High-Yield Bonds: Analyzing the Risk and Return Tradeoff When Rates are Negative

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In a world where some investors pay the government for the privilege of lending it money—and where even fixed income securities with the lowest investment-grade credit ratings yield barely more than 1% per annum—the "hunt for yield" becomes ever more challenging. One way for fixed income fund managers to augment their expected return is to buy securities with lower credit quality. Besides providing bigger coupon payments, high-yield bonds also come with the added benefit of being more negatively correlated with sovereign bonds than their more highly rated peers. The latter not only reduces overall portfolio volatility, but also countervails some of the losses from rising interest rates.

In this paper, we examine the risk characteristics of corporate bond portfolios, with particular attention on the differences between investment-grade and high-yield securities. Although our initial focus is on the Eurozone, where most of the debt with negative interest rates is located, we were able to replicate the same findings when examining similar USD-denominated portfolios. Using a combination of risk analysis and stress testing, we find that the price variations of the more highly rated instruments were primarily driven by changes in risk-free interest rates. The risks and returns of the high-yield bonds, on the other hand, seemed to be entirely due to changes in credit-risk premia, which often moved in the opposite direction of interest rates. The latter led to a significant reduction in overall portfolio risk, and, in the case of the USD example, even resulted in a lower predicted volatility for the sub-investment-grade portfolio, compared with its higher-quality equivalent.

The Hunt for Yield

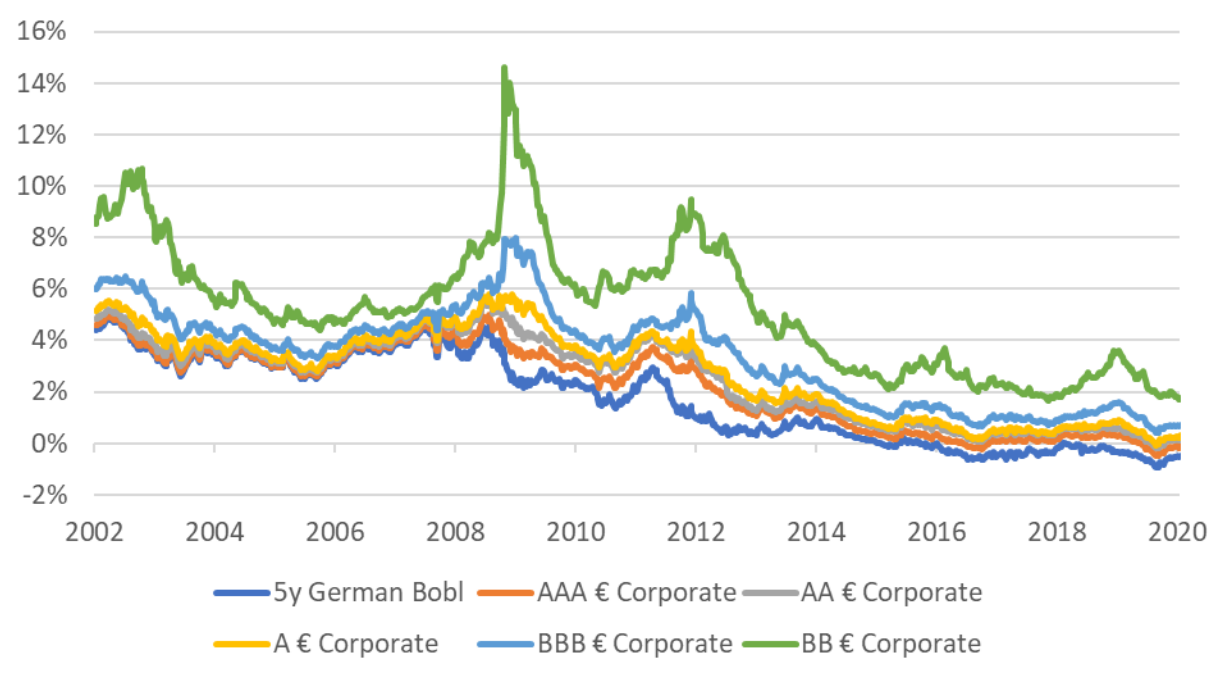
When I took out my first life-insurance policy in Germany in the mid-1990s, it came with a guaranteed interest rate of 4%. Of course, that was at a time when investors could expect an annual return of 6% by simply lending their money to the government for 10 years. Since then, long-term Bund yields have come down significantly, bottoming out in August 2019, when the Finanzagentur issued a 30-year, zero-coupon bond at a yield of -0.11%. This meant that the initial buyers at the time effectively agreed to pay the German government a tenth of a percentage point every year for the next three decades for the privilege of lending it their money. At that time, the entire German yield curve was in negative territory.

As risk-free yields steadily declined, the Federal Finance Ministry followed suit and successively lowered the legal interest requirement, to help take some of the pressure off increasingly struggling insurance providers and asset managers. Yet, with the lowest-rated investment-grade corporate issuers paying barely 1% per annum on their euro-denominated debt, even the current minimum required return of 0.9% can seem like a big challenge, and the hunt for yield is likely to get even more desperate.

Traditionally, fixed income fund managers, looking to enhance the expected return of their portfolio, had several options. One was to move out along the maturity dimension. In a "normal", upward-sloping yield-curve environment, loans with a longer time until final repayment command a higher interest rate, to compensate investors for the prolonged uncertainty. Also, lenders who tie down their money at a fixed rate for a longer time period expose themselves to potential opportunity costs, if interest rates go up. This is reflected in a greater sensitivity to discount-rate changes, called the "duration" of the bond. The longer the remaining time to maturity of the bond, the greater the detrimental price effect of a lower yield.

Another way of raising the expected reward on an investment is to take on a greater risk of not getting one's money back. This can be achieved by purchasing securities from issuers with lower creditworthiness. Depending on their risk appetite, buyers of corporate debt could earn several percentage points on top of the yield of a comparable government bond. In the early 2000s—before the global financial crisis—a euro-denominated bond with a BBB rating (the lowest in the so-called "investment-grade" category) and a typical maturity of 5 years would pay a risk premium of 1.5-2% over a comparable German Bundesobligation ("Bobl").

Average 5-year zero-coupon yields based on Axioma Fixed Income Spread Curves



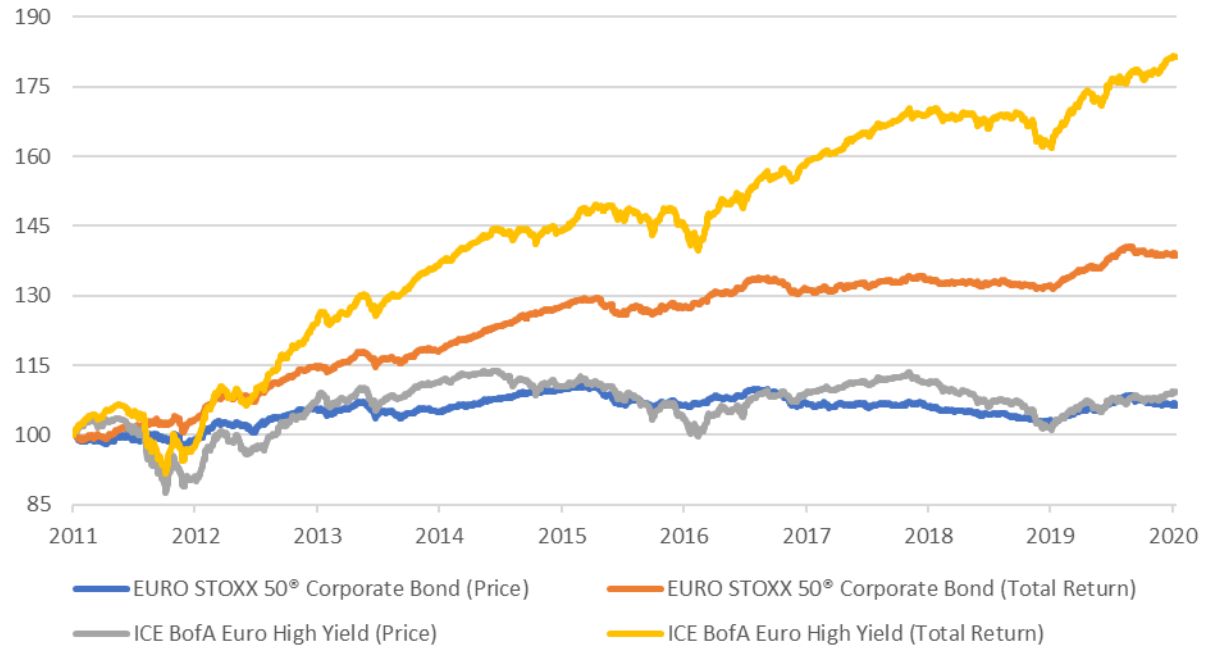
Source: Axioma Fixed Income Spread Curves

A similar yield pickup can be expected today. However, as risk-free rates are substantially lower than they were 20 years ago, the average total yield of an investment-grade bond is now between -0.2% and +0.7%. When German government yields reached their lowest level on record in August 2019, financial media reported that between a quarter and one third of global debt outstanding had negative yields. For euro-denominated securities, the percentage was even higher, at around 50%. At the time, average yields by rating band ranged from -0.50% for the highest-quality AAA category to 0% for single-A issuers and +0.50% for borrowers with a BBB rating, according to the Axioma Fixed Income Spread Curves.

It's All About the Interest…

Though bond-price changes caused by fluctuations in risk-free interest rates and credit spreads can be significant, the long-term performance of a fixed income portfolio tends to be driven by interest income. When looking at the price return series of the EURO STOXX 50® Corporate Bond index since its inception at the end of 2010, we see that it has frequently reverted to its starting level of 100, vacillating within a range of 14 points.

Euro corporate bond index returns



Sources: Qontigo, The Intercontinental Exchange, FRED®

The reason for this mean reversion is that bonds are issued at a price of 100 (par) and then redeemed at the same value when they mature. The ensuing "pull-to-par" effect will, therefore, eventually offset all interim gains and losses from changes in rates and spreads. At the same time, the coupons on any new debt will constantly adapt to the current interest-rate environment, ensuring that new bonds are issued at prices close to par.

The EURO STOXX 50® Corporate Bond total return index, meanwhile, steadily climbed to 138.7 as of December 31, 2019, implying an average annualized return of 3.7% over the past 9 years. The corresponding return of the ICE BofA Euro High Yield index was 6.8%.

For 2019, the total return of the high-yield index was 11.3%, with 4.1% coming from interest and 7.2% from changes in prices. The latter was mostly due to a substantial tightening in credit-risk premia of around 200 basis points, on top of a 0.5% decline in the 10-year Bund rate. The decreases in rates and spreads also benefitted higher-rated issues, though to a lesser extent. The price return of EURO STOXX 50® Corporate Bond index was 3.2%, while interest payments added another 1.8%, taking the total return for 2019 to 5.0%.

Why Negative Interest Rates?

When I started my career as a fixed income sell-side analyst 20 years ago, my manager asked me what the maximum price for the Bund Future could be. He expected, of course, that I would reason that interest rates can never drop below zero—because that doesn't make any sense, does it?—and that, therefore, the largest present value of 10 coupons of 6% and a notional repayment of 100%, discounted at a an IRR of 0%, would be 160%. Well, last time I checked, the price of the current front-month contract was just above 170.

Why, then, is something that seemed completely inconceivable only a few years ago, now becoming more and more accepted?

It All Started with the Central Banks

Since the European Central Bank (ECB) cut its deposit rate to -0.10% in June 2014, monetary-policy setters in Sweden[1], Switzerland, Denmark and Japan have followed its lead and lowered the interest they pay on deposits from commercial banks into negative territory. The ECB and the Swedish Riksbank both cited concerns about inflation expectations being too low as their main reasons for the moves. The Danish Nationalbank (DN) and the Swiss National Bank (SNB), on the other hand, used the negative deposit rates to disincentivize foreign investment, in order to reduce the pressure on their appreciating currencies. Britain and the US have, so far, been spared negative rates.

The negative deposit rates meant that commercial banks had to pay a "penalty" on any "idle" cash they would leave with the central bank. This should encourage financial institutions to put their money to work by lending it to companies and households, thus incentivizing investment and consumer spending. Despite claims from the European Central Bank that its negative rate policy had been "effective" in increasing bank lending, financial institutions still ended up paying more than €7 bn in interest for their deposits with the central bank in 2018.

A Matter of Trust and Liquidity

If it is a desire for security that prevents commercial banks from lending more money to their customers, then an ultra-safe, highly liquid government security with a yield of -0.3% may look like an attractive alternative to paying 0.5% to the central bank. The same argument may apply to investors outside the banking sectors. If a fund manager gets an inflow of new money that they want to safely park somewhere until a suitable investment opportunity presents itself, the same sovereign bond may seem like an attractive interim solution. Alternatively, there might even be an explicit requirement in the investment mandate to keep a certain percentage of the fund's capital in safe, easy-to-liquidate securities.

The Greater Fool Theory

Of course, buyers of government bonds may also speculate that someone will, at some point, purchase the security from them at an even higher price. This is sometimes derisively referred to as the "greater fool theory", although the potential reasons for why the price may increase could be manifold. In particular, in the current environment of geopolitical and economic uncertainty, any turn for the worse—such as setbacks in the US-China trade or Brexit negotiations, a renewed flare-up of tensions in the Middle East, recession fears in Europe, a global pandemic—could bring back the familiar **flight-to-quality** flows from stock markets into government bonds. And with that formerly "unbreakable" threshold of zero already breached, there is no telling how much deeper yields can descend into negative territory.

[1] Sveriges Riksbank had already briefly lowered its deposit rate to -0.25% in 2009, but that was primarily to keep the interest-rate corridor around its major repo rate symmetrical at +/-50 basis points.

The recently reinstated **bond purchasing program from the European Central Bank**—currently €20 bn per month plus reinvestments of previously bought, matured issues—is likely to add further downward pressure on euro-sovereign yields.

Finally, in an upward-sloping curve environment, there is also the so-called "**rolldown" return**. As the bond gets shorter in maturity, it rolls down the curve to a lower yield level, which will have the opposite, upward impact on its price. Part of this is, however, likely to be offset by an opposing pull-to-par effect, which we described above. As it is hard to conceive that a government would issue debt with a negative coupon—meaning that the creditor would have to pay the debtor interest over the life of the security—a bond with a negative yield is likely to trade at a premium over its par value. As the instrument will be redeemed at par at maturity, the premium will be amortised over time. However, most of this takes effect toward the end of the bond's life, so that the rolldown return can outweigh the pull-to-par effect for newly issued debt.

A New Reality

Even though the concept of negative nominal interest rates may still seem new, investors have been accepting negative "real" yields for quite some time now. The chart below shows average monthly yields on 5-year German government bonds, adjusted for inflation expectations over the same time horizon. We see that these have been continually negative since the summer of 2011 and seemed to have stabilized around -2% for almost 4 years.

Average monthly real yields on 5-year German government bonds

Source: Deutsche Bundesbank

Risk Analysis of EUR Corporate Debt

In this section, we examine the risk of two representative, euro-denominated corporate bond portfolios, breaking down the overall volatility into contributions from risk-free interest rates and credit spreads. One portfolio comprises debt from issuers with an investment-grade rating between AAA and BBB, while the other contains high-yield securities rated BB to CCC. The analysis was conducted on the Axioma Risk platform, using Qontigo's new, Axioma Granular Fixed Income Risk Model. For the calibration, we used weekly returns over a 5-year period with a half-life of 1 year. The table below shows standalone

standard deviations for both rates and spreads, as well as the contributions from each type of risk factor. All numbers are shown in percent per annum.

Expected volatility based on weekly returns over 5 years with a half-life of 1 year

	Investment grade		High yield	
Risk type	**Standalone risk**	**Risk contribution**	**Standalone risk**	**Risk contribution**
Interest rates	1.57	1.35	0.94	-0.09
Credit spreads	0.83	0.24	2.03	1.83
Total	**1.59**	**1.59**	**1.74**	**1.74**

Source: Axioma Risk

Given the much higher spread volatility of the high-yield portfolio—which is around 2.5 times that of its investment-grade counterpart—one may be inclined to assume that its overall risk must also be much higher. After all, it would make intuitive sense that a higher probability of not getting one's money back should also be reflected in greater overall volatility. This is indeed true for spread volatility by itself, which has been shown to be roughly proportional to the spread level, which is, in turn, a reflection of the issuer's perceived creditworthiness.

Yet, total risk for the high-yield portfolio is only about 10% higher than that of its investment-grade equivalent (1.74% versus 1.59%). This is attributable to the strong negative correlation between risk-free interest rates and credit spreads, as the contribution of -0.09% in the last column of the table indicates. If, on the other hand, rates and spreads were perfectly positively correlated, the total risk of the portfolio would be simply the sum of the standalone numbers, as all securities are exposed to both types of risk factors.

When comparing the contributions from interest rates in each portfolio to the corresponding standalone volatilities, it is striking how much bigger the diversification effect is in the high-yield portfolio. This is due to three reasons:

1. The negative correlation between rates and spreads tends to be much more pronounced for securities with lower credit quality than for higher-rated bonds;
2. Risk premia for lower-rated bonds are considerably more volatile, meaning that a rise in interest rates will be offset by a much bigger tightening in spread; and,
3. The interest rate risk of the high-yield portfolio was lower to begin with, as bonds with lower credit quality tend to have shorter maturities and are often callable.

The offsetting effect of rate and spread movements in the high-yield portfolio means that the latter is entirely dominated by credit risk. In contrast, the risk and returns of higher-rated securities seem to be mostly driven by changes in risk-free interest rates, which account for about 84% of total portfolio variation.

The fact that the volatility (and, presumably, the return) of the high-yield portfolio is predominantly due to issuer credit risk is good news for fundamental managers. It means that they can focus on what they are really good at, i.e., predicting the performance and (default) risk of individual companies. As a credit portfolio manager once explained to me, "outperforming a fixed income benchmark is often not so much about picking the winners, but about avoiding the losers." In other words, sell the likes of Enron, Worldcom and Parmalat before they default.

EUR Scenario Analysis

To assess the impact of rising interest rates and sovereign yields, we ran a number of stress tests on the same portfolios from the previous section. These included the following three historical scenarios from 2017 and 2018.

- **ECB gets hawkish:** European Central Bank President Mario Draghi expresses his confidence that monetary policy is working by strengthening economic recovery and restoring inflationary pressures in the Eurozone at the bank's annual conference in Portugal.
- **ECB announces tapering:** following strong economic growth for the Eurozone in 2017, an ECB board member announces that the bank may not extend its bond buying program beyond the expiry date at the end of 2018.
- **Stock market correction:** a sudden flare-up of inflation fears triggers a global stock-market sell-off of around 9%. Sovereign yields rise at the same time, resulting in simultaneous losses for both major asset classes.

The exact dates of which are shown in the table below, together with the actual changes in the 10-year Bund yield and the corresponding returns of the EURO STOXX 50® stock index. We also performed a so-called "transitive" stress test, in which we estimated the impact of a 25-basis point rise in the 10-year Bund yield, using correlations and betas from the three months leading up January 17, 2020.

Scenario definitions

Scenario	Start	End	10y Bund	EURO STOXX 50®
ECB get hawkish	26-Jun-2017	07-Jul-2017	0.32%	-2.9%
ECB announces tapering	15-Dec-2017	23-Jan-2018	0.22%	2.9%
Stock market correction	23-Jan-2018	09-Feb-2018	0.17%	-9.1%
10y Bund +25bp	17-Oct-2019	17-Jan-2020	0.25%	1.1%

Source: Qontigo

It is worth noting that the simulated 1.1% stock-market return in the last, transitive scenario is much lower than the actual return of 8.2% for the stated period. The reason for this is that over the calibration period, the generally strong inverse relationship between stock and bond prices had been unusually weak, as investors in the two asset classes appeared to be at odds about the outlook for the world economy. While the prospect of an impending trade deal between China and the United States propelled equity markets to ever higher heights, bond traders seemed to remain much more cautious, and yields trended in a relatively narrow range. This resulted in an uncommonly low beta between share-price and yield in the calibration.

The table below shows simulated corporate bond returns for each scenario, broken down by broad rating. All returns are in percent, normalized to a duration of 4 years. The investment-grade buckets (AAA-BBB) all show losses of similar magnitude across all scenarios. This confirms our earlier finding that the performance of these higher-rated securities seems to be primarily driven by interest rates rather than credit spreads. This contrasts with the categories of lower credit quality, in which the distribution of returns was far more varied. In fact, their relative performance compared with the investment-grade issues seemed to depend on what share prices did during the respective period.

In the two scenarios, in which share prices went up (ECB tapering and recent correlations), the lower-rated securities show much smaller losses or even a profit. This makes sense, as the ability to repay their debt will depend a lot more on company performance for firms with a lower credit quality, which means that their risk premium over government bonds will be much more (negatively) correlated with their share price. In the case of the ECB-tapering scenario, the resulting spread tightening seems to have more than offset the rise in risk-free interest rates. The opposite effect could be observed during the stock market correction in February 2018, when widening risk premia led to a significant underperformance of sub-investment grade debt.

Simulated EUR corporate bond returns by broad rating

Rating	ECB gets hawkish	ECB announces tapering	Stock market correction	10y Bund +25bp
AAA	-1.3	-1.1	-0.7	-1.1
AA	-0.8	-0.7	-0.5	-0.7
A	-1.0	-0.8	-0.7	-0.9
BBB	-0.9	-0.6	-0.7	-0.9
BB	-0.6	0.3	-1.2	-0.1
B	-0.7	0.8	-1.1	0.2
CCC	-0.9	0.2	-0.9	0.1

Source: Axioma Risk

The results seem to confirm the potential benefit of holding lower-rated securities in an environment of rising interest rates. In three of the four scenarios, the negative correlation between interest rates and credit spreads appears to have dampened or even reversed the losses from rising sovereign yields. It was only in the extreme stock market correction scenario that the inverse relationship of share prices and corporate risk premia appeared to have prevailed.

But even in an environment of simultaneously rising sovereign yields and falling share prices, high-yield bonds can still generate a positive total return when incorporating annual interest income, due to their much higher coupon. Euro-denominated, BB-rated securities, for example, come with an average yield-pickup of 2.5% over same-maturity German Bobls, and the premium doubles or even triples, when moving further down the rating spectrum to single-B and CCC, respectively. Even after the infamous bond-market "massacre" of 1994, when a surprise rate hike by the Federal Reserve Bank triggered a sharp sell-off in the US Treasury market, many high-yield funds—in particular those with shorter-dated paper—ended the year firmly in the black.

Analyzing USD-denominated Corporate Bonds

We repeated the analysis from above on two equivalent USD-denominated corporate bond portfolios, to see if we could observe the same phenomena in an environment where yields were well above zero. When looking at the risk-analysis results in the table below, we see that the profile of the US high-yield portfolio looks very similar to its European counterpart, even showing (coincidentally) the same overall volatility of 1.76%. Furthermore, the risk seems to stem entirely from variations in credit spreads, with interest-rate fluctuations effectively neutralized by opposing changes in risk premia.

Comparing the standalone factor volatilities once again highlights a much higher interest-rate risk for the investment-grade portfolio compared with the high-yield portfolio. Again, this is due to a much longer duration of the former compared with the latter. However, in contrast to the European example, the bigger contribution from rate risk also led to a much higher overall volatility—almost twice as much as the high-yield fund. And even though there was some offsetting effect from credit spreads, it only reduced total risk by around one tenth. The risk of high-yield portfolio, in contrast, is once again entirely driven by variations in credit spreads, while changes in interest rates seem to be cancelled out by opposing movements in risk premia.

USD Credit: Expected volatility based on weekly returns over 5 years with a half-life of 1 year

	Investment grade		High yield	
Risk type	**Standalone risk**	**Risk contribution**	**Standalone risk**	**Risk contribution**
Interest rates	4.47	4.02	2.29	0.07
Credit spreads	1.99	-0.43	2.78	1.69
Total	**3.59**	**3.59**	**1.76**	**1.76**

Source: Axioma Risk

Scenario analysis seems to confirm the same pattern, indicating that the simulated returns of investment-grade bonds were primarily due to changes in risk-free rates, while the relative performance of high-yield assets depended on what happened to share prices over the analysis period. For the USD funds, we used slightly different historical episodes, in order to capture significant upward movements in US Treasury yields. The direction of the stock market in each period depended on whether the underlying sentiment was one of optimism regarding the economy and trade, or whether investors were more concerned about rising inflation and the corresponding response from the central banks.

- **Trump rally:** following the election of Donald Trump as President of the United States, share prices soar, fueled by promises of tax cuts and infrastructure spending, while Treasury yields rise in anticipation of Fed rate hikes and over concerns about the fiscal implications.
- **Inflation fears:** a sudden flare-up of inflation fears triggers a global stock-market sell-off of around 9%. Sovereign yields rise at the same time, resulting in simultaneous losses for both major asset classes.
- **Fed too aggressive:** sovereign yields rise, while share prices fall over concerns that the Federal Reserve may raise rates too fast and too much in the light persistently high inflation.
- **Trade deal hopes:** China and the United States announce that they are looking to resume trade talks, raising hopes of a forthcoming deal.

The exact dates for the historical scenarios can be found in the table below, together with the changes in interest rates and corresponding stock-market returns. The numbers in each scenario are the actual returns of the STOXX® USA 900 benchmark index, apart from the last row, which shows a simulated performance based on a 40-basis point upward shock in the 10-year Treasury rate and daily return correlations over the three months ending January 17, 2020.

USD scenario definitions

Scenario	Start	End	10y Treasury	STOXX® USA 900
Trump rally	08-Nov-2016	25-Nov-2016	0.50%	4.0%
Inflation fears	23-Jan-2018	08-Feb-2018	0.22%	-8.9%
Fed too aggressive	24-Aug-2018	02-Nov-2018	0.39%	-5.3%
Trade deal hopes	03-Sep-2019	13-Sep-2019	0.43%	3.4%
10y Treasury +40bp	17-Oct-2019	17-Jan-2020	0.40%	1.7%

Source: Qontigo

The simulated returns in the table below highlight a clear distinction between investment-grade and high-yield securities. It is remarkable how consistent the numbers are across the four top rating buckets, but it confirms the observation from above that the returns of higher-quality issues are primarily driven by changes in interest rates. In fact, the actual figures are very close to what one would obtain by simply multiplying the change in the 10-year Treasury rate by a duration of 5 years—which is the value we normalized the returns to in order to make them comparable.

Simulated USD corporate bond returns by broad rating

Rating	Trump rally	Inflation fears	Fed too aggressive	Trade war hopes	10y Treasury +40bp
AAA	-1.9	-0.9	-2.1	-1.9	-1.7
AA	-1.9	-0.9	-2.0	-1.8	-1.5
A	-2.0	-0.9	-2.0	-1.9	-1.6
BBB	-2.0	-0.9	-2.1	-1.8	-1.5
BB	-1.2	-1.2	-1.7	-0.5	-0.2
B	-0.6	-1.8	-2.4	0.4	0.2
CCC	-0.4	-3.0	-3.1	1.6	0.9

Source: Axioma Risk

The performance of the high-yield bonds, on the other hand, seemed to depend on the direction of the equity market—similar to what we observed for the European portfolios. And the extent of the out- or underperformance against the higher-rated issues seemed to once again depend on the credit quality. Especially in the bullish trade-war-hopes environment, tighter spreads seemed to more than offset the effect of higher risk-free rates, even turning a profit for issues rated single-B and below.

Given more recent correlations, a rise in Treasury yields would also result in an outperformance of high-yield versus investment-grade bonds. It is worth noting that we are only looking at the relative movement of sovereign yields, credit spreads and share prices. The numbers in the table reflect an environment in which government bond rates go up. This could, for example, be driven by a containment of the coronavirus or renewed optimism about a trade deal between China and the United States. A further deterioration in the geopolitical environment and an accompanying flight to quality, on the other hand, would reverse those simulated numbers.

Conclusion and Outlook

In the current climate of ongoing geopolitical and economic uncertainty, it would be reasonable to assume that government bond yields are likely to remain at their presently low/negative levels for some time. Short-term interest-rate futures for the Fed Funds target rate and the Bank of England base rate both imply that the next move from those two major central banks is going to be downward, while the European Central Bank is not expected to touch its refinancing rate until at least the end of 2021.

With their yield-pickup of 2% or more, sub-investment-grade bonds are therefore likely to remain on investors' radar screens. And in addition to the augmented interest income, high-yield debt also comes with the supplementary benefits of reduced overall price variation and a built-in cushion against rising interest rates.

The breakdown by risk-factor type in our analysis highlighted that—in contrast to investment-grade issues—the volatility of a high-yield portfolio is primarily driven by variations in credit spreads. Changes in risk-free rates, on the other hand, seemed to be largely offset by opposing moves in risk premia. This not only effectively eliminates interest-rate risk, but also makes the fund manager's job easier in that he or she can focus on issuer-specific criteria, rather than the overall direction of sovereign yields. It also means that, if the economic growth outlook were to improve and government yields and share prices were to rise again, the latter would result in tighter credit spreads. As the stress-test analysis showed, this is likely to benefit high-yield securities to a larger extent than investment-grade bonds.