ARTICLE

For professional investors

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Solvency II integration in factor credit strategies

- Solvency II requires risk-related capital buffers for corporate bonds
- Factors provide higher return on capital than passive portfolios
- Solvency-integrated factor portfolios further improve return on capital



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Introduction

Insurance companies in the European Union are subject to the Solvency II regulatory framework requiring them to hold capital buffers as a protection against adverse movements in their investment portfolios. Several member states impose very similar capital requirements on their pension funds too. Solvency II is causing regulated insurers and pension funds to shift their attention from optimizing the risk-adjusted return (e.g. the Sharpe ratio) to optimizing the return on capital, i.e. the average return on a portfolio divided by the amount of required Solvency II capital.

In this article we demonstrate how Solvency II capital requirements can be integrated into factor strategies to increase the return on capital. We focus on the credit risk solvency capital requirement (SCR) for corporate bonds, which stipulates that institutions should hold more capital for longer-dated and lower-rated bonds. Even though volatility and the SCR are correlated, they are not the same. Especially in the shorter-duration segment of the market we observe differences between volatility and the SCR, leading to different portfolios.

Because factor investment strategies are systematic, they lend themselves very well to the explicit incorporation of the SCR. Using well-researched factors value, momentum, size, low risk, and quality, a factor portfolio generates a higher Sharpe ratio than a passive credit

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portfolio by harvesting factor premiums. Given the positive correlation between the SCR and volatility, a factor portfolio already gives investors a higher return on capital. By explicitly taking the SCR into account, the portfolio provides an optimal exposure to those bonds that score well on factors, but require a limited amount of capital, thus further improving the return on capital.

Below, we first provide a brief recap of the SCR for credit risk under Solvency II. Then we show that multi-factor portfolios generate a higher return on capital than a passive portfolio, primarily by offering a higher return for the same SCR. Finally, we demonstrate that by explicitly taking the SCR into account, investors can make their own trade-off between return and the required amount of Solvency capital, leading to an optimal return-on-capital ratio.

Recap of the credit risk capital requirement under Solvency II

Solvency II requires regulated insurers and pension funds to maintain buffers to ensure they can withstand adverse price movements in their corporate bond portfolios due to fluctuations in interest rates and credit spreads. In this article we only consider the credit risk SCR, because interest rate exposure is often managed separately in the context of an institution's liabilities.

A corporate bond's credit risk SCR depends on its duration and its credit rating. Figure 1 illustrates this relationship between duration, rating, and the SCR. Clearly, shorter-dated, higher-rated bonds are treated more favorably than longer-dated, lower-rated bonds. For example, the SCR for a BBB-rated bond with 5-year duration is nearly four times as high as for an A-rated bond with 2½-year duration. To earn the same return on capital the return will need to be four times as high as well.

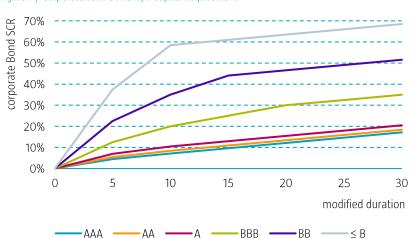


Figure 1 | Corporate bond Solvency II Capital Requirement

Source: Robeco, European Union.



Factor portfolios have an attractive return on capital

In an earlier white paper¹, we documented that the SCR is highly correlated with realized credit volatility. Using updated data up to 2017, we find a correlation of 85% for rating-duration portfolios. Given this strong correlation between the SCR and credit volatility, portfolios that obtain a high return on volatility (Sharpe ratio) are also attractive from a return-on-capital perspective. In previous research we have shown that high Sharpe ratios can be obtained by tilting the portfolio towards factors; see, for example, our recent white paper² for an introduction to the low-risk, quality, value, momentum, and size factors, and their historical Sharpe ratios.

Here, we show the return-on-capital ratio³ for each factor over the period 1994-2017; see Figure 2. The chart depicts the return on capital for a portfolio consisting of the best 10% of the bonds according to each factor (labelled D1). These factor portfolios are constructed separately for the global investment grade universe and the global high yield universe.

Clearly, the D1 portfolios generated a higher return on capital than the market index. The size, value and momentum D1 portfolios had higher returns with similar SCRs, while the low-risk/quality D1 portfolio generated market-like returns with lower SCRs. By tilting a portfolio towards bonds that score well on factors, and avoiding bonds that have poor factor scores, investors can construct a portfolio that has a higher return on capital than a portfolio that passively tracks the market.

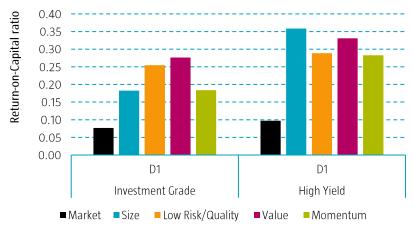


Figure 2 | Return-on-capital ratio for factor top decile portfolios

Source: Robeco, Bloomberg Barclays. USD+EUR-denominated corporate bonds, 1994-2017. Decile portfolios constructed by equally weighting top ranked bonds and holding them for 12 months.

Houweling, 2012, "The impact of Solvency II on investing in corporate bonds", Robeco white pape

² Houweling & van Zundert, 2018, "Factor investing in investment grade & high yield corporate bonds an overview". Roberg white paper

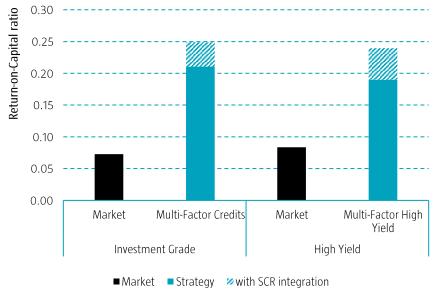
³ The return is calculated as the annualized average credit spread return over all months in the research period; likewise, the capital is calculated as the average of the credit risk SCR in each month.



Although the results in Figure 2 show that factors are useful building blocks in constructing portfolios, they are not representative of a realistic investment strategy: the analysis assumes perfect liquidity and zero transaction costs for each bond, uses a fixed investment horizon, and could have concentrated positions in particular issuers, sectors, or regions.

Our multi-factor credits and multi-factor high yield strategies explicitly take liquidity, transaction costs, and turnover into account, and result in well-diversified portfolios. They therefore offer more realistic expectations for attainable improvements in the return-on-capital ratio. The solid bars in Figure 3 show the return on capital for these strategies, using returns after conservatively estimated transaction costs. Both in the investment grade and high yield markets, a multi-factor strategy delivers a substantially higher return on capital than the market, mainly by generating higher returns with a market-like SCR. Within investment grade, the increase in the return on capital was driven by the multi-factor portfolio generating a credit return of 2.1% compared to a credit return of 0.7% for the market, while the average SCR was comparable; 9.9%, compared to a 9.0% SCR for the market. Similarly within high yield, the multi-factor portfolio attained a credit return that was substantially higher than the market; 4.8%, while the market returned 2.4%. The average SCR for the portfolio was less than that of the market, 25.0% compared to 28.6%.

Figure 3 | Return-on-capital ratio for multi-factor credits and multi-factor high yield strategies, without SCR integration (solid bars) and with SCR integration (striped bars), and the investment grade and high yield market index



Source: Robeco, Bloomberg Barclays. USD+EUR-denominated corporate bonds, 1994-2017.

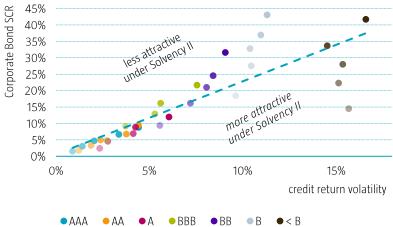


Explicit integration of SCR improves return on capital

As mentioned earlier, credit volatility and SCR are highly correlated, but not perfectly (i.e. 85%). To explore their differences, we create 35 bond portfolios, by first splitting bonds into seven rating categories (AAA, AA, A, BBB, BB, B, and CCC and lower), and then creating five equally-populated duration portfolios within each rating category. Figure 4 plots the realized volatility against the SCR, visually confirming the positive correlation between the two measures (see the dashed line).

However, we also find, especially within high yield, that longer-duration bonds have a high SCR compared to their volatility, while shorter-duration bonds have a low SCR compared to their volatility. This implies that in a SCR-based framework, shorter-duration bonds are more attractive than they are in a volatility-based framework.

Figure 4 | The solvency capital requirement (SCR) versus credit volatility for rating-duration portfolios (color is rating; shading is duration: darker=longer duration, lighter=shorter duration)



Source: Robeco, Bloomberg Barclays. USD+EUR-denominated corporate bonds, 1994-2017.

Next, we investigate the benefits of incorporating the SCR explicitly into our multi-factor strategies. Figure 3 above has already demonstrated the added value of integrating SCR into our multi-factor strategies. The striped bars show the additional return on capital that can be obtained by explicitly incorporating the SCR into the selection model.

To explain this in more detail, in Figure 5 and Figure 6 we explore the effects of incorporating the SCR into the multi-factor model. The rightmost dots show our standard Multi-Factor Credits strategy (including up to 10% BBs) and Multi-Factor High Yield strategy (including up to 10% BBBs) without SCR integration. By incorporating SCR we are in fact penalizing bonds that require more Solvency capital. This leads to a reduction in the SCR of the portfolio. Within investment grade, the SCR can be more than halved, reducing it from almost 10% in



our standard portfolio to just below 4%. Within high yield, the SCR decreases from almost 25% to just below 14%.

As we move to the left in the charts, we gradually increase the importance of the SCR in the bond selection. This results in an improvement in the return on capital, as the portfolio moves closer to the dashed optimal return-on-capital line. The first steps deliver a substantial increase in the return on capital, as the SCR of the portfolio is reduced while credit returns only modestly decline. Portfolios that integrate the SCR also have a lower credit volatility and beta, and a higher Sharpe ratio. We see that they also have lower durations and a higher average credit rating.

At a certain point, giving more weight to the SCR leads to a portfolio that is dominated by low-SCR bonds. This reduces the portfolio's exposure to our factors and causes a disproportionally large decline in credit returns (i.e. the leftmost dots).

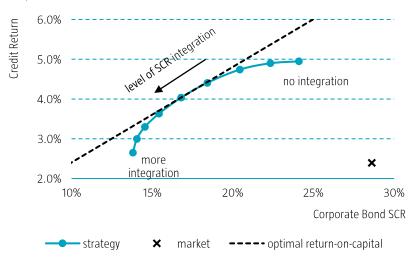
2.5% **Credit Return** 2.0% no integration 1.5% 1.0% more × integration 0.5% 2% 4% 6% 8% 10% 12% Corporate Bond SCR ---- optimal return-on-capital strategy market

Figure $5 \mid$ Impact of integrating the SCR in investment grade multi-factor strategies on SCR, return, and return on capital

Source: Robeco, Bloomberg Barclays. USD+EUR-denominated investment grade corporate bonds, 1994-2017.



Figure 6 | Impact of integrating the SCR in high yield multi-factor strategies on SCR, return, and return on capital



Source: Robeco, Bloomberg Barclays. USD+EUR-denominated high yield corporate bonds, 1994-2017.

The optimal level of SCR integration is highly dependent on the specific goals and guidelines of the client. It depends on the level of risk one is willing to take, the corresponding amount of Solvency II capital, and the desired level of credit returns. We have demonstrated that by incorporating the SCR into the multi-factor model, we can efficiently improve the return-on-capital ratio and flexibly tailor a portfolio to match the desired risk and return profile.

Conclusions

The Solvency II regulatory framework requires insurers in the European Union, as well as pension funds in several member states, to maintain capital buffers to protect their investment portfolios in the event of negative events. This causes an increased focus on return-on-capital optimization. In this article we have shown how we can explicitly integrate Solvency II capital requirements into factor credit strategies. This allows investors to design portfolios with a higher return on capital than standard factor strategies, which already offer a higher return on capital than a passive credit portfolio.

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