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Does Carry add value to existing credit factors?

Vania Valerie
Researcher

Patrick Houweling
Researcher and Portfolio Manager

Jeroen van Zundert
Researcher

- Carry is one of the latest candidates to join the 'factor zoo'
- A critical look reveals that Carry offers higher return due to higher risk
- De-risked Carry is too similar to Value to add value to existing factors

Since the birth of the Capital Asset Pricing Model (CAPM), academics and practitioners have continuously expanded this model with a range of factors, leading John Cochrane[1] to coin the term 'factor zoo'. In this article, we analyze the Carry factor as yet another potential addition to the corporate bond factor zoo.

As in the equity market, the number of factors is also growing in the corporate bond market. To date, the most common factors in the credit market are size, value, momentum, and low risk, as documented in our article.[2] Since this study, we have also analyzed the Quality factor and came to the conclusion that, in the corporate bond market, the Quality factor is a natural extension of the Low-Risk factor: part of Quality's alpha is subsumed by Low-Risk, but Quality still adds value to the factor mix.[3]

'Carry earns its higher return by taking more risk'

[1] See "Presidential Address: Discount Rates" (Cochrane, 2011). Among others, Harvey, Liu, and Zhu (2016) pose a challenge to factor investors by concluding that only a handful of over 300 factors are statistically significant. They suggest that the crowding out of the existing factors is to be taken into account prior to extending the factor list.
[2] See "Factor Investing in the Corporate Bond Market" (Houweling & Van Zundert, 2017) or our white paper "Smart credit investing: harvesting factor premiums" (2016).
[3] See our white paper "The Quality of Low-Risk Credits" (2016).

As for carry, our empirical evidence shows that the carry premium in the corporate bond market is driven by taking higher risk, both higher credit market risk and higher default risk. Also, our analyses show that the risk-adjusted outperformance of a carry portfolio versus the market is statistically insignificant. Lastly, we find that a carry portfolio behaves very similarly to a value portfolio, despite the fact that carry does not make a link to the bond's fundamental risk as value does.[4] Moreover, the similarity is amplified once we start correcting for the risk bias in carry. We therefore conclude that carry is not a separate factor in the corporate bond market.

What is Carry?

In general, carry is defined as the expected return of an asset when market circumstances stay the same. Traditionally, carry has been applied to currency markets. However, a recent academic study[5] documents that this carry definition can be applied to a vast array of asset classes and finds that carry also predicts the returns of equities, government bonds, commodities, credits, and equity options. For the credit part, however, the authors use index-level data with investment grade ratings only. In contrast, we analyze carry portfolios of individual bonds with either an investment grade or a high yield rating.

In our analyses, we focus on the credit component of corporate bond returns: the return in excess of duration-matched Treasuries. Thus, we define carry as the expected credit return. Assuming that the bond does not default, the expected credit return to maturity is the credit spread: the additional yield of the corporate bond on top of the Treasury bond yield. As the credit spread is a readily available measure, constructing a carry portfolio with this definition is straightforward: select bonds with high credit spreads.[6] Below we will first analyze carry portfolios using this simple definition. This approach is also taken by another study on corporate bond factor investing.[7] Then, we will refine the definition of carry by including the 'roll-down-the-curve' effect.

Risk and return of Carry portfolios

We evaluate the performance of the carry factor over the period from January 1994 to June 2016. In each month, we sort bonds on their credit spread, divide them into five equally-weighted portfolios, and hold them for 12 months. The returns and volatilities of each portolio are provided in Figure 1.

[4] In this paper, we make a distinction between value and carry. Value in the credit market is defined as the credit spread of a bond relative to its fundamental risk. On the other hand, carry picks the bond with the highest expected return as proxied mainly by its credit spread, regardless of its underlying risk.
[5] See "Carry" (Koijen, Moskowitz, Pedersen, & Vrugt, 2016).
[6] Specifically, we use option-adjusted spread (OAS) as the credit spread measure, which is computed as the difference between the yield of the corporate bond and the yield of a duration-matched Treasury bond, corrected for any embedded optionality, such as callability of the bond.
[7] See "Common Factors in Corporate Bond and Bond Fund Returns" (Israel, Palhares, & Richardson, 2016)

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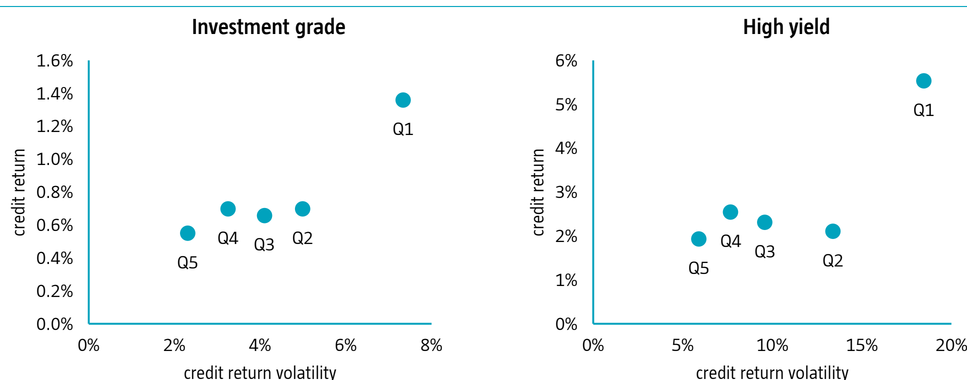
Figure 1 | Risk-return plot of Carry quintile portfolios for USD investment grade and high yield



Source: Robeco, Barclays. Sample period: January 1994 - June 2016. Credit returns are in excess of duration-matched Treasuries.

We observe that while the returns generally increase from the lowest carry bonds (Q5) to the highest ones (Q1), their volatilities disperse even more widely and monotonically. As a result, the Sharpe ratio (return per unit of risk) does not increase from Q5 to Q1. This dispersion in volatility is also observable through other risk measures as shown in Table 1. The bonds with the highest carry in investment grade are those with the highest risk: higher duration, lower credit rating, higher beta, and lower Distance-to-Default (DtD). Similarly in high yield, high carry is characterized by lower rating, higher beta, lower DtD, but lower duration, which indicates a downward-sloping credit spread curve. We thus conclude that high-carry bonds – simply defined as bonds with higher credits spreads – earn not only higher returns, but are also substantially more risky than low-carry bonds. Next, we investigate whether a more refined definition of carry generates better results.

Table 1 | Risk profile of Carry quintile portfolios in USD investment grade and high yield

	Investment grade					High yield				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Volatility (%)	7.34	4.99	4.10	3.25	2.31	18.45	13.39	9.59	7.68	5.90
Spread-duration (y)	7.44	7.18	6.43	5.34	3.88	3.67	4.19	4.40	4.47	4.28
Rating[8]	BBB	BBB+	A-	A	A+	CCC+	B-	B+	BB-	BB
Credit beta	1.95	1.26	0.90	0.61	0.33	1.93	1.24	0.93	0.73	0.53
Distance-to-default	4.81	5.49	5.66	6.00	6.66	2.06	2.84	3.38	3.96	4.46

Source: Robeco, Barclays. Sample period: January 1994 - June 2016.

[8] The average rating of AAA = 1, AA+ = 2, etc., and transformed back to a notation in letters.

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Refining Carry with roll-down

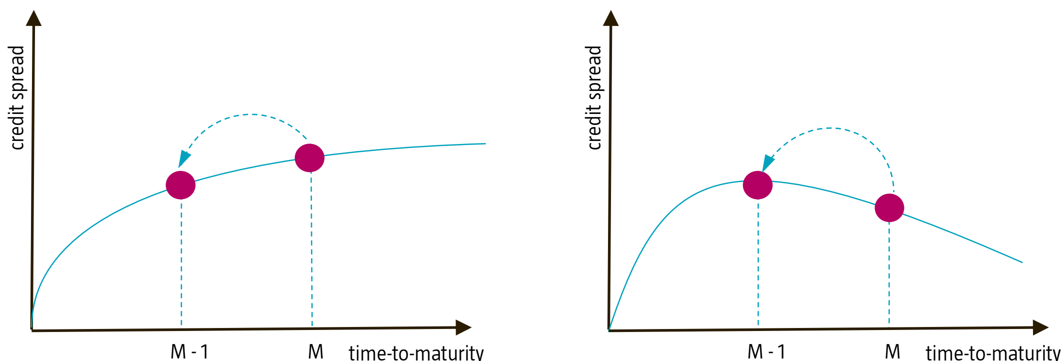
While the definition of carry as the credit spread is straightforward, it does ignore the expected spread change over the investment horizon. If the credit spread is expected to decrease (increase), this adds (detracts) to the expected return. Given our 12-month holding period, we need to form an expectation about the credit spread in one year's time. To do so, we invoke the basic assumption of the carry factor that market circumstances do not change. For corporate bonds, this means that the credit spread curve does not change. The left part of Figure 2 illustrates an upward-sloping credit spread curve. As the entire curve stays the same and the bond's maturity M shortens by one year to M-1, the bond 'rolls down the curve', leading to a positive expected return as a result of the credit spread tightening. On the other hand, if the credit spread curve is downward-sloping, the bond 'rolls up the curve' as illustrated in the right part of Figure 2, leading to a negative roll-down return.

Thus, carry is the sum of the credit spread, also called the 'pick-up', and the roll-down:

$$\text{carry} = \text{pick-up} + \text{roll-down}$$

where roll-down is calculated as the change in the spread as the bond rolls down (or up) the credit spread curve, multiplied by the spread-duration in order to obtain the expected return.

Figure 2 | Illustrations of a bond rolling down (left chart) or up (right chart) the credit spread curve

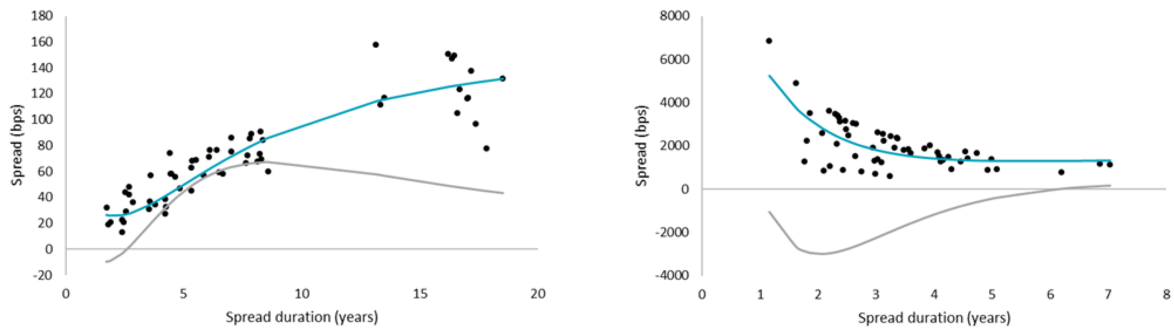


Source: Robeco

Estimating credit spread curves

Even though the definition of roll-down is intuitive, the credit spread curve is actually difficult to compute as the curve needs to be specific to the issuer of the bond. Most issuers have only a few bonds outstanding, and, especially in the high yield market, many issuers have even just one bond outstanding. Therefore, we resort to using bonds from other issuers that are comparable to the issuer of the bond. Specifically, we group the bonds of companies that are similar in their credit rating and liquidity, as well as the issuer's sector and financial leverage. This results in a relatively homogenous group of bonds. Subsequently, we estimate a curve per group, with two examples provided in Figure 3.

Figure 3 | Examples of estimated spread curves in June 2016



Source: Robeco, Barclays. Estimated curves are in blue, the implied roll-down is in grey, and individual bonds are represented by the black dots. Left is a sample of AAA/AA bonds of companies with low leverage and high liquidity; right is a sample of CCC/CC bonds with high leverage and low liquidity.

To assess the impact of roll-down on the carry measure, we compute the average roll-down and credit spread over a one-year horizon across all bonds over the last five years of our sample (June 2011 to June 2016). We find that the roll-down is on average 30 bps in investment grade and -50 bps in high yield, given that the credit spread is on average 160 bps and 540 bps, respectively. This suggests that high yield bonds typically roll up the curve (downward-sloping curve), as in the example on the right in Figure 3.

Carry portfolios including roll-down

Figure 4 shows the volatility and average return of carry quintile portfolios over the research period from January 1994 to June 2016, where carry now includes both pick-up and roll-down. For comparison, the results for the spread-only carry portfolios are also included in the charts. We observe that the inclusion of roll-down in the carry definition partly reduces the volatility dispersion, as the Q1 and Q2 portfolios have become more risky and the Q4 and Q5 portfolios less risky. Nonetheless, the high-carry portfolios are still much more volatile than the low-carry portfolios, both in investment grade and in high yield. Further, Figure 4 shows that the inclusion of roll-down not only reduces the risk bias, but also flattens out the returns from Q1 to Q5.

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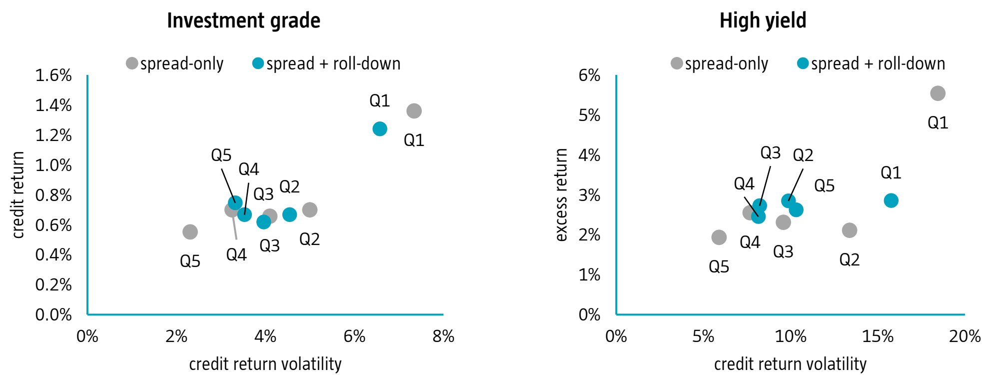
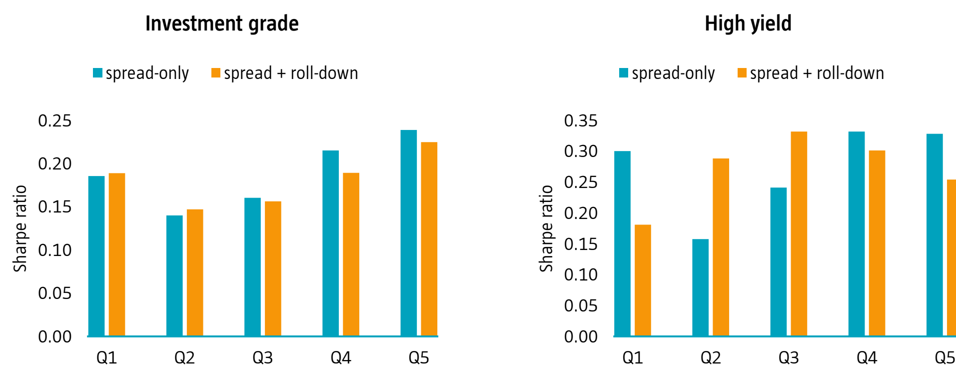
Figure 4 | Risk-return plot of Carry quintile portfolios in USD investment grade and high yield, with Carry defined either as spread or spread + roll-down



Source: Robeco, Barclays. Sample period: January 1994 - June 2016. Credit returns are in excess of duration-matched.

Figure 5 shows the Sharpe ratios of the carry portfolios for investment grade (IG) and high yield (HY). If carry were a successful factor, the Sharpe ratios would be monotonically decreasing as we would move from the highest carry to the lowest carry portfolio. However, in both universes, the highest carry portfolio does not show a superior Sharpe ratio to the other four portfolios. The Sharpe ratio of Q1 in IG is 0.19 and in HY is 0.18. Based on these results, carry should not be considered as a factor by an investor to build a credit portfolio.

Figure 5 | Sharpe ratio of Carry (pick-up + roll-down) quintile portfolios in USD investment grade and high yield



Source: Robeco, Barclays. Sample period: January 1994 - June 2016.

De-risking the Carry factor would make it Value-like

One could argue that the construction of the carry portfolios is naïve, as the tendency of the carry factor to select more risky bonds could be mitigated by constructing the portfolios in a more risk-neutral manner. However, doing so would make the carry factor very similar to the value factor. Recall that value in the credit market is defined as the credit spread of a bond

relative to the underlying risk.[9] By construction, credit spread is the overlapping variable in both the carry and the value factor.[10] If all bonds with the same credit spread would be equally risky, then carry and value would be equal. Thus, if we were to correct the carry factor for more and more risk measures, and construct a risk-neutral carry portfolio, it would become more and more similar to a value portfolio.[11] Therefore, we do not think that risk-neutralization of the carry portfolio is the right 'fix' to the carry factor.

However, even without making carry risk-neutral, we find that carry is already similar to value. In Table 2, we provide three regressions. First, we regress carry on the credit market. We find that there is no significant alpha, confirming the finding of the previous section that stand-alone, carry does not generate a premium. Then, in regression II we regress carry on value, and in regression III on value, size, low risk and momentum, while controlling for the credit market. In neither of these regressions is the alpha significantly positive. Moreover, we find economically large (0.82 to 1.06) loadings on value, which are also highly statistically significant. This indicates that the value factor subsumes the carry factor.

Table 2 | Regression of the outperformance over the market of Carry Q1 portfolio on the credit market return, and the outperformance of the Q1 Size, Low-Risk, Value, and Momentum portfolios

	Investment grade			**High yield**		
	I	II	III	I	II	III
Alpha	0.03%	0.00%	0.05%	-0.05%	-0.21%	-0.19%
	(0.77)	(-0.09)	(1.17)	(-0.41)	(-2.39)	(-2.11)
Market	0.46	0.14	-0.23	0.43	0.17	0.14
	(6.93)	(1.97)	(-1.09)	(6.09)	(2.62)	(1.16)
Value		0.82	1.06		0.98	1.08
		(5.16)	(5.48)		(9.36)	(7.64)
Size			-0.19			-0.11
			(-1.62)			(-1.17)
Low Risk			-0.55			0.05
			(-2.18)			(0.25)
Momentum			0.26			-0.08
			(1.50)			(-0.49)

Source: Robeco, Barclays. Sample period: January 1994 - June 2016. *t*-statistics are provided between brackets.

[9] See our white paper "Smart credit investing: the value factor" (2016).
[10] Even if roll-down is added to the credit spread in the refined carry definition, it only constitutes a small part of the overall carry: about 16% for IG (30 out of 190 bps) and 10% for HY (-50 vs. 490 bps).
[11] We have done extensive testing with risk neutralizations, e.g. using duration and distance-to-default*. Whenever we found alpha, it was always subsumed by our own value definition, which uses a large number of risk neutralizations.

Conclusions

The concept of carry has recently been applied in more asset classes than only currencies. In the credit market, carry can be defined as the credit spread in its simplest form, or as the credit spread plus the roll-down, i.e. the expected return of a bond after rolling down the curve, which is assumed to stay the same. We construct this credit spread curve by grouping similar bonds from similar issuers.

Regardless of the carry definition used, we find that high-carry bonds do offer higher returns than low-carry bonds, but these higher returns can be attributed to their higher risk. Therefore, they do not offer a higher Sharpe ratio. Our research also shows that the carry factor has a large overlap with the value factor. As sorting the bonds based on their carry leads to picking the most risky bonds, a risk neutralization can be applied to improve the performance. However, doing this only increases the similarity between carry and value. Therefore, given the existence of the value factor, we conclude that there is no place for a carry factor in the corporate bond factor zoo.

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