



Patrick Houweling, Robeco

Mr. Houweling is Portfolio Manager Conservative Credits and Multi-Factor Credits in the Credit team. He is also Senior Quantitative Researcher. Mr. Houweling is a graduate from the Erasmus University Rotterdam and holds a Ph.D. in Finance as well as a Master's degree in Financial Econometrics from Erasmus University Rotterdam.



Jeroen van Zundert, Robeco

Jeroen is Quantitative Researcher with Robeco. He holds a Msc. (cum laude) in Quantitative Finance & Actuarial Science and a Msc. (cum laude) in Operation Research & Management Science from Tilburg University. After an internship, he joined Robeco in 2012. His area of expertise is credit selection and equity selection strategies.

SMART CREDIT INVESTING: HARVESTING FACTOR PREMIUMS

Patrick Houweling & Jeroen van Zundert

Introduction

- The Size, Low-Risk, Value and Momentum factors have high returns and Sharpe ratios in the corporate bond market. However, they may outperform or underperform the market for prolonged periods, resulting in drawdowns and high tracking errors.
- By combining factors in a multi-factor portfolio, the drawdowns and tracking errors become much smaller, while the high returns and Sharpe ratios are conserved.
- Corporate bond factors can add about 1% return a year in a strategic multi-asset portfolio, regardless of whether the portfolio is already allocated to equity factors.

Factor investing

Investors are increasingly allocating their investments to factors. Factor portfolios differ from traditional portfolios by following a systematic, rules-based approach to harvest a specific factor premium, such as Size, Low-Risk, Value and Momentum. The motivation for this shifting investment paradigm is two-fold. First, factors have delivered high Sharpe ratios over the long term. Second, factors explain a large part of the alpha of successfully managed funds. Since these funds often tilt only implicitly or weakly to factors, investors have started to strategically and explicitly allocate to factors to generate alpha. Although most factor research focuses on the equity market, the concept and benefits of factor investing apply equally well to the corporate bond market.

Factor investing in the corporate bond market

In other notes, we discuss the individual Low-Risk, Size, Momentum and Value factors. In this note, based on our academic paper "Factor Investing in the Corporate Bond Market", we show not only the risk-return profile of individual factors, but also of a multi-factor portfolio. Such a multi-factor portfolio combines the four factors in a single portfolio in order to diversify across the factors. This makes the alpha more stable over time. For instance, Value might underperform over a certain period, while Low-Risk outperforms.

We show that the multi-factor portfolio retains the high Sharpe ratio of the individual factors, but with smaller drawdowns and lower tracking error versus the market.

Furthermore, in this note we analyse factor investing in a multi-asset context, demonstrating the added value of the corporate bond factors beyond the equity factors.

We conclude by explaining how an investor can further improve the generic factor strategies described in our academic work in order to successfully implement factor strategies in actual investment portfolios.

Evaluating and defining factors for corporate bonds

To evaluate the factors, we use 20 years of monthly data on all constituents of the Barclays US Investment Grade and US High Yield indices. Every month, we create equally weighted portfolios based on the factor definitions (see below). In addition to the single-factor

portfolios, we also construct a multi-factor portfolio that invests 25% in each of the four factor portfolios. We analyse the excess returns over duration-matched Treasuries to properly filter out the interest rate component, i.e. the term premium. We have two reasons for doing this, namely (1) most institutional investors manage the interest rate exposure of their total portfolio separately, e.g. using interest rate swaps or bond futures and (2) investors buy corporate bonds to harvest the default premium on top of the term premium, because the term premium itself can be more efficiently harvested by investing in government bonds.

Academic evidence is scarce, but emerging

In contrast to the academic literature on equity markets, where factors have been documented since the 1970s, the evidence for corporate bond markets is more recent and more limited. Of the four factors, Low-Risk and Momentum are best documented. Studies on Value and Size are close to non-existent. When defining factors in our study, we make sure that the definitions (1) are consistent with the existing literature, (2) only use bond characteristics that are readily available (e.g. spread, rating, maturity) and (3) are intuitive for a corporate bond investor. Specifically, we refrain from using accounting or equity data in our academic paper. At the end of this note, however, we show the additional improvements one can gain by improving on the generic factor definitions, e.g. by using accounting and equity data.

Size

Smaller companies tend to be ignored by many investors, because investors typically aim to efficiently cover a large percentage of the market capitalization of the credit market using a limited number of analysts. From that perspective, companies with a larger weight in the index are more efficient to cover than companies with a smaller index weight.

Therefore, to define the Size factor in the corporate bond market, we use the total size of a company's public debt instead of the size of individual bonds. The Size factor portfolio invests every month in 10% of the bonds belonging to the smallest companies in the index.

Low-Risk

Previous studies show that bonds with lower risk earn higher risk-adjusted returns, where maturity and/or rating are typically used as risk measures. So, portfolios of shorter-dated and higher-rated bonds historically had higher Sharpe ratios than the market. To construct our Low-Risk factor portfolio for investment grade, we first select all bonds rated AAA to A-, hence excluding the most risky bonds rated BBB+, BBB or BBB-. From these bonds, we select each month the shortest maturity bonds such that the portfolio makes up 10% of the total number of bonds. For high yield, we follow the same procedure, selecting bonds rated BB+ to B- in the first step, excluding the most risky ratings CCC, CC and C.

Value

As far as we know, Correia et al. (2012) is the only paper on Value investing in the corporate bond market. They show that bonds that are undervalued versus their 'fair' value subsequently outperform the market, and vice versa. They estimate the fair credit spread using a variety of risk measures, including leverage and profitability. For consistency with the Low-Risk factor, we choose rating and maturity as risk measures. Otherwise, we follow the methodology of Correia et al. (2012). The Value factor portfolio consists of the 10% most undervalued bonds, i.e. bonds whose market spread is high compared with other bonds with similar rating and maturity.

Momentum

Momentum is the effect that past winners tend to be future winners and, similarly, that past losers tend to be future losers. Previous research shows that the Momentum effect is present in the high yield market, but not in the investment grade market. We follow Jostova et al. (2013) by defining Momentum as the past 6-month return. The 10% bonds with the highest past returns are selected for the Momentum factor portfolio.

Factor portfolios show high risk-adjusted returns

Investment grade

Figure 1 plots the risk and return of each factor portfolio in the investment grade market.

We note that each factor has a distinctive risk-return profile. The Low-Risk portfolio has a slightly higher return than the market, but with much lower volatility. Value, on the contrary, has a higher volatility, but more than compensates this via a higher return.

Momentum and Size have a volatility similar to the market, but with higher returns. The volatility of the multi-factor portfolio, being the average of the four factors, is similar to the market. However, its annualized return is 0.85% higher. The Sharpe ratios of 0.32 (Size),

0.42 (Low-Risk), 0.31 (Value) and 0.33 (multi-factor) are significantly higher than the market Sharpe ratio of 0.13. However, the Sharpe ratio of Momentum in investment grade is not significantly different, which has also been documented in previous studies.

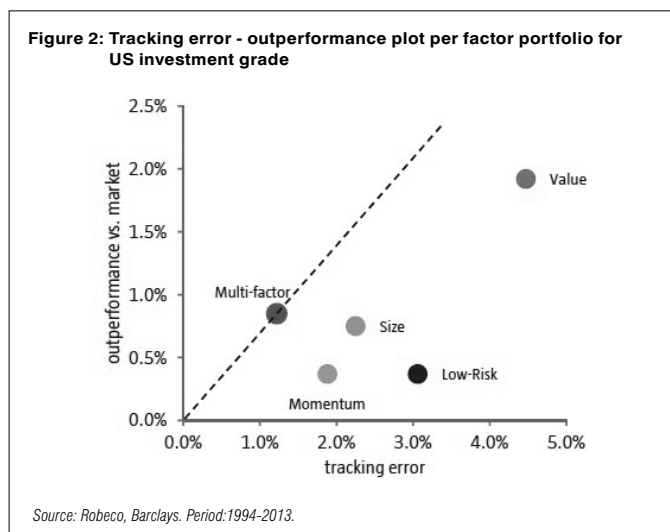
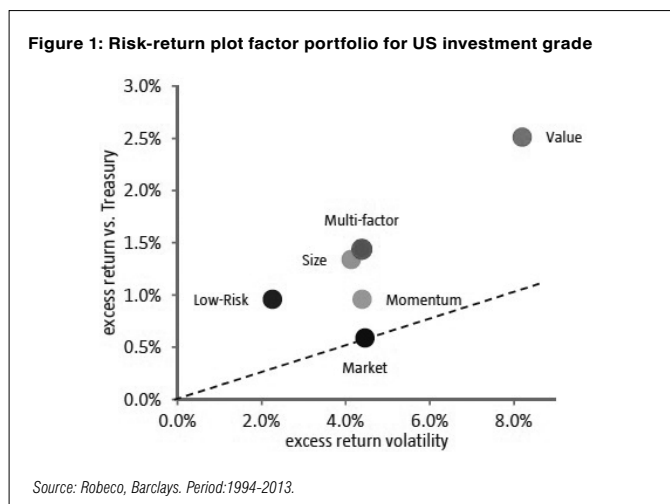
Figure 2 shows the same portfolios, evaluated relative to the market, so plotting tracking error versus outperformance. The results show that from this perspective the individual factors are less attractive. Especially Low-Risk and Value have large tracking errors in comparison with the market volatility of 4.5% due to their large beta deviations. For Value, this is compensated by a substantial outperformance of 1.9% a year, but for Low-Risk it is not, resulting in an information ratio of only 0.12. However, it is the factor with the highest Sharpe ratio. This highlights the importance of a long investment horizon, because the single factor-portfolios can be risky in the short term for benchmarked investors. The multi-factor portfolio, on



The quote

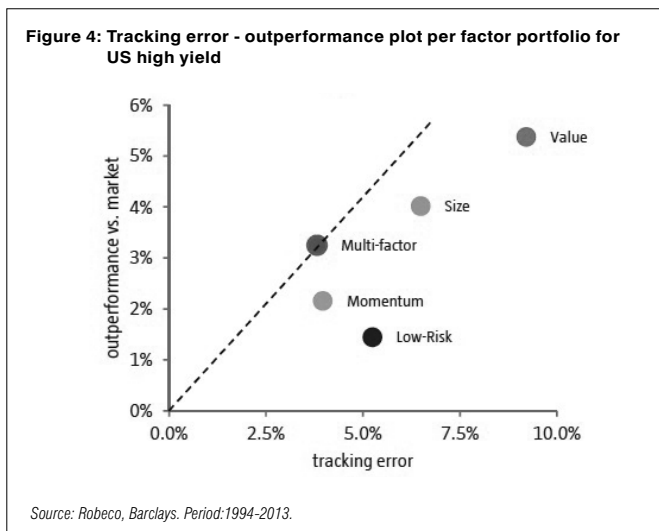
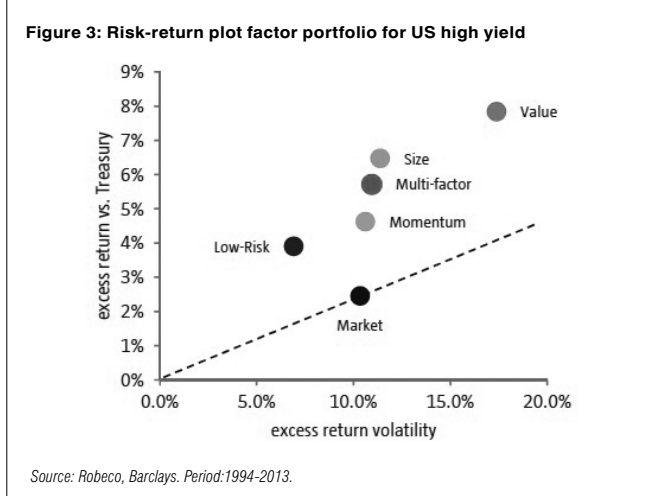
Studies on Value and Size are close to non-existent.

the other hand, combines a high Sharpe ratio with a high information ratio. The reason is that it diversifies across the individual factors, mitigating the possible underperformance of one or more factors for prolonged periods of time. This leads to a lower tracking error than that of the individual factors, while maintaining the outperformance.



High yield

Figure 3 shows the risk and return of the high yield factor portfolios. The results are similar to those in investment grade. Low-Risk has a much lower volatility than the market and Value a higher volatility. The Sharpe ratios of the four factors range from 0.44 (Momentum) to 0.57 (Low-Risk and Size), significantly larger than the market Sharpe ratio of 0.24. The multi-factor portfolio's volatility is similar to the market's, but its Sharpe ratio is more than twice as high (0.52 versus 0.24) due to its higher return. Figure 4 shows the factor portfolios in a relative risk framework. As in investment grade, the information ratio of Low-Risk is the lowest, only 0.28. The other factors have information ratios ranging from 0.55 (Momentum) to 0.62 (Size). Again, combining the four factors in a multi-factor portfolio leads to the highest information ratio, 0.86.



Results also valid after transaction costs

In our academic paper we conduct numerous robustness checks. The most important check is that these results also hold after transaction costs. Although the factors have higher turnover than the market and therefore incur higher transaction costs, the Sharpe ratios remain substantially larger than of the market. The multi-factor Sharpe ratios drop from 0.33 to 0.26 in investment grade and from 0.52 to 0.46 in high yield, but are still significantly larger than the market's Sharpe ratio. Furthermore, in our academic paper we show that the results are robust to the exact definition of the factors.

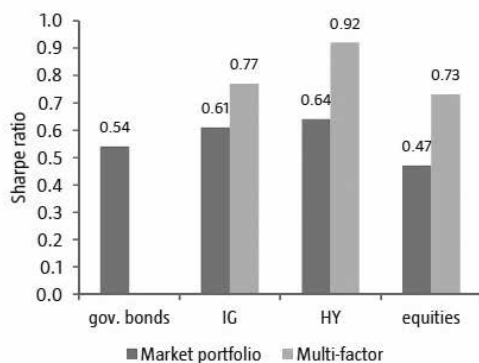
Corporate bond factor investing increases the return of a multi-asset portfolio

In the previous section we have shown the added value of factor investing within the corporate bond market. However, investors usually invest in other asset classes as well, such as equities and government bonds. An investor might already be allocating his equity portfolio to factors, and wonder about the added value of factor investing in his corporate bond portfolio. To answer this

question, we analyse a hypothetical multi-asset portfolio containing 20% government bonds, 40% equities, 20% investment grade corporate bonds and 20% high yield corporate bonds. In a traditional portfolio, all allocations are to the market indices. Next, we test three alternative allocations, where we (1) allocate only the equity portfolio to a multi-factor portfolio, (2) allocate only the corporate bond portfolios to the multi-factor portfolios and (3) allocate both the equity and corporate bond portfolios to multi-factor portfolios.

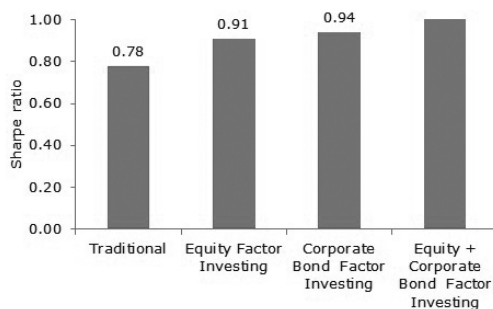
To evaluate the equity multi-factor portfolio, we use decile Size, Value and Momentum portfolios from the website of Kenneth French. The equity market factor is also obtained from this source. Unfortunately, the website does not provide a Low-Risk factor, so we obtain the return of the MSCI MinVol Index via Bloomberg instead. The government bond return is the return on the Barclays 7-10yr US Treasury index. All these returns are in excess of the 1-month T-bill rate. Therefore, we add back the interest rate component to the corporate bond indices and factor portfolios to compare the asset classes on an equal footing.

Figure 5: Sharpe ratios market and factor portfolios over the risk-free rate for government bonds, investment grade (IG), high yield (HY) and equities



Source: Robeco, Barclays, Bloomberg, Data Library Kenneth French. Period:1994-2013.

Figure 6: Sharpe ratios multi-asset portfolios over the risk-free rate



Source: Robeco, Barclays, Bloomberg, Data Library Kenneth French. Period:1994-2013.

Corporate bond factor allocation pushes up the Sharpe ratio of a multi-asset portfolio

Figure 5 shows the Sharpe ratio of the market and the multi-factor portfolio per asset class. The improvements of the factor portfolios versus their respective market indices are substantial, with Sharpe ratios increasing by 0.14 (IG), 0.33 (HY) and 0.23 (equities). Figure 6 shows the Sharpe ratio of the multi-asset portfolio and the three alternative portfolios. Investing in the corporate bond multi-factor portfolio boosts the Sharpe ratio from 0.78 to 0.94. Investors that already allocate to the equity factors and decide to invest in the corporate bond multi-factor portfolio too, see their Sharpe ratio grow from 0.94 to 1.05. In both cases, the corporate bond factor allocation contributes almost 1% to the improved return, while the volatility is virtually unchanged.

Smart factor investing

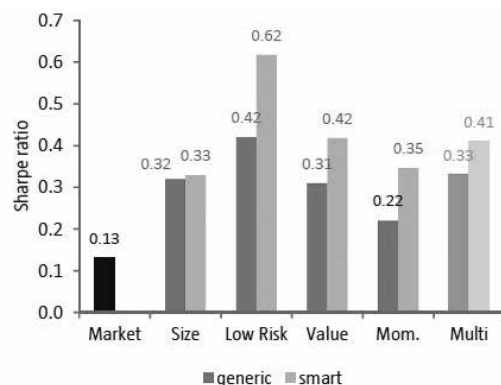
So far in this note, we have analysed the benefits of factor investing following academic conventions. However, Robeco research has shown that it is possible to improve upon these results in two ways: (1) smarter factor definitions and (2) smarter portfolio construction rules.

Using smarter factor definitions

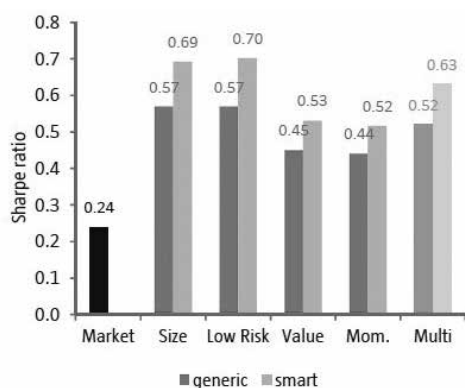
To smarten the factor definitions, it is important to understand the latent risks in each factor and to mitigate these risks if they are not properly rewarded with higher returns.

Moreover, since risk itself is unobservable and multi-dimensional it is advisable to diversify across risk measures. We found that is especially beneficial to expand the scope of the risk measures beyond bond market characteristics, and use accounting and equity data as well. For instance for Low-Risk, we do not only control for risk via rating and maturity, but also for the amount of leverage the company is taking on, and how much risk its equity shows. To enhance Value, we do not only look at rating and maturity to calculate the 'fair' credit spread, but also at company characteristics. Moreover, we account for the nonlinear relationship between credit spreads and risks. Momentum has the tendency to prefer high-risk securities to low-risk securities after a bull market, and vice versa. In our models, we correct for this bias. Moreover, we use equity market information in our Momentum definition.

Figure 7: Sharpe ratios generic and smart factor definitions investment grade



Source: Robeco, Barclays, Bloomberg. Period:1994-2013.

Figure 8: Sharpe ratios generic and smart factor definitions high yield

Source: Robeco, Barclays, Bloomberg. Period:1994-2013.

Sharpe ratios increase

Figure 7 (investment grade) and Figure 8 (high yield) show the Sharpe ratios of the generic and smart factor definitions. In both universes and for all factors, the Sharpe ratios improve, with most improvements ranging from 0.08 to 0.20. The multi-factor (“Multi”) Sharpe ratio improves 0.08 in investment grade, and 0.11 in high yield. Clearly, by using smarter definitions, the benefits of factor investing increase.

Smarter portfolio construction rules

Besides smarter factor definitions, the portfolio construction rules can also be made smarter to enhance performance. Below we list some examples:

1. Turnover can be reduced substantially by not immediately selling a bond once it no longer belongs to the top decile. By postponing the sell, for example until the bond drops out of the top 50%, investors can save costs. This requires a careful analysis, because the trade-off between give-up in alpha and prevented transaction costs can be different for different factors.

2. In a single-factor portfolio, one could easily go against other factor premiums. For instance, in a Low-Risk portfolio, one could end up with safe but very expensive bonds. To avoid this, one has to take other factors into account while constructing the portfolio. In Robeco Conservative Credits, our Low-Risk Investment Grade strategy, we also take Size, Value and Momentum into account, albeit with a smaller weight in the overall model to maintain the Low-Risk profile.
3. Large sector and region bets should be prevented. For instance, in the second half of 2007, a generic Value strategy would have mainly bought financials as their credit spreads widened, but in 2008 this would have led to a large drawdown. Limiting the portfolio weight of a single sector prevents concentrated positions, and improves the diversification of the portfolio.

Conclusions

In this note we show strong empirical evidence for the existence of Size, Low-Risk, Value and Momentum factor premiums in the corporate bond market. All factors have substantially higher returns and Sharpe ratios than the market. The tracking errors, however, are relatively large, highlighting the risk of underperforming the market over shorter investment horizons. By investing in a multi-factor portfolio instead, which diversifies across the four factors, the tracking error and drawdowns versus the market are reduced while the high returns and Sharpe ratios are preserved. For investment grade, the Sharpe ratio increases from 0.13 to 0.33 when investing in a multi-factor portfolio instead of in the market index. For high yield, the Sharpe ratio increases from 0.24 to 0.52.

In a multi-asset context, by allocating to corporate bond factors investors can improve the Sharpe ratio by 0.1 and their return by about 1%, regardless of whether they already allocate to factors in their equity portfolio. Although these results are already strong, there is still much to be gained by enhancing the investment process. This can be done by using smarter factor definitions and by improving portfolio construction rules. **FS**