It’s What You Say and What You Buy: A Holistic Evaluation of the Corporate Credit Facilities

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Abstract
We document that the announcement of the corporate credit facilities by the Federal Reserve (PMCCF and SMCCF) had an immediate positive impact on corporate bond market prices and liquidity, with a third of the effect realized on the announcement date. We document immediate pass-through into primary markets, particularly for eligible issuers. Improvements continue after the initial announcement is made as additional information is shared and purchases begin, with the impact of bond purchases larger than the impact of purchases of ETFs. Exploiting cross-sectional evidence, we see that the improvement in corporate credit markets can be attributed both to announcement effects of Federal Reserve interventions on the economy more broadly as well as to the facilities specifically, through differential effects on eligible issues.

Key words: corporate credit facilities, bond liquidity, credit spreads, purchase effects

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To view the authors’ disclosure statements, visit https://www.newyorkfed.org/research/staff_reports/sr935.html.
1 Introduction

“The effect of the programmes is more psychological than financial... The Fed has
totally achieved their target.”


The corporate bond market experienced historic turmoil in March 2020, with spreads spiking
to historic highs. As investors shed risky assets in response to the COVID pandemic and
associated shutdowns, U.S. investment grade corporate bond issuance slowed to levels not
seen since the financial crisis. As part of an extensive set of measures to support the U.S.
economy, the Federal Reserve announced its first ever corporate credit facilities (CCFs) on
March 23, 2020 in order to support the supply of capital market credit to the non-financial
corporate sector. The facilities were designed with a two-pronged approach, facilitating ac-
cess to primary markets through direct lending in the Primary Market Corporate Credit
Facility (PMCCF) and acting in secondary markets through purchases of individual bonds
and exchange-traded funds (ETFs) through the Secondary Market Corporate Credit Facility
(SMCCF).

In this paper, we document the impact of the announcements of the CCFs and quantify
the direct impact of secondary market purchases. We offer a holistic evaluation of the impact
of the facilities announcements and purchases on: i) Secondary bond market functioning,
both in spread and liquidity terms, ii) Market expectations of default, iii) Pass-through to
functioning in associated derivatives markets, and iv) Primary market functioning, both in
quantity and spread terms. We identify both the overall announcement effect on market
prices and liquidity as well as the direct impact of purchases, calculating the impact on
eligible securities and the corporate bond market more broadly.

Theory suggests a number of channels for the facilities to impact corporate credit. First,
as part of a suite of Federal Reserve actions, announcements may improve prospects for
the U.S. economy, reducing the quantity of corporate credit risk and the prices investors are willing to pay for that risk. Second, facilities may impact intermediation, arising from dealers’ increased willingness to trade securities that now have a buyer of last resort. Third, there may be a direct impact on eligible securities from purchases and the presence of a backstop facility. We use different features of the facilities and the announcements, as well as daily data on ETF and individual bond purchases by the Fed to shed light on the relative importance of these channels, but do not view them as mutually exclusive. We find evidence for each of these hypotheses, with both pricing and liquidity dramatically impacted by the initial announcements, and credit spreads more influenced by direct purchases.

We document a dramatic improvement in average duration-matched spreads of 140 basis points in the three months after the initial announcement of the facilities. We estimate that a third of the improvement occurred on March 23, the initial announcement date of the facilities. A further third happened by April 9 when the facility term sheet was revised and additional information provided, and the last third only after the commencement of facility purchases on May 12. Expected default frequencies did not fall nearly as quickly, suggesting that the initial price impact acted to reverse the increase in the price of credit risk, rather than the market expectations of the amount of credit risk. Adjusting credit spreads for default probabilities, the initial improvement around March 23 was actually higher (168 bp), suggesting risk premia decreased even more than spread levels. Similarly, almost half of the approximately 200 bps improvement in average bid-ask spreads between March 20 and June 26 occurred on March 23, and another 60 bps by April 9. Though average bid-ask spreads continued to improve, SMCCF purchases of ETFs had no discernible improvement on bid-ask spreads. Bid-ask spreads on bonds bought directly by the facility improved 2.5 bps per every million of cash bond purchases, more than 5 percent of the baseline improvement.

In addition to looking at the impact on secondary markets, this paper is the first to document formally how interventions in secondary markets affect primary market functioning. Improvements in secondary market conditions pass-through to the primary market in two
ways: directly since primary market pricing is usually benchmarked to secondary market prices of similar bonds, and indirectly by increasing the willingness of dealers to underwrite bond issuance. Consistent with this hypothesis, we find an immediate improvement in primary market issuance and pricing after the facility announcement, particularly for issuers eligible for the facility. By the end of June, investment grade issuers issued more than $702 billion of senior unsecured and secured bonds, nearly double issuance by the same point in 2019. We document, however, that the existence of the facility does not distort issuance decisions, with issuers not changing maturity of issued bonds to target SMCCF eligibility, nor does it appear to distort relative pricing across issuer riskiness.

In order to understand the channels through which the CCFs affect bond markets, we estimate differences in the impact on eligible and non-eligible securities. The approach is illustrated by the three bond “indices” shown in Figure 1: investment-grade rated bonds eligible for direct purchases by the facility; investment-grade rated bonds ineligible for direct purchases by the facility; and high-yield rated bonds. The left panel shows duration-matched spreads while the right panel shows bid-ask spreads. Comparing changes across the three indices, we see that the biggest improvements in spreads and bid-ask spreads of bonds eligible for direct purchases by the facility, with a noticeable acceleration in improvement around the commencement of cash bond purchases on June 16. Thus, Figure 1 summarizes some of the basic findings of our paper: though market conditions have improved for all traded bonds, improvements have been biggest for bonds eligible for direct purchases by the facility and, in particular, for bonds bought in greater volumes by the facility. These differential improvements are most pronounced in spread space, with less differentiation in liquidity improvements across different parts of the bond market.

Since there is significant variation over time in which bonds trade and the composition of the sample, in regressions we unpack the differences in eligibility between ratings and maturity and add controls for bond characteristics such as the size of the bond, age and other characteristics associated with pricing. Generally, if the impact of the March 23 an-
Figure 1. Largest impact for bonds eligible for purchases. This figure plots the average duration-matched spreads (left panel) and effective bid-ask spreads (right panel) for three bond indices: investment-grade rated bonds eligible for direct purchases by the facility; investment-grade rated bonds ineligible for direct purchases by the facility; and high-yield rated bonds. Spreads computed as equal average across all available bonds. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Duration-matched spreads

(b) Effective bid-ask spreads

nouncement was on economic conditions more broadly, we would expect high yield issuers to be more affected, as increases in income would have greater impacts on issuers closer to default. In contrast, if the impact is from the direct interventions by the facility, it should be seen mostly on eligible issuers. Consistent with the importance of the announcements to the overall economy, the March 23 announcement effect on spreads is actually smaller for investment-grade bonds. This differential impact arises despite an increased demand for investment grade bonds, as we find that net customer flows were persistently lower for high yield bonds at this time relative to the start of the year. Interestingly, looking at bid-ask spreads, there is little differential impact across eligibility criteria, until facility purchases begin. Once ETF purchases begin, bid-ask spreads on investment grade bonds bought indirectly through ETFs decrease faster than those on their high yield counterparts, with bid-ask spreads on an investment grade bond roughly 7 bps lower than bid-ask spreads on high yield bonds bought at the average purchase pace.

An alternative interpretation of the differential improvements in investment grade bonds
arises from characteristics of indiscriminate asset sales. These may occur when asset owners need liquidity, but buyers need to invest in producing information on “safe” securities which were previously information insensitive. Indeed, Gorton and Ordonez (2014) argue that this sudden regime shift in information sensitivity of securitized assets during the financial crisis led to the ABS fire sales in fall of 2007. Figure 1 shows the dramatic increase in March 2020 in bond spreads of the highest rated issuers, which is consistent with this type of regime shift, since the highest rated issuers are not more sensitive to the shock. We find that while deteriorations in pricing and bid-ask spreads were uniform across issuers, improvements in secondary market conditions for bonds eligible for facility purchases are larger for issuers that were least affected by the COVID shock (those that have experienced smaller deteriorations in profitability in the first quarter of the year). This is consistent with the facilities providing a backstop to the market and removing some of the need to produce information about investment grade assets.

Another eligibility difference is in bond maturity, as the PMCCF will purchase bonds with a maximum maturity of 4 years and the SMCCF will purchase bonds with a maximum maturity of 5 years. To the extent that the COVID shock differentially increased the default risk of issuers with near term refinancing needs, issuers eligible for the facilities should experience a reduction in default risk, as the facilities provide certainty for those issuers’ ability to refinance at reasonable prices. Consistent with this, we find that spreads decrease the most for bonds maturing before September 2025, both across and within issuers. This spread improvement occurs although neither bid-ask spreads nor net customer flows are differentially affected. This suggests that the improvements in credit spreads for shorter maturity bonds are primarily due to improvements in perceptions of risks of those bonds rather than actual increases in trading activity.

A number of recent studies have focused on the disruptions in asset markets in March 2020. Duffie (2020), Schrimpfl et al. (2020), and He et al. (2020) study the disruptions in the Treasury market, focusing on the role that margins and intermediary constraints more
generally played in Treasury market illiquidity that arose due to arbitrageurs’ precipitous exit from Treasury-futures trades. More closely related to our work, D’Amico et al. (2020), Kargar et al. (2020), Haddad et al. (2020), Nozawa and Qiu (2020), and O’Hara and Zhou (2020) all study the disruptions in the secondary corporate bond market and the improvement in secondary corporate bond market functioning following the facilities announcement. Our study differs from these prior papers along five dimensions. First, we study multiple dimensions of secondary market functioning – priced spreads, expected default frequencies, effective bid-ask spreads, and net customer flows – and show that the improvements are not uniform across different metrics. Second, we utilize the design of the facility, in particular, the eligibility criteria for direct purchases by the secondary market facility, to isolate the direct effect of the announcement from the overall improvements in market conditions. Third, we use the volume of purchases by the facility, both indirectly through ETF purchases and directly through cash bond purchases, to disentangle the effect of actual purchases from the announcement effect. Fourth, we shed light on the spillover to secondary market conditions for bonds ineligible for facility purchases by studying changes in the liquidity provision by eligible sellers to the facility relative to the rest of the bond-level top dealers. Finally, we document the improvement in primary market conditions for corporate issuers. Unlike Acharya and Steffen (2020), we find that issuance has increased across the credit spectrum since the facilities announcement, and not just for issuers at the top of the credit spectrum.

This paper is also related to the literature studying the impact of the European Central Bank’s (ECB) Corporate Sector Purchase Programme (CSPP) on corporate bond markets in the European Union. Grosse-Rueschkamp et al. (2019) and Todorov (2020) document that the announcement on the CSPP reduces bond yields of firms with eligible bonds. Grosse-Rueschkamp et al. (2019) show that this leads to a substitution away from bank loans, relaxing bank balance sheet constraints and leading to a re-allocation of bank credit to small and medium enterprises (Ertan et al., 2018). From a market financing perspective, Todorov (2020) shows that both market and funding liquidity of bonds eligible for purchases by the
CSPP improves on announcement of the program. This differential improvement in funding and trading conditions for eligible bonds incentivized issuers to modify characteristics of their issuance to match eligibility criteria (De Santis and Zaghini, 2019). Relative to this literature, we show that, although secondary market functioning improved on the CCF announcement differentially more for facility-eligible bonds, liquidity improvements were not localized to eligible bonds, and issuers do not seem to tailor characteristics of newly issued bonds to facility eligibility criteria. This is perhaps not surprising: while the CSPP is a monetary policy tool, in the United States, the purpose of the CCFs is instead to improve the functioning of the private corporate bond market, with facilities’ purchases expected to terminate by September 30, 2020.

More broadly, this paper is related to the literature on the effect that intermediary constraints play in equilibrium risk premia (see e.g. He and Krishnamurthy, 2012, 2013; Adrian et al., 2014; Brunnermeier and Sannikov, 2014; Adrian and Boyarchenko, 2012) and market liquidity provision (see e.g. Gromb and Vayanos, 2002; Brunnermeier and Pedersen, 2009; Gromb and Vayanos, 2010). In the corporate bond market in particular, Adrian et al. (2017b) document a contemporaneous stagnation of dealer balance sheets, dealer deleveraging, and improvement in traditional metrics of secondary market liquidity after the 2007 – 2009 financial crisis. Measuring the relationship between dealer balance sheet constraints and bond-level liquidity, Adrian et al. (2017a) document that indeed the relationship between balance sheet constraints and liquidity provision in the secondary corporate bond market changes after the implementation of post-crisis banking regulation. We contribute to this literature by measuring the extent to which liquidity facility announcements and purchases pass through facility counterparties to the rest of the corporate bond market.

The paper proceeds as follows: In Section 2, we describe the facilities and related announcements. Section 3 describes the data used in this paper, and Section 4 the impact of the announcements on credit spreads and measures of market functioning. Next, in Section 5, we explore variation in the impact of the facilities across industries that were differently af-
fected by the COVID shock. We then look directly at the impact of the purchases in Section 6, and explore possible mechanisms in Section 7. Finally, we describe the impact on primary issuance in Section 8 and conclude in Section 9. Technical details on sample cleaning and variables construction are relegated to the Appendix.

2 Corporate Credit Facilities

On March 23, 2020 the Federal Reserve announced a number of interventions to respond to the pandemic. In corporate credit, the Federal Reserve established the Primary Market Corporate Credit Facility (PMCCF) and the Secondary Market Corporate Credit Facility (SMCCF). We summarize the key dates of announcements related to the corporate credit facilities in Appendix Tables A.1 (PMCCF timeline) and A.2 (SMCCF timeline). The facilities were designed to work together to support market functioning for corporate bonds and syndicated loans, with an overarching goal of facilitating credit provision to the non-financial corporate sector of the U.S. economy. The announcement included term sheets for both facilities that outlined key terms and applicability. Key features of the term sheet included the following eligibility conditions for issuers: rated investment grade by two or more nationally recognized statistical rating organizations (NRSROs), headquartered in the United States and with material operations in the United States. Issuers must not be receive direct financial assistance under pending federal legislation. The SMCCF would purchase bonds up to a 5 year maturity, while the PMCCF would purchase new debt with up to a 4 year maturity. In addition, the SMCCF announced that it would purchase eligible bond portfolios in the form of exchange traded funds (ETFs).

At the same time the Federal Reserve announced a number of actions including: 1) 

\footnote{Both facilities were established by the Federal Reserve under the authority of Section 13(3) of the Federal Reserve Act, with approval of the Treasury Secretary. The Federal Reserve will establish a special purpose vehicle (SPV) through which the PMCCF will make loans and purchase bonds. The Treasury, using funds appropriated to the Exchange Stabilization Fund (ESF) through the CARES Act, will make an equity investment in the SPV. The SPV will be used for the PMCCF and the Secondary Market Corporate Credit Facility.}
purchasing Treasuries and Agency securities, 2) establishing the Term Asset-Backed Securities Loan Facility (TALF) 3) expanding the Money Market Mutual Fund Liquidity Facility (MMLF) to include a wider range of securities, including municipal variable rate demand notes (VRDNs) and bank certificates of deposit and 4) expanding the Commercial Paper Funding Facility (CPFF) to include high-quality, tax-exempt commercial paper as eligible securities and reduced the pricing of the facility.

In addition to the initial announcement, we identify dates on which the Federal Reserve shared additional details about key terms of the program, focusing on statements which affect the eligibility of certain issues or issuers. On April 9, 2020, the size of the combined facilities was effectively increased with an increase in Treasury capital from $10 billion to $50 billion. Updated term sheets added concentration limits and clarified the definition of eligibility to include firms that were rated investment grade as of March 22, 2020 but no lower than BB- when purchased by facility (“fallen angels”). The SMCCF also extended eligibility for purchase to high yield ETFs. On June 19, details on the approach of the SMCCF to purchasing individual corporate bonds were announced. Initially, the facility aims to purchase a broad market index of individual bonds from corporations that satisfy a few simple criteria: maturity of under 5 years, domiciled in the U.S., not an insured depository institution, and meets the issuer rating requirements. This was in contrast to the previous market interpretations that the facility would require issuers to self-certify eligibility.

The SMCCF began purchasing ETFs on May 12, 2020 and cash bonds on June 16, 2020. The PMCCF was launched on June 29, 2020.

3 Data

3.1 Secondary market corporate bond data

We use corporate bond transactions data from a regulatory version of the Trade Reporting and Compliance Engine (TRACE), which contain price, uncapped trade size, and buyer and
seller identities as well as other trade terms. Registered FINRA dealers are identified by a
designated Market Participant Identifier (MPID), and non-FINRA members are identified
either as C (for client), or as A (for a non-member affiliate). Transactions are required to
be reported in real-time, with 15 minutes delay, which at times need to be cancelled or
corrected. In the regulatory version of TRACE cancelled and corrected records are linked
with a control number, so we keep the most up to date record of the trade. We also address
multiple reporting of interdealer trades, as well as trades that were executed through a non-
exempt Alternative Trading System (ATS) as described in Adrian et al. (2017a). Additional
details on cleaning of TRACE data are available in Appendix A.1.

Using traded prices and quantities from TRACE, we construct bond-day level measures
of priced spreads (see Section 3.3 for details) and secondary market liquidity (see Section
3.4).

3.2 Bond and issuer characteristics

We use bond and issuer characteristics from Mergent FISD. For time-varying bond character-
istics, such as the amount outstanding and the credit rating of the bond, we use information
contemporaneous with the trading date. We coalesce bond-level ratings by multiple rating
agencies into a single number based on the plurality rule: if a bond is rated by more than
one agency, we use the rating agreed upon by at least two rating agencies and use the lowest
available rating otherwise.

In addition to characteristics from Mergent FISD, we obtain one year expected default
frequencies (EDFs) from Moody’s KMV, available at the bond-day level. EDFs measure the
probability of a firm’s bond experiencing a credit event (failure to make a scheduled principal
or interest payment) over the following year, constructed from a Merton (1974)-style model.
EDFs thus provide a timely measure of the credit worthiness of both the firm as a whole and
the firm’s individual bonds.

\footnote{See https://www.moodysanalytics.com/-/media/products/edf-expected-default-frequency-overview.pdf.}
Finally, we use two measures of stress faced by issuers due to the COVID-19 epidemic. At the industry level, we sort 3-digit NAICS industries into quartiles based on the 3 month decline in the total number of employees from January to April 2020, as reported by the Bureau of Labor Statistics, and compare bonds issued by issuers in industries in the bottom quartile (most affected) to those in the middle two quartiles (moderately affected) and those in the top quartile (least affected) of employment changes. At the issuer level, we sort firms into quartiles based on the Q1 2020 percentage growth rate of EBITDA, as reported by Compustat, and compare bonds issued by issuers in the bottom quartile (most affected) to those in the middle two quartiles (moderately affected) and those in the top quartile (least affected) of Q1 2020 income growth rate.

3.3 Corporate bond spreads

We compute duration-matched spreads at the bond-trade level, similar to Gilchrist and Zakrajšek (2012). Given a bond-trade-level duration-matched (or "Z" spread) on bond \( b \) on trade date \( t \), \( z_{b,k,t} \), we aggregate to the bond-trade day level by averaging using trading volume weights:

\[
z_{b,t} = \frac{\sum_{k \in K_{b,t}} z_{b,k,t} V_{b,k,t}}{\sum_{k \in K_{b,t}} V_{b,k,t}},
\]

where \( K_{b,t} \) is the set of all trades in bond \( b \) in on trading day \( t \) and \( V_{b,k,t} \) is the volume of the \( k^{th} \) trade in bond \( b \) on trade date \( t \).

Duration-matched spreads measure the spread differential between corporate bonds and Treasuries with similar duration, capturing risk premia for both the differential credit and liquidity risk between Treasuries and corporate bonds. To separate these two components, similar to Gilchrist and Zakrajšek (2012), we estimate the duration-matched spread that would be predicted based on bond and issuer characteristics. The default-adjusted spread

\(^3\)Figure A.1 in the Appendix plots the distribution of employment growth by industry.
for bond $b$ on date $t$ (or “$D$”-spread), $d_{b,t}$, is then calculated as the difference between the priced and the predicted duration-matched spread on bond $b$ on date $t$

$$d_{b,t} = z_{b,t} - \hat{z}_{b,t},$$

where $\hat{z}_{b,t}$ is the predicted duration-matched spread. Details of both of these calculations are available in Appendix A.2.

### 3.4 Liquidity measures

Given the heterogeneity of corporate bonds, and the skewed distribution of trading frequency, calculating prices and therefore measuring liquidity at the bond-day-level is not straightforward. However, this level of granularity is needed for estimating the short-term impact of the facilities. Our baseline sample covers 9,765 corporate bonds, associated with 5,493,948 trades. In the 100 days of our sample, a bond is traded in 49 days on average, the 5% most traded bonds are traded on all 100 days, and the 5% least traded bonds are traded only once or twice. On average, conditional on a trade, each bond in the sample is traded 9 times each day, with $643,524$ average trade size.

These limitations on the availability of traded prices led us to focus on two liquidity measures: effective bid-ask spread, and net customer volume. Effective bid-ask spread is the difference between volume-weighted buy price and volume-weighted sell price. For the calculation of the spread, we consider dealer-client trades between 8 am and 6 pm, excluding weekends and SIFMA holidays. Net customer volume is the difference between buys and sells from the client’s perspective, so that the net customer volume is positive if customers buy more bonds than they sell. It measures the net buying pressure, which drive the interdealer flow and overall trading activity. For the calculation of the net flow, we condition on dealer-client trades, where trades after 6 pm are counted towards the following day net flow calculation. Based on various robustness checks, and the number of trades in the
“after-market” hours, the measures are not sensitive to the choice of time thresholds. In our regressions, we standardize net customer flow by the gross customer trading volume (sum of customer buy and customer sell volume) to address heterogeneity in average levels of trading activity across bonds.

3.5 CDS data

Spreads and liquidity of single-name CDS and CDS indices at a daily frequency are sourced from Markit. For single-name CDS, we use spreads of CDS contracts written on USD-denominated senior unsecured debt (tier=SNRFOR) of U.S. firms, and the common no restructuring assumption (docclause=XR14). For the same entities, if the data is available, we also use some measures from Markit CDS liquidity report, including index membership flag, bid-ask spread, dealers count per tenor, total number of end-of-day contributions, and weekly gross and net notional volumes and contracts from the Depository Trust and Clearing Corporation (Table 6). The liquidity data covers the universe of the most commonly traded single-name CDS contracts.

In addition to the single-name CDS contracts, which their liquidity has been hampered in the post-2007 financial crisis and might not react to the facilities as quickly as other credit instruments, we also analyze the impact on CDX.NA.IG and the CDX.NA.HY indices, with 5-, 7-, and 10-year maturity. Although the 5-year maturity is typically the most liquid, we are interested studying the facilities impact across the term-structure curve given the 5-year maturity limit in the SMCCF. The CDX.NA.IG is a basket of 125 North American IG single-name CDSs, and the CDX.NA.HY is a basket of 100 North American HY single-name CDSs. The price of an index is determined by supply and demand. The price, therefore, might deviate from the price of a basked of single-name CDSs that replicates the cash flow and credit risk exposure of the index contract. This results in index-to-CDS basis. We calculate

\[4\] In addition to the conditions we apply to filter the CDS spreads data, we apply two additional conditions to the liquidity metrics data. Specifically, PrimaryCoupon=\(Y\) and Range=Average. “PrimaryCoupon” indicates whether the running coupon is the primary coupon for the entity-tier; and, “Average” range represents the mean of entity-tier bid-ask spreads.
the index-to-CDS basis, which is argued by Junge and Trolle (2015) to be a measure of overall liquidity of the CDS market, as the difference between the index spread and the intrinsic value implied by the spreads of its constituents. We analyze both on- and off-the-run indices. For more details on single-name CDS and the indices, see Boyarchenko et al. (2020).

3.6 Sample selection

To capture the effect of the corporate credit facilities on the primary and secondary corporate bond markets, we focus on the evolution of the markets since January 2020. From the universe of corporate bonds with issue and issuer information in Mergent FISD, we exclude bonds issued in foreign currency, bonds issued as either Yankee or Canadian bonds, convertible and asset backed bonds, as well as bonds that remain unrated more than 2 weeks after the initial offering date. Finally, we only retain senior and senior secured bonds issued by issuers domiciled in the U.S.

4 Effect of Facilities

We begin by evaluating the effect of the facilities on pricing and liquidity in the secondary market for corporate bonds. Our approach focuses on disentangling the impact of the initial announcements on the market for securities eligible for direct purchases by the SMCCF and the pass-through of that impact to the overall market. We concentrate on three main dimensions of CCF eligibility: the maturity date of the bond, the credit rating of the bond, and whether the bond is issued by a bank or bank subsidiary.

4.1 Empirical design

To take into account the potentially long-lasting impact of the March 23 announcement on the secondary market, our main object of interest is the cumulative change in each metric.

\footnote{If spreads for an index are available for two different versions of the same series simultaneously, we choose the version with the largest number of contributing dealers.}
relative to the corresponding peak during the week of March 16 - 20, 2020. This approach also has the benefit of creating an apples-to-apples comparison to secondary market conditions prior to the start of the COVID-19-related market disruptions in March. In particular, for each metric $M$ for bond $b$ trade date $t$, we estimate the following regression

$$
\Delta M_{b,t} = \alpha_t + \beta_{b,t}\text{Bank issuer dummy}_b + \beta_{m,t}\text{Maturity before Sep 2025}_b
$$

$$
+ \beta_{hy,t}\text{HY dummy}_b + \vec{\gamma}_t\text{Bond characteristics}_b + \epsilon_{b,t},
$$

where $\Delta M_{b,t}$ is the cumulative change in metric $M$ relative to the peak in metric $M$ for bond $b$ during the week of March 16 - 20, 2020. Specification (1) thus estimates the improvements in secondary market pricing and functioning for each individual bond, as a function of bond and issuer characteristics. A negative estimate of $\beta_{m,t}$ and a positive estimate of $\beta_{b,t}$ and $\beta_{hy,t}$ indicates that secondary market conditions for bonds eligible for direct purchases by the facility have improved more relative to secondary market conditions for bonds not eligible for direct purchases. In addition to the three characteristics of interest – dummy for issuer being a bank or a bank subsidiary, dummy for the bond maturing on September 30, 2025 or earlier, and high yield rating dummy – we control for standard bond characteristics: log age, log amount outstanding, log offering amount, 144a registration dummy, shelf registration dummy, callable dummy, and secured dummy. We estimate specification (1) as a repeated panel for each trading date in the sample.

While the bank issuer dummy is invariant across all bonds of the issuer, bonds issued by the same issuer can have different maturity dates and different individual bond ratings. For these two characteristics, we can thus refine specification (1) to use the within-issuer variation in secondary market conditions

$$
\Delta M_{b,t} = \alpha_t + \beta_{m,t}\text{Maturity before Sep 2025}_b + \beta_{hy,t}\text{HY dummy}_b
$$

$$
+ \vec{\gamma}_t\text{Bond characteristics}_b + \text{Issuer fixed effect}_b + \epsilon_{b,t}.
$$

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Specification (2) thus identifies the marginal improvements in secondary market conditions for bonds issued by the same issuers that are eligible for direct purchases by the SMCCF, over and above the improvement in secondary market conditions for bonds issued by the same issuer that are ineligible for direct purchases.

4.2 Secondary market pricing

Figure 2 plots the estimated coefficients, together with 95 percent confidence bands, for characteristics of interest from the regression of improvements in duration-matched spread for specification (1) (without issuer fixed effects, left column) and specification (2) (with issuer fixed effect, right column). Consider first the average effect $\alpha_t$, reported in the first row. For both specifications and consistent with the index-level patterns we observed in Figure 1, average duration-adjusted spreads rose leading up to the announcement of the facilities on March 22, 2020, and have abated since. While, in aggregate, average spreads have retraced most of their gains from the start of the year, Figure 2b provides us with the first indication that these improvements have not been uniform across the universe of traded bonds, with within-issuer average credit spreads only retracing about half way relative to the levels of duration-matched spreads at the beginning of the year.

Turning next to the characteristics that determine direct purchase eligibility, Figure 2c shows that spreads on bonds issued by bank-affiliated issuers have not narrowed to the same extent as bonds of other issuers. While spreads on the average bond have retraced 200 bps since the March 16 - 20, 2020, highs, the spread on an average bond issued by a bank-affiliated issuer has only retraced by 150 bps. Comparing instead bonds that satisfy the facility maturity cut-off, Figure 2d shows that spreads on bond that mature prior to September 2025 have retraced more than spreads on the average bond, even once we include issuer fixed-effects (Figure 2e). That is, spreads on bonds of the same issuer that mature before September 2025 have retraced more than spreads on bonds that have more than five years of maturity remaining. Moreover, once cash bond purchases commence on June 16,
spreads on bonds that mature before September 2025 more than retrace the 150 bps increase to March 16 - 20, 2020, suggesting that direct purchases by the facility serve to further reduce spreads on eligible bonds. We return to the question of the effect of purchases in Section 6. Finally, Figure 2f shows that spreads on high yield bonds increased 400 bps more in the run up to the March 22 announcement than the average bond and have since retraced only 300 bps, with a small reversal at the commencement of the cash bond purchases. Once we control for issuer fixed effects, Figure 2g shows that, while there was little difference between investment grade and high yield bonds of the same issuer prior to the facilities announcement, spreads on high yield bonds have retraced more than spreads on investment grade bonds of the same issuer but the difference has shrunk once facility purchases commenced on May 12.

Overall, Figure 2 shows that, while duration-matched spreads have decreased on average, both across and within issuers, spread decreases have been biggest for bonds eligible for direct purchases by the facility. Figure 3 shows that the same patterns hold for the default-adjusted spreads as well, suggesting that the improvements in spreads we saw in Figure 2 are primarily due to a reduction in the default risk premium priced in corporate bond spreads. Figure 4 shows, however, that the announcement of the facilities also led to a decrease in one year expected default frequencies. Focusing first on the specification without issuer fixed effects, we see that, while the expected default frequency of the average bond is little changed since the start of the year, the expected default frequency of bonds maturing prior to September 2025 and the expected default frequency of high yield bonds rose ahead of the facilities announcement on March 22, started retracing after the April 9 term sheet update but remain elevated relative to the start of the year. Once we control for issuer fixed effects, Figure 4b shows that, for the average bond of the average issuer, expected default frequencies exhibit the same pattern of an increase ahead of the facilities announcement and a gradual decrease starting in the second week of April but to a level higher than at the start of the year. Figure 4e further shows that, although the expected default frequencies on bonds maturing before September 2025 rose more than the expected default frequencies
of longer maturity bonds of the same issuer, the subsequent decline in expected default frequencies has been similar across bond maturities. That is, expected default frequencies of bonds maturing before September 2025 remain even more elevated relative to the start of the year than expected default frequencies of longer maturity bonds of the same issuer.

Taken together, Figures 2 – 4 show that, although the primary effect of the facilities announcement is to reduce the default risk premium charged in the secondary corporate bond market, with the biggest improvements in spreads for bonds eligible for direct purchases by the facility, the facility announcement has also served to mitigate somewhat the rise in one year expected default frequencies. Given the “bridge financing” nature of the facilities, however, the improvements in expected default frequencies are biggest for longer-maturity bonds and for investment grade bonds: conditional on the issuers not defaulting in the short run, the expected default frequency of long term bonds is lower.

4.3 Secondary market liquidity

We turn now to the impact of the facilities announcement on secondary bond market liquidity. Figure 5 plots the estimated coefficients, together with 95 percent confidence bands, for characteristics of interest from the regression of improvements in effective bid-ask spread for specification (1) (without issuer fixed effects, left column) and specification (2) (with issuer fixed effects, right column). Starting with the average effect $\alpha_t$, we see that, on average, bid-ask spreads have retraced from their March highs, to nearly the levels at the start of the year. Figure 5d shows that, although bonds maturing before September 2025 are on average less liquid (have higher effective bid-ask spreads) than longer maturity bonds, their relative (il)liquidity has remained roughly constant since the start of the year. Similarly, in Figure 5f, we see that high yield bonds, while on average less liquid than investment grade bonds, did not become relatively more illiquid in early March and thus have not had relatively large improvements in liquidity since. Once we control for issuer fixed effects (Figure 5b), we see that the changes in bid-ask spreads on the average bond of the average issuer have
been small since the start of the year, suggesting that the improvements in average bid-ask spreads we observed in Figure 5a are concentrated among particular issuers, rather than within bonds of particular issuers. Relatedly, Figure 5e shows that, although bonds maturing before September 2025 are less liquid on average than longer maturity bonds of the same issuer, the relative liquidity of the two groups of bonds is little changed since the start of the year. Finally, within the same issuer, there is little difference in liquidity between investment grade and high yield bonds.

The lens of net customer flow offers insights into the fundamental drivers of market liquidity. When net customer flow is larger (more positive), customers buy a greater volume of bonds than they sell to dealers in the market, corresponding to less stress on secondary market functioning. On average, net customer flow decreased prior to the facility announcement, indicating greater selling pressure from customers, both across issuers (Figure 6a) and within issuer (Figure 6b). The average net customer flow stabilized, albeit at a lower level than the start of the year, in April. The commencement of ETF purchases on May 12 stimulated an additional temporary increase in average net customer flow toward the end of May/beginning of June, and we also estimate an additional improvement following the commencement of cash bond purchases on June 16.

Comparing the improvements in net customer flows for bonds eligible for direct facility purchases, on average, bonds maturing prior to September 2025 face greater selling pressure, but that differential remains largely unchanged over the course of the year. There are, however, signs of improved net customer flow in the shorter maturity bonds once cash bond purchases commence on June 16, both across issuers (Figure 6d) and within issuers (Figure 6e). Interestingly, Figure 6f shows that, in the month prior to the facility announcement, high yield bonds experienced less selling pressure than investment grade bonds, suggesting that secondary market functioning was relatively less impaired for high yield bonds. Consistent with this hypothesis, in unreported results, we find that, while the average trade size and number of trades remains roughly constant for high yield bonds in the month prior to
the facility announcement, the number of investment grade trades increases but the average trade size decreases, suggesting greater disturbance in the liquidity of the investment grade market. Controlling for issuer fixed effects in Figure 6g shows that this is a cross-issuer effect, with little differentiation in net customer flow between investment grade and high yield bonds of the same issuer.

So how can we reconcile the dramatic improvements since the facility announcement in the priced spreads on bonds and, especially, on bonds eligible for direct purchases by the facility, with improvements in secondary market liquidity that have not been concentrated in bonds eligible for direct purchases? The corporate credit facilities stand as “lender of last resort” facilities in the corporate bond market, providing a “buyer of last resort” in the secondary market. That is, the announcement of the facilities on its own is sufficient to reduce fire sales incentives in the market, effectively establishing a floor on secondary market prices of eligible bonds. Until the facility began purchases, especially the cash bond purchases, however, the facility was not a direct supplier of liquidity in the market, explaining both the lack of an eligible-bond-specific effect on liquidity prior to the start of cash bond purchases and the emerging signs of differential improvement in the liquidity of eligible bonds after June 16.

4.4 Pass-through to CDS spread trades

The results in Section 4.2 suggest that improvements in secondary market spreads have been particularly pronounced for bonds maturing prior to September 2025, even when comparing bonds issued by the same issuer. One potential explanation for this differential improvement is differential liquidity of contracts on matched-maturity single name CDS contracts: if market participants can use the CDS market to more easily hedge risks of shorter maturity bonds, then an overall improvement in risk attitudes will translate into a greater reduction in secondary market spreads of shorter maturity bonds. Similar to specification (1), we estimate the relationship between the cumulative change in bid-ask spreads and net notional as
a fraction of gross notional for single name CDS contracts relative to the peak in the week of March 16 – 20 and issuer characteristics:

$$\Delta M_{f,t} = \alpha_t + \beta_{b,t} \text{Bank issuer dummy}_f + \beta_{idx,t} \text{SN in IDX}_{f,t} + \beta_{hy,t} \text{HY dummy}_{f,t} + \epsilon_{f,t},$$

where SN in IDX$_{f,t}$ is a dummy equal to 1 if the single name CDS contract on issuer $f$ is included in any series and version of either the North American investment grade or high yield (CDX.NA.IG or CDX.NA.HY) CDS index on date $t$.

Figure 7 plots the estimated coefficients, together with the 95 percent confidence bands, for characteristics of interest from the above regression of improvements in effective bid-ask spreads on the 5 year single name CDS contracts (left column) and single name net notional outstanding as a fraction of gross notional (right column). Starting with the effective bid-ask spreads, Figure 7a shows that, on average, effective bid-ask spreads on 5 year CDS contracts increased ahead of the facilities announcement but have not retracted substantially since. Even more puzzlingly, effective bid-ask spread on high yield single names rose relatively less (Figure 7e) since the start of the year and have also stabilized at levels similar to those the week of March 16 – 20. Indeed, the only segment of the five year single name CDS market that exhibits an improvement in effective bid-ask spreads relative to March levels are the contracts not included in a CDS index, which is traditionally the less liquid segment of the single name CDS market (Figure 7g).

The right column of Figure 7 shows that these patterns in the effective bid-ask spreads on 5 year CDS contracts are consistent with the overall trading activity in the CDS market. On average, net notional as a fraction of gross notional has not changed meaningfully since the beginning of the year (Figure 7b), but selling pressure has relatively increased in for high yield single names (Figure 7f) and for single names included in an index (Figure 7h). That is, while for the average issuer, net selling pressure has remained relatively stable over the course of the year, net selling pressure has increased for more risky names and more liquid
names.

Turning next to the cross-maturity heterogeneity, Figure 8 shows that these effects are bigger for shorter maturities. Indeed, for the three year contract, the relative improvement in effective bid-ask spreads on high yield single name CDS since the facilities announcement is even statistically significantly bigger than the improvement in spreads on investment grade bonds. That is, improvements in effective bid-ask spreads on single name CDS are bigger for shorter maturity contracts, written on either high yield single names or on names not included in an index or, in other words, contracts that traditionally are less liquid, with little improvement in the effective bid-ask spreads on the average CDS name of any maturity. Thus, if the differential improvement in secondary market bond spreads on bonds maturing before September 2025 were due to the relative ease of hedging of risks to those bonds in the CDS market, the improvements would be concentrated in spreads on bonds of issuers whose single name CDS contracts are not included in a CDS index. Instead, we see the differential improvement in spreads on shorter maturity bonds even within an issuer.

What leads to a differential improvement in effective bid-ask spreads for high yield single name CDS and CDS not included in an index? The net notional changes we documented in Figures 7f and 7h suggest that the causes are different across the two dimensions, with liquidity of CDS not in an index most likely improving due to increased interest in buying protection on those names. Figure 9 suggests that the differential improvement in the liquidity of high yield single name CDS contracts may instead be due to relatively smaller dislocations between the single name and index CDS markets for high yield names. Although the index-single-name basis widened for both investment grade and high yield indices in late March (around the index roll date), the basis for the CDX.NA.HY index has returned to be close to 0 across all maturities, while the convergence of the index-single-name basis has been slower for the CDX.NA.IG index, especially for shorter maturities. The right column of Figure 9

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6Boyarchenko et al. (2020) show that, post-crisis, the majority of both gross and net notional outstanding of single name CDS is concentrated in names included in an index, with the prevalence of single name contracts not included in an index declining over time.
shows that this differential improvement in the index-single-name basis is partially due to increased willingness of dealers to provide quotes for the high yield but not the investment grade index. In addition, deviations in the pricing of the investment grade index may be bigger due to market participants’ expectations of firm downgrades, which would lead to substantial revisions in the composition of the investment grade index before the next roll date in September. Thus, liquidity in high yield single name CDS improved differentially since March because of relatively smaller dislocations in the high yield CDX market, not because of increased hedging demand (buying pressure) stemming from the corporate bond market.

5 Have improvements been uniform across issuers?

The analysis so far has concentrated on improvements in secondary market pricing and liquidity for the average issuer. We study whether these improvements have been homogeneous across issuers affected differentially by the COVID-19 pandemic and associated economic disruptions. We consider issuer heterogeneity along two dimensions. First, we group issuers according to aggregate employment losses between January and April 2020 at the 3-digit NAICS industry level, comparing secondary market conditions for issuers in more affected industries to those for issuers in less affected industries. Second, we sort issuers based on Q1 2020 profitability, comparing secondary market conditions for issuers with relatively high Q1 2020 profitability with those with relatively low Q1 2020 profitability.

5.1 Sectoral level

We sort 3-digit NAICS industries into quartiles based on the 3 month decline in the total number of employees from January to April 2020, as reported by the Bureau of Labor Statistics. We consider industries falling in the bottom quartile (Q1) as being most affected by the COVID-19 related economic disruptions, industries falling in the middle two quart-
tiles (Q2/Q3) as being moderately affected, and industries falling in the top quartile (Q4) of employment growth as being least affected. We evaluate whether secondary market improvements have been uniform across least and most affected industries by estimating the following regression:

\[
\Delta M_{b,t} = \alpha_t + \beta_{b,t} \text{Bank issuer dummy}_b + \beta_{m,t} \text{Maturity before Sep 2025}_b \\
+ \beta_{hy,t} \text{HY dummy}_b + \beta_{b,q2,t} \text{Bank issuer dummy}_b \times 1_{Q2/Q3} \\
+ \beta_{m,q2,t} \text{Maturity before Sep 2025}_b \times 1_{Q2/Q3} + \beta_{hy,q2,t} \text{HY dummy}_b \times 1_{Q2/Q3} \\
+ \beta_{b,q3,t} \text{Bank issuer dummy}_b \times 1_{Q4} + \beta_{m,q3,t} \text{Maturity before Sep 2025}_b \times 1_{Q4} \\
+ \beta_{hy,q3,t} \text{HY dummy}_b \times 1_{Q4} + \gamma_b \text{Bond characteristics}_b + \epsilon_{b,t},
\]

where \(1_{Q2/Q3}\) is a dummy for the issuer being in an industry falling in the middle two quartiles of employment growth distribution, and \(1_{Q4}\) is a dummy for the issuer being in an industry falling in the top quartile of employment growth distribution. Negative interaction coefficients \(\beta_{q2,t}\) and \(\beta_{q4,t}\) indicate that secondary market conditions have improved relatively more for bonds issued by firms in industries in the middle two quartiles and the top quartile, respectively, relative to bonds issued by firms in industries in the bottom quartile of the employment growth distribution.

Figure 10 plots the estimated coefficients, together with the 95 percent confidence bands, for characteristics of interest from the above regression of improvements in duration-matched (\(Z\)-spread, left column) and default-adjusted (\(D\)-spread, right column) spreads. Figures 10c and 10d show that the relatively bigger improvements in spreads – both on a duration-matched and default-adjusted basis – on bonds maturing before September 2025 are mostly uniform across industries. Although spreads on shorter maturity bonds issued by issuers in moderately affected industries are on average higher than the spreads on similar bonds issued by issuers in most and least affected industries, the spread differential remains relatively flat over the course of the year.
Figure 10e documents instead that industry heterogeneity translates into heterogeneous improvements in the spread between investment grade and high yield bonds. While the spread between investment grade and high yield bonds was similar across issuers in different industries prior to the facilities announcement on March 22, since then, the biggest improvements in spreads on high yield bonds are for issuers in industries in the top quartile of the employment distribution, meaning industries where COVID related employment losses have been smaller. Comparing the improvements in duration-matched spreads to the improvements in default-adjusted spreads in Figure 10f, we see that the cross-industry heterogeneity in the high yield spreads improvement is more pronounced on a duration-matched basis. This suggests that the larger improvements in spreads on high yield bonds issued by issuers in least affected industries is to a large extent due to larger improvements in issuer expected default frequencies and, to a smaller extent, due to greater improvement of the default risk premium on such bonds.

In contrast, Figure 11 shows that, while there is cross-industry heterogeneity in the sensitivity of bid-ask spreads and net customer flow to bond maturity and credit rating, that sensitivity has stayed constant over the course of the year. That is, the decline in bid-ask spreads and the increase in net customer flows since the March 22, 2020, announcement that we saw in Figure 5 – 6 are not concentrated in bonds issued by issuers in specific industries. Rather, as intimated by the lack of a differential improvement in liquidity conditions for bonds eligible for direct purchases by the facility, there has been a broad improvement in secondary market liquidity since the facilities announcement.

5.2 Issuer level

We now turn to cross-issuer heterogeneity in improvement in secondary market functioning since the facilities announcement on March 22. We sort issuers into quartiles based on 2020 Q1 quarter-over-quarter growth rate of EBITDA, as reported in Compustat.\(^7\) We consider

\(^7\)The distribution of 2020 Q1 quarter-over-quarter growth rate of EBITDA is plotted in Figure A.2.
issuers falling in the bottom quartile (Q1) as being most affected by the COVID-19 related economic disruptions, issuers falling in the middle two quartiles (Q2/Q3) as being moderately affected, and issuers falling in the top quartile (Q4) of profitability as being least affected. We evaluate whether secondary market improvements have been uniform across least and most affected firms by estimating the following regression:

\[
\Delta M_{b,t} = \alpha_t + \beta_{b,t} \text{Bank issuer dummy}_b + \beta_{m,t} \text{Maturity before Sep 2025}_b \\
+ \beta_{hy,t} \text{HY dummy}_b + \beta_{b,q2,t} \text{Bank issuer dummy}_b \times 1_{Q2/Q3} \\
+ \beta_{m,q2,t} \text{Maturity before Sep 2025}_b \times 1_{Q2/Q3} + \beta_{hy,q2,t} \text{HY dummy}_b \times 1_{Q2/Q3} \\
+ \beta_{b,q3,t} \text{Bank issuer dummy}_b \times 1_{Q4} + \beta_{m,q3,t} \text{Maturity before Sep 2025}_b \times 1_{Q4} \\
+ \beta_{hy,q3,t} \text{HY dummy}_b \times 1_{Q4} + \gamma_t \text{Bond characteristics}_b + \epsilon_{b,t},
\]

where \(1_{Q2/Q3}\) is a dummy for the issuer falling in the middle two quartiles of Q1 2020 profitability growth distribution, and \(1_{Q4}\) is a dummy for the issuer falling in the top quartile of Q1 2020 profitability growth distribution. Negative interaction coefficients \(\beta_{q2,t}\) and \(\beta_{q4,t}\) indicate that secondary market conditions have improved relatively more for bonds issued by firms in the middle two quartiles and the top quartile, respectively, relative to bonds issued by firms in the bottom quartile of the Q1 2020 profitability growth distribution.

Figure 12 plots the estimated coefficients, together with the 95 percent confidence bands, for characteristics of interest from the above regression of improvements in duration-matched (\(Z\)-spread, left column) and default-adjusted (\(D\)-spread, right column) spreads. The figure shows that the cross-firm heterogeneity only has a differential effect in spreads on bonds maturing before September 2025. While at the start of the year the maturity premium for bonds issued by more profitable issuers was half of the maturity premium for lower profitability issuers, the maturity premium after the facility announcement is more similar across issuers, suggesting that spreads on bonds maturing before September 2025 issued by more profitable firms have declined more than spreads on similar maturity bonds issued by
more affected issuers. Similarly, Figure 13c shows that, while there has been little differential improvement in effective bid-ask spreads on bonds maturing prior to September 2025 issued by least profitable issuers, effective bid-ask spreads for shorter maturity bonds of less affected issuers have retraced differentially more than spreads on longer maturity bonds. In contrast, the right column of Figure 13 shows that improvements in net customer order flow are relatively homogeneous across differentially affected issuers.

Putting these results together, we have that, while deteriorations in pricing and bid-ask spreads were uniform across issuers, improvements in secondary market conditions for bonds eligible for facility purchases are larger for issuers that have experienced smaller deteriorations in profitability in the first quarter of the year. One potential explanation for the differential improvement across issuers is the differential information sensitivity of these securities (see e.g. Gorton and Ordonez, 2014; Dang et al., 2013). The economic uncertainty created by the rapid global spread of COVID-19 at the end of February and beginning of March lead to investors perceiving bonds of all issuers as being potentially risky, leading to a deterioration in pricing and liquidity across the board. The announcement of the facilities reduces the incentives to acquire information about securities eligible for direct purchases by the facility, especially for less affected firms, as the facility acts as a buyer of last resort in the market. This improves the relative pricing and the bid-ask spreads charged on the eligible bonds issued by less affected firms, without generating a differential increase in net customer order flow.

6 Purchase effects

Given the strong response of markets to announcement about the facilities, a natural question is whether purchases are necessary to maintain the positive secondary market conditions. To help answer this question, we examine the response of secondary market spreads and liquidity to the facility purchases themselves.
6.1 It’s not what you buy

We begin with a reduced-form estimate of the purchase effect, by exploring whether market conditions have improved differentially for bonds held by ETFs bought in any (positive) quantity by the facility. In particular, we modify specification (1) and estimate

$$\Delta M_{b,t} = \alpha_t + \beta_{etf,t}\mathbb{1}_{\text{in ETF},b,t} + \beta_{bt,\text{Bank issuer dummy}} b,t + \beta_{mt,\text{Maturity before Sep 2025}} b,t + \gamma_{hy,t}\text{HY dummy}_{b,t} + \gamma_{etf,t,\text{Bank issuer dummy}} b,t \times \mathbb{1}_{\text{in ETF},b,t}$$

where $\mathbb{1}_{\text{in ETF},b,t}$ is a dummy for bond $b$ held on trade date $t$ by any ETF bought by the SMCCF. Negative estimates of the interaction coefficients $\beta_{etf,t}$ indicate that secondary market conditions for bonds held by ETFs purchased by the facility have improved relatively more than bonds not held by ETFs.

Figure 14 plots the estimated coefficients, together with the 95 percent confidence bands, for characteristics of interest from the above regression of improvements in duration-matched spreads since the facilities announcement for the specification with (right column) and without (left column) issuer fixed effects. Figures 14a and 14b show that, on average, the improvement in spreads on bonds held by ETFs and other bonds has been similar, both across and within issuers. The biggest differential improvement is between bonds maturing by September 2025 held by ETFs and other shorter maturity bonds, with spreads on shorter maturity bonds held by ETFs retracing relatively less than spreads on other bonds of similar maturity. Figure 14e shows that this differential persists even after controlling for issuer fixed effects, so that spreads on shorter maturity bonds held by ETFs have retreated less than spreads on similar maturity bonds issued by the same issuer that are not held by ETFs purchased by the facility.
Turning to Figure 15, we see that the differential improvement in duration-matched spreads for eligible bonds not held by ETFs translates into a differential improvement in default-adjusted spreads not held by ETFs purchased by the facility. In particular, Figure 15d shows that the increase in default-adjusted spreads on bonds maturing before September 2025 in the beginning of March was concentrated in bonds held by ETFs, with the differential to default-adjusted spreads on similar maturity bonds not held by ETFs purchased by the facility growing since ETF purchases commenced on May 12. Thus, although on average, duration-matched and default-adjusted spreads have improved at a similar pace for bonds held by ETFs purchased by the facility as for other bonds, the improvement in spreads on bonds eligible for direct purchases by the facility that are held by ETFs purchased by the facility has been relatively more muted.

Instead, Figure 16 shows that, in effective bid-ask spread terms, the situation is somewhat reversed. On average, bid-ask spreads on bonds held by ETFs purchased by the facility improved more since the facility announcement than bid-ask spreads on other bonds. This overall improvement in bid-ask spreads on bonds held by ETFs purchased by the facility, occurring primarily in advance of the purchases actually commencing on May 12, could be potentially attributed to the extraordinary in-flows into bond ETFs in April 2020. Turning next to the coefficients on direct purchase eligibility criteria, we see that bid-ask spreads on bonds eligible for direct purchases by the facility only began improving relative to the average bond ahead of the commencement of cash bond purchases on June 16. Coincident with that improvement, bid-ask spreads on bonds ineligible for direct facility purchases but that were held by ETFs purchased by the facility also retraced somewhat.

Finally, Figure 17 shows that improvements in net customer order flow have a similar pattern to improvements in credit spreads. For the average bond, improvements in net customer order flow is similar across bonds held by ETFs purchased by the facility and other bonds. The relative improvement in net customer order flow for bonds maturing before September 2025 is bigger if the bond is not held by an ETF purchased by the facility (Figure 17d),
though this heterogeneous response is due to cross-issuer differences rather than within-issuer differences in net customer order flow (Figure 17e). Finally, Figure 17f shows that the slower pace of net customer order flow for high yield bonds is concentrated in high yield bonds held by ETFs purchased by the facility.

6.2 But how much you buy and how you buy it

The above results suggest that, while inclusion in a purchased ETF’s portfolio does not, on average, lead to greater improvements in either credit spreads or customer net order flow, inclusion in a purchased ETF’s portfolio does mitigate some of the differential in improvement in secondary market conditions for bonds eligible for direct purchases by the facility. Intuitively, bonds ineligible for direct purchases by the facility benefit from purchases if they are held by an ETF purchased by the facility. To evaluate the impact of the actual quantity of purchases conducted by the facility, we disaggregate the volume of ETF purchases into the implied volume of (indirect) bond purchases by the facility using trade-date-specific portfolio weights of each ETF. To simplify the interpretation of the estimated coefficients, we standardize the cumulative purchase volume within each trading date

$$\Delta \text{Vol}_{b,t} = \frac{\sum_{s \leq t} \text{Vol}_{b,s} - \mathbb{E}_t \left[ \sum_{s \leq t} \text{Vol}_{b,s} \right]}{\sigma_t \left( \sum_{s \leq t} \text{Vol}_{b,s} \right)},$$

where $\sum_{s \leq t} \text{Vol}_{b,s}$ is the cumulative volume of bond $b$ bought by the facility up to date $t$ either directly through cash bond purchases or indirectly through ETF purchases, $\mathbb{E}_t \left[ \sum_{s \leq t} \text{Vol}_{b,s} \right]$ is the cross-sectional average of cumulative volume at date $t$, and $\sigma_t \left( \sum_{s \leq t} \text{Vol}_{b,s} \right)$ is the cross-sectional standard deviation of cumulative volume at date $t$. We then estimate the relationship between the cumulative change in each secondary market conditions metric since the commencement of purchases on May 12, bond and issuer characteristics, and the

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8See Figure A.3 for the time series of daily purchases by the facility, split by security type.
cumulative purchases of bond \( b \) up to date \( t \):

\[
\Delta M_{b,t} = \alpha_t + \beta_{vol,t} \sqrt{\text{Vol}_{b,t}} + \beta_{b,t} \text{Bank issuer dummy}_b + \beta_{m,t} \text{Maturity before Sep 2025}_b \\
+ \beta_{hy,t} \text{HY dummy}_b + \beta_{b,vol,t} \text{Bank issuer dummy}_b \times \sqrt{\text{Vol}_{b,t}} \\
+ \beta_{m,vol,t} \text{Maturity before Sep 2025}_b \times \sqrt{\text{Vol}_{b,t}} + \beta_{hy,vol,t} \text{HY dummy}_b \times \sqrt{\text{Vol}_{b,t}} \\
+ \beta \text{Bond characteristics}_b + \epsilon_{b,t}.
\]

Negative estimates of the interaction coefficients \( \beta_{.,vol,t} \) indicate that improvements in secondary market conditions have been bigger for bonds bought at higher rates by the facility.

Figure 18 plots the estimated coefficients, together with the 95 percent confidence bands, for characteristics of interest from the above regression of improvements in duration-matched spreads since May 12 for the specification with (right column) and without (left column) issuer fixed effects. Figure 18a shows that facility purchases, on average, have had a meaningful impact on the bond duration-matched spreads, over and above the decline in credit spreads due to overall market improvements. This effect is both statistically and economically significant. While the spread on an average bond declined by roughly 75 bps since the start of purchases on May 12, a purchase pace of one standard deviation above average decreases spreads by an additional 25 bps, or a third of the baseline effect. The estimated purchase effect is also sizable relative to the cumulative 90 bps improvement in average spreads prior to the commencement of purchases, which can be attributed to the facility announcement alone.

Figure 18b shows that the differential improvement in average spread due to purchases persists even after including issuer fixed effects, so that spreads on bonds bought by the facility at a greater pace decline more than spreads on other bonds of the same issuer. In addition, comparing the estimated effect of cumulative purchases over time, Figures 18a and 18b show that the relative impact of cash bond purchases is substantially larger than the effect of ETF purchases, with a noticeable acceleration of the effect of cumulative purchases.
on the average spread once cash bond purchases begin on June 16.

Turning to the differential effect of purchases for bonds satisfying eligibility criteria, Figures 18d and 18f show that spreads on ineligible bonds that were purchased indirectly by the facility declined more than spreads on other ineligible bonds. For high yield bonds, this relative improvement in spreads on ineligible bonds purchased by the facility disappears once cash bond purchases commence. Once we control for issuer fixed effects, there is little differential improvement in high yield bonds purchased by the facility. Moreover, on a default-adjusted basis, spreads on high yield bonds have increased relative to investment grade bonds of the same issuers (Figure 19g), suggesting that risk premia on high yield bonds have decline less than risk premia on investment grade bonds of the same issuers.

Consider now the impact of facility purchases on effective bid-ask spreads, plotted in Figure 20. Figure 20a shows that ETF purchases have no discernible impact on effective bid-ask spreads of the average bond. Bid-ask spreads on high yield bonds purchased by the facility have improved less than bid-ask spreads on other high yield bonds (Figure 20f), but these differences decline once cash bond purchases commence. Turning to net customer order flow, Figure 21a shows that net customer order flow increases differentially more for bonds purchased at a higher rate by the facility. Within issuers, we see in Figure 21b that the differential improvement in net customer order flow accelerates when cash bond purchases commence, echoing the greater impact of cash bond purchases than ETF purchases on the corporate bond market that we saw in Figure 18.

7 Potential mechanisms

Section 4 documents that the facilities announcement led to a dramatic improvement in average credit spreads and liquidity conditions, with improvements in default-adjusted spreads on the average bond larger than the improvements in maturity-matched spreads. Coupled with the improvements in liquidity on facility announcement, this suggests that the primary
effect of the facilities announcement is through a reduction in risk premia. From a theoretical perspective, reductions in risk premia can arise through either reductions in uncertainty – for example, the existence of the facilities removing the extreme left tail of possible outcomes – or reductions in risk prices. In this Section, we examine the relevance of the intermediary constraints channel for post-announcement improvements in secondary market conditions. From the perspective of intermediary asset pricing, the facilities act by providing a “specialist” buyer of corporate credit, relaxing balance sheet constraints of marginal intermediaries in the corporate bond market. Improvements in balance sheet constraints of the marginal intermediary lead to a reduction in the intermediary’s effective risk aversion, explaining both the substantial improvement in credit spreads and liquidity conditions.

We approach this question in three steps. First, we study whether dealers that historically represent the majority of dealer-to-customer volume in a given bond increase their intermediation activity following the facilities announcement. Increased intermediation activity by these marginal intermediaries in each individual bond would suggest that the facilities announcement serves to relax balance sheet constraints across all dealers. Second, we compare the relative increase in intermediation activity by the eligible sellers registered with the facility, using the differential timing of registration across dealers\(^9\) to more precisely identify the facility registration effect. Differential increases in intermediation activity by dealers registered as eligible sellers with the facility suggest that the improvement in balance sheet constraints is particularly pronounced for dealers with direct access to the facility. Finally, we relate the increases in intermediation provided to the volume sold by each seller to the facility, either through ETFs or cash bond sales. In all three cases, we study both intermediation activity in the corporate bond market and in the CDS market since, as documented in Boyarchenko et al. (2018), large dealers are frequently intermediaries in both markets.

\(^9\)See Table A.4 for the current list of eligible sellers and the facility registration dates.
8 Effects on primary market issuance

The end goal of the corporate credit facilities is to support the provision of credit to non-financial corporations in the U.S. We now turn to the primary market issuance activity in the corporate bond market, focusing on the dollar amount of corporate bonds issued since the start of the year and the offering spreads paid by the issuers.

We make four changes relative to the methodology we used to evaluate the affect of the facilities on the functioning of the secondary market. First, reflecting the relatively low frequency of corporate bond primary issuance, we focus on the cumulative amount issued since the start of the year, instead of bond-level changes in metrics since the initial facility announcement on March 22, 2020. Second, instead of using bond-level credit ratings to determine CCF eligibility of the primary market issuances, we use issuer-level credit ratings, with more details on the issuer-level credit ratings available in Appendix A.3. Third, since the PMCCF also includes a “majority U.S. operations” eligibility criterion, we examine differences in primary market issuance and pricing between issuers that do and do not satisfy this restriction, as well as the credit rating, maturity and issuer industry restrictions that are applicable for both CCFs. We describe our procedure for identifying issuers that are likely to satisfy the majority U.S. operations restriction in Appendix A.4, although we note that we cannot identify a definitive source for this measure. Finally, offering yields are priced as spreads to nearest-maturity on-the-run Treasury yields. Thus, our measure of primary market spreads is the spread of the offering yield to the corresponding nearest-maturity on-the-run Treasury yield, as described in Appendix A.5, rather than either the duration-matched or the default-adjusted spreads we studied in the secondary market context.

8.1 Extensive margin: who has issued?

Figure 22 plots the cumulative amount issued in the primary corporate bond market since January 1, 2020, together with the cumulative amount issued by the same week last year.
Starting in the top left panel, Figure 22a plots the cumulative amount issued by banks and bank subsidiaries in blue, and by all other corporate issuers in grey. Prior to the facility announcement on March 22, 2020, the cumulative amount issued by non-banks in 2020 was similar to the cumulative amount issued by non-banks during the similar period in 2019. In contrast, the cumulative amount issued by banks prior to the facility announcement was lagging substantially relative to the cumulative amount issued by banks during the similar period in 2019, with the slow down in issuance most notable during the last two weeks of February and the first two weeks in March. The facility announcement catalyzed a dramatic acceleration of the pace of issuance for non-banks, with the year-to-date cumulative issuance as of the time of writing nearing $1 trillion, as compared to less than $500 billion at the same time last year. While issuance by banks and bank subsidiaries has also accelerated since the facility announcement, suggesting an improvement in primary market conditions even for issuers not eligible for participation in the CCF, the cumulative pace of bank issuance still somewhat lags that from 2019, with the year-to-date issuance by banks at approximately $35 billion, as compared to almost $40 billion at the same time last year.

Turning next to Figure 22b, we see that the acceleration in the pace of issuance triggered by the announcement of the CCF is not concentrated in the five year or less maturities that are eligible for purchases by SMCCF. Instead, the year-to-date issued amount in the more than 5 years maturity category in 2020 is nearly double relative to that issued during the same period last year ($660 billion in 2020 vs $340 billion in 2019). Similarly, the issuance of bonds with maturity of five years or below in 2020 is also nearly double relative to that issued during the same period last year ($340 billion in 2020 vs $155 billion in 2019). These results suggest that issuers are not issuing debt specifically targeting SMCCF purchase eligibility, as was the experience with the European Central Bank’s Corporate Sector Purchase Program (CSPP) (see e.g. De Santis and Zaghini, 2019). Instead, consistent with the improved overall secondary market functioning we documented above and the continued demand for long-term fixed income assets by long-term investors, such as pension funds (see e.g. Greenwood and...
Vayanos, 2010), issuers issue across the maturity spectrum.

Figure 22c shows that, prior to the March 22, 2020, issuance by investment-grade rated issuers was lagging relative to the pace of issuance in 2019. The announcement of the facilities, however, spurred a dramatic increase in the pace of investment grade issuance, with year-to-date investment grade issuance almost double what was issued during the same period in 2019. High-yield-rated issuers did not experience the same sort of slow down in issuance at the start of the year, partially since high yield issuance is in general slow at the start of the year, but neither has the pace of high yield issuance accelerated to the same extent after the facilities announcement. Thus, although the facilities announcement improves primary market conditions across the board, the improvement for issuers not eligible for the facilities has been more gradual. A similar pattern can be seen in Figure 22d, with issuers with majority operations in the U.S. accelerating their issuance after the facilities announcement more than issuers without majority of U.S. operations.

Turning finally to heterogeneity in issuance across industries (Figure 22e) and across firms (Figure 22f), we see that the facilities announcement has served to accelerate credit provision to the most affected industries and firms. Figure 22e shows that, although cumulative issuance before the facilities announcement for the most affected (Q1) and least affected (Q4) industries was below the amount issued by the same industries in a comparative period in 2019, the issuance pace has accelerated since. For issuers in the most affected industries (bottom quartile of employment loss distribution), the year-to-date issuance is 3.5 times larger than over the same period in 2019; for issuers in the moderately affected industries (middle quartiles of employment loss distribution), the year-to-date issuance is 2.8 times larger; and, for issuers in the least affected industries (top quartile of employment loss distribution), the year-to-date issuance is 1.5 times larger. Similarly, Figure 22f shows that the most affected firms (bottom quartile of Q1 2020 profitability) were unable to issue prior to the facilities announcement. These issuers were able to begin issuance following the April 9, 2020, with year-to-date issuance double the amount issued by the same issuers in a comparative period.
in 2019. For issuers in the middle two quartiles of the Q1 2020 profitability distribution, year-to-date issuance is 2.4 times larger than the 2019 issuance; and for issuers in the top quartile of the Q1 2020 profitability distribution, year-to-date issuance is 1.5 times larger.

### 8.2 Intensive margin: at what price?

Consider now the prices at which issuers have been able to issue debt in the primary market since the start of the year. Figure 23 plots the offering-volume-weighted average and interquartile range of offering spread to matched-maturity Treasuries for fixed coupon bonds issued since February 1, 2020. Across most characteristics, the offering spread has remained relatively flat over the year. The clearest improvement in pricing since the facilities announcement is in the split between investment grade and high yield issuers (Figure 23c). Offering spreads rose for both investment grade and high yield issuers ahead of the facilities announcement on March 22, 2020, but especially so for the high yield issuers. Noticeably, the improvement in offering spreads for investment grade issuers only commenced after the April 9, 2020, term sheet update, reflecting perhaps the concern about continued eligibility of issuers that were investment grade rated as of March 22 but investors may have feared would be subsequently been downgraded.

Turning now to cross-industry (Figure 23e) and cross-firm (Figure 23f) heterogeneity in offering spreads, we see that the biggest improvements in offering spreads are for firms in least affected industries (fourth quartile of the employment losses distribution) and for firms in the top quartile of Q1 2020 profitability distribution. Thus, although the announcement of the facilities has improved the ability of all firms to issue in the primary market, the improvements in offering spreads have been biggest for firms least affected by the COVID-19 pandemic.

Overall, the results in Figures 22 and 23 suggest that, while the announcement of the facilities has helped to get credit flowing to the corporate sector of the U.S. economy, the existence of the facilities does not seem to be distortionary. Issuers do not seem to be modify-
ing their issuance behavior to target facility eligibility. While offering spreads have decreased since the facility announcement, lower credit quality issuers, issuers in more affected industries, and issuers with lower Q1 2020 profitability continue to face higher offering spreads, suggesting that the existence of the facilities does not distort risk pricing in this market.

8.3 Underwriting activity

We conclude this section by examining how underwriting activity has changed since the facilities announcement on March 22, 2020. Similarly to the dealer activity in the secondary markets that we studied in the previous section, we consider changes in underwriting activity for: lead underwriters that were in the top 20 lead underwriters in 2019, lead underwriters that have subsidiaries that are registered as eligible sellers with SMCCF, and lead underwriters whose eligible seller subsidiaries represent the top 10 SMCCF counterparties by volume. Starting with the lead underwriter information from Mergent FISD, we hand-match each reported lead underwriter to the corporate parent and, if applicable, to the registered eligible seller. We rank underwriters at the parent level based on the total offering amount that they underwrote in 2019; the top 20 underwriters represent 95 percent of the total 2019 issuance. Similarly, we rank eligible sellers based on the volume-to-date (as of June 30, 2020) sold to SMCCF across both ETF and cash bonds; the top 10 eligible sellers represent 84 percent of total volume of purchases made by the facility.

Figure 24 plots the cumulative issuance amount underwritten by different groups of underwriters, together with the cumulative amount underwritten by the same underwriters in 2019 in a comparative period, as well as the spreads to nearest-maturity Treasury. The right column of Figure 24 shows that offering spreads have declined for issues underwritten by all types of underwriters. In quantity terms, however, we see that the amount underwritten by underwriters outside the top 20 underwriters has lagged relative to the amount such underwriters were responsible for in 2019. Indeed, smaller underwriters only re-commenced underwriting issues the week of the first ETF purchases by the facility (week ending May
16). Comparing the volume of issuances underwritten by eligible sellers to issuances underwritten by other institutions, we see that issuance underwritten by eligible sellers increased immediately following the facility announcement, while the issuance underwritten by other underwriters only accelerates at the commencement of ETF purchases on May 12. Finally, Figure 24e shows that this acceleration in issuance underwritten by eligible sellers is particularly pronounced for issuance underwritten by the top 10 sellers to the facility. Interestingly, the commencement of purchases does not seem to have had a differential effect on issuance underwritten by the eligible sellers.

9 Conclusion

The corporate credit facilities represent an unprecedented intervention by the Federal Reserve in corporate credit markets, and an opportunity to deepen our understanding of those markets. We document that there is a sizable announcement effect when the CCFs are announced, both for bonds that are eligible for the facilities and for those that are not. We find evidence both of reduced risk premia after announcement as well as increased intermediation from dealers, especially those which are eligible to transact with the facility. The impact on prices is differentially larger for eligible issuers, while the impact on liquidity appears to be more widespread.

Given the scale of the announcement effect, it is natural to wonder if the presence of the facility as a backstop would have been enough to ensure a recovery in market functioning, without any purchases. We estimate a statistically significant effect of the dollars of purchases, suggesting that the amount of purchases also matters, particularly for measures of liquidity such as spreads. However, individual bond purchases appear to have more of an effect than do ETFs. Whether there are nonlinearities between the impact of purchases that are small relative to market volumes and no purchases at all is, however, nearly impossible to estimate.
References


Figure 2. Duration-matched spreads have retraced from March 22 highs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in duration-matched spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 3. Default-adjusted spreads have retraced from March 22 highs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in default-adjusted spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 4. Expected default frequencies have retraced from March 22 highs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in expected default frequencies on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).
Figure 5. Effective bid-ask spreads have retraced from March 22 highs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in effective bid-ask spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 6. Customer net flow have increased from March 22 lows. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in net customer flow as a fraction of total volume on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
**Figure 7. CDS liquidity.** This figure plots the estimated coefficients from the regression of cumulative issuer-level changes effective single name CDS bid-ask spreads (left column) and net notional as a fraction of gross notional (right column) on bank issuer, bond maturity prior to Sep 2025, high yield rating, and inclusion in an CDS index dummies. 95% confidence bands based on heteroskedasticity-robust standard errors reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, 5 year BAS

(b) Constant, Net notional

(c) Bank dummy, 5 year BAS

(d) Bank dummy, Net notional

(e) HY dummy, 5 year BAS

(f) HY dummy, Net notional

(g) Not in IDX, 5 year BAS

(h) Not in IDX, Net notional

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Figure 8. CDS bid-ask spreads at different maturities. This figure plots the estimated coefficients from the regression of cumulative issuer-level changes effective single name CDS bid-ask spreads on 3 year (left column), 7 year (middle column), and 10 year (right column) contracts on bank issuer, bond maturity prior to Sep 2025, high yield rating, and inclusion in an CDS index dummies. 95% confidence bands based on heteroskedasticity-robust standard errors reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

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This figure plots the estimated coefficients from the regression of cumulative issuer-level changes effective single name CDS bid-ask spreads on 3 year (left column), 7 year (middle column), and 10 year (right column) contracts on bank issuer, bond maturity prior to Sep 2025, high yield rating, and inclusion in an CDS index dummies. 95% confidence bands based on heteroskedasticity-robust standard errors reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).
**Figure 9. CDX liquidity.** This figure plots the index - single name basis (left column) and index depth (right column) for investment grade and high yield North American CDS indices. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).
Figure 10. Spread improvements biggest for firms in least affected industries. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in duration-matched (left column, $Z$-spread) and default-adjusted (right column, $D$-spread) spreads on bond maturity prior to Sep 2025 and high yield rating dummies, and interaction between maturity and industry rank dummies. 3 digit NAICS industries ranked into quartiles based on total employment changes from January to April 2020, with Q1 the most affected (biggest employment losses). All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, $Z$-spread

(b) Constant, $D$-spread

(c) Maturity dummy, $Z$-spread

(d) Maturity dummy, $D$-spread

(e) HY dummy, $Z$-spread

(f) HY dummy, $D$-spread
Figure 11. Liquidity improvements homogeneous across firms in different industries. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in effective bid-ask spreads (left column) and net customer flow as a fraction of total customer volume (right column) on bond maturity prior to Sep 2025 and high yield rating dummies, and interaction between maturity and industry rank dummies. 3 digit NAICS industries ranked into quartiles based on total employment changes from January to April 2020, with Q1 the most affected (biggest employment losses). All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, BAS spread

(b) Constant, net customer flow

(c) Maturity dummy, BAS spread

(d) Maturity dummy, net customer flow

(e) HY dummy, BAS spread

(f) HY dummy, net customer flow
Figure 12. Spread improvements biggest for least affected firms. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in duration-matched (left column, Z-spread) and default-adjusted (right column, D-spread) spreads on bond maturity prior to Sep 2025 and high yield rating dummies, and interaction between maturity and issuer rank dummies. Issuers ranked into quartiles based on Q1 2020 change in earnings, with Q1 the most affected (lowest earnings growth). All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, Z-spread

(b) Constant, D-spread

(c) Maturity dummy, Z-spread

(d) Maturity dummy, D-spread

(e) HY dummy, Z-spread

(f) HY dummy, D-spread
Figure 13. Liquidity improvements biggest for least affected firms. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in effective bid-ask spreads (left column) and net customer flow as a fraction of total customer volume (right column) on bond maturity prior to Sep 2025 and high yield rating dummies, and interaction between maturity and industry rank dummies. Issuers ranked into quartiles based on Q1 2020 change in earnings, with Q1 the most affected (lowest earnings growth). All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, BAS spread

(b) Constant, net customer flow

(c) Maturity dummy, BAS spread

(d) Maturity dummy, net customer flow

(e) HY dummy, BAS spread

(f) HY dummy, net customer flow
Figure 14. Improvements in duration-matched spreads biggest for eligible securities not held by ETFs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in duration-matched spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 15. Improvements in default-adjusted spreads biggest for eligible securities not held by ETFs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in default-adjusted spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 16. Improvements in effective bid-ask spreads biggest for eligible securities not held by ETFs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in effective bid-ask spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 17. Improvements in net customer flow biggest for eligible securities not held by ETFs. This figure plots the estimated coefficients from the regression of cumulative bond-level changes in net customer flow on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 18. **Purchase impact on duration-matched spreads.** This figure plots the estimated coefficients from the regression of cumulative bond-level changes since the commencement of purchases in duration-matched spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event line at June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 19. Purchase impact on default-adjusted spreads. This figure plots the estimated coefficients from the regression of cumulative bond-level changes since the commencement of purchases in duration-matched spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event line at June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 20. Purchase impact on effective bid-ask spreads. This figure plots the estimated coefficients from the regression of cumulative bond-level changes since the commencement of purchases in effective bid-ask spreads on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event line at June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
**Figure 21. Purchase impact on net customer flow.** This figure plots the estimated coefficients from the regression of cumulative bond-level changes since the commencement of purchases in net customer flow on bank issuer, bond maturity prior to Sep 2025, and high yield rating dummies with (right column) and without (left column) issuer fixed effects. All regressions control for standard bond characteristics. 95% confidence bands based on standard errors clustered at the issuer level reported as shaded areas around the point estimate. Regressions estimated as repeated cross-sections for each trading date in the sample. Event line at June 16 (commencement of cash bond purchases).

(a) Constant, no FE

(b) Constant, FE

(c) Bank dummy, no FE

(d) Maturity dummy, no FE

(e) Maturity dummy, FE

(f) HY dummy, no FE

(g) HY dummy, FE
Figure 22. Primary market issuance improved since CCF announcement. This figure plots the year-to-date (through June 27, 2020) cumulative issuance in U.S.D billion terms, together with the corresponding year-to-date cumulative issuance in 2019. Figure 22d: issuers classified as having majority of operations in the U.S. if at least half of their employees are reported to be in the U.S. in latest available data. Figure 22e: 3 digit NAICS industries ranked into quartiles based on total employment changes from January to April 2020, with Q1 the most affected. Figure 22f: issuers ranked into quartiles based on Q1 2020 earnings as a fraction of Q4 2019 total assets, with Q1 the most affected. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).
Figure 23. Primary market pricing flat since CCF announcement. This figure plots the average offering spread to nearest-maturity on-the-run Treasury yield for fixed coupon corporate bonds, together with the interquartile range in the spread. Average and interquartile range computed on an offering-amount-weighted basis. Figure 23d: issuers classified as having majority of operations in the U.S. if at least half of their employees are reported to be in the U.S. in latest available data. Figure 23e: 3 digit NAICS industries ranked into quartiles based on total employment changes from January to April 2020, with Q1 the most affected. Figure 23f: issuers ranked into quartiles based on Q1 2020 earnings as a fraction of Q4 2019 total assets, with Q1 the most affected. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).

(a) Bank vs non-bank
(b) By maturity
(c) By credit rating
(d) By U.S. operations
(e) By industry
(f) By profitability
Figure 24. Gains in primary market issuance due to increased activity by large underwriters. This figure plots the year-to-date (through June 27, 2020) cumulative issuance in U.S.$ billion terms, together with the corresponding year-to-date cumulative issuance in 2019. Right column plots the average offering spread to nearest-maturity on-the-run Treasury yield for fixed coupon corporate bonds, together with the interquartile range in the spread. Average and interquartile range computed on an offering-amount-weighted basis. Event lines at: March 22 (initial CCF announcement); April 9 (first term sheet update); May 12 (commencement of ETF purchases); June 16 (commencement of cash bond purchases).
A Technical appendix

A.1 TRACE data cleaning

In our analysis, we use TRACE data provided by FINRA at the end of each business day. Starting in July 2002, each registered FINRA member that is a party to a reportable transaction in a TRACE-eligible security has a reporting obligation. The reporting is done in real-time. The set of TRACE-eligible securities has changed throughout the years. We start our sample in 2005, when all investment-grade and high-yield U.S. corporate bonds were included in the TRACE-eligible securities definition (except for 144A). A trade report includes the security identifier, date, time, size (par value), and price of the transaction. A report also identifies the member firm’s side of the transaction (buy or sell), their capacity as a principal or agent, and the other parties to the transaction. The required reporting time varies between categories of TRACE-eligible securities. Member firms must report a secondary corporate bond transaction as soon as practicable, no later than within 15 minutes of the time of execution. There a few issues that needs to be addressed:

1. **Correction and Cancellations.** A trade record that is corrected or cancelled at a later time because of misreporting remains on the tape, and additional records indicate its current status.

   **What do we do?** We keep the most recent status of each trade record based on the system control number and the record type.

2. **Interdealer Trades.** The reporting requirements require all registered broker-dealers (BDs) to report to TRACE. Hence, a trade between two BDs is reported twice, while a trade between a client and a BD is reported once.

   **What do we do?** To keep one record of each trade, we keep the sell side of an interdealer trade.

3. **Non-Member Affiliates.** While BDs are identified in trade records, clients’ identities are masked, and all clients are reported as “C”. Effective on November 2, 2015, firms are required to identify transactions with non-member affiliates, entering “A” instead of “C” if the affiliate is a non-FINRA member.

   The reporting rule amendment also requires firms to use an indicator to identify certain trades that typically are not economically distinct and, as such, would not provide investors useful information for pricing, valuation or risk evaluation purposes if disseminated publicly. Specifically, FINRA is requiring firms to identify trades with non-member affiliates that occur within the same day and at the same price as a trade between the firm and another contra-party in the same security. Thus, firms are required to use “non-member affiliate—principal transaction indicator” when reporting a transaction to TRACE in which both the member and its non-member affiliate act in a principal capacity, and where such trade occurs within the same day, at the same price and in the same security as a transaction between the member and another counter-party. A firm is not required to append the indicator if it does not reasonably expect
to engage in a same day, same price transaction in the same security with another counterparty as with a non-member affiliate.

**What do we do?** We exclude records where the field SPCL_PRCSG_CD is non-missing. In addition, for volume calculations, we break down dealer-to-client (DC) and dealer-to-affiliate (DA) trading activity. We exclude non-member affiliate trades with the same price and the same size that happen within 60 seconds of each other.

4. **Trades on Electronic Platforms.** With the growth of electronic trading platforms, we see more transactions being executed through such platforms. Electronic platforms may or may not have a reporting obligation. The reporting obligation of an electronic platform is dependent on whether the platform is a party to the trade, and a registered alternative trading system (ATS) with the SEC. An ATS platform is a party to all transactions executed through its system, and therefore has a reporting obligation. An electronic platform that is not an ATS is not necessarily a party to all trades executed through its system so may not always have a reporting obligation.

Trades on an electronic platform which also has a reporting obligation increases the number of observations in the TRACE data. For example, a trade between two member firms on an electronic platform with a reporting obligation results in four observations in the TRACE data: a sell by the first member firm to the platform, a purchase by the platform from the first member firm, a sell by the platform to the second member firm, and a purchase by the second member firm from the platform. This needs to be addressed to avoid an upward-bias of trading activity, and a downward bias of price-based liquidity measures.

**What do we do?** Depending on the analysis, one might want to flag such trades. We use the counterparties identities and FINRA’s TRACE ATS identifiers list to flag such trades. We also construct an additional trade size variable that reset to 0 if the seller is an ATS platform. For trading volume calculations, for example, we use the ATS-adjusted volume variable. If we do not account for multiple trade reports, then we would include some trades more than once depending on whether the counterparties are FINRA members and whether an electronic platform also had a reporting obligation. This would result in an overestimation of the trading activity on electronic platforms with a reporting obligation (e.g., non-6732 ATSs), and an inaccurate comparison of the trading activity between platforms with different reporting obligations (e.g., 6732 ATSs and non-6732 ATSs). Overall, the filter that we apply to the TRACE data ensures that we include each trade only once in our sample.

### A.2 Spreads calculation

We begin by computing duration-matched spreads at the bond-trade level. As in Gilchrist and Zakrajšek (2012), define the Treasury-implied yield $y_{b,t}$ on bond $b$ on trade date $t$ as

$$\sum_{s=1}^{2T} \frac{C_b}{2} Z_t \left( \frac{s}{2} \right) + 100 Z_t (T) = \sum_{s=1}^{2T} \frac{C_b}{2} \left( 1 + \frac{y_{b,t}}{2} \right)^{-s} + \frac{100}{\left( 1 + \frac{y_{b,t}}{2} \right)^{2T}},$$
where $T$ is the time-to-maturity of the bond, $C_b$ is the coupon on the bond, and $Z_t(s)$ is the Treasury zero-coupon bond price for time-to-maturity $s$. The trade-level duration-matched spread on bond $b$ on trade date $t$ is then

$$z_{b,k,t} = y_{b,k,t} - y_{b,t}^f,$$

where $y_{b,k,t}$ is the yield on bond $b$ priced in trade $k$ on trade date $t$. We aggregate to the bond-trade day level by averaging using trading volume weights:

$$z_{b,t} = \frac{\sum_{k \in K_{b,t}} z_{b,k,t} V_{b,k,t}}{\sum_{k \in K_{b,t}} V_{b,k,t}},$$

where $K_{b,t}$ is the set of all trades in bond $b$ in on trading day $t$ and $V_{b,k,t}$ is the volume of the $k^{th}$ trade in bond $b$ on trade date $t$.

Duration-matched spreads measure the spread differential between corporate bonds and Treasuries with similar duration, capturing risk premia for both the differential credit and liquidity risk between Treasuries and corporate bonds. To separate these two components, similar to Gilchrist and Zakrajšek (2012), we estimate the duration-matched spread that would be predicted based on bond and issuer characteristics using the following regression

$$\log z_{b,t} = \alpha + \beta EDF_{b,t} + \gamma F_{b,t} + \epsilon_{b,t},$$

where $EDF_{b,t}$ is the one year expected default probability for bond $b$ on day $t$ estimated by Moody’s KMV, and $F_{b,t}$ is a vector of bond and issuer characteristics: log duration, log amount outstanding, log age of the bond, log coupon rate, a dummy for call provision, and a 3-digit NAICS industry fixed effect. When bond-level EDFs are not available, we use the issuer-level EDF instead and include a dummy variable for whether bond- or issuer-level is used in the specification.

We estimate this regression separately for each credit rating category, allowing different credit ratings to have a different relationship between expected duration-matched spreads and bond characteristics. Table A.3 reports the estimated coefficients for the above regression for the full sample January 1, 2005 – June 30, 2020. The default-adjusted spread for bond $b$ on date $t$ is then calculated as the difference between the priced and the predicted duration-matched spread on bond $b$ on date $t$

$$d_{b,t} = z_{b,t} - \exp \left\{ \alpha + \beta EDF_{b,t} + \gamma F_{b,t} + \frac{\sigma^2}{2} \right\},$$

where $\sigma^2$ is the estimated variance of the idiosyncratic error $\epsilon_{b,t}$.

### A.3 Credit ratings

For secondary market functioning, we classify bonds into investment grade and speculative grade (high yield) categories based on the issue-level credit ratings reported in Mergent FISD. We coalesce bond-level ratings by multiple rating agencies into a single number based on the plurality rule: if a bond is rated by more than one agency, we use the rating agreed
upon by at least two rating agencies and use the lowest available rating otherwise. For our purposes, a bond is identified as investment grade if its plurality rating is BBB- or higher on the S&P ratings scale, or equivalent, and as high yield if its plurality rating is between BB+ and C, inclusive, on the S&P ratings scale, or equivalent. In our sample, few bonds that were investment grade as of March 22, 2020, and have subsequently been downgraded to BB+/BB/BB-; to keep our definitions consistent with facility eligibility, we include those bonds in the investment grade category. Bonds that were investment grade as of March 22, 2020, and have subsequently been downgraded to below BB- on the S&P scale or equivalent but remain rated are included in the high yield category.

Similarly, for primary market functioning, we classify issuers into investment grade and speculative grade (high yield) categories based on the issuer-level plurality rating, with S&P, Moody’s and Fitch issuer-level ratings collected from Thompson Reuters Eikon.

A.4 Identifying majority U.S. operations

We identify companies as having the majority of operations in the U.S. in 2020 if:

1. 50 percent or more of their employees are reported to be located in the U.S., according to the latest available information on employees.

2. For issuers that do not report a geographical split of their employees but report a geographical split of assets, we assume that the majority of their operations are in the U.S. if at least 50 percent of their total assets are located in the U.S.

3. Otherwise, we assume that the issuer has majority of their operations in the U.S. if at least 50 percent of their total debt issuance is U.S.D denominated and is issued as a non-Yankee, non-Canadian bond.

We collect geographical information on employees and assets from three sources:

1. Compustat Geographical Segments file. We manually clean the geographic segments information to identify segments corresponding to the U.S. or, if the reporting company does not report segments at that level of geographic granularity, segments corresponding to North America.

2. Compustat Annual file.


We match firms in Compustat and CapitalIQ to issuers in Mergent FISD based on issuer-level cusips. Additional matches are obtained by fuzzy-matching issuer legal names to company names reported in Compustat and CapitalIQ. We manually verify the quality of the fuzzy-matches, and add additional matches by manually searching public filings of the respective issuers.
A.5 Nearest maturity Treasury spreads

Primary market issuances are priced as a spread to nearest-maturity on-the-run Treasury yields. In particular, we use the following maturity matches in computing the offering spread to the on-the-run Treasury:

- For bonds with less that 4.5 month maturity, spread to the 3 month Treasury bill
- For bonds with maturity of 4.5 months or more and less than 9 months, spread to the 6 month Treasury bill
- For bonds with maturity of 9 months or more and less than 1.5 years, spread to the 1 year Treasury note
- For bonds with maturity of $[1.5, 2.5)$ years, spread to the 2 year Treasury note
- For bonds with maturity of $[2.5, 4)$ years, spread to the 3 year Treasury note
- For bonds with maturity of $[4, 6)$ years, spread to the 5 year Treasury note
- For bonds with maturity of $[6, 8.5)$ years, spread to the 7 year Treasury note
- For bonds with maturity of $[8.5, 20)$ years, spread to the 10 year Treasury bond
- For bonds with 20 years maturity or more, spread to the 20 year Treasury bond

Note that we exclude bonds with more than 40 years maturity (including perpetual bond) from the offering spread summary statistics.
### Table A.1: PMCCF Timeline of Major Events

This table summarizes the major events as of the time of writing for the Primary Market Corporate Credit Facility (PMCCF).

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 22, 2020</td>
<td>PMCCF approved unanimously by the Board of Governors and the Secretary of the Treasury(^a)</td>
</tr>
<tr>
<td>March 23, 2020</td>
<td>Public announcement and initial Term Sheet published(^b)</td>
</tr>
<tr>
<td></td>
<td><strong>Key Facts:</strong></td>
</tr>
<tr>
<td></td>
<td>• The PMCCF and SMCCF are designed to work together to support the flow of credit to large investment-grade U.S. corporations so that they can maintain business operations and capacity during the period of dislocations relative to COVID-19.</td>
</tr>
<tr>
<td>April 9, 2020</td>
<td>Updated Term Sheet Published(^d)</td>
</tr>
<tr>
<td></td>
<td><strong>Key Facts:</strong></td>
</tr>
<tr>
<td></td>
<td>• Treasury capital increased from $10B to $50B</td>
</tr>
<tr>
<td></td>
<td>• Extended eligibility to firms that were rated IG as of March 22, 2020 and downgraded to no lower than BB- at the time of accessing the facility (“fallen angels”)</td>
</tr>
<tr>
<td></td>
<td>• The PMCCF will buy bonds and syndicated loans with maturities up to four years via two different mechanisms:</td>
</tr>
<tr>
<td></td>
<td>1. As the sole investor in newly issued corporate bonds</td>
</tr>
<tr>
<td></td>
<td>2. As a participant in a loan or bond syndication at issuance. Facility may purchase no more than 25 percent of any loan syndication or bond issuance.</td>
</tr>
<tr>
<td>June 29, 2020</td>
<td>Launch date(^e)</td>
</tr>
<tr>
<td></td>
<td>Updated Term Sheet Published(^f)</td>
</tr>
<tr>
<td></td>
<td><strong>Key Facts:</strong></td>
</tr>
<tr>
<td></td>
<td>• Pricing of individual corporate bonds will be issuer specific, informed by market conditions, plus a 100 bps fee, and subject to minimum and maximum yield spreads over comparable U.S. Treasury Securities</td>
</tr>
<tr>
<td></td>
<td>• Pricing of syndicated loans will be the same as that of other syndicate members, plus a 100 bps fee</td>
</tr>
</tbody>
</table>


\(^b\) Federal Reserve Board: [https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b1.pdf](https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b1.pdf)

\(^c\) Federal Reserve Board: [https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm](https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm)

\(^d\) Federal Reserve Board: [https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200409a5.pdf](https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200409a5.pdf)


\(^f\) Federal Reserve Board: [https://www.federalreserve.gov/newsevents/pressreleases/monetary20200629a.htm](https://www.federalreserve.gov/newsevents/pressreleases/monetary20200629a.htm)
Table A.2: SMCCF Timeline of Major Events. This table summarizes the major events as of the time of writing for the Secondary Market Corporate Credit Facility (SMCCF).

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 23, 2020</td>
<td>Initial Term Sheet published&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Key Facts:</td>
</tr>
<tr>
<td></td>
<td>• The PMCCF and SMCCF are designed to work together to support the flow of credit to large investment-grade U.S. corporations so that they can maintain business operations and capacity during the period of dislocation related to COVID-19.&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>• The SMCCF can purchase ETFs or individual corporate bonds</td>
</tr>
<tr>
<td>April 9, 2020</td>
<td>Updated Term Sheet published&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>May 12, 2020</td>
<td>Began purchasing ETFs&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>June 15, 2020</td>
<td>Updated Term Sheet published&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Updated FAQs released&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Key Facts:</td>
</tr>
<tr>
<td></td>
<td>• The SMCCF will purchase corporate bonds to construct a corporate bond portfolio that tracks a broad market index developed for the SMCCF</td>
</tr>
<tr>
<td></td>
<td>• The facility can purchase a broad market index of individual bonds from corporations that satisfy a few simple criteria: maturity of under 5 years, domiciled in the U.S., not an insured depository institution, and meets the issuer rating requirements for Eligible Individual Corporate Bonds</td>
</tr>
<tr>
<td></td>
<td>• Individual issuer weights will form the basis of sector weights, with each issuer mapped to one of twelve sectors. Purchases of corporate bonds will track as closely as possible the sector weights in the index.</td>
</tr>
<tr>
<td>June 16, 2020</td>
<td>Began purchasing individual corporate bonds&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Federal Reserve Board: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b2.pdf
<sup>b</sup> Federal Reserve Board: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200323b.htm
<sup>c</sup> Federal Reserve Board: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200409a2.pdf
<sup>d</sup> Federal Reserve Bank of New York: https://www.newyorkfed.org/newsevents/news/markets/2020/20200511
<sup>e</sup> Federal Reserve Board: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200615a1.pdf
<sup>f</sup> Federal Reserve Bank of New York: https://www.newyorkfed.org/markets/primary-and-secondary-market-faq/corporate-credit-facility-faq
<sup>g</sup> Federal Reserve Bank of New York: https://www.newyorkfed.org/newsevents/news/markets/2020/20200615
Table A.3: Estimated relationship between duration-matched spreads and characteristics. This table reports the estimated coefficients from the regression of log duration-matched spreads on bond-level 1 year expected default frequency (EDF) and bond issuer characteristics. Standard errors clustered at the issuer level reported in parentheses below the point estimates. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

<table>
<thead>
<tr>
<th></th>
<th>AAA,AA</th>
<th>A+,A-A</th>
<th>BBB+, BBB</th>
<th>BBB-</th>
<th>BB+, BB, BB-</th>
<th>B+ and Lower</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.19***</td>
<td>-5.39***</td>
<td>-4.92***</td>
<td>-4.25***</td>
<td>-3.99***</td>
<td>-5.09***</td>
<td>-5.05***</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Log duration</td>
<td>0.34***</td>
<td>0.44***</td>
<td>0.45***</td>
<td>0.48***</td>
<td>0.42***</td>
<td>0.06***</td>
<td>0.29***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Log coupon</td>
<td>0.53***</td>
<td>0.46***</td>
<td>0.43***</td>
<td>0.51***</td>
<td>0.53***</td>
<td>1.22***</td>
<td>0.77***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Log amount outstanding</td>
<td>-0.07***</td>
<td>-0.05***</td>
<td>-0.06***</td>
<td>-0.11***</td>
<td>-0.09***</td>
<td>-0.07***</td>
<td>-0.06***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Log age</td>
<td>-0.06***</td>
<td>-0.05***</td>
<td>-0.05***</td>
<td>-0.02***</td>
<td>-0.03***</td>
<td>-0.08***</td>
<td>-0.08***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Callable</td>
<td>-0.28***</td>
<td>-0.21***</td>
<td>-0.17***</td>
<td>-0.01</td>
<td>-0.10***</td>
<td>-0.25***</td>
<td>-0.19***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.02)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>EDF&lt;sub&gt;1y&lt;/sub&gt; × Firm EDF dummy</td>
<td>0.03***</td>
<td>0.05***</td>
<td>0.04***</td>
<td>0.23***</td>
<td>0.08***</td>
<td>0.08***</td>
<td>0.07***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>EDF&lt;sub&gt;1y&lt;/sub&gt; × Bond EDF dummy</td>
<td>-0.07*</td>
<td>-0.04***</td>
<td>0.08***</td>
<td>0.10***</td>
<td>0.08***</td>
<td>0.06***</td>
<td>0.08***</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

N. obs. 794,284 3,296,510 3,476,717 1,285,831 1,070,938 3,715,628 13,639,908
N. clusters 4,085 20,170 25,738 12,791 12,247 54,234 114,110
Adj. $R^2$ 0.30 0.31 0.32 0.34 0.24 0.42 0.44
Table A.4: List of eligible sellers. This table reports the SMCCF eligible sellers together with the seller registration date with the facility. An eligible seller is considered to be an underwriter if any subsidiary of the corporate parent of the eligible seller is reported as a lead underwriter in any corporate bond issuance in either 2019 or 2020 in Mergent FISD. Source: Federal Reserve Bank of New York, https://www.newyorkfed.org/medialibrary/media/markets/secondary-market-corporate-credit-facility-eligible-sellers.

<table>
<thead>
<tr>
<th>Eligible seller</th>
<th>Registration date</th>
<th>Underwriter?</th>
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<tbody>
<tr>
<td>BMO Capital Markets Corp.</td>
<td>May 7, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Cantor Fitzgerald &amp; Co.</td>
<td>May 7, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Jefferies LLC</td>
<td>May 7, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>NatWest Markets Securities Inc.</td>
<td>May 7, 2020</td>
<td>N</td>
</tr>
<tr>
<td>UBS Securities LLC</td>
<td>May 7, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Wells Fargo Securities, LLC</td>
<td>May 7, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Goldman Sachs &amp; Co. LLC</td>
<td>May 8, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Barclays Capital Inc.</td>
<td>May 11, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>BofA Securities, Inc.</td>
<td>May 11, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Morgan Stanley &amp; Co. LLC</td>
<td>May 11, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>BNP Paribas Securities Corp.</td>
<td>May 12, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Mizuho Securities U.S.A LLC</td>
<td>May 12, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>TD Securities (U.S.A) LLC</td>
<td>May 12, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Amherst Pierpont Securities LLC</td>
<td>May 13, 2020</td>
<td>N</td>
</tr>
<tr>
<td>Deutsche Bank Securities Inc.</td>
<td>May 13, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Citigroup Global Markets Inc.</td>
<td>May 14, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Daiwa Capital Markets America Inc.</td>
<td>May 14, 2020</td>
<td>N</td>
</tr>
<tr>
<td>HSBC Securities (U.S.A) Inc.</td>
<td>May 15, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>J.P. Morgan Securities LLC</td>
<td>May 22, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>RBC Capital Markets, LLC</td>
<td>May 22, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Scotia Capital (U.S.A) Inc.</td>
<td>June 10, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>Credit Suisse Securities (U.S.A) LLC</td>
<td>June 11, 2020</td>
<td>Y</td>
</tr>
<tr>
<td>SG Americas Securities, LLC</td>
<td>June 26, 2020</td>
<td>Y</td>
</tr>
</tbody>
</table>
Figure A.1. Employment losses from January to April 2020. This figure plots the percentage employment losses from January to April 2020 by 3-digit NAICS industry. Monthly employment data from Bureau of Labor Statistics.

Figure A.2. Distribution of Q1 2020 profitability. This figure plots the distribution of Q1 2020 firm-level quarter-over-quarter EBITDA growth rate. Income and balance sheet data from Compustat.
Figure A.3. Daily CCF purchase volume. This figure plots the time series of daily CCF purchase volume by asset class.