Bonds have style, too

A new model for capturing fixed-income risk premia…and much more

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Bonds have style, too?

Style-factor risk premia have been well-documented (and harvested) in the equity world for decades but have proven far more elusive for bonds. The new Axioma Factor-based Fixed Income Model (FFIM) demonstrates that style factors not only do exist in credit, but that they also carry discernible risk premia, which, in turn, can be utilized for systematic, smart-beta investing.

Using "factors" (as opposed to security returns) to analyze portfolio risk and returns, however, is not a new concept to fixed-income investors. On the contrary, the very fact that the properties of debt securities change simply through the passage of time necessitated the introduction of common, generic price drivers, such as yield curves and credit spreads, to enable the modelling of asset and portfolio returns over longer periods. But adding new explanatory variables, such as Beta, Momentum, Size, Steepness, and Value, which had not yet been used in the credit-risk modelling, provides novel ways of slicing and dicing the characteristics of a portfolio, not to mention creating new opportunities for quantitative investment strategies.

There have been frequent attempts to implement fixed-income "smart beta" strategies, in pursuit of the stellar success of those in the equity world. However, many of the these were based on "fundamental" approaches, such as identifying "high quality" companies (i.e., firms with a low probability of default) whose securities offered a spread pickup, compared with a peer group of similar issuers. Yet, none of these endeavors could systematically identify and capture any pure factor returns (and potential premia) underlying these strategies.

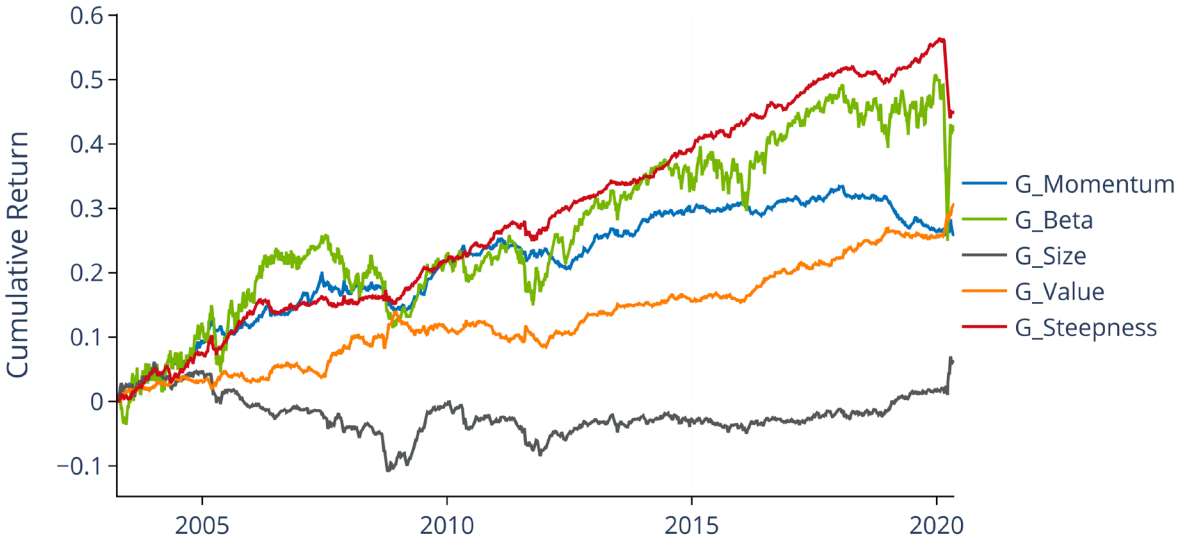
The New Axioma Factor-based Fixed Income Model

Axioma's new Factor-based Fixed Income Model (FFIM) now applies cross-sectional regression techniques—used mostly in equity risk modelling—to issuer spread curves in order to estimate a parsimonious set of credit factors. The underlying variables are changes in the 5-year points of each issuer curve, and the model uses log returns for spread levels above 100 basis points and absolute changes below. The bond exposures to those changes are therefore computed as duration times spread (DTS) or simply spread duration, respectively. Those credit factors are then combined with a set of interest rate (government and swap key rates), volatility, and exchange rate factors to explain the risks and returns of global bond portfolios.

The estimation universe for the credit model spans all currencies, countries, sectors, and credit ratings (investment grade and high yield). All 15 sector and five style factors, as well as the market intercept, are calibrated at a global level. There are also 13 currency and 15 country/region intercepts, and four quality factors each for USD, EUR, and GBP, as well as combined quality factors for the remaining currencies.

In this paper, we will focus on the five style factors and their performance over time, but we will also relate them to the global market intercept and quality factors where appropriate. The graph below shows the cumulative returns of the style factors since 2003.

Cumulative style-factor returns, 2003-2020



Source: Axioma Factor-based Fixed Income Model

As with the underlying spreads, a rise in the timeseries indicates an underperformance of the associated strategy relative to the overall market. The table below shows how each strategy is defined in both the spread and bond spaces.

Interpretation of style factors in terms of synthetic portfolios of issuer curves and bonds

Factor	Long spreads	Short spreads	Long bonds	Short bonds
Beta	Low beta	High beta	High beta	Low beta
Momentum	High spread momentum	Low spread momentum	High price momentum	Low price momentum
Size	Small	Large	Large	Small
Steepness	Shallow/inverted	Steep	Steep	Shallow/inverted
Value	Expensive	Cheap	Cheap	Expensive

Source: Axioma Factor-based Fixed Income Model

The Beta strategy, for example, tracks the spread returns of issuer curves with a low sensitivity to the overall market, relative to curves with a high sensitivity. The fact that the green line trends upward means that issuers with a low beta see their risk premia widen more (or tighten less) in excess to the market average over time than those with a higher sensitivity. So, in order to benefit from this phenomenon, one would have to buy bonds from issuers with a high beta, and short those with a low beta. This may seem counterintuitive at first glance, and certainly opposite to what has been documented for low-beta stocks, but we will examine this effect in more detail further down.

The Momentum and Value factors, meanwhile, exhibit similar behavior to their equity counterparts, meaning that cheap bonds (with a wider spread relative to their corresponding currency/rating cluster curve) will catch up over time, while issuers that have done well or badly over the past six months are likely to continue to do so in the near future. Size, on the other hand, seems to be the only style factor that does not display a noticeable drift. This contrasts with the equity world, where a size premium has been well-documented. However, Size is also defined somewhat differently here, as we will see in the more detailed discussion of the factor later.

An explanatory variable that has no equivalent in equity risk modelling is the so-called Steepness factor. An issuer's exposure to this factor is determined by the differential between the 10-year and the 2-year points of its spread curve. Its associated premium appears to be the largest and most consistent through all market environments. The way the factor is designed, it implies that one would benefit from favoring securities from issuers with steeper spread curves.

The definitions of the style factor exposures are as follows:

- **Beta:** Timeseries sensitivity of issuer-curve changes to overall credit-spread changes
- **Steepness:** Difference in the 10y and 2y curve level
- **Size:** Largest bond amount outstanding for issuer
- **Momentum:** 6-month change in issuer-curve level
- **Value:** Issuer-curve level minus cluster-curve level

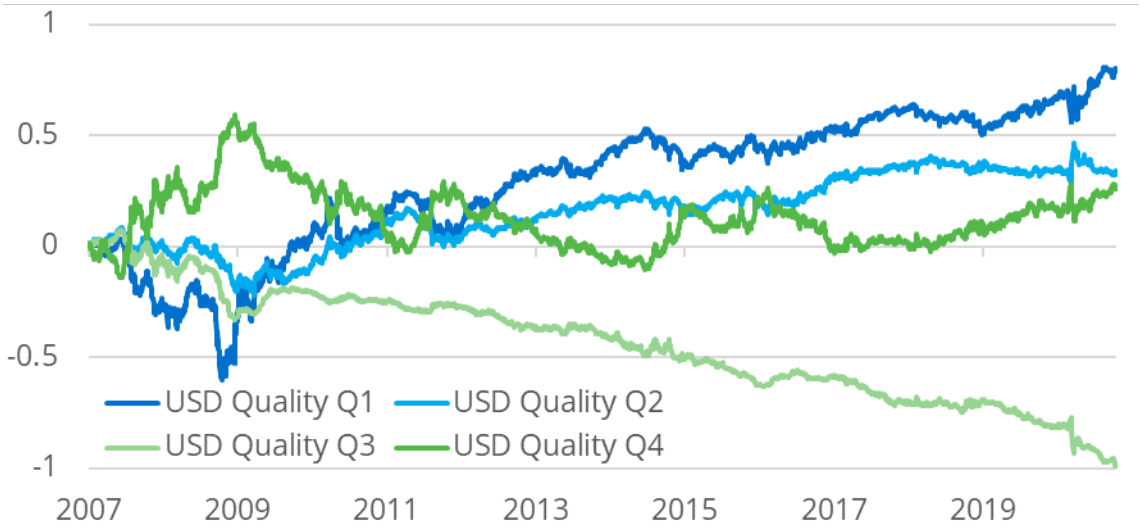
Before examining each style factor in turn, we will first introduce the Quality factors, which we will use in relation to other factors later.

Quality

The model estimates four Quality factors each for the three major currencies (USD, EUR, and GBP) and another set for the remaining currencies combined. Each factor represents a quartile of the cross-sectional distribution of spread levels of all issuer curves in the respective currency. An issuer's exposure to the appropriate factor is determined by its curve's percentile in the cross-sectional distribution. Most curves will be exposed to two quality factors (with the weights assigned through linear interpolation between quartile buckets), except those at the high and low ends of the quality distribution.

The chart below shows the cumulative returns of the four Quality factors for USD-denominated securities since 2007. The returns are in excess of the corresponding currency intercept, with Q1 representing the "best quality" issuers with the tightest spreads, and Q4 showing those with the highest risk premia. A rising line implies that spreads in the quartile widened more than the currency average, while a falling graph signifies a relative tightening.

USD Quality factor cumulative returns since 2007



Source: Axioma Factor-based *Fixed Income Model*

The ascent of the dark green line in 2007 and 2008, for example, indicates that the lowest-quality issues underperformed the three other quartiles, as the global financial crisis unfolded, but then recovered, when credit conditions improved again in 2009 and 2010. Over time, however, there seems to be no particular trend or premium attached to investing in those highest-yielding securities. However, there appears to have been a more pronounced trend in the next higher quartile (Q3). The consistent downward movement of the factor indicates that borrowing costs for those issuers, most of which would have been found in the BBB rating band, have come down more than those for the overall market in the past 14 years.

The opposite seems to have occurred in the highest-quality buckets (represented by the two blue lines), however, which appeared to have lagged behind the market average over time. That said, in periods of crises, it occurs that demand for those safer assets briefly increases, as is implied by the temporary declines of the blue graphs in those periods.

Beta

Beta is the most significant style factor. It can be considered a sort of "correction" to the Global Market Intercept, as it measures the additional sensitivity to movements in the overall market, to which every issuer has unit exposure. The sensitivity of an issuer curve to the factor is calculated by regressing the last 252 overlapping weekly returns against the corresponding market returns, which are, in turn, defined as the weighted cross-sectional average returns of all issuer curves in the estimation universe.

High-yield securities, for example, tend to react more strongly to changes in credit conditions. Therefore, a strategy favoring names with a higher beta—which is what the definition combined with the upward trend of the Beta factor seems to suggest—should also be overweight in names with lower credit quality. This is indeed what the graph below appears to indicate, which shows the cumulative return of the global Beta factor since 2007, together with the timeseries for the USD Quality 3 and Quality 4 factors. The latter two capture the excess performance of the third and fourth issuer-spread quartiles, respectively, over the Global Market and USD Currency Intercept.

Global Beta versus USD Quality 3 and Quality 4 (inverted) cumulative returns 2007-2020

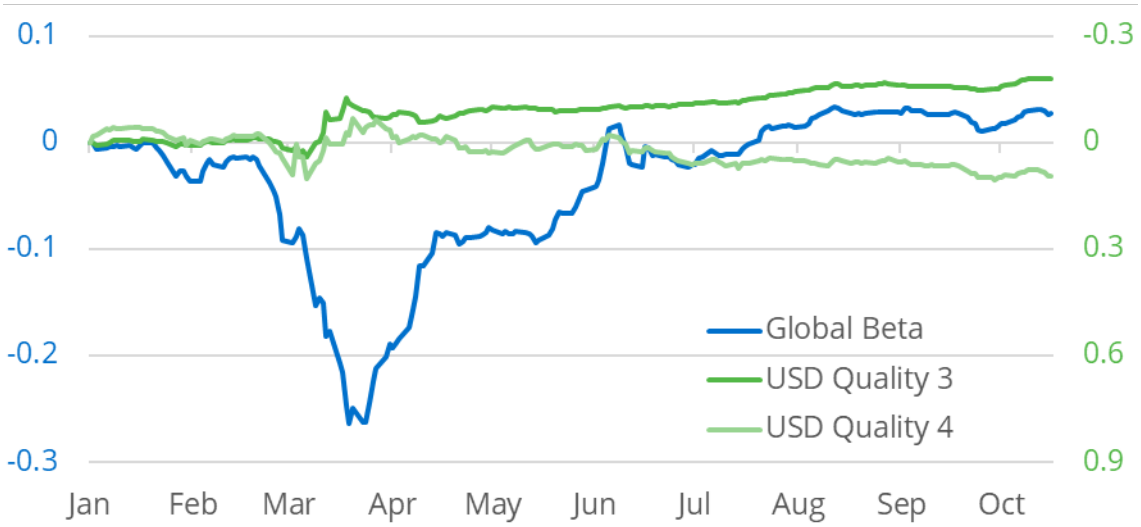
Source: Axioma Factor-based Fixed Income Model

The steady upward trend (or rather downward trend, as it is plotted against an inverted scale) of the Quality 3 factor seems to imply that there is, indeed, a premium attached to investing in higher-spread/lower-quality names, as their spreads appear to have contracted more than the overall market in the past 14 years. However, the same cannot be said about the quartile with the biggest yield mark-up, which, over time, seems to mean-revert toward the market return.

There were, however, stronger fluctuations in the factor returns during the global financial crisis and the Eurozone debt crisis in 2008/9 and 2010/11, respectively. The directional movements of the Beta factor imply that names with a low market-sensitivity did better when credit conditions worsened during the onset of the crises, but then surrendered their gains in the subsequent recoveries. This indicates that, even though higher-beta names have tended to outperform the overall market over time, in periods of severe turmoil, investors still appear to flock toward lower-risk securities. This notion was also underscored by the interaction of the two Quality factors. While lower-rated names experienced an additional underperformance on top of what was already captured by the Global Market, Beta and Currency factors, the next upper quartile appeared to have done a lot better.

The Beta factor also showed a sharp downward spike in the most recent crisis. This time, however, the Quality factors reacted only marginally, indicating that most of the performance of the respective issuer curves had already been explained by the Market Intercept and Beta factors. A closer look at the performance for just 2020 in the chart below even shows that the Quality 4 factor moved slightly in the opposite direction to what we had observed in 2008.

Global Beta versus USD Quality 3 and Quality 4 (inverted) cumulative returns 2020



Source: Axioma Factor-based Fixed Income Model

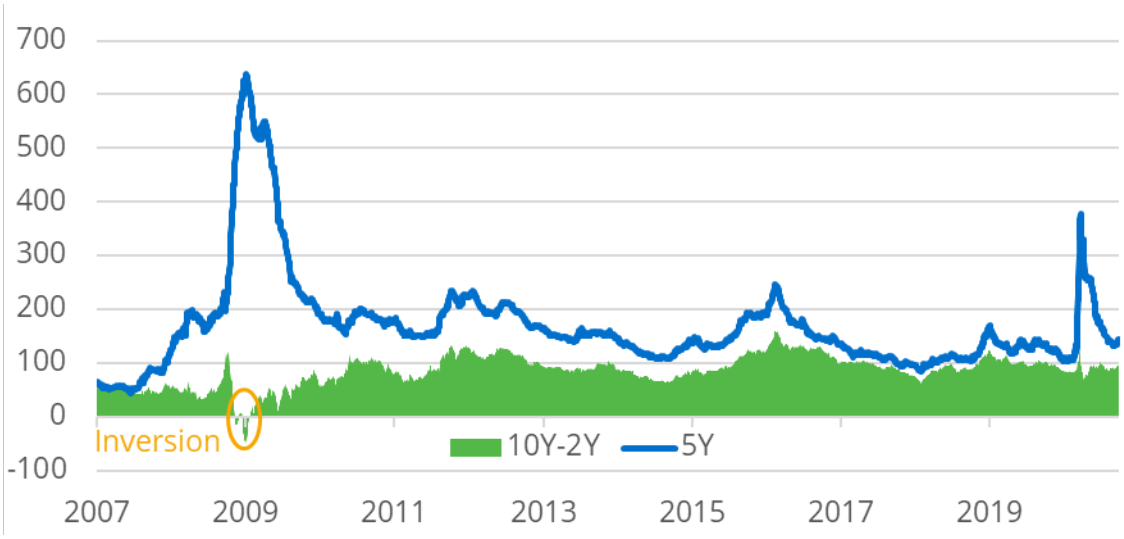
The seemingly close relationship between the Beta and the Quality factors could indicate that there may be a certain collinearity between the factors—that they may not be "orthogonal". This is not surprising, as the exposures to most style and quality factors are based on spread levels, even though they are not identical. However, measures of linear dependence, such as variance inflations factors, turned out sufficiently low, so that concerns about multicollinearity can be discounted.

Steepness

The Steepness factor seemed to have had the largest, steadiest and most consistent premium. It measures returns from changes in the 5-year point of issuers with steep curves relative to those with shallow or inverted curves, over and above the overall market return. It should not be confused, however, with what is commonly known as "carry". There is, of course, also a positive performance impact from investing in securities with a higher coupon or spread, as well as the positive price effect on bonds "rolling down" a steep, upward-sloping curve. That is, however, not what this factor captures.

Rather, the positive trend of the factor, combined with the way the exposures are defined, implies that, over time, the 5-year spreads of issuers with steeper curves have tended to tighten more than the market average in times of falling spreads and widen less when yield premia increased. The chart below shows the 5-year yield pickup over swaps for global, USD-denominated corporate bonds with a BBB rating, together with the corresponding 10-year minus 2-year spread differential.

Global USD BBB corporate 5-year spread and 10-2-year differential

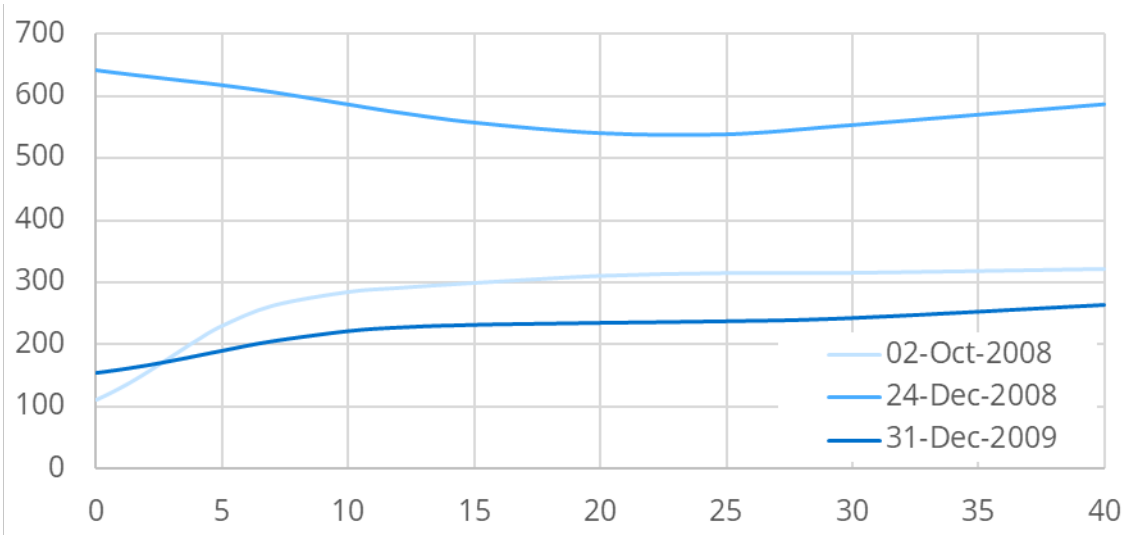


Source: Axioma Fixed Income Spread Curves

We can see that, for most of the time, the two timeseries move in sync. This implies that as borrowing conditions improve, credit curves flatten, while wider spread levels seem to result in a higher yield mark-up for longer-dated debt. The latter makes sense, as investors would want to be compensated for tying up their funds for longer periods, when credit risk increases.

However, this interaction only holds to a certain point in an environment where credit conditions start to worsen significantly. For example, in the first five weeks following the Lehman Brothers collapse in September 2008, the credit curve initially steepened as spreads rose, but then began to invert, as short spreads surged much more than longer maturities. The chart below shows the cluster curves for the same BBB-rated, USD-denominated corporate bonds at the onset, the peak, and the end of the global financial crisis.

Cluster curve for global BBB USD corporate bonds 2008/2009

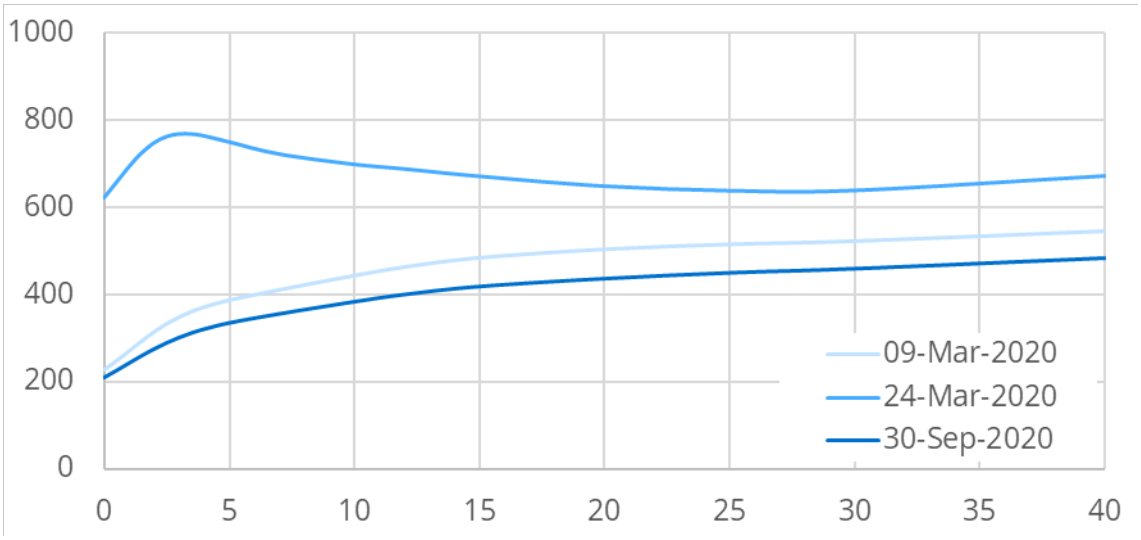


Source: Axioma Fixed Income Spread Curves

A credit-curve inversion is usually a sign that investors are pricing in an increased risk of defaults, demanding higher risk premia for debt that is due for more imminent repayment. It also happens when companies are close to or already in default. In that case, all their debt securities start to trade "on price". This means that investors no longer expect to receive interest, and all bond prices go down to the assumed recovery rate, irrespective of their remaining time to maturity. A conventional yield-to-maturity or spread calculation will then result in much higher levels for shorter bonds, as a much greater implied interest rate would be required to amortize the nominal amount by the time it is due.

Although the BBB curve started to flatten again while spreads continued to surge in March this year, it did not invert this time. However, the next lower rating band (BB) showed some signs of increased default probabilities around the peak of the crisis on March 24, as can be seen in the chart below.

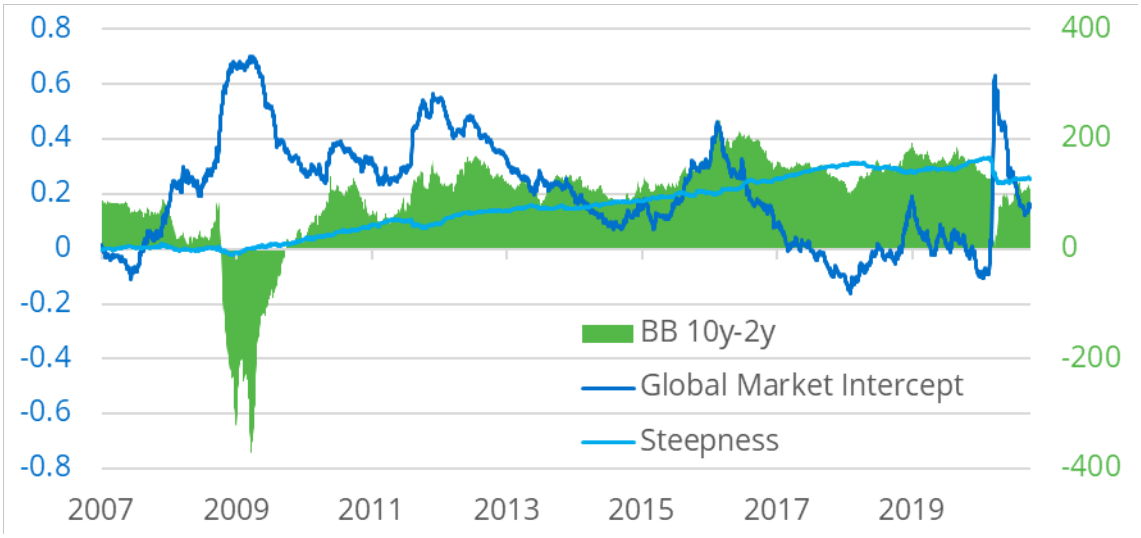
Cluster curve for global BB-rated USD corporate bonds 2020



Source: Axioma Fixed Income Spread Curves

However, the spread between the 10-year and the 2-year BB spread only declined to around -50 basis points this time, compared with -370 basis points at the height of the global financial crisis, as can be seen in the following timeseries chart. In contrast to the previous figure, this one contains the cumulative return of the Global Market Intercept from the factor model instead of the corresponding 5-year rate, alongside the return of the Steepness factor. A close relationship between that factor and the steepness of the curve is also evident, again with the exception of the two extreme credit crises.

Global USD BB 10-2-year spread differential versus FFIM market intercept and steepness



Sources: Axioma Factor-based Fixed Income Model, Axioma Fixed Income Spread Curves

As noted earlier, the Steepness factor has mostly exhibited a steady upward trend over time, although it also recorded a marked downward blip over the course of March this year. As we saw in the curve chart, the curve inversion over the same period meant that shorter maturities—among them the 5-year point—widened more than the long end. As the strategy favors issuers with steep curves, that effect would have been even more pronounced for those, which probably explains the temporary underperformance of the strategy.

Value

The Value factor is designed to capture the excess returns of issuers whose bonds appear to be priced too cheaply, relative to similar companies. The reference group is represented by a cluster curve of global issuers with the same rating, issuing in the same currency. It does not take into account sector or country of the issuer, as these seemed to be of lesser significance. An issuer curve's exposure to the Value factor is measured by the average distance between the logarithmic 5-year spreads of the issuer and the cluster curves over the preceding 30 days.

Global Value versus Market Intercept cumulative returns 2007-2020

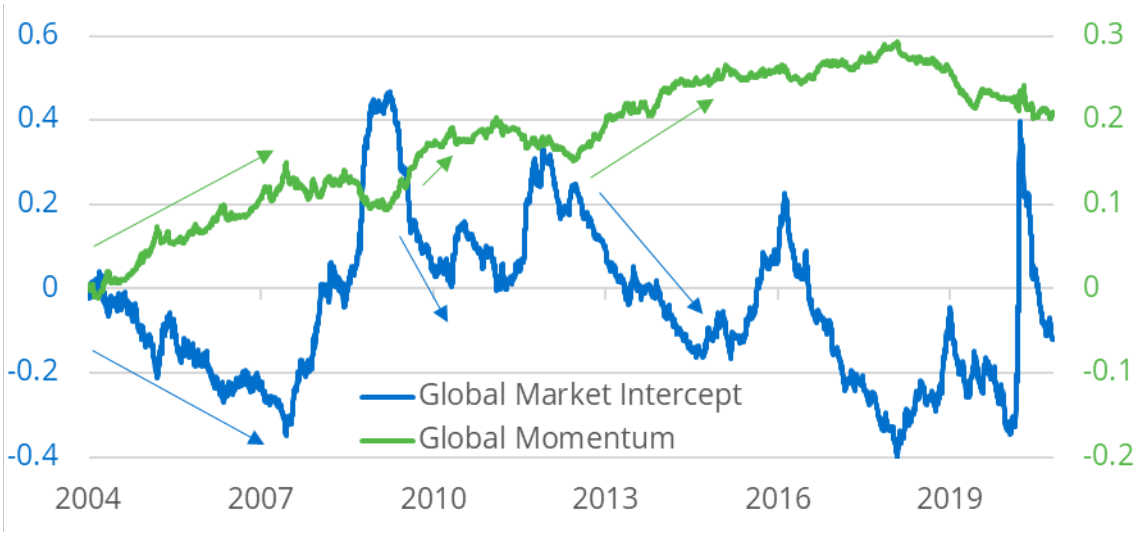
Source: Axioma Factor-based Fixed Income Model

As shown in the chart above, the Global Value factor exhibits a steady premium that appears to be almost independent of the prevailing market environment. Although there is an indication that it benefitted particularly in the phases of surging spread levels at the onsets of the global financial crises and the COVID-19 crisis. The way the factor is designed, it indicates that "cheaper" issuers saw their risk premia widen less than peers that were closer to the currency/rating average.

Momentum

The Global Momentum factor is based on the premise that assets that performed well in the past, are likely to continue to do so in the near future. Exposure to the factor is, therefore, defined as a curve's spread return over the previous six months.

Global Momentum versus Market Intercept cumulative returns 2004-2020



Source: Axioma Factor-based Fixed Income Model

The Momentum factor, represented by the green line in the chart above, once again shows a steady premium over the past 17 years. A comparison with the Global Market Intercept (depicted in blue) indicates that the strategy of buying bonds with a high momentum and selling those with a low exposure appears to work particularly well in times of contracting yield premia. There are also drawdowns in periods of worsening credit conditions, but those appear to be much smaller compared with the previous gains.

Size

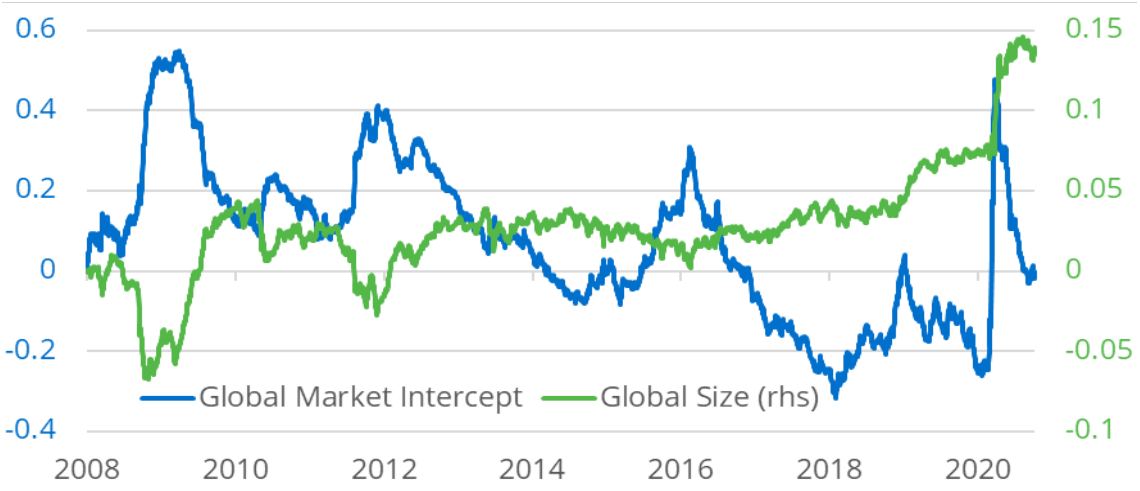
Size appears to be the only style factor in the model that does not display a discernible trend. It is, however, prone to larger fluctuations in times of distress.

As in the equity world, the exposure to the Size factor is determined by how much of an issuer's securities are available to trade, especially during periods of heightened uncertainty. However, unlike in most equity risk models, which traditionally use the market capitalization of a company's stock, the nominal outstanding of an issuer's largest bond appeared to be of greater significance than the total amount of debt. While the former is often a good proxy for liquidity, a large quantity of the latter, in particular in relation to the total assets of a company, can also be an indication that the firm may be struggling financially. This is in contrast to the total equity market capitalization, which is usually seen as an indication that a business is doing well.

Assuming that amount outstanding is an appropriate proxy for the liquidity of an issuer's securities, this should then be reflected in the Size factor performance, especially during times when the ability to easily trade into and out of a position is of utmost importance to investors. We would expect bigger issues to do worse during a downturn, as portfolio managers are likely to liquidate their largest holdings first. But then these same securities should also be the first ones to be bought back in the subsequent recovery.

This is indeed what we observe when looking at the performance of the Size factor relative to the Global Market Intercept, as represented by the green and blues lines, respectively, in the chart below. The downward movement in the green graph, when credit conditions worsened at the end of 2008 (reflected in the sharp rise of the blue series), indicates that investors predominantly sold bigger, more liquid bonds, only to buy them back when things improved in 2009.

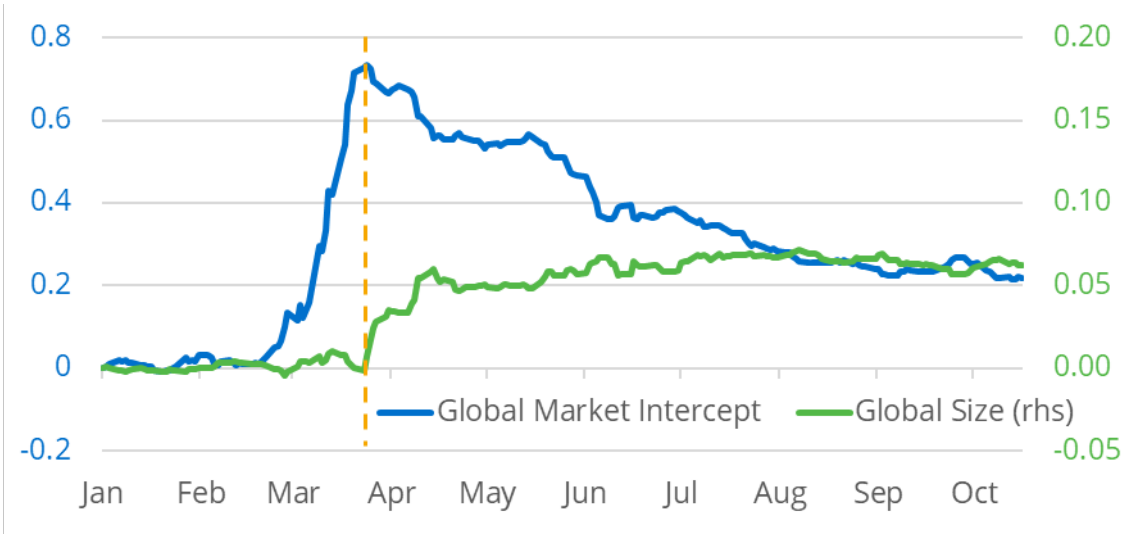
Global Size versus Market Intercept cumulative returns 2008-2020



Source: Axioma Factor-based Fixed Income Model

We see a similar pattern in the Eurozone debt crisis of 2011/12, and, to a smaller extent, during the Chinese stock-market turbulence/energy crisis in 2015/16. Yet, at the onset of the COVID crisis in late February and early March, when spreads shot up, we did not observe the immediate mirror-movement in the Size factor, which indicates that bigger issues were not hit harder than smaller ones. However, bonds from larger issuers then seemed to have benefitted disproportionately from the initial bounce-back.

Global Size versus Market Intercept cumulative returns 2020 to date



Source: Axioma Factor-based Fixed Income Model

Conclusion

The analysis in this paper has demonstrated that style-factor risk premia do exist in the fixed-income world, too. Market practitioners have (intuitively) known about some of them for a long time—and there have been many attempts to capture them—but the Axioma Factor-based Fixed Income Model, for the first time, provides a framework for systematically proving and, ultimately, capitalizing on them.

Fixed-income investors have always been performing relative-value analysis of some sort. This would usually involve the comparison of the yield or spread of an instrument with either its own long-term average or with a suitable peer group of other securities or issuers. This principle also underlies the Value factor definition in the Axioma FFIM. However, the robust, peer-supported issuer and cluster curve estimation process and sophisticated smoothing algorithm underlying the model enable users to perform this kind of analysis in a consistent and systematic manner, which produces demonstrable and quantifiable results.

The persistent upward trend of the Value factor indicates that the corresponding strategy of overweighting securities with a high spread relative to their peer group, while underweighting those closer to the market average, generates a steady outperformance. That said, there are also indications that the approach works even better in times of worsening credit conditions. A Momentum-based approach, on the other hand, seems to benefit more in periods of contracting yield premia—although it also exhibits a discernable general trend. This indicates that at multi-factor strategy might produce even better risk-adjusted returns.

The apparent strong performance over time of issuers with a greater sensitivity to market movements, as captured by the Beta factor, may have seemed surprising to some, especially as it appears to contradict what has been an established strategy in the equity world. However, the comparison with the Quality factors,

especially the third quartile, highlighted that there may also have been a "spillover" effect from the fact that the strategy tends to tilt toward issuers with a higher spread level.

But the model not only helps to uncover risk premia, but also enables users to capture and quantify other known phenomena, such as the importance of large, liquid securities during times of market turmoil, which is reflected in the performance of the Size factor. And the Steepness factor can play an important role in accurately examining the impact of credit-curve dynamics, especially when some of the lower-rated curves invert in times of heightened bankruptcy concerns.