Benchmarking the Effects of the Fed's Secondary Market Corporate Credit Facility Using Yankee Bonds*

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Abstract

We use foreign issuer "Yankee" bonds to benchmark the impact of the Federal Reserve's Secondary Market Corporate Credit Facility (SMCCF) on bonds of US issuers. The SMCCF announcement reduced the relative yield spreads on short-maturity US investment-grade bonds which were targeted by the facility. Yet it also decreased the relative spreads on US long-maturity AA- and A-rated bonds. Moreover, spreads on US BB-rated bonds rose, indicating that the SMCCF harmed these bonds. Using the Amihud measure and bond-CDS basis as proxies for illiquidity, we find that the SMCCF changed both the illiquidity and default risk components of US bond spreads.

Key Words: Federal Reserve Secondary Market Corporate Credit Facility; Yankee Bonds

JEL Codes: G12; G18

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1. Introduction

From late February to mid-March of 2020, news of the spread and severity of the COVID-19 virus shocked financial markets. U.S. equities, as measured by the S&P500 stock index, lost almost one-third of their value while fears of corporate defaults rose. Falato, Goldstein, and Hortaçsu (2021) document that during this period there were unusually large outflows from corporate bond mutual funds and exchange traded funds (ETFs), particularly from funds that held relatively illiquid bonds. Many corporate bond dealers were overwhelmed by sell orders and were unwilling to absorb bonds onto their balance sheets. Kargar et al. (2021) show that bond dealers increasingly acted as brokers, delaying order execution until a buyer could be found, rather than acting as market makers willing to expand their bond inventories.[1] As shown in Figure 1, the flight out of corporate bonds that was worsened by dealer illiquidity led to a sharp increase in corporate bond yield spreads and a decline in US Treasury yields.[2]

The Federal Reserve reacted to these events by providing liquidity in several ways.[3] On March 17, 2020 it announced the Commercial Paper Funding Facility (CPFF) that would purchase commercial paper from eligible issuers and the Primary Dealer Credit Facility (PDCF) that would lend to primary bond dealers at maturities of 90 days or less and collateralized by a variety of securities including investment-grade bonds. On the following day, March 18, it announced the Money Market Mutual Fund Liquidity Facility (MMLF) that would lend to money market funds collateralized by high-quality securities including commercial paper.

On March 23, 2020, the Federal Reserve announced three additional facilities. The Term Asset-Backed Securities Loan Facility (TALF) would purchase securities backed by assets including consumer and small business loans. Under the Primary Market Corporate Credit Facility (PMCCF), the Fed would lend to, or purchase corporate bonds issued by, investment-grade United States (US) businesses having a maturity of up to 4 years. Finally, under the Secondary Market Corporate Credit Facility (SMCCF) the Fed could make secondary-market purchases of investment-grade corporate bonds of US businesses having maturities up to 5

[1] Indeed, O'Hara and Zhou (2021) find that some non-primary bond dealers were net sellers and reduced their bond inventories. Mizrach and Neely (2020) show that dealers' bid-ask spreads for investment grade bonds rose from a median of $0.16 to a median of $1.35 while bid-ask spreads for sub-investment grade bonds increased from $0.26 to $1.00.
[2] A corporate bond's yield spread or "credit spread" is the difference between its yield and the yield on a comparable default-free bond, such as a US Treasury security.
[3] Bordo and Duca (2021) provide a review of the Federal Reserve's interventions during the COVID-19 crisis.

years. The Fed could also purchase shares of exchange-traded funds (ETFs) that hold a broad range of investment-grade corporate bonds.

The PMCCF and SMCCF were the first time that the Federal Reserve established facilities explicitly focused on corporate bonds. The purpose of our paper is to quantify the effects of these programs, particularly the SMCCF, on the secondary market yield spreads and liquidity of corporate bonds. Given the novelty of the SMCCF, our paper joins other recent research that studies this facility. The distinctive feature of our paper is that it uses a different benchmark to gauge the effectiveness of the SMCCF. Since only bonds of US businesses were eligible to be purchased by the Fed under the SMCCF, we compare how the SMCCF reduced the yield spreads on these bonds relative to the yield spreads on "Yankee" bonds having similar ratings and maturities. Yankee bonds are US dollar-denominated bonds registered and traded in the US but issued by foreign corporations and, hence, were typically not eligible for purchase under the SMCCF.

In addition to the requirement that an eligible bond be issued by a US business with material operations in the US, the SMCCF required that the bond have an investment-grade credit rating and also have a maturity of 5 years or less. Other research analyzing the effects of the SMCCF on bond spreads have focused on these credit rating and maturity criteria for eligibility. These studies include Boyarchenko, Kovner, and Shachar (2022), Gilchrist, Wei, Yue, and Zakrajšek (2020), Haddad, Moreira, and Muir (2021), and Nozawa and Qiu (2020), Li and Momin (2020), and Flanagan and Purnanandam (2020).

Boyarchenko et al (2022) analyze the cumulative changes in bonds' yield spreads following the SMCCF announcement relative to their levels before the announcement. Over the 3 months after the announcement, spreads on SMCCF-eligible bonds, defined as being U.S. investment grade and maturing in less than 5 years, declined by 140 basis points (bps) relative to ineligible bonds, where ineligible bonds are defined as investment grade bonds with maturities of more than 5 years or sub-investment grade bonds.

Gilchrist et al. (2020) use a regression discontinuity approach that compares yield spreads on investment-grade bonds with maturities between 4 and 5 years to yield spreads on bonds with maturities between 5 and 6 years. They find no significant difference in spreads for these two bond groups before the SMCCF announcement, but the shorter-maturity group had spreads between 60 to 80 bps less than those of the longer-maturity group during the period after the announcement.[4] Comparing investment-grade bonds issued by the same firm, they find that after the SMCCF announcement spreads on bonds with maturities below 5 years declined by 20 bps relative to spreads on bonds with maturities above 5 years.

Li and Momin (2020) differentiate between SMCCF-eligible issuers versus ineligible ones based on whether they appeared on the SMCCF Broad Market Index that was later announced on June 15, 2020. They estimate that following the March 23 SMCCF announcement, spreads on bonds declined by 51 to 85 bps more for eligible issuers compared to ineligible issuers, and this difference increased to between 71 to 115 bps of spread reduction for bonds maturing in less than 5 years.

Haddad, Moreira, and Muir (2021) also find that the March 23 announcement establishing the SMCCF lowered bond spreads, particularly for investment grade bonds with shorter maturities and those with the highest credit ratings. By comparing changes in bond spreads with changes in credit default swap (CDS) spreads on the same firms, they also find that the decline in spreads was mainly due to improvements in these bonds' liquidity and not a reduction in credit risk. Nozawa and Qiu (2020) also find that the SMCCF announcement reduced yield spreads mainly for investment grade bonds, but they conclude that the decrease was likely caused by the decreased default risk of borrowers rather than changes in bond illiquidity.[5]

Flanagan and Purnanandam (2020) find that, among all SMCCF-eligible bonds, the Fed actually chose to purchase those that tended to be of higher quality before the crisis and to be used as collateral for repurchase agreements (repos). These bonds had a reduction in yield spreads at the time that the Fed announced its actual purchases that was greater than the decline in spreads for eligible bonds that were not purchased.

Our contribution to this literature is to study the effects of the SMCCF by benchmarking corporate bonds of eligible US issuers against Yankee bonds of ineligible foreign issuers but having similar ratings and maturities. This is done using a difference-in-differences methodology. Relative to most other research, we examine more granular rating categories of AA-rated, A-rated, BBB-rated, and BB-rated US and Yankee bonds. We also study the determinants of bonds' changes in spreads following the SMCCF announcement by distinguishing changes in spreads due to default risk versus changes in spreads due to illiquidity. Moreover,

[4] There was no similar discontinuity for high-yield bonds.
[5] They use bid-ask spreads and transaction volumes as proxies for bond illiquidity.

we employ alternative measures of illiquidity, including the Amihud (2002) measure and the bond – credit default swap (CDS) basis.[6]

We find that, relative to spreads on Yankee bonds of the same rating and maturity, the SMCCF decreased spreads on short-maturity AA-rated, A-rated, and BBB-rated US bonds by 64 bps, 41 bps, and 89 bps, respectively. These results are consistent with the SMCCF's objective of targeting direct purchases of US investment-grade bonds having a short maturity of 5 years or less. However, we also find that long-maturity AA-rated and A-rated US bond spreads fell by 51 bps and 31 bps, respectively, relative to their Yankee bond counterparts. Hence, the evidence suggests that there were positive spillovers to higher-rated, long-term US bonds, perhaps due to the SMCCF announcement of purchases of ETFs that could hold these bonds.

In contrast, the SMCCF appears to have harmed sub-investment grade US bonds. Relative to spreads of BB-rated Yankee bonds of the same maturity, spreads of BB-rated short-maturity and long-maturity US bonds rose by 119 bps and 57 bps, respectively, following the SMCCF announcement. This evidence is consistent with BB-rated bonds suffering from the stigma of their explicit exclusion from the SMCCF. In sum, our results indicate that the SMCCF's benefits applied only to investment-grade bonds and were increasing in bonds' credit ratings. The program led to a significant decline in the value of speculative-grade US bonds.

We also find that the announcement of the SMCCF coincided with improved liquidity of US bonds relative to Yankee bonds, but only for bonds with the highest ratings. Based on the Amihud (2002) liquidity measure, liquidity improved for short-maturity AA- and A-rated US bonds and long-maturity AA-rated US bonds, but liquidity worsened for long-dated BBB and BB-rated bonds. When using a subsample of bonds whose issuers have CDS traded on their debt, we find that US bond liquidity improved relative to Yankee bond liquidity for short-dated AA-rated and A-rated bonds: these two groups of bonds experienced a relative decline in their bond-CDS bases of 77 bps and 31 bps, respectively.

Our final set of tests analyze the SMCCF's impact on default risk by examining the reduction in US bond spreads relative to Yankee bond spreads after controlling for changes in illiquidity. Based on the Amihud proxy for illiquidity, we find that the vast majority of relative changes in US spreads attributable to the SMCCF was due to changes in default risk. In contrast, using the bond-CDS basis to proxy for illiquidity

[6] We also perform robustness tests using alternative illiquidity measures proposed by Roll (1984) and Feldhütter (2012) and obtain results that are similar to those using the Amihud (2002) measure.

shows that a majority of the relative reduction in spreads of short-maturity AA-rated and A-rated US bonds was due to improved liquidity rather than a reduction in credit risk. However, the opposite was true for longer-maturity AA-rated and A-rated US bonds. Overall, our evidence suggests that the benefits of the SMCCF for US bonds relative to Yankee bonds was increasing in a bond's credit quality, and the channels through which US bond spreads were reduced included both declines in illiquidity and default risk.

What are the relative merits of using Yankee bonds to benchmark the effects of the SMCCF on US bonds? Other recent studies have used ineligible US bonds as benchmarks based on their greater than 5-year maturity or their issuer's sub-investment grade rating, but these criteria may have downsides. First, while the SMCCF's direct bond purchases were confined to bonds maturing in 5 years or less, its purchases of ETFs included longer-maturity bonds. Moreover, longer-maturity bonds may be indirectly affected if their issuers also had short-maturity bonds eligible for SMCCF purchases. Our results indicate that the SMCCF reduced eligible bond yield spreads by not only improving liquidity but also decreasing issuers' default risks. Hence, when analyzing the SMCCF in a quasi-experimental difference-in-differences context, it is questionable whether long-maturity bonds of US investment-grade issuers are really an "untreated" control. Their use as a benchmark could understate the SMCCF's effects on US short-maturity investment-grade bonds.

Second, using bonds of US issuers with a sub-investment grade rating might also be an imperfect benchmark because the SMCCF could have spillover effects on these bonds. The Fed's purchase of US corporate bonds was unprecedented, and it may have surprised market participants that bonds of sub-investment grade US corporations, which were arguably most endangered by the COVID-19 crisis, would be excluded from emergency aid.[7] Indeed, our evidence suggests that the SMCCF had negative spillovers on US sub-investment grade bonds, so that their use as a benchmark would overstate the effects of the SMCCF on US investment-grade bonds. In contrast, it was likely unsurprising that the SMCCF excluded bonds of foreign issuers so that their spreads would be less affected by the SMCCF announcement.

Our use of Yankee bonds to benchmark the impact of the SMCCF is appealing since they are similar

[7] Also, one might argue that the eligibility of sub-investment grade bonds partially changed over time. While the SMCCF's initial March 23, 2020 term sheet excluded these bonds, the Fed announced a revised term sheet on April 9, 2020 that allowed purchases of "fallen angel" BB-rated bonds with maturities below 5 years if its issuer was investment-grade rated as of March 22, 2020. It also made possible limited purchases of ETFs holding US sub-investment grade bonds, though the "preponderance" its ETF purchases would be ETFs holding investment-grade bonds. Our tests using BB-rated bonds exclude fallen angels given the mixed announcements regarding these downgraded bonds.

to US domestic bonds in terms of their trading, SEC regulation, and disclosure requirements. Controlling for credit ratings and other bond characteristics, Resnick (2012) finds that Yankee bond yield spreads are insignificantly different from those of US domestic bonds.[8] Yet use of Yankee bonds may have two potential shortcomings. First, foreign issuers of Yankee bonds may have been aided by their countries' central banks. The European Central Bank (ECB) and Bank of England (BOE) implemented similar policies around the Fed's announcement of the SMCCF. The ECB announced a €750 billion Pandemic Emergency Purchase Program (PEPP) on March 18, 2020, expanding its existing Corporate Sector Purchase Program (CSPP) that purchased eligible corporate bonds and commercial paper. Similarly, on April 2, 2020, the BOE announced that it intended to purchase at least £10 billion of eligible sterling corporate bonds in the near future.

However, these purchases by foreign central banks were exclusively for bonds denominated in their local currencies and would not directly affect dollar-denominated Yankee bonds traded in the US. Yet it is possible that these central bank purchases gave foreign issuers easier access to refinance in their home countries, affecting the creditworthiness of their dollar-denominated Yankee bonds. To mitigate this possibility, we also analyze the SMCCF over a shorter event window that excludes these foreign central bank interventions. Additionally, we study the SMCCF benchmarked against Yankee bonds of only Canadian and Australian issuers during a time when the governments of these issuers did not intervene in corporate bond markets. The results of these robustness tests are qualitatively the same as our baseline estimates.

A second potential shortcoming from benchmarking the SMCCF with Yankee bonds is that the COVID crisis may have had different effects on foreign countries or on the industries of foreign issuers. Our baseline results correct for the number of COVID cases in each issuer's country. But we also conduct analyses that employ US-Yankee bond issuer industry matching, issuer industry-by-day fixed effects, and geographic region-by-day fixed effects. Again, the qualitative results of these robustness tests match our baseline results.

The next section describes the data used in our empirical work. Subsequent sections report the results of various tests of the SMCCF's effects on US bond yield spreads, liquidity, and default risk.

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[8] However, comparing the yield spreads of Yankee bonds issued by different foreign corporations, Miller and Puthenpurackal (2002) find that spreads are higher when corporations are from countries with poorer investor protection and disclosure.

2. Data and Summary Statistics

Our samples of US and Yankee bond yield spreads and trade quantities are constructed from daily corporate bond transactions and secondary market yields from the Trade Reporting and Compliance Engine (TRACE), developed by the Financial Regulatory Authority (FINRA). The sample period is from January 2, 2020 to June 30, 2020, with the requirement that a bond be traded at least once before and after March 23, 2020, the date when the Federal Reserve announced the SMCCF. On each trading day for each bond, we follow Dick-Nielsen (2014) and exclude cancelled or corrected trades and remove reversal trades. Then for each bond, we take the day's median yield and the total quantity traded during the day as our daily observation.[9] To compute corporate bond yield spreads over comparable Treasury yields, we obtain daily term structures of par yields for Treasuries based on the method of Gurkaynak, Sack, and Wright (2006).[10] Then if on day t corporate bond i's yield equals $y_{i,t}$ and the par yield on a Treasury bond of the same maturity equals y_t, this corporate bond's yield spread equals $s_{i,t} \equiv y_{i,t} - y_t$.

We merge this bond yield spread and trade quantity data with bond characteristics obtained from the Mergent Fixed Income Security Database (FISD). FISD includes a wide variety of individual bond characteristics including a bond's offering date, maturity date, credit rating history, a Yankee bond indicator, and the country of domicile of the bond's issuer. Our sample is restricted to bonds denominated in US dollars and excludes bonds that are convertible, puttable, or asset-backed. Also excluded are equity-like securities, including preferred stock and preferred securities, pass-through securities, and US/foreign agency debt.

To determine which bonds were eligible for direct purchase by the SMCCF, we follow the eligibility criteria in the Federal Reserve's SMCCF term sheets.[11] Since our empirical analysis centers on market reactions around the March 23, 2020 SMCCF announcement, the initial March 23 term sheet is more relevant than subsequent ones. It requires that bonds eligible for direct purchase have issuers that are "U.S. businesses with material operations in the United States." Beginning on April 9, 2020, revised SMCCF term sheets

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[9] As an alternative to the day's median yield, we also calculated a bond's daily yield as a volume-weighted average yield based on all of the day's transactions. The Internet Appendix A.1 reports our main results using this alternative method for calculating yields, and it shows that our estimates are quantitatively very similar.

[10] Data on daily term structures of Treasury par yields for bonds of having maturities at annual horizons of 1 to 30 years were obtained from the Federal Reserve website https://www.federalreserve.gov/data/nominal-yield-curve.htm. We use cubic spline interpolation to obtain yields for every maturity between each annual horizon.

[11] The SMCCF's term sheets can be found at https://www.newyorkfed.org/markets/secondary-market-corporate-credit-facility.

described an eligible issuer as "a business that is created or organized in the United States or under the laws of the United States with significant operations in and a majority of its employees based in the United States." Thus, to be included in our sample of US bonds, we require that FISD report the bond issuer's country of domicile as the United States and that the bond is not labeled as a Yankee bond. Due to initial ambiguity over their eligibility, we also exclude bonds issued by banks and universities since, starting with the April 9, 2020 term sheet, the SMCCF explicitly made bonds of insured depository institutions or organizations receiving CARES Act support ineligible for direct purchase. Similarly, we also exclude "fallen angel" bonds that lost their investment grade status after March 23, 2020 since only with the April 9, 2020 term sheet were some of these bonds designated as eligible.[12]

We also impose several criteria for our sample of SMCCF-ineligible Yankee bonds. A Yankee bond must be designated as such in FISD and have an issuer whose country of domicile is not the United States and not be a foreign subsidiary of a US corporation.[13] To minimize the effects of institutional differences on bond yield spreads, we also include only Yankee bonds of issuers from Europe, Canada, and Australia.[14] Finally, we also exclude FISD-designated Yankee bonds that were issued by US subsidiaries of foreign companies that, based on the SMCCF term sheets, could be considered to have "material operations in the United States."

To determine if a Yankee bond issuer had material US operations, we matched each issuer to Orbis, a Bureau van Dijk global company database that includes information on companies' subsidiaries, including subsidiary locations.[15] We then collect for the year 2019 each Yankee issuer's number of US subsidiaries and exclude bonds of those issuers having 10 or more US subsidiaries. Our various screens on Yankee bonds eliminated all 19 FISD-designated Yankee bonds that the SMCCF directly purchased due to their issuers' US operations. The SMCCF's bond purchases occurred over the period from June 16 to December 31, 2020.[16]

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[12] Less than 2% of our initial sample of bonds were fallen angels. The SMCCF's revised April 9, 2020 term sheet (but not its original March 23, 2020 term sheet) allowed for direct purchases of BB-rated bonds that were rated investment-grade prior to March 23. Since they are treated differently from other BB-rated bonds, our tests exclude them.

[13] FISD uses a separate indicator for Canadian-issuer bonds, which we also include as Yankee bonds. Bonds of foreign subsidiaries of US corporations are excluded due to potential spillovers from US government support of their parents.

[14] European countries include the U.K., Netherlands, Germany, France, Luxembourg, Switzerland, Spain, Norway, Sweden, Ireland, Italy, Finland, Austria, and Belgium.

[15] For some issuers, Orbis reports the company's number of employees in each subsidiary, but this employee data is sometimes missing. However our qualitative results are similar if we use a sample of Yankee bond issuers that excludes those that Orbis reports as having more than 50 employees in all of their US subsidiaries.

[16] Its purchases are reported at https://www.federalreserve.gov/monetarypolicy/smccf.htm and indicate 1,366 unique bond purchases of which 19 bonds of 10 issuers are labeled Yankee bonds in FISD. Four of these Yankee issuers were from Great Britain, 2 from Bermuda, and 1 each from Belgium, Canada, Japan, and Switzerland.

We collect bond ratings made by S&P, Moody's, and Fitch. For each bond, the most recent rating record predating each trading day was used, and if there are more than one most recent rating record, we select the lowest rating. Our data consists of investment-grade bonds (BBB-rated or above) and sub-investment grade bonds rated BB. As discussed earlier, the SMCCF program focused on investment-grade bonds for both individual corporate bond purchases and bond ETF purchases. More precisely, for an individual corporate bond to be an eligible target of SMCCF, the bond must have a remaining maturity of 5 years or less and be issued by a US firm rated at least BBB-/Baa3 as of March 22, 2020. For the bond ETF purchase program, the Federal Reserve's revised April 9, 2020 term sheet states "the preponderance of ETF holdings will be of ETFs whose primary investment objective is exposure to U.S. investment-grade corporate bonds."

The propagation of the COVID-19 pandemic differed across countries, potentially affecting issuers of Yankee bonds differently from issuers of US bonds. To control for such variation, we obtained data from the European Center for Disease Prevention and Control (EUDC) on the cumulative number of COVID-19 cases over the past 14-days per 100,000 population for each of our bond issuers' countries of domicile. This EDUC data begins on December 31, 2019 and extends until June 30, 2020, the end of our sample period.

To study the SMCCF's impact across credit ratings and maturities, we divide our sample into categories of bonds rated AA, A, BBB, and BB.[17] Each of these four rating subsamples is further sub-divided into two groups based on whether a bond's remaining time to maturity is less than or equal to 5 years or greater than 5 years. Consequently, we end up with eight rating and maturity groups of bonds.

Table 1 shows summary statistics of our sample, categorized by the eight rating and maturity subsamples. Bonds rated AA, A, BBB, and BB make up 6.2%, 32.5%, 51.5%, and 9.8% of our sample, respectively. US bonds account for 93.62% of the sample while Yankee bonds make up the remaining 6.38%. The table also shows that for both short-dated and long-dated investment-grade bonds, the sample period mean and median yields tend to be slightly lower for US bonds relative to comparable Yankee bonds. However, the reverse yield relationship occurs for sub-investment grade (BB-rated) bonds. The average maturities and daily quantities traded are roughly the same for US bonds and Yankee bonds for each of the 8 rating-maturity subsamples.

[17] US bonds constitute almost all trades in the rating categories of AAA, B, and CCC during the sample period, and thus are not included in the analysis for lack of a comparison group.

3. The SMCCF's Effects on Bond Yield Spreads

As a prelude to our more formal analysis of US and Yankee bond yield spreads, Figure 2 plots the average daily yield spreads for each rating and time-to-maturity group of bonds. It shows that for each rating-maturity class, average spreads were similar for US and Yankee bonds prior to the SMCCF announcement, but yield spreads of investment-grade US bonds dropped below the spreads of similarly-rated Yankee bonds afterwards. In contrast, following the SMCCF announcement average BB-rated US bond spreads were significantly above BB-rated Yankee bond spreads.

3.1 Difference in Differences Tests by Bond Rating and Maturity Category

We study the effects of the SMCCF on bond spreads by adopting a difference-in-differences (DiD) approach. The first difference in the difference-in-differences strategy is between bonds issued by US firms versus Yankee bonds issued by foreign firms. The second difference is between the period before the Fed's announcement of SMCCF's establishment on March 23, 2020 versus the period after ending on June 30, 2020. Specifically, the difference-in-differences strategy is summarized by the following regression specification:

$$s_{i,t} = \alpha US_i \times SMCCF_t + \beta X_{i,t} + v_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

where $s_{i,t}$ is the yield spread of bond i on day t and US_i is an indicator variable equal to 1 if bond i's issuer is domiciled in the United States (US bond) and 0 otherwise (Yankee bond). $SMCCF_t$ is another indicator equal to 0 if day t is before March 23rd, 2020 and 1 otherwise. $X_{i,t}$ represents a vector of other covariates relating to bond i on day t, v_i indicates bond fixed effects, and η_t indicates day fixed effects. The coefficient α on the interaction term measures the impact of the Fed's intervention through the SMCCF on the spreads of US bonds relative to the spreads of Yankee bonds. Equation (1) is estimated for 8 different categories of US and Yankee bonds matched by their rating (AA, A, BBB, or BB) and their time until maturity (below or above 5 years). Robust standard errors are clustered at both the bond and trading day levels.

Table 2 shows the effects of the SMCCF on US bond spreads relative to Yankee bond spreads following the Fed's announcement. There is a significant decrease in the yield spreads of AA- and A-rated US bonds regardless of their times to maturity. Column 1 shows that after the announcement, yield spreads drop by 32 bps for AA-rated US bonds having maturities of less than 5 years. Controlling the daily amount traded, bond-level time to maturity, and cumulative 14-day COVID-19 cases, column 2 shows that the reduction is even stronger, equal to 64 bps. Similarly, columns 3 and 4 show that the magnitude of the SMCCF's effect on US bond yield spreads ranges between 21 and 41 bps for A-rated bonds with a maturity less than 5 years. Columns 10 and 12 indicate that the effects of the SMCCF on US AA- and A-rated bonds maturing in more than 5 years are similar, equal to 51 bps and 31 bps, respectively, when regressions include controls.

Table 2 columns 5 and 6 show that the announcement led to significantly reduced the spreads of BBB-rated US bonds with maturities of 5 years or less by 77 to 89 bps relative to the spreads of similarly-rated Yankee bonds of the same maturity. However, there is little evidence of a change in relative spreads of BBB-rated US bonds maturing in 5 years or more. Hence, although the SMCCF targeted direct purchases of individual investment-grade bonds with maturities below 5 years, the 5-year limit appears to have been important only for BBB-rated bonds. AA- and A-rated bonds of all maturities appear to have benefited almost equally. Overall, the results show that the SMCCF announcement significantly reduced the spreads on US short-maturity investment-grade bonds relative to spreads on similar Yankee bonds, but the facility's benefits also extended to longer-dated US AA- and A-rated bonds.

The SMCCF explicitly excluded sub-investment grade bonds, and prior to our analysis it might be unclear whether there would be positive or negative spillovers to these bonds.[18] If the Fed's investment-grade bond purchases or other US government interventions benefited bond dealers such that they would be more willing to hold inventories of US bonds of all ratings, one might expect a decline in the spreads of US BB-rated bonds relative to spreads of similar Yankee bonds. However, Table 2 clearly shows this conjecture was not the case. As evidenced by columns 7 and 8, the yield spreads of BB-rated US bonds with maturities below 5 years rise between 83 to 119 bps relative to spreads of their Yankee bond counterparts following the SMCCF announcement. Column 16 shows that the increase in yield spreads is smaller and only marginally significant for US BB-rated bonds maturing in more than 5 years but is still absolutely large at 57 bps. Apparently, US sub-investment grade bonds suffered the stigma of exclusion from the Fed's emergency assistance. In sum, the results indicate that the benefits of the SMCCF apply only to investment-grade bonds,

[18] As mentioned earlier, only on April 9, 2020 did the revised SMCCF term sheet allow "fallen angel" BB-rated bonds to be eligible for direct purchase, but these bonds are excluded from our data on BB-rated bonds. That term sheet also extended the SMCCF to make limited purchases of ETFs holding sub-investment grade bonds, but it stated that the "preponderance" of purchases would remain in ETFs holding investment-grade bonds.

and the evidence suggests that it significantly harmed speculative-grade US bonds.

3.2 Triple Difference Comparing Investment Grade to Sub-investment Grade Spreads

Table 2 shows that upon the news of the SMCCF, the yield spreads of US investment-grade bonds generally fell significantly relative to comparable Yankee bonds. However, a concern is that the COVID-19 crisis may have harmed foreign issuers more than US issuers, which could have generated the relatively higher yield spreads of Yankee bonds relative to US bonds. For example, relative to US issuers, foreign issuers may have been concentrated in industries more adversely affected by the COVID-19 crisis or their domestic macro-economies may have suffered greater downturns. A way to partly alleviate this concern is to estimate a triple difference regression that compares changes in yield spreads of BB-rated US bonds relative to BB-rated Yankee bonds with changes in yield spreads of each investment-grade rating category of US bonds relative to the same investment-grade rating category of Yankee bonds, where changes are measured from before until after the SMCCF announcement. Specifically, we estimate the equation

$$s_{i,t} = \alpha_0 US_i \times SMCCF_t \times IG_{i,t} + \alpha_1 US_i \times SMCCF_t + \alpha_2 SMCCF_t \times IG_{i,t} + \beta X_{i,t} + \nu_i + \eta_t + \varepsilon_{i,t} \qquad (2)$$

where $IG_{i,t}$ is a dummy variable equal to 1 if bond i is rated AA, A, or BBB on day t and 0 if it is rated BB. Essentially, equation (2) uses relative changes in spreads on US and Yankee BB-rated bonds as a benchmark to compare relative changes in spreads on US and Yankee investment-grade bonds. Equation (2) is run separately for AA, A, and BBB-rated bonds of each maturity category. The coefficient α_0 on the interaction term measures the impact of the Fed's SMCCF announcement on US bond spreads for each investment-grade rating category and should be a consistent estimate under the assumption that an unobserved shift in bond investors' preferences for US bonds relative to Yankee bonds is the same for investment-grade and speculative-grade bonds.

Table 3 presents the results of the triple-difference regressions. Notably, compared to Table 2, Table 3 shows that the SMCCF had stronger effects on investment-grade bonds with maturities below 5 years. For example, Table 3 shows that yield spreads dropped by 96 bps for AA-rated US bonds maturing in 5 years or less, compared to 64 bps from the simple DiD estimate. These stronger results from comparing investment-grade bonds to BB-rated bonds may be unsurprising given Table 2's evidence of the SMCCF's negative spillover on US BB-rated bonds.

3.3 Robustness Tests

The Internet Appendix reports the results of additional robustness tests that investigate the possibility that the COVID crisis had dissimilar effects on US issuers versus foreign issuers that, in turn, could explain the differences in US and Yankee bond yield spreads. One potential difference between US and foreign issuers is that they might be concentrated in dissimilar industries that were impacted differently by the COVID crisis. To account for this possibility, we carried out two sets of exercises. First, we repeated the regression specification (1) based on a matched sample of US and Yankee bonds. Specifically, each Yankee bond was matched to US bonds in the same rating-maturity group and whose issuer was in the same two-digit SIC industry. We then located the closest US bond(s) in terms of the bond's amount outstanding using the Mahalanobis distance. Second, we estimated regression specification (1) but controlled for issuer industry-by-day fixed effects. Internet Appendices A.2 and A.3 show that these two sets of exercises produced similar results. Relative to our baseline results in Table 2, the SMCCF is estimated to reduce short- and long-maturity US AA- and A-rated yield spreads somewhat less, but short-maturity BBB-yield spreads somewhat more. Moreover, the rise in short-maturity US BB-rated bond spreads following the SMCCF's announcement is even greater.[19] In summary, controlling for issuer industry leaves our qualitative conclusions unchanged.

Another potential difference between US and foreign issuers is that they were affected by dissimilar time-varying macroeconomic factors which drove differences in their yield spreads. While our baseline regressions reported in Table 2 control for the number of COVID cases in each issuer's country, other macro factors may have impacted issuers located in different geographic regions. We account for this possibility by estimating regression specification (1) but control for issuer region-by-day fixed effects. Specifically, issuers are categorized into six different regions: North America, Northern Europe, Western Europe, Southern Europe, and Oceania.[20] Internet Appendix A.4 shows that, relative to comparable Yankee bonds, controlling

[19] For example when controlling for industry-by-day fixed effects, short-maturity US bond yield spreads of AA-, A-, BBB-, and BB-rated bonds are estimated to change by -37, -14, -92, and +213 basis points, respectively, relative to comparable Yankee bonds. Long-maturity AA- and A-rated bonds yield spreads change by -40 and -13 basis points, respectively. All of these estimates are statistically significant.

[20] North America includes Canada and the US; Northern Europe includes Great Britain, Ireland, Norway, Sweden, Finland, and Denmark; Western Europe includes the Netherlands, France, Switzerland, Luxembourg, Germany, Austria, and Belgium; Southern Europe includes Italy and Spain; Oceania includes Australia.

for region-by-day fixed effects somewhat moderates the SMCCF's estimated reduction in US investment grade bond yield spreads but magnifies its estimated rise in US BB-rated bond yield spreads.[21] In general, controlling for time-varying macroeconomic factors delivers results qualitatively similar to those of our baseline results and reinforces evidence that the SMCCF harmed sub-investment grade bonds.

4. Measuring the Effects of the SMCCF Over Shorter Periods

The analysis in Section 3 demonstrates that since the SMCCF's inception, yield spreads of US investment-grade (*sub-investment grade*) bonds fell (*rose*) relative to spreads of Yankee bonds of similar ratings and maturities. However, the regression equation (1) estimating the average effect of the SMCCF does not address the precise times during the March 23 to June 30 2021 period when relative changes in US bond yield spreads occurred. In this section, we examine more finely the timing of these changes.

4.1 Week-Specific Effects

The results in Table 2 do not indicate whether spreads reacted to the Fed's announcement or its actual purchase of corporate bonds and bond ETFs. The Fed announced the SMCCF on March 23 but did not begin to purchase bond ETFs until May 12 and individual bonds until June 15. If the average effects in Table 2 occur mostly before May 12, we may conclude that the SMCCF's announcement raised investor expectations of future Fed demand for bonds that, in turn, led to higher initial prices and lower spreads prior to the Fed's actual bond purchases.

To this end, we estimate the dynamics of the SMCCF's effects on corporate bond yield spreads. Specifically, we repeat the specification in (1) but replace the single SMCCF indicator variable with a series of weekly indicator variables:

$$s_{i,t} = \sum_{\substack{w=0,..7,\\ 9,...,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + v_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

where $Week_w$ is an indicator variable that equals 1 when day t is in week w and 0 otherwise. The series of coefficients α_w, $w = 0,..7, 9,…,26$, capture the effects of time variation in spreads of US bonds relative to Yankee bonds for each week during our sample period. Week 0 marks the first week of our sample starting on

[21] Short-maturity US AA-, A-, and BB-rated bond spreads are estimated to change by statistically significant -35, -30, and +151 bps, respectively, relative to comparable Yankee bond spreads. Long-maturity US A-rated and BB-rated bond spreads change by a statistically significant -51 and 119 bps relative to spreads of their Yankee counterparts.

January 1, 2020, week 8 begins on February 24 which is the start of heighted stress on the bond market due to news of the COVID pandemic. An indicator for this week is omitted, so that it serves as the benchmark for the other α_w coefficient estimates. The Fed announced the establishment of the SMCCF on Monday March 23, 2020 which is the start of week 12. Actual Fed purchases of bond ETFs begin on Tuesday May 12, 2020 which is in week 19, and Fed buying of individual bonds begins on Monday June 15, 2020, which is week 24.

Estimation of regression equation (3) also permits testing for parallel trends during the period prior to the announcement of the SMCCF in week 12, thereby ensuring the validity for our DiD strategy to identify the subsequent effects of the SMCCF on bond yield spreads. Thus, we need to show that the yield spreads of US bonds and Yankee bonds are not statistically different before the announcement.

Figure 3 plots the coefficients α_w and their 95% confidence intervals for each rating and time-to-maturity group of bonds over the sample period. Panel A provides several important findings regarding the SMCCF's effects on bonds maturing in less than 5 years. First, the announcement of the SMCCF at the beginning of week 12 significantly lowered the spreads of all three US investment-grade bond ratings classes relative to the spreads of similarly-rated Yankee bonds. However, the effect on BBB-rated US bonds was short-lived as there was no significant difference between their yields and those of comparable Yankee bonds by the fifth week after the announcement.

Second, the SMCCF had more persistent benefits to AA- and A-rated US bonds. The difference between spreads of AA-rated Yankee bonds and US bonds was the greatest during the SMCCF announcement week 12 and then monotonically declined until there was no significant difference by week 21. The difference between spreads on A-rated Yankee bonds and US bonds was also at a maximum during week 12 but remained significantly different throughout the remainder of our sample period (week 26). Yet for both of these higher credit quality rating classes, there is no indication that the Fed's actual purchase of bond ETFs in week 19 and individual bonds in week 24 led to contemporaneous changes in the difference between Yankee and US bond spreads. Hence, as rational expectations of future demand and an absence of arbitrage would predict, spreads adjusted prior to the actual purchase of bonds by the Federal Reserve.

Third, the general pattern of the coefficients α_w for BB-rated bonds is the reverse of those for investment-grade bonds. BB-rated US bond spreads were slightly higher than those of their Yankee counterparts starting in week 9, but this difference widens during the SMCCF announcement week 12 and remains significantly higher through week 15. The relative spreads of US BB-rated bonds were highest in week 14, even though the Fed announced on April 9th of that week that the SMCCF might purchase limited amounts of ETFs holding sub-investment grade bonds. Overall, this evidence is consistent with BB-rated US bonds suffering the stigma of being largely left out of the SMCCF program.

Figure 3 Panel B shows the effects of the SMCCF on bonds with maturities greater than 5 years. For AA-rated and A-rated bonds, the pattern of the coefficients α_w shows that Yankee and US bond spreads were significantly different during the announcement week 12. However, the difference continued to grow until around weeks 16-17 before subsequently narrowing. For both of these rating classes, significant differences between Yankee and US bond spreads remained throughout the remainder of the sample period.

In contrast, there was never a significant decline in long-maturity BBB-rated US bond spreads relative to Yankee bond spreads. Spreads on long-dated BB-rated US bonds became significantly higher than those of similar Yankee bonds during week 15 and were also significantly higher during the last three weeks of our sample period. Hence, we see that the SMCCF, which focused on US investment grade bonds with below 5-year maturities, had a positive spillover only to longer-term AA-rated and A-rated US bonds.

Both panels of Figure 3 show that the yield spreads of US and Yankee bonds of most rating and time-to-maturity groups were not statistically different before the week 12 announcement of the SMCCF, thereby supporting the parallel trend assumption of our DiD analysis. An exception is BB-rated bonds with maturities below 5 years where the difference in yield spreads between US and Yankee bonds rose a couple of weeks before the news of the SMCCF.

4.2 Effects Around the SMCCF Announcement Day

Given the evidence of a significant change in yield spreads during the weeks shortly after the SMCCF announcement, in this section we narrow our focus to examine spread movements during the couple of days right before and after the March 23, 2020 announcement date. There are at least two reasons for doing so. First, by restricting the estimation to a short time window, we minimize possible confounding effects due to policy actions by other central banks that occurred near, but not coincident with, the SMCCF's announcement. Second, time-varying economic factors that may have different effects on US versus foreign yield spreads would be minimized around a short SMCCF announcement window. For example, although the pre-trend analysis performed at a weekly frequency in Figure 3 validated our DiD strategy, Figure 2 shows that the yield spreads of investment-grade Yankee bonds tended to edge higher than those of similar US bonds two days before the SMCCF announcement date. A very plausible explanation for this prior rise in Yankee bond spreads can be linked to a global shortage of US dollars. As a March 19, 2020 CNBC article pointed out:

> "*…the demand for dollars is huge, and it's exacerbating dislocations across financial markets. The demand is coming from all sorts of sources — banks, issuers of dollar-denominated debt; investors selling dollar-based assets; companies looking for cash for U.S. operations; and foreign banks looking to help customers. All of them are pressuring the currency*."[22]

Figure 4 shows the US dollar index against currencies of other advanced economies. The dollar index first falls and then quickly surges in the middle of March, and the situation does not improve until the Federal Reserve expanded swap lines to foreign central banks on March 19th. Although the sudden rise in the value of the dollar does not directly affect dollar-denominated bonds, it could have a greater impact on the default risk of Yankee bond issuers relative to US issuers if investors believe that foreign issuers will have relatively more difficulty accessing US dollar funding.[23]

Although this pre-announcement difference is less apparent at a weekly frequency, as a robustness check we follow Haddad, Moreira, and Muir (2021) and consider a shorter daily time window. Specifically, following the same sampling rule as described in Section 2, we collect intra-day bond transactions on March 20th (Friday), March 23rd (Monday) and March 24th (Tuesday); that is, from one business day before until one business day after the SMCCF announcement.[24] Then we estimate our baseline DiD regression in equation (1) over this 3-day period.

Table 4 reports regression estimates over this short time window, where all regressions include country of domicile and trading day fixed effects and Newey and West (1987) robust standard errors are reported in parentheses.[25] The use of intra-day bond transactions indicates stronger effects of the SMCCF compared to our previous estimates. For instance, Column 2 of Table 4 finds that the yield spreads of short-

[22] https://www.cnbc.com/2020/03/19/a-global-rush-into-the-us-dollar-is-driving-extreme-market-moves-and-a-temporary-shortage.html

[23] For instance during the European debt crisis, the French bank Société Générale was unable to obtain dollar funding to repay its dollar-denominated debt but had enough euro funding to pay its euro-denominated debt.

[24] The sampling rule is the same as in Section 2 except that we do not require each bond to be traded at least once before and after March 23rd. As a result, we control for country of domicile fixed effects instead of bond fixed effects over this short time window.

[25] Results are similar if standard errors are clustered at trading days as in Tables 2 and 3, though the statistical significance tends to be weaker due to the small number (3) of clusters.

maturity AA-rated US bonds fall by 122 bps relative to comparable Yankee bonds immediately after the SMCCF announcement. This magnitude is almost double that of our baseline estimate of a 64 bp decline given in Table 2. In general, the results from this shorter time window around the announcement display a pattern consistent with the baseline DiD estimates: for the same rating, the SMCCF had a greater impact on shorter maturity bonds and the effect on reducing US bond spreads relative to Yankee bond spreads was increasing in bonds' credit quality.[26]

We also estimate the triple difference regression specification (2) over this same announcement window. Thus, this regression compares changes in yield spreads of SMCCF ineligible BB-rated US bonds relative to ineligible BB-rated Yankee bonds with changes in yield spreads of each investment-grade rating category of potentially eligible US bonds relative to the same investment-grade rating category of ineligible Yankee bonds, where changes are measured from one day before until one day after the SMCCF announcement. The results, reported in the Internet Appendix A.5, indicate that the SMCCF significantly reduced yield spreads of all rating categories of both short- and long-maturity US investment-grade bonds by magnitudes greater than those of our baseline estimates reported in Table 3.[27] Therefore, the results of using this 3-day window further confirm our qualitative findings that were found using a longer estimation window.

4.3 Effects Over a Shorter Window Using Only Canadian and Australian Yankee Bonds

As noted earlier, some foreign central banks, including the ECB and BOE, implemented policies similar to the SMCCF around the time of the SMCCF's announcement.[28] Consequently, our baseline analysis may underestimate the effects of the SMCCF on US bond yield spreads because, by its use of comparable Yankee bond yields as a benchmark, it implicitly assumes that European issuers of Yankee bonds were unaffected by their central banks' interventions.

To address the issue, we restrict Yankee bonds to those having issuers from Canada and Australia and select an estimation window during which the governments of these countries did not intervene in corporate

[26] However, caution is required when interpreting the results using BB-rated bonds since there were only a small number of transactions during the three days.
[27] The reduction in US bond yield spreads due to the SMCCF are estimated to be 311, 440, and 489 basis points for short-maturity AA-, A-, and BBB-rated bonds, respectively, and 79, 199, and 78 basis points for long-maturity AA-, A-, and BBB-rated bonds, respectively.
[28] The ECB announced on March 18, 2020 its intention to purchase €750 billion of euro-denominated corporate bonds and the BOE announced on April 2, 2020 its intention to purchase at least £10 billion of eligible sterling corporate bonds.

bond markets. The Bank of Canada announced its Corporate Bond Purchase Program on April 15, 2020, which began operation on May 26, 2020. On November 3, 2020, the Reserve Bank of Australia announced a program to purchase Australian Government and state and territorial government bonds, but not corporate bonds. Therefore, to attenuate the confounding effects of policies similar to the SMCCF from other central banks, we estimate the DiD specification (1) using Yankee bonds of only Canadian and Australian issuers and include bond transactions only until April 15, 2020.

Table 5 presents the results of this estimation. Compared to our baseline results in Table 2, the SMCCF is estimated to have greater effects on short-maturity US bonds, reducing the yield spreads of US AA-, A-, and BBB-rated bonds by 91, 47, and 176 basis points, respectively, and increasing the yield spreads of BB-rated bonds by 143 basis points. This evidence supports the notion that Yankee bond issuers from Europe may have been partially aided by their central banks' interventions in bond markets around the time of the SMCCF. However, the estimates in Table 5 also indicate that the SMCCF led to a more moderate reduction of yield spreads of long-dated AA-rated bonds (35 bps) and A-rated bonds (34 bps). Overall, we can conclude that using a sample of Yankee bonds of Canadian and Australian issuers unaffected by central bank interventions produces similar qualitative results to those of our baseline regressions.

5. The SMCCF's Effects on Bond Liquidity

A stated purpose of the SMCCF was "to support credit to employers by providing liquidity to the market for outstanding corporate bonds."[29] This section examines the effects of the SMCCF on the liquidity of US corporate bonds. We measure a bond's illiquidity using two different proxies, the Amihud (2002) measure and the bond - credit default swap (CDS) basis.

5.1 Amihud Measure

The Amihud (2002) illiquidity measure is based on the model of Kyle (1985) and estimates the price impact of trades. Specifically, suppose a particular bond trades N_t times during period t, and the j^{th} trade is at price P_j which leads to a return of $r_j = (P_j\text{-}P_{j\text{-}1})/P_{j\text{-}1}$. Then if this trade is for a face value amount in \$ millions of q_j, the bond's illiquidity measure for period t equals

[29] See https://www.federalreserve.gov/monetarypolicy/smccf.htm .

$$ILLIQ = \frac{1}{N_t}\sum_{j=1}^{N_t}\frac{|r_j|}{q_j} \quad (4)$$

Since calculating *ILLIQ* requires multiple trades during a period, to obtain sufficient numbers of trades we calculate each bond's *ILLIQ* measure using a period of one week. Figure 5 plots the time series of average Amihud illiquidity measures for each rating and time-to-maturity group of bonds. The Amihud illiquidity measure displays time variation similar to the bond yield spreads in Figure 2: it peaked on or slightly prior to the announcement of the SMCCF on March 23 and began to decline afterwards. To see whether the liquidity of US corporate bonds and Yankee bonds differed starting at the announcement of the SMCCF, we consider the following specification

$$ILLIQ_{i,t} = \alpha US_i \times SMCCF_t + \beta X_{i,t} + \nu_i + \eta_t + \varepsilon_{i,t} \quad (5)$$

where $ILLIQ_{i,t}$ is the Amihud illiquidity measure of bond *i* during week *t* and the coefficient α on the term $US_i \times SMCCF_t$ indicates whether US bond illiquidity changed relative to Yankee bond illiquidity after the SMCCF's announcement in week 12.

Table 6 presents the results of regression (5) where, similar to our analysis of yield spreads, we run separate regressions for AA-rated, A-rated, BBB-rated, and BB-rated bonds, first having maturities below 5 years and then having maturities above 5 years. For short-maturity bonds, there is a significant improvement in the liquidity of AA-rated and A-rated US bonds relative to same-rated Yankee bonds, but no significant change BBB- and BB-rated bond liquidity. At longer maturities, the results indicate an improvement in US bond versus Yankee bond liquidity only for AA-rated bonds and a worsening of liquidity for US BBB- and BB-rated bonds relative to similar Yankee bonds. Hence, the relative increase in US bond liquidity after the SMCCF announcement was confined to AA-rated bonds and short-dated A-rated bonds, and liquidity was unchanged or worsened for other bonds. This evidence is consistent with bond investors and dealers focusing their trades on the best credit quality US bonds at the expense of lower quality bonds.

To track the liquidity change over time for each group of our bonds, we consider a specification similar to regression equation (3) except now the dependent variable is the Amihud illiquidity measure for each bond:

$$ILLIQ_{i,t} = \sum_{\substack{w=0,..7,\\9,...,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + v_i + \eta_t + \varepsilon_{i,t} \quad (6)$$

Estimation of regression equation (6) is also used to test for parallel trends in order to validate regression (5).

Figure 6 plots the coefficients α_w and their 95 percent confidence interval for each rating and time-to-maturity group of bonds over the sample period. Week 8, the start of the crisis period, is omitted as a benchmark. Both panels of Figure 6 show that, the Amihud liquidity measures of US and Yankee bonds are not statistically different prior to the SMCCF's announcement in week 12, thereby supporting our estimates in Table 6. Notably, the relative liquidity of AA-rated and A-rated US bonds with maturities less than 5 years rises immediately after news of the SMCCF, and it remains higher for AA-rated bonds until the end of the sample period. Immediately following the SMCCF announcement, there is an improvement in the relative liquidity of longer-maturity US AA-rated bonds, but it lasts only a couple weeks. Figure 6 also shows that relative liquidity worsened for long-maturity US BBB- and BB-rated bonds soon after the SMCCF announcement, and the decline in the liquidity BBB-rated US bonds was long-lived. Overall, we find that the SMCCF's benefit to the relative liquidity of US bonds was increasing in their credit quality.

5.2 Bond-CDS Basis

Both credit default swap (CDS) spreads and bond yield spreads are premiums for insurance against default losses on an issuer's debt, and in a frictionless financial market they would be approximately equal for the same issuing firm at the same maturity horizon. However, CDS are considered to be more liquid than most individual bonds, which can generate a difference in their spreads for the same issuer. Therefore, the difference between an issuer's bond yield spread and its CDS spread, defined as the bond-CDS basis, is a measure of the bond's relative illiquidity premium.[30] In this section, we calculate the bond-CDS basis for US bond issuers and Yankee bond issuers that have CDS traded on their debt.

We obtain from Markit daily single-name CDS spreads from January through June 2020 for US dollar-denominated contracts of which the reference entities are covered in our corporate bond sample.[31] For each of our sample's bonds that have a reference entity in Markit, we take the CDS contract that matches the

[30] It is more common to quote the CDS-bond basis, which is typically negative. We work with its opposite, the bond-CDS basis to make this illiquidity measure comparable to the positive Amihud measure.
[31] We take the CDS 'doc clause' to be Modified Modified Restructuring (MM14) or Modified Restructuring (MR14).

bond's seniority (secured debt/ senior unsecured debt/ subordinated). Markit provides a term structure of CDS spreads with maturities of 0.5, 1, 2, 3, 4, 5, 7, 10, 15, 20 and 30 years, and we select the spread closest to the bond's maturity. A matched bond's bond-CDS basis is calculated as difference in its yield spread minus its reference entity's CDS spread. Hence, denote $BCDS_{i,t}$ as the bond-CDS basis for bond i at date t.

Table 7 provides summary statistics for the subsample of US and Yankee (foreign) issuers that have CDS traded on their debt. These statistics are presented for each of the 8 credit rating-maturity categories. The table shows that the average and median bond-CDS bases tend to increase as the quality of the issuer's bond rating declines. Also note that there are relatively few observations for the categories of BB-rated Yankee bonds and also AA-rated Yankee bonds having a maturity exceeding 5 years. Hence, tests of liquidity based on these categories should be interpreted with caution.

Figure 7 plots the average bond-CDS basis over time for each rating and time-to-maturity group of bonds. Before COVID-19 stressed the bond market, the average bond-CDS bases of US and Yankee bonds were similar and close to zero, except for the aforementioned cases of long-maturity BB-rated and AA-rated bonds with few Yankee bond observations. In March, the average bond-CDS bases became significantly positive, particularly for bonds maturing in 5 years or less. However bond-CDS bases started to decline immediately following the announcement of the SMCCF, with the bases for short-maturity AA-rated and A-rated US bonds remaining below those of similar Yankee bonds for some time. This preliminary evidence is consistent with the SMCCF reducing US bond illiquidity.

Table 8 reports the results of running regression (5) but where the dependent variable is now the bond-CDS basis illiquidity measure, $BCDS_{i,t}$, rather than the Amihud illiquidity measure, $ILLIQ_{i,t}$. The table indicates a negative α coefficient for AA- and A-rated bonds with maturities below 5 years, consistent with the SMCCF reducing the relative illiquidity for these US bonds. Columns (2) and (4) show the bond-CDS bases for short-maturity AA- and A-rated US bonds declined relative to those of Yankee bonds by 77 bps and 31 bps, respectively.

The post-SMCCF decline in illiquidity for short-maturity AA- and A-rated US bonds is consistent with the result in Table 6 that used the Amihud measure. However, the results in Table 8 differ for other bond rating-maturity classes. They indicate that the bond-CDS bases of AA-rated long-maturity US bonds rose relative to those of similar Yankee bonds. Moreover, the bond-CDS basis for both short- and long-maturity

US BB-rated bonds fell relative to Yankee bonds. These reactions are opposite to those found using the Amihud measure, and the contrary findings could be due to the small samples of Yankee bond-CDS bases rather than inherent differences in the illiquidity proxies.

To track the time series of bond-CDS bases for each group of our bonds and to test for parallel trends as validation of the DiD regressions, we re-run regression (6) but where the dependent variable is the bond-CDS basis $BCDS_{i,t}$ rather than the Amihud measure, $ILLIQ_{i,t}$. Figure 8 plots the weekly coefficient estimates α_w and their 95 percent confidence intervals for each rating and time-to-maturity group of bonds for the periods during which bond-CDS bases are available. Week 8, the beginning of the COVID crisis period, is omitted and serves as a benchmark.

Panel A of Figure 8 shows that immediately after the SMCCF announcement, the bond-CDS bases of short-maturity AA-rated and A-rated US bonds fell relative to those of Yankee bonds, suggesting a prompt improvement in relative liquidity. It also shows that the bond-CDS bases of US and Yankee bonds with maturities below 5 years were similar prior to the SMCCF announcement, with the possible exceptions of A-rated and BB-rated bonds where there is evidence that Yankee bonds became relatively illiquid in week 11, possibly due to a dollar shortage.

Figure 8 Panel B examines bonds with maturities above 5 years and supports the parallel trend assumptions except for AA-rated and BB-rated bonds. It shows that the bond-CDS bases of AA-rated US bonds edged higher relative to similarly-rated Yankee bonds during week 10 and 11 while those of BB-rated Yankee bonds edged lower, as also evidenced in Figure 7. Therefore, the DiD results in Table 8 for these classes are likely to be an underestimate of the SMCCF's effects on the bond-CDS bases of longer-maturity AA-rated and BB-rated US bonds.

In addition to the Amihud (2002) and bond-CDS based measures of illiquidity, Internet Appendix A.6 provides results from estimating equation (5) using two alternative illiquidity measures: the Roll (1984) covariance of returns measure and the imputed roundtrip trading cost measure of Feldhütter (2012). Its findings confirm this section's general result that the SMCCF improved the liquidity of US bonds relative to Yankee bonds primarily for bonds of the highest credit quality.

6. The SMCCF's Effects on Default Risk and Illiquidity Components of Yield Spreads

The spread between a corporate bond's yield and the yield on a comparable default-free Treasury bond includes a component reflecting the corporate bond's default risk and also a component reflecting its illiquidity. The question we now address is whether the SMCCF announcement reduced US bonds' yield spreads relative to those of Yankee bonds by solely reducing their relative illiquidity or whether there was also a relative decline in US bonds' default risks.

While the objective of the SMCCF was to improve secondary market corporate bond liquidity, there are at least two ways that its announcement might also reduce eligible US bonds' default risks relative to those of Yankee bonds. First, the PMCCF was also announced on March 23, 2020, and its eligibility criteria for primary market bond purchases was very similar to those of the SMCCF. The PMCCF term sheet stated "The Facility will purchase bonds and make loans that have interest rates informed by market conditions," which is sufficiently vague to include the possibility that purchases might lower an eligible issuer's future debt servicing costs and, in turn, its likelihood of default.[32] Second, if the SMCCF's secondary market purchases of an eligible issuer's future bonds was expected to reduce their illiquidity premia, it would raise these bonds' primary market prices, thereby also reducing the issuer's debt servicing costs and chance of default.[33]

To analyze whether the SMCCF announcement affected the relative default risk component of US bond spreads, we repeat the regression in equation (1) but now include a measure of the bond's illiquidity as an explanatory variable. This is done by first using the Amihud illiquidity measure and, second, using the bond-CDS basis illiquidity measure. If spreads were reduced mainly through an illiquidity channel rather than default risk, the coefficient α on the indicator variable $US_i \times SMCCF_t$ should be insignificantly different from zero or small in magnitude relative to its value when the illiquidity measure is absent from the regression.

6.1 Results Using the Amihud Illiquidity Measure

The results of running regression equation (1) that include the Amihud illiquidity measure $ILLIQ_{i,t}$ as one of the control variables are reported in Table 9. First, note that for each rating-maturity group subsample, the estimated coefficient on *ILLIQ* in each bond yield regression is positive and statistically significant as would be expected. Second, comparing the estimated coefficients on $US \times SMCCF$ in Table 9 to those in Table

32 See https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b1.pdf.

33 The initial March 23, 2020 term sheets of the SMCCF and PMCCF stated that these facilities could purchase bonds at least until September 30, 2020 unless they were extended by the Fed. See https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b2.pdf. Both facilities were extended but then new purchases were terminated on December 31, 2020.

2 shows that they are almost unchanged. For instance, controlling for illiquidity decreases the coefficient from -63.6 bps to -62.4 bps for AA-rated US bonds maturing in 5 years or less. All of the coefficients on *US*×*SMCCF* that were statistically significant in Table 2 remain so in Table 9. The very minor change in these coefficients implies that the SMCCF reduced US bond yield spreads by more than what a reduction in bond illiquidity suggests, consistent with it also reducing US bonds' default risks relative to the default risks of similar Yankee bonds.

6.2 Results Using the Bond-CDS Basis

Table 10 shows the results of running regression equation (1) with the bond-CDS basis $BCDS_{i,t}$ included as an explanatory variable. Since the bond-CDS sample is only a subset of the corporate bonds used in our baseline DiD analysis reported in Table 2, the results in Table 10 are not comparable. Thus, Table 10 also reports benchmark DiD results for each rating-maturity class excluding the bond-CDS basis from the regression. Comparing the benchmark results to those that include the bond-CDS basis highlights several findings. First, for each rating-maturity class, the estimated coefficient on $BCDS_{i,t}$ is positive and statistically significant, similar to the results in Table 9 using Amihud measure.

Second, relative to the Amihud measure, using the bond-CDS basis indicates that a larger proportion of the SMCCF's reduction of US bond spreads relative to Yankee bond spreads came through a decline in illiquidity, at least for short-maturity AA- and A-rated bonds. Controlling for illiquidity using the bond-CDS basis decreases the magnitude of the estimated coefficients on *US*×*SMCCF* for short-dated AA- and A-rated bonds by 82% and 55%, respectively. In contrast, the estimated coefficients barely change for bonds with maturities above 5 years. This is consistent with the SMCCF's stated goal of providing liquidity to short-dated bonds of high credit quality. However, the findings also indicate that enhanced bond liquidity accounts for only a proportion of the relative reduction in US bond spreads, suggesting that the SMCCF also significantly reduced the default risk of US bonds relative to Yankee bonds.

7. Examining the SMCCF's Effects on Default Risk Using CDS

This section further explores the previous section's evidence that the SMCCF's relative reduction in US bond yield spreads came through declines in both illiquidity and default risk. Given that CDS are a more pure measure of default risk and less affected by illiquidity, we re-examine the impact of the SMCCF on default risk by re-running regression (1) but using CDS spreads, rather than bond yield spreads, as the dependent variable.

For this estimation, we include all US and Yankee (foreign) corporations that have CDS traded on their debt. We categorize each of these corporations by their Markit "implied rating" as of the first week of 2020, dividing them into AA-rated, A-rated, BBB-rated, and BB-rated corporations. For each of these corporations, we select the 3-year CDS spread as representative of an insurance premium on short-term debt and the 10-year CDS spread as representative of an insurance premium on long-term debt. Thus, we obtain 8 rating-maturity categories for both US and Yankee corporations.

We run regression (1) with the CDS spread of reference entity (issuer) i at date t, $CDS_{i,t}$, as the dependent variable. The regression controls for CDS reference entity fixed effects and standard errors are clustered at CDS entity and trading day levels. Table 11 reports the results of the 8 rating-maturity subsamples. It shows that the SMCCF lowered US CDS spreads relative to Yankee CDS spreads for issuers with AA-implied ratings, both for short-term contracts (106 bps) and long-term contracts (188 bps). The SMCCF had no significant effects on the relative CDS spreads of US versus Yankee issuers with A-implied ratings or BBB-implied ratings. However, Table 11 indicates that for both short- and long-maturity CDS contracts, the SMCCF raised US corporate CDS spreads relative to Yankee corporate CDS spreads for issuers with BB-implied ratings, consistent with the SMCCF harming US sub-investment grade issuers.

These CDS spread results in Table 11 are qualitatively similar to those in Table 2 where the dependent variable was bond yield spreads. In both cases, the net benefit of the SMCCF in reducing US corporate spreads versus Yankee corporate spreads was increasing in credit quality, being a positive or insignificant reduction for investment-grade bonds and being a significant increase for sub-investment grade bonds. However, the magnitude of the effects is generally smaller when using CDS spreads compared to bond spreads. If the SMCCF reduced both the relative default risk and illiquidity of US investment-grade bonds, one would expect it to have larger magnitude effects on bond spreads compared to CDS spreads.

To track the temporal change of CDS spreads for each rating-maturity class, and also to validate our DiD results of Table 11, we re-run regression (3) but where the dependent variable is $CDS_{i,t}$. Figure 9 plots the weekly coefficient estimates α_w and their 95% confidence intervals for each group of issuers. Week 8, the beginning of the COVID crisis period, is omitted and used as a benchmark. The figure shows that immediately after the SMCCF was announced, both 3-year and 10-year US CDS spreads fall relative to Yankee CDS spreads for issuers with AA-implied ratings. For US issuers with BB-implied ratings, however, their 3-year and 10-year CDS spreads rise significantly compared to Yankee issuers with the same ratings.

Figure 9 also shows that both 3-year and 10-year CDS spreads of US and Yankee issuers with A/BBB/BB-implied ratings are not statistically different prior to the announcement of the SMCCF in week 12, validating our DiD results in Table 11. Before the SMCCF, the CDS spreads of US issuers with AA-implied ratings remained lower than those of similarly-rated Yankee issuers, but their differences in spreads were stable, albeit becoming statistically insignificant in weeks 10 and 11. Thus, our Table 11 DiD results using CDS spreads for issuers with AA-implied ratings appear valid and, if anything, the estimated coefficients understate the SMCCF's effect on reducing the default risk of AA-rated US issuers.

8. Conclusions

Using Yankee bonds as a benchmark to assess the SMCCF, we find that the announcement of this facility led to a relative reduction in US bond yield spreads that was increasing in a bond's credit quality. While the facility was specifically targeted to short-maturity, investment-grade US bonds, our results show that it also benefited AA-rated and A-rated US bonds having longer maturities. Perhaps due to the stigma of being explicitly excluded from the SMCCF's purchases, our evidence also indicates that sub-investment grade US bonds were actually harmed, as their yield spreads rose substantially relative to the yield spreads of Yankee bonds of the same ratings and maturities.

The stated objective of the SMCCF's purchases was to improve bond liquidity. Yet when using either the Amihud measure or the bond-CDS basis as a proxy for illiquidity, we find that only a portion of the facility's benefit came through improved liquidity. Our empirical evidence shows that a significant part of the reduction in US bond spreads relative to Yankee bond spreads following the SMCCF announcement derived from a decrease in default risk.

Overall, our evidence supports the conclusion that the SMCCF attained its objective of benefiting investment-grade US firms. However, our findings also point to a possible unintended consequence of the SMCCF in that it appears to have significantly hurt US sub-investment firms whose bonds were excluded from the facility. Since sub-investment grade corporations and the employment that they provided were most imperiled by the COVID-19 crisis, omitting their bonds from the facility appears counterproductive.

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Tables

Table 1: Summary Statistics

This table presents summary statistics of data used in the baseline empirical analysis. It shows several statistics of bond yield spreads (in percentage points), time to maturity (in years), transaction quantities (in $ thousands), and the 14-day cumulative numbers of COVID-19 cases per 100,000 population for each bond rating and time-to-maturity category. Bond yield spreads are measured as the difference between the bond yields and U.S. Treasury par yields of the same maturity on the same trading day. Daily bond yields and trade quantities are from TRACE. Bond characteristics, including maturity dates and bond ratings, are from Fixed Income Security Database. Data are winsorized at the 1st and 99th percentiles to remove outliers.

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
AA-rated, maturity < 5 years						
Yield spreads	10,560	0.554	0.319	6,503	0.780	0.468
Time to maturity	10,560	2.310	2.270	6,503	1.917	1.537
Quantity ($ thousands)	10,560	3,180	844	6,503	3,274	940
COVID cases	10,560	51.6	25.6	6,503	23.1	10.5

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
A-rated, maturity < 5 years						
Yield spreads	64,356	0.845	0.531	5,714	1.003	0.658
Time to maturity	64,356	2.428	2.375	5,714	2.343	2.227
Quantity ($ thousands)	64,356	1,951	461	5,714	2,358	606
COVID cases	64,356	54.5	55.7	5,714	28.9	8.6

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BBB-rated, maturity < 5 years						
Yield spreads	106,164	1.883	1.237	4,879	2.272	1.572
Time to maturity	106,164	2.624	2.633	4,879	2.537	2.515
Quantity ($ thousands)	106,164	1,540	324	4,879	1,907	542
COVID cases	106,164	55.7	63.0	4,879	27.4	11.6

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BB-rated, maturity < 5 years						
Yield spreads	22,573	4.472	3.640	1,013	3.444	3.326
Time to maturity	22,573	2.915	3.014	1,013	2.719	2.606
Quantity ($ thousands)	22,573	2,917	901	1,013	4,329	1,570
COVID cases	22,573	50.9	20.6	1,013	23.4	13.5

Table 1 Cont'd

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
AA-rated, maturity > 5 years						
Yield spreads	12,243	1.042	0.974	2,225	1.324	1.281
Time to maturity	12,243	17.062	17.929	2,225	16.571	18.578
Quantity ($ thousands)	12,243	3,500	973	2,225	3,013	984
COVID cases	12,243	53.1	42.3	2,225	21.9	11.6

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
A-rated, maturity >5 years						
Yield spreads	92,851	1.376	1.255	3,576	1.532	1.438
Time to maturity	92,851	16.751	16.488	3,576	13.186	9.533
Quantity ($ thousands)	92,851	2,362	490	3,576	2,247	580
COVID cases	92,851	52.9	42.3	3,576	24.2	0.6

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BBB-rated, maturity > 5 years						
Yield spreads	145,533	2.381	2.073	7,099	2.666	2.278
Time to maturity	145,533	14.385	9.715	7,099	15.706	14.975
Quantity ($ thousands)	145,533	2,537	495	7,099	2,691	600
COVID cases	145,533	53.8	48.6	7,099	26.1	13.6

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BB-rated, maturity > 5 years						
Yield spreads	24,748	4.588	4.152	1,617	4.410	4.611
Time to maturity	24,748	9.059	7.249	1,617	15.053	14.597
Quantity ($ thousands)	24,748	4,194	1,375	1,617	7,733	2,684
COVID cases	24,748	47.5	2.8	1,617	24.2	12.0

Table 2: The Effect of SMCCF on Bond Yield Spreads

This table shows DiD estimates for each rating and time-to-maturity group of bonds. The data are daily corporate bond transactions from January 2020 to June 2020. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs), (BB, ttm<5 yrs) , (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond Yield Spreads															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA >5 yrs	AA >5 yrs	A >5 yrs	A >5 yrs	BBB >5 yrs	BBB >5 yrs	BB >5 yrs	BB >5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.317***	-0.636***	-0.210***	-0.410***	-0.767***	-0.893***	0.828***	1.194***	-0.411***	-0.505***	-0.203***	-0.313***	-0.138	-0.103	0.064	0.571*
	(0.057)	(0.073)	(0.052)	(0.072)	(0.215)	(0.261)	(0.239)	(0.314)	(0.034)	(0.056)	(0.047)	(0.068)	(0.114)	(0.144)	(0.282)	(0.291)
Ln(quantity)		-0.011***		-0.010***		-0.005		-0.013		-0.006***		-0.003***		0.003		-0.001
		(0.002)		(0.002)		(0.003)		(0.016)		(0.001)		(0.001)		(0.002)		(0.007)
Time to maturity		-102.845*		-5.776		-160.798***		184.700		46.215		-52.303**		-46.492*		30.186
		(53.115)		(54.899)		(52.675)		(144.726)		(37.599)		(23.540)		(24.822)		(161.179)
COVID cases		0.006***		0.005***		0.003		-0.006		0.002**		0.002***		-0.001		-0.009***
		(0.001)		(0.001)		(0.002)		(0.005)		(0.001)		(0.001)		(0.001)		(0.001)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,063	17,063	70,070	70,070	111,043	111,043	23,586	23,586	14,468	14,468	96,427	96,427	152,632	152,632	26,365	26,365
R^2	0.794	0.804	0.786	0.788	0.767	0.767	0.748	0.748	0.912	0.913	0.854	0.855	0.850	0.850	0.846	0.847

Table 3: Triple Difference Analysis: The Effect of SMCCF on Investment-Grade versus BB-Rated Bond Yield Spreads

This table shows DiDiD estimates for each rating and time-to-maturity group of investment grade bonds relative to BB-rated bonds. The data are daily corporate bond transactions from January 2020 to June 2020. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020 and 0 otherwise. The indicator IG equals 1 if the bond is investment-grade when traded and 0 otherwise. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is the 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1, 2, 3, 4, 5 and 6 present DiDiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs), (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs) and (BBB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond Yield Spreads					
	AA < 5 yrs (1)	A < 5 yrs (2)	BBB < 5 yrs (3)	AA >5 yrs (4)	A >5 yrs (5)	BBB >5 yrs (6)
US×SMCCF×IG	-0.955***	-1.125***	-1.629***	-0.205	-0.222	-0.234
	(0.285)	(0.244)	(0.319)	(0.299)	(0.293)	(0.288)
US×SMCCF	1.316***	0.856***	0.801***	0.411	0.055	0.175
	(0.254)	(0.242)	(0.251)	(0.288)	(0.298)	(0.280)
SMCCF×IG	-2.082***	-1.736***	-0.355	-1.743***	-1.515***	-0.904***
	(0.201)	(0.218)	(0.268)	(0.270)	(0.280)	(0.274)
Ln(quantity)	-0.012	-0.009*	-0.001	-0.013**	-0.005**	0.004**
	(0.011)	(0.005)	(0.004)	(0.005)	(0.002)	(0.002)
Time to maturity	96.429	56.190	-94.232***	108.207	-20.624	-34.030
	(144.266)	(58.011)	(34.921)	(86.876)	(57.783)	(34.277)
COVID cases	-0.007***	0.002	0.002	-0.006***	0.001	-0.001**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	40,649	93,656	134,629	40,833	122,792	178,997
R^2	0.794	0.807	0.779	0.889	0.897	0.866

Table 4: The Effect of SMCCF on Bond Yield Spreads: A Short Time Window

This table shows DiD estimates for each rating and time-to-maturity group of bonds. The data are intra-day corporate bond transactions on March 20th, 23rd and 24th. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is the 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs), (BB, ttm<5 yrs) , (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include country of domicile and trading day fixed effects. Heteroskedasticity-autocorrelation robust standard errors are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond Yield Spreads															
	AA	AA	A	A	BBB	BBB	BB	BB	AA	AA	A	A	BBB	BBB	BB	BB
	< 5 yrs	< 5 yrs	< 5 yrs	< 5 yrs	< 5 yrs	< 5 yrs	< 5 yrs	< 5 yrs	>5 yrs	>5 yrs	>5 yrs	>5 yrs	>5 yrs	>5 yrs	>5 yrs	>5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-1.732***	-1.217***	-1.097***	-1.097***	-1.514***	-1.647***	3.943***	1.384*	-1.221***	-0.430***	-1.028***	-1.056***	-0.006	-0.124	1.731***	-0.254
	(0.055)	(0.061)	(0.063)	(0.063)	(0.215)	(0.214)	(0.440)	(0.747)	(0.040)	(0.085)	(0.071)	(0.070)	(0.125)	(0.120)	(0.148)	(0.172)
Ln(quantity)		-0.363***		-0.219***		-0.293***		0.045		-0.327***		-0.133***		-0.350***		-0.772***
		(0.031)		(0.030)		(0.037)		(0.174)		(0.016)		(0.006)		(0.009)		(0.041)
Time to maturity		-0.343***		-0.331***		-0.659***		-1.487***		-0.003***		-0.006***		-0.024***		-0.045***
		(0.018)		(0.019)		(0.068)		(0.108)		(0.001)		(0.001)		(0.002)		(0.006)
COVID cases		0.044***		-0.004		-0.004		-0.246***		0.060***		-0.010***		-0.013***		-0.027***
		(0.005)		(0.003)		(0.006)		(0.052)		(0.006)		(0.001)		(0.002)		(0.002)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,008	8,008	24,866	24,866	31,205	31,205	6,664	6,664	4,525	4,525	16,979	16,979	24,342	24,342	6,553	6,553
R^2	0.102	0.180	0.024	0.054	0.001	0.009	0.029	0.071	0.297	0.448	0.043	0.065	0.002	0.056	0.020	0.087

Table 5: The Effect of SMCCF on Bond Yield Spreads: Using Only Canadian and Australian Yankee Bonds

This table shows DiD estimates for each rating and time-to-maturity group of bonds. The data are daily transactions of US, Canadian and Australian corporate bonds from January 2020 to April 15^{th}, 2020. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23^{rd} 2020. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs), (BB, ttm<5 yrs) , (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

	Bond Yield Spreads															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA >5 yrs	AA >5 yrs	A >5 yrs	A >5 yrs	BBB >5 yrs	BBB >5 yrs	BB >5 yrs	BB >5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.619***	-0.907***	-0.278**	-0.472***	-1.266**	-1.762**	1.800***	1.426***	-0.138*	-0.351**	-0.212*	-0.335**	-0.325	-0.274	0.863***	1.640***
	(0.080)	(0.088)	(0.117)	(0.161)	(0.602)	(0.817)	(0.510)	(0.391)	(0.071)	(0.165)	(0.111)	(0.126)	(0.222)	(0.255)	(0.102)	(0.119)
Ln(quantity)		-0.009***		-0.009***		-0.009**		-0.041**		-0.007***		-0.004**		0.002		-0.010
		(0.003)		(0.002)		(0.004)		(0.017)		(0.002)		(0.001)		(0.002)		(0.009)
Time to maturity		-99.389		60.804		-134.574**		212.263		58.373		-55.255***		-89.461***		-48.262
		(93.059)		(86.342)		(63.736)		(246.698)		(60.537)		(16.190)		(25.925)		(249.113)
COVID cases		0.007***		0.004**		0.011		0.008		-0.011***		0.003**		-0.001		-0.017***
		(0.001)		(0.002)		(0.007)		(0.007)		(0.001)		(0.001)		(0.002)		(0.001)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,890	7,890	39,489	39,489	63,533	63,533	14,365	14,365	7,458	7,458	57,283	57,283	88,943	88,943	16,268	16,268
R^2	0.829	0.831	0.823	0.823	0.784	0.784	0.779	0.780	0.924	0.924	0.873	0.873	0.854	0.854	0.851	0.851

Table 6: The Effect of SMCCF on Bond Liquidity Using the Amihud Measure

This table presents estimates of panel regressions of bond liquidity on the interaction of indicator SMCCF and indicator US for each rating and time-to-maturity group of bonds. The data are daily corporate bond transactions from January 2020 to June 2020. Bond liquidity is calculated based on Amihud (2002) using weekly transaction data. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs) , (BB, ttm<5 yrs), (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Amihud Illiquidity Measure															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA >5 yrs	AA >5 yrs	A >5 yrs	A >5 yrs	BBB >5 yrs	BBB >5 yrs	BB >5 yrs	BB >5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.039***	-0.132***	-0.028	-0.066**	-0.003	0.029	0.057	0.141	-0.212***	-0.560***	-0.050	-0.083	0.043	0.152***	0.172***	0.230**
	(0.014)	(0.034)	(0.026)	(0.033)	(0.021)	(0.032)	(0.046)	(0.226)	(0.079)	(0.176)	(0.042)	(0.081)	(0.026)	(0.043)	(0.045)	(0.089)
Ln(quantity)		-0.011***		-0.019***		-0.027***		-0.038***		-0.033***		-0.046***		-0.043***		-0.059***
		(0.001)		(0.001)		(0.002)		(0.004)		(0.004)		(0.002)		(0.002)		(0.005)
Time to maturity		29.904		8.718		-15.309		-0.123		64.844		-15.759		46.602		98.929
		(23.120)		(26.753)		(28.962)		(68.395)		(82.541)		(41.043)		(34.818)		(110.627)
COVID cases		0.002***		0.001**		-0.001		-0.002		0.006***		0.001		-0.002***		-0.001
		(0.0005)		(0.0004)		(0.0004)		(0.003)		(0.002)		(0.001)		(0.001)		(0.001)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,063	17,063	70,070	70,070	111,043	111,043	23,586	23,586	14,468	14,468	96,427	96,427	152,632	152,632	26,365	26,365
R^2	0.439	0.451	0.399	0.408	0.379	0.388	0.430	0.438	0.368	0.386	0.367	0.381	0.373	0.384	0.382	0.393

Table 7: Summary Statistics of Bonds with Traded CDS

This table presents summary statistics of bonds for which CDS spreads are available. It shows several statistics of bond yield spreads (in percentage points), bond-CDS bases (in percentage points), times to maturity (in years), transaction quantities (in $ thousands), and 14-day cumulative numbers of COVID-19 cases per 100,000 population for each bond rating and time to maturity category. Bond yield spreads are measured as the difference between the bond yields and U.S. Treasury par yields of the same maturity on the same trading day. Bond-CDS basis is the difference between the bond yield spread and the CDS spread of the closest maturity on the same trading day. Daily bond yields and trade quantities are from TRACE. Bond characteristics, including maturity dates and bond ratings, are from Fixed Income Security Database. Data are winsorized at the 1st and 99th percentiles to remove outliers.

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
AA-rated, maturity < 5 years						
Yield spreads	2,772	0.443	0.241	922	0.827	0.459
Bond-CDS basis	2,772	0.265	0.079	922	0.618	0.272
Time to maturity	2,772	2.275	2.129	922	1.828	1.495
Quantity ($ thousands)	2,772	2,979	822	922	3,411	899
COVID cases	2,772	60.5	90.9	922	7.2	0.1

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
A-rated, maturity < 5 years						
Yield spreads	27,153	0.735	0.451	1,426	0.959	0.707
Bond-CDS basis	27,153	0.459	0.216	1,426	0.596	0.365
Time to maturity	27,153	2.425	2.323	1,426	1.969	1.764
Quantity ($ thousands)	27,153	2,127	580	1,426	3,708	1,586
COVID cases	27,153	53.7	48.6	1,426	22.1	0.9

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BBB-rated, maturity < 5 years						
Yield spreads	43,894	1.563	1.041	642	2.443	1.845
Bond-CDS basis	43,894	0.923	0.501	642	1.876	1.305
Time to maturity	43,894	2.582	2.542	642	2.576	2.734
Quantity ($ thousands)	43,894	1,644	410	642	1,206	243
COVID cases	43,894	56.7	70.3	642	29.1	27.9

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BB-rated, maturity < 5 years						
Yield spreads	5,594	4.387	3.379	165	3.297	2.731
Bond-CDS basis	5,594	2.484	1.933	165	0.289	-0.044
Time to maturity	5,594	2.565	2.463	165	2.746	2.606
Quantity ($ thousands)	5,594	2,527	731	165	1,496	328
COVID cases	5,594	51.9	25.6	165	14.9	0.1

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
AA-rated, maturity > 5 years						
Yield spreads	3,434	0.968	0.920	281	1.021	0.734
Bond-CDS basis	3,434	0.311	0.230	281	0.343	0.245
Time to maturity	3,434	17.393	16.977	281	7.357	7.011
Quantity ($ thousands)	3,434	4,004	1,125	281	3,298	890
COVID cases	3,434	59.3	90.8	281	2.6	0.04

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
A-rated, maturity > 5 years						
Yield spreads	38,787	1.263	1.161	1,214	1.811	1.651
Bond-CDS basis	38,787	0.433	0.353	1,214	0.530	0.484
Time to maturity	38,787	16.062	15.214	1,214	12.377	9.708
Quantity ($ thousands)	38,787	2,809	700	1,214	2,624	887
COVID cases	38,787	51.8	25.6	1,214	25.8	0.9

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BBB-rated, maturity > 5 years						
Yield spreads	62,171	2.205	1.950	2,008	2.698	2.150
Bond-CDS basis	62,171	0.824	0.653	2,008	1.054	0.732
Time to maturity	62,171	15.443	10.189	2,008	18.353	19.448
Quantity ($ thousands)	62,171	2,762	611	2,008	2,113	400
COVID cases	62,171	54.4	55.7	2,008	24.3	17.4

Statistic	Obs US	Mean US	Median US	Obs Yankee	Mean Yankee	Median Yankee
BB-rated, maturity > 5 years						
Yield spreads	5,375	4.421	3.892	280	3.808	2.783
Bond-CDS basis	5,375	1.472	1.157	280	0.770	0.521
Time to maturity	5,375	9.940	7.638	280	18.839	19.845
Quantity ($ thousands)	5,375	4,624	1,367	280	6,560	1,587
COVID cases	5,375	50.0	13.9	280	1.8	0.01

Table 8: The Effect of SMCCF on Liquidity Using the Bond-CDS Basis

This table presents panel regressions of the bond-CDS basis on the interaction of indicator SMCCF and indicator US for each rating and time-to-maturity group of bonds. The data are daily bond-CDS basis calculated using daily bond transaction data and CDS spreads from Markit. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. Ln (quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is the cumulative 14 day number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs)), (BB, ttm<5 yrs) , (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond-CDS Basis Illiquidity Measure															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA > 5 yrs	AA > 5 yrs	A > 5 yrs	A > 5 yrs	BBB > 5 yrs	BBB > 5 yrs	BB > 5 yrs	BB > 5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.487***	-0.769***	-0.180***	-0.305***	-0.795	-1.183	-0.730***	-1.411***	0.132**	0.200**	-0.086**	0.003	-0.341**	-0.303	-2.185	-3.924**
	(0.100)	(0.157)	(0.050)	(0.075)	(0.642)	(0.831)	(0.206)	(0.438)	(0.056)	(0.089)	(0.040)	(0.044)	(0.164)	(0.187)	(1.708)	(1.608)
Ln(quantity)		-0.005		-0.008***		-0.006*		-0.003		-0.003		-0.001		-0.003*		0.014
		(0.003)		(0.002)		(0.003)		(0.016)		(0.002)		(0.001)		(0.002)		(0.012)
Time to maturity		194.997**		-4.754		-29.118		266.297		-0.876		-48.700		24.335		48.884
		(73.220)		(46.801)		(114.051)		(475.181)		(43.753)		(32.004)		(40.078)		(330.326)
COVID cases		0.004***		0.004**		0.007		0.012**		-0.001*		-0.002***		-0.001		0.062***
		(0.002)		(0.002)		(0.005)		(0.005)		(0.001)		(0.001)		(0.002)		(0.020)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,694	3,694	28,579	28,579	44,536	44,536	5,759	5,759	3,715	3,715	40,001	40,001	64,179	64,179	5,655	5,655
R^2	0.814	0.821	0.797	0.797	0.743	0.743	0.721	0.721	0.889	0.890	0.850	0.851	0.779	0.779	0.722	0.726

Table 9: Yield Spreads, the SMCCF, and Amihud Illiquidity

This table shows DiD estimates for each rating and time-to-maturity group of bonds that control for the Amihud measure of bond illiquidity. The data are daily corporate bond transactions from January 2020 to June 2020. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is 14-day cumulative number of COVID-19 cases per 100,000 population. *ILLIQ* is the bond illiquidity measure based on Amihud (2002) using weekly transaction data. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs) , (BB, ttm<5 yrs), (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond Yield Spreads															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA >5 yrs	AA >5 yrs	A >5 yrs	A >5 yrs	BBB >5 yrs	BBB >5 yrs	BB >5 yrs	BB >5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.311***	-0.624***	-0.206***	-0.402***	-0.766***	-0.903***	0.782***	1.079***	-0.405***	-0.492***	-0.200***	-0.309***	-0.143	-0.121	0.034	0.530*
	(0.056)	(0.074)	(0.051)	(0.071)	(0.214)	(0.260)	(0.233)	(0.325)	(0.033)	(0.056)	(0.047)	(0.067)	(0.113)	(0.143)	(0.280)	(0.290)
ILLIQ	0.150***	0.097***	0.125***	0.118***	0.342***	0.345***	0.809***	0.815***	0.029***	0.023***	0.051***	0.050***	0.115***	0.118***	0.177***	0.179***
	(0.035)	(0.034)	(0.014)	(0.014)	(0.025)	(0.025)	(0.114)	(0.115)	(0.009)	(0.008)	(0.005)	(0.005)	(0.008)	(0.009)	(0.031)	(0.031)
Ln(quantity)		-0.010***		-0.008***		0.004		0.019		-0.006***		-0.001		0.008***		0.010
		(0.002)		(0.002)		(0.003)		(0.016)		(0.001)		(0.001)		(0.002)		(0.007)
Time to maturity		-105.758**		-6.802		-155.521***		184.799		44.730		-51.514**		-52.001**		12.478
		(51.516)		(54.291)		(54.324)		(194.693)		(37.129)		(23.724)		(24.202)		(160.154)
COVID cases		0.006***		0.005***		0.003		-0.005		0.001*		0.002***		-0.0004		-0.009***
		(0.001)		(0.001)		(0.002)		(0.005)		(0.001)		(0.001)		(0.001)		(0.001)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,063	17,063	70,070	70,070	111,043	111,043	23,586	23,586	14,468	14,468	96,427	96,427	152,632	152,632	26,365	26,365
R^2	0.795	0.805	0.788	0.789	0.773	0.773	0.762	0.762	0.913	0.914	0.856	0.856	0.852	0.852	0.848	0.849

Table 10: Yield Spreads, the SMCCF, and Bond-CDS Illiquidity

This tables shows DiD estimates for each rating and time-to-maturity groups of bonds that control for the bond-CDS basis as an illiquidity measure. The data are daily corporate bond transactions from January 2020 to June 2020. The indicator US equals 1 if the bond is issued by a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. The bond-CDS basis, *BCDS*, is the difference between bond yield spreads and CDS spreads. Ln(quantity) is the natural logarithm of the bond transaction quantity in US dollars. COVID cases is 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 16 present DiD estimates for bond groups (AA, ttm<5 yrs), (A, ttm<5 yrs), (BBB, ttm<5 yrs) , (BB, ttm<5 yrs), (AA, ttm ≥5 yrs), (A, ttm ≥5 yrs), (BBB, ttm ≥5 yrs) and (BB, ttm ≥5 yrs), respectively. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Bond Yield Spreads															
	AA < 5 yrs	AA < 5 yrs	A < 5 yrs	A < 5 yrs	BBB < 5 yrs	BBB < 5 yrs	BB < 5 yrs	BB < 5 yrs	AA >5 yrs	AA >5 yrs	A >5 yrs	A >5 yrs	BBB >5 yrs	BBB >5 yrs	BB >5 yrs	BB >5 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.940***	-0.165***	-0.505***	-0.224***	-0.802	0.268**	0.819*	2.191***	-0.508***	-0.678***	-0.372***	-0.374***	0.243	0.417***	-1.419	0.265
	(0.173)	(0.051)	(0.079)	(0.052)	(0.846)	(0.111)	(0.471)	(0.522)	(0.083)	(0.044)	(0.061)	(0.068)	(0.186)	(0.087)	(1.721)	(0.637)
BCDS		1.007***		0.919***		0.905***		0.973***		0.848***		0.614***		0.576***		0.429***
		(0.018)		(0.021)		(0.027)		(0.092)		(0.081)		(0.046)		(0.034)		(0.120)
Ln(quantity)	-0.006	-0.001*	-0.004*	0.003**	0.005	0.010*	-0.057**	-0.055**	-0.004*	-0.001	0.0001	0.001	0.006**	0.008***	-0.007	-0.013
	(0.004)	(0.001)	(0.002)	(0.001)	(0.005)	(0.005)	(0.022)	(0.024)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.027)	(0.015)
Time to maturity	206.921***	10.542	-18.451	-14.082*	-165.666*	-139.310***	164.878	-94.179***	38.827	39.570	-69.253*	-39.375	27.642	13.618	-21.367***	-42.345***
	(68.151)	(7.453)	(48.003)	(7.966)	(94.591)	(13.712)	(300.677)	(0.001)	(23.322)	(34.930)	(39.107)	(41.181)	(40.156)	(36.093)	(0.071)	(0.0005)
COVID cases	0.005***	0.001**	0.005***	0.001**	0.004	-0.002*	-0.007**	-0.018***	0.002**	0.003***	-0.001	0.001	-0.004*	-0.003***	0.024	-0.002
	(0.002)	(0.0004)	(0.002)	(0.0005)	(0.005)	(0.001)	(0.003)	(0.005)	(0.001)	(0.0001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.018)	(0.009)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,694	3,694	28,579	28,579	44,536	44,536	5,759	5,759	3,715	3,715	40,001	40,001	64,179	64,179	5,655	5,655
R^2	0.845	0.994	0.805	0.944	0.776	0.937	0.769	0.878	0.937	0.985	0.879	0.921	0.857	0.902	0.827	0.847

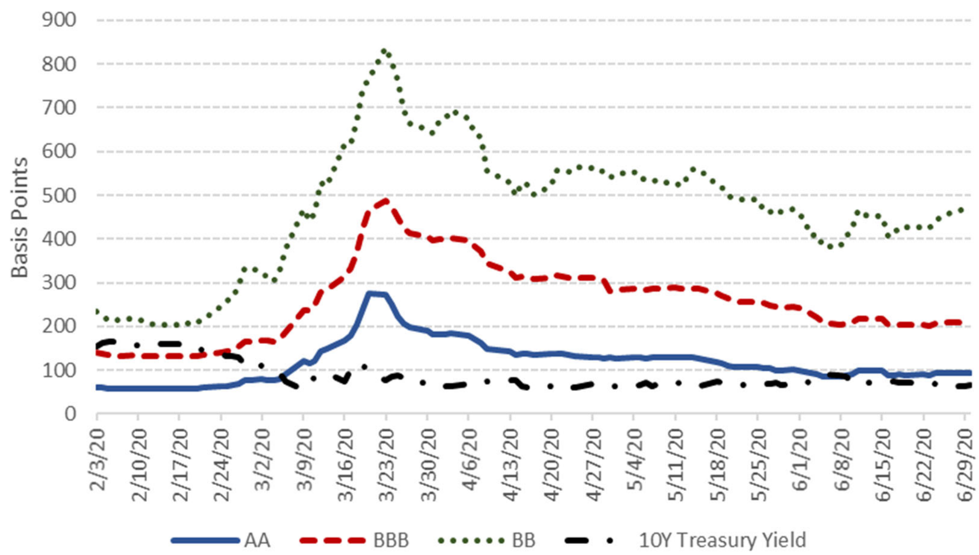
Table 11: The Effect of SMCCF on CDS Spreads

This table shows DiD estimates for each group of credit default swaps (CDS). The data are daily CDS spreads from January 2020 to June 2020. The CDS are grouped by their Markit implied credit ratings in the first week of 2020. The indicator US equals 1 if the CDS reference entity is a US company, and 0 otherwise. The indicator SMCCF equals 1 if the transaction occurs on and after March 23rd 2020. COVID cases are the 14-day cumulative number of COVID-19 cases per 100,000 population. Columns 1 to 8 present DiD estimates for 3-year CDS, and column 9 to 16 present the results for 10-year CDS. All specifications include CDS reference entity and trading day fixed effects. Robust standard errors are clustered at the CDS entity and trading day level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	CDS Spreads															
	AA 3-yr	AA 3-yr	A 3-yr	A 3-yr	BBB 3-yr	BBB 3-yr	BB 3-yr	BB 3-yr	AA 10-yr	AA 10-yr	A 10-yr	A 10-yr	BBB 10-yr	BBB 10-yr	BB 10-yr	BB 10-yr
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
US×SMCCF	-0.116***	-0.106***	-0.049	-0.103	-0.006	0.015	0.499***	0.593**	-0.192***	-0.188***	-0.066	-0.064	0.023	0.095	0.555***	0.691***
	(0.010)	(0.008)	(0.061)	(0.083)	(0.087)	(0.122)	(0.161)	(0.232)	(0.019)	(0.015)	(0.065)	(0.090)	(0.099)	(0.127)	(0.134)	(0.233)
COVID cases		-0.001**		0.001*		-0.0004		-0.002		-0.0002		-0.00002		-0.001		-0.002
		(0.0002)		(0.0005)		(0.001)		(0.002)		(0.0004)		(0.001)		(0.001)		(0.003)
CDS Ref Entity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,179	2,179	5,679	5,679	14,808	14,808	14,289	14,289	2,050	2,050	5,685	5,685	14,743	14,743	14,037	14,037
R^2	0.775	0.776	0.593	0.593	0.608	0.608	0.563	0.563	0.820	0.820	0.697	0.697	0.670	0.670	0.646	0.646

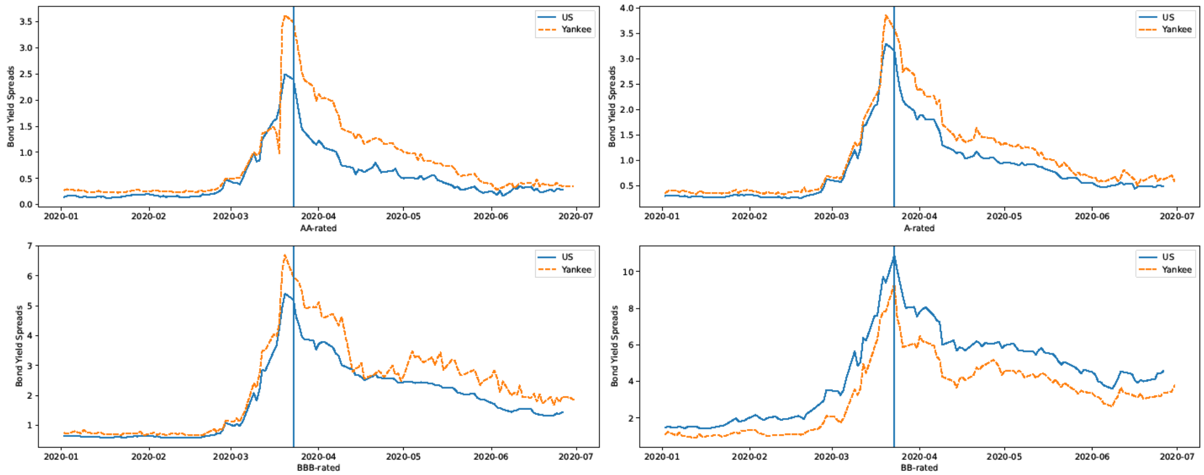
Figures

Figure 1: Option-Adjusted Spreads of AA-, BBB-, and BB-rated Corporate Bonds



Source: ICE BofA Indices

A: Bonds Maturing in 5 Years or Less



B: Bonds Maturing in More Than 5 Years

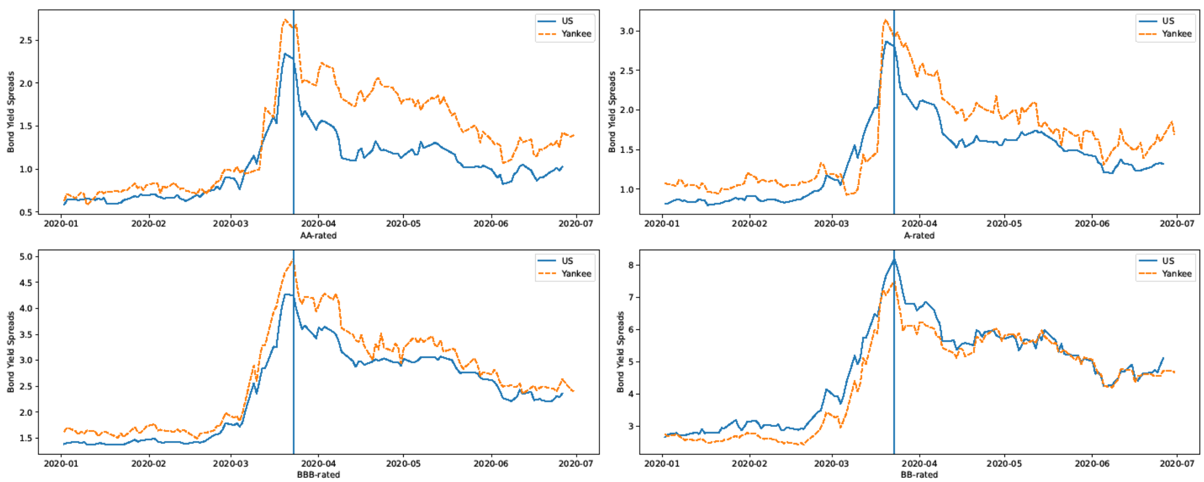


Figure 2: Daily Yield Spreads of US and Yankee Bonds

This figure plots the average daily yield spreads (in percentage points) for each rating and time-to-maturity group of US (solid line) and Yankee (dashed line) bonds. Panel (A) shows the average daily yield spreads of bonds maturing in 5 years or less. Panel (B) shows the average daily yield spreads of bonds maturing in more than 5 years. The vertical line indicates March 23 on which the Federal Reserve launched the SMCCF. The data are daily corporate bond transactions from January 2020 to June 2020.

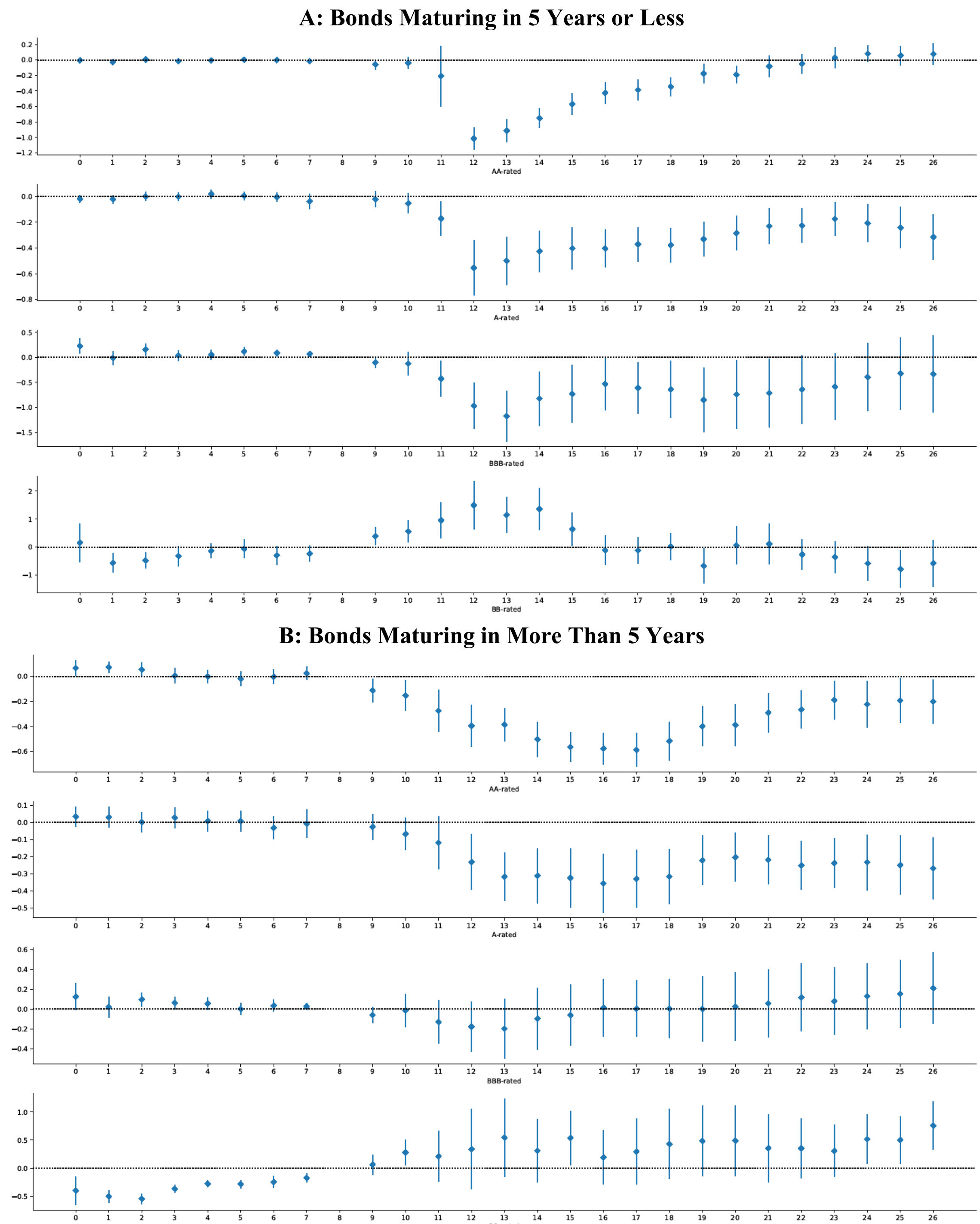


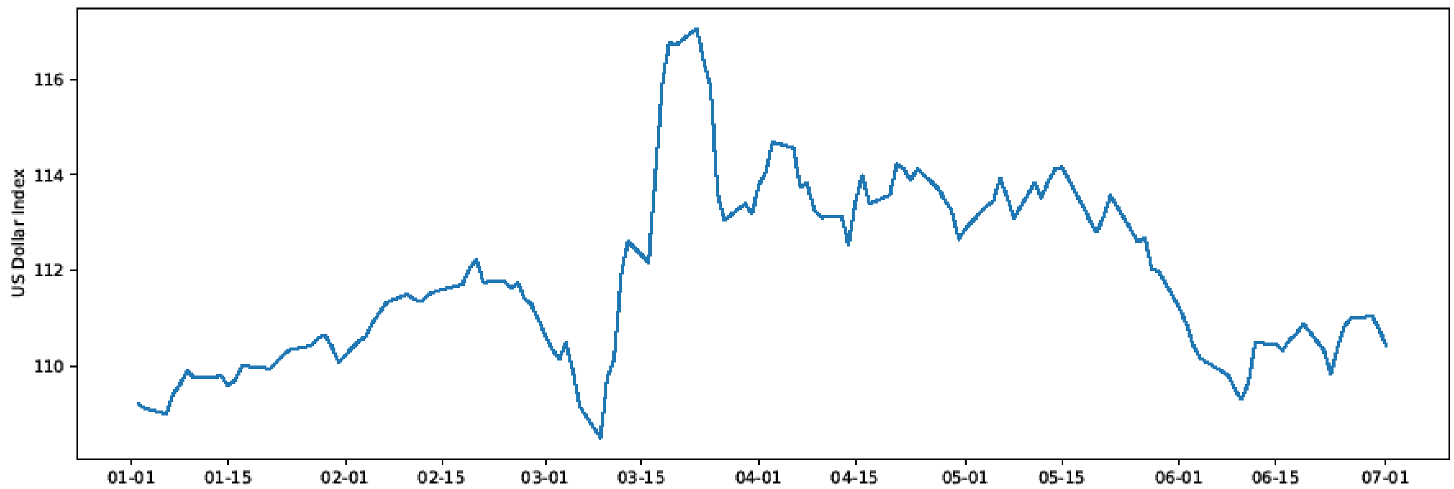
Figure 3: Dynamics of SMCCF's Impact on Corporate Bond Yield Spreads

This figure plots the coefficient estimates from regressions of week-specific effects of SMCCF on bond yield spreads. The blue dots are the point estimates $\{\alpha_w, w = 0,..7, 9,\ldots,26\}$ from the regression

$$s_{i,t} = \sum_{\substack{w=0,..7,\\ 9,...,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + v_i + \eta_t + \varepsilon_{i,t}$$

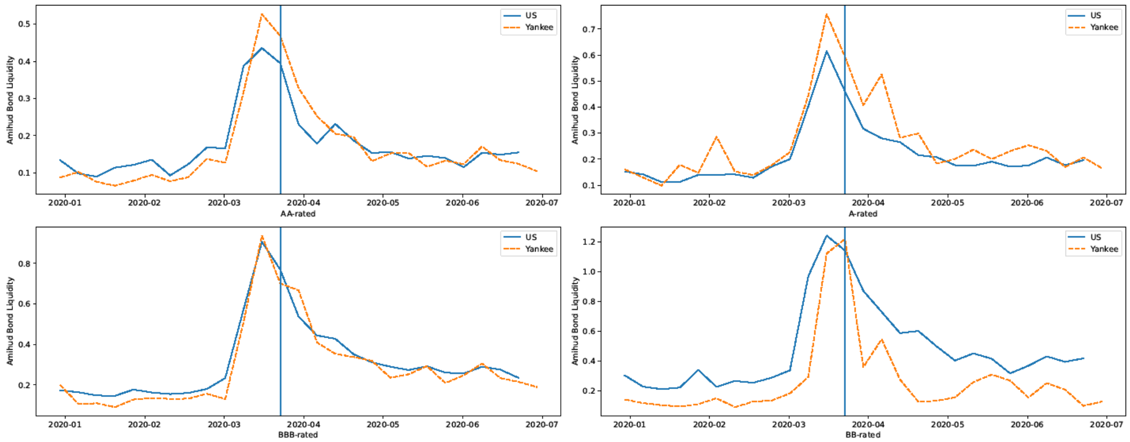
for each rating and time-to-maturity class. Week 8 is used as a benchmark and omitted from the regression. The blue lines are the 95 percent confidence intervals. Panel (A) shows the coefficient estimates and confidence intervals for bonds maturing in 5 years or less. Panel (B) shows the coefficient estimates and confidence intervals for bonds maturing in more than 5 years. The data are daily corporate bond transactions from January 2020 to June 2020. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level.

Figure 4: US Dollar Index



This figure displays the nominal advanced foreign economies US dollar index in the first half of 2020. Data is from the Federal Reserve.

A: Bonds Maturing in 5 Years or Less



B: Bonds Maturing in More Than 5 Years

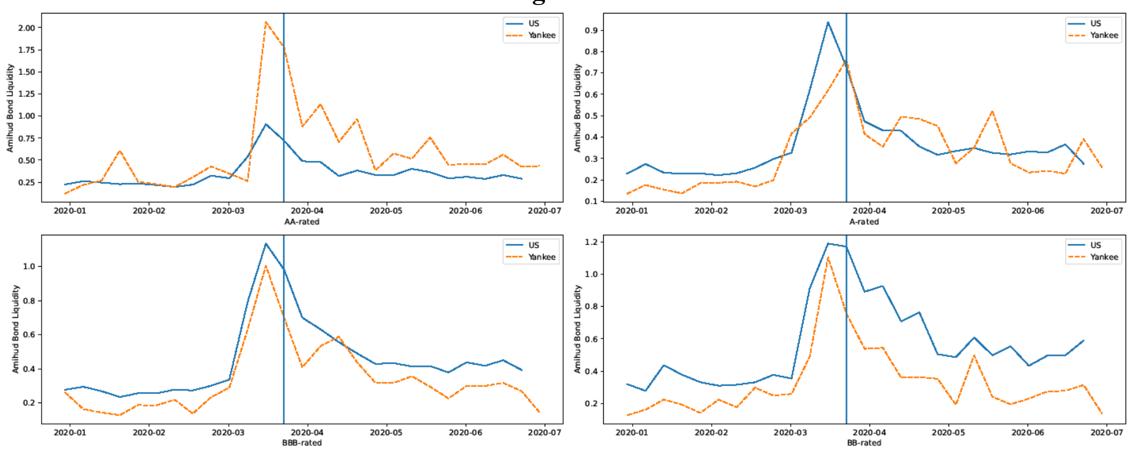
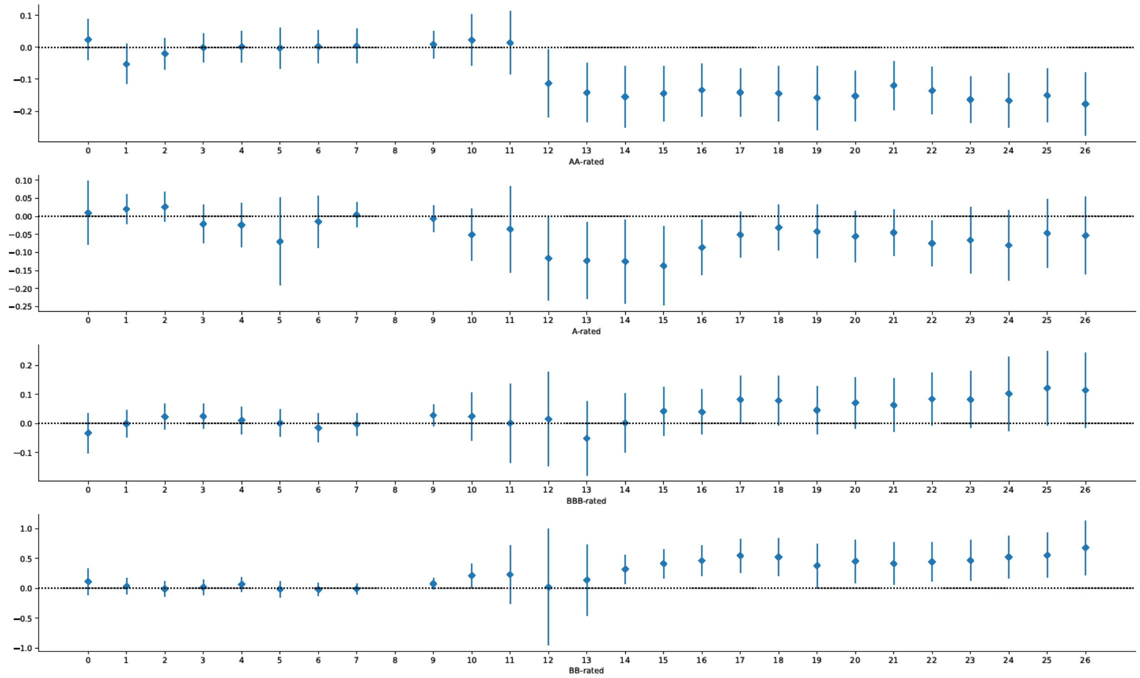


Figure 5: SMCCF and Amihud Bond Illiquidity

This figure plots the average weekly bond illiquidity for each rating and time-to-maturity group of US (solid line) and Yankee (dashed line) bonds. Panel (A) shows the illiquidity of bonds with maturities of 5 years or less. Panel (B) shows the illiquidity of bonds with maturities above 5 years. The vertical line indicates March 23 on which the Federal Reserve launched the SMCCF. Bond illiquidity is calculated based on Amihud (2002) using weekly bond transaction data.

A: Bonds Maturing in 5 Years or Less



B: Bonds Maturing in More Than 5 Years

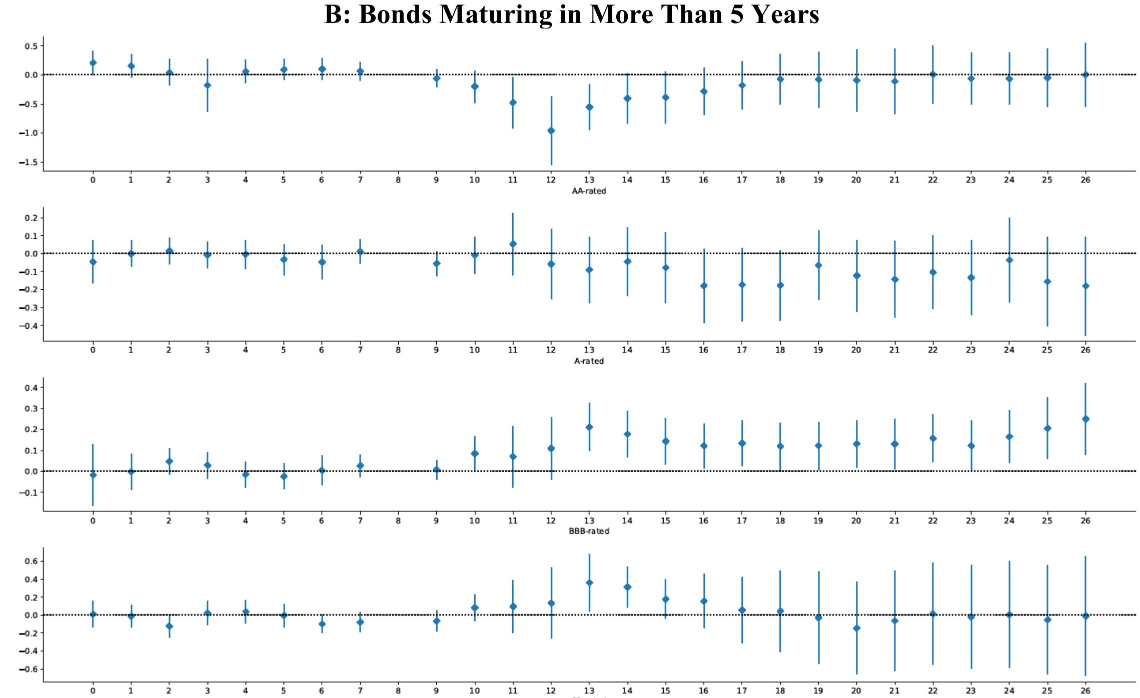


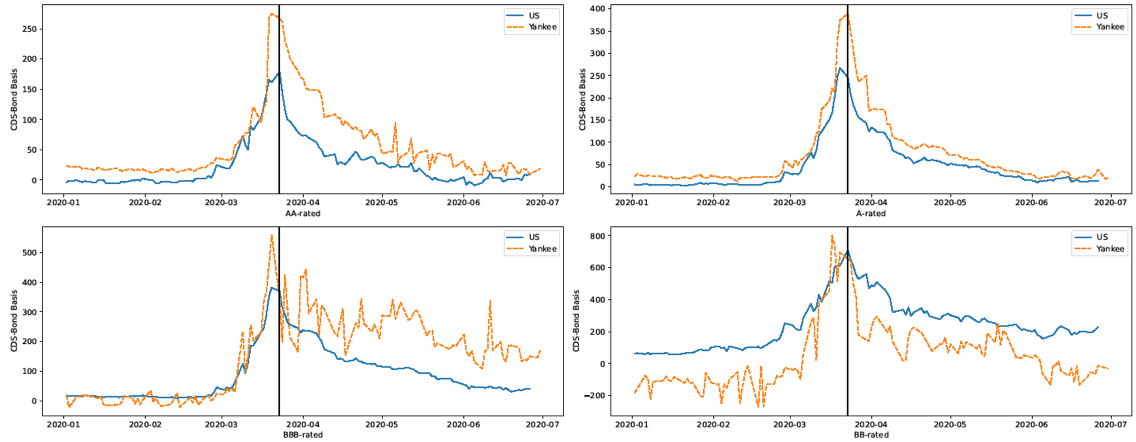
Figure 6: Dynamics of SMCCF's Impact on Amihud Bond Illiquidity

This figure plots the coefficient estimates from regressions of week-specific effects of SMCCF on bond liquidity. The blue dots are the point estimates $\{\alpha_w, w = 0,..7, 9,\ldots,26\}$ from the regression

$$ILLIQ_{i,t} = \sum_{\substack{w=0,..7,\\ 9,...,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + v_i + \eta_t + \varepsilon_{i,t}$$

for each rating and time-to-maturity class of US and Yankee bonds. Week 8 is used as a benchmark and omitted from the regression. The blue lines are the 95 percent confidence intervals. Panel (A) shows the coefficient estimates and confidence intervals for bonds maturing in 5 years or less. Panel (B) shows the coefficient estimates and confidence intervals for bonds maturing in more than 5 years. The data are daily corporate bond transactions from January 2020 to June 2020. Bond illiquidity is calculated based on Amihud (2002) using weekly transaction data. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level.

A: Bond-CDS Basis for Bonds Maturing in 5 Years or Less

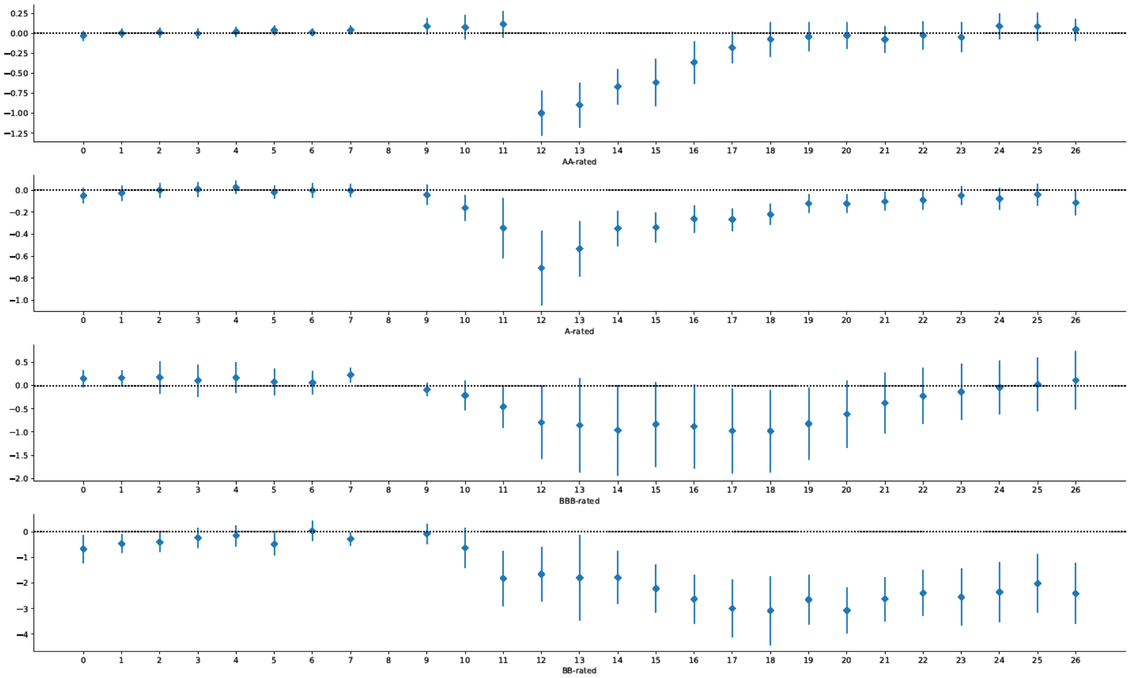


B: Bond-CDS Basis for Bonds Maturing in More Than 5 Years

Figure 7: SMCCF and Bond-CDS Illiquidity

This figure plots the average daily bond-CDS basis for each rating and time-to-maturity group of US (solid line) and Yankee (dashed line) bonds. Panel (A) plots the bond-CDS basis for bonds maturing in 5 years or less. Panel (B) plots the bond-CDS basis for bonds maturing in more than 5 years. The vertical line indicates March 23 on which the Federal Reserve launched the SMCCF. The bond-CDS basis is calculated from daily yield spreads of TRACE and daily CDS spreads of Markit from January 2020 to June 2020.

A: Bonds Maturing in 5 Years or Less



B: Bonds Maturing in More Than 5 Years

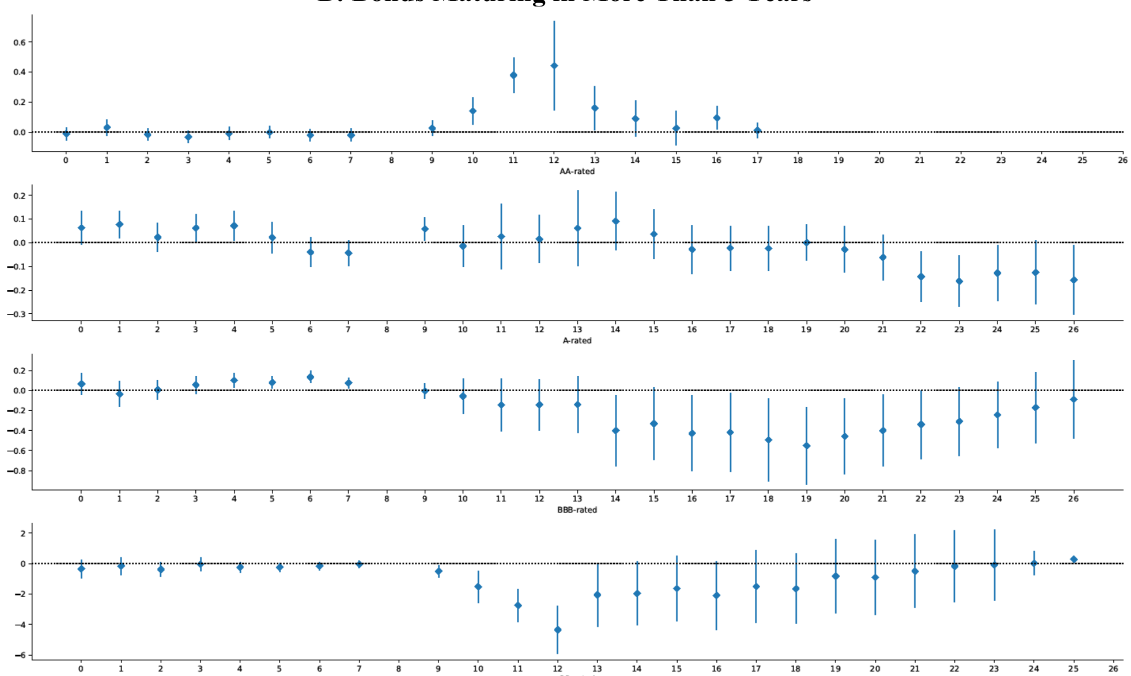


Figure 8: Dynamics of SMCCF's Impact on Bond-CDS Illiquidity

This figure plots the coefficient estimates from regressions of week-specific effects of SMCCF on the bond-CDS basis. The solid line are the point estimates $\{\alpha_w, w = 0,..7, 9,\ldots,26\}$ from the regression

$$BCDS_{i,t} = \sum_{\substack{w=0,..7,\\ 9,..,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + \nu_i + \eta_t + \varepsilon_{i,t}$$

for each rating and time-to-maturity class of US and Yankee bonds. Week 8 is used as a benchmark and omitted from the regression. The blue lines are the 95 percent confidence intervals. Panel (A) shows the coefficient estimates and confidence intervals for bonds maturing in 5 years or less. Panel (B) shows the coefficient estimates and confidence intervals for bonds maturing in more than 5 years. The bond-CDS basis is calculated from daily yield spreads of TRACE and daily CDS spreads of Markit from January 2020 to June 2020. All specifications include bond and trading day fixed effects. Robust standard errors are clustered at the bond and trading day level.

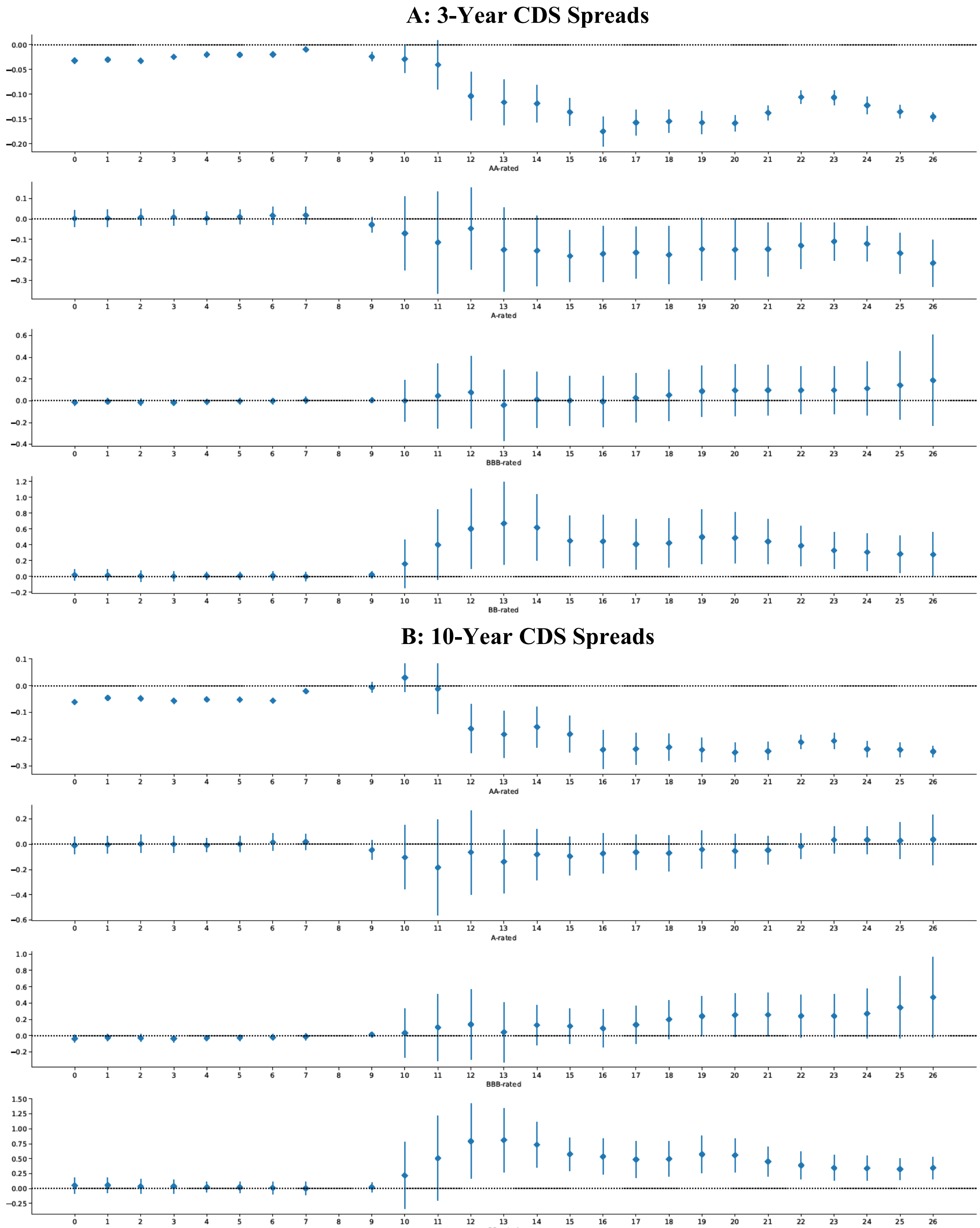


Figure 9: SMCCF and CDS Spreads

This figure plots the coefficient estimates from regressions of week-specific effects of SMCCF on CDS spreads. The solid line are the point estimates $\{\alpha_w, w = 0,..7, 9,\ldots,26\}$ from the regression

$$CDS_{i,t} = \sum_{\substack{w=0,..7,\\ 9,..,26}} \alpha_w US_i \times Week_w + \beta X_{i,t} + \nu_i + \eta_t + \varepsilon_{i,t}$$

for each rating-maturity class. Week 8 is used as a benchmark and omitted from the regression. The blue lines are the 95 percent confidence intervals. Panel (A) shows the coefficient estimates and confidence intervals for 3-year CDS contracts. Panel (B) shows the coefficient estimates and confidence intervals for 10-year CDS contracts. The data are CDS spreads of US and Yankee issuers from January 2020 to June 2020. All specifications include CDS reference entity and trading day fixed effects. Robust standard errors are clustered at the reference entity and trading day level.