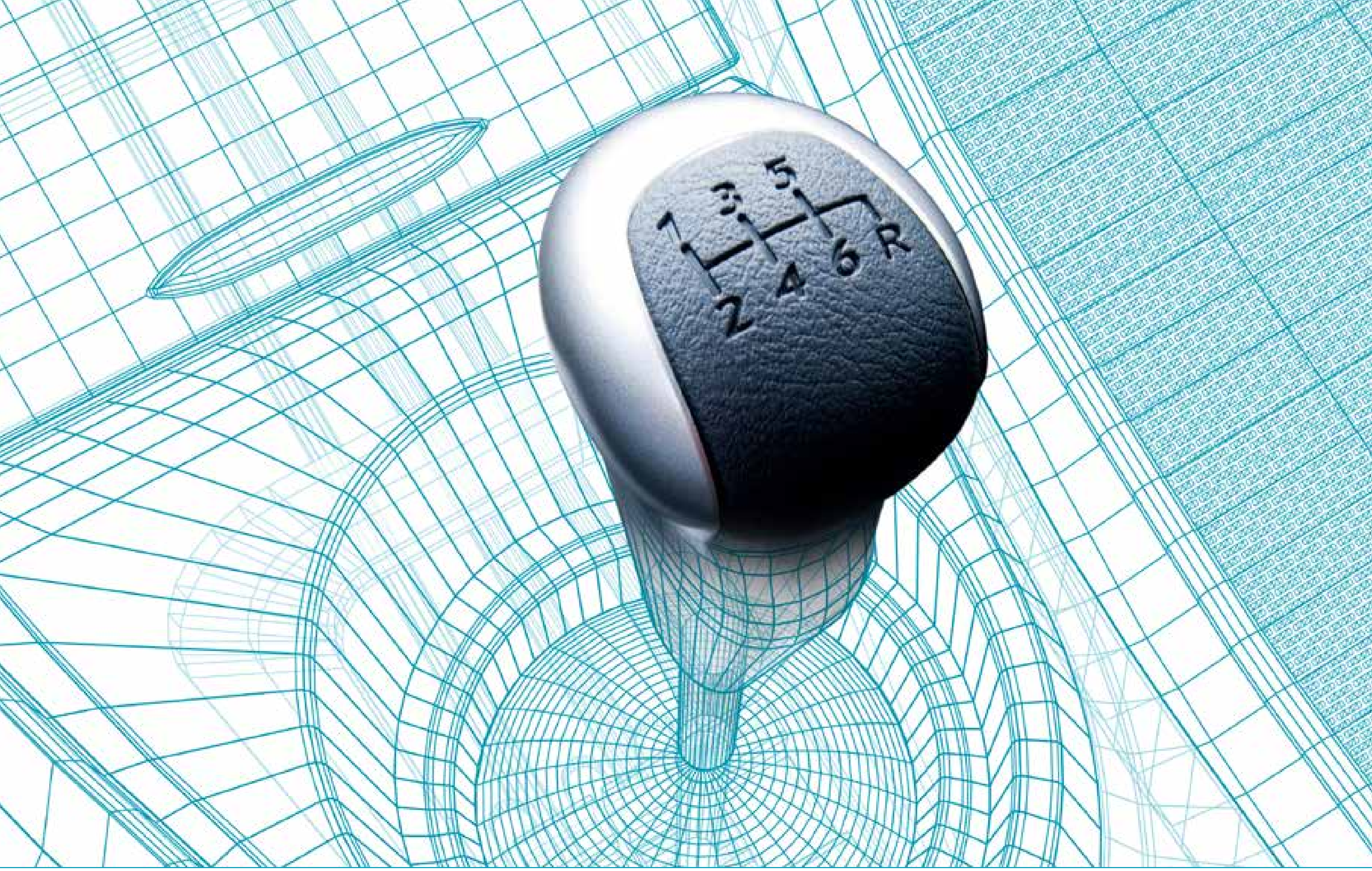


Factor investing in corporate bond markets

CLIENT CASE STUDIES

ROBECO
The Investment Engineers

For professional investors only

Factor investing in corporate bond markets

CLIENT CASE STUDIES

November 2018

CONTENTS

WELCOME TO THE WORLD OF FACTOR INVESTING IN CREDITS

Low Risk, Quality, Value, Momentum, Size. These are well-known style factors: characteristics that can help explain differences in the risk and return of stocks and bonds. In recent years investors have started to tilt their portfolios towards factor strategies in order to take advantage of the higher risk-adjusted returns, lower fees and diversification benefits that such strategies can offer.[1]

Initially factor investing was primarily popular in the equity domain, but investors are increasingly looking to reap the benefits of factors in other asset classes too or to implement factor investing in a multi-asset context. The same forces that make factor investing work for equities – investor behavior, market constraints and regulations – are also applicable to other asset classes. Its application in the corporate bond market is now at the forefront of factor investing's dissemination beyond the world of equities.

However, before investors strategically allocate to factors in corporate bond markets, they need to be convinced that such an approach can fulfil their needs. First, by answering questions such as: does factor investing work for credits, and what is its added value for this asset class? Second, many investors have been wary of implementing factor investing in corporate bonds because of the potential challenges that are specifically applicable to this market. For example, lower liquidity, higher transaction costs, and the additional complexity of having to choose between different bonds issued by the same entity.

In this booklet, we address these questions and challenges by looking at the lessons learned from our experiences with some major institutions who have incorporated factor investing for corporate bonds into their investment portfolios. In Part I, we introduce factor investing, its origins, the factors themselves and their definitions in the corporate bond market. Part II outlines some of the implementation challenges that apply specifically to factor investing in bond markets. In Part III, we outline the parameters within which factor strategies can be customized to fulfill the requirements of individual clients.

1. Estimates of the amount of money invested in factor strategies vary from one source to another, ranging from USD 1 to 2 trillion globally in most cases. In an October 2017 report, Morgan Stanley estimated that almost USD 1.5 trillion was invested in smart beta, quant and factor-based strategies and that assets under management have been growing by 17% per year on average since 2010.

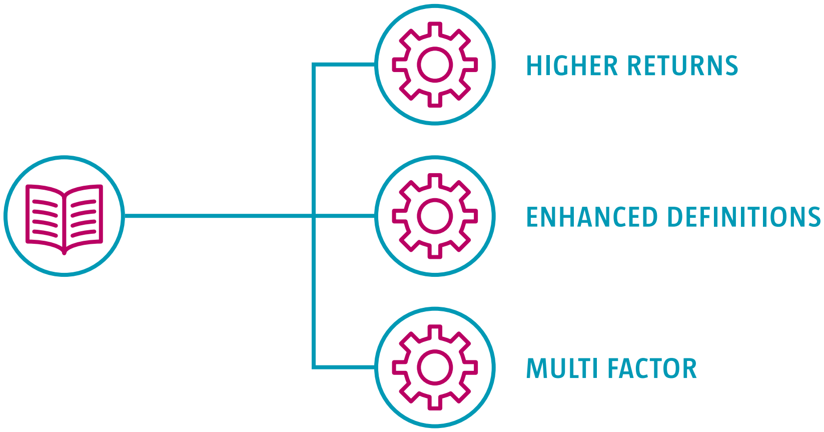
In Part IV we present a number of client case studies that illustrate five different rationales for implementing factor credit solutions. These clients have all successfully implemented factor strategies as part of their credit portfolio and used these to fulfill a wide array of investment objectives. These range from a factor credit solution to enhance the Sharpe ratio for an investor that had already implemented equity factors, a low-fee alternative to passive investing that delivers higher returns, a diversifying addition to a multi-manager pool, a strategy to enhance yield with low-risk credits, and a bespoke solution that incorporates solvency capital requirements.

We hope that by sharing our knowledge and experience, we can give you a better insight into the world of factor investing in credits and that this will help with your asset allocation and investment strategy decisions.

Patrick Houweling
Head of Quantitative Credits

PART I

Factor investing in the corporate bond market



Factor investing's origins date back to the 1970s, when several academic studies recognized that assets have a number of inherent risk and reward 'attributes' or 'factors', in addition to their traditional asset-class labels. The advent of increased computing power and availability of data in the 1990s allowed these factors to be tested and researched in far greater detail, with historical performance analyses in a number of regions (US, Europe, global, and emerging markets) and asset classes (equities, fixed income, commodities, FX).

However, it took until 2009 for investors to start acting on this research. The breakthrough occurred when a report was published analyzing the performance of one of the world's largest sovereign wealth funds which invests Norwegian oil revenues. Professors Ang, Goetzmann and Schaefer demonstrated that the value generated by the fund's active management did not reflect true skill (alpha), but could for a large part be explained by implicit exposures to systematic factors (betas).

The report also showed that these factor exposures are the result of bottom-up manager selection. Therefore, the authors recommended a long-term strategy incorporating an explicit top-down exposure to proven factors. More and more investors started discovering that their portfolios were also unintentionally or weakly tilted to factors and began strategically and explicitly allocating to them to generate better risk-adjusted returns. Initially the focus was on equities, but in recent years the scope has been expanding to include other asset classes.

At Robeco, we have been successfully managing quantitative strategies since the 1990s and have carried out extensive empirical testing over long periods in different markets. We have been developing factor models in credit markets since the end of the 1990s. In the last decade, we have launched a number of credit factor strategies: Robeco Conservative Credits (2012), Robeco Multi-Factor Credits (2015) and Robeco Multi-Factor High Yield (2018). Our credit expertise has also been incorporated in several multi-asset solutions.

FACTORS GIVE ACCESS TO HIGHER RISK-ADJUSTED RETURNS

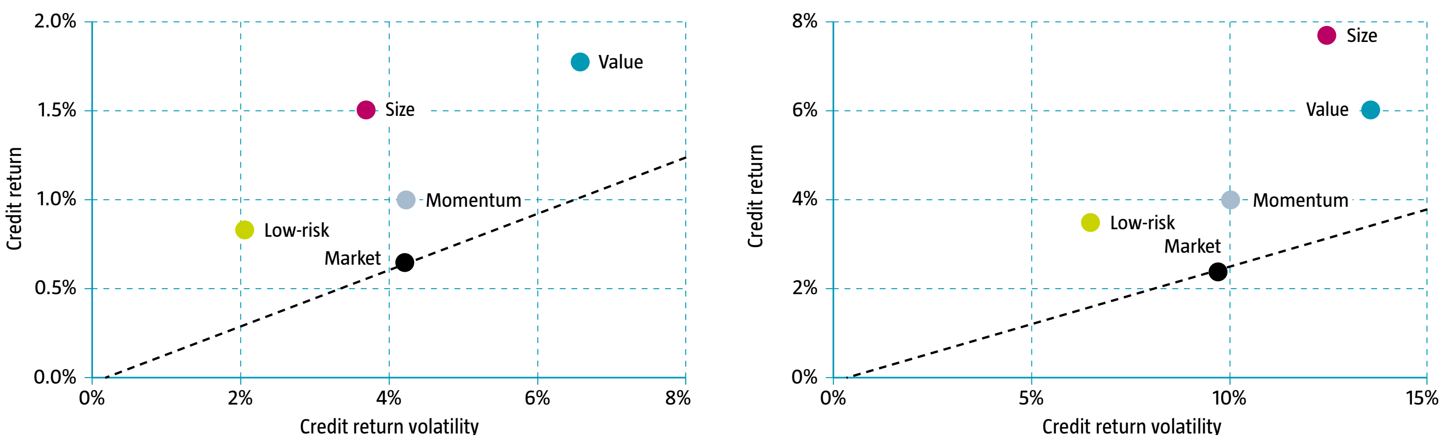
Those same factors that are well-established in equity markets are also present in corporate bond markets. This is logical as the reasons why factor premiums exist can be largely attributed to human behavior and will therefore not be restricted to one asset class. This behavior could either be an irrational bias, such as overreaction, overconfidence, or herding, or a rational response to regulation or incentives. This means that factor portfolios that seek to benefit from these behavioral patterns should work in any asset class.

Factor portfolios are constructed by sorting bonds according to proven characteristics in order to harvest their factor premiums. For example, the size category contains bonds issued by small companies; low-risk bonds are issued by solid, 'dull' companies with good credit ratings that are less likely to get into financial difficulties; value selects bonds whose credit spreads look attractive compared to the incurred level of risk; and momentum identifies companies that have performed well in the past and are likely to continue to do so in the future.

In Figure 1 we summarize these four factors by plotting the risk and return of each factor portfolio over the period 1994-2017 for investment grade and high yield credits. Each factor has been defined as documented in our academic paper on factor investing in the corporate bond market.[2] We find that each factor delivers a higher risk-adjusted return than the market, by improving the return and/or reducing the volatility. Our research also demonstrates that each factor has a distinct risk-return profile and that the mutual correlations between the factors are relatively low.

2. Houweling, Van Zundert, 2017, "Factor investing in the corporate bond market", *Financial Analysts Journal.*

Figure 1: Risk-return plot per factor portfolio for US investment grade (left) and high yield (right)



Source: Robeco, Bloomberg Barclays. Methodology as in Houweling & Van Zundert (2017). Extended sample period: 1994-2017.

ENHANCED FACTOR DEFINITIONS

The results presented in Figure 1 are based on the recognized generic factor definitions in the academic literature. Rather than just taking these generic definitions and applying them directly in our factor investing strategies, we have fine-tuned or enhanced them to improve their risk-adjusted returns. One way to achieve this is to identify and minimize exposure to unrewarded risks. Another way is to make the most of all the sources of information at our disposal, by including a broader range of characteristics that together more robustly measure exposure to a certain factor. This means going beyond bond-specific data and also looking at, for example, equity and accounting data. This fine-tuning is an ongoing process and when new or alternative data becomes available, we assess their added value compared to the existing sources to further improve our models.

Standard academic **low-risk** definitions use credit ratings and bond maturity as measures of risk, but the disadvantage of ratings is that they only adjust slowly to new information about the issuing company. In our enhanced low-risk definition, we therefore also use other risk measures, such as the amount of leverage the company is taking on and its distance-to-default. In addition, we add **quality** variables, such as a firms' profitability and cash flow-generating ability. Our research shows that in the case of credits, the low-risk and quality factors are quantitatively and qualitatively similar, so we combine them into a single enhanced low-risk/quality factor.[3]

Generic definitions of **value** use a bond's credit rating and maturity as measures of risk to calculate its 'fair' credit spread – a level that offers sufficient reward for the associated level of risk. However, this method is prone to the 'value trap' – buying cheap bonds that are cheap for good reason, as the credit rating does not necessarily reflect all the relevant risks. It takes a while for rating agencies to process changes in a company's financial situation and to reflect this in their credit rating. To enhance value, we calculate the fair credit spread using additional company-level risk measures based on equity and accounting information.[4] Furthermore, unlike the generic approach to value that assumes a straight line-relationship between credit spreads and risks, our enhanced method allows for realistic credit curves.

The generic definition of **momentum** in credit markets uses past credit returns, but this has been shown to work poorly in the investment grade credit market, because low dispersion and pull-to-par (the effect in which the price of a bond converges to par value as time passes) make it hard to identify bonds that outperform. The risk profile of this approach also varies over time, because the momentum factor selects high-risk securities in bull markets and low-risk securities in bear markets. Instead of bond momentum, Robeco's enhanced momentum factor uses momentum spillover from the equity market to the credit market: recent winners from the stock market tend to be future winners in the credit market.[5] It also corrects for time variation in risk by ranking companies based on their stock-specific equity return, thus removing the beta component.

3. Houweling, Van Zundert, Muskens, Whirdy, 2016, "The quality of low-risk credits", Robeco white paper.

4. Houweling, Van Zundert, Beekhuizen, Kyosev, 2016, "Smart credit investing: the value factor", Robeco white paper.

5. Haesen, Houweling, Van Zundert, 2017, "Momentum spillover from stocks to corporate bonds", *Journal of Banking and Finance.*

A generic approach to incorporating **size** in a factor strategy would lead to a portfolio that consists primarily of small firms and bonds, which would make it a rather illiquid portfolio, unsuitable for active management. In Robeco's factor strategies, small firms are overweighted and large firms are underweighted during the portfolio construction phase, resulting in a more efficient way to obtain exposure to the size factor.

Table 1: Generic versus enhanced factors

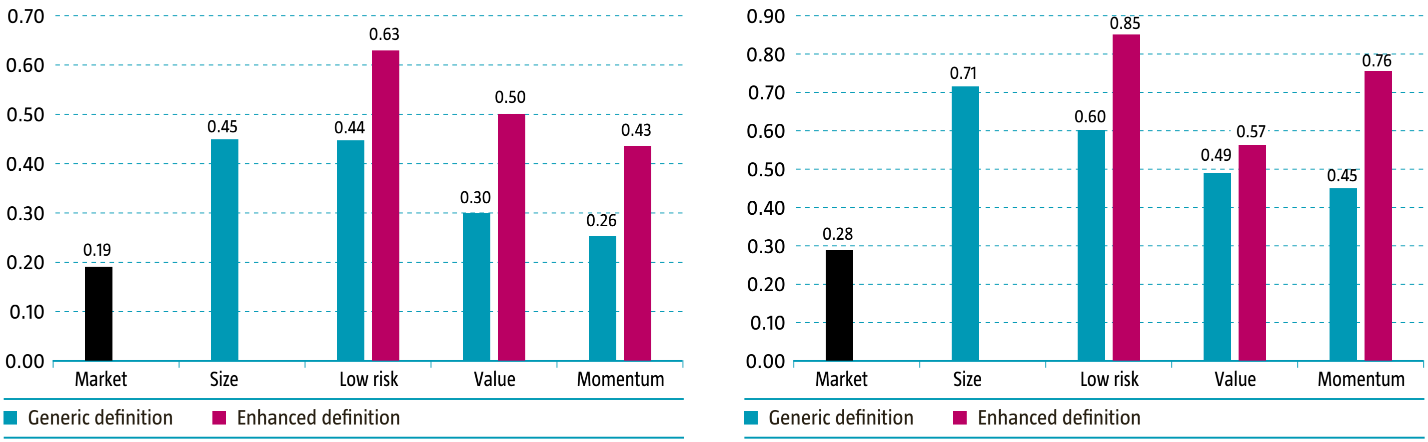
	Low Risk/Quality	Value	Momentum	Size
Goal	Select low-risk bonds of low-risk & high-quality issuers	Select bonds that are cheap relative to their risk	Select companies that recently outperformed	Select bonds of small firms
Generic definition*	Rating & maturity	Regress credit spread on rating & maturity	Past 6-month bond return	Market value of company in corporate bond index
Enhanced definition	– Use accounting and equity market data – Combine low-risk and quality variables	– Use accounting and equity market data – Create accurate peer groups	– Use equity momentum – Control for time-varying risk	– Equally-weighted portfolio

Source: Robeco. * As defined in Houweling, Van Zundert, 2017, "Factor investing in the corporate bond market", *Financial Analysts Journal*

Our research shows that using these enhanced definitions has the potential to further improve the Sharpe ratio.[6] Figure 2 shows the Sharpe ratios of both the generic and enhanced factor definitions for the investment grade and high yield markets from 1994 to 2017.

6. Houweling, Van Zundert, 2015, "Smart credit investing: harvesting factor premiums", Robeco white paper.

Figure 2: Sharpe ratios for generic and enhanced factors for US investment grade (left) and high yield (right)



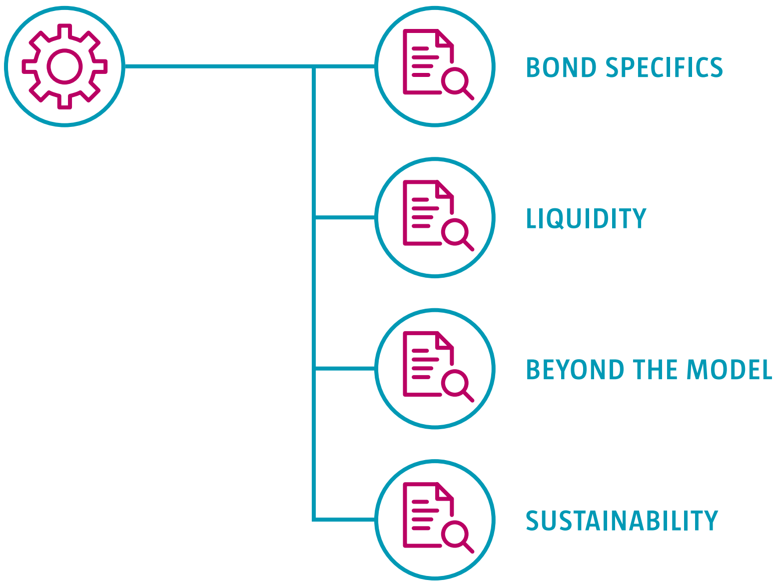
Sources: Robeco, Bloomberg Barclays. Generic factor definitions as in Houweling, Van Zundert, 2017, "Factor investing in the corporate bond market", *Financial Analysts Journal*. Extended sample period until December 2017. Credit returns measured over duration-matched government bonds.

A MULTI-FACTOR APPROACH

In addition to the stand-alone performance of the individual factors, we also looked at the mutual correlations between the factors. We found these correlations to be relatively low, as each factor benefits from a distinct behavioral pattern to earn its premium. This means that value, for instance, may underperform over a certain period while low risk outperforms. Therefore, a multi-factor approach, that allocates to multiple factors in a single portfolio, benefits from diversification over the individual factors, making the alpha more stable over time. This is evident in the lower tracking error of a multi-factor portfolio compared to the tracking errors of single-factor portfolios. Moreover, a multi-factor portfolio retains the high Sharpe ratio generated by the individual factors, but with smaller drawdowns and a lower tracking error versus the market. This mitigates the risk of temporary underperformance, and generates an attractive information ratio in addition to the attractive Sharpe ratio.

PART II

Overcoming implementation challenges



Although stocks and bonds both depend on the financial well-being of the issuing company and their returns tend to be positively correlated, they are different instruments with their own unique characteristics. Implementing a factor investing strategy for corporate bonds involves certain implementation challenges that differ from those associated with factor investing in equities. Below we discuss some of the main challenges and how to tackle them.

DEALING WITH BOND-SPECIFIC CHARACTERISTICS

A company typically issues only one or two types of stock (common and preferred), but far more bonds, sometimes dozens. And these bonds have different characteristics, such as maturity date, size, currency, and subordination. These characteristics require careful treatment, especially in defining the factors and designing the investment process.

For example, to benefit from the low-risk factor, investors need to be able to distinguish between low- and high-risk bonds from the same issuer. Another example is the value factor, where the differences between the relative attractiveness of each individual bond from one issuing company have to be evaluated. Not all bonds are necessarily equally attractive: some might be cheap, others expensive. Finally, the portfolio should be sufficiently diversified in terms of the number of issuers: in the event that one company has several bonds that fulfil our investment criteria, there should be limitations on the portfolio's overall exposure to any single issuer as all of a company's bonds are exposed to the same issuer default risk.

It is also important to establish that a real economic and legal link exists between the bond and the parent company. A correct bond-parent link is essential to ensure that the accounting and equity data that feed into the model score for that bond are relevant. For example, in the event of a default, if a bond issued by a subsidiary is not guaranteed by the parent company, the bond holders can only make a claim on the subsidiary's assets and not on those of the parent company. This illustrates how important it is to assess the credit quality of the subsidiary in order to establish the level of risk associated with the bond.

11,880

Number of bonds in Barclays Global Aggregate Corporates Index*

81

Number of AT&T bonds in Barclays Global Aggregate Corporates Index*

USD 9,291 bln

Total market value of bonds in Barclays Global Aggregate Corporates Index*

USD 26.8 bln

Total trading volume in USD Investment Grade bonds on a single day**

Sources: *Barclays, end October 2018
**TRACE, 31 October 2018

INCORPORATING ILLIQUIDITY AND TRANSACTION COSTS IN THE PROCESS

In addition to their characteristics, bonds differ substantially in terms of their liquidity. Whereas some bonds trade every day, others trade only infrequently. In the same context, transaction costs can vary significantly from one bond to another. Both research and implementation of factor portfolios need to take these variations in availability and cost into account. Factor strategies should be designed in such a way that they provide an optimal balance between factor exposures and alpha potential on the one hand, and turnover and transaction costs on the other.

Robeco has developed a methodology to measure the liquidity of individual bonds in real time. Our system collects liquidity information from a range of sources, including trading systems and pre-trade transparency platforms. All this information is then combined to create an estimate of the tradeable volume for each specific bond. This allows us to select those bonds where the trade has a high probability of being executed, resulting in more efficient implementation.[7]

7. Whirdy, Houweling, Muskens, Van Zundert, 2016, "Implementing factor strategies in the corporate bond market", Robeco white paper.

RISKS BEYOND THE SCOPE OF THE FACTOR MODEL

When presenting our factor credit strategies, we are frequently asked whether a multi-factor model can capture all the risks of investing in a corporate bond. The honest answer is no. A model is a best-efforts representation of the many risks associated with the bond and its issuer. With the increased availability of data and computational power, models have become richer over time, increasing their ability to better evaluate risks.

Nonetheless, there are still risks that we cannot represent as a numerical value. This may be because of their complexity, or a lack of relevant (historical) data to verify models. Examples include measuring the quality of a company's management, the impact of new legislation on a company's business, or the risk associated with the country in which the company operates. Other challenges for a purely quantitative approach are events that will materially change the company, but are not yet reflected in current data. For example, a company announcing a merger or an acquisition, or splitting-off a part of its business.

In view of these non-quantifiable risks and material events, we incorporate human checks in the investment process of our factor strategies. Before we make an investment in a bond that is top-ranked in the multi-factor ranking model, one of our credit analysts performs a final check to identify risks and events beyond the scope of the model. If they flag such a risk, we do not invest in the bond, and we move on to the next investment opportunity. This happens in 5 to 10% of cases. We may also decide to sell an existing portfolio holding if a new risk is flagged. This happens a few times a year for each portfolio. With these fundamental checks we aim to avoid losers that could be selected in a purely quantitative investment process.

INTEGRATING SUSTAINABILITY

Clients are increasingly aiming to improve the sustainability profile of their investment portfolios. At Robeco we have a long track record in integrating sustainability into the investment process of our strategies. We incorporate sustainability into our flagship factor credit strategies in four specific ways:[8]

- We require the ESG score of the portfolio to be better than the ESG score of the benchmark, as measured by the RobecoSAM SmartESG score. This restriction is used in constructing the portfolio, alongside other risk and allocation restrictions, while the primary goal is to optimize factor exposures.
- As described above, our fundamental analysts conduct a check on risks beyond the scope of the model. This includes ESG-related risks, such as poor governance, controversial behavior, or large claims resulting from litigation.
- We exclude companies that are on the Robeco Exclusion List.[9] This relates to companies that exhibit controversial behavior (i.e. violations of the UN Global Compact Principles), companies that manufacture controversial weapons, and companies that are involved in the production of tobacco products.
- We engage with companies to improve their corporate behavior on environmental, social and/or corporate governnance-related issues.[10] The goal of our engagement with companies is to improve their long-term performance and ultimately the quality of the investments we make for our clients.

Specific clients may have requirements that go beyond this standard sustainability integration. In the next chapter we look more closely at some bespoke sustainability solutions.

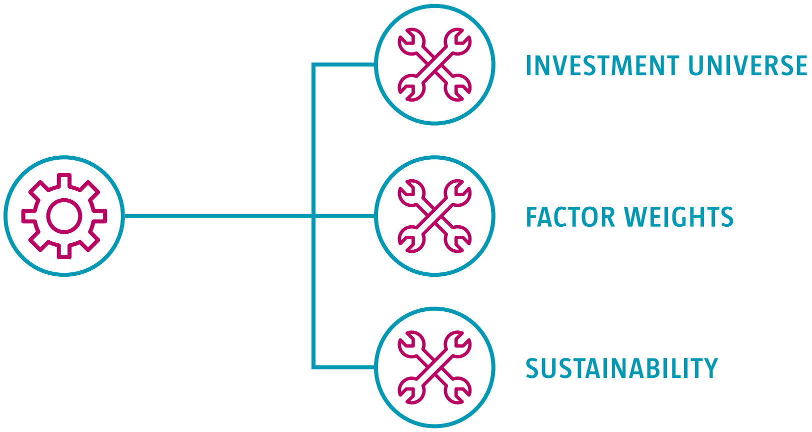
8. See Muskens, Houweling, Whirdy, Van Zundert, 2016, "Integrating sustainability into factor credit strategies", Robeco white paper.

9. The Robeco Exclusion Policy can be downloaded from our website: https://www.robeco.com/docm/docu-exclusion-policy-and-list.pdf

10. The Robeco Engagement Policy can be downloaded from our website: https://www.robeco.com/docm/docu-robeco-engagement-policy.pdf

PART III

Customization: one size doesn't fit all



The results of our research underscore the benefits of implementing factor investing in credits. However, there is not a one-size-fits-all solution, as each investor will have different requirements in terms of risk and return and may have to cope with different restrictions. Pension funds, for example, are unlikely to have the same investment objectives as sovereign wealth funds or family offices.

Some investors will have different priorities which will affect how they design their factor portfolios – optimizing return, enhancing the Sharpe or information ratio, reducing costs or setting specific risk and allocation constraints. Before we look at a few specific client cases, here is a more general introduction to ways in which a factor strategy can be customized.

INVESTMENT UNIVERSE

Clients may have specific reasons, goals or restrictions which require them to define their own investment universe. The size or 'breadth' of the investment universe and the number of investment opportunities is a crucial factor in determining a strategy's success, but as long as we are confident that a factor strategy can still achieve what it sets out to, we can customize the investment universe to fit specific client requirements. Some examples are listed below.

- **Ratings:** the universe is usually either investment grade or high yield, but we can adjust this to include or exclude certain ratings; a high yield strategy excluding CCCs, for example.
- **Currencies:** typically the universe is global and includes all currency denominations, but euro or US dollar-only universes are possible too.
- **Maturities:** typically the universe includes all maturities, but we can apply stricter maturity universe guidelines (e.g. 1-5 year or 1-10 year) should clients require this.
- **Sectors:** typically all sectors are included in the investment universe, but we can exclude certain sectors (financials for example), or apply values-based exclusions, e.g. tobacco companies or weapons manufacturers.

Irrespective of the chosen investment universe parameters, FX, duration, and credit beta exposures can all be hedged to the client's desired targets using derivatives.

FACTOR WEIGHTS

Robeco's multi-factor strategies provide balanced exposure to all factors, meaning that each factor is equally represented in the portfolio, resulting in optimal diversification. The beta of such a balanced strategy is around 1, making it easy to benchmark the portfolio to a standard index. However, in dialogue with the client, we can also design strategies that are tilted to one or more specific factors. In such factor-tilted strategies we still incorporate the other factors to avoid undesired negative factor exposures. The most popular option we see is a tilt to the low-risk factor. Such a strategy invests in shorter-dated bonds from safer issuers and its shorter duration makes it a natural fit for investors with shorter-dated liabilities.

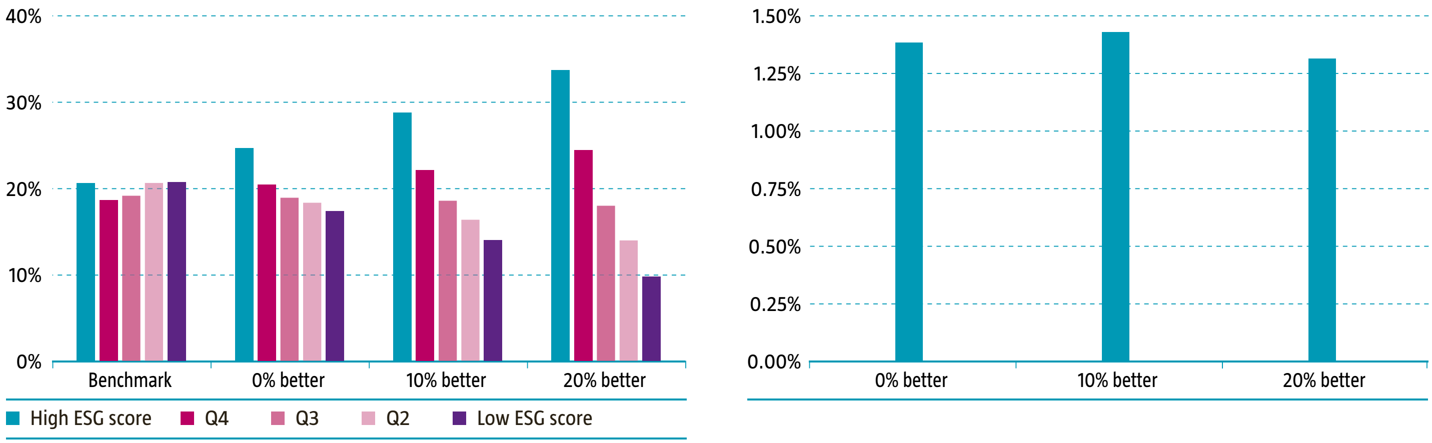
ADDITIONAL SUSTAINABILITY CRITERIA

Investors may also have requirements in terms of sustainability enhancement that go beyond Robeco's standard ESG integration. These can range from specific exclusion criteria, to further ESG enhancement or the addition of carbon footprint goals.

Customized solutions can be created to fulfill certain client requirements or specific targets. These can then be backtested using a combination of RobecoSAM's historical company-level sustainability data and Robeco's historical bond and equity databases. Below are some examples.

- **Enhanced ESG score versus the benchmark**
  Figure 3 shows the impact of increasing ESG targets on the sustainability profile and the outperformance of a factor strategy.
- **Investment portfolio with reduced environmental impact**
  RobecoSAM has data on the CO_2 emission, energy consumption, water use, and waste generation of individual companies, which we can use to design strategies that have less environmental impact on these specific aspects versus the benchmark.
- **Sector exclusion**
  For example, tobacco, alcohol, weapons, gambling.
- **Positive screening**
  To select companies that contribute positively to the UN's Sustainable Development Goals (SDGs), RobecoSAM has developed a framework that allows us to assess the extent to which a company contributes to one or more of the 17 SDGs.

Figure 3: Impact on sustainability profile (left) and outperformance versus benchmark (right) of requiring the portfolio's ESG score to be x% better than the benchmark for a sample investment strategy.



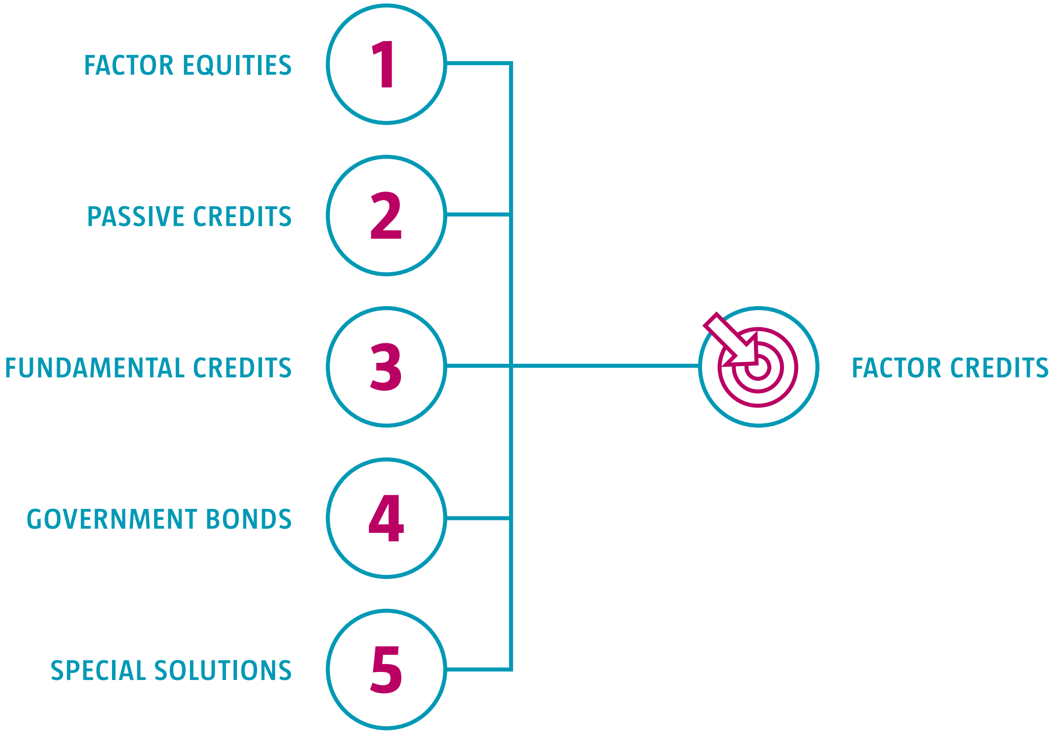
Source: Robeco, RobecoSAM, Bloomberg Barclays, FactSet. Sample period: 2003-2017. The value of your investments may fluctuate. Results obtained in the past are no guarantee for the future.

Table 2: Summary of the customization options available

Factors	Single-factor or multi-factor
Region	Global or regional
Ratings	IG, HY, or combination
Maturities	Full spectrum, or only shorter-dated bonds
Currencies	Global, or only specific currencies
Sectors	All sectors or some exclusions, e.g. sin sectors
Objective	Sharpe optimization, return optimization, information ratio optimization, or return-on-capital optimization (insurers)
Integration	Sustainability, Solvency II
Vehicle	Fund or mandate

Source: Robeco

PART IV
Client case studies



1 FROM FACTOR EQUITIES TO FACTOR CREDITS

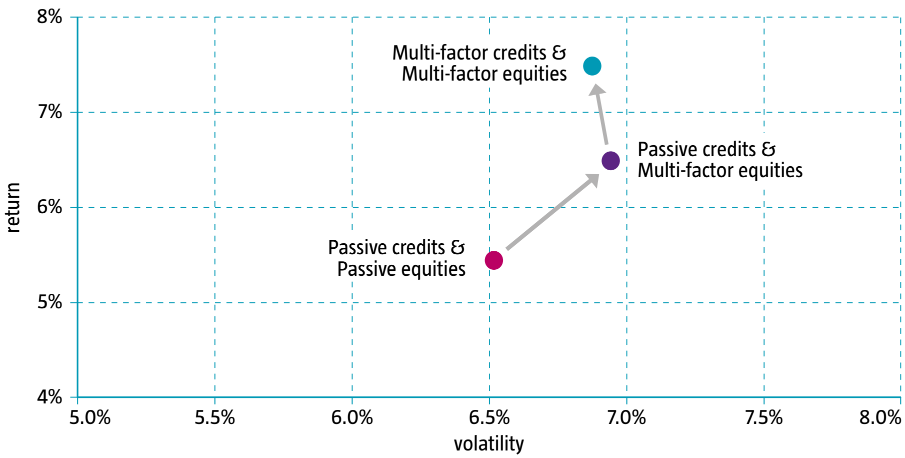
In this section we present two examples of clients who have successfully expanded the scope of their factor allocations. These are investors who started factor investing in the equity market several years ago and have more recently expanded their scope to include the credit market.

Factor investing beyond equities

According to FTSE Russell's annual smart beta survey,[11] 48% of asset owners worldwide have implemented smart beta strategies in their portfolios. Survey participants cite return enhancement, improved diversification, and cost savings as the primary reasons for taking this step. However, despite the large allocation to bonds in asset owners' asset mixes, there are still less smart beta strategies being implemented for fixed income. Only 9% of those asset owners who took part in the survey are currently invested in fixed income smart beta, with an additional 24% currently evaluating or planning to evaluate these strategies in the next 18 months. So, 33% is invested or plans to invest, leaving 67% that has not allocated and has no intention of doing so in the next 18 months.

There are good reasons to consider allocating to fixed income factor strategies. Our research has shown that the main benefits cited above apply just as much to fixed income as they do to equities: factor portfolios have higher expected returns than passive portfolios; they have low correlations with traditional active portfolios and lower fees. Moreover, our analyses show that equity and credit factors have low mutual correlations, so that allocating to factors in both markets benefits from diversification while harvesting factor premiums.
This is shown in Figure 4, which illustrates how a hypothetical multi-asset portfolio can be improved by replacing the passive credit allocation with a multi-factor credit portfolio. The chart shows that this enhances the overall return of the multi-asset portfolio without affecting the associated level of risk.

Figure 4: Risk-return plot of multi-asset portfolios



Source: Robeco, Bloomberg Barclays. Methodology as in Houweling, Van Zundert (2017). Extended sample period: US 1994-2017.

11. FTSE Russell, 2018, "Smart beta: 2018 global survey findings from asset owners".

PENSION FUND

This client had implemented factor investing for its equity portfolios and wished to expand its application to credits.

This pension fund is a long-standing Robeco client, invested in various equity and fixed income strategies, including a quantitative low-risk equity strategy. In 2013, they approached us, as they were looking for a low-risk credit manager.

The rationale behind their decision to take this step was to benefit from the low-risk factor in the credit market too: to earn the market return, while strongly reducing the volatility, thus realizing a higher Sharpe ratio than the index. As they were already familiar with low-risk investing in equity markets, they were aware of the large tracking error a single-factor, low-risk credit portfolio has compared to the market index. They were not concerned about this high tracking error, and were not expecting outperformance nor a high information ratio versus the market. They were focused on improving the Sharpe ratio of their portfolio, as ultimately this reduces the risk of underfunding and the pension fund's inability to meet its liabilities.

We carried out several analyses for this client, including simulations that showed the benefits of replacing their traditional credit portfolio with a low-risk credit portfolio. The most important conclusion was that this would lead to a significant reduction in volatility, while only having a negligible effect on returns, resulting in a substantial improvement in the Sharpe ratio.

In 2014, after an extensive search, Robeco was selected to manage a low-risk investment grade strategy for this pension fund. An important consideration was our strong reputation in quant equity and quant credits, as demonstrated by our live track records and academic publications. Since implementing their portfolio in October 2014, it has realized a credit spread return of 0.9% with a volatility of 0.9% and a Sharpe ratio of 1.08. This compares very favorably to a realized credit spread return of 1.0%, a volatility of 2.3% and a Sharpe ratio of 0.45 for the market index (figures as of August 2018).

The value of your investments may fluctuate. Results obtained in the past are no guarantee for the future.

PENSION FUND

This client approached us in 2017 to become one of their strategic partners in investigating the added value of factor investing in the credit market.

The pension fund is well-known for its innovative way of investing and often cited as being one of the frontrunners in adopting factor investing in equities. They started strategically allocating a large part of their equity portfolio to factors several years ago and were pleased with the performance this had generated.

In 2017 they decided to investigate the extent to which factor investing could be applied in credit markets too. The main objective of this project was to see if the expected return of the credit portfolio could be improved without increasing its risk. We worked closely with this client over the next 12 months, conducting numerous analyses to answer their questions. These questions initially focused on understanding credit factors: studying their returns, the associated risks, their correlations with other markets, and also their correlation with factors in those markets. Later the questions progressed to the implementation phase: understanding a factor strategy's allocations to ratings, sectors, and maturities, and tackling illiquidity, transaction costs and hedging costs in the investment process. The final considerations were the choice of the factor mix and the investment universe.

The customized multi-factor strategy for this client went live in the fourth quarter of 2018. The strategy has been designed in close cooperation with the client and is fully benchmark agnostic in order to provide an optimal risk-adjusted return.

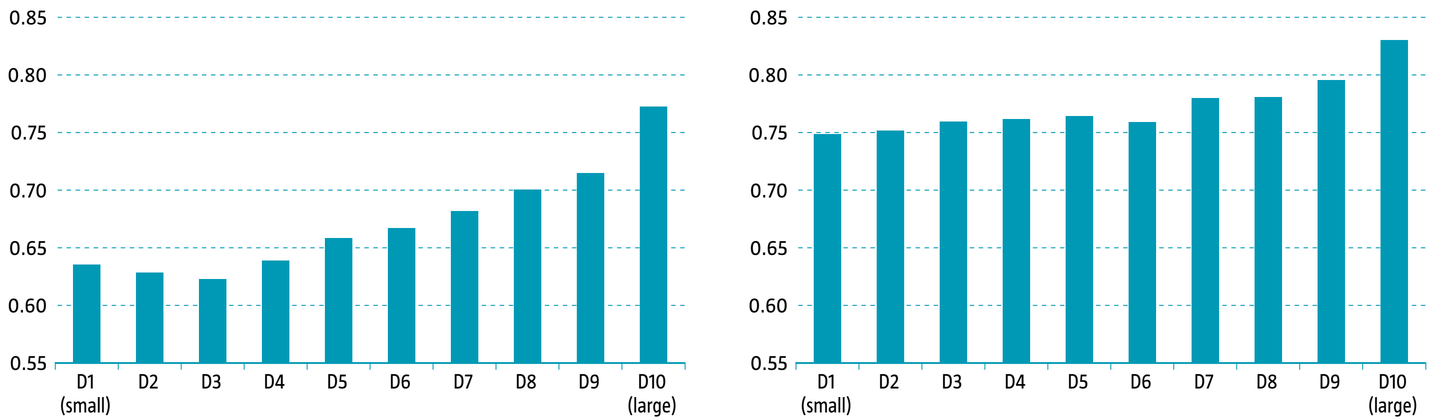
2 FROM PASSIVE CREDITS TO FACTOR CREDITS

Our second case study looks at a client who asked us to find an alternative to passive investing in the credit markets. The aim was to mitigate the disadvantages of passive investing while maintaining a fee level below that of a traditional active fund.

Passive credit solutions – not all they seem

Investors are becoming increasingly aware that market value-weighted corporate bond indices have various shortcomings that make them inefficient investments. As a result of the way they are constructed, such indices assign a larger index weight to companies that have issued more debt. Although this does not necessarily mean that these companies are also more risky – they could also have a large equity buffer on their balance sheets – our research shows that larger companies in the credit indices are also more leveraged, as shown in Figure 5. This means that investors who invest in a credit product that passively implements a market value-weighted index are more exposed to riskier firms.

Figure 5: Leverage per size decile for USD investment grade (left) and USD high yield (right)

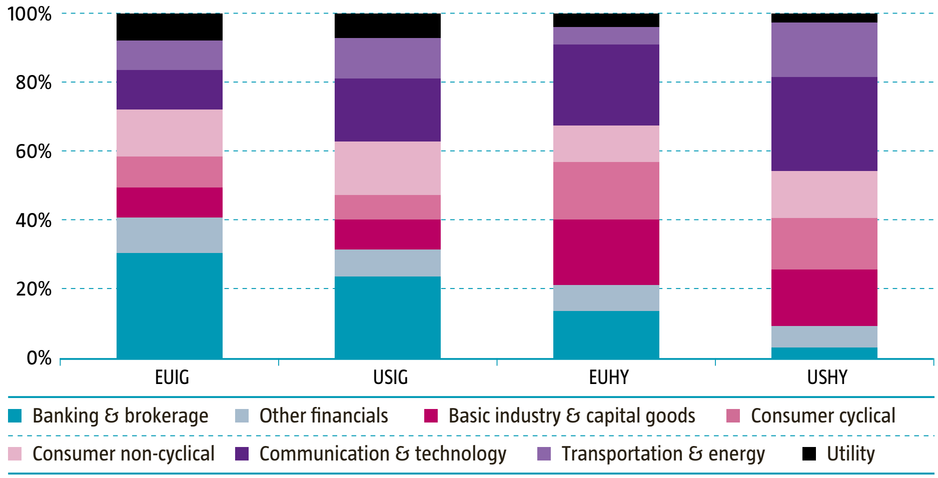


Source: Robeco, Bloomberg Barclays, FactSet. Sample period: US Aggregate Corporate, US High Yield Corporate, average over 1994-2017.

A further disadvantage of market value-weighted indices is that they tend to be concentrated in a small number of sectors that happen to have issued high levels of debt in the recent past. Figure 6 shows that investment grade indices are currently biased towards the banking sector, and high yield indices to the telecom and energy sectors. Unfortunately, episodes of abundant debt issuance generally do not end well. Several examples come to mind: the telecom sector around the turn of the century (and the subsequent burst of the dotcom bubble), the banking sector in 2007 (and the ensuing credit crisis), and energy companies in 2015 (many of which got into financial distress due to a significant decline in the oil price). A Barclays study[12] shows that these high-profile events are not isolated examples: periods of higher issuance tend to be followed by periods of lower returns, and vice versa.

12. Barclays, 2014, "Issuance patterns and performance of credit indices".

Figure 6: Index weights per sector



Source: Robeco, Bloomberg Barclays. Euro-Aggregate Corporate (EUIG), US Aggregate Corporate (USIG), Pan-European High Yield (EUHY), US High Yield Corporate (USHY), as of December 2017.

Credit indices are notoriously difficult to track and this is another disadvantage. They contain thousands of relatively illiquid bonds and there is a relatively high turnover in terms of index constituents due to new issuance and redemptions. This makes it very difficult for passive investment vehicles to effectively replicate index returns, as the combination of frequently changing constituents and high transaction costs results in underperformance versus the index.[13]

This brings us to the lack of sustainability integration in market value-weighted indices. The ESG profile of their investment portfolios is an increasingly important consideration for many clients. However, as long as bonds meet the index criteria, they will be included irrespective of the ESG behavior of the issuing company. Active managers, on the other hand, can actively choose whether or not to buy a bond, and can incorporate ESG information into the decision-making process.

Finally – and perhaps this is stating the obvious – market value-weighted indices ignore research insights about factors, meaning that these indices contain both cheap and expensive bonds (value factor), low- and high-risk bonds (low-risk factor), winners and losers (momentum factor), and small and large firms (size factor). By applying factor investing principles, investors can construct a credit portfolio with a higher expected return and/or lower expected risk.

13. Houweling, 2012, "On the performance of exchange-traded funds, *Journal of Index Investing"*.

TOP GLOBAL CONSULTANT

At the end of 2014, we were invited by the fixed income research team at a top global consultant who had read our research paper 'Factor Investing in the Corporate Bond Market', to discuss setting up a multi-factor credit fund for their clients.

At the time, we had just published the first version of this paper online. Fast forward to 2018 and that same paper has been published in the Financial Analysts Journal and awarded a Graham and Dodd Award of Excellence, while our multi-factor credit strategies have now attracted over a billion euros in assets.

Back in 2014, however, there was just the research paper, and no multi-factor strategy, although our low-risk credits strategy had been up and running for a number of years. Nonetheless, the consultant's researchers were very interested in our findings about multi-factor portfolios, and particularly keen to hear our thoughts on turning these findings into an actual investment strategy. They told us that they were looking for a smart beta manager to replace the investments they had in passive credit vehicles. Their requirements were for the strategy to be highly systematic, well-diversified and strongly exposed to factors and for it to be duration-, beta- and FX-neutral versus the benchmark. Another important requirement was that the management fee level should be between that of a passive and active strategy. Attractive fees were important to the consultant's clients, mostly pension funds, who wanted to reduce cost levels to be able to pay out more to their participants. The ultimate objective was to provide higher returns, net of fees, than passive credit vehicles. By harvesting factor premiums, a factor-based strategy is much better positioned to generate higher returns for pension fund participants than passive credit products.

We took this 'homework' away with us and used it to design our global multi-factor credit strategy. We had several more meetings with the consultant, each time providing them with backtest and robustness test results, and more information on the characteristics of the strategy and how it was allocated to sectors, regions, ratings, etc. In June 2015, Robeco QI Global Multi-Factor Credits went live. On launch day, we received the highest rating from this consultant, a great reward for an intensive six-month collaboration. Since then, we have received inflow into the strategy on numerous occasions from the consultant's fiduciary and advisory clients. Since inception, it has outperformed its benchmark, the Bloomberg Barclays Global Aggregate Corporate Index, by 48 basis points per annum, with an information ratio of 0.78 and a Sharpe ratio that is 0.19 higher than the benchmark, 0.94 versus 0.75 (figures as of August 2018).

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3 FROM FUNDAMENTAL CREDITS TO FACTOR CREDITS

Our third case shows how a multi-factor portfolio can offer diversification benefits when added to a pool of actively managed credit funds.

The power of the diversifier

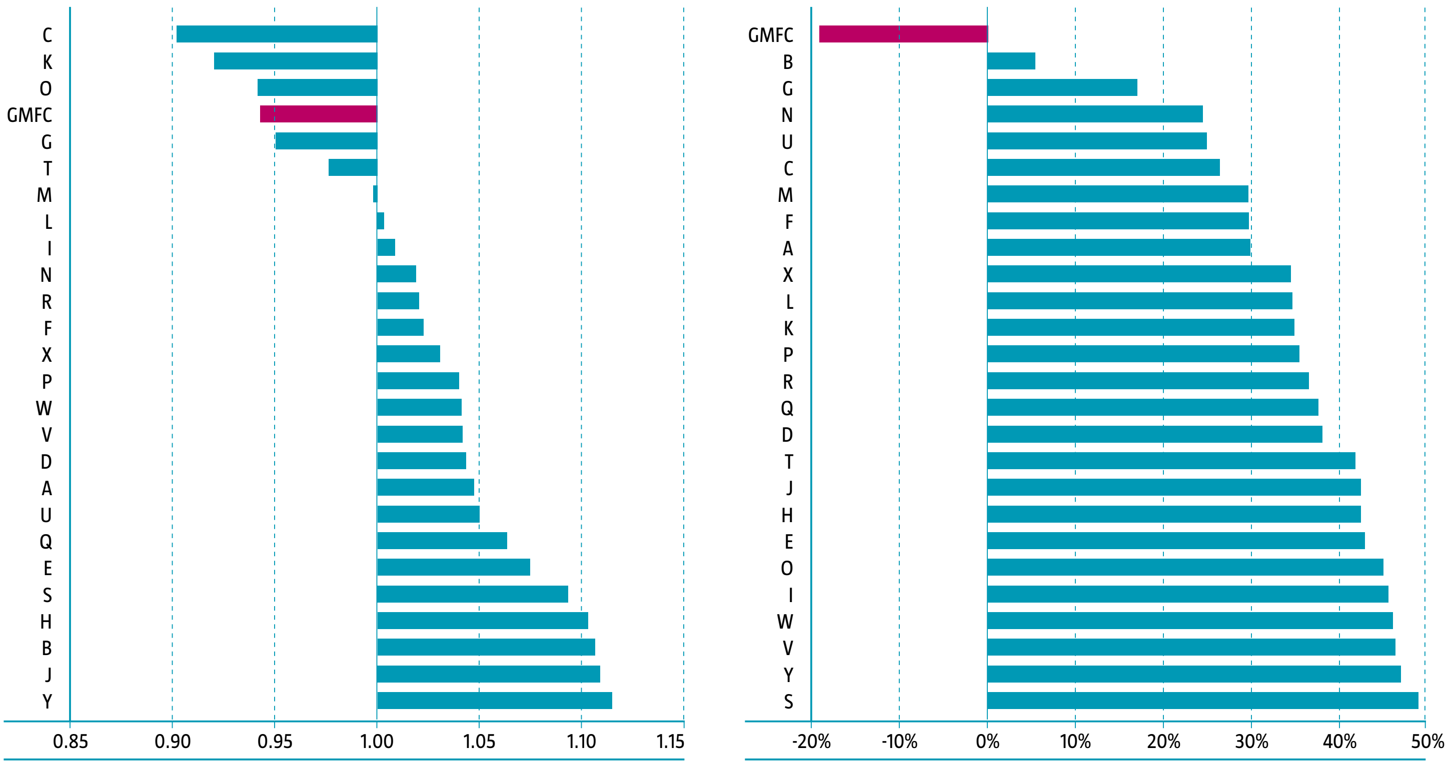
Many asset owners hire multiple credit managers to diversify the risk-return profile of their overall credit portfolio. Ideally, those managers should run their portfolios according to different investment styles, so that their low mutual correlation generates the desired diversification benefits. However, many traditional managers are surprisingly similar in their investment style. In our study of 25 global investment grade mutual funds (see Figure 7), we found a median correlation of 39% between any two managers, in terms of their outperformance versus the benchmark.[14] One of the most plausible explanations for this positive correlation is that 19 out of 25 managers had a beta larger than 1 versus the benchmark. In other words, they displayed risk-seeking behavior. This finding concurs with academic studies showing that many investors exhibit 'reaching for yield' behavior, i.e. they buy lower-rated, longer-dated bonds to increase the yield, thereby also increasing the risk of their portfolio.[15]

Similarly, another study documents that funds typically use a limited number of styles in their investment process, and that the carry style is the most popular choice.[16] Carry as a credit investment style seeks to optimize the yield or credit spread of the portfolio; high-carry opportunities are found typically in longer maturity buckets and lower rating categories. As we found in our own research, high-carry bonds are much riskier than low-carry bonds and do not provide higher risk-adjusted returns than the market.[17]

These findings on traditional managers are in stark contrast with how factor-based strategies work, in particular our own multi-factor credit strategy. We construct the portfolio to ensure that it is ex-ante beta-neutral versus the benchmark and provides balanced exposure to multiple factors. Using the same data as above, we found that our multi-factor strategy had a beta just below 1, and most importantly, that it had a *negative* average correlation with traditional managers. Therefore, this multi-factor credit strategy acts as a diversifier in a client's multi-manager credit portfolio, making its overall performance more stable.

14. Houweling, 2017, "Global Multi-Factor Credits as a style diversifier", Robeco white paper, extended sample period July 2015-June 2018.
15. Becker, Ivashina, 2015, "Reaching for yield in the bond market", *The Journal of Finance*. Choi, Kronlund, 2015, "Reaching for Yield by Corporate Bond Mutual Funds", *Financial Analysts Journal*.
16. Israel, et al., 2018, "Common factors in corporate bond returns", *Journal of Investment Management*
17. Valerie, Houweling, Van Zundert, 2017, "Does Carry add value to existing credit factors?", Robeco white paper.

Figure 7: Beta vs. the market (left) and average outperformance correlation (right) of 25 fundamentally managed global credit funds (A to Y) and Robeco QI Global Multi-Factor Credits (GMFC)



Source: Robeco, Bloomberg Barclays, Morningstar Direct. Sample period: July 2015-June 2018. Beta and outperformance are calculated vs. Bloomberg Barclays Global Aggregate Corporates Index.

PRIVATE BANK

This client was looking to add diversification to its pool of actively managed credit funds.

In 2016 we were invited to present our Global Multi-Factor Credit strategy to an Italian private bank which offers several fund-of-fund solutions to its clients. One of these is made up of several actively managed global credit funds. They were looking for a manager as an addition to this fund pool that would bring 'something different to the table'. They recognized that it's not only a manager's performance that is important, but also when and how this performance is generated. They had conducted an analysis of the performance generated by their existing managers, and found that they tended to outperform and underperform at roughly the same time.

They were very interested in our multi-factor strategy as its systematic style of investing was very different from the approaches of their existing managers. We provided them with the historical performance of our fund, which was less than one year old at the time, and with backtest figures over a longer sample period. We also sent them performance attributions to beta allocation, sector allocation, and issuer selection. They liked the fact that the vast majority of the strategy's performance is generated by issuer selection, and that beta allocation contributed only negligibly. In the end, they concluded that our multi-factor strategy would make an attractive addition to their global credit pool and decided to replace one of their managers with our strategy.

We set up a segregated account for them to provide them with a fund with daily liquidity. We then received the physical bond portfolio of the previous manager and converted it into our preferred portfolio; selling unattractive bonds with low factor scores, and replacing them with top-ranked bonds. Since inception in March 2017, the portfolio has generated a cumulative outperformance of 95 bps versus the Bloomberg Barclays Global Aggregate Corporate Index, with an information ratio of 2.62. Over this period, the beta was exactly 1.00 versus the benchmark (figures as of August 2018).

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4 FROM GOVERNMENT BONDS TO FACTOR CREDITS

Our fourth example demonstrates how the low-yield environment of recent years also causes investors to assess new options to boost returns and how a factor approach can be used to do this.

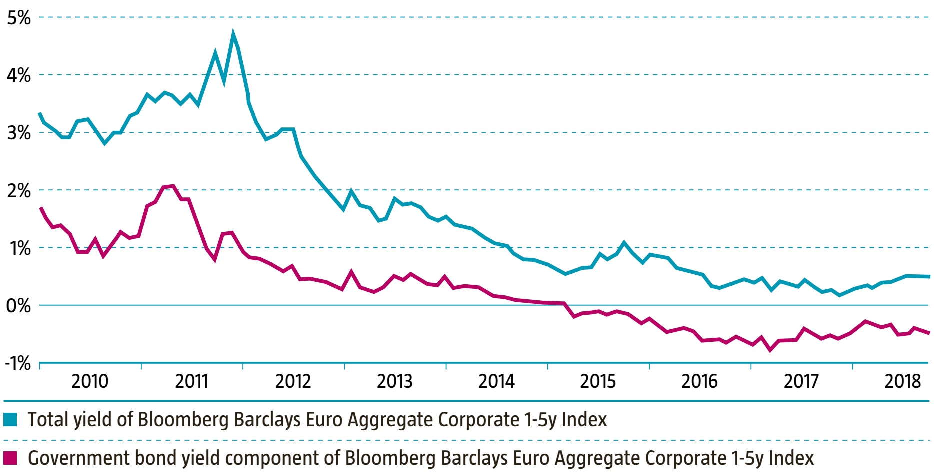
Boosting returns in a low-yield world

Interest rates and government bond yields are at historically low levels due to central bank policies of the last decade and persistently low inflation. The ensuing search for yield has pushed investors into riskier assets to generate higher returns on their portfolios, for example switching out of government bonds into corporate bonds. For many investors, taking on the full credit risk volatility is a bridge too far. A low-risk credit portfolio offers an attractive intermediate solution, with substantially lower volatility than the beta-1 credit index.

Academic and Robeco research[18] has shown that despite their lower volatility, low-risk credits are still expected to earn the same credit return as the market over a full cycle. This is known as the low-risk effect and is a phenomenon that makes low-risk credits an attractive alternative to low-yielding government bonds as they are expected to earn the full credit risk premium, but with less volatility.

18. Ilmanen, et al., 2004, "Which risks have been best rewarded?", *Journal of Portfolio Management*. Houweling, et al., 2012, "The low-risk anomaly in credits", Robeco white paper.

Figure 8: Short-term Euro government bond and corporate bond yields



Source: Bloomberg Barclays, Robeco

INSURANCE COMPANY

Back in 2011, when short-term German government bond yields were approaching 0%, this client was worried about low yield levels and their impact on the expected returns of its fixed income portfolio.

They needed to generate sufficient returns on their investments to be able to pay their future liabilities. These liabilities had a relatively short interest rate duration, because of the nature of the company's non-life insurance business. With government bond yields drifting ever lower, they were facing difficulties in reaching their return target.

They started to looked for an alternative to their low-yielding, shorter-dated German government bond investments. However, switching into full-blown, beta-1 credits was too risky an alternative, because of the higher credit volatility and default risk, and also because of the poor match with the shorter duration of their liabilities.

At the time, we were just developing our Conservative Credits strategy: a strategy that aims to harvest the low-risk factor premium, by investing in shorter-duration bonds issued by higher-quality firms. The duration of a Conservative Credits portfolio is about 2.5 years and it allocates substantially more to AAA-, AA- and A-rated bonds, and less to BBB-rated bonds, than the investment grade corporate bond index.

This strategy was a perfect fit with the client's requirements: the duration was in line with their liabilities, the yield was substantially higher than that of short-dated government bonds (1.4% for the Conservative Credits portfolio compared to 0.2% for German government bonds with the same duration), and the credit beta was approximately 0.4, so that the portfolio was expected to have less than half the credit volatility of the investment grade corporate bond index.

The portfolio went live in April 2012. Since then, it has generated 1.2% more return annually than duration-matched government bonds, with only 0.7% additional volatility (figures as of August 2018).

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INSURANCE COMPANY

In early 2016 the search for yield led this client to invest in our Conservative Credits strategy.

Over the investment period, the portfolio has generated a total return of 1.0%, which is exactly twice as high as the return they would have made if they would have invested in local money market funds. With a Sharpe ratio of 0.6, the return on the Conservative Credits portfolio was relatively stable. In 2018, after two years of positive experience with this low-risk investment grade strategy and with yields having fallen to even lower levels than they were in 2016, this same client asked us to apply the concept to the high yield market. Their high yield portfolio is expected to go live in the fourth quarter of 2018.

5 SPECIAL SOLUTIONS WITH FACTOR CREDITS

Our final case gives an example of a very specific application of a multi-factor credits solution, namely that of enhancing the return on solvency capital for insurers.

A Solvency II solution

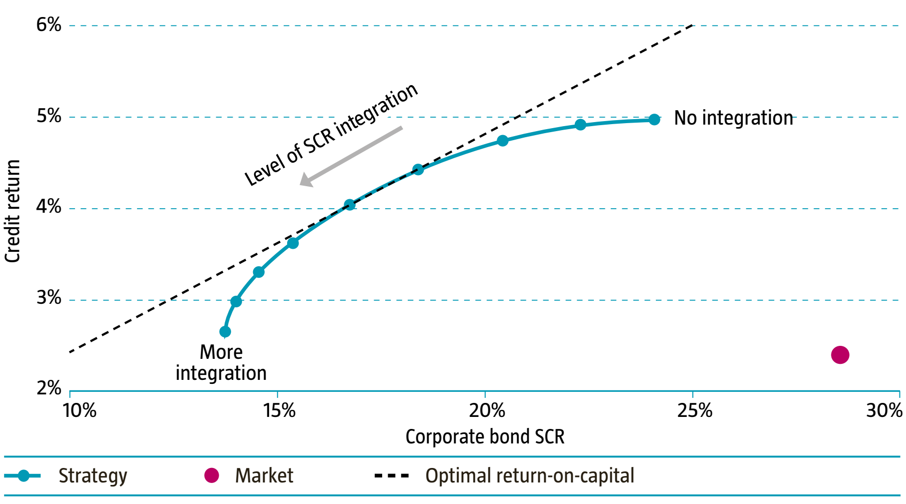
Under the Solvency II regulatory framework, insurance companies in the European Union and pension funds in selected member states, are required to hold capital buffers as a protection against adverse movements in their investment portfolios. Solvency II is causing regulated entities to shift their attention from optimizing the risk-adjusted return (e.g. the Sharpe ratio) to optimizing their return on capital, i.e. the return on a portfolio divided by the amount of required Solvency II capital.

This is particularly relevant for corporate bonds, as Solvency II stipulates a Solvency Capital Requirement (SCR) that is larger for longer-dated and lower-rated bonds. In our research, we found that credit volatility and the SCR are positively correlated.[19] Therefore, factor portfolios, which are known to deliver higher returns on volatility than the market, also deliver higher returns on capital. The low-risk factor in particular has historically demonstrated strong results on both metrics; something which can be achieved by tilting the portfolio to shorter-dated and higher-rated corporate bonds. Several European insurance companies invest in our Conservative Credits strategy, which provides strong exposure to the low-risk factor, while also taking other factors into account.

19. Houweling, Muskens, 2018, "Factor investing under Solvency II", Robeco white paper

Despite their high correlation, volatility and the SCR are not identical. We observe differences between volatility and the SCR, especially in the shorter-duration segment of the market, which results in a different portfolio composition. This means that investment strategies that not only provide exposure to factors but also explicitly incorporate the SCR can lead to better return-on-capital results for insurance companies and regulated pension funds. Next we present a recent example of a client who asked us to design a tailor-made, SCR-optimal factor strategy.

Figure 9: Impact of integrating the SCR in multi-factor high yield strategies on Solvency Capital Requirement (SCR), return, and return on capital



Source: Robeco, Bloomberg Barclays. Universe: USD and EUR High Yield Corporates, 1994-2017.

PENSION FUND

This client asked us to design and implement a factor strategy that provides an optimal return on Solvency II capital.

In various EU member states, pension funds are legally treated as life insurance companies and are therefore subject to the Solvency II regulatory framework. One such pension fund was interested in our multi-factor high yield strategy, but required us to look at it from a return-on-capital angle rather than our traditional Sharpe ratio angle.

In 2018 we conducted a collaborative research project with this pension fund. We first looked at our base case multi-factor high yield strategy and found that it had already delivered a higher return on capital than the benchmark over the backtest period (1994-2017): 19% versus 8%. As mentioned above, this is the result of the high correlation between credit volatility and the SCR, so that Sharpe ratio-optimized factor strategies already deliver an attractive return on solvency capital too.

The next step in the project was to explicitly incorporate the SCR into the multi-factor strategy. This means that the SCR-integrated strategy selects bonds that not only have more attractive factor exposures than the average bond in the benchmark, but also have lower SCRs. By increasing or reducing the importance of the SCR in the bond selection process, the pension fund was able to choose a desired trade-off between optimizing the SCR, the return or the return on capital. This trade-off is shown in Figure 9. If we start with the base case multi-factor strategy without SCR integration, giving more weight to the SCR in the selection model leads to a decrease in the SCR, a smaller decrease in the credit return, and an improvement in the return-on-capital ratio. In the end, the pension fund was able to choose how much return it was willing to give up to get a lower SCR and a better return on capital. This bespoke multi-factor high yield strategy was implemented late in 2018.

THE NEXT STEP

We hope you have enjoyed reading about the opportunities credit factor investment strategies can offer and our experiences with a number of major institutions that have successfully implemented factor-based solutions in their credit portfolios. As we have demonstrated, there is no one-size-fits-all solution. Each investor has different requirements in terms of risk and return, may have to cope with certain restrictions and has specific investment goals.

At Robeco, we have solid research and investment track records. We are happy to discuss and analyze your requirements and then devise and test a customized strategy to ensure that we find the best solution to fulfill your requirements. Please contact us if you would like to further explore the benefits factor investing can offer.

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Additional Information for investors with residence or seat in the United Arab Emirates

Some Funds referred to in this marketing material have been registered with the UAE Securities and Commodities Authority (the Authority). Details of all Registered Funds can be found on the Authority's website. The Authority assumes no liability for the accuracy of the information set out in this material/document, nor for the failure of any persons engaged in the investment Fund in performing their duties and responsibilities.

Additional Information for investors with residence or seat in the United Kingdom
Robeco is subject to limited regulation in the UK by the Financial Conduct Authority. Details about the extent of our regulation by the Financial Conduct Authority are available from us on request.

Additional Information for investors with residence or seat in Uruguay
The sale of the Fund qualifies as a private placement pursuant to section 2 of Uruguayan law 18,627. The Fund must not be offered or sold to the public in Uruguay, except in circumstances which do not constitute a public offering or distribution under Uruguayan laws and regulations. The Fund is not and will not be registered with the Financial Services Superintendency of the Central Bank of Uruguay. The Fund corresponds to investment funds that are not investment funds regulated by Uruguayan law 16,774 dated September 27, 1996, as amended.

Additional Information concerning RobecoSAM Collective Investment Schemes
The RobecoSAM collective investment schemes ("RobecoSAM Funds") in scope are sub funds under the Undertakings for Collective Investment in Transferable Securities (UCITS) of MULTIPARTNER SICAV, managed by GAM (Luxembourg) S.A., ("Multipartner"). Multipartner SICAV is incorporated as a Société d'Investissement à Capital Variable which is governed by Luxembourg law. The custodian is State Street Bank Luxembourg S.C.A., 49, Avenue J. F. Kennedy, L-1855 Luxembourg. The prospectus, the Key Investor Information Documents (KIIDs), the articles of association, the annual and semi-annual reports of the RobecoSAM Funds, as well as the list of the purchases and sales which the RobecoSAM Fund(s) has undertaken during the financial year, may be obtained, on simple request and free of charge, via the website www.robecosam.com or www.funds.gam.com.

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