
Bond Pricing: Agreeing to Disagree

Morningstar Research

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Introduction

The SEC recently began requiring mutual funds to file form N-PORT for public release each fiscal quarter. The form includes detailed, holding-by-holding information for bonds, provides a richer, more consistent set of data than was previously required, and helps to fill a hole in information accessibility for investors.

Because bonds don't trade as readily as stocks, whose end-of-day prices are easy to observe, most bonds must be assigned prices at the end of each day for use in calculating mutual fund net asset values. We have used N-PORT to examine differences among bond prices to calculate those net asset values across the universe of U.S. taxable bond, municipal bond, and allocation mutual funds. Because reporting requirements are specific and mostly standardized, we are able to look at and compare bond holdings across funds and firms and infer the prices used to mark bonds in their portfolios.

The degree to which bond prices are "high" or "low" can have consequences for the price at which investors transact when buying and redeeming mutual fund shares. If the security prices used to calculate a portfolio's net asset value are high, investors selling shares will receive more, while those buying shares will pay more for them, and vice versa.

Results at the bond-by-bond and sector-by-sector levels were eye-opening in their dispersion and especially so at the end of 2020's first quarter. This paper is meant to surface and illuminate that data. We have also done preliminary work examining the consistency with which mutual fund complexes price their bonds. The preliminary results are reassuring in that the average deviations for most firms were relatively modest.

Key Takeaways

- ▶ SEC form N-PORT is an excellent tool to improve transparency for investors. It provides a richer, more consistent dataset allowing for better comparisons of fixed-income portfolios both contemporaneously and over time.
- ▶ We used N-PORT data to impute and compare the prices of bonds held in U.S. taxable bond, municipal bond, and allocation mutual funds.
- ▶ Differences in the pricing of individual bonds has implications for the calculation of funds' net asset values. We found fairly large differences among prices for individual bonds across the fund universe, especially so at the end of 2020's first quarter. Preliminary work examining the consistency of pricing by individual mutual fund complexes, however, showed relatively modest deviations from each other.

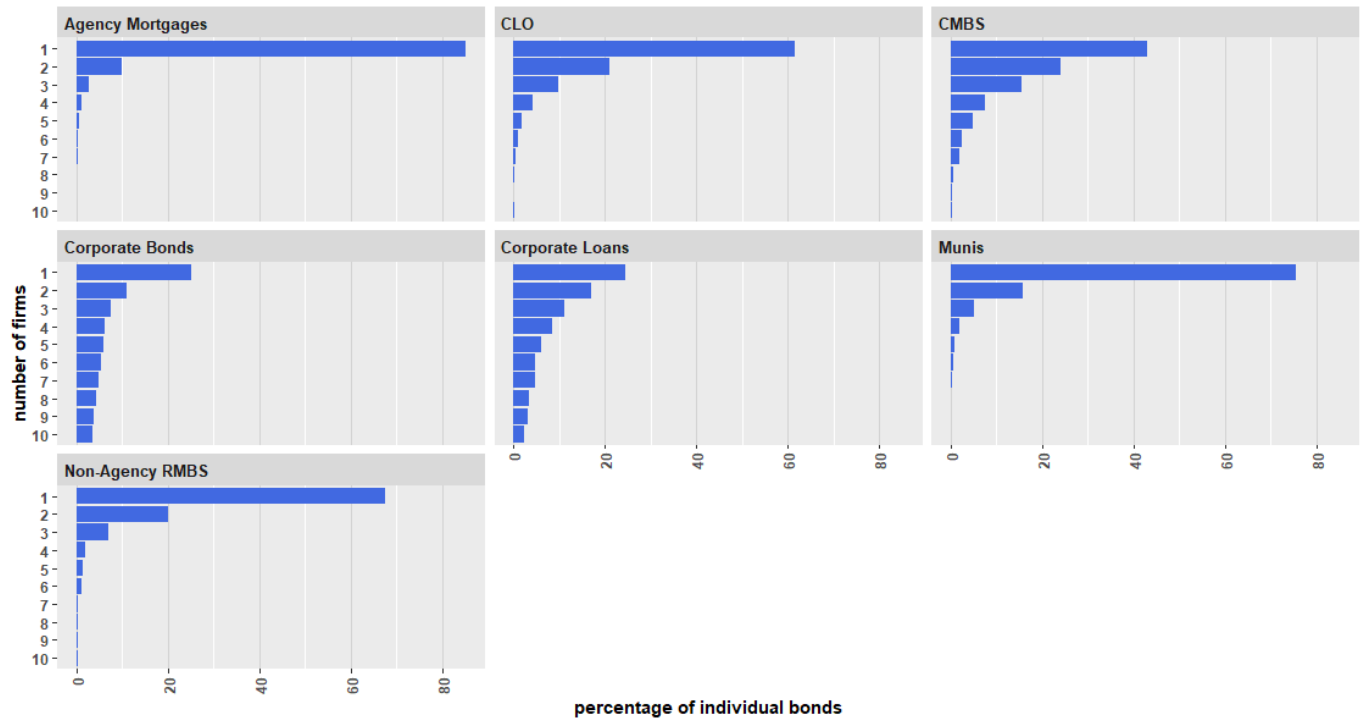
Moving at the Speed of Bonds

Heisenberg's uncertainty principle is a notion in quantum physics that more or less says there's a limit to how accurately you can describe the position of a very tiny, fast-moving object. With some exceptions, the bond market's problem is quite the opposite. How do you determine the price of a bond if it's not moving at all?

There are important exceptions, but most bonds just don't trade that often. The bond market operates in a different paradigm than stocks, which mostly trade on exchanges at lightning-fast speeds and incredibly high trading volumes. But while some government bonds move quickly and in large volumes too, some old, low-balance agency mortgage-backed securities may barely trade at all, and the situation is similar in other sectors where the amount of trading may be comparatively small. On an average day, U.S. equity markets regularly trade more than \$500 billion worth of stock. U.S. corporate bonds? Maybe \$25 to \$30 billion. Other segments even less. In fact, of all the corporate bonds that traded in 2019, only a bit more than half of them traded at least once every three weeks throughout the year.

Those trading figures don't come as much of a surprise given the diffusion of ownership among many bonds. In some sectors, huge swaths of issuance are purchased by large investors such as insurance companies and pensions, who tuck them away and hold them until maturity. Meanwhile, among bonds in mutual funds, most individual issues are held in strategies run by a small number of asset managers.

The data in Exhibit 1 plot how many bonds in each sector were held by mutual funds of the specified number of firms during the second quarter of 2020. In the case of municipals, for example, the top bar shows that more than 75% of bonds in municipal-bond funds were each held in portfolios managed exclusively by one asset manager. Approximately 16% were held by the funds of two firms, and so forth.

Exhibit 1 Bonds vs. Number of Firms Holding Them in Mutual Funds

Source: Morningstar Calculations, SEC EDGAR. Data as of 06/30/2020.

One of the biggest problems is how to figure out what those bonds are worth when they aren't trading. Bonds fall somewhere in the middle between stocks that trade in frequency measured by milliseconds and privately held assets that may go 20 years without changing hands. If the problem is similar to that of pricing private assets, though, why not just handle pricing the same way?

Price Matters

Whereas a bank with loans on its balance sheet may not need to know their precise prices every single day, investment funds with so-called daily liquidity features can't function without them. Every time an investor purchases shares in a fund or chooses to sell some—activities that open-end mutual funds are required to facilitate every day—the transaction has to be done based on the value of the whole portfolio in which those shares represent ownership.

In effect, it takes something that would otherwise be an accounting entry back into the real world. There are immediate consequences: If the security prices used to calculate a portfolio's value are higher than they should be, investors selling shares will get more than they're entitled to, while those buying shares will wind up paying more, and vice versa. As such, one element of an asset manager's job is to act as a referee for investors coming in and out. That means assuring every investor that even if a fund isn't buying and selling securities in its portfolio every time investors buy or sell fund shares, the prices at which they do so are fair.

There are so many checks and balances that allegations of abuse are extremely few and far between in the mutual fund world, but firms do have some skin in the game. Performance records and fees are inextricably linked to asset prices. However unlikely it may be for an asset manager to nefariously massage prices in order to try and game the recorded value of a portfolio, incentives do exist. Even simply keeping prices from moving around as much as they otherwise might would lessen an investment's record of volatility. That would make it look safer to investors focused on that metric and its overall profile much better to those looking at "risk-adjusted" return measures such as the Sharpe ratio. It's an open secret in the industry that, while it may not be deliberately deceptive, private investment funds trafficking in illiquid markets sometimes generate very modest price volatility belying their real underlying risk. It was fortunately an extreme outlier but keeping prices from moving was a cornerstone feature of Bernie Madoff's fraud. Even less-nefarious pricing errors, if made at a high enough magnitude across a large enough number of holdings, could have meaningful consequences.

An asset manager and a pricing service were accused of tinkering with prices back in 2000. Two Heartland municipal funds were heavily invested in small, nonrated municipal bonds, which had previously delivered generous income and very little price volatility. It turned out that several bonds in both portfolios had endured serious credit problems and defaults but had not been marked down as much as they ought to have been or concurrent with their troubles. When the jig was up, one fund lost 44% in a day, and the other 70%. The SEC eventually settled with both Heartland and pricing-service IDC, finding that the two worked together to hide what was actually happening.

That was clearly an aberrant situation, and the fund industry hasn't seen anything quite like it over the past 20 years. It illustrates the point, though, of how consequential bond pricing can be.

How to Be the Referee

For securities regulated under the Investment Company Act of 1940, which include mutual funds, the ultimate responsibility for determining pricing policies falls to boards of directors. And while those boards normally rely on funds' asset managers to actively oversee and manage the process, both typically delegate the responsibility for pricing bonds to a so-called arm's length actor such as a third-party pricing service. A fund's board and management usually select one or more pricing services to provide information that will be used to value their portfolios every single day.

While it may be the board's ultimate responsibility, fund managers make it their business to know and understand the functioning and efficacy of the services they choose. They want to be sure that a service has access to the best available information about markets for which it is supplying prices, as well as the in-house expertise to use that information. That can be a very tall order.

The bond market is gargantuan and spread across multiple sectors, most of which have subsectors and subsectors of subsectors. And while the definition of a common stock can only be stretched so far, even two slightly different bonds from one issuer that otherwise look nearly the same may have features that differ enough to warrant marking one at half the price of the other.

Regardless of which pricing services a firm goes with, though, there typically need to be backups. The breadth and volume of data that is required—and in a hurry—to strike the NAV for a mutual fund is daunting. Yet there are always bonds for which a price may not show up or that is clearly an error. Each fund has to arrive at a net asset value every single trading day, though, and by that stage there's no time for debate.

That generally means taking prices from a series of services and setting up a so-called pricing waterfall for fund custodians to follow, and then arrive at a price to be used in striking NAVs across all of an asset manager's portfolios.

Comparing the Data

Examining the difference in assigned prices across mutual funds has always been a worthy but difficult endeavor. A fund's annual report is effectively the gold standard for information about a portfolio, but even versions filed electronically with, and available through, the SEC are generally in formats that make analyzing them at the holding level extremely difficult. That information knot is a challenge that the SEC has worked on for years, eventually leading to a 2015 proposal for investment company reporting modernization rules. Among other requirements was the filing of form N-PORT. The rules were technically adopted in 2016 but rounds of adjustments and extended timelines for implementation meant that fund management firms didn't begin filing N-PORT forms until 2019.

The new form can be more truly considered an electronic document than most other SEC filings, and the list of portfolio-specific data that firms must include is more extensive and practical than almost anything they've been required to provide publicly before, including portfolio-level risk metrics that are critical to evaluating fixed-income funds. The data supplied for individual holdings is an especially helpful addition. Morningstar has collected millions of portfolio holdings directly from fund companies over the years, but even when firms go out of their way to be helpful in how they deliver them, many do not provide them in full, or the same way as each other.

The standardization built into the N-PORT framework has been key to making possible the analysis included here. We are now able to more reliably look at and compare bond holdings across funds and their asset managers.

Methodology

In that pursuit, we have examined portfolios from four quarters of data submitted via N-PORT between September 2019 and June 2020. Because funds file their reports based on fiscal-year schedules that do not always comport to the calendar year, some do not submit calendar-year quarter-end data. A very large cross section of the universe does, however, and in most cases for which we discuss pricing differences, we have chosen to look at quarter-end data to capture as many observations on the same dates as possible.

In doing so, we have looked at bonds appearing in U.S. mutual funds classified either as fixed-income or allocation portfolios (which typically hold both stocks and bonds by design) in those quarter-end filings. We then matched them by their identifiers with every other occurrence of ownership across all funds in the group.

The data in N-PORT is prescribed by SEC instruction. As such, there's an expectation that it has been thoroughly scrubbed before submission to the SEC. There are reasons to be cautious, though, particularly in cases where data may be calculated differently from firm to firm. For example, the SEC's instructions stipulate that funds may use "their own internal methodologies and the conventions of their service providers, provided the information is consistent with information that they report internally and to current and prospective investors."

This analysis doesn't rely on data likely to fall under that description, but there is still room for inconsistency. When reporting individual holdings, for example, funds are instructed to provide their value in U.S. dollars, as well as a "balance," and to note whether the latter is expressed in number of shares, principal amount, or other units. Although firms typically report bond holdings in terms of principal amount, some occasionally report the same information but label it as "number of shares." In most cases, such data appear consistent with principal amounts, but we have observed outliers and have eliminated from our datasets securities labeled that way to try to avoid the introduction of errors.

For the purpose of grouping securities more effectively, we have used a variety of Morningstar data sources to assign bonds to credit-quality cohorts. We have also eliminated securities from our dataset for which we were not able to identify a rating. We did not do so, however, for municipal bonds. That sector has a very large number of issues and issuers who have deliberately chosen not to pay third-party agencies for ratings. There are exceptions, but the market generally considers them as high-yield securities and treats them differently than rated issues.

Industry practice among asset managers is to use only one price for a bond, regardless of which or how many of its portfolios hold it. As such, we required not just two different funds to price a bond, but funds overseen by at least two different firms. Since we require at least two firms' funds to hold a bond on a given date, that excludes a large number of bonds—a substantial majority in the case of municipals—that are held exclusively in portfolios managed by an individual firm. We also removed from our analysis bonds whose extreme pricing results appeared likely to have been the product of data-quality issues.

More generally, the filing of N-PORT documents is still a new endeavor, and there may be problems still in need of correction. Our review of the data suggests it to be sound, and we have made efforts to test and validate its accuracy, but we must allow for the possibility that errors in the reporting of some data may have affected our results. (We provide a summary of the number of funds and individual bonds that make up the sample set of our pricing analysis, broken out by sector and credit quality, in the Appendix.)

Although firms are not required to explicitly report the price at which a security was logged for the purpose of NAV calculation, the balance and value data they report can typically be used to impute the price at which it was marked. In general, dividing the figure provided for each bond's value by its balance or amount will produce a percentage result equivalent to the price at which the bond was recorded. For the example in Exhibit 2, we took the value posted for an HCA Inc. bond, divided it by the reported balance, and multiplied the result to get a dollar price consistent with bond-pricing convention.

Exhibit 2 Imputing the Price of a Bond

Issuer	Coupon %	Maturity	Balance (\$)	Value (\$)
HCA INC.	5.88	2029	33,920,000	39,262,400

$$\begin{aligned} (\text{Value}/\text{Balance}) \times 100 &= \text{Implied Bond Price} \\ (\$39,262,000 / \$33,920,000) \times 100 &= \$115.75 \end{aligned}$$

$$\text{Implied Bond Price} = \$115.75$$

Source: Morningstar.

Using holdings data from N-PORT across the universe of bond and allocation funds, we examined sectors that included government bonds, corporate bonds, municipal bonds, nonagency residential mortgage bonds, commercial mortgage-backed securities, collateralized loan obligations, and bank loans.

In particular, we looked at how individual bonds were priced compared with each other, and across firms, market sectors, credit-quality strata, and time. The metric we used was the widest range of a bond's prices as a percentage of its mean average. For example, a bond appearing in funds of three different firms might show its prices as \$100.50, \$100.00, and \$99.50.

Exhibit 3 Calculating a Bond's Price-Spread Percentage

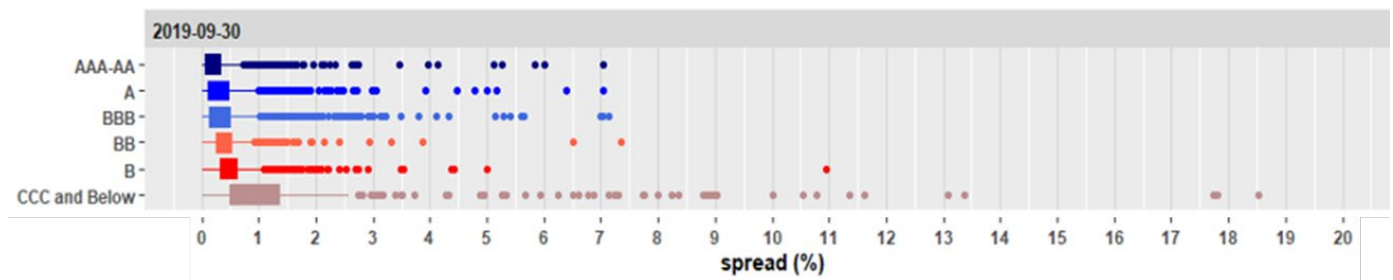
	Dollars
Price 1	100.50
Price 2	100.00
Price 3	99.50
Price Spread (range between highest and lowest price)	1.00
Mean average of all prices	100.00
Price spread as a percentage of average price	1.00%

Source: Morningstar.

As shown in Exhibit 3, our calculation notes that the widest range in price among the three bonds is \$1, their mean average is \$100, and the range value as a percentage of the mean is 1%. (In order to calculate the average, we have used only one price from each firm. This is to avoid a situation in which a firm's price would carry more weight in calculating the average simply because it has many instances of the same bond across its funds.) From now on we will refer to that metric as a "price-spread percentage" or simply "price-spread."

Exhibit 4, and similar examples we've included elsewhere in this paper, use boxes whose left and right sides illustrate where the 25th and 75th percentiles, respectively, fall for the data, a so-called interquartile range, or IQR, of price-spreads, as we've defined them. The thin lines extending to the left and right of the boxes (sometimes referred to as whiskers) represent data in each direction that stretch no more than 1.5 times the range described by the box, while individual dots represent outliers that go beyond that range. Exhibit 4 shows a box-plot example for corporate bond price spreads from September 2019.

Exhibit 4 Corporate Bonds: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR. Data as of 09/30/2019.

Observations

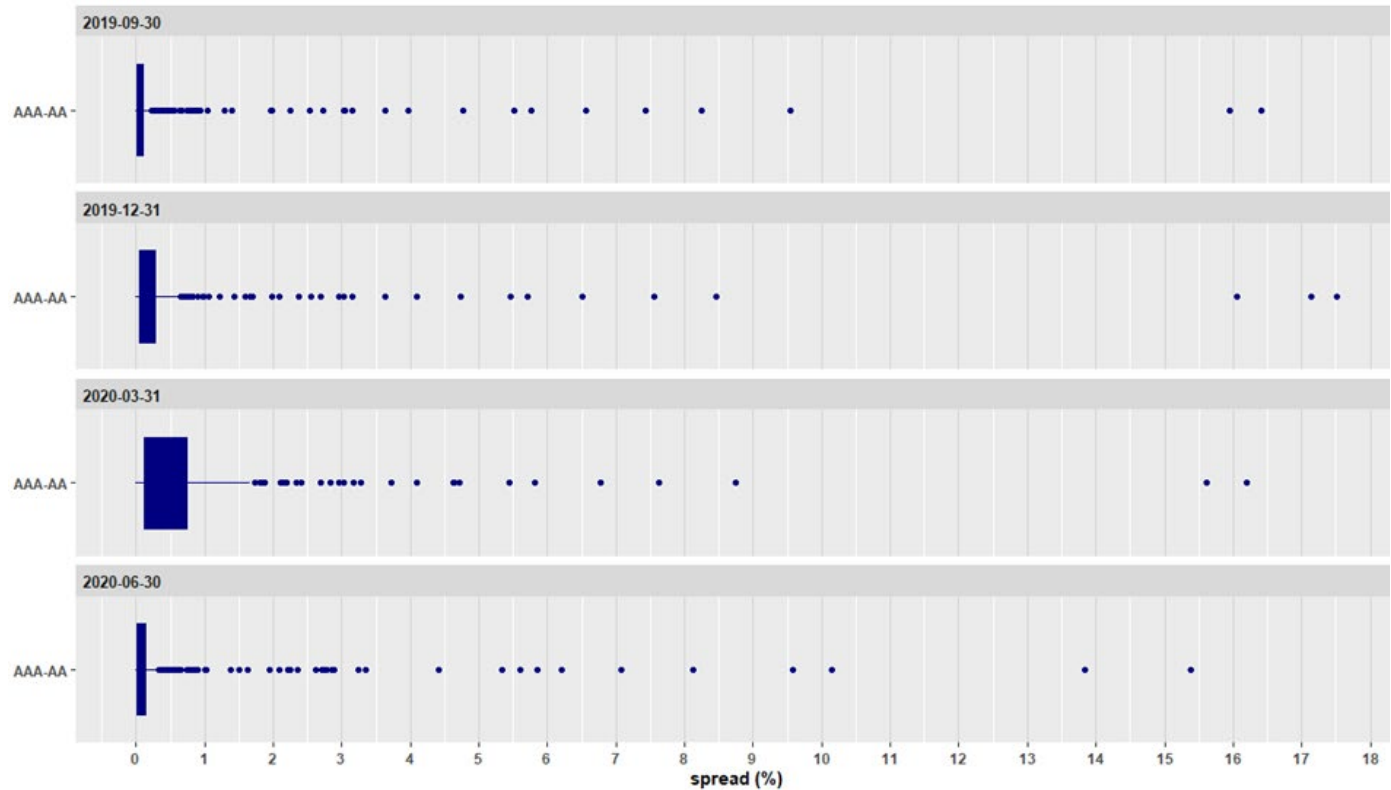
We wholly expected to find dispersion among bond prices. There are simply too many bonds of too many stripes for pricing to be entirely consistent across pricing services and asset-management firms. There are also small differences in practices among firms, such as whether they price bonds based on the bid, ask, or mid-price offered by a service. Such decisions may not create a significant problem but could still

cause some data to skew slightly in one direction or another, particularly at the firm level. Overall, we also expected that the more diffuse a sector in terms of issues and issuers, the more dispersion we would find, and vice versa.

But while that turns out to be the general trend, it's not axiomatic.

For one thing, the first quarter of 2020 was so extraordinary that even U.S. government debt, the world's most homogenous, liquid bond market, had some trouble. Although so-called on-the-run Treasuries that serve as bellwether trading instruments reportedly continued to trade very tightly, one of the alarm bells that sent markets and regulators scurrying was reported widening of bid-ask spreads for off-the-run Treasury bonds, which normally boast tight spreads, as well. That phenomenon was addressed by a variety of steps taken by regulators including the Fed, but we can see that even when pricing bonds at the end of March, the range of price spreads by our measure was fairly wide, and at the high end got close to 1%. (The data excludes TIPS.)

As noted earlier, we examined portfolios that were submitted via form N-PORT at each quarter-end from September 2019 through June 2020, and the four box plots in Exhibit 5 show the spectrum of price-spread percentages among U.S. government bonds across fund portfolios on each quarter-end date. Notably, half of the Treasuries—represented by the blue box—were reported with prices that differed from one another by between 0.1% and 0.7% on March 31, 2020.

Exhibit 5 U.S. Government Bonds ex-TIPS: Price-Spread Percentages by Credit Rating

Source: Morningstar calculations, SEC EDGAR.

Corporate Credit: An Unpredictable Tale

Given the structure and nature of the investment-grade corporate, below-investment-grade (junk bond) corporate, and leveraged (corporate) bank-loan markets, there's a fairly predictable hierarchy in terms of day-to-day trading and liquidity among them. The investment-grade corporate market is comparatively large and liquid; the junk-bond market less so. Historically the leveraged bank-loan market would have been a distant third. The market itself used to be a lot smaller, and loans have features that distinguish them from bonds, not least of which is that loan trade settlement itself can sometimes take several days.

Structural market changes have blurred those lines in recent years. On the bond side, trends in issuance created unusual dynamics, including a dramatic shift in the population of quality tiers of the corporate bond market. Twenty-five years ago, bonds rated AAA, AA, and A comprised between 70% and 75% of that market, with the BBB cohort accounting for between 25% and 30%. Fast forward to today and BBB debt—the lowest tier of investment-grade—now comprises more than half of all investment-grade corporate debt outstanding.

Meanwhile, the junk-bond market trend has mostly been the opposite. For most of the 1990s, single-B debt was the sweet spot in junk bonds. That primacy has effectively flipped since the 2008 financial

crisis. After peaking at a remarkable 25%-plus of the junk market, CCCs' percentage share plummeted, and issuance of BB debt soared. By 2013 that cohort took over as the group's largest. The BB cohort further exploded in size as the coronavirus pandemic triggered downgrades among investment-grade borrowers to junk ratings.

The ultimate outcome has been a remarkable shift. More than half of the corporate bond market—as a whole—is concentrated in its "middle" tiers of BBB and BB debt; 25 years ago, that figure was less than a third. There are structural reasons the two remain differentiated, including requirements for many investors to stick with investment-grade debt. Ultimately, though, concentration in investment-grade issuance has settled closer to its lower rungs as higher-rated companies have consistently taken on more debt, while the bulk of activity in below-investment-grade debt has migrated to its highest-rated strata. Meanwhile, within the past couple of years the BBB range of the market has alone been more than 2 or 3 times the size of the entire junk-bond market.

As for the leveraged bank-loan market, it's nearly unrecognizable from 25 years ago. Whereas the syndication of bank loans for sale to institutional investors was a comparatively niche business back then, they are a central feature of corporate finance today, with loans and junk bonds often forming the backbone of large leveraged buyouts and mergers and acquisitions activity. Even 10 years ago, the loan market was less than half the size of the junk-bond market. The reasons for the shift have a lot to do with changes in the private equity and banking industries, but the size of the bank-loan market now regularly matches that of the junk-bond market.

Those factors likely all played a role in shaping an environment in which price spreads across corporate markets seemed out of character, especially at the end of March 2020. In the weeks leading up to that point, the COVID-19 pandemic hit business sectors very differently, with certain industries imploding while others thrived. That triggered shocks large and small across different parts of both the bond and equity markets and meant that some of the usual rules of thumb, whether related to quality, bid-ask spreads, or just about anything else, were reliable one day and useless the next. Ultimately, corporate bonds had already been digging their way out of the mess by the time March 31 came around, but it was still early days.

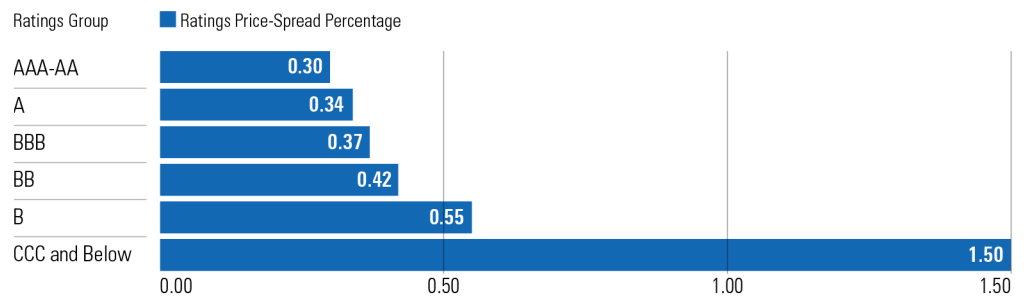
One of the aforementioned rules of thumb says that you'd normally expect individual highly rated corporate bonds to carry prices quite close to each other, so even the earlier example of a 1 percentage point difference would normally be considered a fairly wide range.

Even at the end of September 2019 when things were calmer, though, there were notable price spreads. For example, we looked at corporate bonds with ratings of either AAA or AA whose prices occupied a range of 10 or fewer basis points (0.10%) using the price-spread method we described above (difference between highest and lowest price, divided by average of prices). They comprised approximately 400 bonds appearing at least 1,600 times across different firms' portfolios. Among the other roughly 500 corporate bonds with AAA or AA ratings that we observed, though (showing up at least 3,400 times), the price range was roughly 50 basis points (0.50%).

That may not seem like much. Consider, however, that the Morningstar U.S. Corporate Bond Index returned an annualized 4.5% for five years through the end of 2019. Using the index as a proxy, a price difference of 0.50% for a corporate bond would be equivalent to more than 10% of an average year's returns.

The effect is even more notable when you look across the spectrum of credit ratings in Exhibit 6. In particular, corporate bonds with below-investment-grade ratings generally had price ranges of 0.4% or higher in September 2019, with those rated CCC or lower averaging roughly 1.5%. On a relative basis, the importance of those numbers might have been more muted under a more favorable—read: higher—interest-rate regime, but with market yields at such low levels in recent years, those pricing gaps become more meaningful.

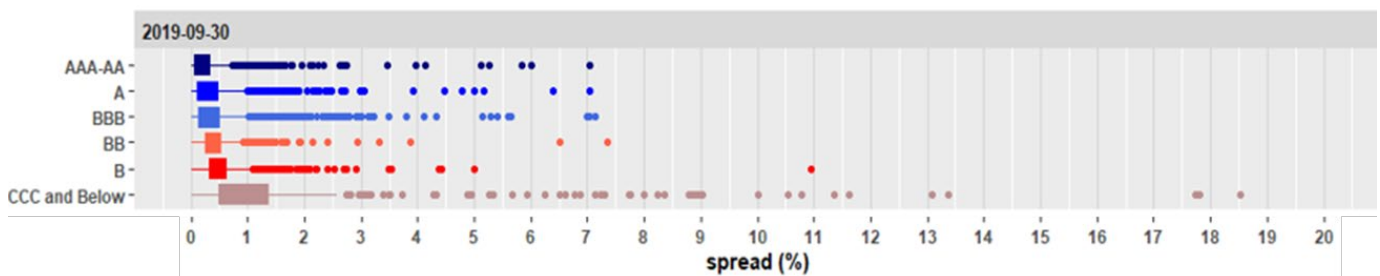
Exhibit 6 September 2019: Average Corporate Bond Price-Spreads by Credit Quality



Source: Morningstar calculations. SEC EDGAR. Data as of Sept. 30, 2019.

The data are averages, though. And while outliers are not rampant, neither are they rare. Even in September 2019, for example, the data for investment-grade bonds show price-spread percentages that cluster in the lower end of the range—but there are numerous examples for which the difference between the minimum- and maximum-observed prices for the same bonds occurred well into the high single digits.

Exhibit 7 Corporate Bonds: Price-Spread Percentages by Credit Rating

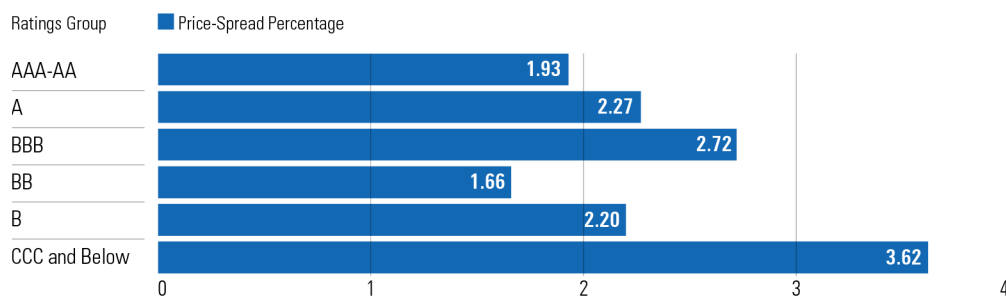


Source: Morningstar calculations, SEC EDGAR. Data as of 09/30/2019.

Although the vast majority of corporate bonds across the credit spectrum saw less-dramatic price gaps, approximately 800 of them, appearing at least 6,200 times in mutual fund portfolios, carried pricing ranges of 1% or more as of September 2019. That was during a decidedly healthy period in the bond market, three quarters into a year during which credit performed well and pricing should have been relatively consistent.

Of course, pricing in early 2020 was anything but. The pandemic-triggered sell-off that began in late February sent a severe shock through nearly every layer of the bond market. That shock was shorter lived than many others of the past given how aggressively the Fed and Treasury responded, and many markets began to recover in late March. Even so, data from the end of the month provided a snapshot of how shaken and disjointed markets remained.

Exhibit 8 March 2020: Average Corporate Bond Price-Spreads by Credit Quality



Source: Morningstar calculations. SEC EDGAR. Data as of March 31, 2020.

Note that the scale for Exhibit 8 is different from that in Exhibit 6 because the pricing range as of March 2020 for every credit cohort was many times its September 2019 size.

It's clear that there were odd things going on given that the price spread ranges don't neatly increase from higher- to lower-quality cohorts. There are a handful of possible explanations, not least of which is that the sample sizes are quite disparate, with many fewer bonds per cohort as you go down the quality ladder. The sell-off didn't treat all bonds equally either, though, as so much uncertainty about the paths of the pandemic, the U.S. Treasury, the Fed, and congress pushed different parts of the market around in one direction or another, sometimes daily. Over the course of the first few weeks of March, for example, investment-grade corporates plummeted more than 15% in just nine days, while high-yield debt, which also lost plenty for a time, did so more gently over a longer period.

Against that backdrop, it's not surprising to see the differences in price dispersion at the end of that month. Of the nearly 5,000 corporate bonds in the BBB rated cohort at the end of 2020's first quarter, the average bond was held in portfolios run by at least eight firms, and price spreads among them averaged more than 2.5 percentage points.

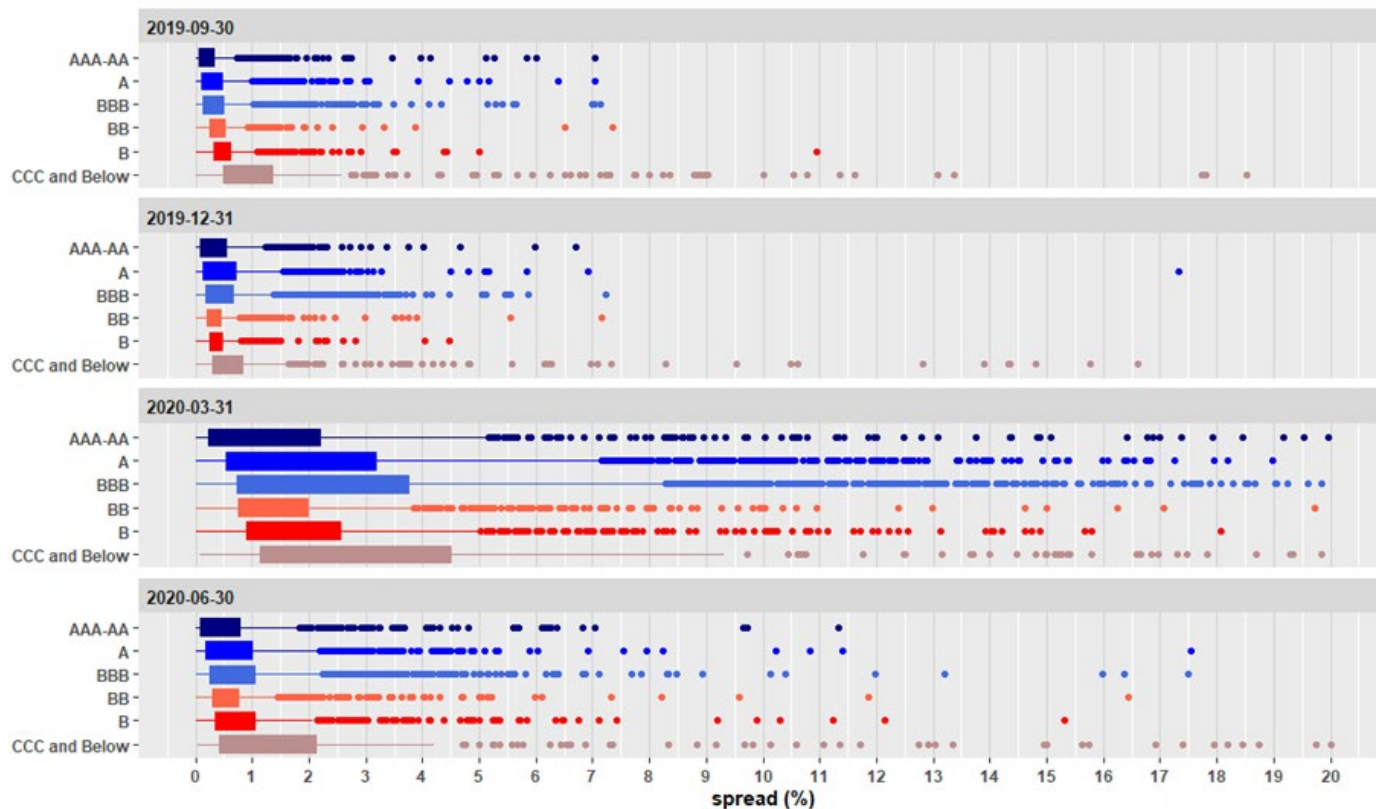
The yawning spread range for BBB bonds is unusual but not entirely surprising given the environment leading up to, and the evolution of, the sell-off. The BBB market cohort had outsize growth in recent

years as investors foraged for as much income as they could acquire without dipping below the investment-grade floor, and issuers found themselves able to take on leverage at relatively modest interest rates. That risk-taking didn't slow the market down, though. BBB corporates were on fire in 2019, gaining roughly 16% that year, and close to 3% in early 2020 before the COVID-19-triggered sell-off. Once that began in early March, BBB corporates, on average, gave back all they gained in 2019 and then some over the course of just a few weeks.

Regardless of the ratings cohort, it's clear that the market's panic did more than simply drive prices down. As unusual as the data in Exhibit 8 appear, those in Exhibit 9 really tell a story of how extreme pricing uncertainty became. By the end of March 2020, huge swaths of corporate debt were being priced all over the map from one firm to another, with large groups of bonds showing price-spread percentages in ranges of between four and nine percentage points and still numerous outliers pricing even wider than that.

It's also worth noting that while equity markets have more than recovered since the March 2020 period, several elements of the fixed-income market were slow to do so, and the breadth of pricing ranges among corporate bonds that still remained at midyear appeared to reflect that. Exhibit 9 shows data for all four of the calendar quarters through June 2020.

Exhibit 9 Corporate Bonds: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

As alluded above, the bank-loan market, while much more tightly tied to the junk-bond world than it used to be, still has meaningful differences—the most basic of which is that loans aren't actually securities as they're most commonly defined. That has a variety of implications, but the most notable is probably that they don't fall under the same regulatory schemes that govern securities at both the state and federal levels in the United States. As such, the loan market hasn't been forced to tighten its trading-settlement norms in the same way as is required for other instruments, including stocks and bonds, which must trade with T+2 settlement, meaning that payment for and delivery of securities is required to occur two business days after the day a trade occurs.

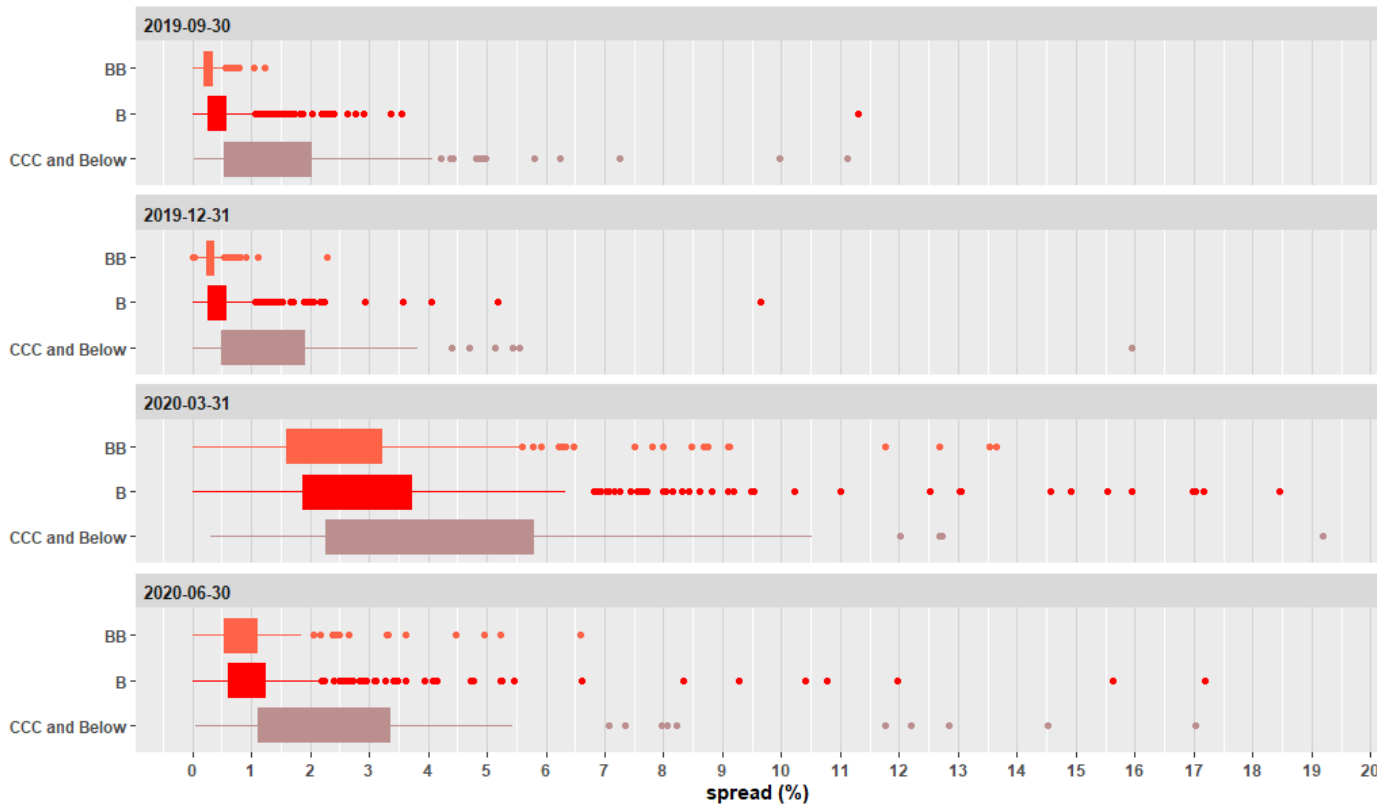
Players involved in that market have successfully pushed Wall Street to get bank-loan settlement much closer to that of securities markets in recent years, but loan settlements can occasionally stretch out for days and even weeks. That alone changes the playing field, and if nothing else it reduces the audience likely, or even able, to purchase loans.

Another important factor is that collateralized loan obligations, or CLOs, have grown to be a voracious consumer on the demand side of the loan market. That serves the latter well in many ways, but it also means that once CLOs snap up large swaths of new loan issuance, those loans generally stay on the books of CLOs until they are repaid, refinanced, or sold because of trouble.

For those and other reasons, bank loans don't usually generate as much trading volume as many other sectors, including corporate bonds. Secondary loan-market trading totaled around \$750 billion in 2019, for example, while high-yield corporate bonds traded somewhere around 3 to 4 times that number.

The trends across ratings groups tend to track each other in direction and proportion, even in cases for which the sample set was fairly modest. At the end of March 2020, for example, there were approximately 380 corporate bonds rated CCC and lower, which were priced by different firms approximately 1,250 times. By contrast, the same observations among bank loans were around 90 loans and 200 pricings. Yet, the interquartile range of prices for corporate bonds rated CCC and below at the end of March 2020 was approximately 1.2% to 4.5%, while that range came out between approximately 2.2% to 5.7% for loans in the same ratings cohort.

Exhibit 10 Leveraged Bank Loans: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

Securitized Debt: A Multi-Climate Ecosystem

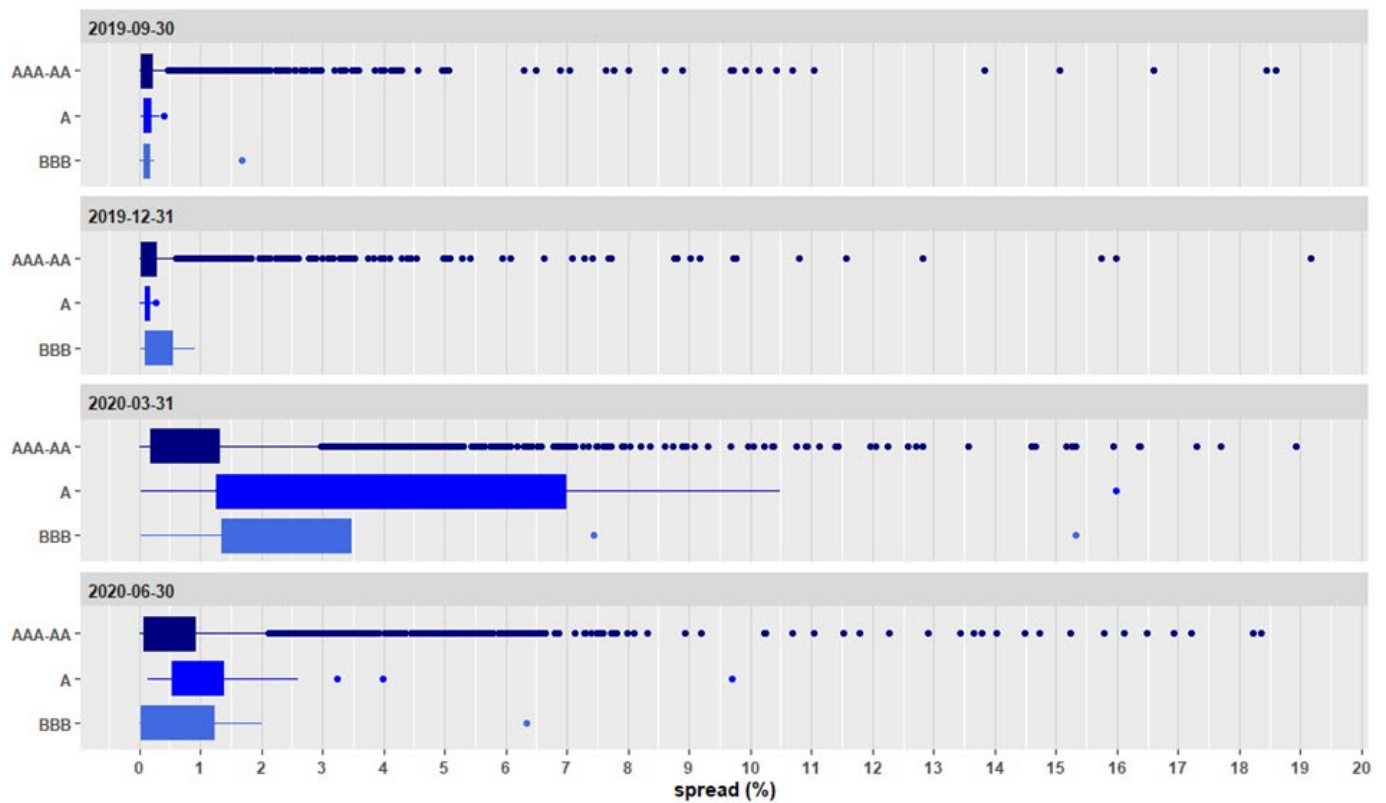
The universe of securitized debt is heterogenous. Wall Street has figured out ways to package and sell just about anything and everything in tranches of securitized bonds. The various kinds run the gamut from basic structures with gilded collateral such as government-agency mortgages guaranteed by Ginnie Mae, Fannie Mae, and Freddie Mac, to asset-backed securities holding subprime auto loans, to the nonagency residential-mortgage securities whose failings brought the global financial system to its knees during the 2008 financial crisis.

When it came to prices in the government-agency mortgage market, though, they didn't offer as many surprises as we found elsewhere. Note that the next chart contains data for both government-guaranteed agency mortgage-backed securities and a small cohort of so-called credit risk transfer securities issued by Fannie and Freddie that do not carry their guarantees. Comparatively speaking, that market is still small, with somewhere around \$50 billion in securities outstanding. In part because they're relatively new, and even more so because many asset managers consider them vulnerable to

trouble given their issue sizing and capital structure placement, CRTs are still not widely held by mutual funds, whereas the opposite is true of guaranteed agency mortgages.

As such, the AAA-AA cohort is far and away dominated by agency-guaranteed pass-through securities, generally to the tune of 3,000 to 5,000 individual bonds with more than 10,000 observations, at each quarter-end. There are a handful of highly rated CRTs in the sample that generally carried pricing spreads wider than those in the guaranteed cohort, but the rest comprise the small groups of A and BBB rated securities, of which those held by at least two firms numbered between 20 and 30 with between 60 and 80 observations.

Exhibit 11 Government Agency Mortgage-Backed Securities: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

That said, even interquartile price spreads for the AAA-AA cohort went near or over the 1% mark in March and June 2020. It's worth noting, though, that even within the large body of mortgages held in mutual fund portfolios, many are pools that began with larger principal balances that have since dwindled as homeowners have paid off or refinanced their loans. Meanwhile, of mortgage bonds priced by at least two firms on a given date, the average bond we observed was still held by only 2.6 firms. It's reasonable to assume that such dispersion and differentiation has had some effect on pricing.

Moreover, a big portion of liquidity and trading in the government-agency mortgage universe resides in the so-called TBA market. TBAs are effectively forward contracts for mortgage pools that work a lot like futures contracts. They are standardized and even more easily traded than actual mortgage-backed securities, which attracts investor interest and activity. So, despite the massive size of the agency mortgage market itself (approximately \$9 trillion outstanding), a great deal of actual buying and selling occurs in the TBA market, which traded more than \$230 billion per day on average in 2019, as compared with around \$20 billion for actual mortgage-backed securities.

Wrap it up, I'll Take it: CLOs

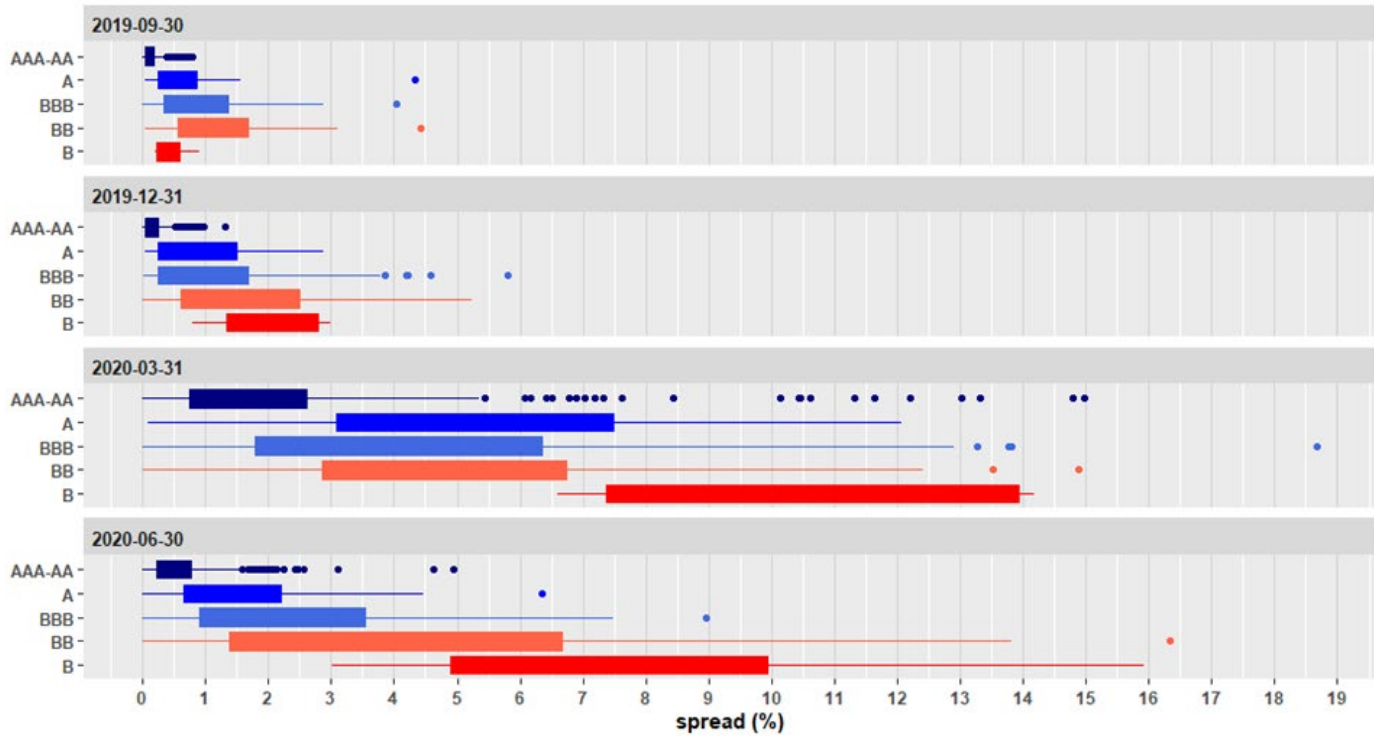
The past couple of years have also been a high-profile time for CLOs. Cracks in the underlying bank-loan market have been a major culprit. One reason has simply been the explosion of loan issuance. The underlying leveraged-loan market has grown to roughly \$1.2 trillion, up from a post-crisis low of around \$500 billion in 2010. Among the numerous reasons has been pull from the CLO market itself, which has absorbed huge chunks of loan supply in recent years.

Morningstar research from 2019 noted that large institutions in Japan had been voracious buyers whose demand has historically been critical, particularly at times when issuance has waned. Japanese banks have at times reportedly been responsible for buying as much as half to three fourths of new AAA CLO issuance. Estimates of their holdings diverge depending on how the market is sliced up, but 2019 data from the Nikkei Asian Review suggested that a subset of five Japanese banks alone held somewhere between 15% and 25% of outstanding CLOs. Whenever questions arise about whether and how much they're planning to buy in the new issue market, deal flow reportedly slows to a crawl.

Most CLO investors are considered buy-and-hold types—including the Japanese banks—and it had been an open question how well the secondary market for CLOs would fare in a market crisis. Trading among CLOs was already relatively light when compared with other bond-market sectors. The data are fragmented, but depending on which metrics or sources you use, daily trading has historically run somewhere between \$75 million and \$150 million per day in recent years.

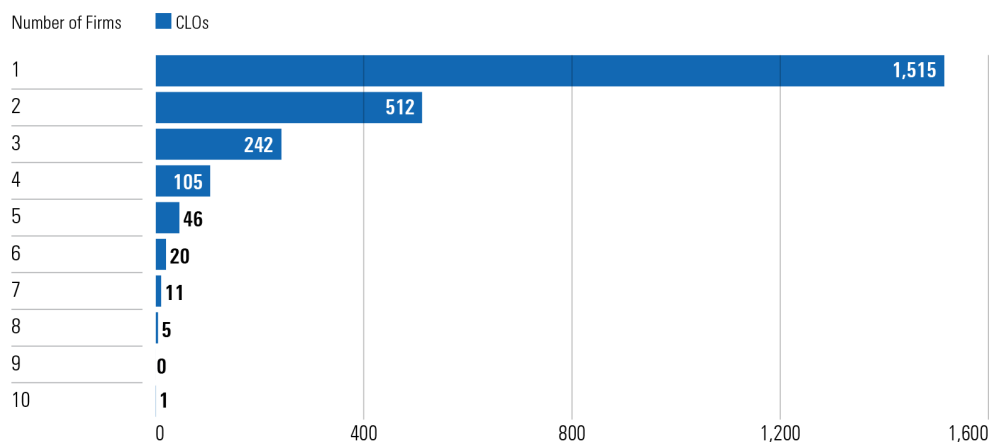
The good news for the sector is that however dark the clouds may have become as the COVID-19 crisis worsened, government support of the market—and in many cases simply the expectation that the government would help—eventually did. And though new issuance reportedly plummeted, investors were also said to have traded existing paper in the absence of new deals. Even then, however, CLO trading is a drop in the bucket when compared with many other sectors. It's generally tracked via so-called BWIC activity (bids wanted in competition), and in 2019 those figures reportedly totaled somewhere between \$30 and \$40 billion—for the entire year. Still, pricing spreads for AAA and AA CLOs didn't expand as jarringly according to March 2020 portfolio data as one might have expected.

Exhibit 12 CLOs: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

There are a few possible explanations, but one notable issue, illustrated in Exhibit 13, is that the majority of individual CLO tranches in mutual fund portfolios in mid-2020 were held in portfolios run by no more than a single firm each. That, combined with the size of the market, supports SS&C GlobeOp published data suggesting that a relatively small number of pricing services garner sufficient patronage from asset managers to be leaders in the space. Under those circumstances, it stands to reason that prices might cluster together more tightly than for much larger markets with bonds held more widely across firms.

Exhibit 13 Individual CLO Securities vs. Number of Firms Holding Them in Mutual Funds

Source: Morningstar calculations. SEC EDGAR. Data as of June 30, 2020.

The other good news for most mutual fund investors is that CLO tranches rated below AAA and AA, while more common in portfolios a few years ago, were much less prominent leading up the early 2020 sell-off. Those mid- and lower-rated tranches were especially hard-hit when the trouble began but comprised only around a tenth as many assets as AAA and AA rated CLO tranches across portfolios in December 2019. So, while price-spread percentages looked pretty awful for mid- and lower-quality tranches in both March and June 2020, most fund investors had little exposure to them.

Private Property: Nonagency Residential Mortgage-Backed Securities

The market for nonagency residential mortgages is an odd duck. For one thing, the residential mortgage-backed securities, or RMBS, sector is heavily populated by so-called subprime mortgage and home-equity loans that were originally made before the 2008 financial crisis. The underlying collateral for many of those pools has seasoned to the point that the most troubled loans have left their pools one way or another, often leaving behind those whose home equity, and loan-to-value ratios have improved in concert with property values and the housing market as a whole. And though there are only a modest number of newly issued nonagency residential mortgage-backed securities with recent vintage, healthy loans, there are also securities with so-called re-performing or even nonperforming loans included in the mix.

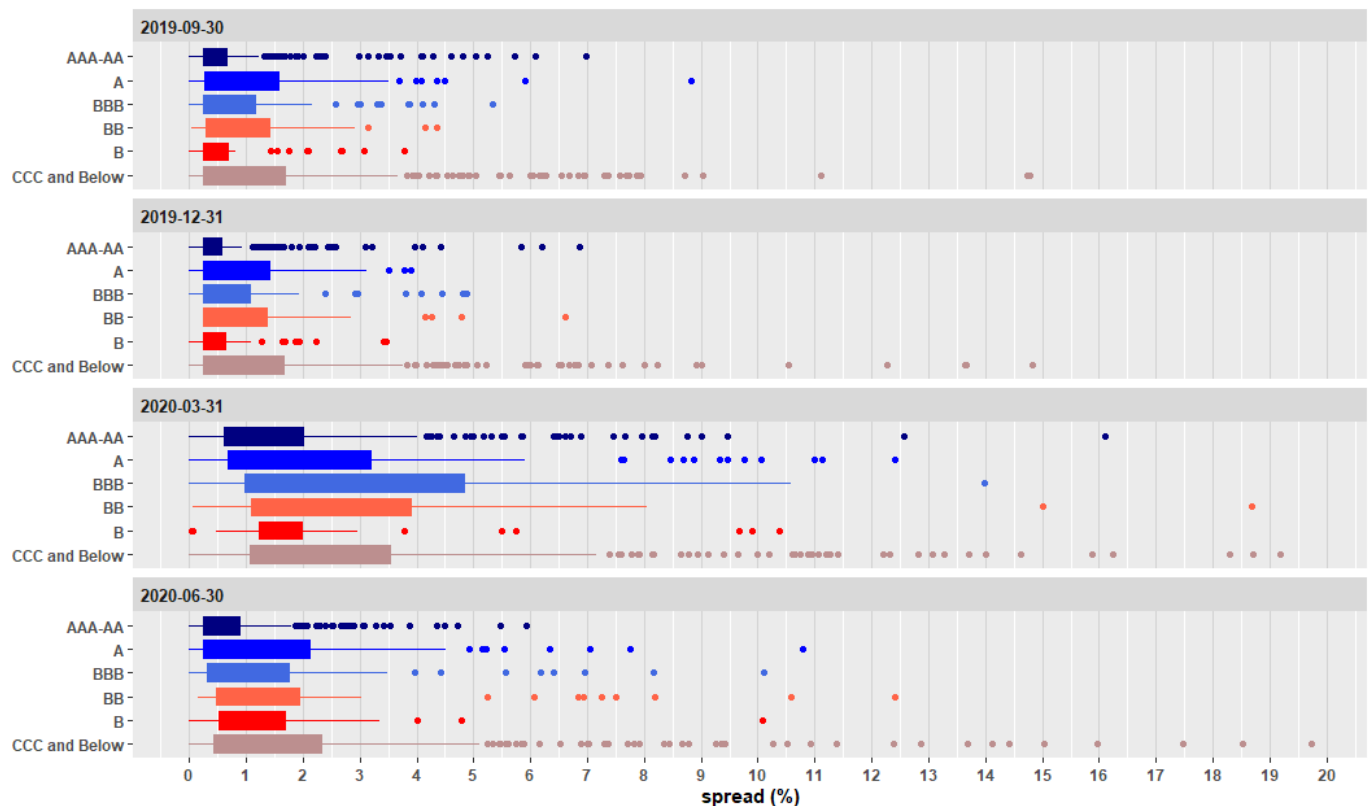
The sector harbors an additional, unusual diversity. The "legacy" securities that were originally created before the 2008 crisis and have remained in the same structure ever since, for example, may have started out as very senior AAA rated tranches, were likely downgraded or even technically defaulted during the crisis (even in the case of only small losses, a AAA security can be considered defaulted) and may have never been re-rated or upgraded. So even in the case of a security that is today considered much safer given the health of its collateral pool and the security's placement in its capital structure, it may still carry a low rating that was never revised. In fact, most mutual funds invested in this sector stick

almost entirely to its highest-priority tranches, which may still cluster in our data with the cohort of those carrying ratings of CCC and below.

By contrast, some legacy underlying loans have been repackaged into newer securities with recent issuance dates that may have more up-to-date and thus higher letter ratings. The same may be true of re-performing loans that as well have been packaged up into nonagency securities. As such, assignment to ratings buckets for bonds in our dataset with very similar collateral may be somewhat idiosyncratic. It's not surprising then that the price-spread trends overall were idiosyncratic as well, such that trends down the ratings ladder appear "normal" at some points and less so at others.

Meanwhile, principal balances for legacy collateral have continued to fall — by most accounts around 15% per year — likely leaving somewhere between \$300 and \$500 billion in outstanding principal depending on how it's counted. Legacy securities have become much more difficult to find and don't trade that often as a result. That lack of turnover, the small concentration of investors, and the fact that many rely on a small number of pricing services with expertise in the sector, may help explain why the sector's March 2020 price spreads didn't gap out as widely as those of other ratings and sectors.

Exhibit 14 Nonagency Residential Mortgage-Backed Securities: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

Commercial Mortgage-Backed Securities

Commercial mortgage-backed securities while similar in name and payment-order structure at a high level, usually have very different dynamics than those backed by residential loan collateral. Some are the result of loan-level structural elements. Most commercial mortgages are made for 10 years, for example, and carry prepayment penalties during an early lockout period of at least a few years. That stands in contrast to residential mortgage loans that are often written for 30 years with no prepayment penalties. The most important difference, of course, is simply that CMBS are backed by commercial properties, which can span a range of sectors, including those tied to office, retail, lodging, and industrial space. (There's also a segment backed by multifamily housing projects, many of which carry government guarantees.)

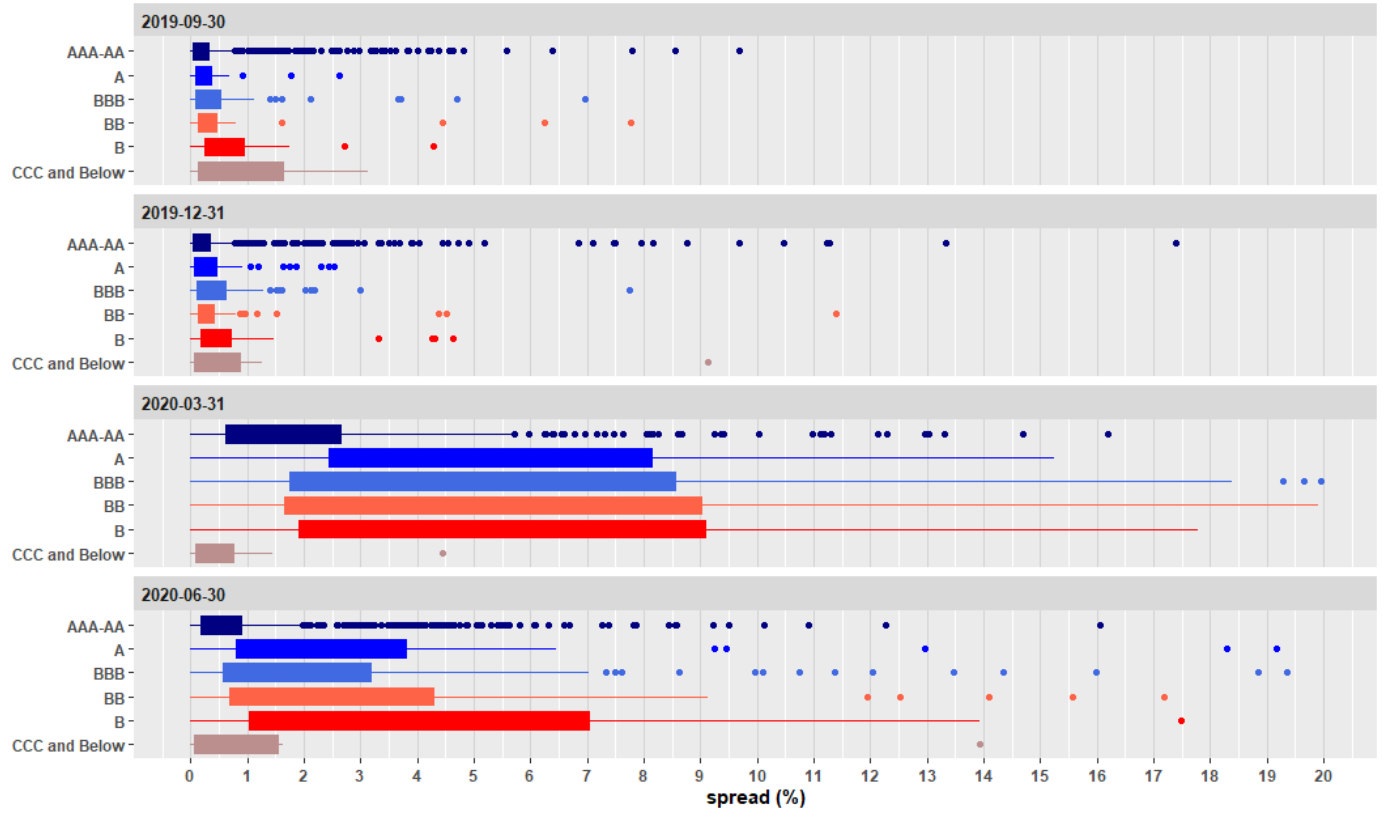
Another critical feature of the CMBS cohort is its ratings distribution. Unlike the RMBS group, which is barbelled across credit grades, the CMBS group is concentrated at the AAA-AA level. In fact, that AAA-AA count rose notably to roughly 950 bonds as of June 2020, from 600 as of September 2019. Meanwhile, the mid-quality and below-investment-grade tier counts were fairly similar in size and distribution, except in the case of CCC and below. Compared with an RMBS CCC-and-below cohort of more than 400 bonds, the bottom-rated CMBS group was never more than 10 bonds.

Although it's difficult to make definitive comparisons between RMBS and CMBS as a result, comparing their price spreads from before and after the March 2020 COVID-19 sell-off underscores the difference in bondholder treatment of securities backed by home loans and those populated by loans to businesses with more specific economic relationships.

In September and December 2019, for example, the interquartile range of price spreads for RMBS extended as far as the 1.5% or 2% level down the credit ladder. The IQRs were generally much tighter for CMBS. That sector's price spreads among bonds with ratings between single A down to single B blew out much wider than for RMBS after the COVID-19 crisis hit, though, with yawning IQRs that spanned from 2% to 9%.

That makes intuitive sense given tremendous uncertainty over the future of the lodging and retail sectors (including malls), and even that for office space, as the pandemic surged. And while price spreads improved by the end of June, they remained notably wide even then.

Exhibit 15 Commercial Mortgage-Backed Securities: Price-Spread Percentages by Credit Rating

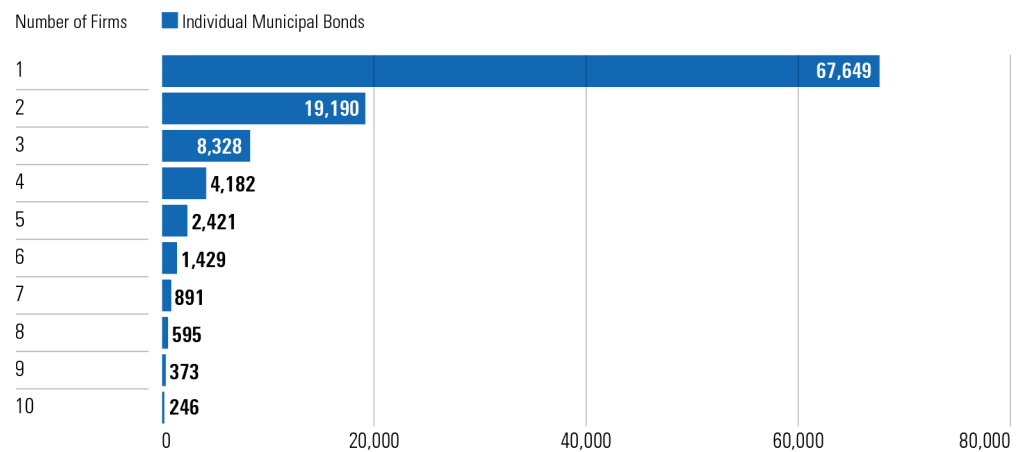


Source: Morningstar calculations, SEC EDGAR.

Municipals

Data for municipal bonds is difficult to unpack for a number of reasons. One overarching issue is that as we noted earlier, the vast majority of municipal bonds held in mutual funds are held exclusively in the funds of no more than a single firm each. As such, those bonds have no other prices against which to be compared. In other words, only around 20% of municipal bonds in the fund universe wind up in our analysis. Moreover, the majority of *those* bonds are held in the portfolios of only two asset managers.

Exhibit 16 Municipal Bonds vs. Number of Firms Holding Them in Mutual Funds

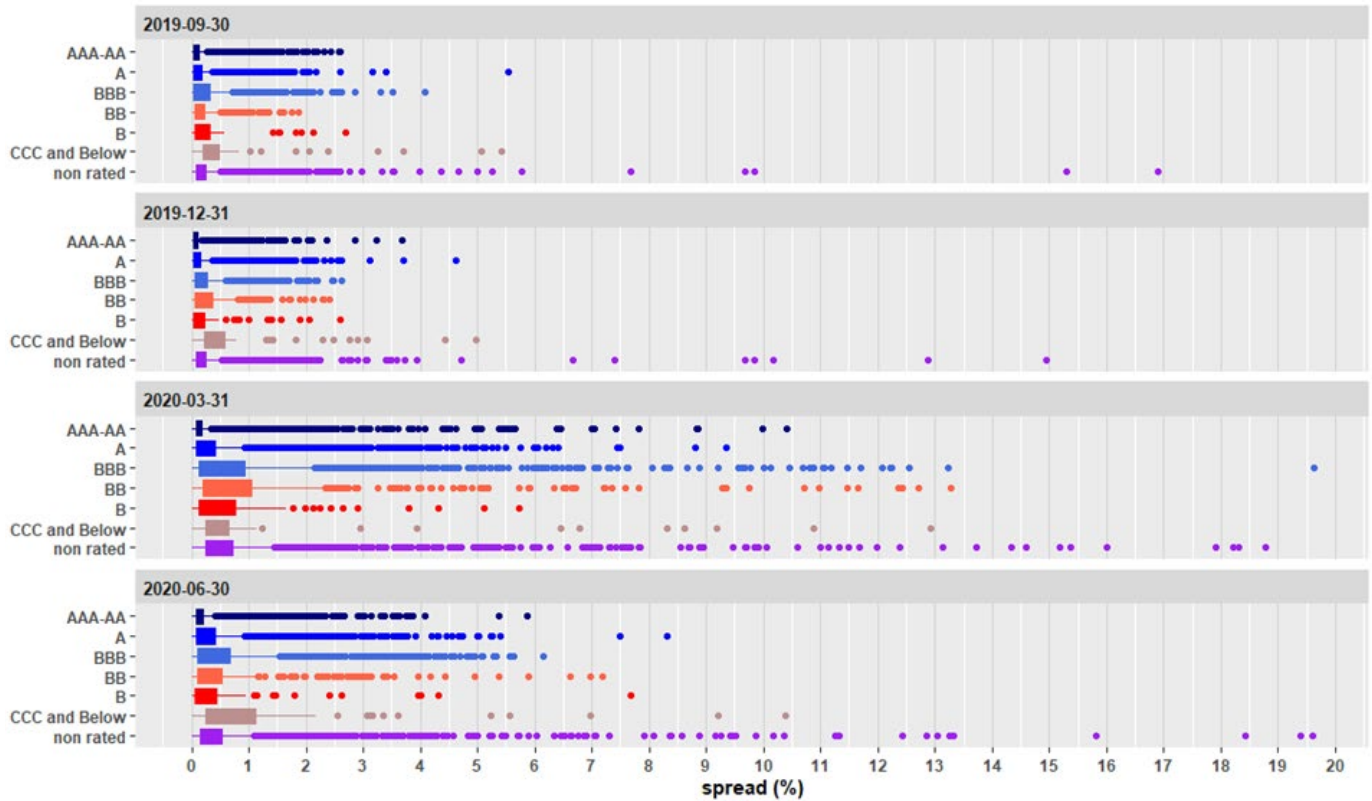


Source: Morningstar calculations. SEC EDGAR. Data as of June 30, 2020.

That makes sense given the nature of the municipal bond market. It is home to bonds issued by thousands of municipal authorities, and by extension, many thousands of projects or facilities that receive debt financing through one of them. The contrast between corporate bond and municipal bond indexes illustrates the point. Depending on their rules, the former generally have fewer than 10,000 issues; broad municipal-bond indexes may easily have 40,000 or 50,000. What's more, a broad muni index may comprise bonds with a value of \$1 or \$2 trillion, while a broad high-grade corporate index—with a fifth of the number of bonds—may represent a market of \$8 to \$10 trillion.

In Exhibit 17, the overall range of price-spread percentages is relatively consistent with what we have seen for other sectors when you include outlier bond prices. Yet interquartile ranges by quality cohort nearly all stayed inside of 1%, even at the end of March 2020.

Exhibit 17 Municipal Bonds: Price-Spread Percentages by Credit Rating



Source: Morningstar calculations, SEC EDGAR.

There are a variety of other reasons that may contribute to the higher homogeneity of pricing we see in the municipal dataset. The landscape of pricing services has changed quite a bit in recent years, but that has been especially true in the municipal space. For many years, asset managers favored two pricing services, but after each was acquired by other companies, both were eventually purchased by a third. That left room for others to enter the market, but among mutual funds there are still just two dominant pricing services. There do appear to be at least one or two juggernauts on the taxable side as well, but managers have noted that they often use a mix of additional pricing services to handle various taxable sectors in which they have a particular competence.

The nature of municipal-bond portfolio management itself may be a factor. Most funds are run with tax efficiency in mind, and that usually means one of a couple of different styles. Some firms put a lot of emphasis on tax-lot management and offsetting gains and losses with very targeted trading, for example, while others may simply not trade very much at all. In either case, it usually means less buying and selling. And though overall trading data for the municipal market shows volumes that are at least as large as for many taxable sectors, that trading is relatively diffuse and municipal-bond funds tend to have lower turnover, on average, than taxable portfolios. Even if you throw out 300 of the highest

turnover taxable-bond funds in Morningstar's database (in order to minimize the impact of those that use futures and forward contracts that can inflate turnover statistics), the average taxable fund still logged more than 60% annual turnover. By contrast, the average municipal-bond fund's turnover came in around 33%.

When you combine that difference with the large number of bonds that are not widely held to begin with, it suggests that a comparatively large number of municipal bonds in fund portfolios aren't being traded by their funds and are not likely trading elsewhere, either. The second element is important because it may explain why exogenous activity may not be influencing prices for fund-held municipal bonds quite as often as it does in some of the taxable sectors we've examined.

A Work in Progress

We have also embarked on a review of price-spread deviations as they occur by firm. We do that at the sector level on a given date by looking at every bond held in at least one portfolio at a firm (whose fiscal year syncs with calendar quarters), that is also in a portfolio managed by at least one other firm. We then run our price-spread analysis for each of those bonds and average them by firm, further weighting the results by the magnitude of exposure we found for each bond.

As with our other analyses, that means bonds are not included if they did not appear in the portfolio of any fund with a fiscal schedule lining up with calendar quarters. And here, too, we do not use prices in cases for which a firm listed a holding's principal balance in shares rather than dollars, with a goal of ensuring that the pricing data we derive has not been corrupted by ambiguous unit labeling. We present a sample of data below, using this method for corporate bonds. (Each group of four bars represents data spanning the four quarter-end dates from September 2019 through June 2020.)

Exhibit 18 Corporate Bonds: Weighted Average of Firms' Price-Spread Deviations



Source: Morningstar calculations, SEC EDGAR.

The data represent a selection of larger firms with bonds that meet the criteria above. In other words, the data and charts herein are a snapshot of trends we've observed, but they may not match what we would see looking at the entirety of a firm's bond inventory. Moreover, we are only including here a look at the corporate bond landscape, with plans to further refine and examine additional data as we observe new quarters of published N-PORT data.

Given the levels of dispersion we observed at the bond level for corporate debt, it was reassuring to see that the averages for most firms' prices were relatively modest. Although Exhibit 18 displays weighted averages, the same was generally true on a nominal, mean-average basis, as well. The widest average pricing spreads for any firm, at any of the four quarter-end dates we examined, were approximately 0.50%. Those which approached that level meanwhile, either positive or negative, were all as of March 31, 2020.

Conclusion

On the whole we consider our results to be noteworthy for the fact that individual bond prices used by mutual fund complexes appear to differ much more widely and distinctly than we would have expected—even during periods of relative calm—given the modest handful of mainstream third-party pricing services generally used by most mutual fund complexes. Nearly every portfolio manager we cover has agreed that the early 2020 trouble was one of the most unusual bond sell-offs in decades. The pricing data we were able to glean using form N-PORT has truly underscored that. The uncertainty surrounding bond prices in periods of severe market stress, such as the onset of the COVID-19 pandemic, can be extraordinary.

In isolation, that observation might be alarming. As a reminder, though, it is one made at the level of individual bonds within discrete sector cohorts, and that effect appears to be mitigated when looking at bonds grouped by the firms in whose portfolios they are held. Those results are preliminary but suggest that the phenomenon may not be as extreme when examined on a firm-by-firm basis.

We do not view these studies as the end of an exploration but rather a beginning. Form N-PORT will provide a variety of items offering additional opportunity for investigation. There are a number of lenses through which to do so, and the march of time will provide more datasets. For starters, we expect to further examine trends in bond pricing across firms, in similar fashion to the exercise reflected in Exhibit 18. We will also seek to learn whether there is useful information to be gleaned by examining pricing data down to the fund level. Although pricing decisions themselves are typically done at the fund-complex level, it is still possible that concentrations among bond sectors or types may render some individual funds more susceptible to skewed pricing than others.

Ultimately, we do not view our results thus far as definitive, but rather as useful guides to further exploration. ■■

Appendix

Exhibit 19 Number of Mutual Funds Used in Price-Spread Analysis

Date	Taxable and Allocation	Municipal
September 30, 2019	1,277	214
December 31, 2019	1,425	212
March 31, 2020	1,638	222
June 30, 2020	1,648	224

Source: Morningstar calculations. SEC EDGAR. Data as of June 30, 2020.

Exhibit 20 Number of Individual Bonds Used in Price-Spread Analysis

Ratings Group	Corporate Bonds	Bank Loans	CMBS	RMBS	CLOs	Agency MBS	US Govt Bonds	Municipal Bonds
September 30, 2019								
AAA-AA	898	—	613	322	343	3,476	419	2,646
A	3,222	—	64	108	27	21	—	2,710
BBB	4,935	—	84	73	117	9	—	1,831
BB	1,389	233	52	48	41	—	—	538
B	930	551	32	58	3	—	—	122
CCC and Below	436	105	7	426	—	—	—	108
NR	—	—	—	—	—	—	—	2,441
December 31, 2019								
AAA-AA	911	—	693	350	364	3,613	432	2,834
A	3,223	—	76	101	35	30	—	2,842
BBB	4,918	—	105	60	120	12	—	2,082
BB	1,407	236	65	44	49	—	—	567
B	937	579	38	49	4	—	—	121
CCC and Below	428	102	9	424	—	—	—	117
NR	—	—	—	—	—	—	—	2,465
March 31, 2020								
AAA-AA	876	—	912	354	377	5,218	416	2,965
A	3,195	—	71	116	39	29	—	2,911
BBB	4,915	—	98	59	131	12	—	2,148
BB	1,483	238	63	41	51	—	—	573
B	959	564	34	45	4	—	—	113
CCC and Below	378	111	8	424	—	—	—	95
NR	—	—	—	—	—	—	—	2,595
June 30, 2020								
AAA-AA	823	—	957	342	427	5,109	382	3,010
A	3,075	—	77	119	44	33	—	2,983
BBB	4,791	—	96	61	134	12	—	2,161
BB	1,456	229	67	48	53	—	—	558
B	931	564	36	46	4	—	—	114
CCC and Below	347	94	7	441	—	—	—	92
NR	—	—	—	—	—	—	—	3,046

Source: Morningstar calculations. SEC EDGAR. Data as of June 30, 2020. U.S. Government Bonds do not include TIPS.

References

CBOE US Equities Market Volume Summary data

FINRA Trace Fact Book, FINRA Transaction Information

Investment Company Act of 1940

JPMorgan, CLO Liquidity in the Time of Social Distancing (Redux), June 12, 2020.

JPMorgan, MBS Credit Monthly, November 2020.

Kakouris, R. 2020. "US leveraged loan market wraps 6-month trek from COVID lows to positive returns."

S&P Global Market Intelligence. Sept. 21, 2020.

Kirschner, v. JP Morgan Chase Bank, N.A. et al. S.D.N.Y. 2020.

Jacobson, E. "Lessons From the Heartland." *Morningstar*. Dec. 28, 2000.

Morningstar Indexes

Municipal Securities Rulemaking Board, quarterly statistical summaries.

SEC administrative proceeding, *In the Matter of FT Interactive Data*, Dec. 11, 2003.

SEC administrative proceeding, *In the Matter of Heartland Advisors, Inc.*, and others. Jan. 25, 2008.

SEC Form N-PORT

SEC Investment Company Reporting Modernization Rule, Federal Register vol. 82, No. 239, 2017.

Sierra, M. 2019. "Leveraged Loan Market Size Doubles in 10 Years." *Reuters*. Dec. 23, 2019.

SIFMA: US Corporate Bond Trading Volume data

SS&C Blog. "Evaluating the evaluations vendors: benchmark study." Aug. 9, 2019.



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