For professional investors - Marketing communication

OUT-PERFORMING CORPORATE BOND INDICES WITH FACTOR INVESTING

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BNP PARIBAS ASSET MANAGEMENT

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For this paper we have considered a number of factors from value, quality, low risk and momentum styles and show that these factors can be used to select the corporate bonds with the highest risk-adjusted returns. Our results have been confirmed for the three largest corporate bond universes, namely those defined by U.S. Investment Grade, Euro Investment Grade and U.S. High Yield benchmark indices. The factors we investigated can be used to create investment strategies designed to out-perform these benchmark indices by overweighting the cheapest bonds with the strongest performance trends from the most profitable, better managed and less risky companies.

FACTOR INVESTING

Factors are characteristics of companies that can be used to compare a company with its peers. Factors tend to be classified into different styles: value, quality, low risk and momentum. Value factors measure how cheap a company is, quality factors measure how profitable and well managed a company is, risk factors measure how risky a company is and momentum factors measure how a company is performing in the financial markets relative to its peers.

For equities, these four styles of factors - value, quality, momentum and low risk – have been receiving considerable attention for decades because they can be used to pick the stocks with the highest returns and to design strategies that out-perform market capitalisation indices over time. Cheaper stocks with the strongest past returns and from the most profitable, better managed and less risky companies tend to out-perform. Thus, strategies that overweight such stocks, relative to the market capitalisation benchmark indices, tend to out-perform at least when sector, regional, size and market exposure biases, relative to the benchmark index, are avoided.

FACTOR INVESTING FOR CORPORATE BONDS

It is remarkable that not much attention has been devoted to assessing the extent to which such factors can be used to design strategies capable of out-performing the corporate bond benchmark indices. After all, the total outstanding amount of corporate bonds issued by non-financial companies globally in 2018 was USD 12.95 trillion according to the Organisation for Economic Co-operation and Development.

We have done just that, first in a paper about the low risk style, Leote de Carvalho et al. (2014), and more recently in a paper about the four factor styles, Heckel et al. (2019). In the first we show that less risky bonds earn higher risk-adjusted returns and in the second we show that factors from the value, quality, low risk and momentum styles can be used to select the bonds with the highest risk-adjusted returns and to design strategies that out-perform the market capitalisation benchmark indices.

DIFFERENCES BETWEEN EQUITY AND CORPORATE BOND FACTOR INVESTING

Factor investing in corporate bonds is, however, not as straightforward as for equities and there are a number of differences that need to be taken into account. First, for each company there may be many bonds with different maturities and specifications, and hence with different risk. Second, the risk of each bond changes as time passes because the time-to-maturity decreases. Third, corporate bonds trade in fragmented and opaque over-the-counter (OTC) markets. Fourth, corporate bonds offer relatively poor liquidity and many are difficult to trade since many investors buy and hold them until maturity. Fifth, unlike stocks, where investors may expect to earn outsized returns from companies that see their market capitalisation

growing significantly over time, the returns earned by bond investors lending to those same companies is not going to be as significantly impacted by the growing equity capitalisation. A company growing in market capitalisation may simply grow its debt by issuing more bonds without any visible impact on the returns earned by current bond holders.

All of these questions need to be addressed when designing factor investing strategies for corporate bonds. An additional difficulty arises from the fact that constructing factors based on fundamental data is more difficult for corporate bonds than for equities because it requires linking the pricing data of the many individual bonds issued by a given company to its fundamental characteristics in a robust manner. The fact that a particular bond keeps its name through maturity even when its issuer company changes name, e.g. because of merger or acquisition, adds to the difficulty of creating such link, in particular since relying on CUSIP and tickers is not sufficient to produce good coverage and a reliable history.

We managed to overcome these difficulties as explained in Heckel et al. (2019). We considered the three largest corporate bond universes, separately: U.S. investment grade (IG), Euro IG and U.S. high yield (HY). Performing the analysis on three separate universes allows us to test for the robustness of the results while limiting data snooping. Also, we considered a total of 33 factors across the four styles - value, quality, low risk and momentum, which also help reduce data snooping as we do not keep only what has performed the best but, instead, we keep all factor ideas as listed in exhibit 1, page 4.

THE DATA

A number of the factors considered uses with fundamental data taken from the Worldscope database for companies and from the IBES database for analysts' forecasts of fundamental data. Both databases were linked to the Bank of America Merrill Lynch (BofAML) database to ensure the link of each bond to its obligor through time. This required carefully taking into account the impact of mergers and acquisitions throughout history. A proprietary methodology for linking the different databases was used for this purpose.

For the bond returns we used data from the BofAML database. The data is free of survivorship bias: whenever a company defaults, the returns of its bonds are based on their final traded price, reflecting the market's expected recovery rate. The excess returns from each corporate bond versus duration-matched Treasuries are provided. Market value, time to maturity, credit rating and credit spread are also provided.

THE FACTORS FOR CORPORATE BONDS

We used factors derived from factor ideas from the equity markets while adapting them to the corporate markets using intuitive arguments. In some cases this requires significant changes in terms of the way the information is used, as explained below.

The value style is about investing in cheap securities. We considered two types of value factors. The first favours bonds with a larger option-adjusted spread (OAS) relative to a fair value OAS obtained from a regression of the OAS of bonds against their time to maturity and distance to default. Bonds with an OAS larger than fair value OAS are undervalued. The second type of value factor aims at identifying value traps, i.e. companies that may appear to be cheap based on traditional value measures such as book-to-price, cash-flow yield, earnings yield or sales yield, but are in fact cheap because they are closer to default. Avoiding the companies with the larger values of these ratios will likely exclude such companies.

While for equity investors this may sound counter intuitive, remember that bond investors do not capture an upside: they just earn the yield for as long as there is no default. Thus, between two bonds with the same spread and duration, we prefer the bond of the company with a higher price being paid by equity investors for its book value, earnings or cash-flow because equity investors are pricing a lower probability of default by showing confidence in the future of the company.

EXHIBIT 1: LIST OF FACTORS CLASSIFIED INTO STYLES

FACTOR STYLE	DESCRIPTION	FACTOR	PREFER HIGH/LOW FACTOR VALUES
VALUE	Prefer cheaper firms	Spread relative to distance to default	HIGH
	Avoid value traps	Book to price	LOW
		Cash-flow to price	LOW
		Reported earnings to price	LOW
		IBES earnings forecast to price	LOW
		Sales to price	LOW
QUALITY	Prefer firms capable of covering debt with generated income	Cash-flow to debt	HIGH
		Free cash-flow to debt	HIGH
		Gross profit to debt	HIGH
		EBITDA to debt	HIGH
		EBITDA to interest expenses	HIGH
		Accruals (Op) to total assets	LOW
		Accruals (Fr) to total assets	LOW
	Avoid aggressive issuers	Capital expenditures relative to total assets	LOW
		Change of debt relative to total assets	LOW
		Financing cash to debt	LOW
		Annual percentage change in total assets	LOW
LOW RISK	Prefer less indebted firms	Leverage	LOW
		Distance to default	HIGH
	Prefer less risky firms	Stock beta (historical 3-year weekly returns)	LOW
		Stock volatility (historical 3-year weekly returns)	LOW
MOMENTUM	Prefer firms with stronger medium-term equity momentum and weaker short-term equity momentum	12 months – 1 month momentum	HIGH
		12 months – 1 month alpha	HIGH
		12 months – 1 month information ratio	HIGH
		12 months – 1 month Jensen information ratio	HIGH
		6 months – 1 month momentum	HIGH
		Momentum relative to the 52 weeks high	HIGH
		1 month reversal momentum	LOW
	Prefer firms with stronger fundamental momentum	6 months momentum in earnings revision	HIGH
		12 months momentum in earnings revision	HIGH
		Annual change in standardised IBES long term earnings growth forecast	HIGH
		Annual change in standardised earnings	HIGH
		Annual change in standardised free cash-flow	HIGH

Source: Heckel, T., Z. Amghar, I. Haik, O. Laplénie, and R. Leote de Carvalho. 2019. "Factor investing in corporate bond markets: enhancing efficacy through diversification and purification!" *The Journal of Fixed Income*

For the quality style we also consider two types of indicators. The first measures the ability of a company to cover its debt with generated income. We prefer companies with more cash-flow, profits and earnings relative to their debt or to their expenses. We also prefer bonds from companies with lower accruals relative to assets. A second type of quality indicator avoids aggressive businesses. We avoid companies with increasing expenditure or debt relative to their assets, or with lower amounts of cash relative to debt.

The low risk style is about earning higher risk-adjusted returns from lower risk companies. We used two types of risk measures. First we prefer bonds of companies with lower leverage and lower distance to default. Second we prefer bonds from companies with lower equity beta and lower historical volatility of stock returns. For the momentum style, we use two types of momentum. The first is based on the performance of the company in the equity markets. Much like for stocks, we prefer bonds from companies that outperform their peers in the equity markets in the medium term (six to 12-month horizon). But in the short term, we prefer bonds from companies that just underperformed, as it is the case for equities. Jensen information ratio is the average of the residuals of a regression of stock excess returns against market capitalisation index excess returns, divided by the volatility of those same residuals. The second type is fundamental momentum.

We prefer bonds from companies with stronger earnings revisions momentum, a stronger annual change in long-term earnings growth forecasts standardised by the annual volatility of those same forecasts, a stronger annual change in earnings per share standardised by the volatility of the annual changes in earnings per share, and an annual change in free cash-flow standardised by the volatility of the annual changes in free cash-flow.

PROPRIETARY FACTOR MODELLING APPROACH

The success of factor investing in corporate bonds is strongly dependent on controlling for known risk variables in particular OAS, duration, size and sectors. We have developed a proprietary modelling approach, local scoring, that does just that in a rather simple and efficient way and that is superior to other alternative approaches such as stratified sampling or optimisation as shown in our paper, Heckel et al. (2019). It is based on comparing each bond only to bonds with a similar risk profile. This new approach can be seen as an improvement of stratified sampling.

PREPARATION FOR THE STUDY

Before simulating the historical performance of our factor strategies we first filtered the universe starting by removing all non-senior debt from the respective Merrill Lynch index. This is important because these bonds are not comparable to senior bonds. We also removed bonds with the longest time to maturity, because there are too few of them, and illiquid bonds, such as bonds with low face value bonds or bonds with stale prices. The filtered universe for U.S. IG is composed of about 1,000 bonds from 350 issuers at the start of the period and about 3,000 bonds from 700 issuers at the end of 2017. For Euro IG there are about 250 bonds from 150 issuers at the start of the period and about 1,000 bonds from 350 issuers at the end. The U.S. HY universe includes about 200 bonds from 100 issuers at the start and 600 bonds from 300 issuers at the end.

THE RESULTS

For each universe we carried out historical simulations of monthly rebalanced strategies built from the factors in Exhibit 1. The portfolios for each style are obtained by equally weighting each factor in each style while using our proprietary approach, the local scoring approach. For all, we equally weight each of the four styles. The factors were used to identify and buy the issues with higher expected risk-adjusted returns, while selling the issues with the lowest expected returns.

EXHIBIT 2: INFORMATION RATIO:SECTOR, OAS, DURATION AND SIZE NEUTRAL

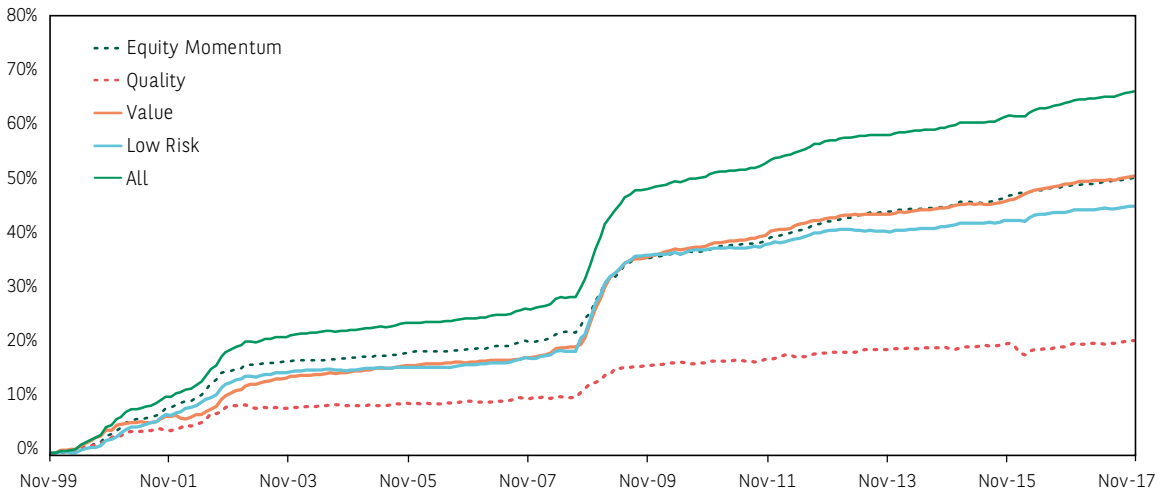
	U.S. IG	Euro IG	U.S. HY
VALUE	2.11	1.77	1.48
QUALITY	1.33	0.96	0.96
LOW RISK	1.74	1.34	0.99
MOMENTUM	2.37	2.14	1.57
ALL	**2.35**	**2.17**	**1.85**

Source: Heckel, T., Z. Amghar, I. Haik, O. Laplénie, and R. Leote de Carvalho. 2019. "Factor investing in corporate bond markets: enhancing efficacy through diversification and purification!" *The Journal of Fixed Income*

The information ratios in Exhibit 2 are based on the average annual alpha generated over time from the factor strategies divided by the annualised volatility of this alpha. In this regression, we use the monthly returns generated from the historical simulations against the returns of the equally weighted universe. The returns used for each corporate bond to generate the results are all in excess of duration-matched Treasuries. No transaction costs were included. In our paper, Heckel et al. (2019), we considered more realistic multi-factor strategies which also take into account transaction costs. We show that these results are robust and can be used in real investment applications. The results show that all factor styles can be used to construct out-performing strategies, with momentum the strongest followed by value. Quality and low risk also show significant performances but smaller than for momentum and value. This means that all factor styles contribute positively to the multi-factor model.

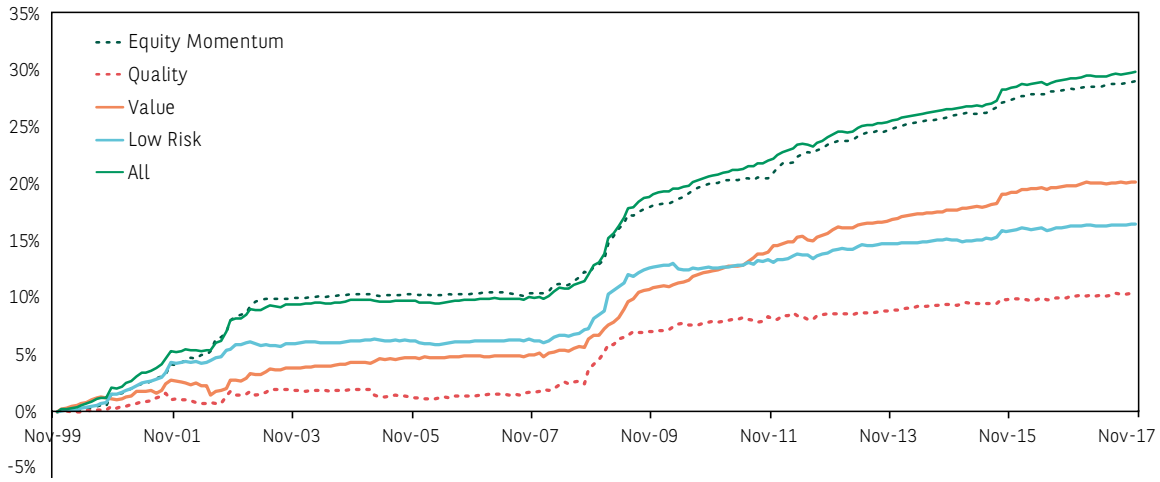
In exhibit 3, 4 and 5 we plot the sum of the monthly alphas for the aggregation of factors in each factor style and for the aggregation of all factors for all three universes considered, respectively. All factors styles added to performance of the underlying strategies although, in the period, the quality factors added less than the other styles. The diversification effect arising from combining the four factor styles explains the better performance of the curves including all styles. Finally, the results show good performances also during crisis periods. In fact, it is in such periods that the excess returns tend to be larger.

EXHIBIT 3: U.S. INVESTMENT GRADE SUM OF EXCESS RETURNS



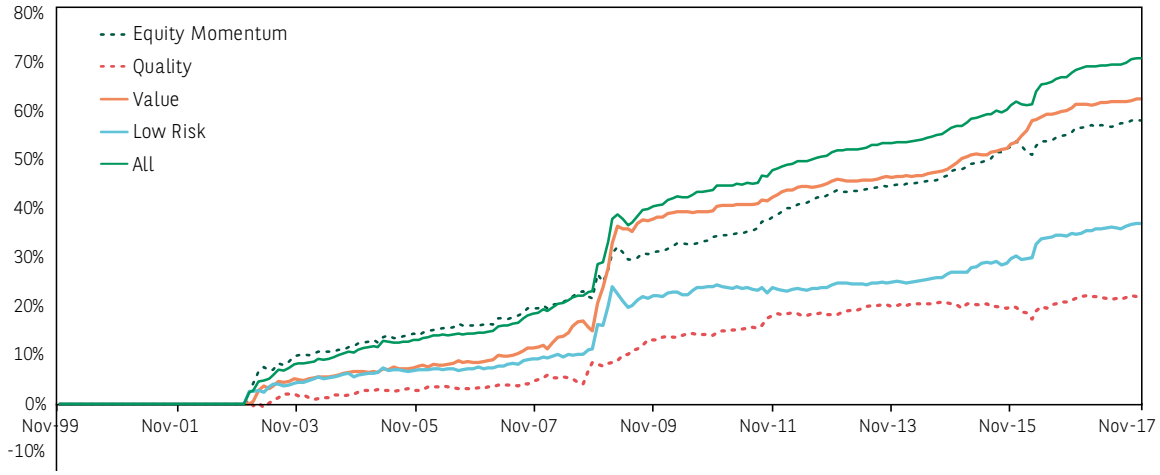
Source: BNP Paribas Asset Management, Bank of America Merrill Lynch, FactSet, IBES, Bloomberg (2018).
Based on monthly returns in USD. Past performance is not indicative of future performance. For illustration purposes only.

EXHIBIT 4: EURO INVESTMENT GRADE SUM OF EXCESS RETURNS



Source: BNP Paribas Asset Management, Bank of America Merrill Lynch, FactSet, IBES, Bloomberg (2018).
Based on monthly returns in EUR. Past performance is not indicative of future performance. For illustration purposes only.

EXHIBIT 5: U.S. HIGH YIELD SUM OF EXCESS RETURNS



Source: BNP Paribas Asset Management, Bank of America Merrill Lynch, FactSet, IBES, Bloomberg (2018).
Based on monthly returns in USD. Past performance is not indicative of future performance. For illustration purposes only.

CONCLUSION

Factor investing in corporate bonds is still relatively new, particularly when compared to factor investing in equities. We have demonstrated that value, quality, low risk and momentum are factor styles that can also be used to construct investment strategies that out-perform the market capitalisation indices for U.S. IG, Euro IG and U.S. HY.

We used factors derived from the equity markets while adapting them to the corporate markets using intuitive arguments. We also propose a new proprietary approach to factor modelling adapted for factor investing in corporate bonds that allows for easy control of the many undesired risk exposures of each bond, namely OAS, duration, size and sectors. Using numerical historical simulations we demonstrate the significance of our results for the three investments universes considered: U.S. and Euro Investment Grade and U.S. High Yield.

In terms of applications, factor investing in corporate bonds is particularly promising as a diversifier of traditional active management, which more often than not relies on taking spread, duration and sector views. It is also promising as an alternative to passive investing in corporate bonds. Corporate bonds benchmark indices can be difficult to replicate because of the lack of liquidity of many bonds and also because these indices tend to have high levels of turnover as a consequence of the dynamic nature of the corporate bond markets, with steady streams of new issues, repayments, maturities and rating changes.

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