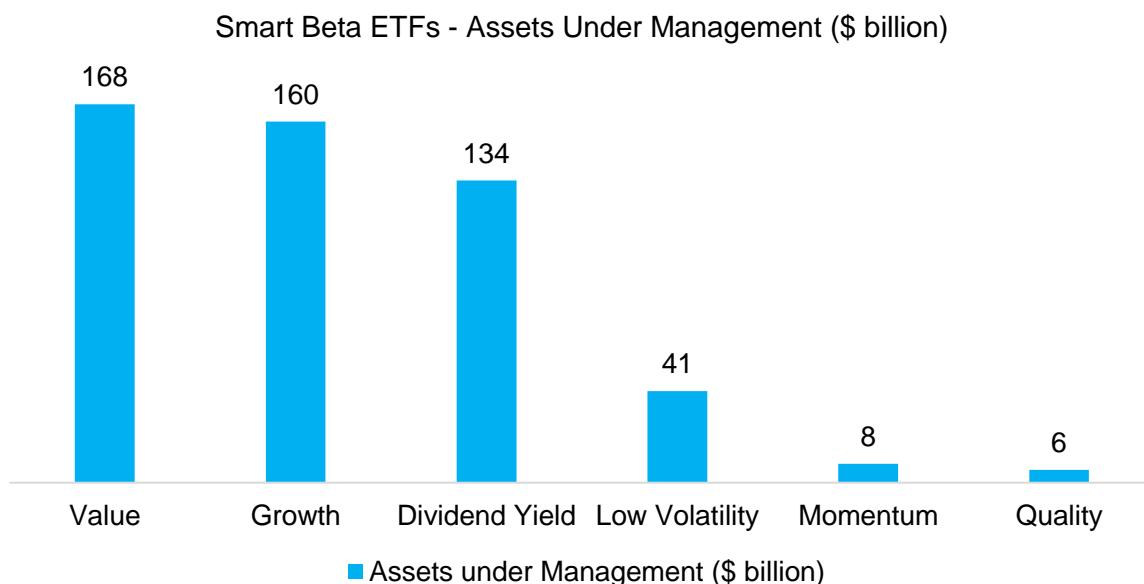
The chart below shows the assets under management in smart-beta products as of early 2018, highlighting that investors have allocated almost equally to both the Value and Growth factors. That is despite hardly any empirical evidence suggesting excess returns from the Growth factor are positive.



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Moreover, Growth and Value tend to be negatively correlated, which implies that if value stocks show structural positive returns, then growth stocks are likely to generate negative excess returns over time.



Source: ETF.com, FactorResearch

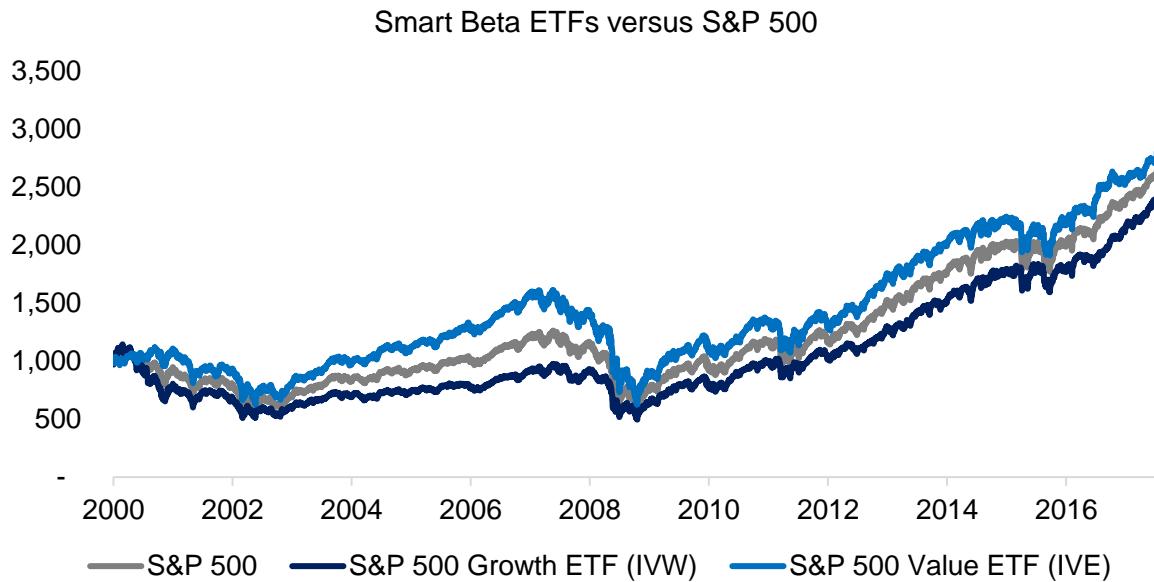
Surprisingly, there are hardly any assets allocated to the Momentum factor, despite a significant amount of empirical evidence suggesting this factor generates attractive returns. Some research even suggests that the Momentum factor yields the highest returns of all factors over time.

Investors who consider smart-beta products to be part of their investible universe are likely to base that decision on the empirical research of factor investing. It is therefore somewhat perplexing that actual allocations seem unrelated to the results of empirical research.

SIMPLICITY VERSUS COMPLEXITY

The success of smart-beta ETFs can be explained by their foundation in solid academic research, low fees and transparency. They are much easier to analyse than mutual funds as their strategy is clearly defined, the complete holdings tend to be available on the websites of the issuers for immediate download, and they are exchange-traded instruments. As such, the simplicity of smart-beta ETFs is a winning formula.

However, from a performance contribution perspective, smart-beta ETFs are not that simple and can be considered an unusual choice for harvesting factor returns. The chart below shows the performance of the S&P 500 versus the two largest smart-beta ETFs in the US. We can observe that while the Value smart-beta ETF has outperformed the S&P 500 and the Growth smart beta ETF since 2000, they are shown to be highly correlated.



Source: BlackRock, FactorResearch

Investors are likely to be challenged on a daily basis to explain if the positive or negative performance of their smart-beta ETFs can be explained by the beta or the factor. A more transparent investment strategy would be an allocation to the S&P 500, which can be achieved via an ETF at almost zero cost today, and a long-short factor portfolio.

Until a few years ago there were few ways available for investors to access factor returns directly. However, after the financial crisis most investment banks created risk premia desks, which allow institutional investors to buy long-short factor portfolios at competitive prices.

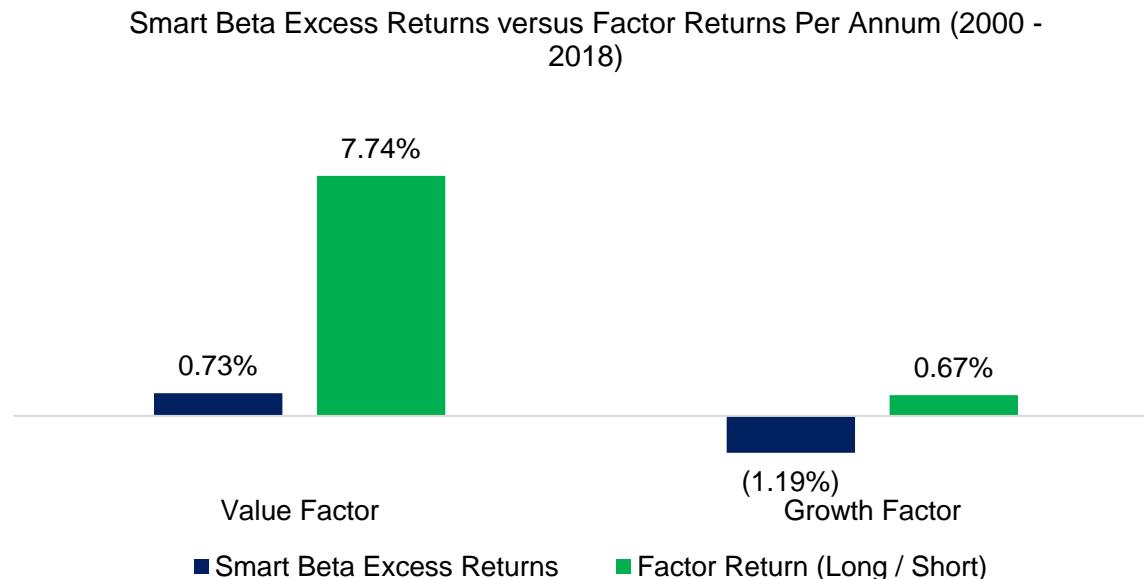
More recently, long-only factor futures have been launched for European and US stock markets. Such derivatives can be used efficiently to create long-short factor exposure by combining them with a short position in the index future. In the US, investors can even purchase long-short factor ETFs, even though these have relatively low assets under management.

Naturally, some investors are constrained from buying products with short positions. But this should be reconsidered, given that there are now more investible products that simplify factor investing.

REALISED VERSUS EXPECTED RETURNS

Investors allocating to smart-beta ETFs are likely to have consumed some of the research on factor investing and reasonably expect that they are able to harvest these factor returns, at least partially. However, it is worth highlighting that there is a significant difference between realised smart-beta excess returns and returns from theoretical long-short portfolios. The chart below shows the excess returns per year from the largest Value and Growth smart beta ETFs which were all issued in 2000. They therefore have the longest trading history of smart-beta ETFs as well as the theoretical factor returns. It is possible to

observe that investors' return expectations based on academic research would not have been fulfilled by investing in smart-beta ETFs.



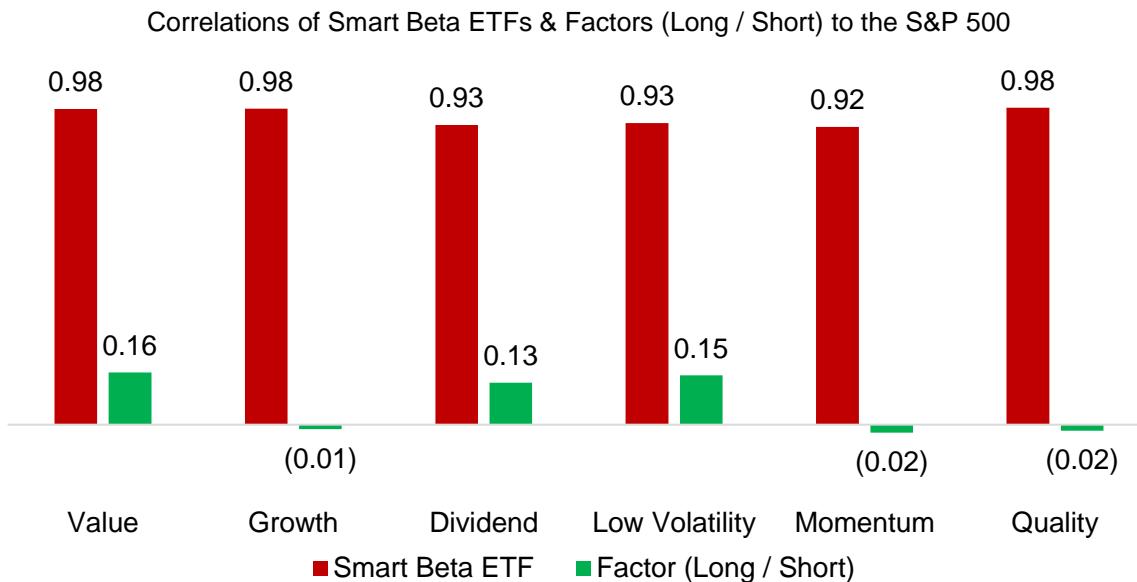
Source: BlackRock, FactorResearch

The discrepancy in returns can likely be explained by the different portfolio construction. Smart-beta ETFs are essentially index trackers with factor tilts that are expressed in slight overweight and underweight positions. Long-short factor portfolios are created by taking the top and bottom of stocks ranked by factors, which results in more extreme portfolios.

INVESTOR OBJECTIVES VERSUS PRODUCT CHARACTERISTICS

The FTSE Russell's 2017 Smart Beta Investor Survey highlighted that the most important objective for allocating to smart beta strategies was risk reduction, followed by return enhancement. However, given that smart-beta ETFs are effectively long-only products with slight factor tilts, diversification benefits and an associated risk reduction are likely to be limited.

The chart below shows the correlations of the largest smart beta ETFs and long-short factors for the well-known factors in the US stock market to the S&P 500. The long-short factors are created by constructing beta-neutral portfolios by ranking the top and bottom 30% of the US stock universe by the factors, which are defined in line with academic and industry standards. The analysis highlights that the smart-beta correlations to the S&P 500 are well above 0.9, indicating limited risk reduction potential.



Source: FactorResearch

As expected, the correlations of the long-short factors to the S&P 500 are almost zero. This makes these much more attractive additions to an equity-centric portfolio from a diversification and risk reduction perspective.

FURTHER THOUGHTS

Despite these challenges, smart-beta products remain a useful addition to the investment universe as they are mainly being used to replace core mutual funds, which is forcing active fund managers to reduce fees on these. Costs have a significant impact on returns, especially over the medium to long term, and from that perspective, smart-beta ETFs are a smart choice.

Having said this, investing should not be so complicated, and investors should have the opportunity to buy long-short factor exposure from various providers as efficiently as long-only exposure. It looks likely there will be more product launches that empower investors to directly harvest factor returns transparently and cost-efficiently.

FACTOR OLYMPICS Q1 2018

And the Winner is...

April 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- 2018 started negative for the majority of factors
- Momentum, Quality and Growth showed the strongest performance
- Low Volatility, Dividend Yield and Value generated negative returns

INTRODUCTION

We present the performance of seven well-known factors on an annual basis for the last 10 years and the first quarter 2018. It is worth mentioning that not all factors have strong academic support, e.g. Growth lacks a long-term track record of positive excess returns; however, is still a widely-followed investment style.

METHODOLOGY

The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks in the US, Europe and Japan and 20% in smaller markets. Only stocks with a minimum market capitalisation of \$1 billion are included. Portfolios rebalance monthly and transactions incur 10 basis points of costs. Please see our Factor Guide for the factor definitions.

FACTOR OLYMPICS (LONG / SHORT): GLOBAL

The table below shows the factor performance for the last 10 years ranked top to bottom. The global series is comprised of all developed markets in Asia, Europe and the US. Aside from displaying the factor performance the analysis highlights the significant factor rotation in terms of profitability from one year to the next.

The first quarter of 2018 shows a continuation of 2017, i.e. risk-off factors like Quality and Growth generated positive while risk-on factors like Size and Value generated negative returns. Momentum, which has a large bias towards the Technology sector in the long portfolio, is leading factor performance. It is worth highlighting that negative returns for the multi-factor portfolio, which allocates equally across the seven factors, are relatively rare.

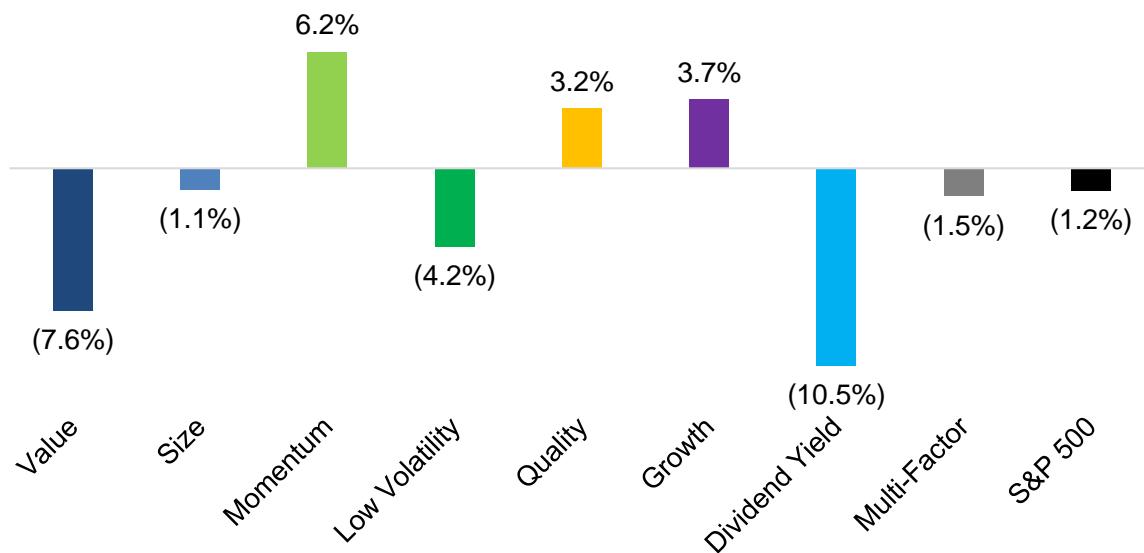
Factor Olympics (Long / Short): Global											
Positive Returns	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 Q1
	Dividend Yield 9.0%	Value 28.2%	Quality 7.4%	Low Volatility 24.4%	Low Volatility 17.5%	Low Volatility 20.4%	Low Volatility 29.4%	Momentum 26.9%	Dividend Yield 14.3%	Quality 15.5%	Momentum 5.0%
	Low Volatility 6.7%	Size 16.1%	Low Volatility 6.5%	Momentum 14.9%	Momentum 11.0%	Momentum 14.1%	Value 4.3%	Low Volatility 18.7%	Value 13.9%	Growth 14.8%	Quality 3.1%
	Value 5.5%	Dividend Yield 11.8%	Size 6.3%	Growth 14.1%	Multi-Factor 3.8%	Quality 9.7%	Multi-Factor 4.2%	Growth 15.7%	Size 8.3%	Momentum 10.5%	Growth 3.1%
	Quality 3.7%	Growth 10.9%	Growth 5.2%	Quality 10.6%	Size 2.9%	Multi-Factor 6.5%	Dividend Yield 3.1%	Quality 12.4%	Low Volatility 5.2%	Low Volatility 7.3%	Low Volatility 0.2%
	Size 1.8%	Quality 6.0%	Multi-Factor 4.4%	Multi-Factor 7.4%	Dividend Yield 1.1%	Dividend Yield 3.5%	Quality 0.5%	Multi-Factor 8.1%	Multi-Factor 3.3%	Multi-Factor 4.6%	Multi-Factor 0.2%
	Multi-Factor 1.7%	Multi-Factor 2.3%	Dividend Yield 4.3%	Dividend Yield 2.5%	Quality 0.0%	Size 2.7%	Momentum 0.1%	Size 4.7%	Quality 0.2%		
			Momentum 3.4%								
Negative Returns	Momentum (4.6%)	Low Volatility (15.2%)	Value (2.4%)	Size (3.6%)	Value (11.0%)	Growth (4.9%)	Size (3.2%)	Dividend Yield (10.4%)	Growth (8.6%)	Size (0.5%)	Size (0.3%)
	Growth (10.5%)	Momentum (41.4%)							Momentum (10.2%)	Dividend Yield (6.3%)	Multi-Factor (0.5%)
Market	2008 (38.2%)	2009 28.7%	2010 9.8%	2011 (6.2%)	2012 17.6%	2013 32.2%	2014 9.7%	2015 3.8%	2016 7.9%	2017 18.3%	2018 (2.8%)

Source: FactorResearch

FACTOR PERFORMANCE 2018 Q1: US

The table above reflects the global factor performance and it is interesting to analyse how homogeneous the performance is across regions. The global performance is significantly weighted towards the US, so it is not surprising that factor performance in the US in Q1 2018 is very similar to the global returns. The Low Volatility factor exhibits interest rate-sensitivity and has been negatively impacted by rising interest rates in the US.

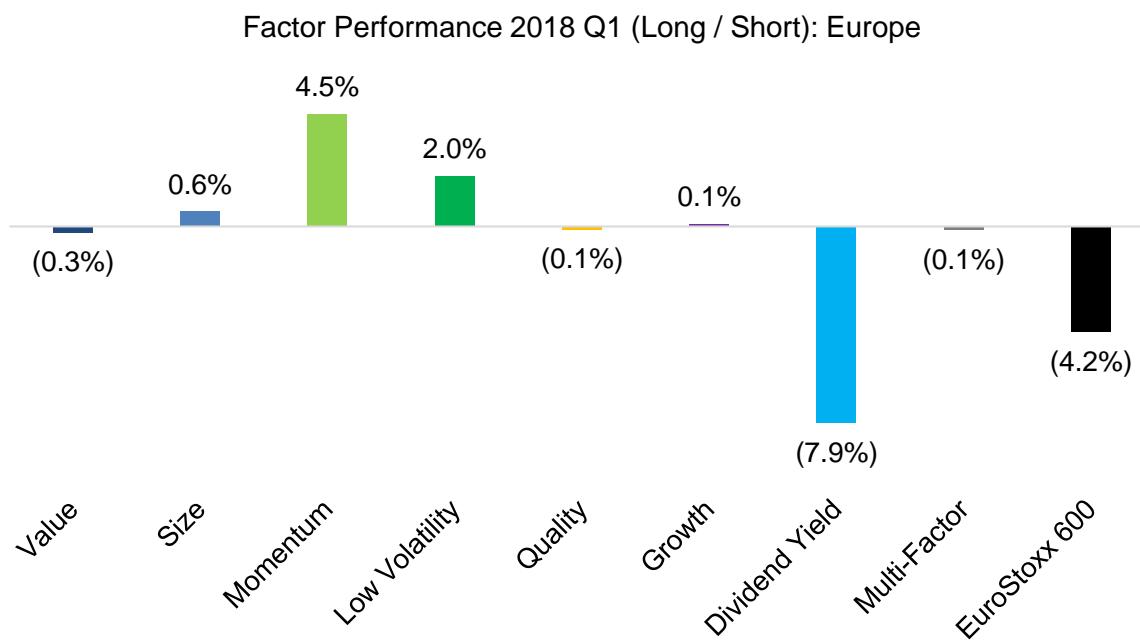
Factor Performance 2018 Q1 (Long / Short): US



Source: FactorResearch

FACTOR PERFORMANCE 2018 Q1: EUROPE

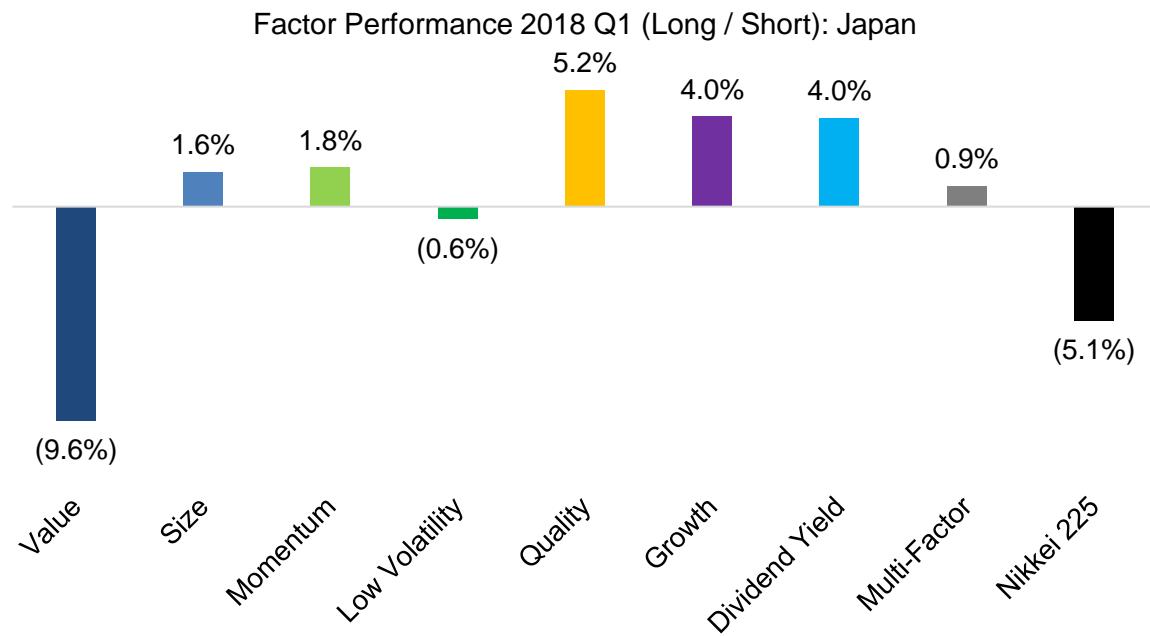
The factor performance in Europe is similar to the US, but somewhat less extreme in either direction. A key discrepancy is the performance of the Low Volatility factor, which is negative in the US while positive in Europe. Perhaps this reflects investors expectations of interest rates rising faster in the US compared to Europe.



Source: FactorResearch

FACTOR PERFORMANCE 2018 Q1: JAPAN

Factor performance in Japan is comparable to the US and Europe. The largest discrepancy is the Dividend Yield factor, which was positive in Japan while negative in the two other regions. The factor generated a much more attractive performance over the last two decades in Japan than on a global basis, which we highlighted in our report Resist the Siren Call of High Dividends.

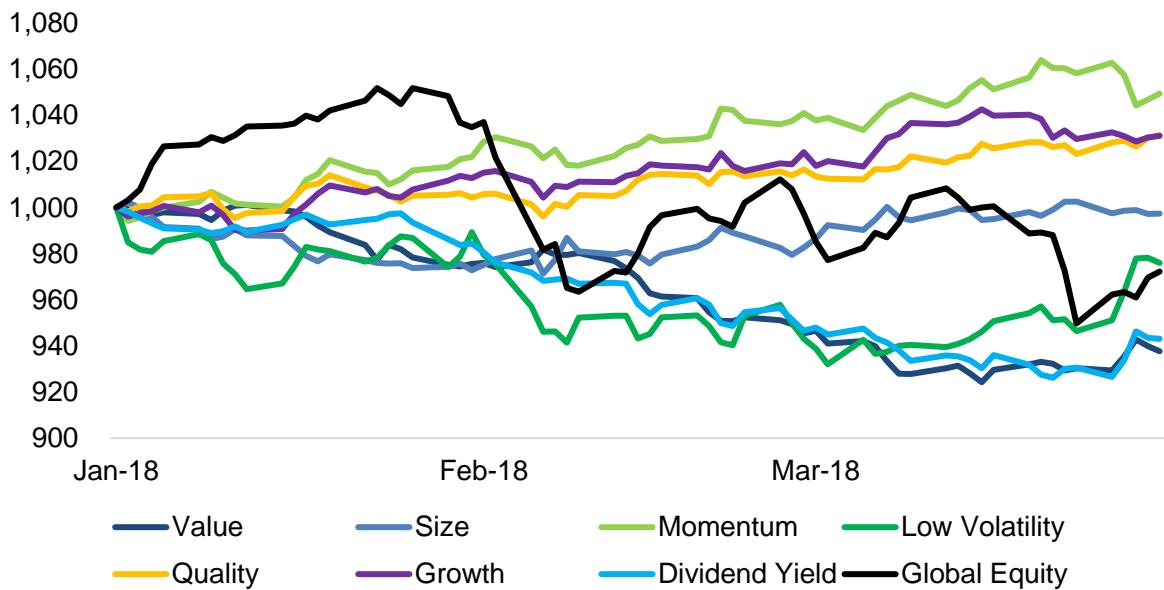


Source: FactorResearch

FACTOR PERFORMANCE 2018: PERFORMANCE CHART

The chart below shows the factor performance in Q1 2018 and we can identify one cluster of correlated factors, which comprises Growth, Quality and Momentum. The Technology sector currently contributes a significant amount of stocks to these three factors as Tech companies have shown strong growth in sales and earnings (Growth) and also feature high profitability and low levels of debt (Quality), which has led these stocks to outperform others (Momentum).

Factor Performance Q1 2018 (Long / Short): Global



Source: FactorResearch

The correlation matrix below highlights the global one-year factor correlations. We can observe strong relationships between Momentum and Growth as well as Quality and Growth, which might be considered a portfolio risk. Investor looking to diversify that risk can consider the Value factor, which shows negative correlations to all three.

	Value	Size	Momentum	Low Volatility	Quality	Growth	Dividend Yield	Global Equity
Value	1	0.03	(0.49)	0.12	(0.35)	(0.52)	0.51	(0.11)
Size	0.03	1	(0.11)	(0.30)	(0.01)	(0.02)	0.02	(0.24)
Momentum	(0.49)	(0.11)	1	(0.12)	0.32	0.54	(0.61)	0.15
Low Volatility	0.12	(0.30)	(0.12)	1	0.37	0.23	0.45	0.23
Quality	(0.35)	(0.01)	0.32	0.37	1	0.74	(0.30)	0.27
Growth	(0.52)	(0.02)	0.54	0.23	0.74	1	(0.41)	0.17
Dividend Yield	0.51	0.02	(0.61)	0.45	(0.30)	(0.41)	1	(0.04)
Global Equity	(0.11)	(0.24)	0.15	0.23	0.27	0.17	(0.04)	1

Source: FactorResearch

FURTHER THOUGHTS

The factor performance in Q1 2018 showed consistent trends and has been essentially a continuation of 2017. Value has generated the worst factor performance in the first quarter after the same position for the entire year of 2017 and it will be interesting to see if a factor rotation will set in, or if factor momentum prevails.

FACTOR EXPOSURE ANALYSIS: DOW JONES

Dissecting the Dow

March 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor exposure should be considered a source of returns as well as of risk
- Factor biases can be measured top-down or bottom-up
- The results of the two approaches do not necessarily reconcile

INTRODUCTION

Factor investing has become immensely popular in recent years and assets in smart beta products surpassed \$1 trillion in 2017. However, factor exposure should be regarded as much as a source of returns as of risks because factor performance is highly cyclical with some factors exhibiting significant multi-year drawdowns. Some investors prefer to avoid large factor biases in their portfolios, which requires an assessment of the factor exposure. In this short research note we will highlight the two primary approaches for measuring factor exposure, which are regression and ranking-based methodologies, and will take the Dow Jones Industrial Average as a proxy for a simple stock portfolio.

METHODOLOGY

We focus on analysing the exposure to seven factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield. These are created via long-short beta-neutral portfolios based on the top and bottom 10% of the US stock market. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

We apply two methodologies for measuring the factor exposure of a stock portfolio:

1. Regression-based (top-down): The returns of the portfolio are regressed against the factor performance with a one-year lookback period
2. Ranking-based (bottom-up): Each stock is ranked on each factor relative to all other stocks and then assigned a ranking score, which is then aggregated on portfolio level for each factor

DOW JONES CHARACTERISATION

In advance of the analysis it is worth highlighting that the Dow Jones is a reasonable example of a common stock portfolio given 30 well-known constituents; however, not a well-designed index. The index weights are based on stock prices as compared to the more accepted methodology of calculating weights based on free-float market capitalisations. Due to this arcane index rule a company like Goldman Sachs, which has a high absolute share price, currently receives a weight of 7.3% compared to 0.4% for General Electric, despite having a smaller market capitalisation. The index's full name of Dow Jones Industrial Average is appropriate given that the Industrials sector has a much larger weight in the Dow

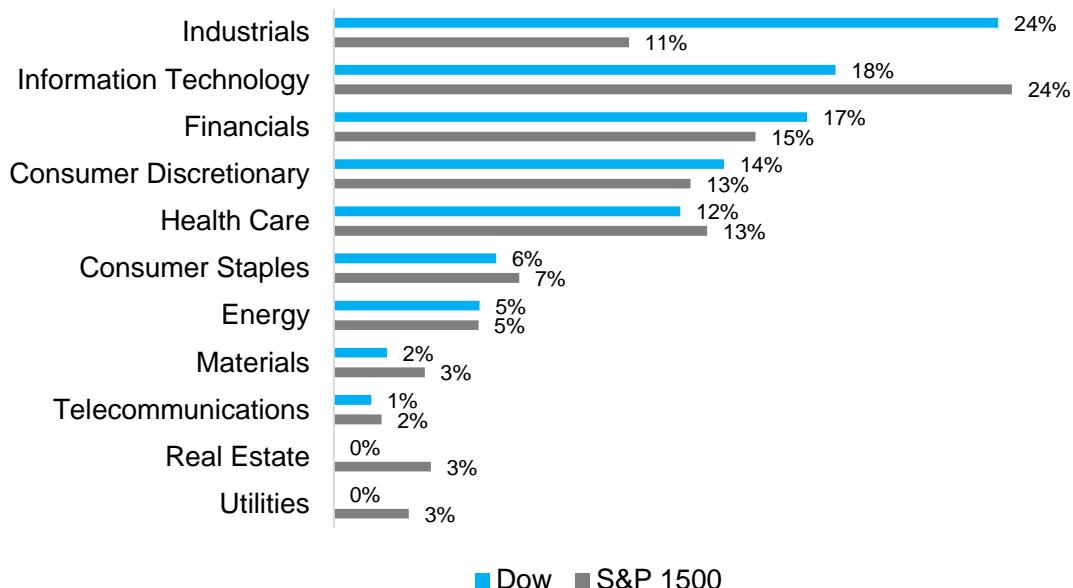


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Jones than in other common indices. The chart below shows the breakdown by sectors of the Dow Jones and the S&P 1500, which covers approximately the stock universe used in the construction of the factor portfolios.

Breakdown by Sectors: Dow Jones versus S&P 1500

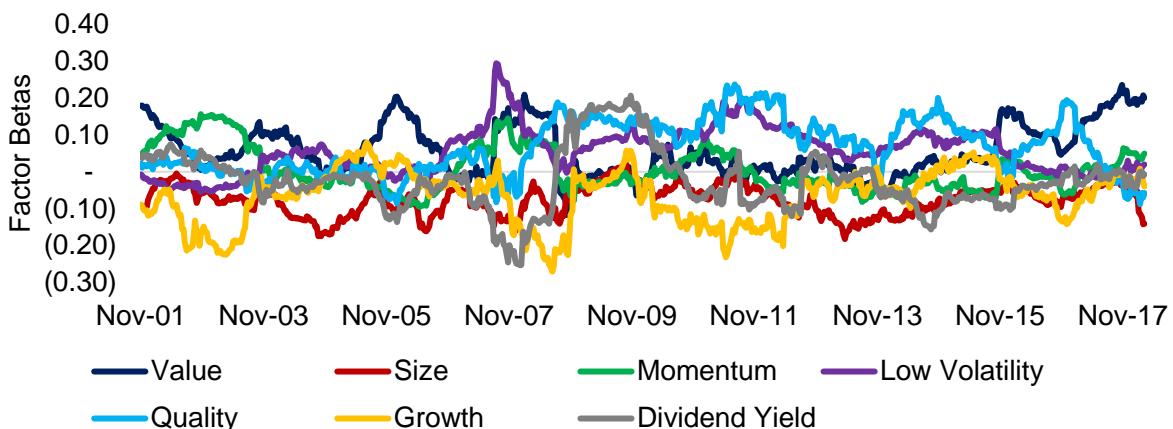


Source: S&P, FactorResearch

FACTOR EXPOSURE ANALYSIS: REGRESSION-BASED

The chart below shows the factor betas for seven factors and the Dow Jones based on a regression analysis using a one-year lookback for the period from 2001 to 2017. The analysis highlights how much of the returns of the Dow Jones can be explained by exposure to certain factors. We can observe that the factor exposure varies over time, but that it is difficult clearly identifying any structural factor exposure.

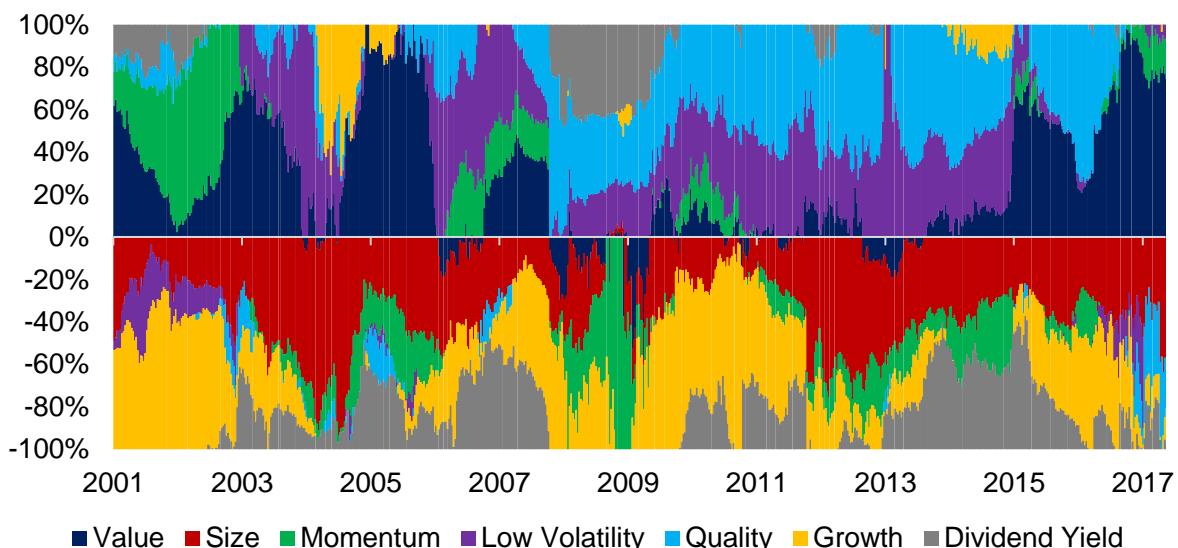
Factor Betas: Dow Jones



Source: FactorResearch

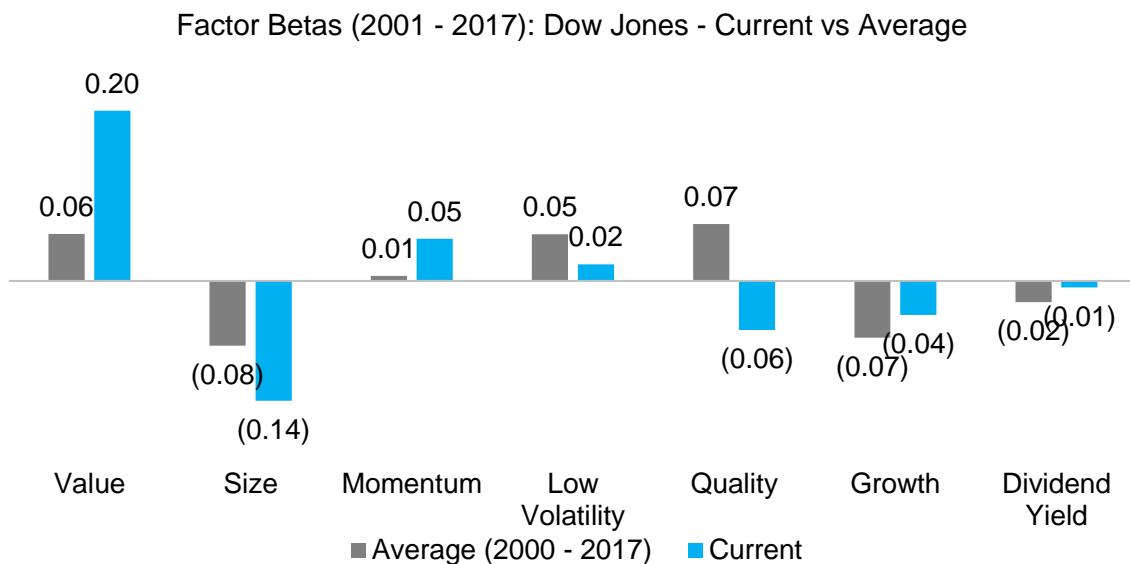
We can normalise the factor betas by differentiating between positive and negative factor exposure, which is shown below. This analysis highlights structural factor exposure of the Dow Jones, mainly a positive bias to the Value, Low Volatility and Quality factors and negative exposure to Size and Growth. The biggest discrepancy compared to larger indices like the S&P 1500 is the significant overweight in the Industrial and underweight in the Technology sectors, which likely explains the factor biases, e.g. Industrial stocks are likely to be cheaper and less volatile than Technology stocks. Given that the Dow Jones contains 30 companies with relatively large market capitalisations, the negative bias to the Size factor is to be expected.

Factor Exposure Analysis: Dow Jones



Source: FactorResearch

In addition we can contrast the average versus current factor exposure of the Dow Jones. We can observe that the factor betas are significantly different currently compared to historical averages and especially pronounced for the Value factor, which is defined by a combination of price-to-earnings and price-to-book multiples. Currently the Value factor beta is highest of all betas, highlighting that the Dow Jones contains cheap stocks on relative basis, which can likely be explained the low amount of Technology stocks compared to the S&P 1500.



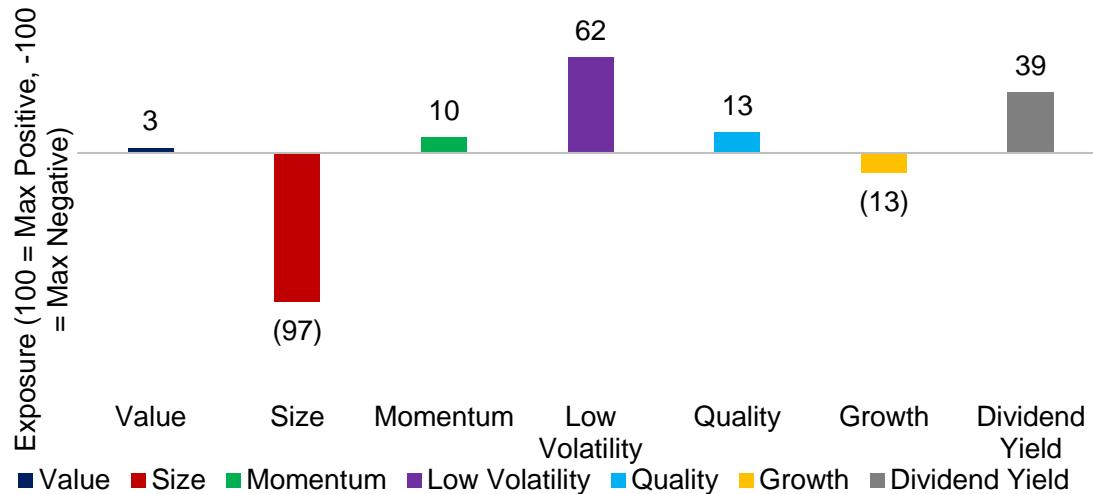
Source: FactorResearch

FACTOR EXPOSURE ANALYSIS: RANKING-BASED

The bottom-up ranking-based methodology for measuring factor exposure is an alternative to the top-down regression analysis. Instead of analysing historical returns, this approach ranks every stock for each factor on a daily basis, which is then aggregated for each factor on portfolio level. Therefore this methodology is much more data-intensive and requires more computations than the regression analysis.

The chart below shows the current factor exposure of the Dow Jones, which can be contrasted with the results above. This analysis results in a somewhat different assessment of current factor exposure, mainly a large negative Size and positive Low Volatility and Dividend Yield exposure, which is somewhat intuitive as the Dow Jones contains large, mature companies, which exhibit relatively low stock volatility and pay high dividends. Although it would be convenient to reconcile both analysis, the two approaches have different methodologies. The statistical regression analysis is backward-looking and aims at explaining what has been driving portfolio returns while the fundamental ranking-based approach is more spot-focused, therefore likely has more significance for the current factor exposure.

Factor Exposure Analysis (Ranking-Based): Dow Jones - Current



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the factor exposure of the Dow Jones derived from two different methodologies. Investors who view factor exposure as a source of risk and desire to hedge this, have several options available. Naturally they change their existing portfolio, but that is often viewed as undesirable. An alternative would be to actively hedge the portfolio by adding or subtracting factor exposure, which can be achieved with exchange-traded factor futures or custom portfolios with tailored factor exposure.

FACTOR PORTFOLIOS: TURNOVER ANALYSIS

What's my Portfolio Churn?

March 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor portfolios have an annual turnover over more than 100%
- The turnover rate varies substantially across factors
- Decreasing the rebalancing frequency reduces turnover, but also risk-return ratios

INTRODUCTION

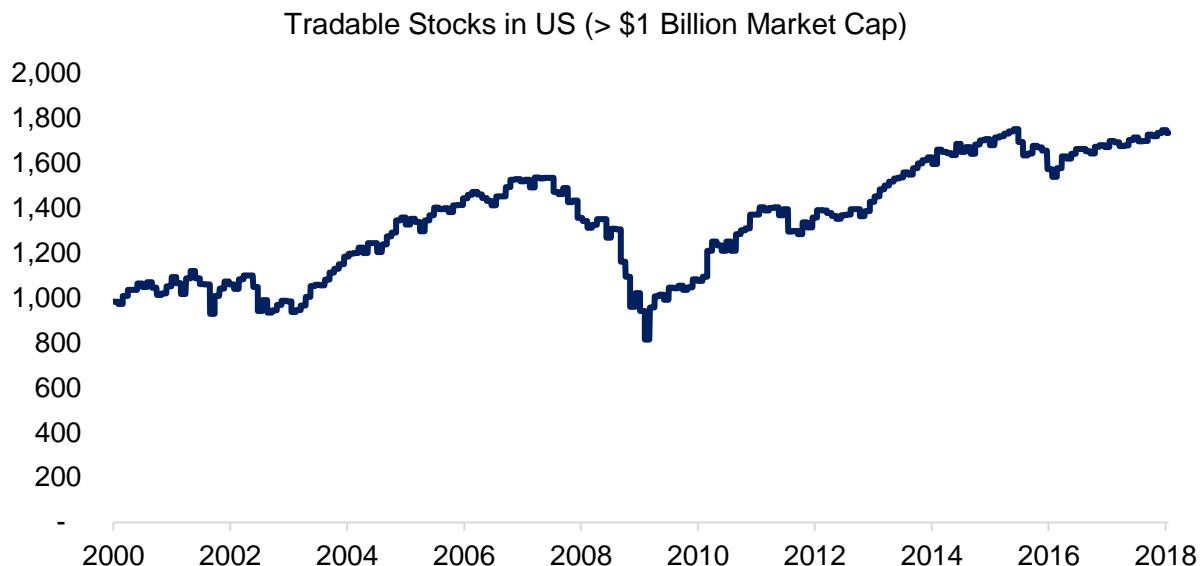
Some ETF investors claim that passive index products are superior to actively managed funds due to lower turnover and therefore less transaction costs. While this is partially true, most investors are unlikely to be familiar that indices such as the S&P 500 have a relatively high amount of turnover. The average tenure in the S&P 500 has decreased from 33 years in 1964 to 24 years in 2016, which implies an 8% turnover per annum, and is expected to shrink further. Stated differently, about half of the current members of the index will be replaced over the next 10 years, which is not in line with a buy-and-hold philosophy. In the factor investing space the high turnover of factor portfolios is often cited as a reason for the mediocre performance of live investible factor-based products compared to their theoretical backtesting. In this short research note we will analyse the turnover of common equity factors in the US.

METHODOLOGY

We focus on seven factors namely Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield as well as a multi-factor portfolio, which allocates equally to these. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks of the US stock market. The multi-factor portfolio is based on the intersectional model, which selects the stocks in the intersection of the factors. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

TRADABLE STOCK UNIVERSE

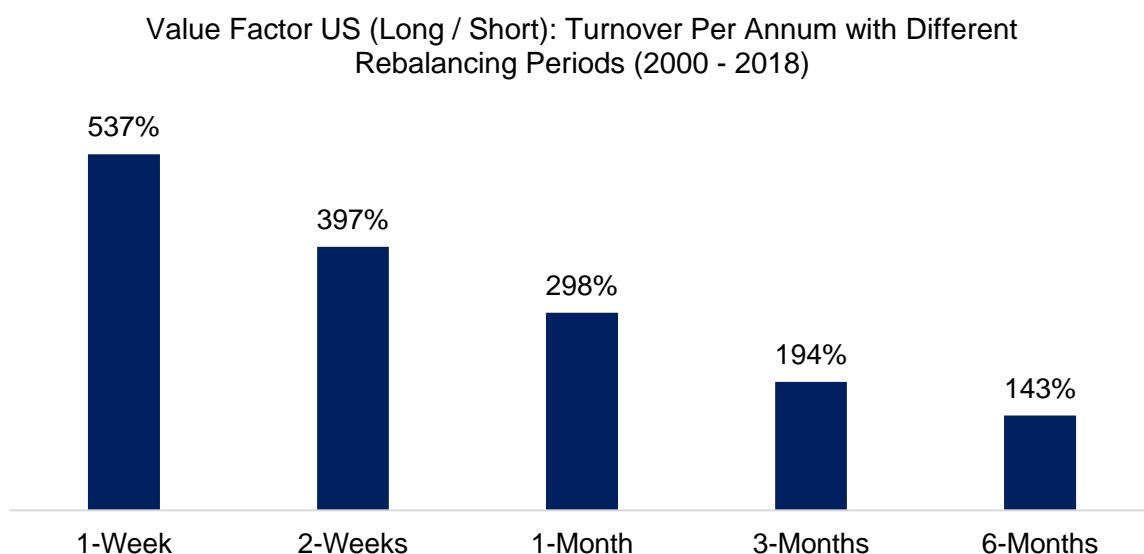
Before we analyse the factor turnover, it is worth providing details on the factor construction. Our universe of stocks in the US includes all companies with a minimum market capitalisation of \$1 billion, which equates to approximately 1,700 stocks as of the first quarter of 2018. Portfolios are created by the top and bottom 10% of the stock market ranked by a factor, which results in a long-short portfolio of approximately 340 stocks. The chart below shows the number of stocks available since 2000, which fluctuates with the ups and downs of the stock market given the minimum market capitalisation constraint.



Source: FactorResearch

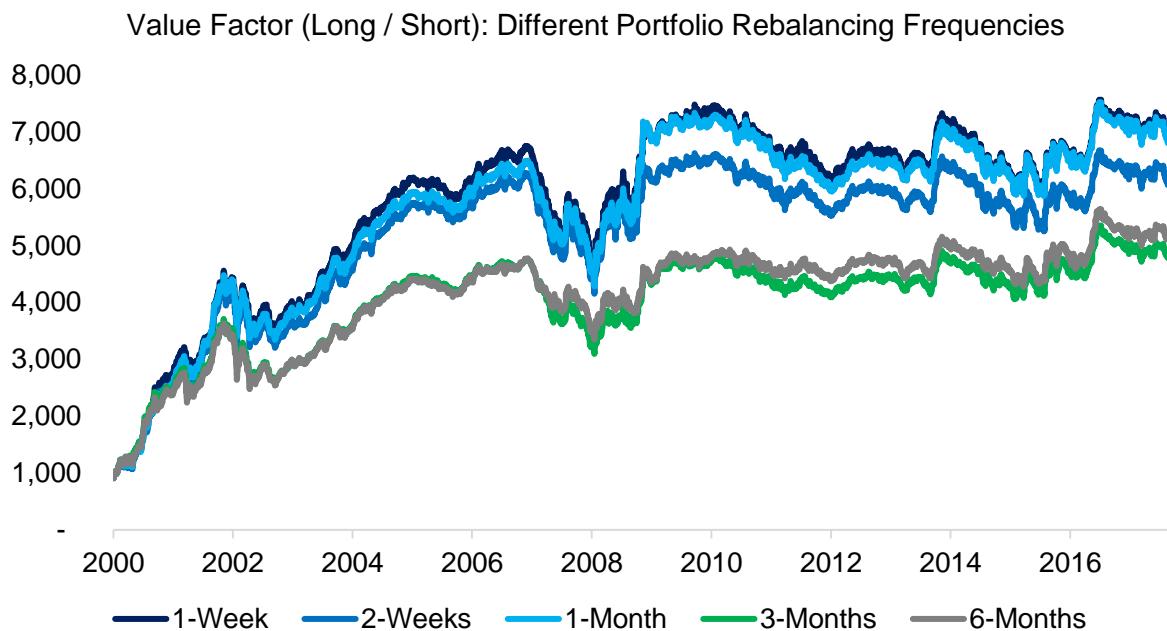
VALUE FACTOR US: TURNOVER PER ANNUM

The chart below shows the turnover per annum of a long-short portfolio of Value stocks, which are defined by a combination of book-value and price-earnings multiples, in the US for different rebalancing periods. We can observe that even with monthly rebalancing, which might be considered the standard for institutional investors on average, the turnover per annum is significantly above 100%.



Source: FactorResearch

Investors concerned with the high turnover can consider reducing the rebalancing frequency. The chart below highlights the performance of the Value factor (long-short) in the US at different rebalancing periods and we can observe similar profiles for weekly to monthly rebalancing while quarterly and semi-annually were less attractive for the period from 2000 to 2017. Weekly rebalancing repositions the portfolio more quickly to opportunities, but naturally at the expense of higher turnover and more transaction costs.

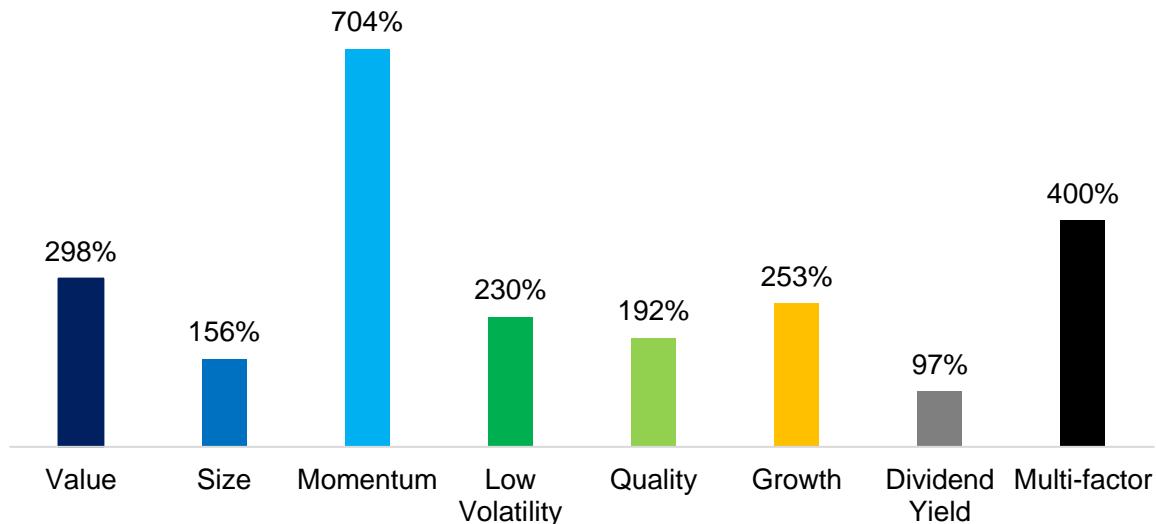


Source: FactorResearch

TURNOVER PER ANNUM ACROSS FACTORS & A MULTI-FACTOR PORTFOLIO

The chart below shows the turnover per annum for seven common factors and a multi-factor portfolio with monthly rebalancing. We can observe that Momentum has the highest turnover, which can be explained by the factor definition of buying the winning and shorting the losing stocks as these change constantly, highlighting the Darwinian nature of the stock market. The multi-factor portfolio shows the second highest turnover while Dividend Yield has the lowest turnover. It is interesting to observe that factors like Quality and Growth, which are exclusively based on fundamental data and not price-based, still show a relatively high turnover. Fundamental data in the US gets released on a quarterly basis, but naturally companies release their data on different dates. Factor definitions play a role as well and the shorter the lookback, e.g. one-year versus three-year earnings growth, the more turnover can be expected.

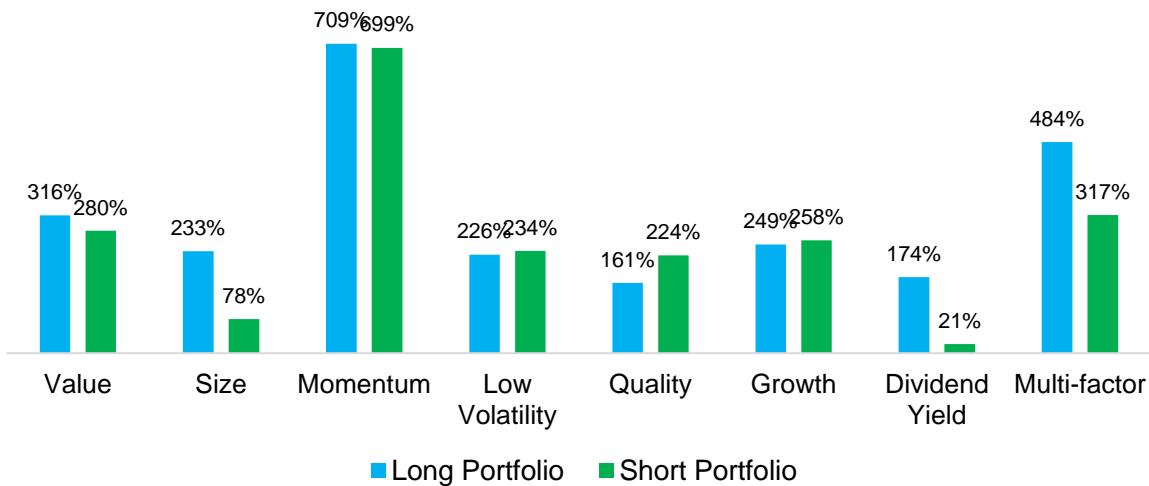
Factors US (Long / Short): Turnover Per Annum with Monthly
Rebalancing (2000 - 2018)



Source: FactorResearch

In addition to analysing the turnover of factors on portfolio level, we can also differentiate between the long and short portfolios. We can observe that the turnover is spread equally over the long and short portfolios for most factors, except for Size and Dividend Yield. The turnover of the short portfolio of the Size factor is significantly lower than that of the long portfolio, which can be explained that large companies, e.g. Microsoft, which comprise the short portfolio, tend to stay large and not change too often. The short portfolio of the Dividend Yield factor also shows relatively low turnover, which can be explained that these are companies that pay no dividend, e.g. technology companies, and therefore remain in the short portfolio for long periods of time.

Factors US: Long & Short Portfolios: Turnover Per Annum with Monthly Rebalancing (2000 - 2018)



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the turnover per annum of common factors and a multi-factor portfolio, which is relatively high with monthly rebalancing compared to an equity index like the S&P 500. The disadvantages of elevated turnover rates are high transaction costs, unfavourable taxation and more operational complexity. However, decreasing the turnover by moving to less frequent rebalancing than monthly leads to less attractive risk-return ratios as we highlighted in our recent report Factor Construction: Portfolio Rebalancing. Portfolio managers should evaluate the benefits of higher risk-adjusted returns on a post tax-basis assuming different transaction and market impact costs, which is a challenging analysis given the numerous inputs required.

EQUITY FACTORS & GDP GROWTH

Does Strong Economic Growth Equate to High Factor Returns?

March 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Economic cycles have a clear impact on factor performance
- Some factors show pro-cyclical while others highlight anti-cyclical characteristics
- Given that real GDP is not published in real-time, it is unlikely effective for factor selection

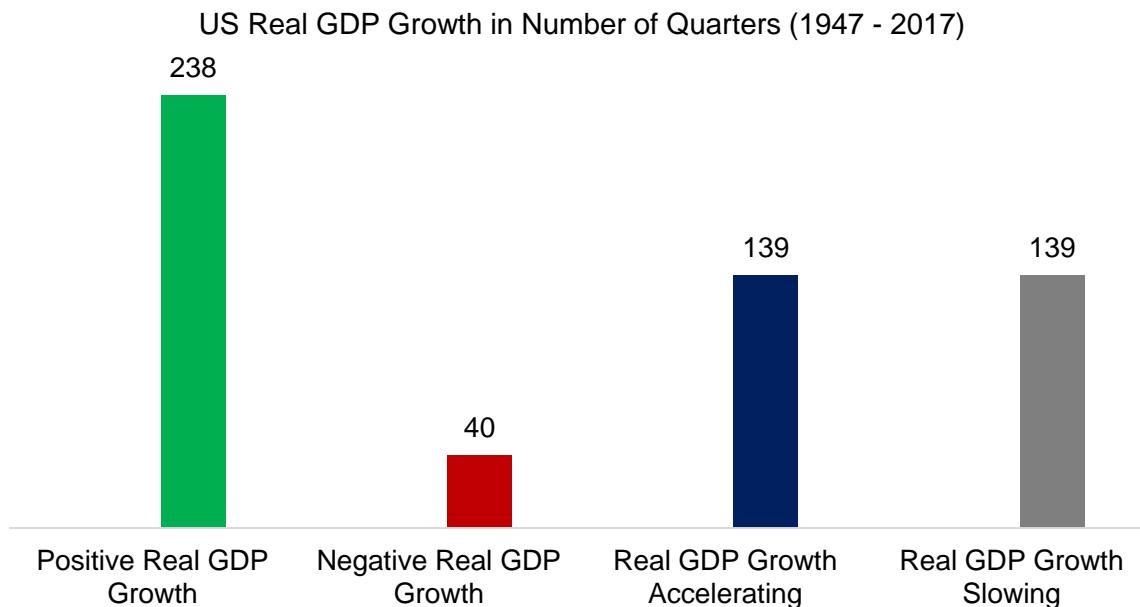
INTRODUCTION

Financial commentators frequently explain a rising stock market by the strength of the economy, which is rather intuitive. If the economy grows, then investors would expect public companies to grow their revenues and earnings, which should be reflected in rising stock prices. However, research by Dimson et al (2002) revealed that there is a modest negative correlation between long-run equity returns and economic growth by analysing multiple countries over a century. One explanation for this growth puzzle is that markets are forward-looking and current stock prices already reflect the economic growth. In factor investing economic cycles are often considered for factor selection and in this short research note we will analyse the relationship between equity factor returns and real GDP growth in the US.

METHODOLOGY

In this research report we initially focus on the Value, Size and Momentum factors from Fama-French, which are constructed as dollar-neutral long-short portfolios based on the top and bottom 10% of the US stock market. The data includes companies with small market capitalisations, excludes transaction costs and is available since 1926. We expand the factor set by the Low Volatility, Quality, Growth and Dividend Yield factors based on our own data, which is available since 2000. These are created via long-short beta-neutral portfolios and only include stocks with a market capitalisation of larger than \$1 billion. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

Real GDP data is sourced from the Federal Reserve Bank of St. Louis and available since 1947. The chart below shows the number of quarters with positive and negative real GDP growth as well as accelerating and decelerating growth, which is defined as the last quarter divided by the average growth of the previous four quarters. We can observe that more than 85% of the quarters showed positive real GDP growth, highlighting the remarkable growth of the US economy, and that the split between acceleration and slowdown was equal.

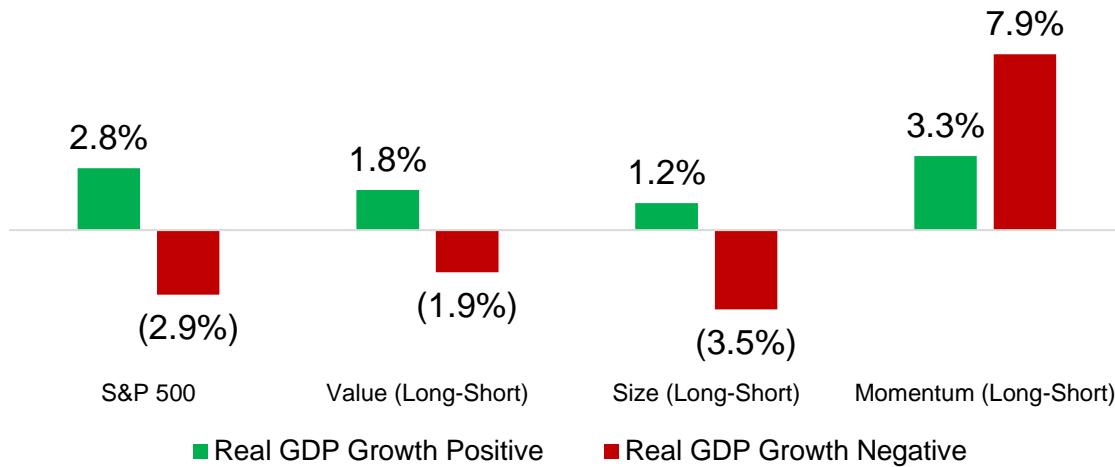


Source: Federal Reserve Bank of St. Louis, FactorResearch

EQUITY FACTORS & REAL GDP GROWTH: 1947–2017

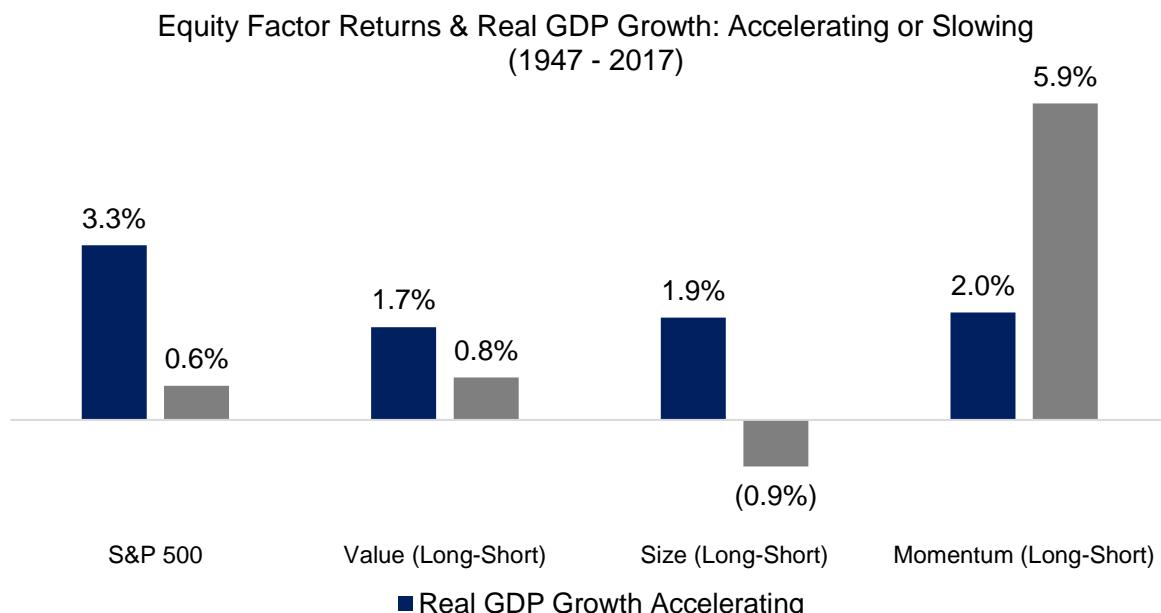
The chart below shows the returns of the S&P 500 and three factors (long-short) since 1947 sorted by positive and negative quarters of real GDP growth. We can observe that equity markets as well as the Value and Size factors generated positive returns in periods of economic growth and negative returns in periods of decline. The analysis highlights that the Value and Size factors, despite being long-short portfolios, might not be optimal diversifiers for an equity-centric portfolio given their pro-cyclical characteristics. Momentum shows higher returns in periods of economic decline than growth, which makes the factor more attractive from a diversification perspective.

Equity Factor Returns & Real GDP Growth: Positive or Negative (1947 - 2017)



Source: Fama-French, Federal Reserve Bank of St. Louis, FactorResearch

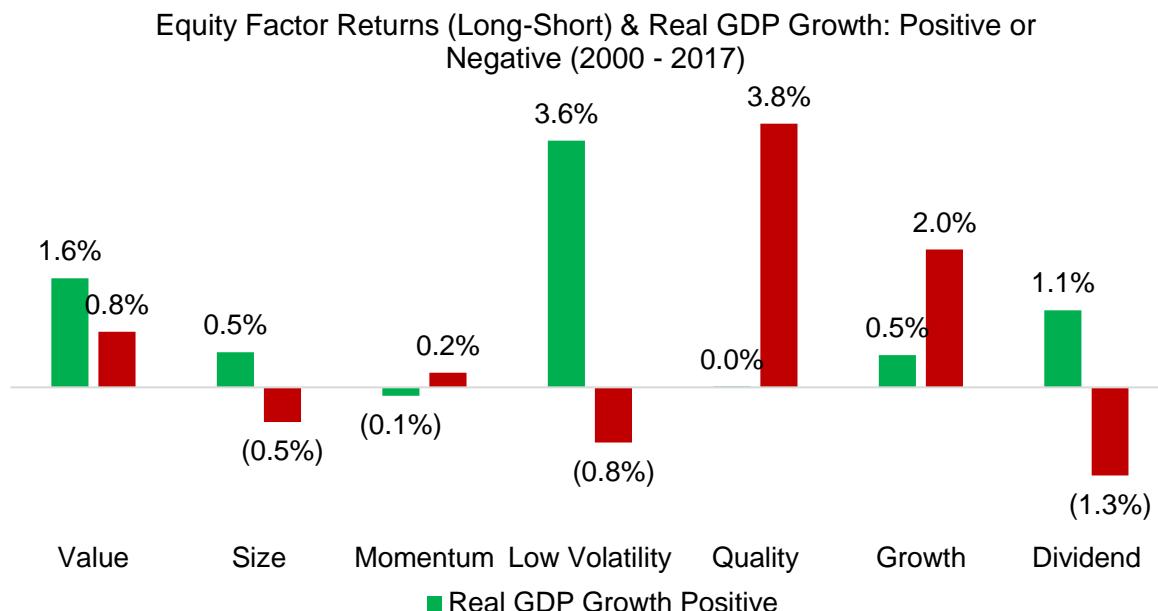
In addition to analysing the economy by periods of absolute positive and negative growth, we can also observe the factor performance in periods of acceleration and slowdown, which splits the observation period of 1947 to 2017 into an equal amount of quarters. The chart below highlights that the equity and long-short factor performance was positive on average and that only the Size factor was negatively impacted by declining growth. The analysis highlights again the pro-cyclical nature of the Value and Size factors.



Source: Federal Reserve Bank of St. Louis, FactorResearch

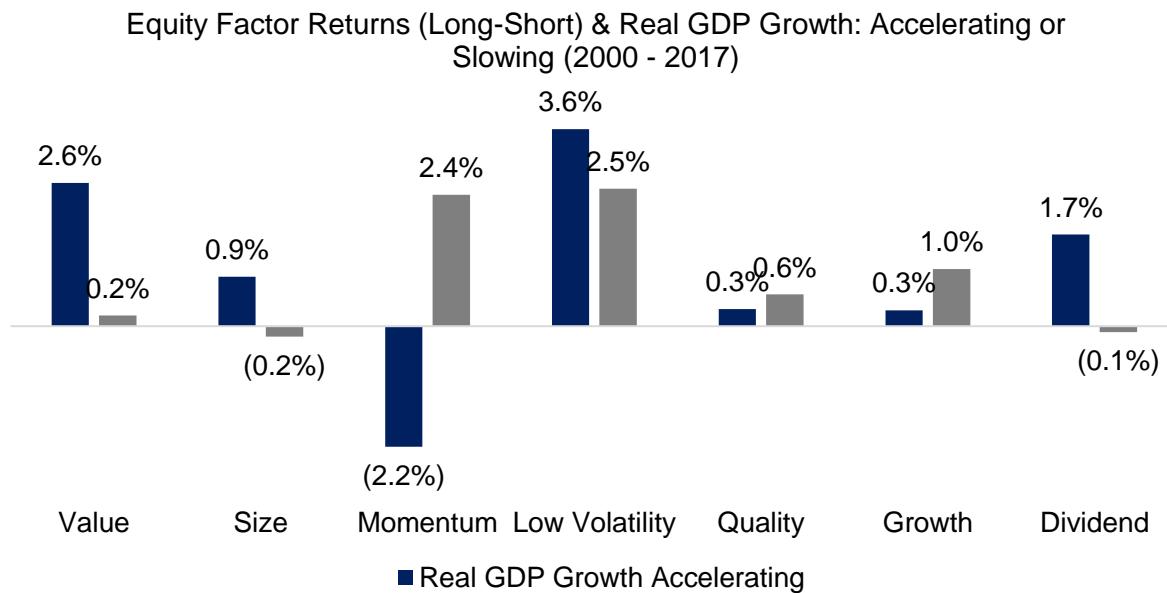
EQUITY FACTORS & REAL GDP GROWTH: 2000–2017

We can extend the analysis by adding additional factors, where data is available since 2000. The chart below shows the performance for seven factors from 2000 to 2017, which was quite heterogeneous when divided into periods of positive and negative real GDP growth. It's worth highlighting that there were only 7 quarters of negative real GDP growth since 2000, so the results have to be taken with caution.



Source: Federal Reserve Bank of St. Louis, FactorResearch

The chart below shows the factor performance in periods of real GDP acceleration and slowdown and we can observe again the slightly pro-cyclical nature of the Value and Size factors as well as the anti-cyclical nature of the Quality and Growth factors. The performance of the Momentum factor during real GDP acceleration is significantly impacted by Q2 2009, where stock markets and the economy recovered from the Global Financial Crisis and the factor experienced its well-documented crash.

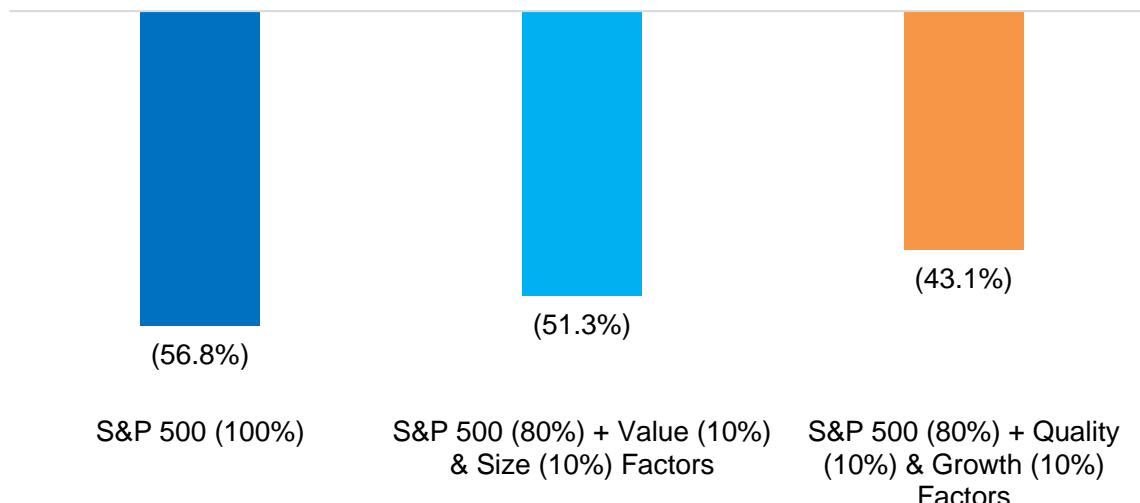


Source: Federal Reserve Bank of St. Louis, FactorResearch

DIVERSIFICATION FOR AN EQUITY-CENTRIC PORTFOLIO

Given that factors exhibit different performance across economic cycles, investors can evaluate which factors offer most diversification benefits. Although there is a significant amount of empirical evidence suggesting that the Value factor generates attractive returns across time, it might not be the optimal factor for reducing the risk of an equity-centric portfolio from a drawdown perspective given its pro-cyclical nature. The analysis below compares the maximum drawdowns of the S&P 500 with two portfolios that include the S&P 500 and long-short factor portfolios. The combination of the S&P with Value and Size factors generated a higher drawdown than the combination with Quality and Growth factors, reflecting the pro- and anti-cyclical characteristics.

Diversification for an Equity-Centric Portfolio: Max Drawdowns (2000 - 2017)



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the performance of common factors in different periods of real GDP growth and notes pro-cyclical and anti-cyclical characteristics. Naturally economic data does not tend to get published in real-time and is often revised, therefore can not be used directly for factor selection. However, there are potentially some leading indicators of real GDP growth that might be worth exploring from a factor risk management perspective, which is a topic for another research note.

DIVIDEND YIELD COMBINATIONS

Enhancing Dividend Yield

March 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Buying high yielding and selling low yielding stocks is not an attractive strategy
- Combining Dividend Yield with Quality & Growth factors improves the performance
- Interestingly Dividend Growth adds relatively little value

INTRODUCTION

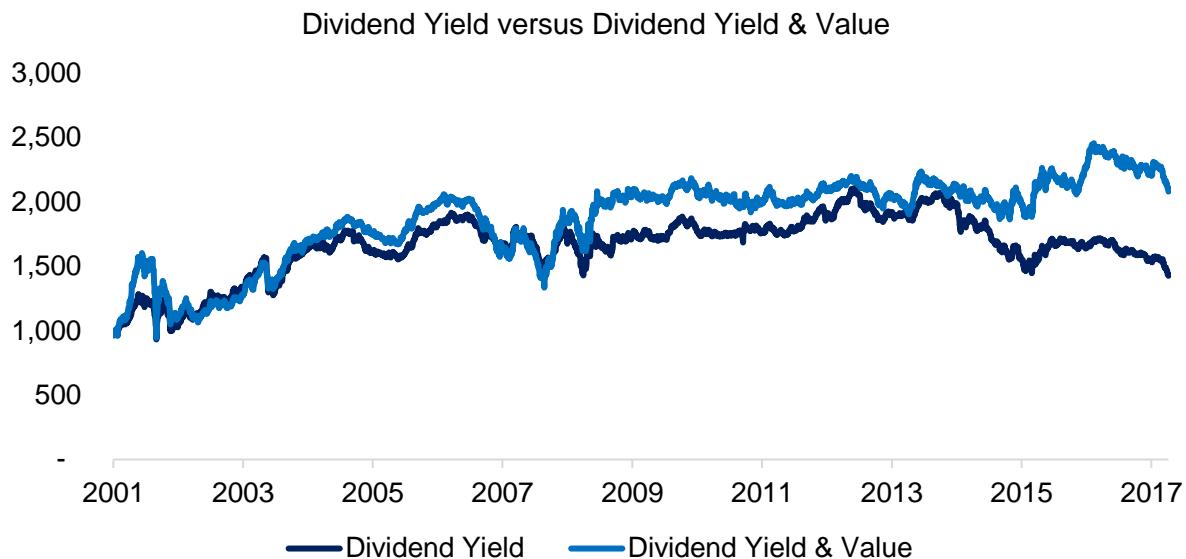
According to MorningStar assets under management of smart beta products breached \$1 trillion in 2017 and more than half of the assets were invested in just three factors: Value, Growth and Dividend Yield. Naturally there is a significant amount of empirical evidence that suggests Value stocks generate positive excess returns across time, but much less evidence for the latter two factors. We published a research note in 2017—Resist the Siren Call of High Dividend Yields—where we highlighted that buying high yielding and selling low yielding stocks has been a highly unattractive strategy over the last century. High dividend yields typically indicate high risks and investors have not been compensated for taking these, especially on an after-tax basis. However, perhaps the risks can be mitigated by combining high dividend yields with other factors. In this short research note we will analyse various Dividend Yield factor combinations.

METHODOLOGY

In this research report we focus on six factors namely Dividend Yield, Value, Momentum, Quality, Growth and Dividend Growth. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks of the US stock market. The factor combinations are based on the intersectional model, which selects the stocks in the intersection of the factors. Only stocks with a market capitalisation of larger than \$1 billion are included. Portfolios are rebalanced monthly and each transaction occurs costs of 10 basis points.

DIVIDEND YIELD VERSUS DIVIDEND YIELD & VALUE

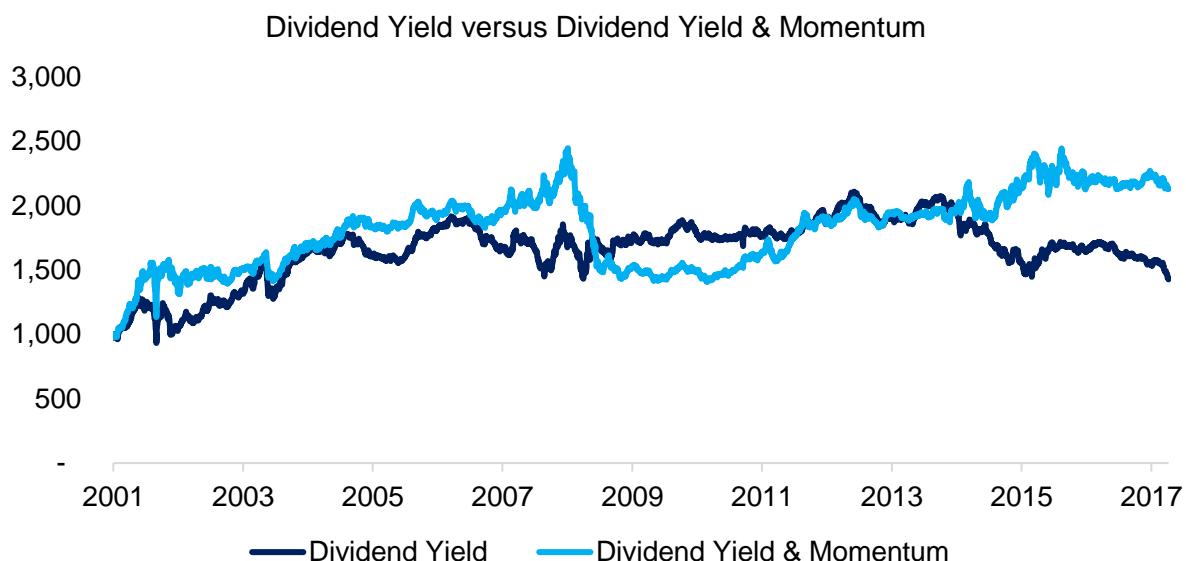
The chart below shows the performance of a long-short portfolio based on the Dividend Yield factor and an equal-weight combination of Dividend Yield and the Value factor, e.g. the long portfolio will contain stocks that are high yielding and cheap on price-to-earnings and book-value multiples. We can observe that both profiles are comparable, which is not unexpected given that Dividend Yield can also be considered a Value metric.



Source: FactorResearch

DIVIDEND YIELD VERSUS DIVIDEND YIELD & MOMENTUM

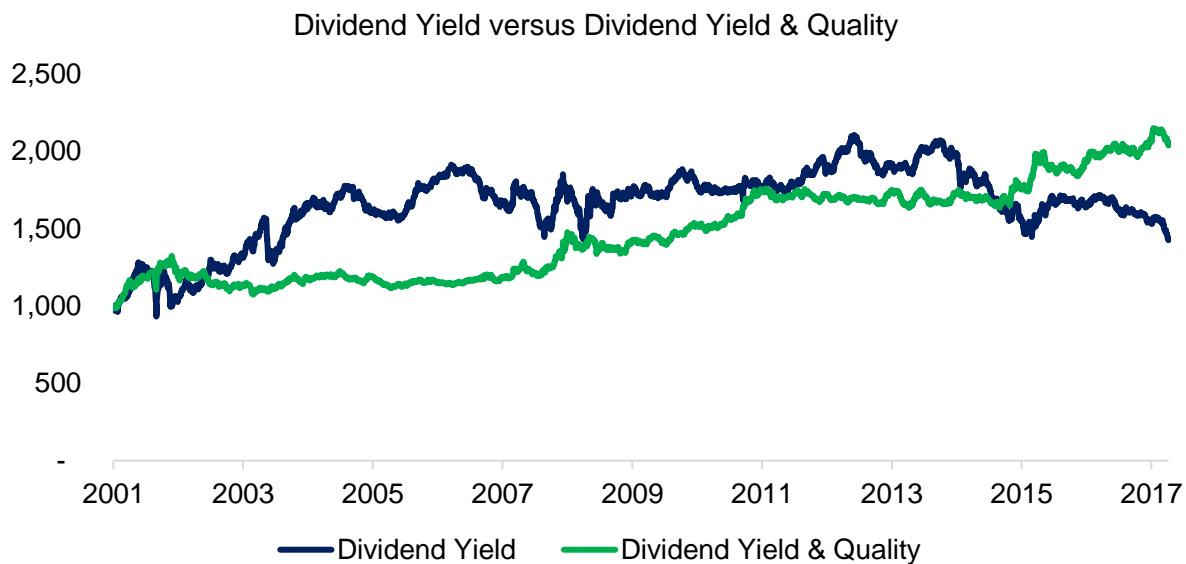
Given that Dividend Yield and Value are positively correlated, investors might want to combine Dividend Yield with a factor that offers a low or negative correlation. Momentum fulfills that criteria and we can observe that this combination looks substantially different to the Dividend Yield factor on its own. However, the performance does not look particularly attractive and we can clearly identify the Momentum crash of 2009.



Source: FactorResearch

DIVIDEND YIELD VERSUS DIVIDEND YIELD & QUALITY

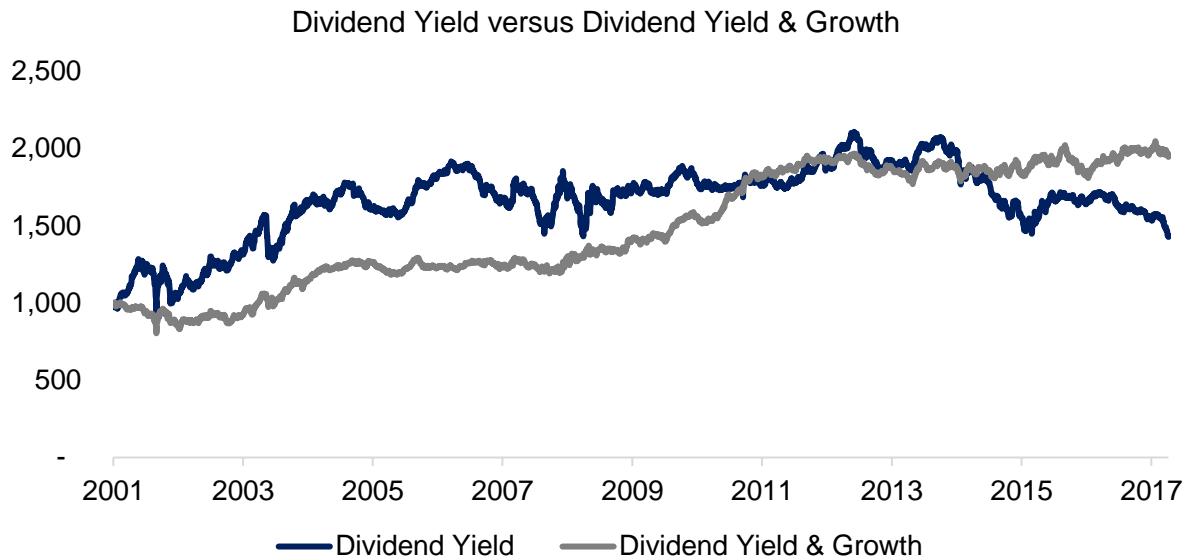
One of the key concerns of yield-seeking investors is reductions in dividends. Investors can therefore look for stocks that are high yielding and quality companies, which we define as corporates with high returns-on-equity and low debt-to-equity ratios. The chart below shows the combination of the Dividend Yield and Quality factors, which highlights a more consistent performance compared to Dividend Yield on a stand-alone basis.



Source: FactorResearch

DIVIDEND YIELD VERSUS DIVIDEND YIELD & GROWTH

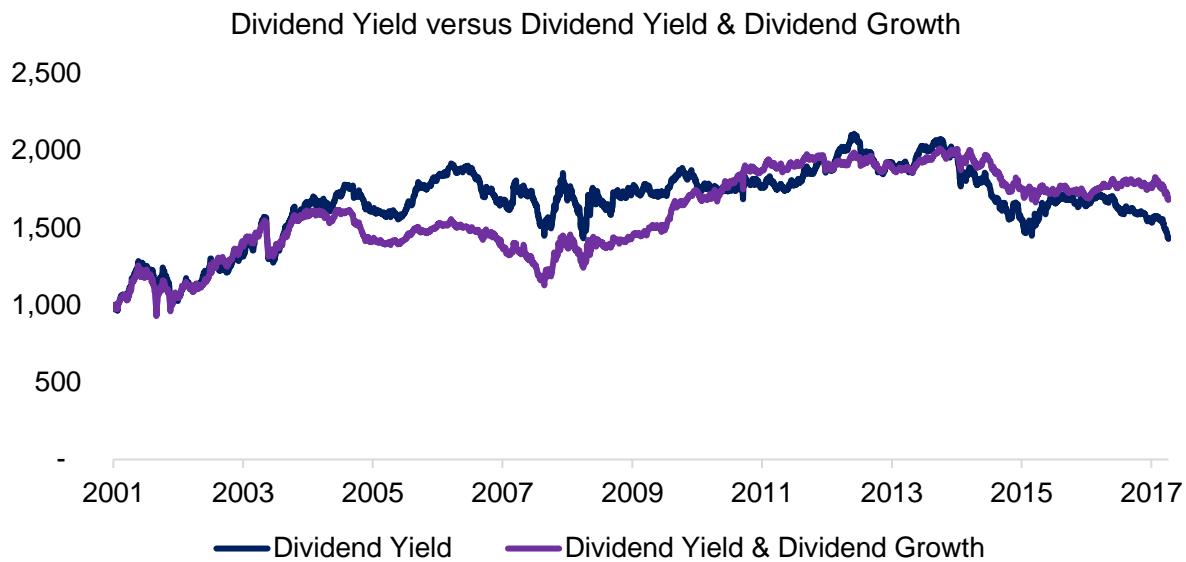
As an alternative to looking for high yielding, quality companies, investors can also consider companies that are showing high growth rates in sales and earnings, which should mitigate the risk of a dividend reduction and potentially even lead to increases in the dividend. The chart below shows the combination of the Dividend Yield and Growth factors, which highlights a relatively consistent performance.



Source: FactorResearch

DIVIDEND YIELD VERSUS DIVIDEND YIELD & DIVIDEND GROWTH

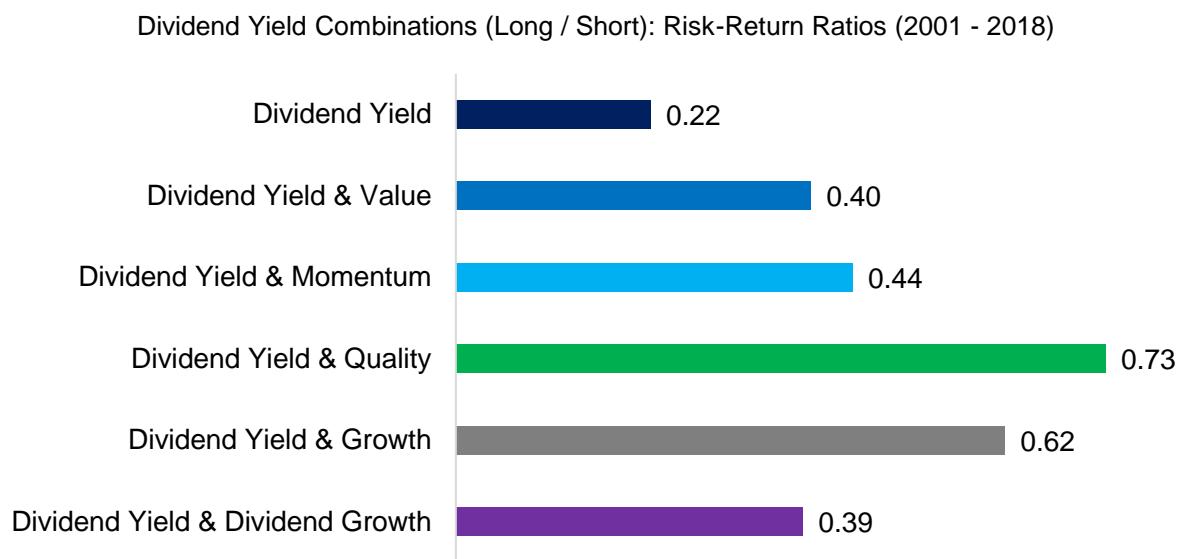
Instead of focusing on quality and growing companies, investors can also select stocks with high dividend yields and growing dividends. Interestingly this combination does not improve the performance and can be explained by that Dividend Growth, which we define as the annual growth in dividends, shows an almost flat performance since 2000. The long portfolio of Dividend Growth consists of companies that rapidly increased their dividends, i.e. represents companies that likely restructured their business recently, while the short portfolio comprises companies that recently cut their dividends, i.e. stocks that likely have been declining for a while as dividend cuts tend to reflect ailing businesses. Dividend Growth effectively represents a combination of the long side of the Value factor and short side of the Momentum factor, which we have seen in the analysis above as not accretive to the Dividend Yield factor.



Source: FactorResearch

DIVIDEND YIELD COMBINATIONS: RISK-RETURN METRICS

In addition to observing the performance of the dividend yield combinations, we can also analyse the risk-return ratios for the period from 2001 to 2017. All combinations show higher risk-return ratios than the Dividend Yield factor on a stand-alone basis, which highlights diversification benefits. The factors that likely mitigate the risk of dividend reductions, i.e. Quality and Growth, improve the risk-return ratios most.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights various combinations of Dividend Yield and other factors, where the Quality and Growth factors lead to the highest increases in risk-return metrics, which is intuitive. Naturally this implies avoiding the stocks with the highest yields, which can be emotionally challenging in this yield-starved environment.

FACTOR CONSTRUCTION: PORTFOLIO REBALANCING

Weekly, Monthly, Quarterly?

February 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor portfolios do not benefit significantly from intra-month rebalancing
- However, too infrequent rebalancing leads to lower risk-return ratios
- The robustness of factor performance at different rebalancing periods is one of the advantages of factor investing

INTRODUCTION

Creating factor portfolios requires investors to make a number of decisions regarding portfolio design and can be considered as much an art as science. The sorting metrics need to be defined, the stock universe, the top and bottom cut-off levels, and the rebalancing periods. The latter, i.e. how frequent the portfolio needs to be rebalanced, might seem trivial, but markets have gotten more efficient and quicker rebalancing might be advantageous. Academic research typically assumes quarterly or monthly portfolio rebalancing, which seems rather infrequent in the age of high-frequency trading. In this short research note we will analyse the impact of the rebalancing frequency on a multi-factor portfolio and four single factors.

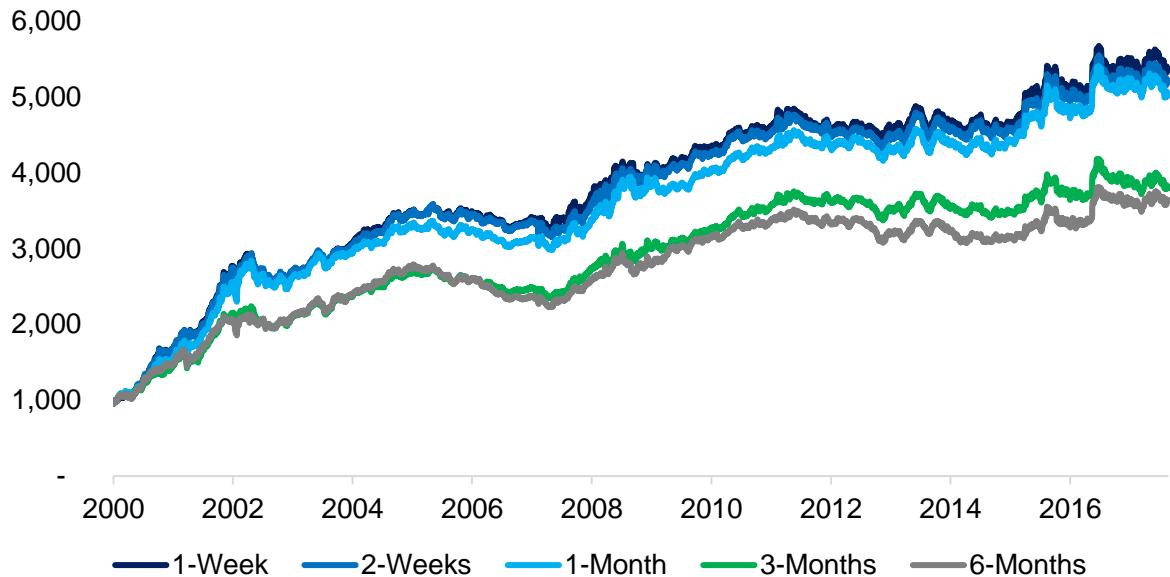
METHODOLOGY

In this research report we focus on four factors namely Value, Size, Momentum and Quality. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks of the US stock market. The multi-factor portfolio is comprised of the four factors and is created via the intersectional model, which selects the stocks in the intersection of the factors. Only stocks with a market capitalisation of larger than \$1 billion are included and each transaction occurs costs of 10 basis points.

MULTI-FACTOR PORTFOLIO: REBALANCING FREQUENCIES

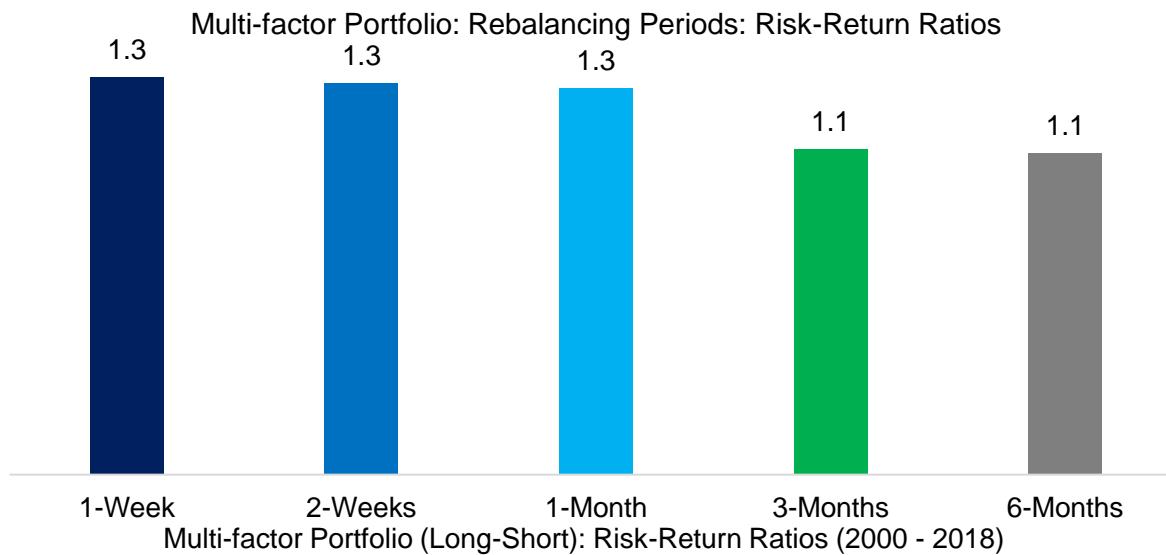
The chart below shows the performance of a long-short multi-factor portfolio in the US, which ranks stocks for the Value, Size, Momentum and Quality factors. E.g. the long portfolio contains stocks that are cheap, small caps, have shown a good relative performance over the last 12 months and rank highly on quality metrics. The portfolio is rebalanced at different intervals and we can observe that the profiles are almost identical in terms of trend. However, the portfolios with more frequent rebalancing, i.e weekly to monthly, show a consistent outperformance to portfolios that rebalance on a quarterly or semi-annual basis.

Multi-factor Portfolio: Different Rebalancing Periods



Source: FactorResearch

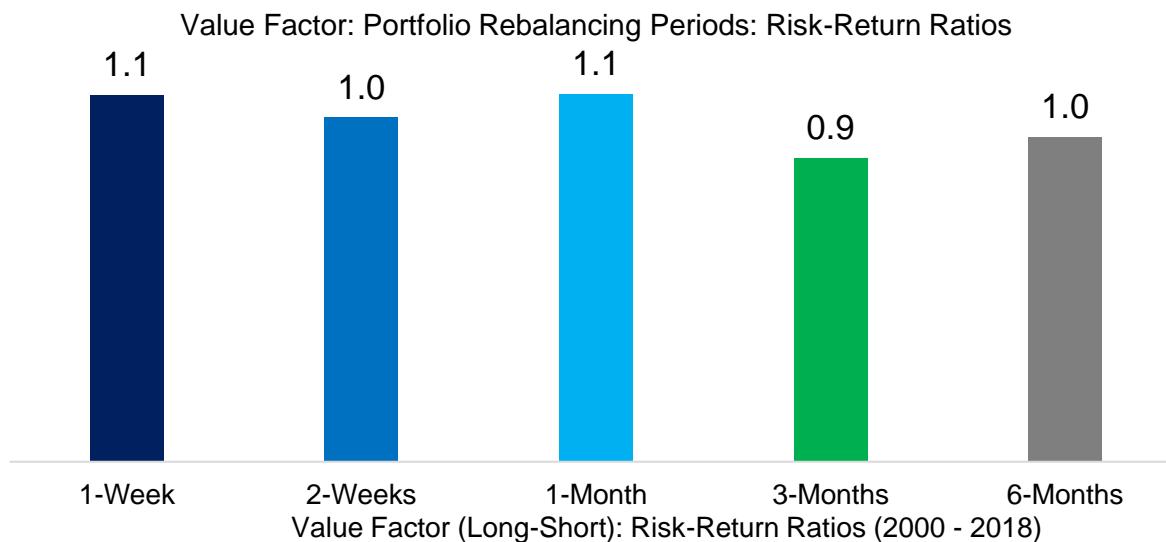
Investors might argue that a more frequent rebalancing adapts the portfolio quicker to company news and market changes, naturally at the price of more transaction costs. The multi-factor portfolio selects stocks based on the intersectional model, which means the stocks in the intersection of factors (please see this report for further model details Multi-factor Model 101). These stocks don't rank particular high on a single factor, but rank highly on average across the factors, which results in a portfolio of stocks that does not change often as the multi-metric ranking process provides a degree of stability. The chart below exhibits the risk-return ratios of the multi-factor portfolio with different rebalancing frequencies. More frequent rebalancing generates higher ratios, albeit with only a marginal difference between weekly and monthly rebalancing.



Source: FactorResearch

VALUE FACTOR: REBALANCING FREQUENCIES

In addition to analysing the impact of the rebalancing frequency on the multi-factor portfolio we can also observe the changes for the individual factors. The chart below shows the risk-return ratios for the Value factor and highlights that the rebalancing frequency has a minor impact on the ratio. The factor is defined as a combination of price-to-book and price-to-earnings multiples, which only change significantly when corporate earnings are released. Given that listed companies in the US publish quarterly earnings, stocks in the long and short portfolios of the Value factor do not change too often.

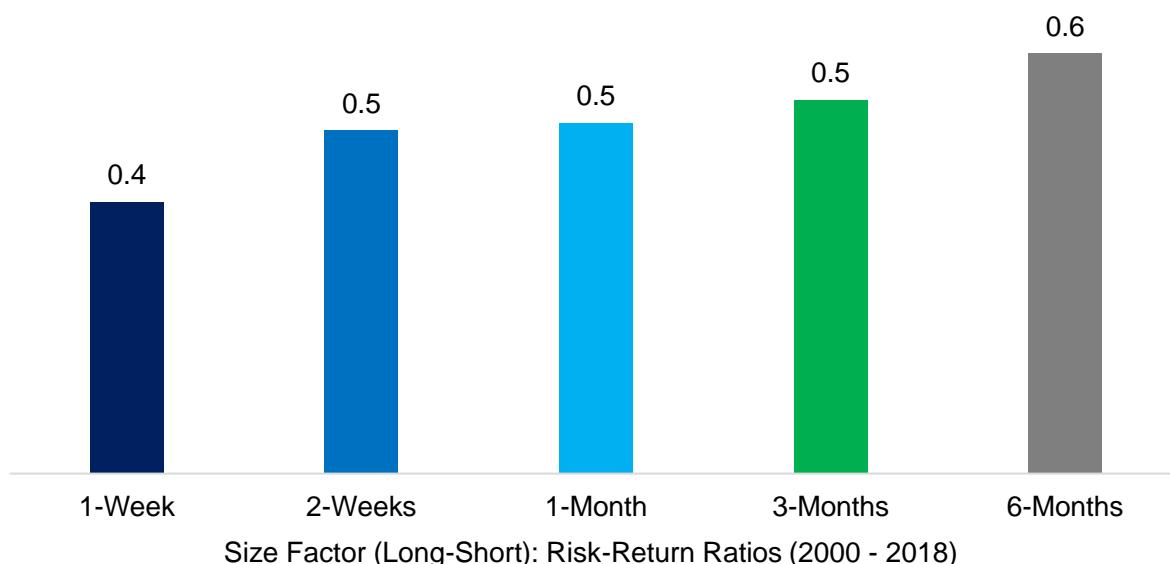


Source: FactorResearch

SIZE FACTOR: REBALANCING FREQUENCIES

The impact on the Size factor, which is defined as buying small and shorting large companies, highlights a linear increase in the risk-return ratio with a decreasing rebalancing frequency. The results can be explained by portfolio construction, which requires companies to have a minimum market capitalisation of \$1 billion. More frequent rebalancing leads to more companies being beneath the threshold, which then results in a higher turnover and more transaction costs. If we exclude transaction costs from the analysis, then the risk-return ratios do not show that less frequent rebalancing is more favourable.

Size Factor: Portfolio Rebalancing Periods: Risk-Return Ratios

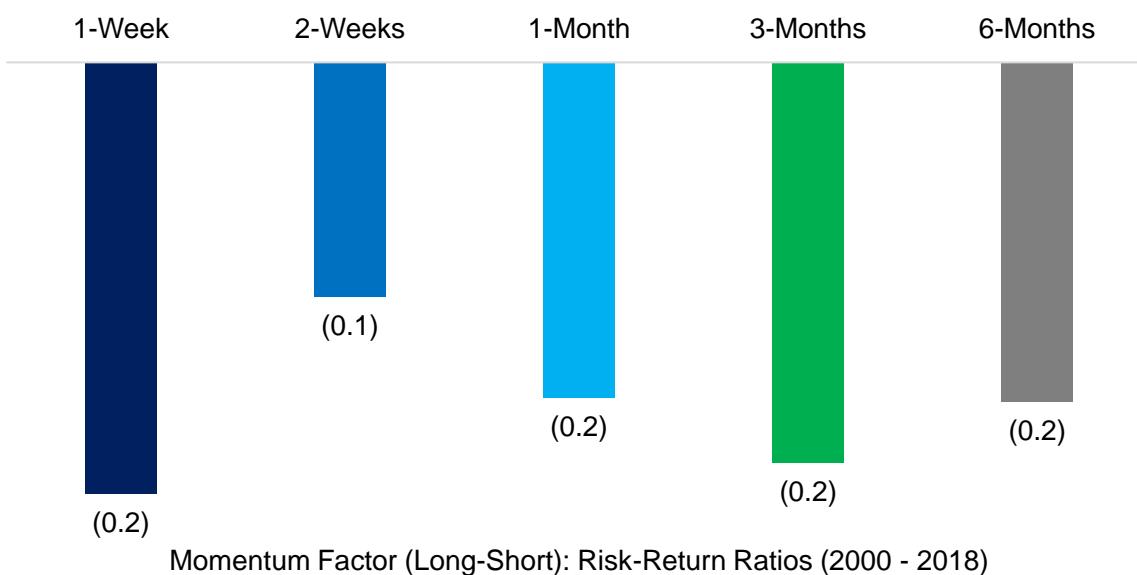


Source: FactorResearch

MOMENTUM FACTOR: REBALANCING FREQUENCIES

The Momentum factor, which buys winning and shorts losing stocks, generated a poor performance over the period 2000 to 2018, which explains the negative risk-return ratios. The factor has a much higher turnover than the other factors as the stocks are selected exclusively on the 12-month price performance, which changes daily, and not fundamentals like the Value and Quality factors. Investors therefore might expect that more frequent rebalancing is most favourable for this factor as it incorporates the latest price changes. However, the analysis below shows that this is not the case, which can partially be explained by higher transaction costs from more frequent rebalancing.

Momentum Factor: Portfolio Rebalancing Periods: Risk-Return Ratios

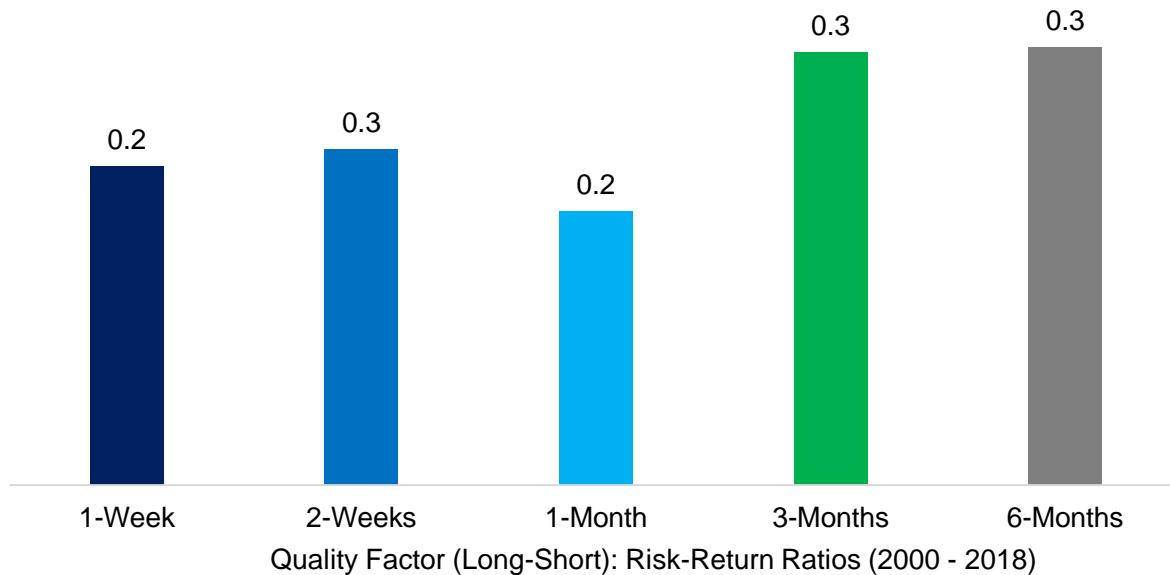


Source: FactorResearch

QUALITY FACTOR: REBALANCING FREQUENCY

The impact of the rebalancing frequency on the Quality factor, which is defined as a combination of return-on-equity and debt-over-equity ratios, is heterogeneous. The factor definition is exclusively based on fundamentals, which means that the stocks in the long and short portfolios only change when earnings are released. It is therefore intuitive that the rebalancing frequency does not have a significant impact on this factor.

Quality Factor: Portfolio Rebalancing Periods: Risk-Return Ratios



Source: FactorResearch

FURTHER THOUGHTS

This short research notes highlights that the impact of the rebalancing frequency on a multi-factor and single factor portfolios is mixed. Weekly rebalancing is not advantageous to monthly rebalancing, but too infrequent rebalancing reduces the risk-return ratios. Naturally transaction costs have an impact on the analysis and with continuously decreasing costs, more frequent rebalancing might become more attractive, although the benefits are likely to be marginal. The robustness of factor performance across different rebalancing periods is one of the advantages of factor investing.

SEQUENTIAL MODEL: SORTING BY 5 FACTORS

Pick a Factor, then Tilt, Tilt, Tilt.

February 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- The sequential model ranks stocks by factors sequentially
- Allows investors to prioritise factors and results in concentrated portfolios
- However, the factor sequence matters and only a few factors can be considered

INTRODUCTION

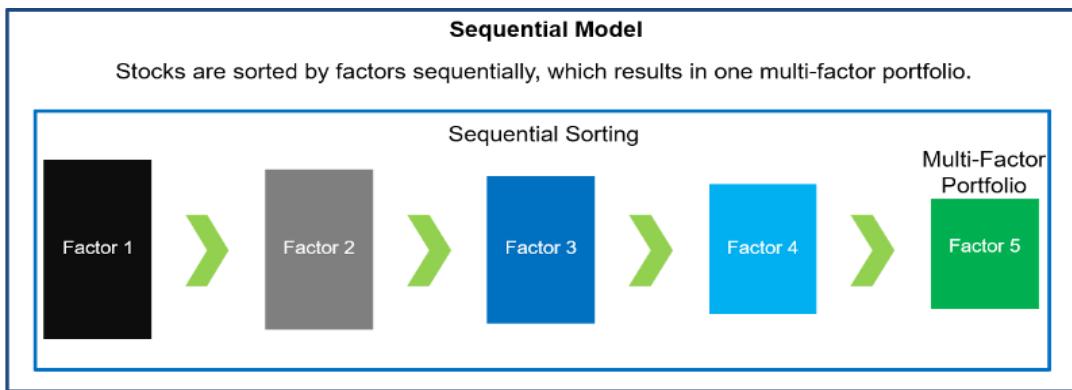
In a recent research report we showed how investors can combine factors into a multi-factor portfolio by ranking for several factors simultaneously (please see Intersectional Model: Sorting by 7 Factors), which results in a portfolio of stocks that rank well on average on the chosen factors. However, some investors have a core philosophy, e.g. are Value investors, and require that all stocks rank highly on this factor. In this case investors can utilise the sequential model, which ranks factors sequentially and allows investors to prioritise specific factors. In this short research note we will analyse the effect of adding an additional four factors sequentially to a Value portfolio in the US.

METHODOLOGY

In this research report we will use the sequential model by sorting stocks for several factors sequentially. We focus on five factors namely Value, Size, Momentum, Low Volatility and Quality and sort in this sequence, which is an arbitrary decision. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 30% of stocks of the US stock market. Portfolios rebalance monthly and include 10bps of transaction costs.

SEQUENTIAL MODEL

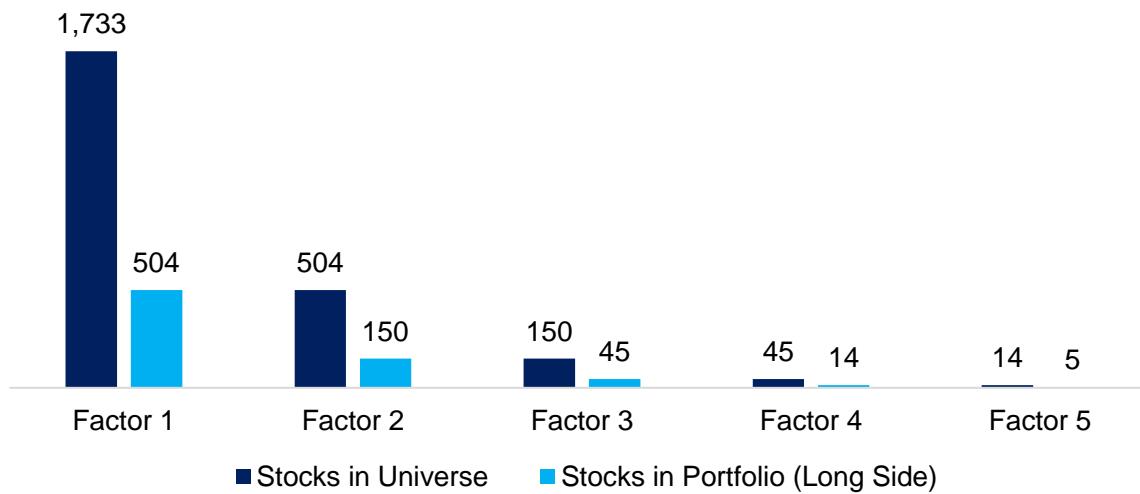
The sequential model ranks stocks by factors sequentially, which means the factor sequence has a significant role on the performance. Investors can prioritise factors as the initial factors have a much larger impact than the later ones. For example, if the first factor is Value, then the stocks in the long portfolio will definitely be cheap stocks, regardless of which factor is used for ranking the stocks thereafter. The graphic below illustrates the sequential model.



Source: FactorResearch

The sequential model is unique as it results in very concentrated portfolios as after each factor ranking the universe of stocks is reduced significantly. The chart below shows that the initial universe of stocks in the US above \$1 billion of market capitalisation consists of 1,733 stocks. The first factor is created by taking the top and bottom 30% of this universe, which implies 504 stocks in the long and 504 stocks in the short portfolio. The second factor then only considers the top 504 stocks for the next ranking on the long side, resulting in a long portfolio of 150 stocks. After four factors there are only 14 stocks in the long and 14 stocks in the short portfolio, which is likely below what investors consider a diversified portfolio. In markets with smaller stock universes only a few factors can be used for a sequential sorting.

Sequential Model: Stocks in US Universe & Portfolio (Long Side)

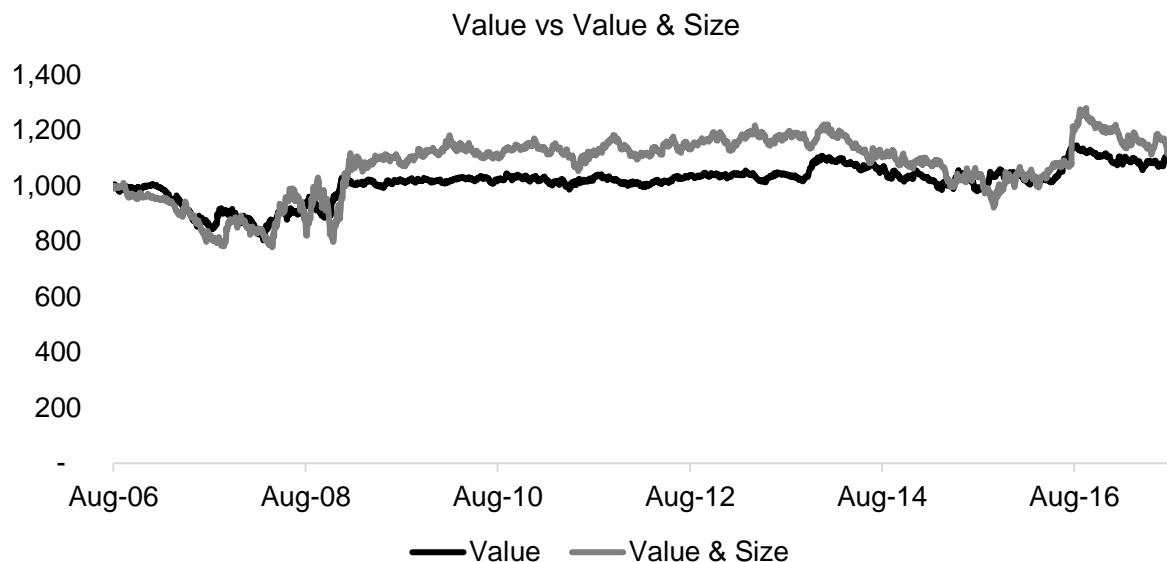


Source: FactorResearch

VALUE VS VALUE & SIZE

The chart below compares the performance of the Value factor versus a portfolio first ranked by Value and secondly by Size, i.e. these are cheap and small stocks in the long portfolio and expensive and large stocks in the short portfolio. We can observe that the performance

of the Value factor is essentially flat for the period from 2006 to 2017. Sorting this portfolio for the Size factor sequentially did not change the results significantly, although the volatility increased, which can be explained by a more concentrated portfolio.

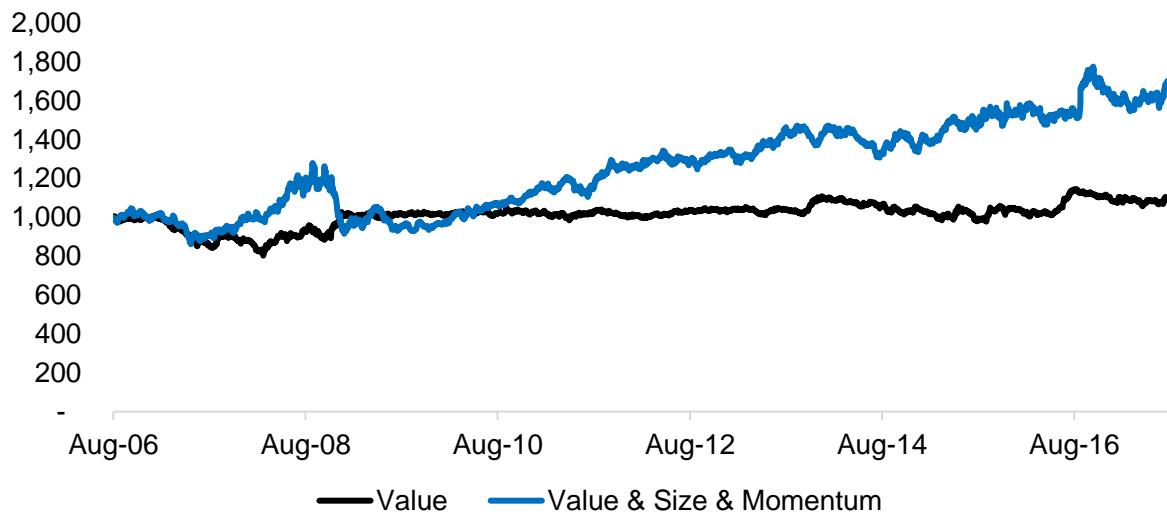


Source: FactorResearch

VALUE VS VALUE & SIZE & MOMENTUM

In the next iteration we add Momentum as a factor, which leads to a considerable improvement in performance, likely driven by greater diversification benefits. The benefit of adding Momentum can be seen during the Global Financial Crisis as the performance turned positive compared to the Value factor in 2008; however, we can also observe the Momentum crash of 2009 in the results.

Value vs Value & Size & Momentum

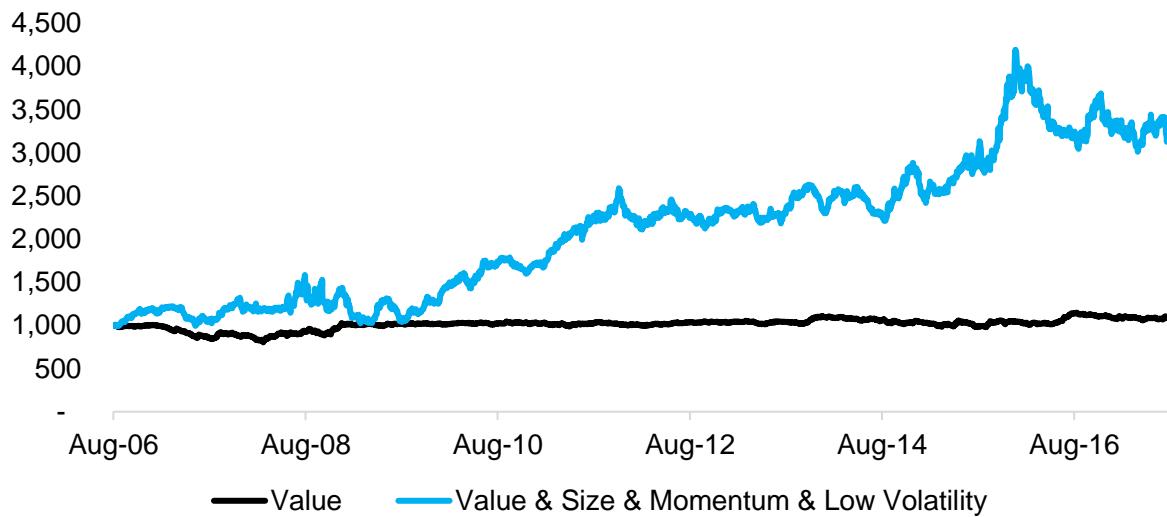


Source: FactorResearch

VALUE VS VALUE & SIZE & MOMENTUM & LOW VOLATILITY

The fourth factor to be added in the sequential sorting is the Low Volatility factor, which further improves the performance. However, the volatility of the sequential portfolio has also increased, which can be explained by a relatively small portfolio of 14 stocks on the long and 14 stocks on the short side.

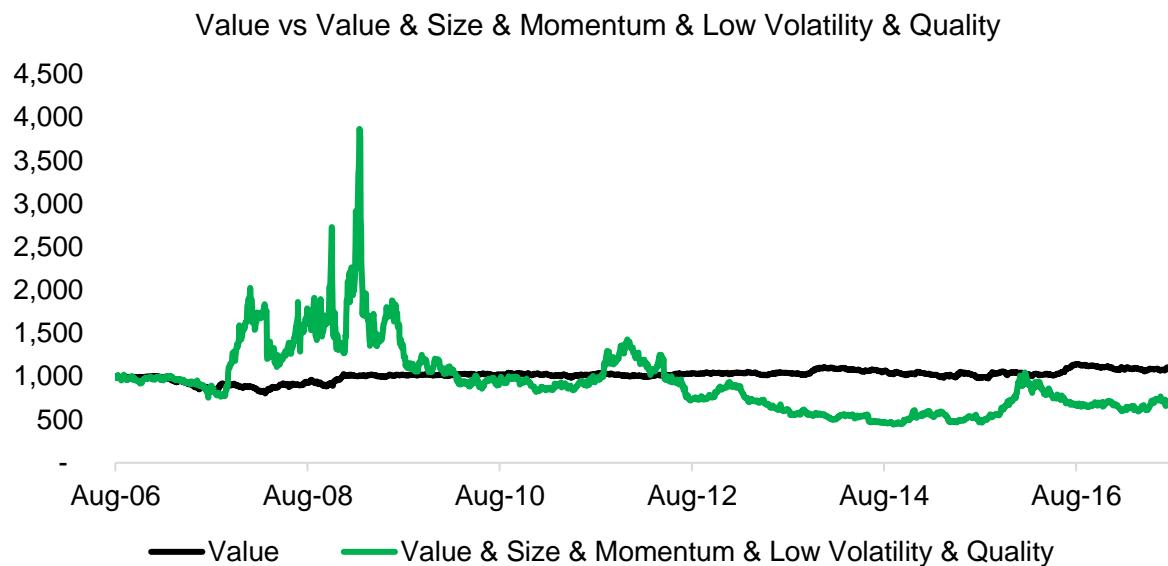
Value vs Value & Size & Momentum & Low Volatility



Source: FactorResearch

VALUE VS VALUE & SIZE & MOMENTUM & LOW VOLATILITY & QUALITY

The final factor to be added in the sequential sorting is the Quality factor, which we define as a combination of low debt-to-equity and high return-on-equity ratios. We observe a clear difference to the previous profiles and high volatility, which can be explained by the low number of stocks in the portfolio, i.e. 5 stocks on the long side and 5 stocks on the short side. The portfolio is no longer dominated by factor exposure, but by single stock risks.

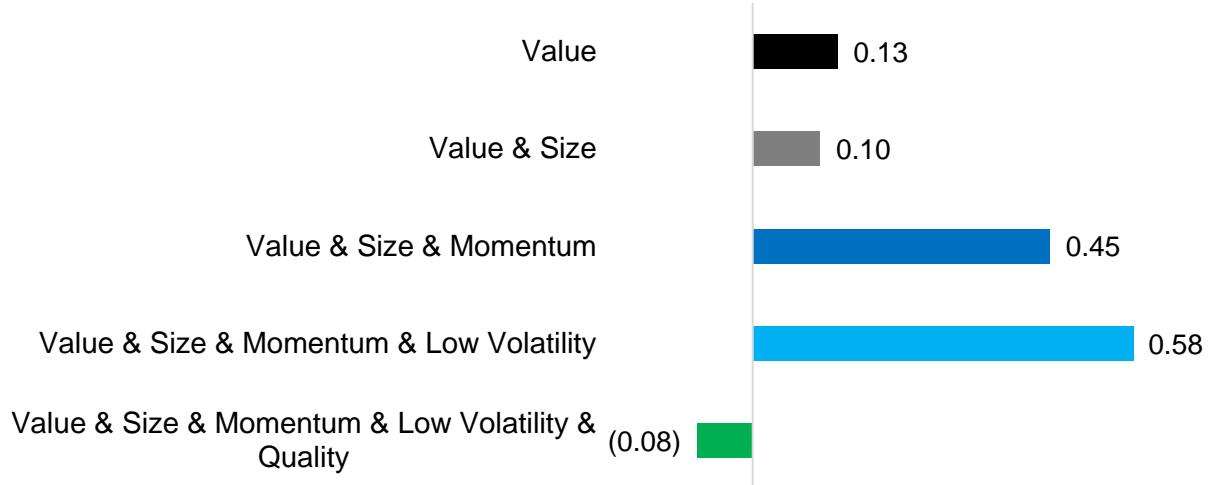


Source: FactorResearch

RISK-RETURN RATIOS

In addition to observing the performance, we can also analyse the risk-return ratios of the sequential portfolios. The analysis highlights that factors like Momentum and Low Volatility increase the risk-return ratios while others like Size decrease it. It is somewhat difficult to derive a conclusion from this analysis given that there are two components driving the performance of the sequential portfolios, i.e. the performance of the single factors and the number of stocks in the portfolio.

Sequential Factor Ranking: Risk-Return Ratios



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights the effect of ranking stocks by factors sequentially, which is one approach to building multi-factor portfolios (please see our White Paper Multi-factor Models 101 for other approaches). The sequential model allows investors to prioritise factors and has the advantage of resulting in a concentrated portfolio of stocks. However, the prioritisation requires investors to have a strong preference for specific factors, which can be a difficult choice given that factors tend to be highly cyclical.

VALUE FACTOR: INTRA VS CROSS-SECTOR

How Effective is Sector-Neutrality?

February 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Intra versus cross-sector Value portfolios share the major trends
- Neutralising the sector exposure increases the risk-return ratio of the Value factor
- However, the benefits are marginal and come with higher operational complexity

INTRODUCTION

2018 started almost identical to 2017 in terms of factor performance in the US—Momentum, Growth and Quality gained while Value lost. Investors with a Value focus naturally hope for a better performance this year as they have effectively experienced a lost decade given a flat factor performance since 2008. Aside from waiting for a more favourable environment for Value stocks, which in itself is challenging to identify, investors aim to improve how they define Value stocks and construct portfolios. One common research question is if there is a difference between sector-neutral and cross-sector portfolios. Investors might assume that the factor performance is more attractive if any unwanted risks such as sector exposure are neutralised. In this short research note we will analyse the Value factor in the US intra versus cross-sector and evaluate eliminating any sector-risks.

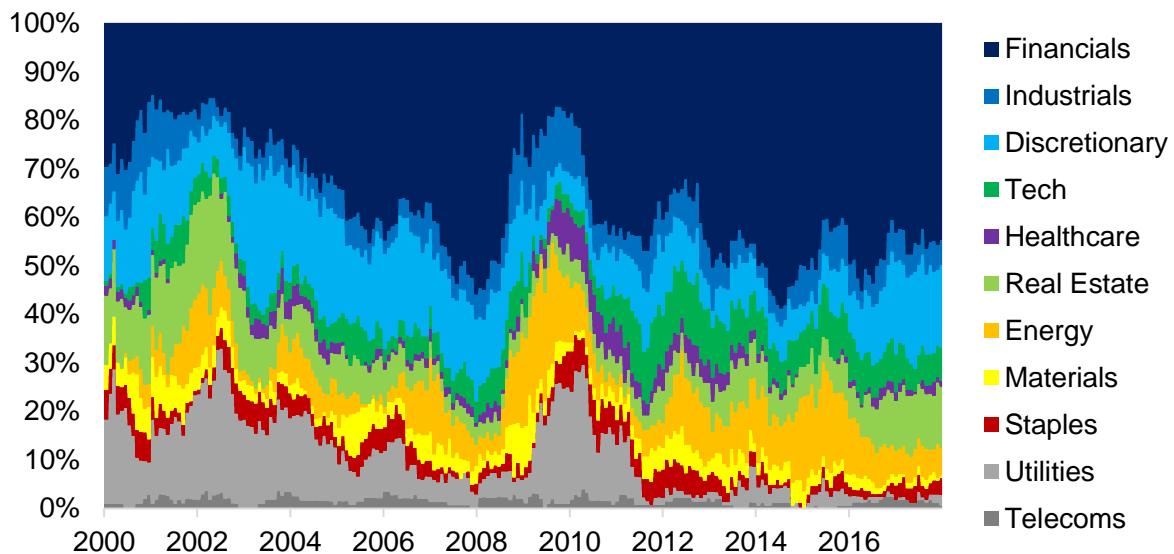
METHODOLOGY

We focus on the Value factor in the US, which is defined as a combination of book-value and price-earnings multiples. The factor is created by constructing long-short beta-neutral portfolios of the top and bottom 30% stocks. Portfolios rebalance monthly and include 10bps of transaction costs. Only companies with a market capitalisation of larger than \$1 billion are included.

VALUE FACTOR: CROSS-SECTOR—BREAKDOWN BY SECTORS

A Value factor portfolio simply represents a portfolio of cheap stocks on the long side and expensive stocks on the short side. The chart below shows the breakdown by sectors for the long portfolio of the cross-sector Value factor in the US from 2000 to 2018. We can observe that Financial stocks dominate the long portfolio currently and historically, i.e. seem perpetually cheap. The analysis highlights the significant sector exposure of the cross-sector portfolio over time, which may be undesirable for investors aiming at harvesting factor returns.

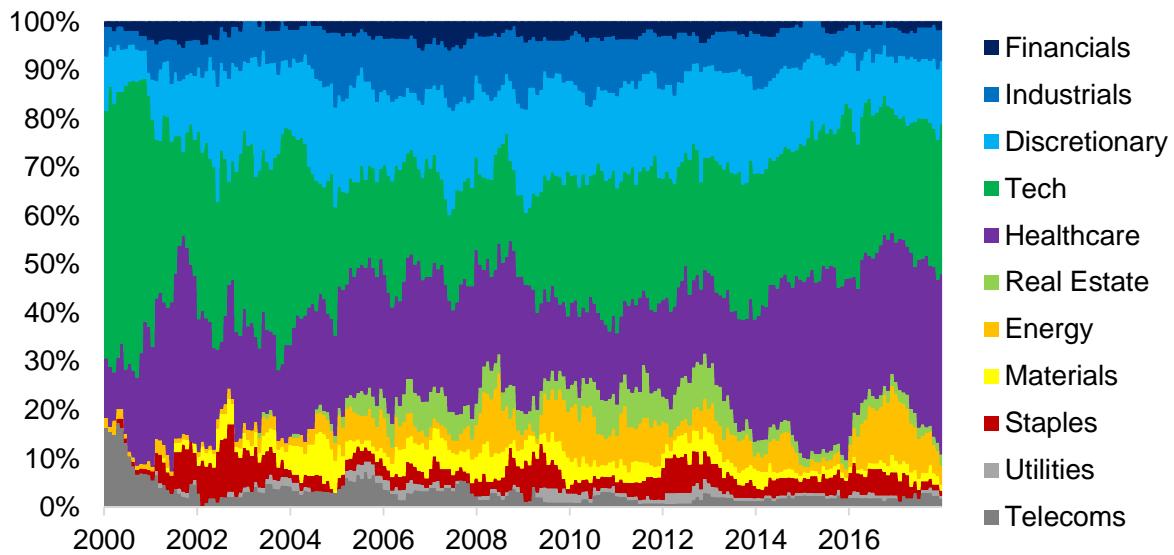
Value Factor US - Long Portfolio: Breakdown by Sectors



Source: FactorResearch

The sector exposure of the short portfolio has varied over time, with the Consumer Discretionary, Technology and Healthcare sectors contributing most stocks. Naturally the sectoral composition depends on the factor definition. Our definition of the Value factor, i.e. a combination of book-value and price-earnings multiples, tends to maximise the universe of available stocks as both metrics are available for all stocks.

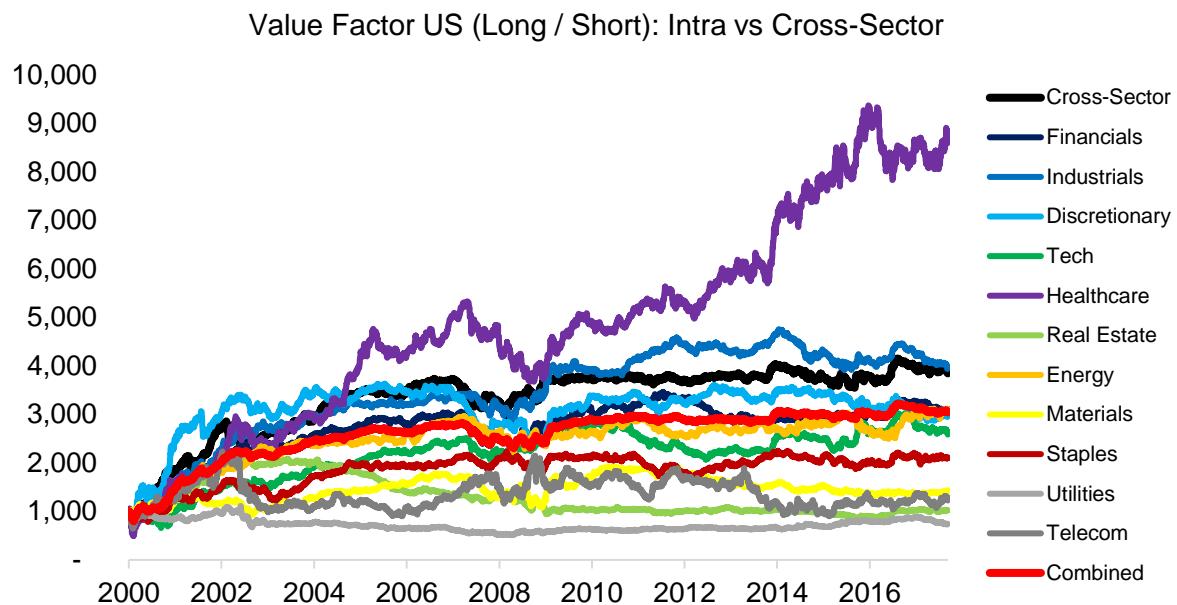
Value Factor US - Short Portfolio: Breakdown by Sectors



Source: FactorResearch

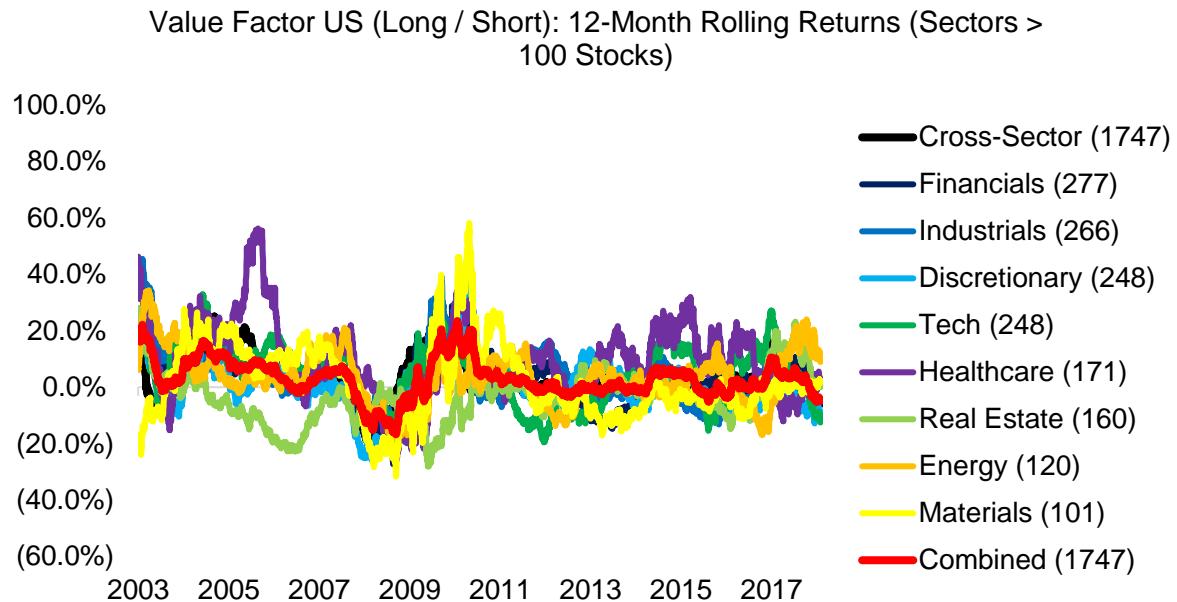
VALUE FACTOR—INTRA VS CROSS-SECTOR: PERFORMANCE

The chart below shows the performance of the Value factor (long / short) in the US from 2000 to 2018 for 11 sectors as well as on cross-sector level. We can observe quite different return profiles for the period with some sectors generating significant returns while others show a flat return profile. The performance of the cross-sector portfolio has been relatively strong and better than that of the combined portfolio, which aggregates the intra-sector profiles and weights these by the number of companies per sector. The trends of the cross-sector and combined portfolios are almost identical, suggesting that sector risks on cross-sector level are being replicated on sub-sector level in the combined portfolio.



Source: FactorResearch

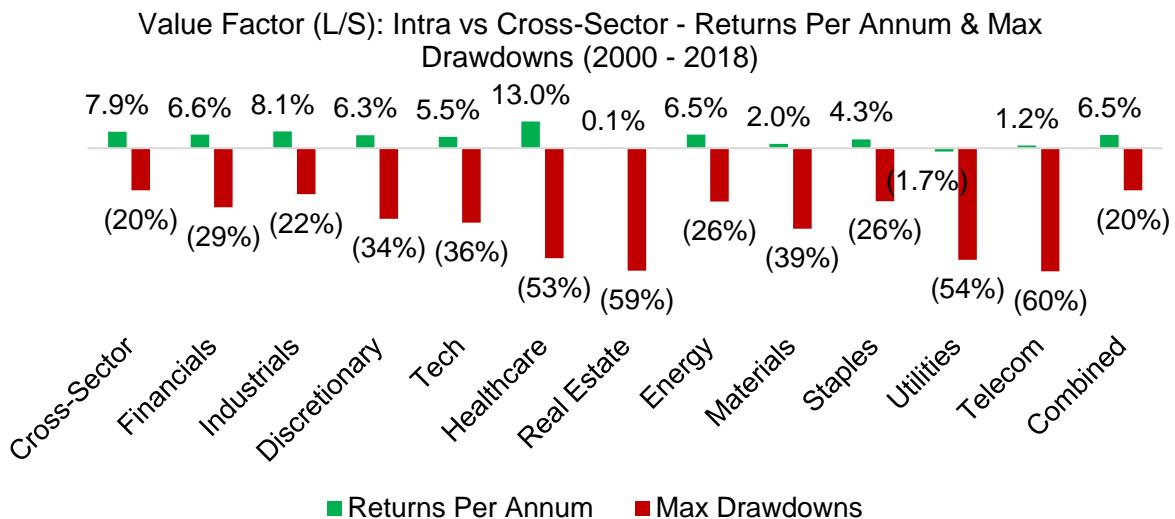
Some sectors like real estate had very few companies in the early years of the analysis, which results in extreme portfolios and may distort the results. The chart below shows the performance as 12-month rolling returns, which makes it easier to analyse similar trends. Any sectors with less than a 100 stocks is removed in order to minimise the impact of single stocks. We can observe that the performance profiles are still heterogeneous, although all portfolios seem to mirror the Global Financial Crisis in 2008–2009 in terms of performance, likely indicating that the performance of the Value factor is impacted by investor sentiment. Other factors, e.g. Momentum, show much more homogeneous performance intra versus cross-sector (please see our report Momentum Factor: Intra vs Cross-Sector Level).



Source: FactorResearch. The numbers in brackets represent the number of stocks per sector.

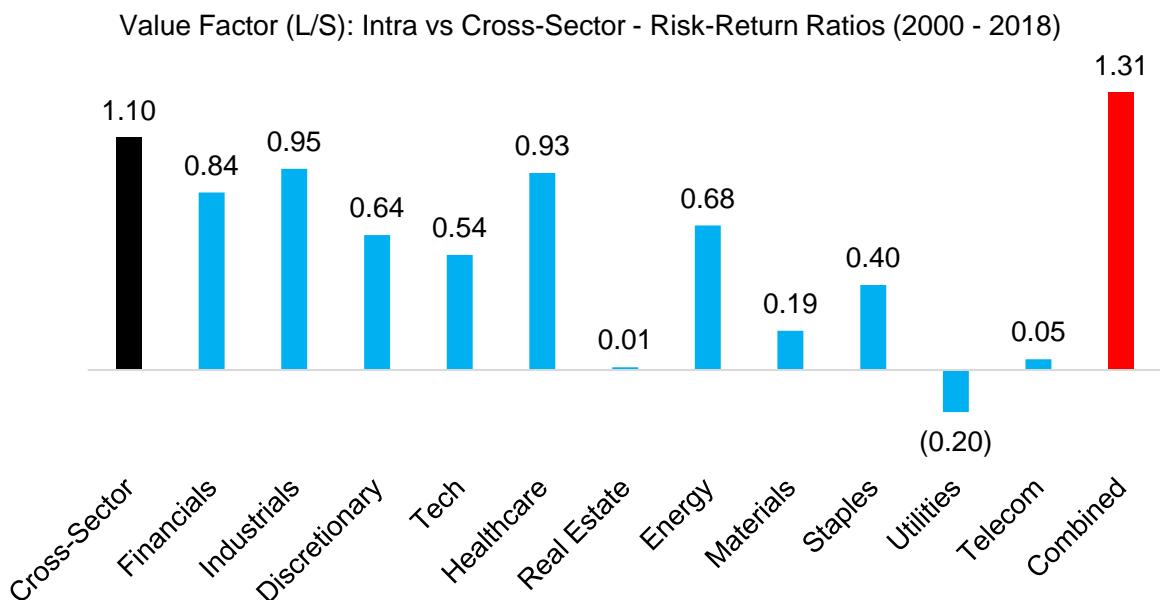
VALUE FACTOR—INTRA VS CROSS-SECTOR: RISK METRICS

In addition to observing the performance we can analyse the risk metrics. The chart below shows the returns per annum and maximum drawdowns from 2000 to 2018, which vary significantly. The intra-sector portfolios show higher drawdowns compared to the cross-sector portfolio, which reflect sector-neutral but less diversified portfolios. Consequently the combined portfolio, which aggregates the intra-sector portfolios, does not show a lower maximum drawdown than the cross-sector portfolio.



Source: FactorResearch

The final chart shows the risk-return ratios, which highlights that the combined portfolio generated the highest risk-return ratio, followed by the cross-sector portfolio. The combined portfolio contains the largest amount of stocks and is therefore much more diversified than any other portfolios, which results in a much lower portfolio volatility and partially explains the high risk-return ratio.



Source: FactorResearch

FURTHER THOUGHTS

This short research note contrasts the Value factor intra versus cross-sector and shows that sector-neutrality offers only marginal benefits to a cross-sector portfolio. Investors might appreciate if sector-risks are neutralised, but it is worth highlighting that the operational complexity increases by managing multiple sector-neutral portfolios, which needs to be considered when constructing a Value portfolio.

WHAT'S IN A FACTOR? BREAKDOWN BY SECTORS

Structural Sector Exposure vs Frequent Sector Rotation

February 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research was originally published by the CFA Institute's Enterprising Investor blog.

SUMMARY

- Some factors show structural sector exposure while others rotate sectors frequently
- Sector concentrations explain factor performance and may represent concentration risks
- Value is currently long Financials, Low Volatility is short Health Care, and Growth is short Energy

INTRODUCTION

Despite all the hustle and bustle surrounding factor investing, considerable uncertainty remains about what factors and their related products represent and contain. For example, there is a large discrepancy between the excess returns of long-short factor portfolios and investable smart beta products. Taking a step further back to the factor construction level, it's illuminating to examine what stocks compose the building blocks of factors.

By analyzing how the factors break down by sector, we can gain valuable insights into factor performance and concentration risks.

With that goal in mind, we explore the six well-known factors—Value, Size, Momentum, Low Volatility, Quality, and Growth—using definitions in line with academic and industry standards and focusing our analysis on the United States. We construct the long and short portfolios using the top and bottom 10% of the stock universe.

THE VALUE FACTOR

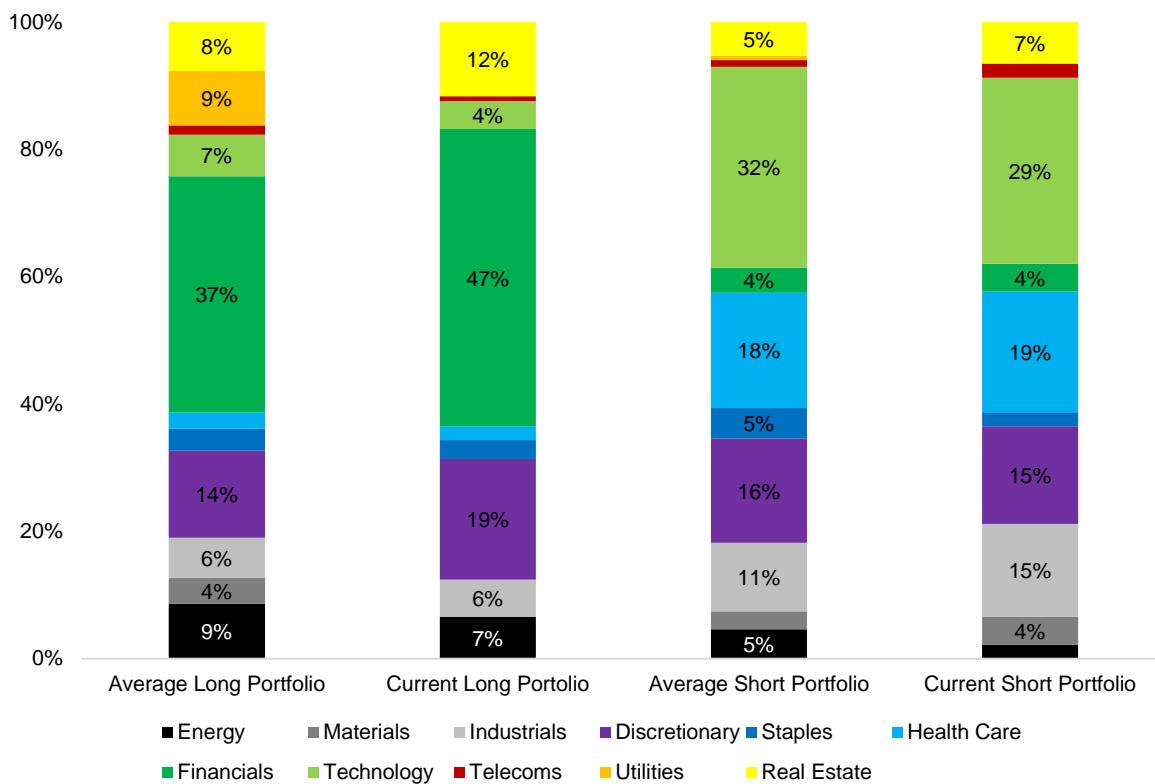
The chart below shows the long and short value factor portfolios by sector, with the average portfolios covering the years 2000 to 2017. Financials make up more of the current long portfolio than the average portfolios, indicating that banks, insurance, and other financial services companies are cheaper today than their historical average. Interestingly, the Technology sector does not compose a larger share of the current short portfolio despite concerns about the high valuations of tech companies like Amazon and Facebook.



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Value Factor US: Breakdown by Sectors

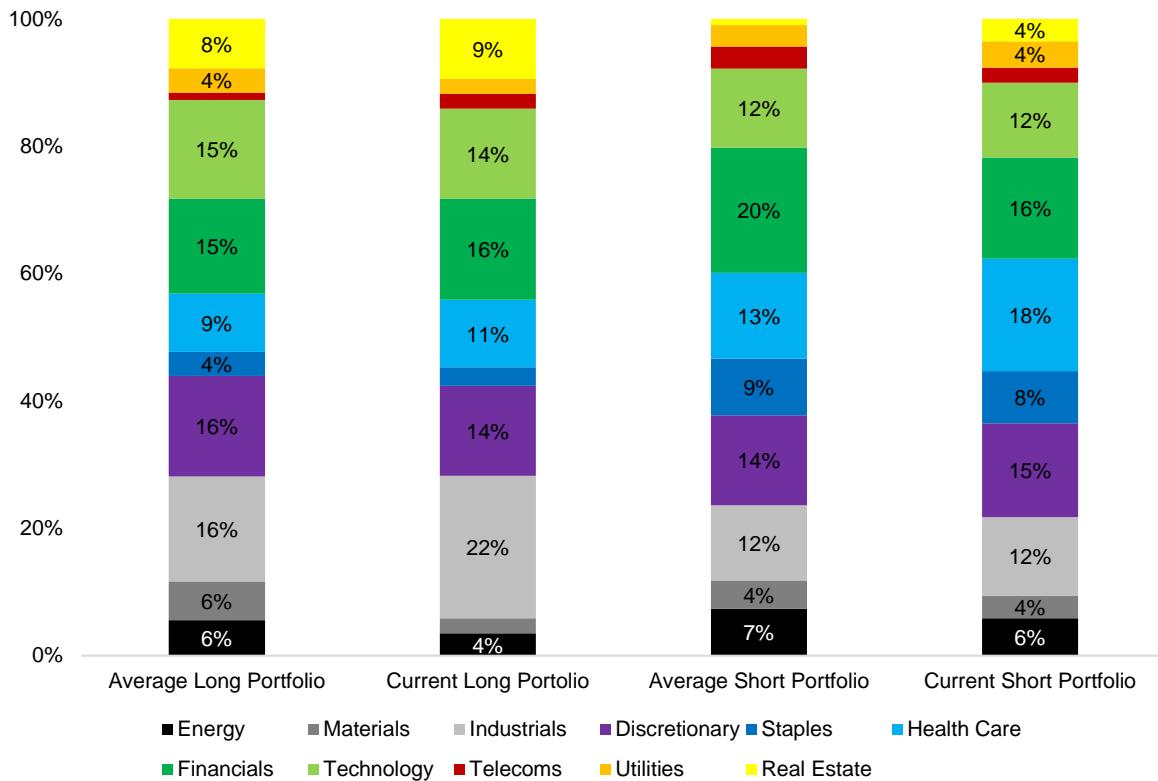


Source: FactorResearch, chart shows all percentages larger than 3%.

THE SIZE FACTOR

The shifting compositions of Size factor portfolios demonstrate how the US stock market has evolved in terms of sectors over time. Neither the long portfolio, which represents small caps, nor the short portfolio, which consists of large caps, shows significant variation in composition today compared to the last 17 years.

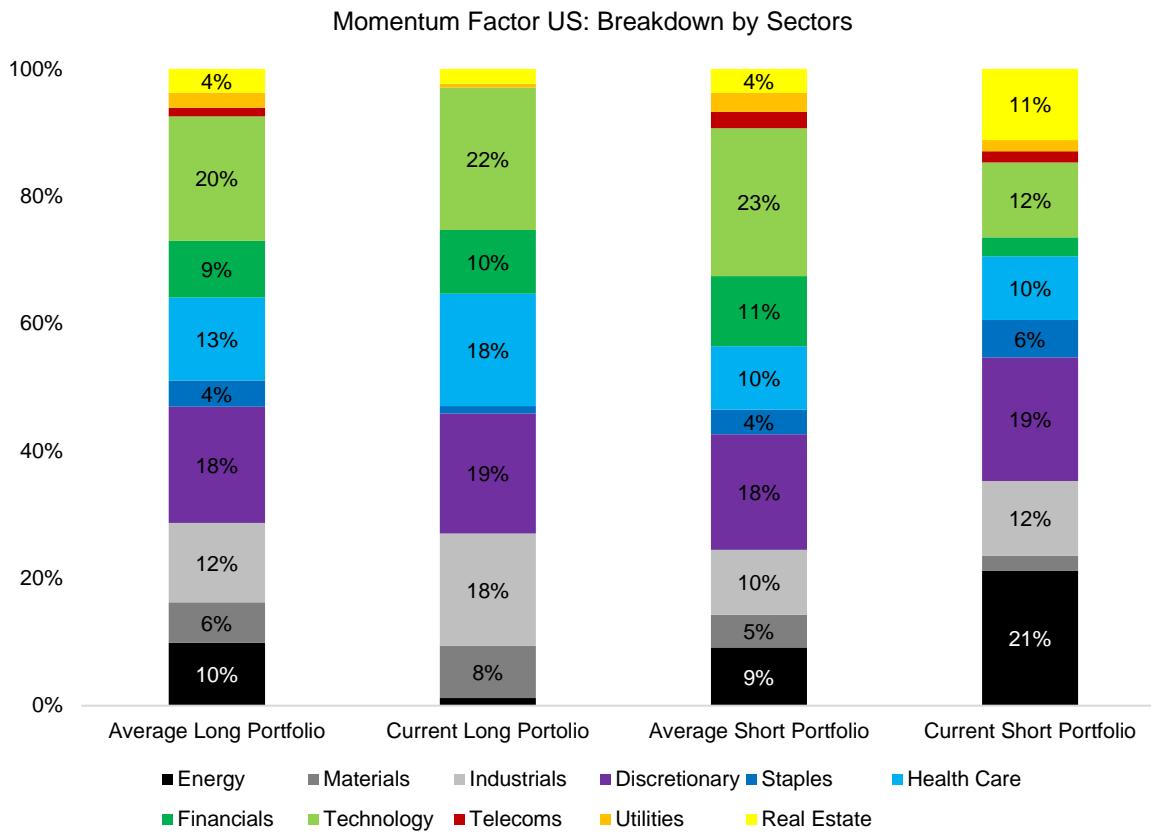
Size Factor US: Breakdown by Sectors



Source: FactorResearch, chart shows all percentages larger than 3%.

THE MOMENTUM FACTOR

Characterized by frequent portfolio changes as the winning and losing stocks over the previous 12 months are constantly rotated in and out, the Momentum factor often mirrors other factors. Because of this, it tends to be well diversified across sectors. Currently, there is almost a zero allocation to Energy stocks in the long portfolios, but nearly twice the historical weight in the short portfolio, indicating the poor performance of oil and gas companies over the previous 12 months.



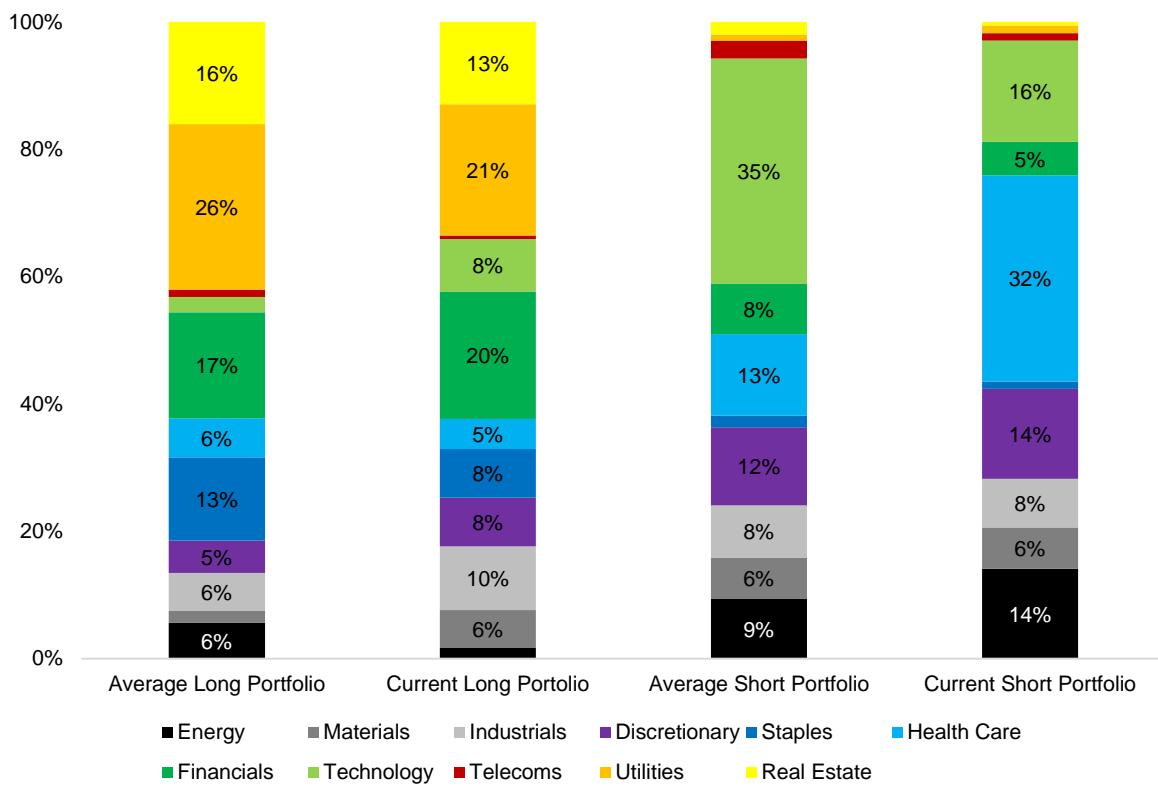
Source: FactorResearch, chart shows all percentages larger than 3%.

THE LOW VOLATILITY FACTOR

Based on strong performance and supportive research, the Low-Volatility factor has gained immense popularity in recent years. The underlying theory behind the factor is that stocks with lower volatility exhibit higher risk-adjusted returns than those with higher volatility. Intuitively, we would therefore expect to find less exciting and less volatile sectors like Utilities and Real Estate in the long portfolio and more dynamic sectors like Technology in the short.

The following chart confirms this. It also shows that there has been minor sector rotation in the long portfolio over time, but a dramatic shift from Technology to Health Care in the short portfolio. Tech companies, which have likely grown into more mature and less volatile businesses, may have been replaced by more volatile biotech companies from the Health Care sector.

Low Volatility Factor US: Breakdown by Sectors

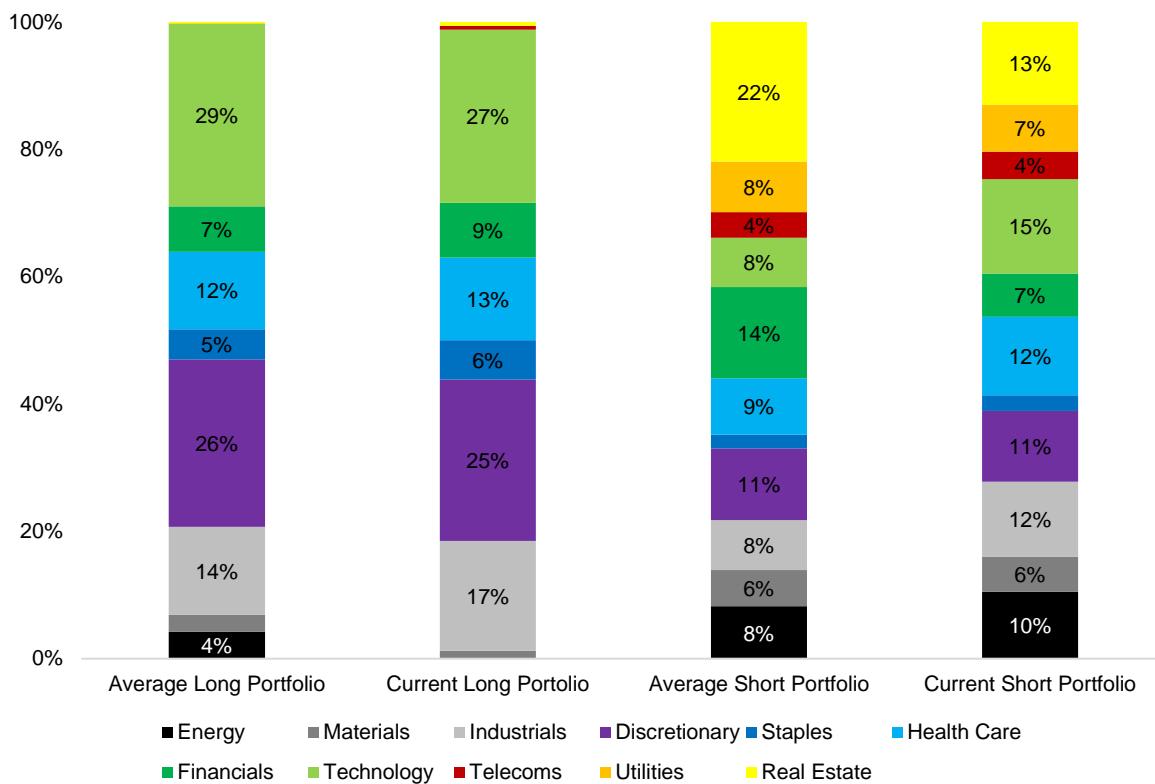


Source: FactorResearch, chart shows all percentages larger than 3%.

THE QUALITY FACTOR

The Quality factor is a combination of profitability and balance sheet ratios. Though it shows no structural changes in the long portfolio, the short portfolio has reduced Real Estate sector exposure. Why the decreased exposure? Real estate stocks (REITs) played a role in the global financial crisis, so likely strengthened their balance sheets thereafter.

Quality Factor US: Breakdown by Sectors

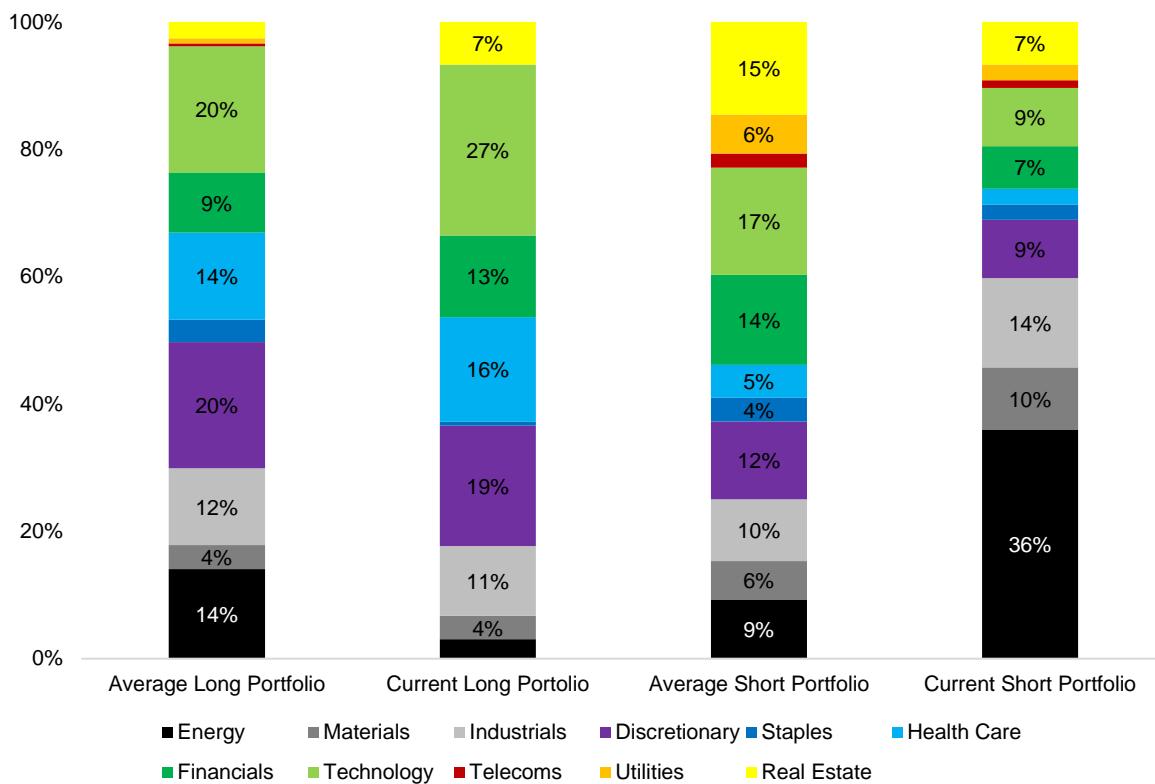


Source: FactorResearch, chart shows all percentages larger than 3%.

THE GROWTH FACTOR

Calculated by a combination of sales and earnings-per-share growth over the last three years, the growth factor shows the greatest sector rotation of all factors and illustrates the ever-changing nature of the economy. The Technology sector currently features larger in the long portfolio, reflecting the strong growth of tech companies in recent years. The short portfolio is dominated by the Energy sector thanks to lower oil and gas prices.

Growth Factor US: Breakdown by Sectors



Source: FactorResearch, Chart shows all percentages larger than 3%.

FURTHER THOUGHTS

Some factors have structural sector exposure while others rotate sectors more frequently. Naturally, the highlighted risks—large sector exposures, among them—could be mitigated by creating factors sector-neutral.

However, our prior research has found that factor trends are remarkably similar intra versus cross-sector. This implies that any sector risks on a cross-sector level are replicated at the intra-sector level, or through sub-sector exposures. It's therefore worth monitoring the sector compositions of factors as a source of risk as well as returns.

FACTOR ETFS & FUTURES

Factor Investing DIY Tools?

February 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Investors can directly access factor returns via ETFs in the US & futures in Europe
- However, neither of these come without some investor concerns
- Realised returns differ substantially from theoretical returns

INTRODUCTION

Despite factor investing having gained immense popularity in recent years, it has been relatively difficult for most investors to directly access long-short factor returns as portrayed in academic and quantitative research. Smart beta ETFs have flourished, but these are long-only products with excess returns that differ from those of the long-short factors (please see our report Smart Beta vs Factor Returns). However, in recent years a few product providers have launched products that allow most investors to gain more direct access to factor exposure. In this short research note we will analyse factor ETFs in the US and factor futures in Europe.

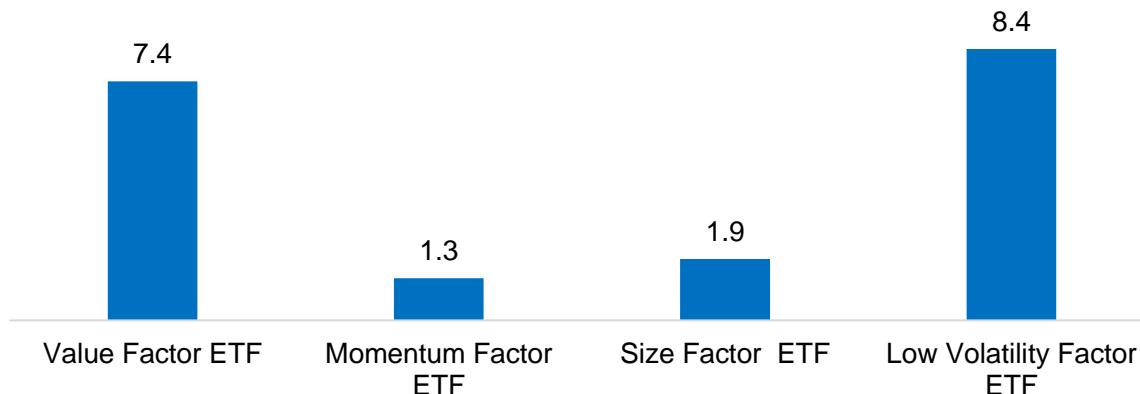
METHODOLOGY

We focus on factor ETFs in the US from AGF Management Limited and factor futures in Europe from the Eurex Exchange. The factor data used in benchmarking the investible products is created by constructing long-short beta-neutral portfolios of the top and bottom 10% stocks ranked by the factors. Portfolios rebalance monthly and include 10bps of transaction costs. Only companies with a market capitalisation of larger than \$1 billion are included.

FACTOR ETFS IN THE US

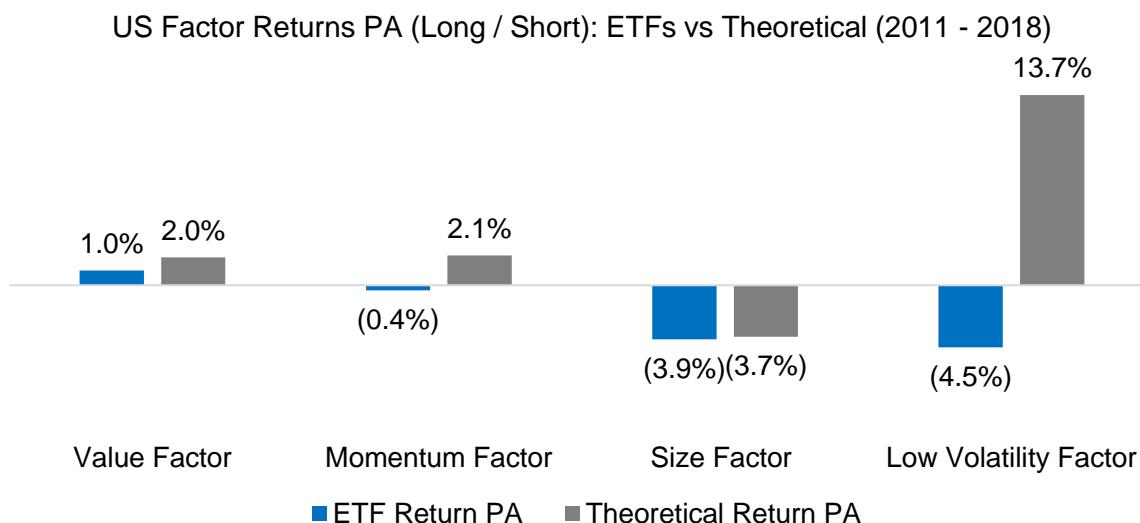
The factor ETFs in the US are available for the Value, Momentum, Size and Low Volatility factors (we ignore the Dividend factor ETF as it has less trading history). They are constructed as dollar-neutral long-short portfolios and rebalance monthly. The ETFs have been launched in 2011 and offer investors the opportunity to directly harvest factor returns via easily-traded securities. Unfortunately the assets under management are below \$10 million for each of the ETFs, which can be seen in the chart below. At that fund size the expense ratios are exceptionally high, which deters investors. However, the ETF provider has agreed to reimburse fees and keep the ratio from exceeding 0.75% per annum, which is competitive for a long-short product.

Factor ETFs in US (Long / Short): ETF AUM (\$m)



Source: AGF, FactorResearch

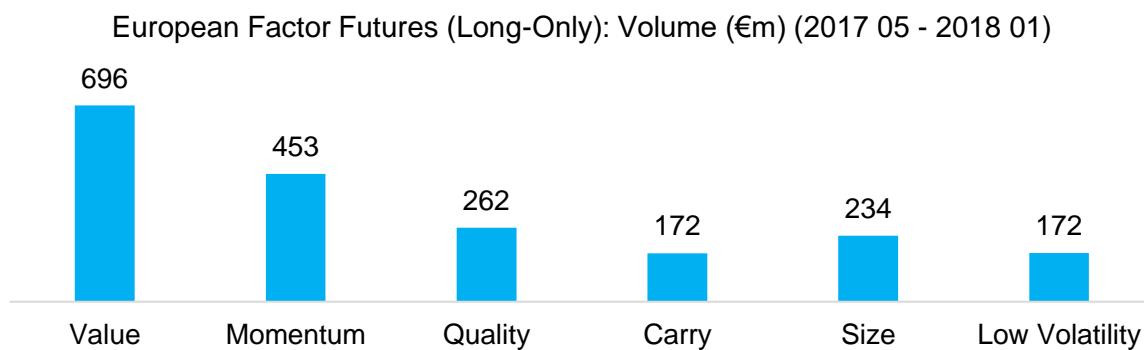
Given that the ETFs have been trading since 2011, we can benchmark these against the theoretical returns, although different factor definitions have to be considered. In the chart below we can see that the performance of the ETFs and the theoretical returns are somewhat comparable for the Value and Size factors, but quite different for Momentum and especially for the Low Volatility factor. The significant difference for Low Volatility can be explained by a divergent portfolio construction as the ETF portfolios are created dollar-neutral compared to beta-neutral portfolios for our factors. The theory behind the Low Volatility factor assumes that stocks with low volatility or beta have higher-risk adjusted returns than stocks with high volatility or beta. If the long and short portfolios are not adjusted for the different betas, then the factor will have structural negative beta, which tends to be punishing in rising markets.



Source: AGF, FactorResearch

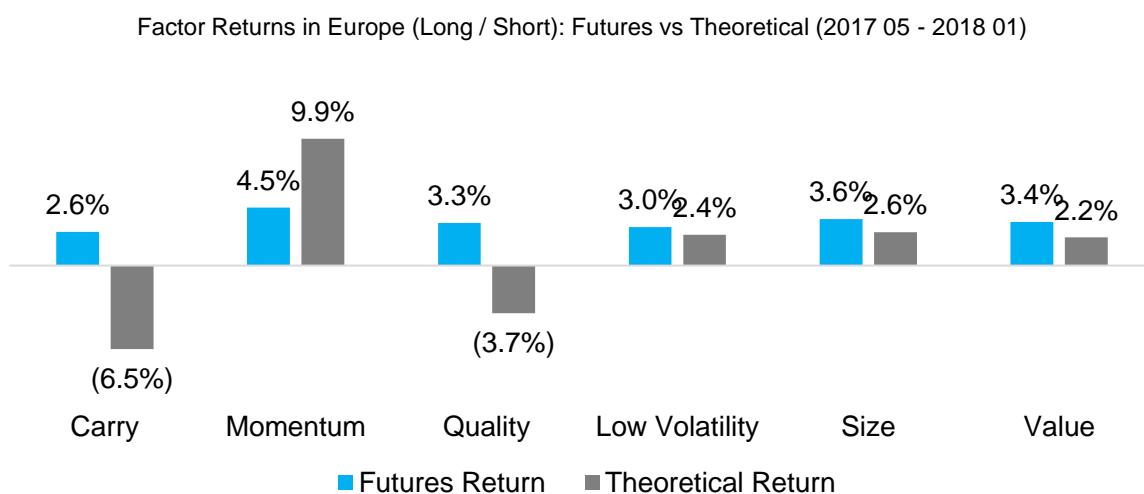
FACTOR FUTURES IN EUROPE

The Eurex Exchange launched factor futures for the STOXX Europe 600 index in 2017, which are long-only products and can be seen as an alternative to smart beta ETFs. The chart below exhibits the volume traded in the contracts in slightly less than a year, which shows a healthy volume. It also highlights that investors had a clear preference for the Value and Momentum factors in 2017 while the Carry and Low Volatility factors were of lesser interest.



Source: STOXX, FactorResearch

Investors can relatively easily create a long-short factor from the long-only factor future by shorting the STOXX Europe 600 index future. The chart below shows the resulting excess returns from the long-short futures portfolios compared to theoretical returns. We can observe significant differences, which are likely explained by different factor definitions. It is worth highlighting that the excess returns from the factor futures have been all positive over the time period, which is slightly unusual given that some of the factors, e.g. Value and Quality, tend to be negatively correlated.



Source: STOXX, FactorResearch

FURTHER THOUGHTS

This short research note highlights how investors can directly access long-short factor returns via exchange-traded products, albeit with some concerns. Investors can partially access factor returns via smart beta ETFs, but it is not particularly easy to distinguish the beta from the factor returns. If the smart beta ETF performance was positive yesterday, was that due to the market or the factor? Investing should not be so complicated and investors should have the opportunity to buy long-short factor exposure from various providers as efficiently as long-only exposure.

FACTOR ALLOCATION MODELS (WHITE PAPER)

Improving Factor Portfolio Efficiency

January 2018. Reading Time: 15 Minutes. Author: Nicolas Rabener.

SUMMARY

- Factor timing and factor risk management are related concepts, but have different objectives
- Factors have unique characteristics that require a tailored risk management approach
- A multi-dimensional factor risk management model shows consistent increases in risk-return ratios and decreases in maximum drawdowns across markets

INTRODUCTION

Smart beta funds surpassed \$1 trillion assets under management in 2017 and factor long-short products have approximately half of that amount in assets. Both product families are based on academic research that has shown that some factors generate positive returns across time, countries and sectors. However, factors, like equity markets, exhibit highly cyclical behaviour and experience significant multi-year drawdowns, which means it is risky for investors to focus exclusively on a single factor. Given this, investors tend to diversify across several factors, which raises the question of how to allocate to factors. In this white paper we will analyse two common approaches to factor allocations, which are equal-weight and risk parity models, and introduce an alternative, which we term the “multi-dimensional factor risk management model”.

METHODOLOGY

We focus on the following six factors: Value, Size, Momentum, Low Volatility, Quality and Growth and the following seven markets: US, Europe, UK, Japan, Australia, Hong Kong and Singapore. The factors are constructed as beta-neutral long-short portfolios by taking the top and bottom 10% of the stock universes in the US, Europe and Japan and 20% in other markets given smaller stock universes. Only stocks with market capitalisations of larger than \$1 billion are considered and 10 basis points of costs per transaction are included. The analysis covers the period from 2000 to 2017.

There are three core approaches for creating multi-factor portfolios (please see our white paper Multi-Factor Models 101 for further information):

- Combination approach: Stocks are ranked by single factors and then single-factor portfolios are combined into a multi-factor portfolio
- Intersectional approach: Stocks are sorted by several factors simultaneously, which results in one portfolio
- Sequential approach: Stocks are sorted by factors sequentially, which results in one portfolio



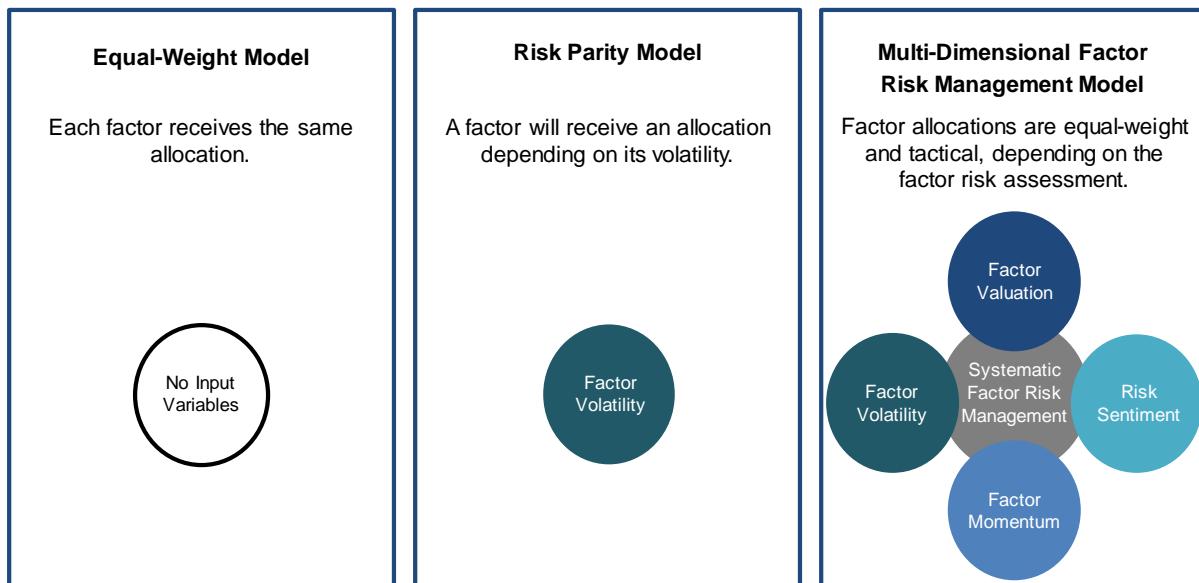
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The factor allocation models are relevant for all approaches, but in this white paper we will analyse the models from the perspective of the combination portfolio. The models are defined as follows:

- Equal-weight model: The allocations are the same for all factors
- Risk parity model: The allocations are risk-weighted, i.e. there are portfolio and factor volatility targets. We derive factor volatility targets by approximating the same portfolio volatility of the equal-weight portfolio.
- Multi-dimensional factor risk management model: The allocations are equal-weight, but tactical. The risk management model is fully systematic and incorporates the following four elements: factor valuations, factor volatility, factor momentum and risk sentiment. The rationale for selecting these four metrics is our understanding of the underlying factor drivers and characteristics. The factor allocations are modelled as either 0% or 100%, depending if the factor risk is determined as high or low. The portfolio therefore holds cash periodically, but no interest income is assumed, which slightly understates the returns.

Factor Allocation Models



Source: FactorResearch

All changes by the allocation models are assumed to be transacted with a time delay of one day and are modelled to avoid aggressive trading, in order to make the results implementable in portfolio management.

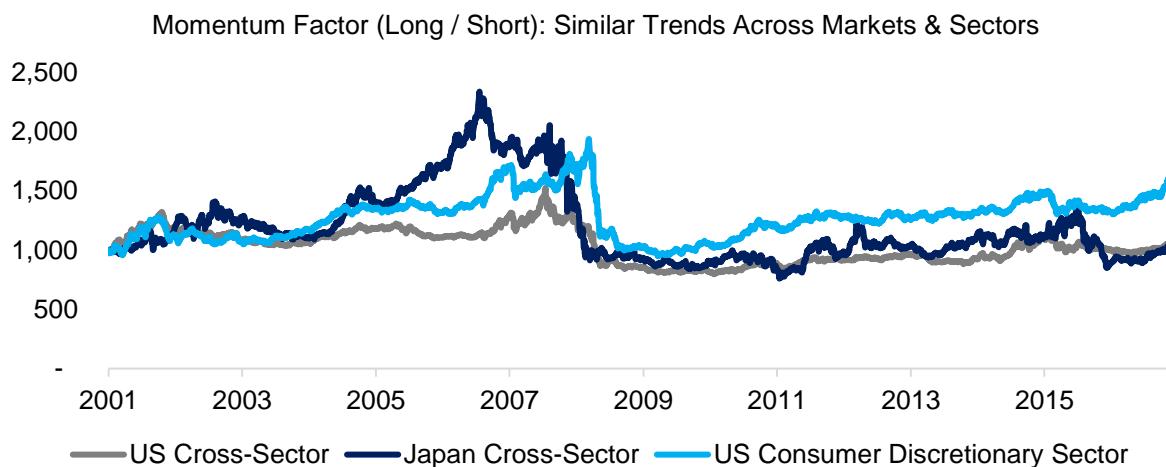
FACTOR TIMING VERSUS RISK MANAGEMENT

Before we analyse the performance of the three factor allocation models it is worth addressing the objectives of the models, which are generally to improve the risk metrics of a multi-factor portfolio, specifically to increase the risk-return ratios and decrease drawdowns. The equal-weight model aims to achieve this by simply diversifying equally across factors

while the risk parity model seeks to equalise the risk of factors by scaling up or down the allocation weights based on factor volatility. The multi-dimensional factor risk management model allocates on a tactical basis and considers the individual characteristics of each factor. The risk parity or multi-dimensional factor risk management model might be characterised as factor timing models, but this would not be an accurate reflection of the objectives. Factor timing, like market timing, aims at improving the performance of factors, which is unlikely achievable. Factor risk management is a related concept but seeks to improve the risk-return metrics, often at the price of performance. Like the two sides of a coin, they are the same, yet different.

FACTOR PERFORMANCE CHARACTERISTICS

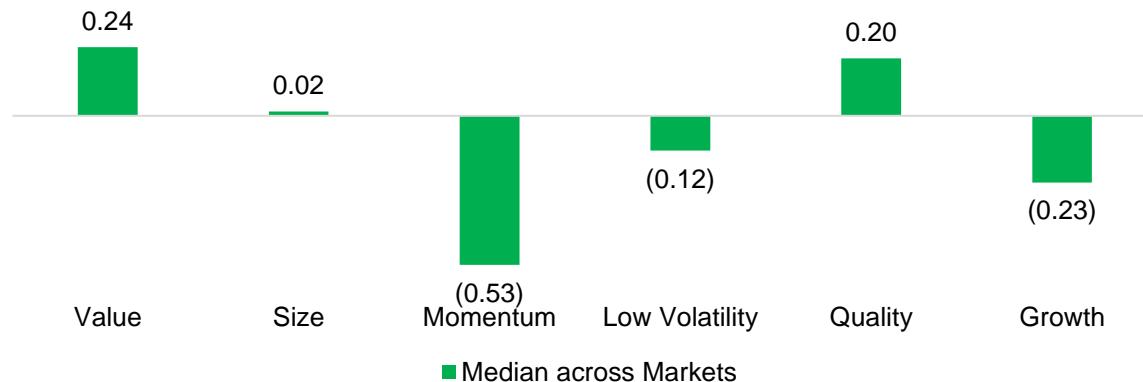
In addition to contrasting the differences between factor timing and risk management we would like to highlight some of the unique characteristics of factor performance. Our research shows that most factors exhibit similar trends across countries, e.g. the performance of the Momentum factor in the US and Japan is comparable. The same applies to cross versus intra-sector, where the factor performance is remarkably similar within a sector compared to the factor performance across all sectors, which can be seen in the chart below. It seems like factors have the same underlying drivers that permeate borders and sectors.



Source: FactorResearch

However, although some factors show the same trends across markets and sectors, the performance for different factors is naturally quite heterogeneous within a country. Changing investor preferences lead to a constant factor rotation in terms of performance. More importantly, factors behave differently from a risk perspective, which can be measured by the skewness of the return distribution. Positive skewness describes a return distribution where frequent small losses and a few extreme gains are common while negative skewness highlights frequent small gains and a few extreme losses. Some factors exhibit positive, some none, and some negative skewness. Interestingly the skewness profile is similar across countries, e.g. the Momentum factor has negative skewness in every single market. The chart below shows the factor skewness profile for the median across markets, which consists of the US, Europe and Asia.

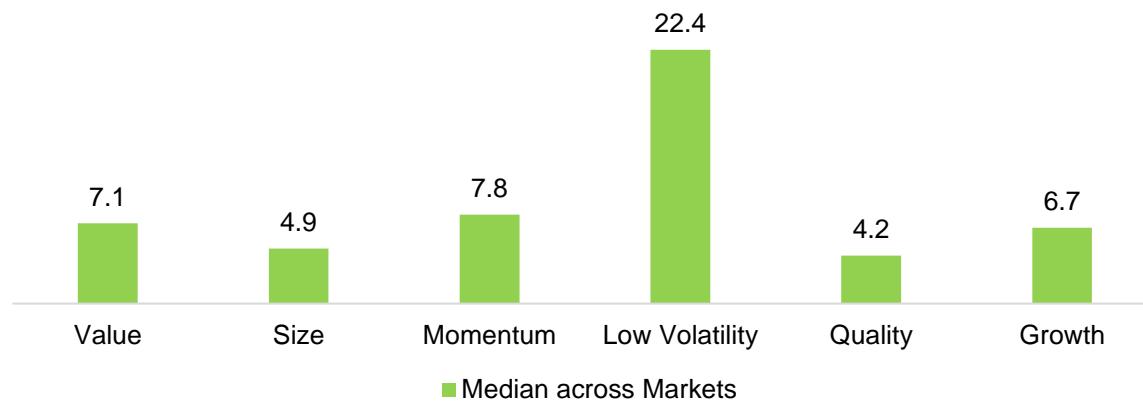
Skewness of Factors (Long / Short): 2000 - 2017



Source: FactorResearch

In addition, we can analyse the kurtosis of factors, which simply said indicates if extreme gains or losses occur more often than investors might anticipate. In the chart below, we can observe that all factors have a kurtosis larger than 3 (normal distribution). The skewness indicates if the extreme returns are more likely to be positive or negative. The Momentum factor shows a high level of kurtosis and negative skewness, which reflects rare, but severe factor crashes.

Kurtosis of Factors (Long / Short): 2000 - 2017



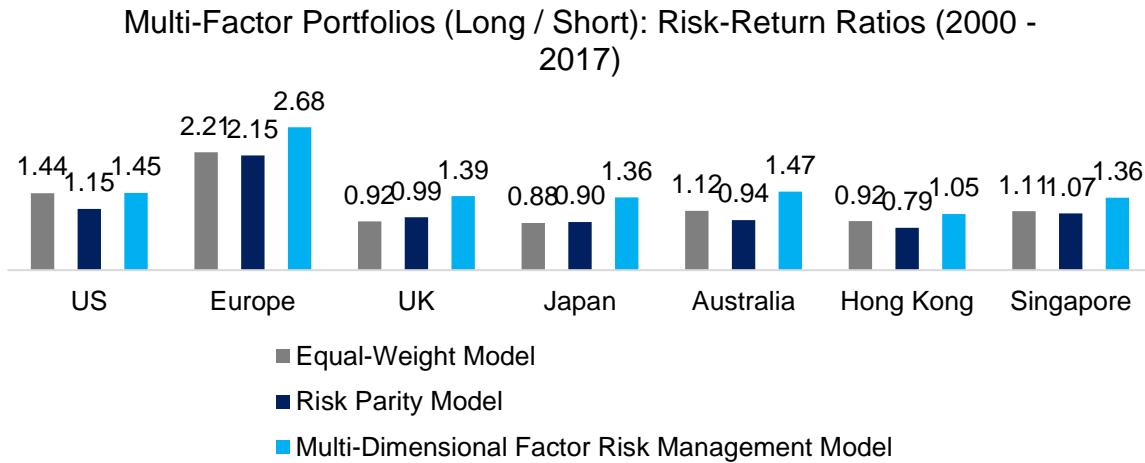
Source: FactorResearch

We believe that a thorough understanding of the underlying factor drivers and unique factor characteristics are essential for creating an effective factor risk management framework.

FACTOR ALLOCATION MODELS

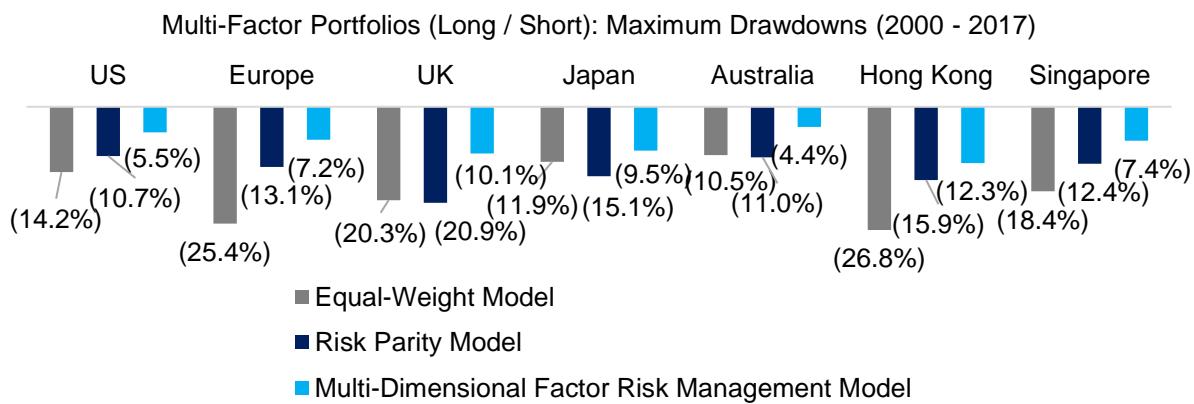
Given that the objective of the factor allocation models is an improvement in risk-metrics, we will compare the risk-return ratios and maximum drawdowns for long-short multi-factor

portfolios across markets. The portfolios include the Value, Size, Momentum, Low Volatility, Growth and Quality factors. In the chart below, we can observe that the multi-dimensional factor risk management model consistently generates the highest risk-return ratios across markets for the period 2000 to 2017, followed by the equal-weight model. The risk parity model shows the lowest ratios on average.



Source: FactorResearch

The next chart highlights the maximum drawdowns for the three factor allocation models across markets. We can observe that the equal-weight model shows the highest drawdowns, while the risk parity model reduces these in most markets. The multi-dimensional factor risk management model shows a significant decrease in maximum drawdowns across all markets.

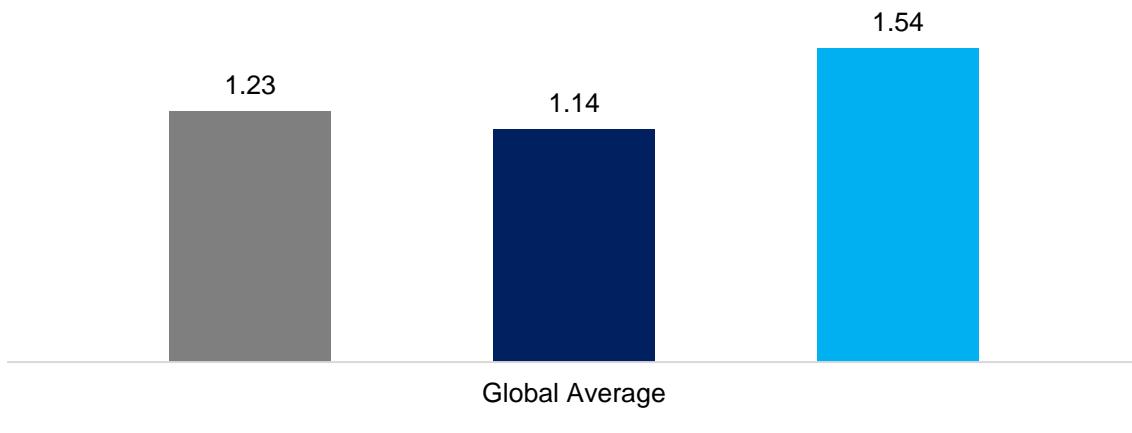


Source: FactorResearch

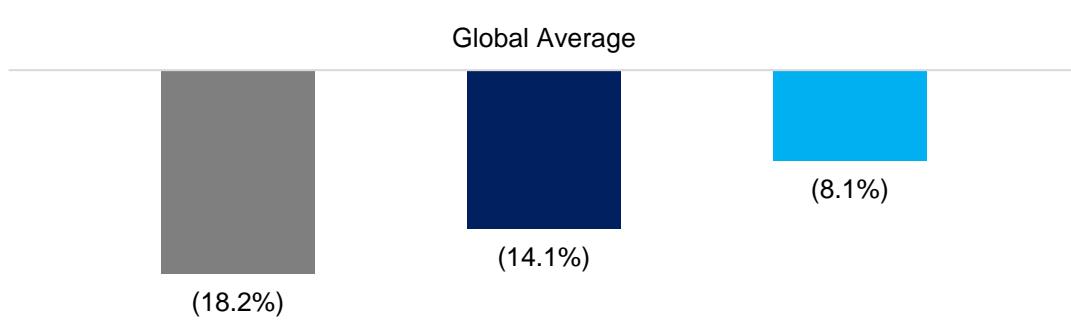
The charts below summarise the results on a global level. It is interesting to observe that the risk-parity model does not improve the risk-return ratio. Risk parity is a well-researched model and often employed across asset classes. Our research indicates that the risk parity approach improves risk metrics if factors or asset classes exhibit negative skewness, e.g.

like the Momentum factor or bonds, but is less effective with factors or asset classes that exhibit positive skewness, e.g. like the Value factor or commodities. Investors should not regard high factor volatility as undesirable or negative per se.

Multi-Factor Portfolios (Long / Short): Risk-Return Ratios (2000 - 2017)

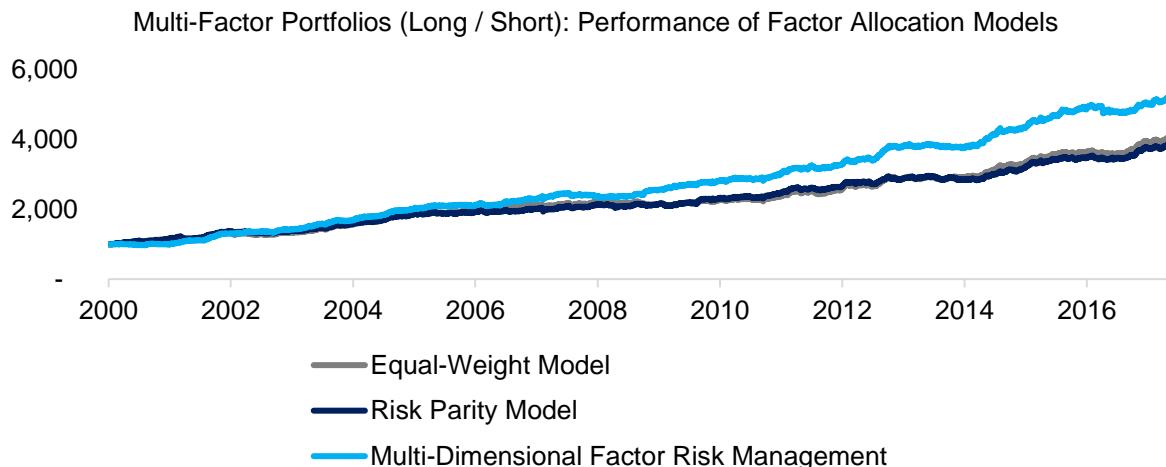


Multi-Factor Portfolios (Long / Short): Maximum Drawdowns (2000 - 2017)



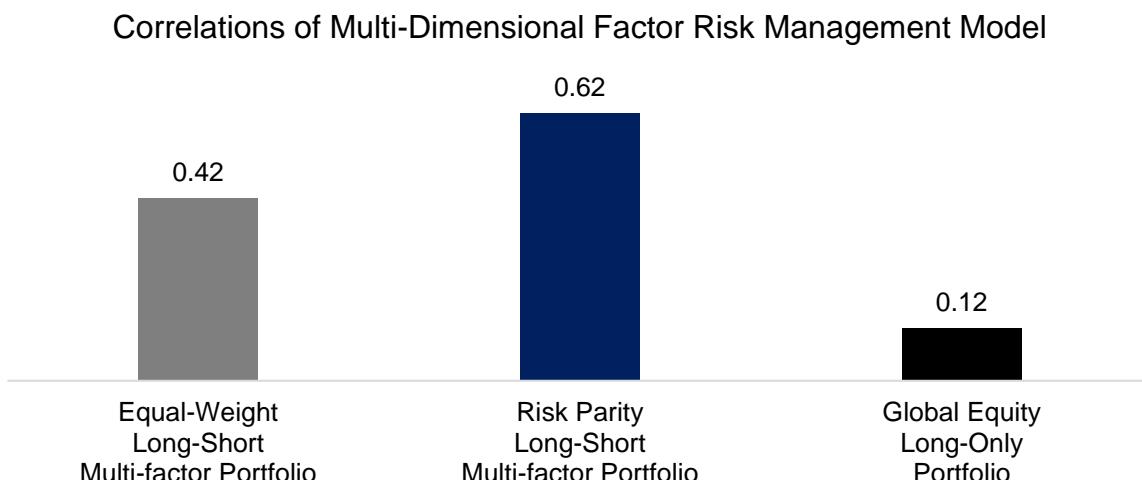
Source: FactorResearch

Although the objective of the factor allocation models is primarily to reduce risk and not to improve returns, we can compare the performance of the global multi-factor portfolios, which is shown on an equal-volatility basis to make the results comparable. We can observe that the equal-weight and risk parity models result in almost the same performance for the multi-factor portfolio, which is reflected in similar risk-return ratios, while the multi-dimensional factor risk management model shows a consistent outperformance.



Source: FactorResearch

The chart below shows the correlations of a long-only global equity portfolio and the multi-factor portfolios from the equal-weight and risk parity models to the portfolio derived from the multi-dimensional factor risk management model. We can observe that the factor allocation models have correlated portfolios, which is to be expected, while the correlation to equities is low, making the portfolio attractive for equity investors from a diversification perspective.



Source: FactorResearch

CONCLUSION

This white paper analyses three different factor allocation models, two of which are commonly used by investors to create multi-factor portfolios. The results highlight that an equal-weight model is better or worse than a risk parity approach, depending if the focus is on increasing the risk-return ratio or decreasing the maximum drawdowns. A third model, the multi-dimensional factor risk management model, shows consistent improvements in risk-metrics across all markets. The model's superior results can be explained by incorporating

multiple variables, which reduce the single-variable risk and reflect the unique characteristics of factors.

FURTHER THOUGHTS

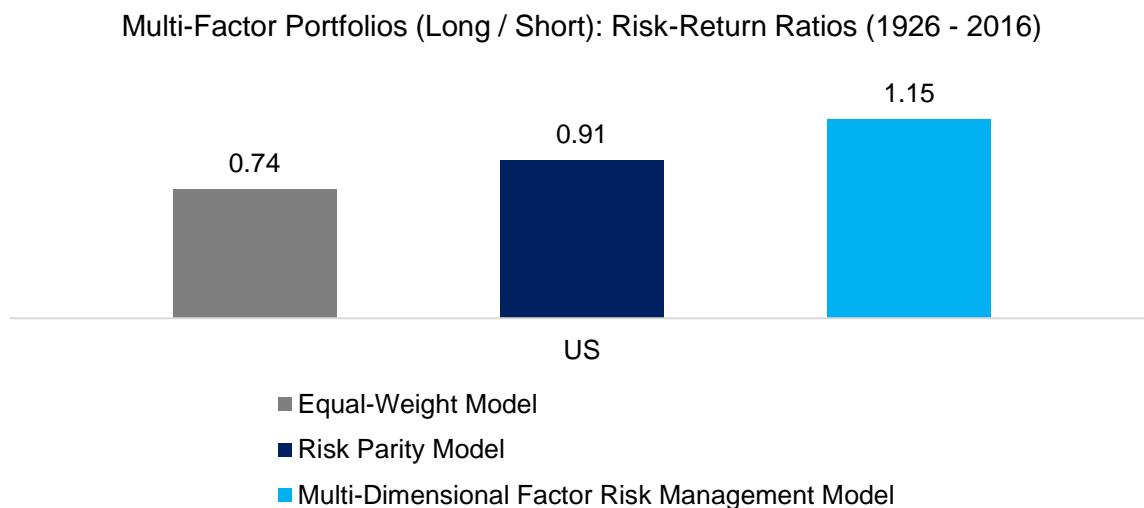
The search for better allocation models is a perpetual one and there are no perfect models. New technologies like machine learning can be applied to enhance existing or create new models. However, we don't think that new factors will be discovered, but we do believe that factor returns can be harvested more efficiently.

APPENDIX

We tested three different factor allocation periods over a period from 2000 to 2017 and can extend the analysis by using data from Kenneth R. French's website, which can be considered an out-of-sample test for the multi-dimensional factor risk management model. The factor allocation models as described in the Methodology section are applied to this extended factor data set.

US FACTORS 1926–2016

Data is available for the US stock market from 1926 to 2016 for the Value, Size and Momentum factors, which are constructed as dollar-neutral long-short portfolios based on the top and bottom 10% of the US stock universe. The chart below shows the risk-returns ratios of the multi-factor portfolios in the US, where we can observe that the risk parity and multi-dimensional factor risk management model both significantly increase the ratios compared to the equal-weight approach.



Source: FactorResearch, Kenneth R. French Data Library

We can also see a meaningful reduction in maximum drawdowns from the risk parity and multi-dimensional factor risk management models, which is shown in the chart below.

Multi-Factor Portfolios (Long / Short): Max Drawdowns (1926 - 2016)

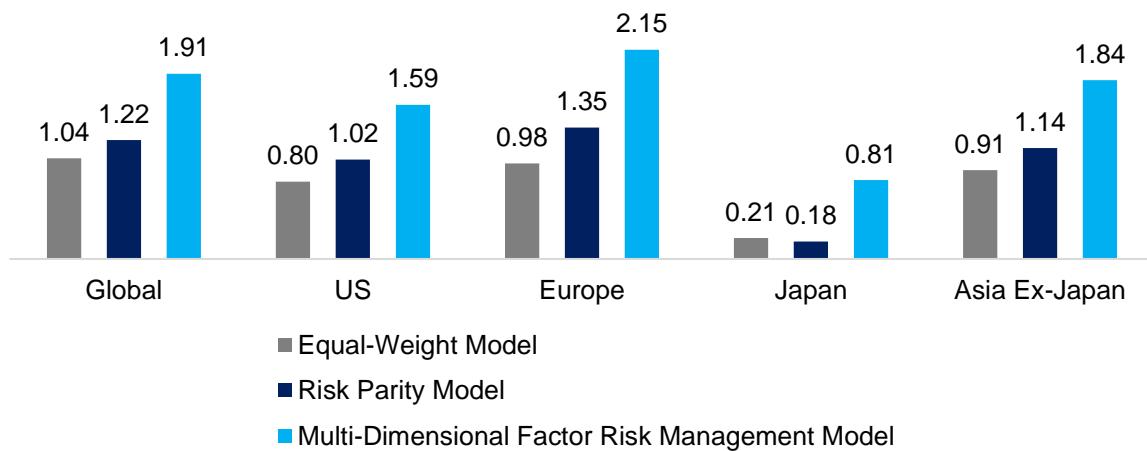


Source: FactorResearch, Kenneth R. French Data Library

INTERNATIONAL FACTORS 1990–2016

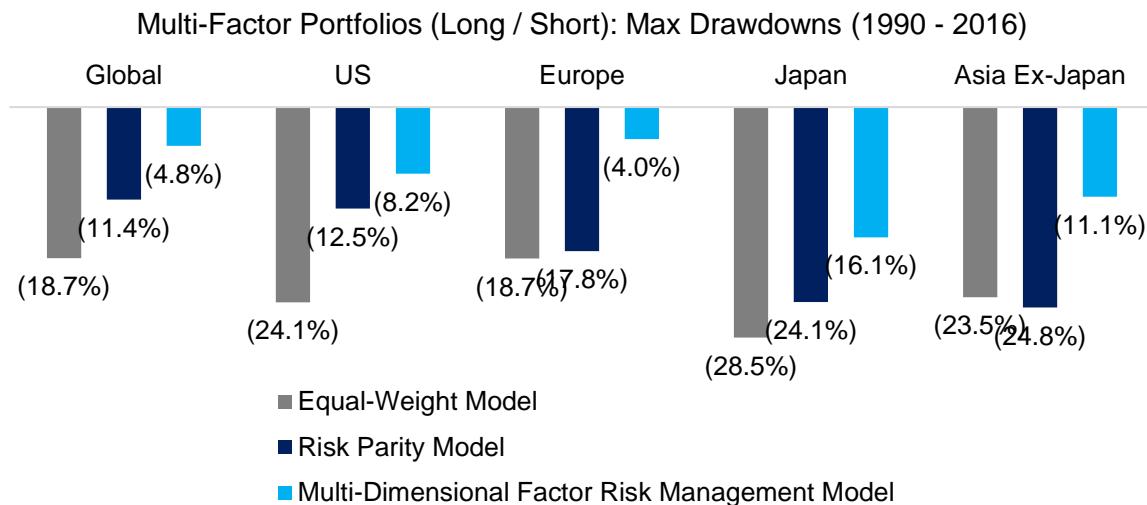
Data is also available for international markets from 1990 to 2016. The Value, Size and Momentum factors are constructed as dollar-neutral long-short portfolios based on the top and bottom 30% of the stock universes. The chart below shows the risk-return ratios for the multi-factor portfolios, where we can observe that the multi-dimensional factor risk management model significantly increases the ratios across all markets compared to the equal-weight or risk parity approaches.

Multi-Factor Portfolios (Long / Short): Risk-Return Ratios (1990 - 2016)



Source: FactorResearch, Kenneth R. French Data Library

Like for the results for the US from 1926, the multi-dimensional factor risk management model meaningfully decreases the maximum drawdowns across markets.

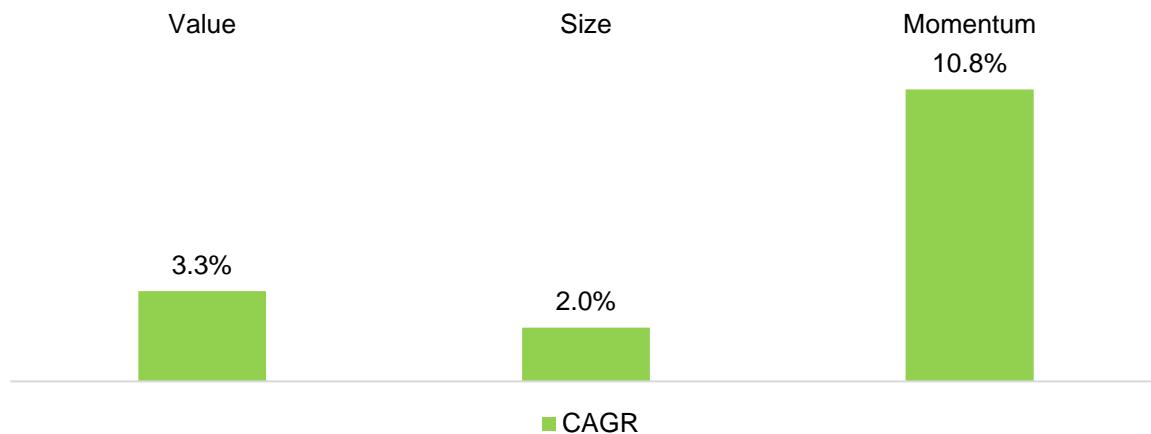


Source: FactorResearch, Kenneth R. French Data Library

APPENDIX DISCUSSION

Comparing the results for the multi-factor portfolios from the main section of this white paper with the results from the Appendix may lead to a slightly different conclusion regarding the effectiveness of the risk parity model. The results from the main section are based on multi-factor portfolios including six factors, cover the period from 2000 to 2017, and indicate no significant improvement to an equal-weight model. The results from the Appendix results include three factors, cover the periods from 1926 to 2016 respectively from 1990 to 2016, and indicate significant improvements to an equal-weight portfolio. The difference can be explained by the Momentum factor, which dominates the performance of the multi-factor portfolios in the Appendix. The chart below shows the CAGRs, but these returns are without transaction costs, which have a larger impact on Momentum given significantly higher turnover.

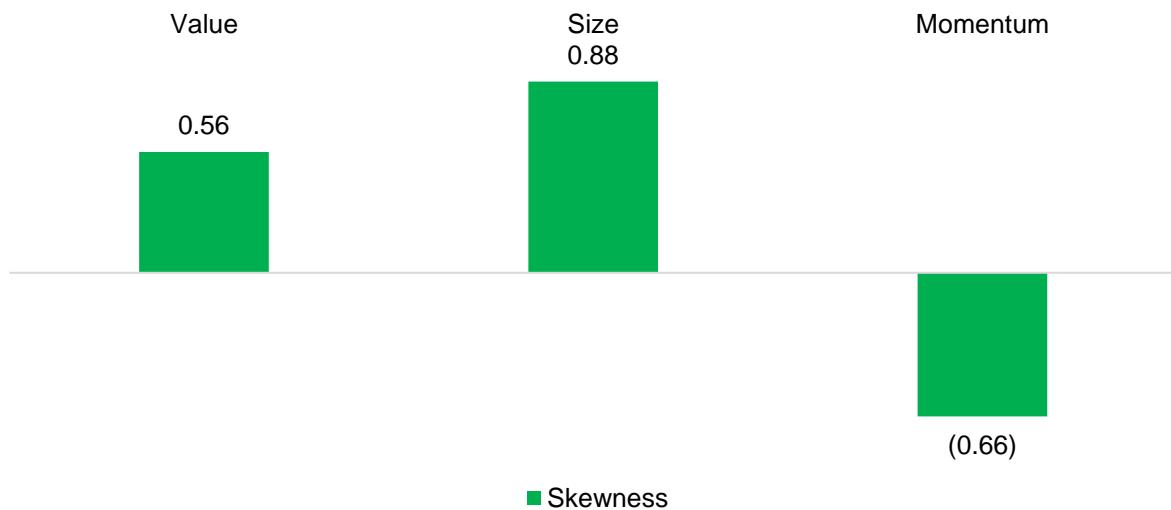
Factor CAGRs excluding Transaction Costs (1926 - 2016)



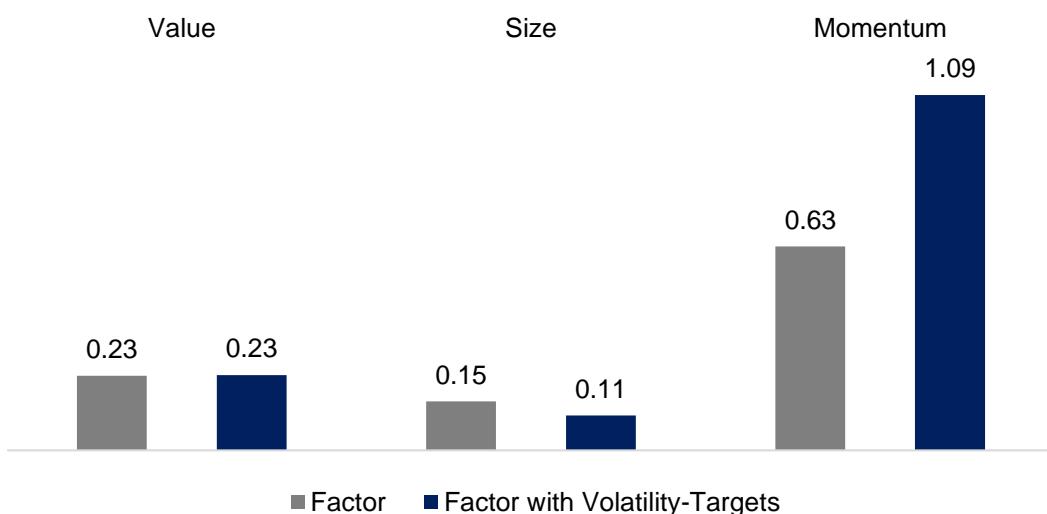
Source: FactorResearch, Kenneth R. French Data Library

If transaction costs would be included, the portfolio would be more balanced in terms of single factor contribution. The charts below show the skewness of the three factors as well the risk-return ratios on single factor basis, once unadjusted and once with volatility-targets, where we can observe that only the Momentum factor improves. Volatility and risk are not necessarily the same.

Skewness of Factors (1926 - 2016)



Risk-Return Ratios (1926 - 2016)



Source: FactorResearch, Kenneth R. French Data Library

VALUE & MOMENTUM FACTOR PORTFOLIOS

How to Combine Cheap and Winning Stocks.

January 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

This research note was originally published at AlphaArchitect.

SUMMARY

- Value and Momentum complement each other given a low or negative correlation
- Investors have different options for combining these two factors
- The multi-factor model selection will be determined by investor preferences

INTRODUCTION

Being a Value investor is difficult in general given that the stocks of a Value portfolios tend to have inherent issues as otherwise they would not be cheap. Having been a Value investor over the past decade has been especially hard as the factor returns were effectively zero—plenty of pain, but no gain. Experiencing this factor cyclical often leads investors to contemplate adding other factors in the hope of improving performance. An obvious candidate would be Momentum as cheap and rising stocks are more appealing than cheap stocks. However, it is not quite straight forward for investors to add Momentum to a Value portfolio as there are several options available. In this short research note we will analyse Value & Momentum portfolios created by three common multi-factor model approaches—the combination, the intersectional and the sequential models.

METHODOLOGY

We focus on the Value and Momentum factors in the US stock market. The factors are created by constructing long-short beta-neutral portfolios of the top and bottom stocks ranked by the factors. Portfolios rebalance monthly and include 10bps of transaction costs. Only companies with a market capitalisation of larger than \$1 billion are included. The following three multi-factor models are utilised:

- Combination model: Single factor portfolios are created and combined into one portfolio
- Intersectional model: Stocks are ranked by several factors simultaneously
- Sequential model: Stocks are sorted by factors sequentially

The portfolios are created so that they approximately contain the same number of stocks, which equates to the top and bottom 10% of the universe of 1,800 stocks. For a detailed report on these three models please see our white paper Multi-factor Models 101.

VALUE VERSUS MOMENTUM (LONG / SHORT)

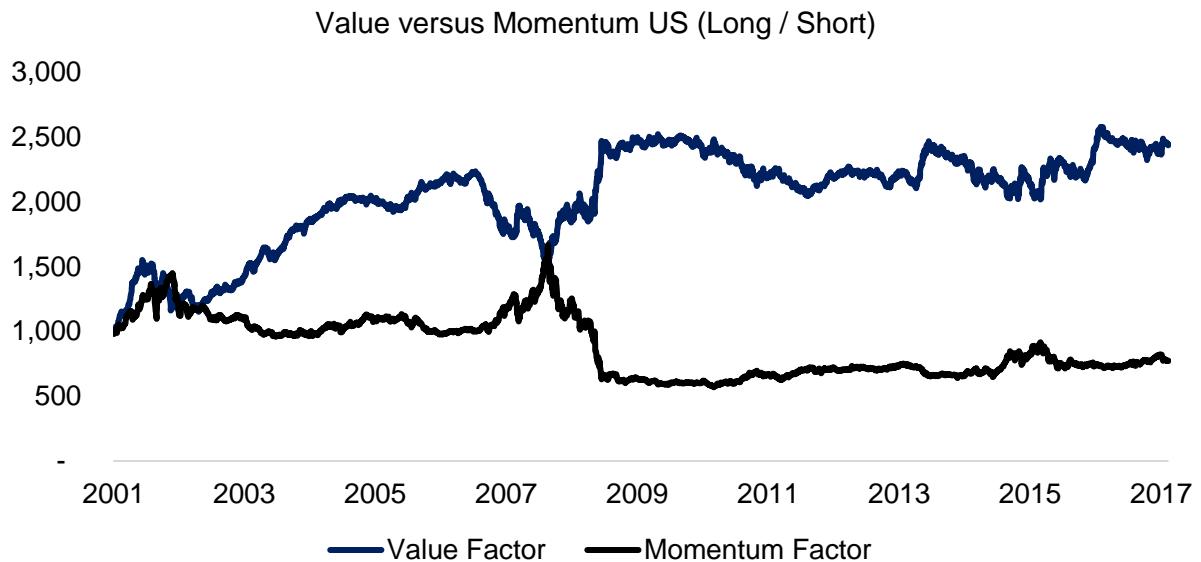
The chart below shows the performance of the Value and Momentum factors in the US. We can observe that there were periods, e.g. during the Global Financial Crisis in 2007 to 2009, where the two factors exhibited significant negative correlation. The Momentum crash of



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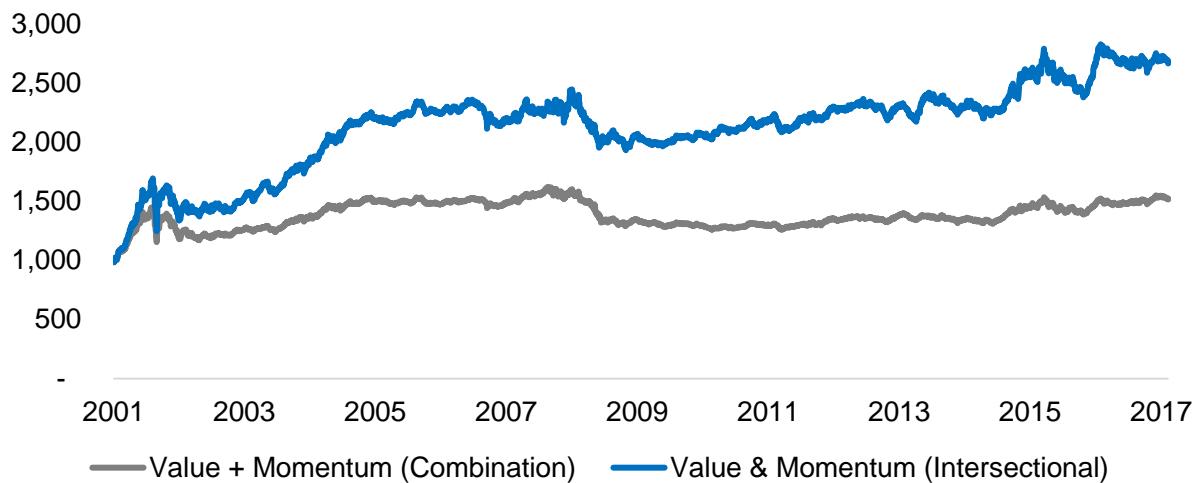
2009 is also clearly visible, which occurred when markets started recovering and the short side of Momentum outperformed the long side significantly. In theory it should be attractive to add Momentum to a Value portfolio from a diversification perspective given the low or negative correlation.



VALUE & MOMENTUM FACTOR PORTFOLIOS: COMBINATION VS INTERSECTIONAL MODEL

The chart below shows the performance of two Value & Momentum factor portfolios, one created via the combination and the other via the intersectional model. We can observe that the trends are quite similar, but that the intersectional portfolio shows far higher returns. The combination model creates Value and Momentum portfolios separately and then combines these two portfolios, which likely contains conflicting positions as Value and Momentum are often negatively correlated, e.g. a stock in the long portfolio of Value might be in the short portfolio of Momentum. The intersectional model selects the stocks in the intersection of the two factors.

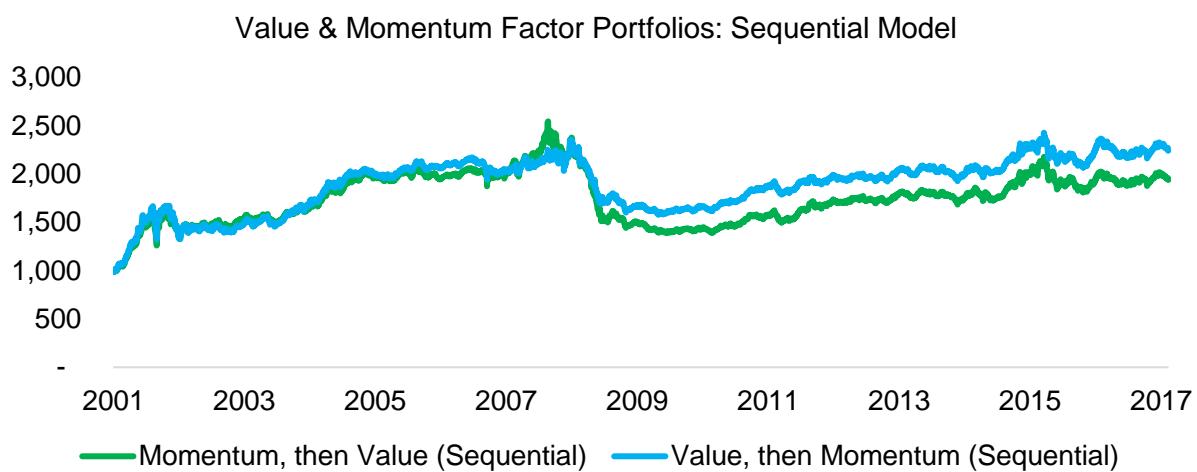
Value & Momentum Factor Portfolios: Combination vs Intersectional Model



Source: FactorResearch

VALUE & MOMENTUM FACTOR PORTFOLIOS: SEQUENTIAL MODEL

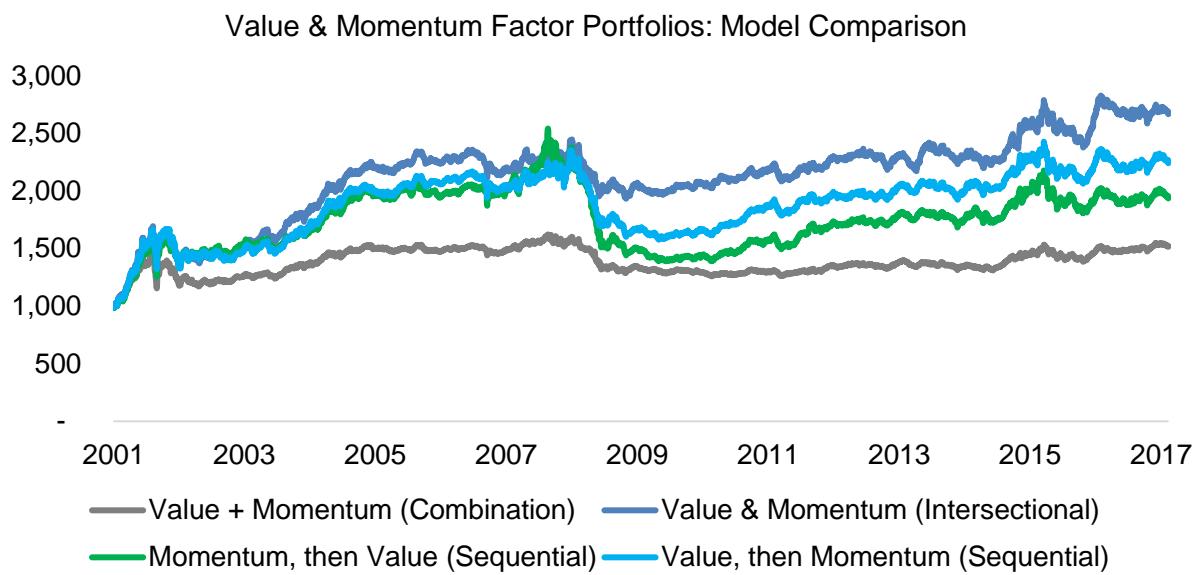
The sequential model ranks stocks for factors sequentially, which requires investors to prioritise factors. This approach is unique given that after each ranking the universe of stocks shrinks significantly, resulting in a very concentrated portfolio. The chart below shows the performance of two portfolios, one ranked first on Value and then Momentum and the other one in the inverse order. We can observe that the profiles look almost identical, which is somewhat surprising. We do see that the portfolio ranked first on Momentum experienced a steeper decline during the Momentum crash, but the diversification benefits seem to be much lower compared to the combination or intersectional model.



Source: FactorResearch

VALUE & MOMENTUM PORTFOLIOS: MODEL COMPARISON

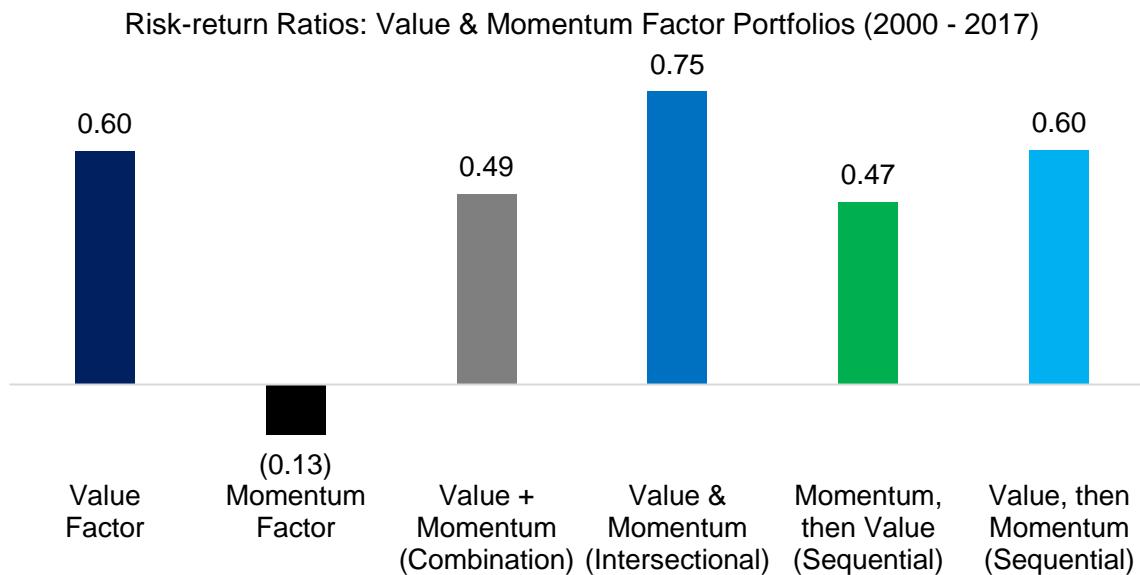
The chart below contrasts all models and we can see that the results are overall comparable in terms of trend. Based on this analysis the intersectional model seems to be most attractive, but it somewhat depends on the observation period. If there are no strong increases or decreases in factor performance, then all models are comparable in terms of performance. However, when factor performance is particular strong or very negative, e.g. for Momentum in 2009, then intersectional model seems to do better, which may be explained by less extreme portfolios.



Source: FactorResearch

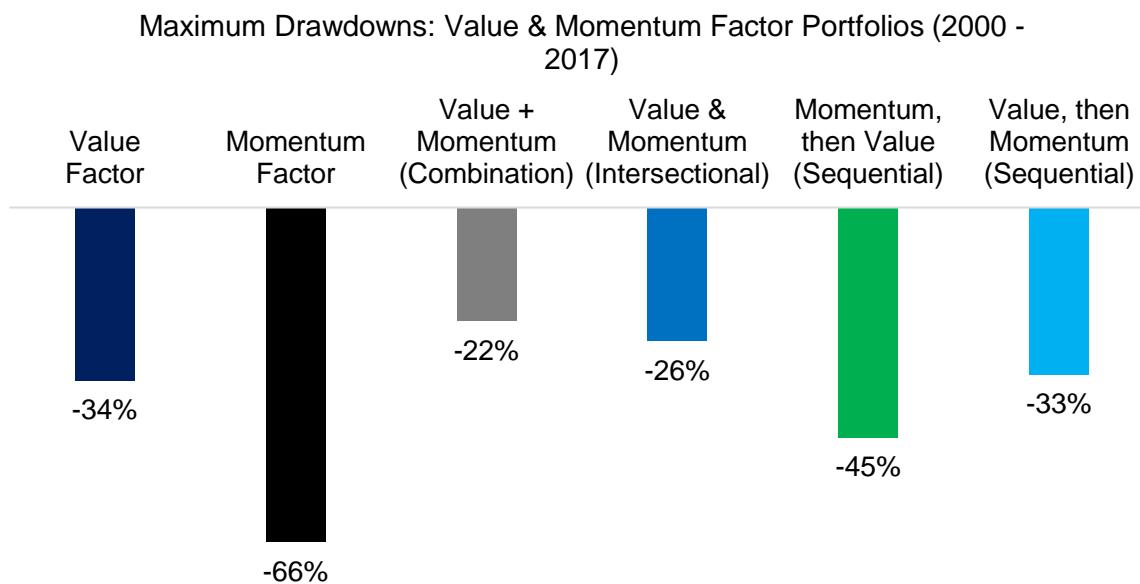
RISK METRICS

In addition to displaying the performance we can also analyse the risk metrics of the different portfolios. The graphic below highlights that the intersectional portfolio generated the highest risk-return ratio for the period from 2000 to 2017 and is the only portfolio that achieves a higher ratio than the Value factor on a stand-alone basis. It is worth highlighting that Momentum crashes a very rare (1932 & 2009) and if we would have picked a different observation period, then adding Momentum might have led to more attractive multi-factor portfolios.



Source: FactorResearch

We can also analyse the maximum drawdowns, which highlight diverse results for the multi-factor portfolios. The drawdowns of the combination and intersectional portfolios are lower than that of the stand-alone Value portfolio, while this is not the case for the sequential portfolios.



Source: FactorResearch

FURTHER THOUGHTS

This short research note highlights different ways of combining Value and Momentum factors. In hindsight adding other factors, e.g. Low Volatility, should have been more profitable as Momentum in the US did not generate attractive returns during the last two decades. However, the long-term track record for these two factors is quite favourable and adding factors that have done better, i.e. performance chasing, is unlikely a recipe for success.

FACTOR INVESTING: GROSS TO NET RETURNS

From Theory to Reality

January 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- Long-short multi-factor portfolios generate attractive returns before fees
- Returns are much less attractive post fees charged historically
- However, some fees in the long-short space are likely justified given higher complexity

INTRODUCTION

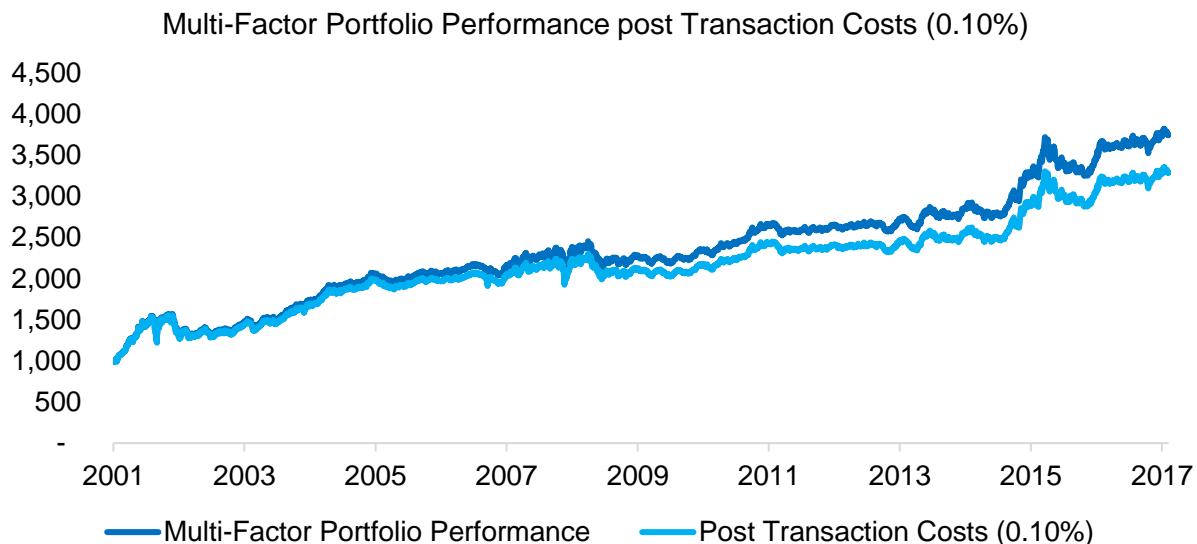
Reality is the murder of a beautiful theory by a gang of ugly facts (Robert Glass, 2002). Factor investing can be considered one of the beautiful theories of the investment world as it is backed by a significant amount of empirical research and can be implemented by investors across markets and asset classes. The gang of ugly facts is that most of the research is based on backtesting, which is full of inherent biases, and investors get charged a variety of fees for accessing the returns from factor investing. In this short research note we will analyse the path from gross to net returns for a long-short multi-factor portfolio.

METHODOLOGY

We focus on four factors namely Value, Momentum, Low Volatility and Quality in the US stock market. The multi-factor portfolio is created via the intersectional model, i.e. by ranking the stock universe by the four factors simultaneously (please see our white paper Multi-factor Models 101 for further details). The portfolio is constructed from the top and bottom 10% of the ranked stocks, is adjusted to achieve beta-neutrality, only includes companies with a market capitalisation above \$1 billion and is rebalanced monthly.

MULTI-FACTOR PORTFOLIO PERFORMANCE POST TRANSACTION COSTS

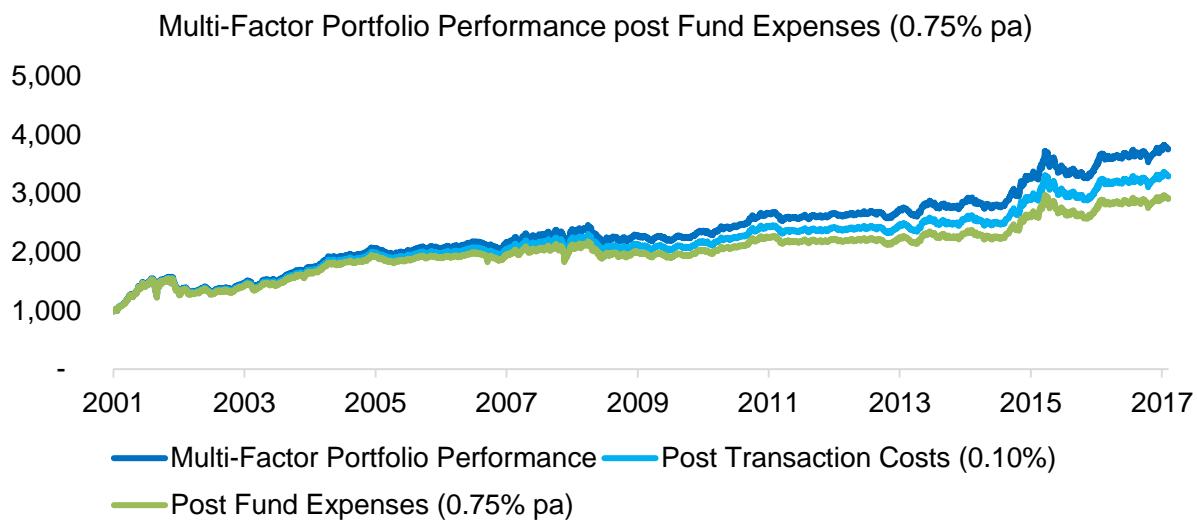
The chart below shows the performance of the long-short multi-factor portfolio before and after transaction costs, which are assumed to be 10 basis points per transaction. Institutional investors can trade for less than 1 basis point per transaction, but the impact costs of executing orders are often multiples of that and should be reflected as well. The portfolio rebalances monthly, but given that the stock selection is based on the ranking of several factors, the turnover is relatively low.



Source: FactorResearch

MULTI-FACTOR PORTFOLIO PERFORMANCE POST FUND EXPENSES

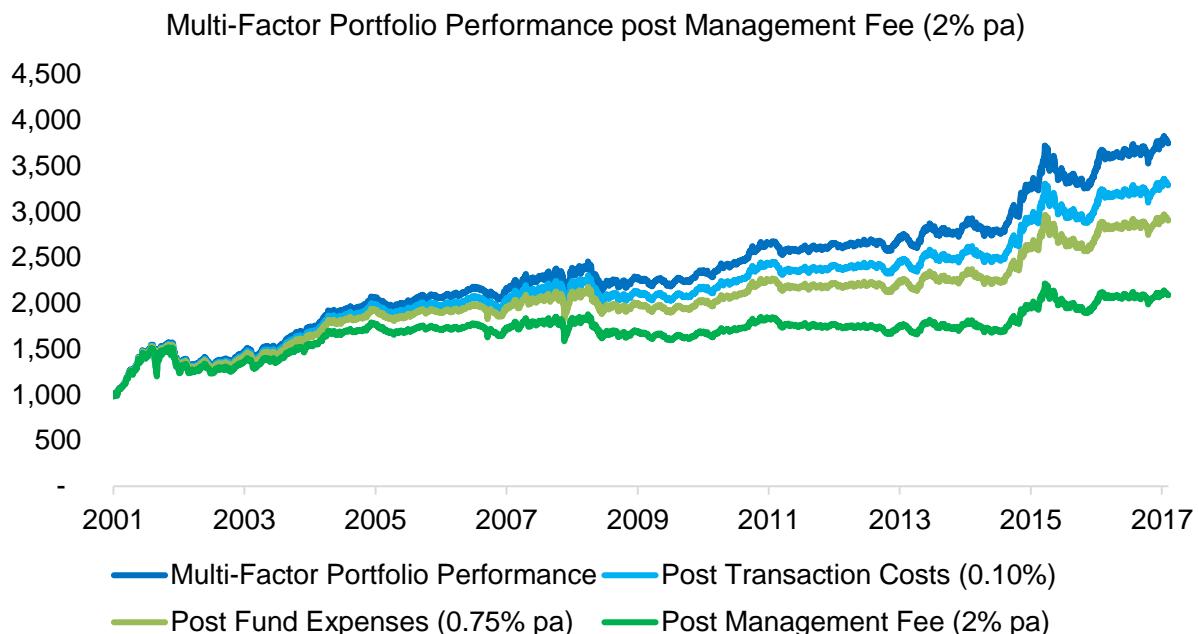
In addition to transaction costs there are a variety of fund and operating expenses. In order to short stocks, borrowing fees need to be paid. If investors gain access to the portfolio via a fund structure, then there will be fees for the fund administrator, custodian, transfer agent, amongst others. Recent regulations in Europe and the US have also imposed new reporting requirements, which have increased the compliance costs. We have assumed 0.75% per annum for fund and operating expenses, which further decrease the performance of the multi-factor portfolio.



Source: FactorResearch

MULTI-FACTOR PORTFOLIO PERFORMANCE POST MANAGEMENT FEE

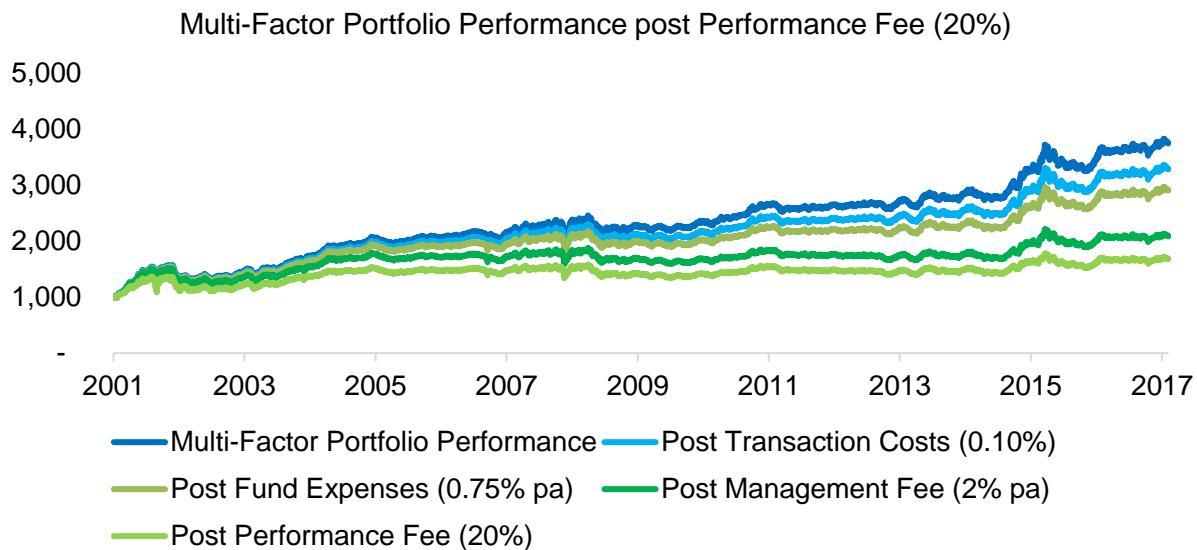
Given that we are analysing a long-short multi-factor portfolio, this would most likely be managed by a hedge fund manager. The traditional management fee was 2.0% per annum, although that has started to decrease in recent years and absolute return-focused UCITS funds are more likely to charge 1.5%. We can observe that the management fee has a significant impact on the performance of the multi-factor portfolio.



Source: FactorResearch

MULTI-FACTOR PORTFOLIO PERFORMANCE POST PERFORMANCE FEE

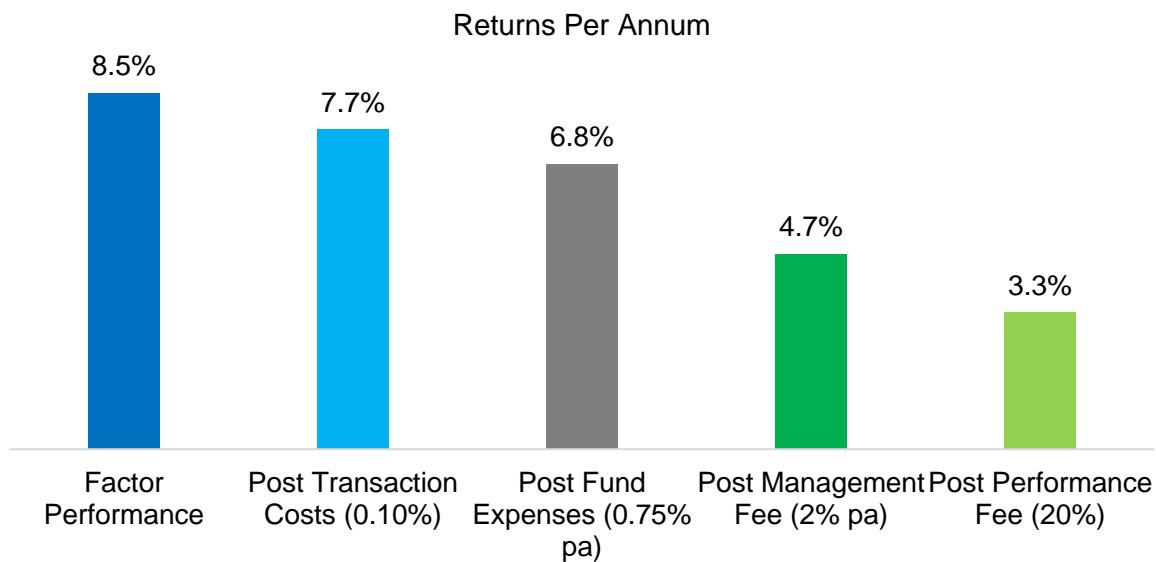
Hedge fund managers also tend to charge a performance fee in order to ensure an alignment of interests with investors. Historically the performance fee was 20% of profits above a high watermark, although this has also started to decrease in recent years. However, investors seem to be more interested in decreasing the management than the performance fee, which is rational given that the performance fee is only charged when investors and the hedge fund manager earn returns. The chart below highlights the significant difference between the gross and net returns for the long-short multi-factor portfolio.



Source: FactorResearch

RETURNS PER ANNUM

The chart below shows the returns per annum for the various scenarios. The net return of 3.3% per annum post all fees can still be considered attractive for a product that has zero correlation with equity markets and therefore is an interesting addition to an equity-centric portfolio from a diversification perspective. Having said this, the other ugly fact, i.e. the analysis is based on backtesting, also needs to be considered by taking a healthy discount on the results.



Source: FactorResearch

FURTHER THOUGHTS

This research note highlights that the returns from a long-short multi-factor portfolio are attractive, but are severely reduced by various types of fees. The costs for accessing these kinds of products have been too high historically as reflected in the low alpha generation of equity hedge funds over time and need to reduce further. However, we don't believe that fees should decrease to almost zero like in the ETF space as long-short products are much complex given factor selection, factor construction and portfolio management, which offer fund managers opportunities for value creation.

MULTI-FACTOR MODELS 101 (WHITE PAPER)

Top-Down vs Bottom-Up

January 2018. Reading Time: 15 Minutes. Author: Nicolas Rabener.

SUMMARY

- Three common approaches for creating multi-factor portfolios are the Combination, the Intersectional and the Sequential models
- The results from the Combination and Intersectional models are comparable in terms of trend
- Each model has its own advantages and disadvantages, the selection will depend on investor preferences

INTRODUCTION

One way to differentiate amongst investment managers is by examining whether they analyse stocks in a bottom-up or top-down approach. Whilst the former describes investors who specialise on individual securities, i.e. traditional stock pickers, the latter group prefers to analyse countries or sectors and therefore focus their efforts more on macro trends. There is no empirical evidence that one of these approaches is superior to the other; rather, the approach reflects the experience and philosophy of the fund manager and his firm. Factor investors can also be differentiated in a similar fashion as some build factor portfolios bottom-up while others create them top-down. In this white paper we provide an analysis of three common approaches for creating multi-factor portfolios, these being the Combination, the Intersectional and the Sequential models.

METHODOLOGY

The analysis focuses on the following seven factors as components of the multi-factor portfolios: Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield across the following seven markets: US, Europe, UK, Japan, Australia, Hong Kong and Singapore. The factors are constructed as beta-neutral long-short portfolios by taking the top and bottom 10% of the stock universes in the US, Europe and Japan and 20% in other markets given smaller stock universes. Portfolios rebalance monthly, only contain stocks with market capitalisations larger than \$1 billion and include 10 basis points of costs per transaction. The analysis covers the period from 2000 to 2017.

MODEL OVERVIEW

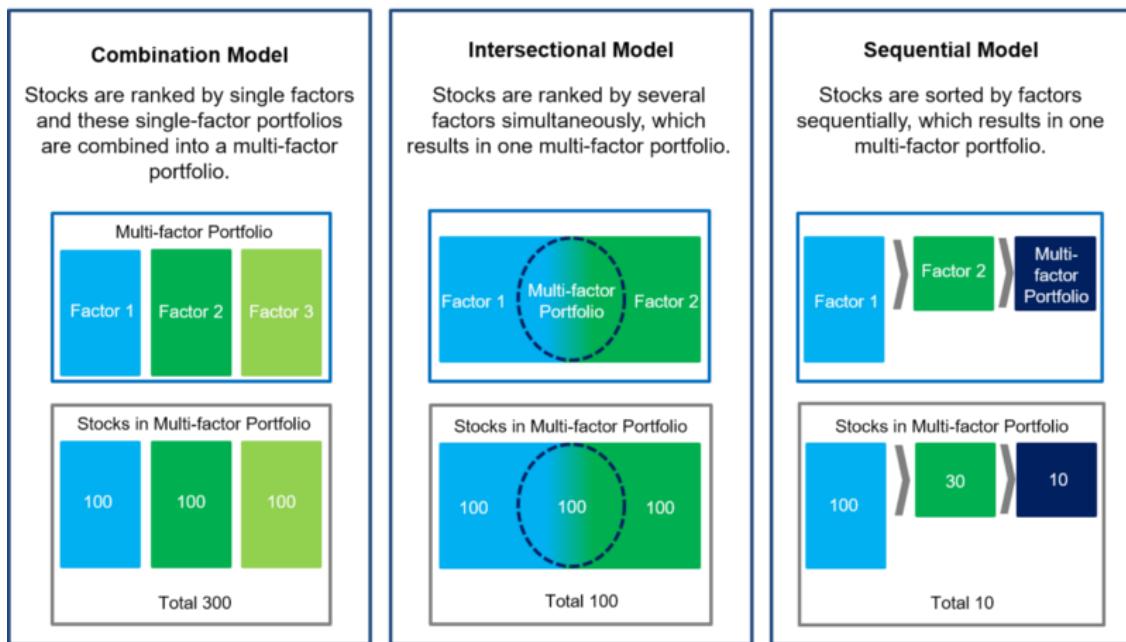
The three common approaches to creating multi-factor portfolios are the Combination, the Intersectional and the Sequential models. The Combination model ranks stocks by single factors and then combines these single-factor portfolios into a multi-factor portfolio. The Intersectional model sorts stocks by several factors simultaneously, which results in only one portfolio. The Sequential model ranks stocks by multiple factors sequentially, which results in one portfolio. The graphic below illustrates the three models and examples of resulting multi-factor portfolios.



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Multi-Factor Portfolio Models



Source: FactorResearch

All three models can be applied to the same universe of stocks. The table below highlights the advantages and disadvantages, which may support an investor in the model selection process.

	Combination Model	Intersectional Model	Sequential Model
Advantages	<ul style="list-style-type: none"> Useful for tactical factor allocation as factors are treated as exchangeable components of the multi-factor portfolio 	<ul style="list-style-type: none"> Results in a portfolio of fewer stocks than the Combination Model 	<ul style="list-style-type: none"> Results in a very concentrated portfolio of stocks
Disadvantages	<ul style="list-style-type: none"> Results in a large portfolio of stocks with likely conflicting positions that is complex to manage 	<ul style="list-style-type: none"> Complex calculations for deriving the portfolio 	<ul style="list-style-type: none"> Results strongly depend on the factor sequence Complex calculations for deriving the portfolio

Source: FactorResearch

SEQUENTIAL MODEL

The model comparison in this white paper will focus on the Combination and Intersectional models and exclude the Sequential model. Although the Sequential model is a common approach for creating multi-factor portfolios and therefore worth highlighting conceptually,

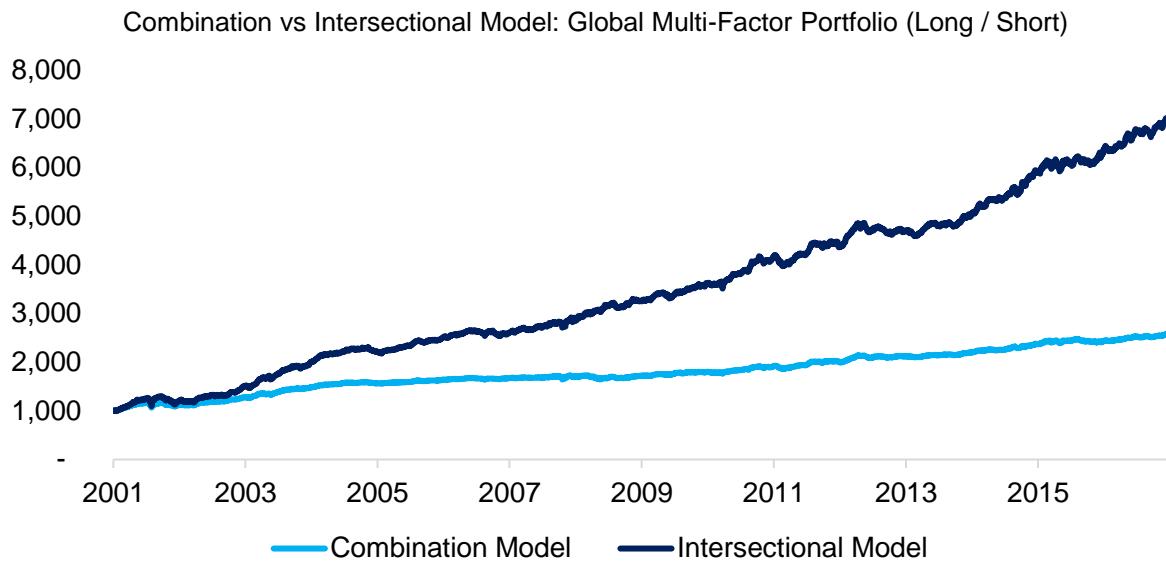
there are two characteristics that make the performance and risk metrics difficult to compare with those of the other two models.

First, the Sequential Model can incorporate only relatively few factors as after each sorting iteration the available stock universe decreases significantly. For example, our definition of the US universe currently includes 1,600 tradable stocks above \$1 billion market capitalisation, which reduces to 480 stocks after sorting by the first factor and then to 144 stocks after sorting for a second factor, assuming 30% percentile for the top and bottom in each iteration. In countries with smaller stock universes, e.g. Australia, this model quickly has too few stocks for achieving a meaningfully diversified portfolio. In comparison, there are no limits to how many factors are used when creating multi-factor portfolios with the Combination or Intersectional model.

Secondly, the results of the Sequential Model strongly depend on the sequence of the factors. For example, if the first factor for sorting is the Value factor, then all stocks will have a Value tilt, regardless of which factors are used for the sorting thereafter. The Combination and Intersectional models treat factors equally in terms of ranking, while this is not the case for the Sequential model.

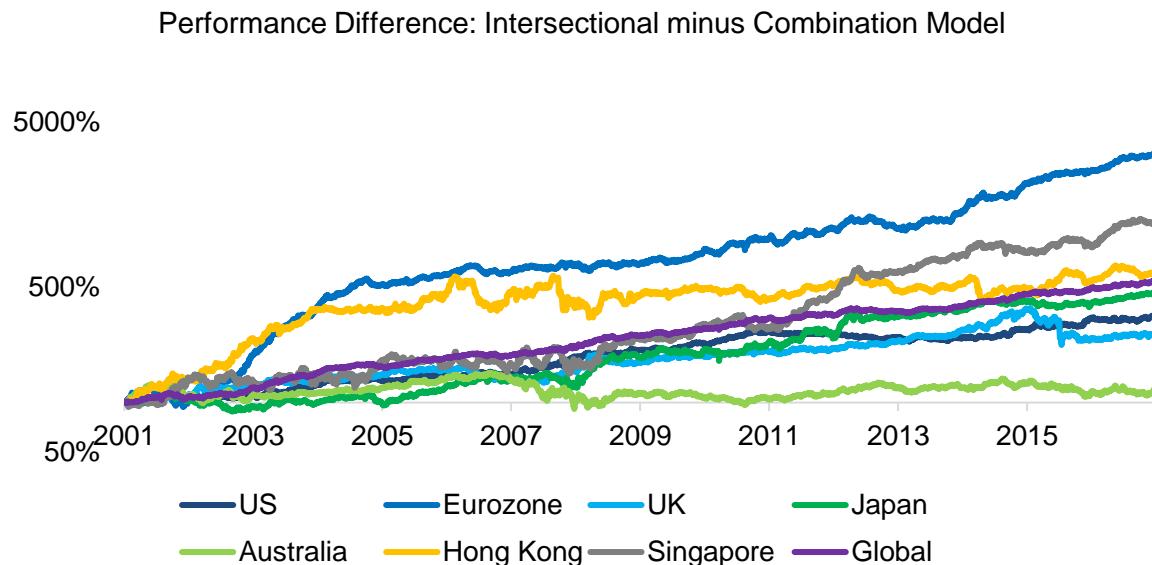
COMBINATION VS INTERSECTIONAL MODEL

The chart below compares the performance of the Combination versus Intersectional models for a global multi-factor portfolio, which is created by equally allocating across the seven factors (Value, Size, Momentum, Low Volatility, Quality, Growth and Dividend Yield) and weighting the country allocations based on the number of stocks available in the seven markets (US, Europe, UK, Japan, Australia, Hong Kong and Singapore). We can observe similar trends, but a clear outperformance of the Intersectional model for the observation period from 2000 to 2017. The multi-factor portfolios from the Intersectional model can be viewed as extreme versions of the portfolios from the Combination model as these hold only a fraction of the number of stocks, i.e. the stocks in the intersection of factors.



Source: FactorResearch

In order to analyse the outperformance of the Intersectional model further, we can study the differences on country level, which are shown on the chart below. We observe that there is a consistent outperformance across most markets, except for Australia. The performance difference seems especially strong in the Eurozone, although this is likely more random than explained by a particular reason.

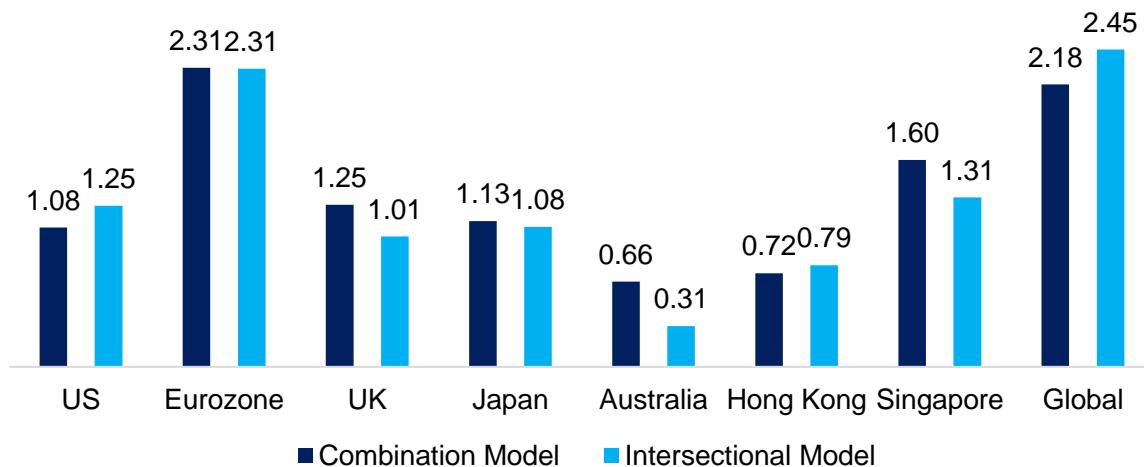


Source: FactorResearch

In addition to observing the performance of the two models, we can also analyse the risk-return ratios across markets, which are shown in the chart below. The Combination model

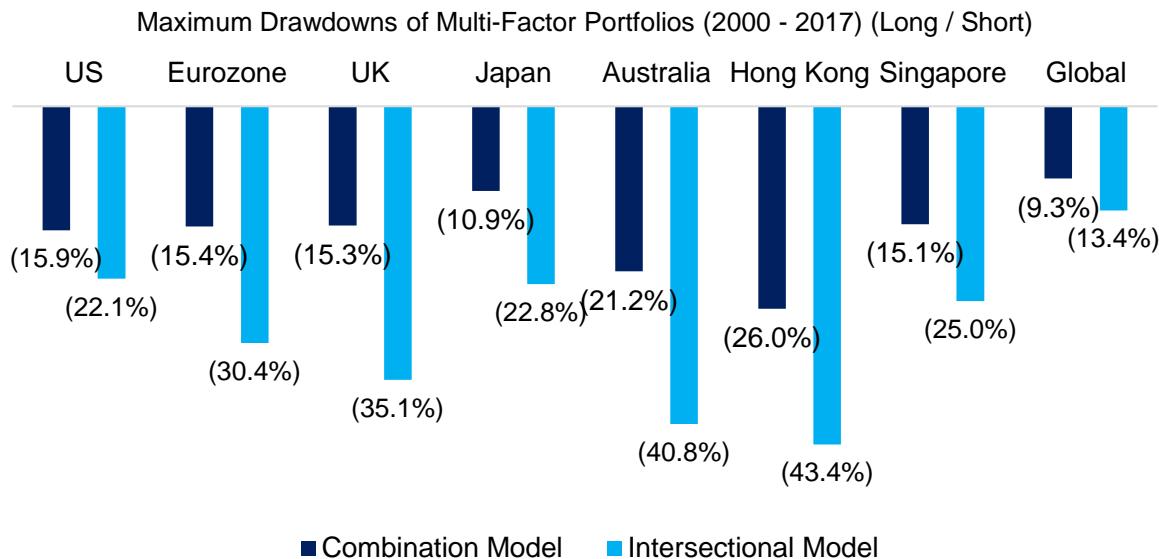
shows higher risk-return ratios than the Intersectional model in most markets. The risk-return ratio of the global multi-factor portfolio is higher for the Intersectional model; however, that can be explained by the large weighting of the US in the portfolio, which is approximately 50%.

Risk-Return Ratios of Multi-Factor Portfolios (2000 - 2017) (Long / Short)



Source: FactorResearch

The higher risk-return ratios of the Combination model are reflected in lower maximum drawdowns compared to the Intersectional model as the chart below shows. The lower drawdowns can be explained by much larger portfolios, which offer significantly higher diversification benefits.



Source: FactorResearch

CONCLUSION

This white paper outlines three common approaches for creating multi-factor portfolios: the Combination, the Intersectional and the Sequential models. The comparison of the performance and risk metrics of the first two models highlights higher returns, but lower risk-return ratios and higher maximum drawdowns for the Intersectional model compared to the Combination model. The Sequential model was excluded from the model comparison as the results are not comparable to the other two models given that only few factors can be included and that the factor weights are not equally-weighted. Investors have the choice of utilising any of the models and can weigh the advantages and disadvantages. The model selection process is likely significantly influenced by the number of stocks of the multi-factor portfolios, which differ substantially and play a significant role in portfolio management from an operational perspective.

FURTHER THOUGHTS

The analysis highlights that multi-factor portfolios, regardless if created via the Combination or Intersectional model, showed attractive returns and risk-return ratios for the period from 2000 to 2017. However, only few factors have shown structural positive excess returns across time and markets and even these are highly cyclical. Factor selection and allocation are challenging subjects and should be coupled with a sound risk management approach.

APPENDIX

Below we exhibit three stock examples of each model, in all cases from the long portfolio. The charts highlight the factor exposure of each stock, which can be positive or negative. If the factor exposure is above 90, then the stock would be included in the long portfolio of a factor, while if the factor exposure was below -90, then the stock would be included in the

short portfolio, assuming the factor takes the top and bottom 10% of the stock market for the portfolio construction.

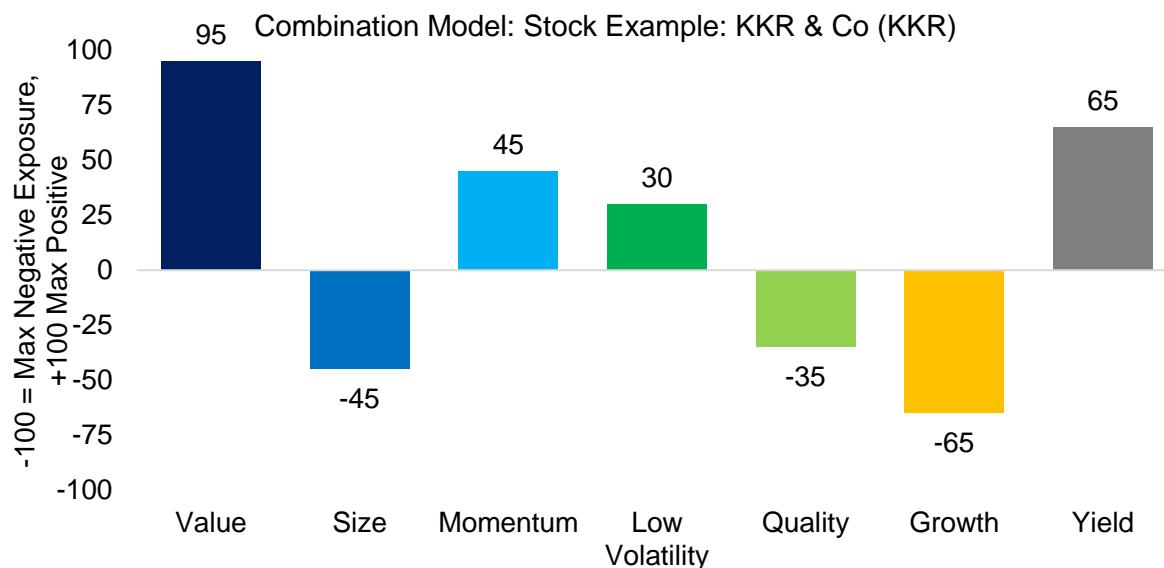
MODEL CHARACTERISTICS

The table below highlights the key differences between the three multi-factor models.

	Combination Model	Intersectional Model	Sequential Model
Calculation Complexity	Easy	Medium	Difficult
Factor Weights	Flexible	Flexible	Inflexible
Factor Sequence	Not relevant	Not relevant	Significant
Number of Factors	Unlimited	Unlimited	Limited
Size of Portfolio	Large	Medium	Small
Conflicting Positions	Yes	No	No
Operational Management	Complex	Medium	Easy
Tactical Allocation	Yes	No	No

COMBINATION MODEL

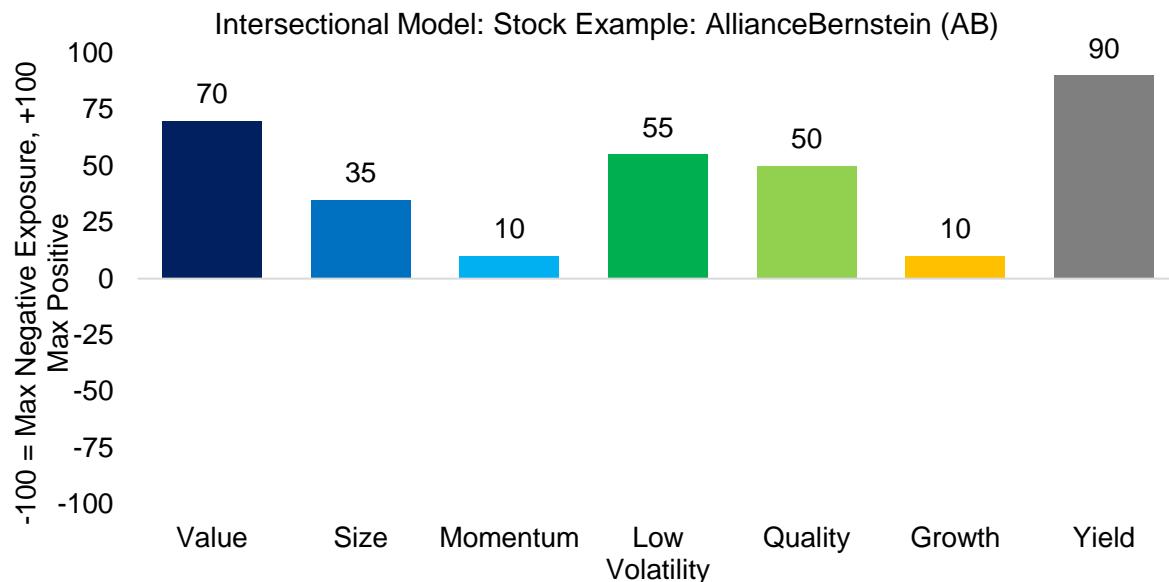
The Combination model ranks stocks by single factors and then combines these single-factor portfolios into a multi-factor portfolio. The stock below is an example from the Value sub-portfolio of the multi-factor portfolio as it ranks highly on the Value factor while the ranking of the other factors is not of importance.



Source: FactorResearch

INTERSECTIONAL MODEL

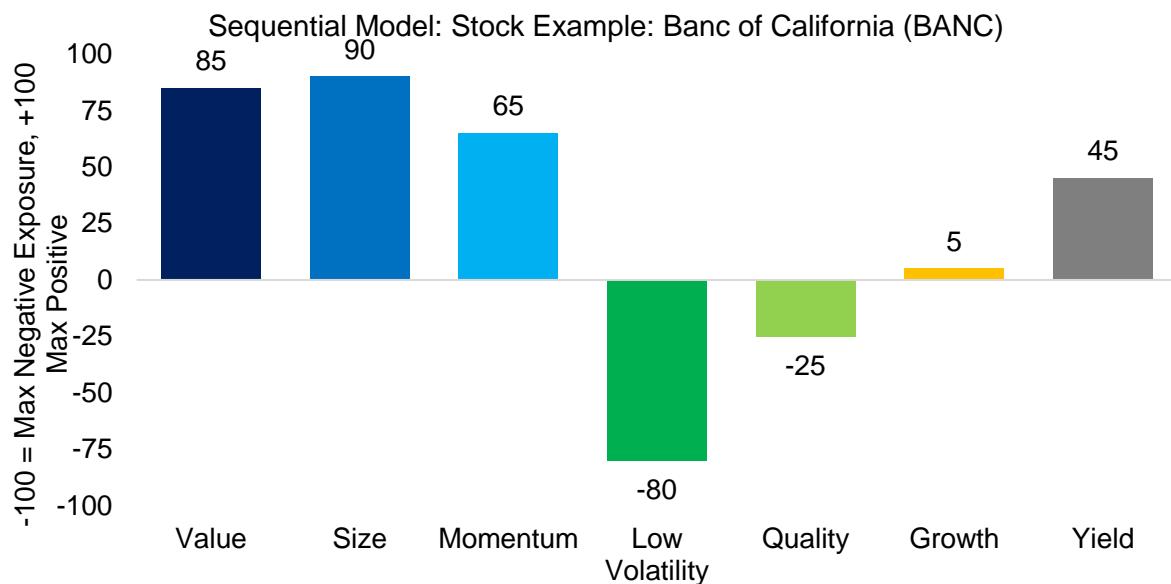
The Intersectional model sorts stocks by several factors simultaneously, which results in only one portfolio. The stock below is an example of the multi-factor portfolio as it ranks highly on average across all factors.



Source: FactorResearch

SEQUENTIAL MODEL

The Sequential model ranks stocks by multiple factors sequentially, which results in one portfolio. The stock below is an example of the multi-factor portfolio, which was created by ranking sequentially by the Value, Size, and Momentum factors. The stock therefore shows exposure to those three factors while being indifferent to other factors.



Source: FactorResearch

FACTOR OLYMPICS 2017

And the winner is...

January 2018. Reading Time: 10 Minutes. Author: Nicolas Rabener.

SUMMARY

- 2017 was a positive year for most factors
- Quality, Growth and Momentum showed the strongest performance
- Value, Dividend Yield and Size generated negative returns

INTRODUCTION

We present the performance of seven well-known factors on an annual basis for the last 10 years and the full-year 2017. It is worth mentioning that not all factors have strong academic support, e.g. Growth lacks a long-term track record of positive excess returns; however, is still a widely-followed investment style.

METHODOLOGY

The factors are created by constructing long-short beta-neutral portfolios of the top and bottom 10% of stocks in the US, Europe and Japan and 20% in smaller stock markets. Portfolios rebalance monthly and include 10bps of transaction costs. Please see our Factor Guide for the factor definitions.

FACTOR OLYMPICS (LONG / SHORT): GLOBAL

The table below shows the factor performance for the last 10 years ranked top to bottom. The global series is comprised of all developed markets in Asia, Europe and the US. Aside from displaying the factor performance the analysis highlights the significant factor rotation in terms of profitability from one year to the next, e.g. last year's winners Dividend Yield, Value and Size, are this year's losers. Factor investing has been at its all-time high in 2017 in terms of popularity according to Google Trends, but factor selection and factor timing are challenging subjects.

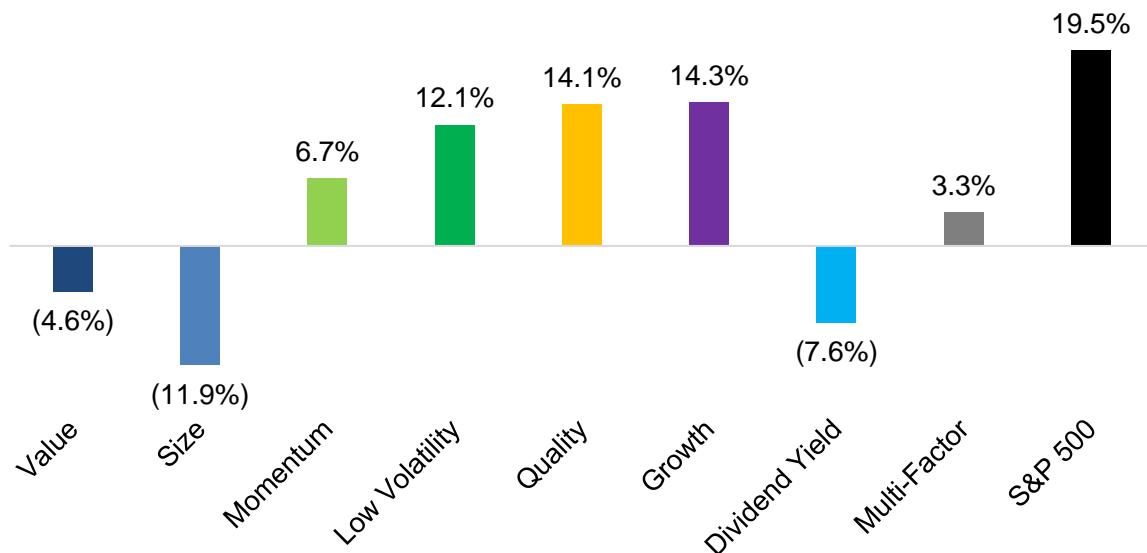
Factor Olympics (Long / Short): Global											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Positive Returns	Momentum 21.3%	Dividend Yield 9.0%	Value 28.2%	Quality 7.4%	Low Volatility 24.4%	Low Volatility 17.5%	Low Volatility 20.4%	Low Volatility 29.4%	Momentum 26.9%	Dividend Yield 14.3%	Quality 15.5%
	Quality 10.6%	Low Volatility 6.7%	Size 16.1%	Low Volatility 6.5%	Momentum 14.9%	Momentum 11.0%	Momentum 3.8%	Momentum 4.3%	Value 18.7%	Value 13.9%	Growth 14.8%
	Growth 6.5%	Value 5.5%	Dividend Yield 11.8%	Size 6.3%	Growth 14.1%	Multi-Factor 3.8%	Size 2.9%	Multi-Factor 4.2%	Growth 15.7%	Size 8.3%	Momentum 10.5%
	Low Volatility 5.4%	Quality 3.7%	Growth 10.9%	Growth 5.2%	Quality 10.6%	Multi-Factor 4.4%	Dividend Yield 7.4%	Dividend Yield 1.1%	Quality 0.5%	Multi-Factor 8.1%	Low Volatility 5.2%
	Multi-Factor 2.3%	Size 1.8%	Multi-Factor 6.0%	Multi-Factor 4.4%	Multi-Factor 2.5%	Dividend Yield 2.5%	Dividend Yield 0.0%	Size 2.7%	Momentum 0.1%	Size 4.7%	Multi-Factor 3.3%
											Multi-Factor 4.6%
											Momentum 3.4%
Negative Returns	Dividend Yield (6.1%)	Momentum (4.6%)	Low Volatility (15.2%)	Value (2.4%)	Size (3.6%)	Value (11.0%)	Growth (0.9%)	Size (0.2%)	Dividend Yield (10.4%)	Growth (8.6%)	Size (0.5%)
	Size (10.2%)	Growth (10.5%)	Momentum (41.4%)		Value (11.0%)		Value (4.9%)	Growth (4.9%)	Value (10.9%)	Momentum (10.2%)	Dividend Yield (6.3%)
	Value (11.6%)										Value (9.2%)
Market	2.7%	(38.2%)	28.7%	9.8%	(6.2%)	17.6%	32.2%	9.7%	3.8%	7.9%	18.3%

Source: FactorResearch

FACTOR PERFORMANCE 2017: US

The table above reflects the global factor performance and it is interesting to analyse how homogeneous the performance is across regions. The global performance is significantly weighted towards the US, so it is not surprising that factor performance in the US in 2017 is very similar to the global one. Value and Size were the consensus trades at the beginning of 2017, but generated the worst returns throughout the year, which highlights the risk of following the consensus.

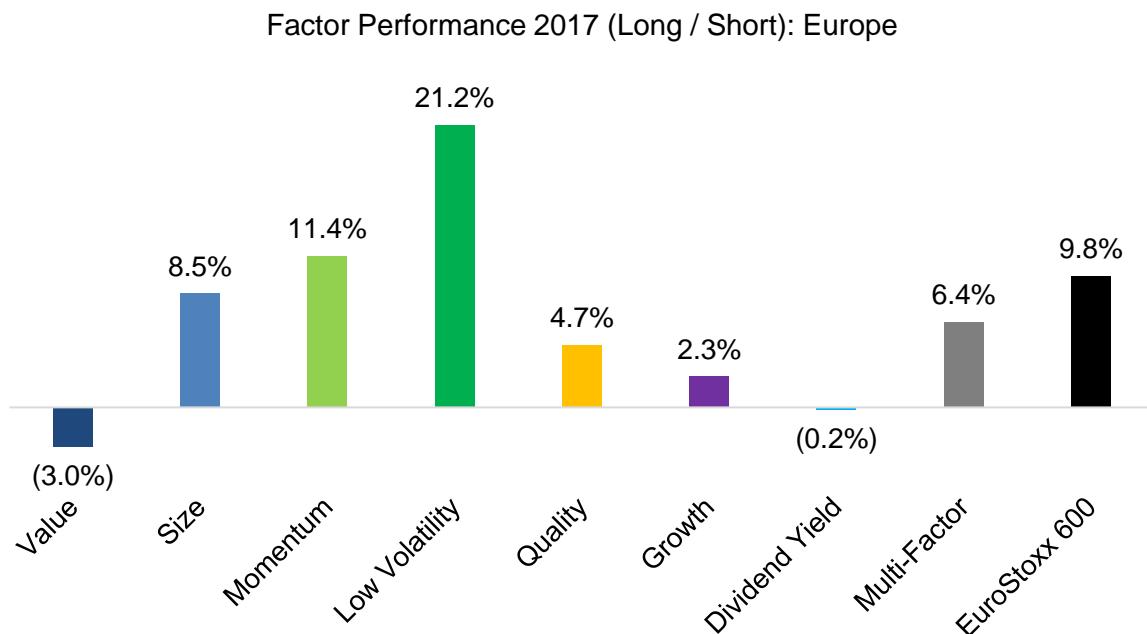
Factor Performance 2017 (Long / Short): US



Source: FactorResearch

FACTOR PERFORMANCE 2017: EUROPE

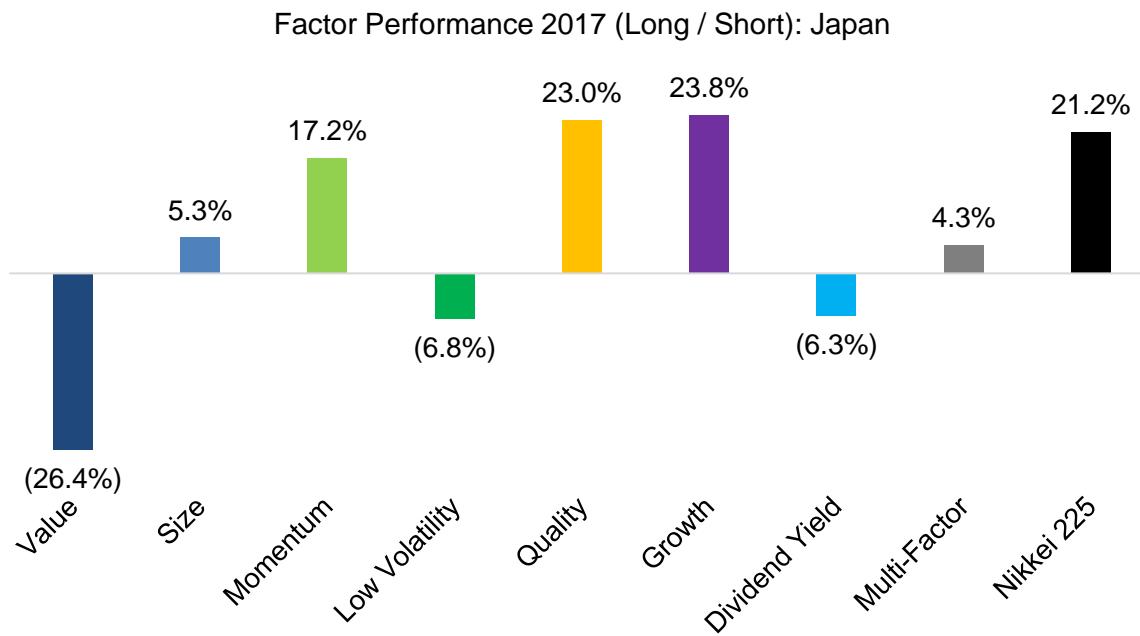
The factor performance in Europe is similar to the US, except for Size, which was negative in the US, but is strongly positive in Europe, perhaps reflecting the more positive economic outlook for the region. Low Volatility generated the highest returns, which may be explained by the continued quantitative easing of the ECB as the strategy performs better when interest rates are declining than when they are rising.



Source: FactorResearch

FACTOR PERFORMANCE 2017: JAPAN

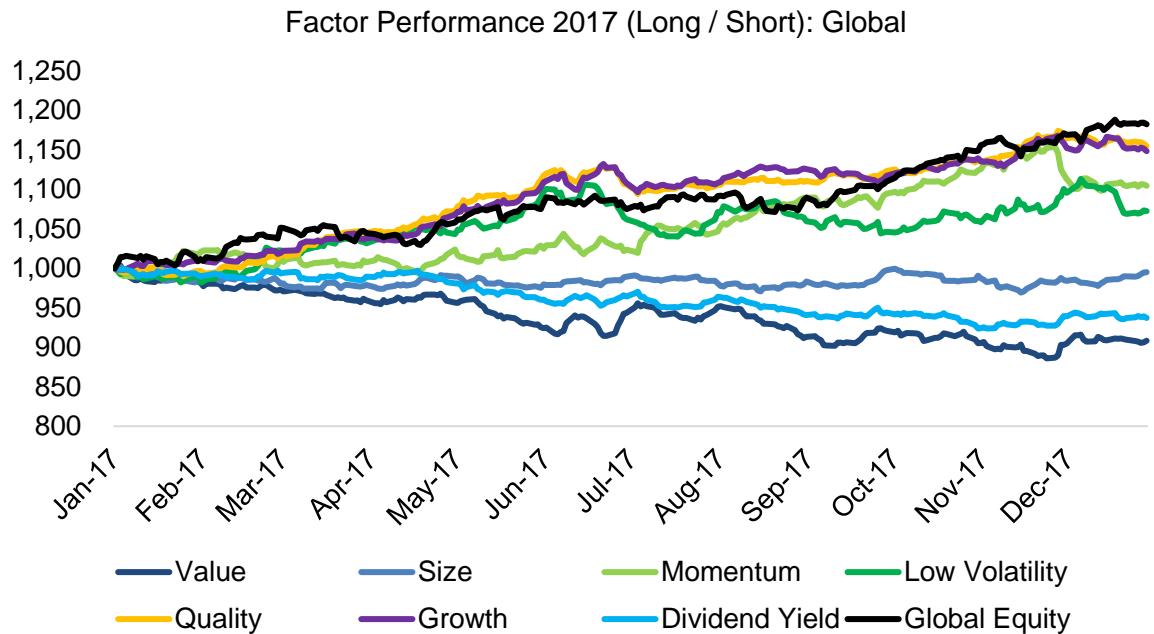
Japan is often treated as a special case in the factor investing space as some strategies, e.g. Momentum, don't work as well as in other countries. We noted in a previous report "Equity Factors in Japan" that although factor performance may be less strong, the trends are still roughly the same. In the chart below we can also observe that the factor performance in Japan is line with other markets, except for Low Volatility.



Source: FactorResearch

FACTOR PERFORMANCE 2017: PERFORMANCE CHART

The chart below shows the factor performance in 2017 and we can observe that Quality and Growth seem almost identical, which can be explained by the Tech sector representing a significant percentage of the long portfolios in both factors. The Tech sector has shown strong growth in sales and earnings over the last few years and also features high profitability and low levels of debt compared to other industries, which explains why the sector is represented in the Quality and Growth factors.



Source: FactorResearch

The correlation matrix below highlights the strong relationship between Quality and Growth, which might be considered a portfolio risk. If the Tech sector starts underperforming, this will likely have a negative impact for both factors. Dividend Yield and Value show negative correlations to both and may be attractive from a diversification perspective.

Global Factor Correlations (Long / Short): Last 12 Months

	Value	Size	Momentum	Low Volatility	Quality	Growth	Dividend Yield	Global Equity
Value	1	0.05	(0.36)	0.08	(0.34)	(0.49)	0.49	(0.03)
Size	0.05	1	(0.13)	(0.31)	0.09	(0.01)	(0.09)	(0.00)
Momentum	(0.36)	(0.13)	1	(0.16)	0.12	0.34	(0.52)	0.16
Low Volatility	0.08	(0.31)	(0.16)	1	0.39	0.25	0.36	0.05
Quality	(0.34)	0.09	0.12	0.39	1	0.72	(0.32)	0.14
Growth	(0.49)	(0.01)	0.34	0.25	0.72	1	(0.46)	0.04
Dividend Yield	0.49	(0.09)	(0.52)	0.36	(0.32)	(0.46)	1	(0.15)
Global Equity	(0.03)	(0.00)	0.16	0.05	0.14	0.04	(0.15)	1

Source: FactorResearch

FURTHER THOUGHTS

The factor performance in 2017 has been very consistent throughout the year with Quality and Growth steadily gaining compared to Value and Dividend Yield losing. The low factor volatility and consistency is likely a reflection of the exceptionally low market and economic volatility; however, these periods don't tend to last long and investors should expect higher market and factor volatility in 2018.