Using risk factors for equity portfolio allocation
SEONEYOND
Volatility management and structured product investment division of Natixis Asset Management

Over the past decade, financial markets have been shaped by the growing interconnexion between asset classes, the increasing frequency and magnitude of shocks, as well as the obvious exhaustion of market trends. Many investors believe that to generate performance in the medium to long term, relying on traditional asset management alone is no longer enough.

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The portfolio management team is daily supported by a quantitative research platform.

With 29 employees, Seeeyond has €15.37 billion in assets under management as of 30/09/2015 (Source: Natixis Asset Management).
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SUMMARY

In this paper we demonstrate the relevance of equity risk factor-based allocation from a portfolio diversification perspective. (1) The medium-term risk generated by the cyclical nature of equity risk factors, (2) their attractive long-term premiums as well as (3) the decorrelation of their returns are the main arguments underlying the relevance of this approach. Our analyses show that a dynamic factor-based allocation strategy has nevertheless a better risk/return profile than a passive approach. This is due to the fact that some factors, such as momentum, have a strong economic contingency that can lessen their attractiveness for the rational investor. They therefore require an active management.
INTRODUCTION

Academic research highlighting new determinants of the equity risk premium was a key element in developing so-called “alternative beta” equity portfolio management styles. Each style draws its essence from the existence of a long-term risk premium related to the underlying factor, such as the value, size or momentum factor. Market experience nevertheless demonstrated the disadvantages of these approaches, which are mainly due to the cyclicity of the factors’ medium-term risk premiums and the extreme risks of some factors. Their relevance is therefore limited to investors with no constraints in terms of long-term investment horizon, or to those with medium term arbitrage capabilities. But in practice, is this arbitrage possible?

Various approaches, known under the generic name of “style rotation”, were developed to exploit this arbitrage, and more specifically the cyclical nature of risk premiums. They also soon revealed major drawbacks, particularly during crises (a resounding example being the 2007-2009 episode). These limits are mainly related to the difficulty of anticipating reversals of factors, generally resulting in substantial losses.

The factor-based approach is therefore nothing new in equity portfolio management. On the other hand, factor-based diversification approaches are new. The underlying principle is to combine risk factors – rather than arbitrage them – in order to generate a better diversification effect; in other words, to build an equity portfolio with a “rainbow” beta. How should these factors be combined? Should one settle for a static allocation or is it better to dynamise it, and how? These are the issues that we propose to discuss in this research paper.

In the first section, we demonstrate the interest of a risk factor-based allocation. The second section addresses the issue of constructing this allocation. The last section concludes with the issue of the sustainability of this approach in the long run.

WHY A FACTOR-BASED APPROACH IS RELEVANT?

Academic research and market experience show that the premiums associated with risk factors are persistent. This gives a robust aspect to the portfolio management styles that attempt to exploit them (e.g. Value, Growth, Minimum Variance, Momentum management styles, etc.). The question then arises, and this is an acute issue, of the interest and the relevance of a global allocation based on these various risk factors.

The first argument in favour of a factor-based allocation approach is based on a rationale of ex ante risk management: it would allow for an integrated control of exposures to each factor ex ante. This proves to be more optimal than an allocation requiring ex post adjustments in order to monitor exposures to risk factors, as in the case of a sector-based allocation for example.

The second argument is based on a “portfolio diversification” perspective. Several empirical studies have concluded that the factor-based approach is better in terms of risk diversification. For instance, Martellini and Deguet (2014) demonstrate empirically that this approach improves the diversification of a multi asset class portfolio within the meaning of the ENUB measure (Effective Number of Uncorrelated Bets) introduced by Meucci (2009).

The third and last argument is given by the investment opportunity offered by the long-term premiums underlying risk factors. Charts 1a and 1b reveal three phenomena: (1) a strong cyclical of factors’ performance over one year, (2) a decorrelation of factors, (3) long periods of negative performance. Investing in a single factor would therefore be risky unless one has a sufficiently long investment horizon.

1. This is the number of actual uncorrelated bets in the portfolio allocation.
HOW CAN ONE BUILD A FACTOR-BASED ALLOCATION?

Based on the empirical observation that momentum portfolios lost 91.6% in two months in 1932, or 73.4% in three months in 2009, and took decades to recoup their losses, Barroso and Santa-Clara (2013) conclude that an investor with a reasonable degree of risk aversion may turn away from such a factor even if its performance is significant (6.7% per year over almost 90 years). In this context, the attractiveness of risk factors for the investor should be assessed prior to the construction of an ad hoc allocation for the purpose of improving the portfolio’s diversification.

ATTRACTIVENESS OF RISK FACTORS

It is common practice to compare investment opportunities in terms of risk and return. We therefore based our comparative analysis of the attractiveness of risk factors on the criterion of risk premium, which combines these two aspects. This criterion is defined as the additional return that an investor would require to relinquish a certain return and receive an uncertain return.

2. Return calculated from US data of Fama and French.
3. The calculation of the risk premium is based on a utility function that measures the satisfaction level of a rational investor. This utility for the investor is assessed on the basis of the characteristics of the investment returns distribution. For example, a higher dispersion of returns has a negative impact on investor’s satisfaction. The latter will thus penalise an investment of which the return deviates sharply from its mean.
We based ourselves on the methodology introduced by Fama and French to represent risk factors through proxy portfolios. We therefore built, based on the MSCI universe, long/short portfolios composed of baskets formed from a ranking in quintiles according to a given criterion: for example, the criterion used for the value factor is the score of Earnings-to-price, Book-to-price and Cashflow-to-price.

Tables 1a and 1b show the breakdown of factor risk premiums into three components: contributions of variance, asymmetry (skewness) and extreme values. We note from the outset that risk premium structures are similar between the two regions, US and Europe. Momentum and value premiums are the highest. The variance explains a very significant part of market, size and volatility risk premiums. Asymmetry and extreme values positively explain momentum premiums with a predominance of extreme values, reflecting the observation made in the academic literature of the presence of crashes in momentum portfolios (Barroso and Santa-Clara, 2013). On the other hand, asymmetry helps reduce the risk premiums of the value factor.

Regarding the effective performance of risk factors and their attractiveness, we find that except for the low volatility factor, all US factors are globally unattractive for a rational investor, while the market factor is attractive for the same level of risk aversion. For Europe, the low volatility factor turns out to be very attractive insofar as it delivers an average return of 4.7% for a premium of 1.8%.

### TABLE 1: BREAKDOWN OF FACTOR RISK PREMIUMS

<table>
<thead>
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<th>a) US: 01/1996-09/2014</th>
<th>b) Europe: 01/1993-09/2014</th>
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<tr>
<td></td>
<td>YEARLY STATISTICS</td>
<td>BREAKDOWN OF RISK PREMIUMS</td>
</tr>
<tr>
<td></td>
<td>RETURN</td>
<td>RISK PREMIUM</td>
</tr>
<tr>
<td>MARKET</td>
<td>7.6%</td>
<td>7.4%</td>
</tr>
<tr>
<td>MOMENTUM</td>
<td>2.6%</td>
<td>14.4%</td>
</tr>
<tr>
<td>VALUE</td>
<td>6.8%</td>
<td>9.6%</td>
</tr>
<tr>
<td>SIZE</td>
<td>2.9%</td>
<td>3.6%</td>
</tr>
<tr>
<td>LOW VOLATILITY</td>
<td>2.1%</td>
<td>2.3%</td>
</tr>
<tr>
<td>EQUALLY WEIGHTED ALLOCATION</td>
<td>3.2%</td>
<td>1.3%</td>
</tr>
<tr>
<td>ISM-BASED ALLOCATION</td>
<td>9.8%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Source: Seeyond

Factors are built according to Fama and French’s methodology within the MSCI universe based on daily data from Bloomberg and Factset. Figures refer to previous years. Past performance does not guarantee future results.

4. We applied a liquidity filter consisting in keeping only 80% of the portfolio by holding the most liquid securities on the basis of their transaction volumes over 3 months.
5. We also conducted robustness analyses consisting in representing risk factors by long only portfolios, which is more in keeping with the perspective of an investor who is precluded from short selling. Results generally confirm the findings of this research paper. These results can be provided upon request.
6. The component denominated “extreme values” comprises the contributions of statistical moments greater than 3 (i.e. above skewness).
7. Note that the factors are represented by long/short self-financed portfolios, which become attractive as soon as their average returns exceed their risk premiums. By construction, the market risk premium is almost equal to the average return of equities minus the average money market rate.
DIVERSIFICATION BENEFITS OF A PASSIVE FACTOR-BASED ALLOCATION

As we have shown, the cyclicality of the performance of risk factors generates risk in the medium term (see charts 1a and 1b). Thus, certain factors are unattractive from a theoretical point of view for the rational investor. However, the combination of these factors within a portfolio strategy would make it possible to benefit from their positive long term performance and the diversification effect generated by the decorrelation of their returns. The most naive and, consequently, the simplest strategy to consider is an equally weighted allocation strategy. The analysis summarised in tables 1a and 1b shows that the diversification generated by this passive factor-based allocation is significant in the two geographical areas. We have risk premiums estimated at 1.3% and 0.7%, respectively, for the United States and Europe, against actual performances of 3.2% and 5.2%. It should be noticed that the risk of these two equally weighted portfolios results primarily from the volatility of returns. This shows that, overall, the diversification effect helps to annihilate extreme risks\(^8\) and stabilise the distribution of returns. **It would therefore be interesting to explore other allocation approaches to take greater advantage of the diversification benefits of risk factors-based investing.**

RELEVANCE OF A DYNAMIC FACTOR-BASED ALLOCATION

The risk premium is a variable that is supposed to reflect macroeconomic and financial risks. Thus, Campbell and Cochrane (1999) show that risk premiums should vary depending on the variability of risk aversion, while Fama and French (1989) demonstrate empirically that risk premiums vary according to the economic cycle. This implies, from a theoretical point of view, that a rational investor would be willing to pay more (i.e. accept a lower premium) for assets that perform better in “periods of turbulence” (i.e. bearish and volatile markets). Furthermore, Daniel et al. (2012) demonstrate that the 13 greatest monthly losses of the momentum factor (US) coincide with a high ex ante probability of being in a so-called “turbulent” market regime. This implies that the risk premium for momentum should be fairly high, to the extent that the rational investor could be discouraged. **The problem that then arises is how to identify objectively these “periods of turbulence” so as to flee factors that become unattractive at these times, such as momentum.**

In practice, it is difficult to identify these phases based on a single indicator (Ilmanen, 2011). Taking the results of a study by Deutsche Bank (2014), we find that a majority of indicators responding to these periods of turbulence (implied volatility, uncertainties in experts’ forecasts, economic growth, investor sentiment, etc.) are generally positively correlated with each others (see chart 2). **What can be concluded from all this? Use market indicators or economic indicators instead?**

![Chart 2: Average correlation between various risk, sentiment and uncertainty indicators](image)

For our analysis, we use the ISM Manufacturing Index. This indicator is based on opinion surveys and is therefore a forward-looking measure helping to interpret the evolution of the economy, which has a strong impact on market sentiment. We therefore analysed a dynamic factor allocation strategy consisting in setting up 100% exposure to a given risk factor in a
phase of economic expansion (ISM greater than or equal to 50), in which investors would be optimistic, in other words phases of positive sentiment. In the opposite case, when the ISM is below 50 (phases of pessimism), the portfolio is 100% invested in money market assets. We focused here on the momentum and value factors because, on the one hand, academic literature has developed arguments that support their links to investor sentiment and, on the other hand, empirical studies prove that they are negatively correlated in the long run and, therefore, consider them as two complementary factors (Asness, Moskowitz & Pedersen 2009). Tables 2a and 2b present the results of this analysis. We note first of all that premiums are radically reduced during expansion phases, with the significant reduction of extreme risk and an increased performance for momentum and, conversely, a significant decrease in the performance of the value factor. We find the opposite is true when the ISM is less than 50: risk premiums are much higher and in parallel the asymmetry and extreme values of returns again explain the cost of risk. This leads us to conclude that when the economic cycle is favourable (i.e. potential phases of optimism), the momentum factor would be attractive while the value factor would be attractive at times of economic downturn (i.e. potential phases of pessimism). This conclusion is valid for both markets: US and Europe.

### TABLE 2: BREAKDOWN OF RISK PREMIUM DEPENDING ON ISM

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<th>a) US: 01/1996-09/2014</th>
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<tr>
<td></td>
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</tr>
<tr>
<td>MOMENTUM</td>
<td>2.6%</td>
<td>14.4%</td>
</tr>
<tr>
<td>MOMENTUM IF ISM&gt;50</td>
<td>8.3%</td>
<td>3.5%</td>
</tr>
<tr>
<td>MOMENTUM IF ISM&lt;50</td>
<td>-8.1%</td>
<td>16.1%</td>
</tr>
<tr>
<td>VALUE</td>
<td>6.8%</td>
<td>9.6%</td>
</tr>
<tr>
<td>VALUE IF ISM&gt;50</td>
<td>-1.4%</td>
<td>4.1%</td>
</tr>
<tr>
<td>VALUE IF ISM&lt;50</td>
<td>23.6%</td>
<td>15.1%</td>
</tr>
<tr>
<td></td>
<td>RETURN</td>
<td>RISK PREMIUM</td>
</tr>
<tr>
<td>MOMENTUM</td>
<td>7.6%</td>
<td>12.0%</td>
</tr>
<tr>
<td>MOMENTUM SI ISM&gt;50</td>
<td>12.7%</td>
<td>2.6%</td>
</tr>
<tr>
<td>MOMENTUM SI ISM&lt;50</td>
<td>-2.2%</td>
<td>12.3%</td>
</tr>
<tr>
<td>VALORISATION</td>
<td>9.0%</td>
<td>9.4%</td>
</tr>
<tr>
<td>VALORISATION SI ISM&gt;50</td>
<td>2.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>VALORISATION SI ISM&lt;50</td>
<td>23.6%</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

Source: Seeyond

Factors are built according to Fama and French’s methodology within the MSCI universe based on daily data from Bloomberg and Factset. Figures refer to previous years. Past performance does not guarantee future results.

The results of this analysis also illustrate the cyclical nature and the negative relationship between the momentum and the value risk factors. These preliminary findings have, therefore, direct implications for the construction of a dynamic factor-based allocation strategy, which would generate a better diversification than the naive approach consisting of equally-weighting the factors. This led us to analysing a more advanced strategy consisting in isolating momentum from the other factors by allocating 100% of the portfolio to this factor when the ISM is greater than or equal to 50. In the reverse case, the portfolio is allocated

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9. We also analysed alternative variants with gradually decreasing allocations to the momentum factor. Results generally confirm the findings of our study. These results can be provided upon request.
equally between the volatility, value and size factors. The results reported in the last lines of tables 1a and 1b show risk premiums of around 3.5% for historical returns of around 11% (i.e. a difference of 7.5%), while the equally weighted portfolios have premiums of around 1% for an effective returns close to 3% (i.e. a difference of only 2%). As we can also see on chart 3, the risk/reward profile of the dynamic approach is significantly better than that of the equally weighted allocation. This proves the substantial contribution of this approach, which consists of isolating the momentum factor, in terms of performance.

**CHART 3: RISK/REWARD PROFILE**

Source: Seeyond

Factors are built according to Fama and French’s methodology within the MSCI universe based on daily data from Bloomberg and Factset. Figures refer to previous years. Past performance does not guarantee future results.
IS THE FACTOR APPROACH SUSTAINABLE IN THE LONG TERM?

The long term sustainability of factor risk premiums is a very important issue. Quite logically, all investors cannot adopt the same strategy at the same time, for instance all buy undervalued securities at the same time. It is mainly for this reason that risk premiums have been persisting for decades. In theory, the average investor should hold the market portfolio (Cochrane, 1999). However, even if the premium associated with a risk factor became nil, it could be interesting to invest in this factor to diversify the aggregated risk of the portfolio. Asness et al. (2014) thus demonstrate that the optimal allocation between the value and the momentum factors is 80% value / 20% momentum on average if the expected performance of the latter is nil.

In addition, the constant heterogeneity of companies’ individual characteristics (age, size, debt, dividend policy, profitability, growth potential, etc.) means there are medium-term performing investment opportunities. The actual existence of these opportunities can be explained by the heterogeneity of risk appetite, or by the existence of behavioural biases affecting the decision-making process among investors. For instance, these biases could generate a cycle of over/undervaluation depending on investor sentiment (Baker and Wurgler, 2006).

Finally, academic literature has put forward arguments supporting not only active portfolio management but also passive management. Some studies show that on average, active management does not outperform passive management once all transaction and management fees have been taken into account, thus strengthening the assumption of efficient markets. Cremers and Petajisto (2009) have nevertheless shown that very active management, which requires a strong deviation of allocation from the allocation of the benchmark, outperforms the latter. The first argument implies that risk factors will persist as long as benchmarks are indices weighted by market capitalisation. The second means that risk premiums will erode regardless of the predominant role of these benchmarks. The substantial market share of index management as well as the nature of the underlying benchmarks are obviously critical elements for the future attractiveness of risk factor-related premiums. This is why the pressure of traditional index management would contribute to curbing the concentration of demand for a given risk factor. It is therefore reasonable to believe in the validity of the argument according to which factor returns will tend to positive equilibrium levels in the long term (Cochrane, 1999).

CONCLUSION

The medium-term risk generated by the cyclical nature of equity risk factors, their attractive long-term premiums as well as the decorrelation of their returns, such are the main arguments underlying the relevance of an allocation approach based on equity risk factors from a risk diversification perspective. A dynamic factor-based allocation strategy has nevertheless a better risk/reward profile than a passive approach. Some factors, such as momentum for example, have a strong economic contingency that can lessen their attractiveness for the rational investor. They therefore require an active management.

The viability of the factor-based approach nevertheless remains dependent on the persistence of the factors’ premiums in the long term. Admittedly, the nature of benchmarks underlying benchmarked portfolio management, as well as the market share of the latter, are obviously critical elements of the future attractiveness of these premiums. The pressure of traditional benchmark-driven portfolio management would therefore contribute to curbing the concentration of demand for a given risk factor. This would suggest that the factors’ returns will tend to positive equilibrium levels in the long run, supporting the conjecture of the factor-based approach sustainability.
REFERENCES


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Document written on December 2015

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