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Do Credit Lines Provide Reliable Liquidity Insurance? Evidence from Commercial-Paper Backup Lines*

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Abstract

Commercial-paper backup lines account for a substantial share of undrawn loan commitments in the corporate sector, but have despite this received scant attention in the credit-line literature. In this paper, I study the liquidity-insurance properties of backup lines using a comprehensive loan- and security-level dataset and the sharp contraction of the Swedish commercial-paper market during the COVID-19 pandemic as an exogenous shock to the supply of market-provided liquidity. I find that backup lines provide commercial-paper issuers with reliable liquidity insurance and that banks' liquidity provision via commercial-paper backup lines in periods of distress does not crowd out lending to other firms.

Keywords: Credit lines; bank lending; liquidity insurance; commercial paper; COVID-19.
JEL Codes: D22; G21; G32

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1 Introduction

Commercial-paper backup lines—credit lines held by commercial-paper issuers as insurance against rollover risk—account for a substantial share of the aggregate volume of undrawn credit-line commitments in the corporate sector. In Sweden, for example, one third of the volume of undrawn credit issued to non-financial firms is held by commercial-paper issuers, which makes backup lines one of the single most important types of credit line held by firms. Despite this, however, backup lines have received scant attention in the corporate-finance literature on credit lines.

This paper aims to fill this gap in the literature by providing granular empirical evidence on three questions about commercial-paper backup lines, motivated by the recent literature on the liquidity-insurance properties of credit lines. First, do backup lines provide commercial-paper issuers with reliable insurance against dry-ups in the supply of market-provided liquidity? Second, do synchronized drawdowns on backup lines by commercial-paper issuers crowd out lending to other firms? Third, are banks' liquidity provision to commercial-paper issuers via backup lines an important driver of developments in credit aggregates? To answer these questions, I undertake an empirical analysis which combines a unique matched loan- and security-level data set—comprising close to the universe of bank loans and debt securities in Sweden—with an exogenous shock to the supply side of the commercial-paper market, namely, the sharp contraction of the Swedish commercial-paper market during the early phase of the COVID-19 pandemic.

I begin by assessing the insurance value of commercial-paper backup lines. I do so by estimating to what extent commercial-paper issuers were able to offset the contraction in the supply of market-provided liquidity by drawing down credit lines from banks. This involves estimating firm-level regressions in which the growth in a firm's total debt between February and May 2020—as well as in each component of total debt—is regressed on the firm's exposure to the commercial-paper market contraction. A firm's exposure is measured as the share of its total interest-bearing debt in February 2020 that consisted of commercial paper falling due between March and May. By thus combining an exogenous and unexpected aggregate shock—the COVID-19 pandemic and its effect on the commercial-paper market—with predetermined cross-sectional variation in firms' exposure to the shock, I am able to plausibly identify the causal effects of the contraction of the commercial-paper market on the growth and composition of firms' debt.

I find no statistically significant effect of a firm's exposure to the commercial-paper market contraction on its total volume of outstanding debt in May. Hence, the drying up of the market did not affect the ability of exposed firms to raise funds in general. A higher exposure is, however, strongly associated with a shift in debt composition, from commercial paper towards bank loans, a shift achieved by means of drawdowns on pre-committed credit lines. In a set of placebo regressions, I show that the share of maturing commercial paper in total debt did not have a significant effect on either the volume or the composition of debt in the period immediately preceding the COVID-19 pandemic, which corroborates the interpretation that the debt substitution during the pandemic indeed was a result of the market contraction. Moreover, I show that commercial-paper issuers were not penalized by banks for drawing down backup lines in response to the market contraction. On the contrary, banks increased the credit-line limits by one SEK for every SEK of drawdowns—so that the undrawn amounts available via credit lines did not decline as a consequence of the drawdowns—while leaving loan rates unchanged.

Commercial-paper issuers could thus fully and efficiently offset the contraction of the market by drawing down bank-provided backup lines. In this way, banks played a vital role in offsetting the contractionary shock to the commercial-paper market induced by the pandemic. However, synchronized drawdowns on credit lines can put severe pressure on banks' liquidity and capital positions and thereby force them to reduce lending to other firms. The second question I address in the empirical analysis is therefore whether the drawdowns on backup lines crowded out bank lending to other firms. If this was the case, the liquidity insurance provided by banks to commercial-paper issuers may have had redistributive effects with adverse aggregate consequences (cf. Greenwald, Krainer and Paul, 2020).

I assess the potential crowding-out effects of drawdowns on commercial-paper backup lines by estimating firm-level regressions in which the supply of bank loans to firms *not* active on the commercial-paper market is regressed on the growth in lending to commercial-paper issuers on the part of each firm's banks. To reduce endogeneity concerns, I instrument the latter with the banks' pre-determined exposure to drawdowns on commercial-paper backup lines, measured as the ratio of maturing paper issued by a bank's borrowers to the size of its total loan portfolio. I find no evidence that banks more exposed to drawdowns on commercial-paper backup lines contracted lending to firms not active on the commercial-paper market relative to less exposed banks; this is true both in the full sample of firms and in subsamples of firms defined by firm size and age. This implies that banks were willing and able to accommodate the increased loan demand resulting from drawdowns on backup lines by commercial-paper issuers.

What enabled the banks to do this? I document two factors that are likely to be important. First, large amounts of deposits flowed into the banking system right before the commercial-paper issuers started to draw down their credit lines, in line with Gatev and Strahan's (2006) deposit-hedge hypothesis. The deposit inflow was in fact larger than the increase in lending, so the loan-to-deposit ratio in the banking sector fell markedly following the onset of the pandemic. Second, the capital ratios of the Swedish banks were high at the outset of the pandemic and eventually increased yet more. On top of this, regulatory capital requirements were lowered after the onset of the pandemic, which further increased the margin between the banks' actual capital ratios and the regulatory requirements. Hence, neither liquidity nor capital constraints prevented banks from accommodating the drawdowns by commercial-paper issuers.

In the final part of the analysis, I show that banks' liquidity provision to commercial-paper issuers via backup lines can be an important driver of developments in credit aggregates. More specifically, I document that the distinctive aggregate developments in bank lending in Sweden early in the pandemic—namely, that lending increased markedly overall, but that the entire increase went to large firms and predominantly occurred through drawdowns on credit lines—is fully accounted for by substitution of bank loans for market funding on the part of commercial-paper issuers. Put differently, the overall increase, as well as the gap between large firms and SMEs, all but disappears once one considers total debt instead of bank loans in isolation. One important implication of this finding is that the difference in the amount of bank loans flowing to SMEs and large firms, respectively, cannot be taken as evidence that the former faced particularly tight financial constraints during the pandemic.

Related literature. This paper provides causal borrower-level evidence showing that backup lines provide commercial-paper issuers with reliable liquidity insurance without crowding out lending to other firms—and that banks' liquidity provision to commercial-paper issuers were an important determinant of aggregate credit flows during the COVID-19 pandemic. In doing so, the paper contributes to three strands of the literature.

First, one of the key issues in the literature on credit lines as liquidity insurance has for a long time been whether or not credit lines provide firms with reliable insurance against liquidity shocks, given that the frequent use of covenants enable banks to restrict firms' access to pre-committed credit lines precisely when they need them the most (see, e.g., Sufi, 2009; Roberts and Sufi, 2009; and Santos and Viswanathan, 2020). More recently, however, several papers have proposed that the type of liquidity shock matters greatly for the insurance value of credit lines, and that the key question therefore is not so much *if* but rather *when*—under what circumstances—credit lines provide reliable liquidity insurance (see, e.g., Almeida, 2021). Recent papers have, for example, shown that credit lines provide reliable insurance against idiosyncratic liquidity shocks in normal times (e.g., Brown, Gustafson and Ivanov, 2021), but that the insurance value deteriorates sharply after adverse shocks to banks' financial health (e.g., Acharya et al., 2020, and Chodorow-Reich and Falato, 2022). I add to this literature by demonstrating that credit lines provide reliable insurance against sudden contractions in the supply of market-provided liquidity, one of the quantitatively most important types of liquidity shocks that credit lines are intended to insure. This finding underscores the importance of distinguishing between different types of liquidity shocks when assessing the insurance value of credit lines.

Second, a recent branch of the credit-line literature focuses on the potential crowding-out effects of synchronized credit-line drawdowns by large firms. Greenwald, Krainer and Paul (2020) and Kapan and Minoiu (2021), for example, provide evidence that credit-line drawdowns by large U.S. firms crowded out new bank lending during the COVID-19 pandemic and argue that this occurred because banks exposed to large drawdowns had to cut new lending to meet regulatory capital requirements (Greenwald, Krainer and Paul, 2020) or became more risk-averse in expectation of future balance-sheet constraints (Kapan and Minoiu, 2021). This contrasts sharply with the findings in this paper, which demonstrate that drawdowns on backup lines by commercial-paper issuers did not crowd out lending to other firms. The apparent discrepancy in findings is instructive, however, because it suggests that the health of the banking system determines whether large credit-line drawdowns have crowding-out effects. More specifically, the mechanisms that Greenwald, Krainer and Paul

(2020) and Kapan and Minoiu (2021) propose as drivers of crowding out are unlikely to have been in play during the pandemic in Sweden, where all important banks were in strong financial shape and no crowding out consequently occurred. Hence, the health of the banking system appears to be a key determinant not only of the insurance value of credit lines—as in Acharya et al. (2020) and Chodorow-Reich and Falato (2022)—but also of the crowding-out risk associated with synchronized drawdowns by large firms.

More generally, the finding that backup lines provide reliable liquidity insurance to commercial-paper issuers without crowding out lending to other firms is consistent with Gatev and Strahan (2006), who, building on Kashyap, Rajan and Stein (2002), propose that banks are uniquely able to insure commercial-paper issuers against contractions in the supply of market-provided liquidity. The reason is that investors tend to place their funds in deposit accounts at banks during periods of market stress, because of deposit insurance and other explicit and implicit government guarantees for banks. While this forces firms that normally rely on debt markets to satisfy their liquidity needs by drawing on bank-provided credit lines—which puts pressure on banks' liquidity positions—it simultaneously provides the banks with the additional liquidity necessary to meet the drawdowns. Hence, when the system works as intended, a run from markets does not affect the overall supply of credit adversely, but simply leads to reintermediation—funds that previously went directly from investors to non-financial firms are instead provided via banks in the form of loans.

The extant empirical evidence for the borrower side of this theory—i.e., that credit lines efficiently insure commercial-paper issuers against shocks to the supply of market-provided liquidity—consists of aggregate and bank-level correlations showing that bank lending, and in particular commitment-based lending, tends to increase during periods of low market liquidity (e.g., Saidenberg and Strahan, 1999, and Gatev and Strahan, 2006). Based on this evidence alone, it is not possible to assess the extent or efficiency of the liquidity insurance afforded by backup lines, nor whether liquidity provision to commercial-paper issuers via backup lines crowd out lending to other firms. By providing causal borrower-level evidence on these issues, I corroborate and extend Gatev and Strahan's (2006) evidence.

Finally, I add to the literature on banks in the early phase of the COVID-19 pandemic, and in particular to the strand of this literature that studies how firms used bank-provided credit lines to deal with the dislocations induced by the pandemic (see, e.g., Li, Strahan and Zhang, 2020; Greenwald, Krainer and Paul, 2020; Chodorow-Reich et al., 2021). My main contribution here is the evidence that banks—by helping to alleviate a major shock occurring in a different part of the financial system—acted as a stabilizing force in the COVID-19 pandemic. This stands in sharp contrast to the Great Recession, where banks on the contrary were a key source of instability in many countries (see, e.g., Acharya and Mora, 2015, and Ippolito et al., 2016).

2 Institutional Background

2.1 The Swedish non-financial commercial-paper market

The commercial-paper market is an important source of short-term financing for large non-financial Swedish firms. In February 2020, at the outset of the COVID-19 pandemic, the total volume of outstanding non-financial paper was 164 billion SEK, or 3.2 percent of Swedish GDP. This is large in international comparison: for example, the amount of outstanding non-financial commercial paper in the US—which arguably has the most well-developed commercial-paper market in the world—was 323 billion USD in February 2020, or 1.5 percent of GDP. Hence, the Swedish market is more than twice as large measured relative to GDP.

The number of issuers on the Swedish market is relatively small, however: in February 2020, there were 80 non-financial firms with outstanding commercial paper and another 11 that had paper outstanding at some point during the preceding year. The large overall volumes on the market are instead a result of these issuers being among the largest firms in the Swedish economy; the average total assets among the issuers included in the analysis in this paper was 53 billion SEK (approximately 5.3 billion USD) around the onset of the pandemic. In terms of industry distribution, 45 percent of the issuers are real-estate companies, 27 percent are in the services industries, 21 percent in manufacturing, and four percent each in the energy and construction industries, respectively.

The average initial maturity of non-financial commercial paper issued on the Swedish market is 4-5 months. In terms of currencies, issues in SEK dominate (76 percent of the total volume of outstanding paper), but euro- and dollar-denominated paper account for non-trivial shares as well (20 and 4 percent, respectively). Turning to the investor side of the market, 83 percent of the commercial paper is held by domestic investors and 17 percent by foreign investors. Interestingly, more than half of the domestically-owned commercial paper issued by non-financial firms is held by other non-financial firms. Other important groups of domestic investors are investment funds (26 percent of the domestically-owned paper) and pension and insurance companies (four percent each).

2.2 Commercial-paper backup lines

Commercial-paper backup lines are credit lines held by commercial-paper issuers for two purposes. The first is to insure the issuer against rollover risk. While commercial paper is short-term funding, most issuers operate on the assumption that their paper routinely will be rolled over at maturity and that their commercial-paper programs therefore provide a stable funding source over time. Issuers keep backup lines in place to ensure that they can substitute bank loans for commercial paper when poor market conditions prevent their maturing paper from being rolled over.

The second purpose of backup lines is to insure investors by lowering the default risk of the issuer; in fact, an issuer typically has to secure a backup line from a bank to obtain a credit rating for its commercial-paper program (Stojanovic and Vaughan, 1998). To ensure that backup lines actually have value for investors, credit-rating institutes usually require that credit lines serving as backups for commercial-paper programs have fairly non-restrictive covenants and that other "funding outs" for the bank are limited. For example, the rating institute DBRS states that "[b]ecause bank lines are in place primarily to deal with commercial paper issues caused by market disruptions, DBRS gives little credit to bank lines that allow the lender to refrain from advancing loans during general market disruptions" (DBRS, 2012).[1] Moreover, the credit lines need to have maturities exceeding those of any outstanding commercial paper.

The credit lines serving as backups for commercial-paper programs are sometimes pure backup lines, but it is more common for issuers to hold general-purpose lines and make sure that the undrawn amounts are large enough to fully cover the their outstanding paper. The backup-line coverage ratio for a firm's commercial-paper program is therefore defined

[1] That covenants are fairly non-restrictive makes it a priori likely that backup lines provide reliable liquidity insurance, but it also means that the crowding-out risk of drawdowns all else equal is larger for backup lines, precisely because it is difficult for banks to refuse to honor drawdown requests. Hence the importance of considering both the liquidity insurance provided to the holder of the backup line and the potential crowding-out effects when assessing the liquidity-insurance properties of commercial-paper backup lines.

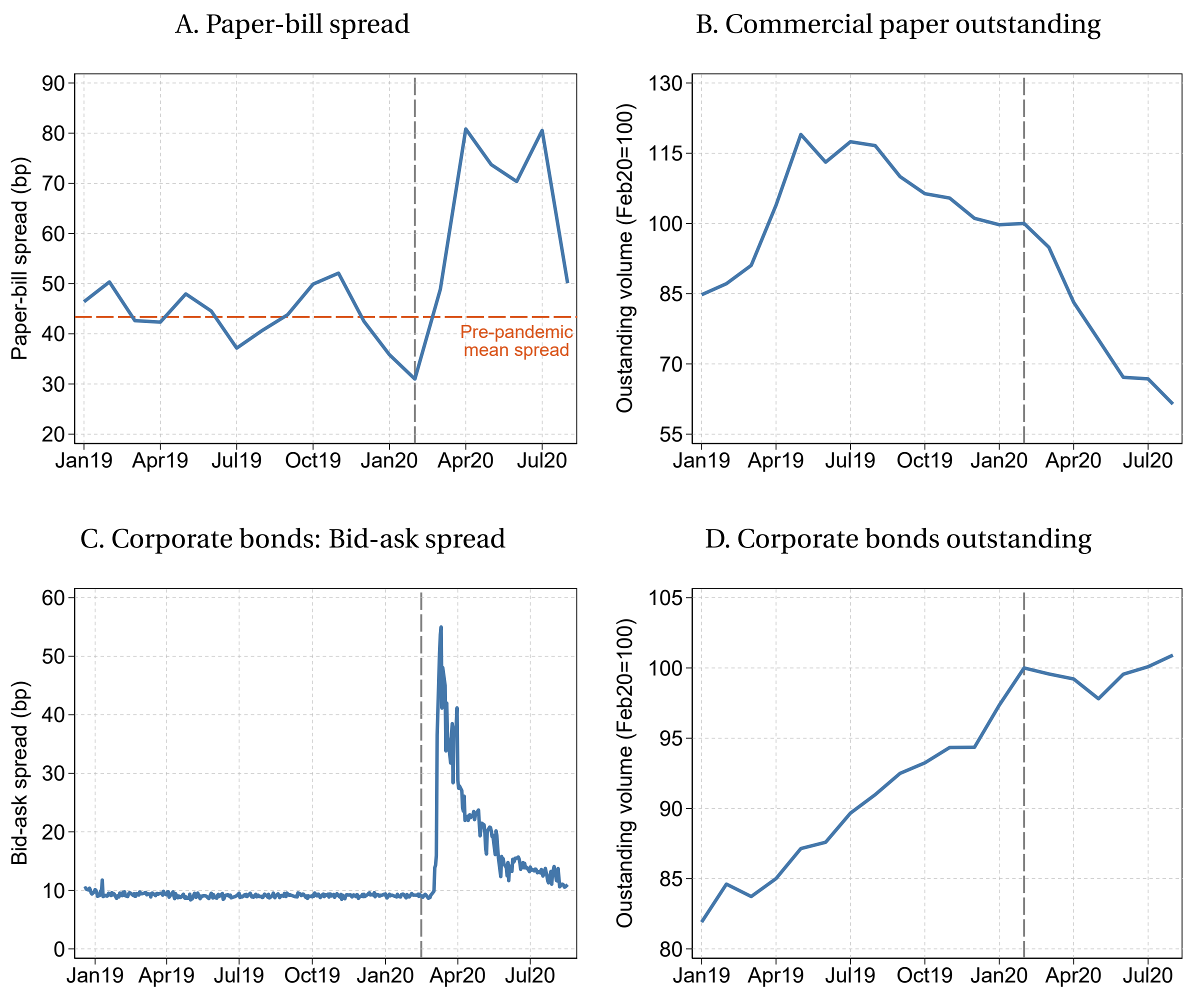
as the ratio of outstanding commercial paper to the total undrawn amount across all credit lines held by the issuer. While rating institutes typically require 100 percent coverage for a commercial-paper program to obtain a credit rating, issuers can under some conditions also count cash and securities towards the liquidity backup; hence, the coverage provided by credit lines may be somewhat below 100 percent even for rated commercial-paper programs (DBRS, 2012). The mean and median ratio of undrawn credit-line capacity to outstanding commercial paper among the Swedish commercial-paper issuers in my sample was 133 and 86 percent, respectively, in February 2020.

2.3 The COVID-19 shock

The supply of short-term funding on the Swedish commercial paper market contracted sharply almost immediately following the onset of the pandemic. This contraction is evident in Figure 1, which shows that the paper-bill spread—a common gauge of the liquidity of the commercial-paper market—doubled relative to its pre-pandemic level (Panel A), while the outstanding volume of paper declined sharply (Panel B). Only in August did the paper-bill spread begin to decrease towards its pre-pandemic level again, but outstanding volumes still remained low. The corporate bond market was also severely affected by the outbreak of the pandemic, as evidenced by a drastic widening of the bid-ask spread (Panel C), but since only a small share of outstanding bonds fall due at any given point in time, this was less consequential in terms of outstanding volumes (Panel D).

To prevent a complete meltdown of the non-financial commercial-paper market, the Riksbank (the Swedish central bank) swiftly launched a backstop facility that offered to purchase investment-grade non-financial paper at rates substantially less favorable than those prevailing before the onset of the pandemic. At its peak in May, the facility held around six billion SEK in non-financial commercial paper, which corresponds to around 3.5 percent of the outstanding volume prior to the onset of the pandemic. While the facility eased conditions on the commercial-paper market, it did not prevent the severe supply contraction documented in Figure 1 from taking place. Nor was this the intention; the facility was set up to be a backstop preventing a complete meltdown of the market—not to fully shield the market from any adverse consequences of the pandemic (for more details on the commercial-paper program, see Sveriges Riksbank, 2020).

Figure 1: Corporate bonds and commercial paper: Volumes and spreads



This figure shows the developments in spreads and volumes of commercial paper and corporate bonds around the onset of the COVID-19 pandemic. Panel A shows the paper-bill spread, computed as the difference between the yield on newly issued investment-grade commercial-paper and the three-month T-bill rate; Panel C the bid-ask spread on corporate bonds; and Panels B and D the outstanding volumes of commercial paper and corporate bonds, respectively, each indexed with February 2020 as base period. Only commercial paper and corporate bonds issued by non-financial firms are included in the figure.

There does, to the best of my knowledge, not exist any systematic evidence on the causes of the contraction of the Swedish commercial-paper market after the onset of the COVID-19 pandemic. Anecdotal evidence suggests, however, that the unprecedented levels of uncertainty prevailing at the time induced a run from the market, partly because many direct investors became unwilling to roll-over maturing paper, and partly because large outflows forced investment funds to sharply reduce their holdings of commercial paper and other assets (see, e.g., the discussion in Wollert, 2020). The available evidence suggests similar causes of the contractions in commercial-paper markets in other countries early in the COVID-19 pandemic (see, e.g., Boyarchenko et al., 2021, and Hill, 2021, for analyses pertaining to the U.S. and the Euro area, respectively).

What is important for the present paper, however, is simply that the supply of liquidity via the commercial-paper market suddenly and drastically contracted after the onset of the pandemic. This happened, moreover, at a time when many firms faced large cash-flow disruptions due to collapsing sales and therefore had unusually large liquidity needs. The liquidity positions of commercial-paper issuers were therefore squeezed from two directions early in the pandemic: the demand for liquidity increased for many firms at the same time as the supply of market-provided liquidity collapsed.

3 Empirical Framework and Data

3.1 Main econometric models

I assess how exposure to the contraction of the commercial-paper market affected the growth and composition of firms' debt using the following econometric model:

$$\frac{Y_{i,t+3}^{k} - Y_{i,t}^{k}}{Y_{i,t}^{T}} = \alpha^{k} + \beta^{k} \cdot \frac{Y_{i,t}^{CPdue}}{Y_{i,t}^{T}} + \gamma^{\mathbf{k}} \cdot \mathbf{X_{i,t}} + \varepsilon_{i,t}^{k}, \tag{1}$$

where the dependent variable is the change in debt of type k extended to firm i between periods t and $t+3$ divided by total debt in period t; the main explanatory variable is the ratio of commercial paper issued by firm i maturing between periods t and $t+3$ to total debt in period t; and $\mathbf{X_{i,t}}$ is a set of control variables. Total debt is defined as the sum of outstanding bank loans, commercial paper, and corporate bonds, i.e., $Y_{i,t}^{T} = Y_{i,t}^{L} + Y_{i,t}^{CP} + Y_{i,t}^{CB}$. The set of controls consists of the following variables: the log of total assets; the log of one plus the firm's age in years; leverage, measured as the ratio of total liabilities to assets; the weighted average of the initial maturity on the firm's outstanding commercial paper; an indicator for whether the firm has an investment-grade rating from at least one rating institute; and the firm's exposure to the COVID-19 shock, measured as the quarterly year-on-year growth in value added between

2019Q2 and 2020Q2 in the industry in which the firm operates. I measure firms' exposure to the COVID-19 shock at the industry level rather than directly at the firm level to avoid including an ex-post firm-level outcome as a control variable.[2]

I estimate (1) on a sample consisting of all firms that were active on the commercial-paper market and had at least one outstanding credit line from a bank in February 2020.[3] I define a firm as being active on the commercial-paper market if it had paper outstanding at some point between February 2019 and February 2020. t and $t+3$ correspond to February and May 2020, respectively, in the baseline specification, but I also run placebo regressions in which the time period is October 2019 to January 2020. To limit the influence of outliers, I exclude observations for which $\left(Y_{i,t+3}^{T} - Y_{i,t}^{T}\right)/Y_{i,t}^{T} > 1$, i.e., observations for which total debt growth exceeds 100 percent over a three-month period.

When $k = T$, the dependent variable in (1) is simply the percent change in firm i's total debt between periods t and $t+3$; hence, β^T captures the effect of exposure to the commercial-paper market contraction on firms' overall ability to obtain credit. When estimating (1) for $k = \{L, CP, CB\}$, I obtain an exact decomposition of the estimated effect on total debt growth into the effects attributable to each type of debt; to see this, note that since $\Delta Y_{i,t}^{T} = \Delta Y_{i,t}^{L} + \Delta Y_{i,t}^{CP} + \Delta Y_{i,t}^{CB}$, we have $\beta^T = \beta^L + \beta^{CP} + \beta^{CB}$. Thus, under the hypothesis that exposed firms (i) were unable to roll over maturing commercial paper, but (ii) were able to fully offset this by increased borrowing from banks, we should find $\beta^T = 0$, $\beta^{CP} < 0$, and $\beta^L > 0$. I then further decompose the bank-loan effect by splitting bank loans into pre-committed credit lines ($Y_{i,t}^{CLpre}$) and other loans (terms loans and new credit lines; $Y_{i,t}^{OtherL}$) and estimating (1) for $k = \{CLpre, OtherL\}$. A credit line is classified as new if it existed in May but not in February. As before, since $\Delta Y_{i,t}^{L} = \Delta Y_{i,t}^{CLpre} + \Delta Y_{i,t}^{OtherL}$, we have $\beta^L = \beta^{CLpre} + \beta^{OtherL}$. Under the hypothesis that the bank-loan effect is fully accounted for by drawdowns on commercial-paper backup lines, we should observe $\beta^{CLpre} > 0$ and $\beta^{OtherL} = 0$.

The identification strategy underlying specification (1), then, is to combine an exogenous

[2] The rating institutes are Moody's, S&P, Fitch, and DBRS, and investment-grade is defined as a rating corresponding to BBB–/Baa3 and higher. The COVID-19 exposure measure is computed based on the most disaggregated industry classification for which data is available in the Swedish national accounts; this classification consists of 33 industries. Firms for which I do not observe the industry code are assigned the value-added growth of the corporate sector as a whole.

[3] I also require that the firm has the legal form *aktiebolag*—the Swedish term for a corporation/limited company—that its ultimate owner is not a public-sector entity, and that it is domiciled in Sweden. On top of this, I drop one firm that was in the process of winding up its commercial-paper program at the outset of the pandemic; including this firm does not alter the results materially.

and unexpected aggregate shock to the commercial paper market—namely, the COVID-19 pandemic—with cross-sectional variation in firms' exposure to that shock. The key identifying assumption is that firms' exposure to the commercial-paper market contraction, $Y_{i,t}^{CPdue}/Y_{i,t}^{T}$, is as good as randomly assigned conditional on observed covariates, which is to say that it needs to be uncorrelated with unobserved factors that affected the growth and composition of firms' debt during the early phase of the pandemic. Recall that the estimation sample only includes firms active on the commercial-paper market, so the identifying assumption is that the variation in exposure to the commercial-paper market contraction is as good as randomly assigned *among commercial-paper issuers.* Put differently, unobserved differences between firms active and not active on the commercial-paper market are irrelevant, since the latter are not part of the sample. I conduct several exercises to assess the validity of the identifying assumption, the results of which will be presented along with the main results.

3.2 Econometric models for crowding-out analysis

The second step of the empirical analysis is to test whether the increased bank lending to firms exposed to the commercial-paper market contraction crowded out lending to other firms. I undertake this analysis on the basis of a firm-level measure of crowding-out risk, constructed as follows. First, I compute a measure of how affected each *bank* was by the contraction of the commercial-paper market. I do this by summing the change in each bank's lending between t and $t+3$ to firms that had commercial-paper maturing between March and May 2020 and then expressing this as a share of the bank's total loan portfolio in February:

$$\xi_{b,t} = \frac{\sum_{i \in \mathcal{I}_b} \Delta Y_{i,t+3}^{L} \cdot \mathbf{1}_{\{Y_{i,t}^{CPdue}>0\}}}{\sum_{i \in \mathcal{I}_b} Y_{i,t}^{L}}, \tag{2}$$

where $\mathcal{I}_b$ is the set of non-financial firms borrowing from bank b, and $\mathbf{1}_{\{Y_{i,t}^{CPdue}>0\}}$ is an indicator function equal to one if firm i had commercial paper maturing between February and May 2020. Intuitively, $\xi_{b,t}$ captures the idea that the more banks lent to commercial-paper issuers, the greater is the risk that they compensated for this by reducing lending to other firms.

Second, to reduce endogeneity concerns, I instrument $\xi_{b,t}$ with each bank's predetermined exposure to the commercial-paper market contraction, defined as the total amount of commercial paper issued by borrowers of bank b maturing between March and May, divided by b's total lending in February. Hence, the bank-level measure of crowding-out risk consists of the fitted values ($\hat{\xi}_{b,t}$) from the following regression:

$$\xi_{b,t} = \alpha + \beta \cdot \frac{\sum_{i \in \mathcal{I}_b} Y_{i,t}^{CPdue}}{\sum_{i \in \mathcal{I}_b} Y_{i,t}^{L}} + \varepsilon_{b,t}. \tag{3}$$

In case some firm i borrowed from multiple banks in period t, I split $Y_{i,t}^{CPdue}$ across the banks in question in accordance with their respective share of the total committed amount of lending to firm i in period t. Estimating (3) confirms that a higher pre-determined exposure to the commercial-paper market contraction is in fact strongly associated with higher actual lending growth to commercial-paper issuers between March and May ($\hat{\beta} = 0.347^{***}$; $F = 19.6$; $n = 17$).

Finally, I compute the firm-level measure of crowding-out risk by taking the weighted average of $\hat{\xi}_{b,t}$ across all of firm i's lenders in period t:

$$\xi_{i,t} = \sum_{b \in \mathcal{B}_i} \omega_{i,b,t} \cdot \hat{\xi}_{b,t}, \tag{4}$$

where $\mathcal{B}_i$ is the set of banks lending to firm i and $\omega_{i,b,t}$ is bank b's share of the total committed amount of lending to firm i in period t.

I then test the crowding-out hypothesis using the following econometric model:

$$\frac{Y_{i,t+3}^{L'} - Y_{i,t}^{L'}}{Y_{i,t}^{L'}} = \alpha + \beta \cdot \xi_{i,t} + \gamma \cdot \mathbf{X_{i,t}} + \varepsilon_{i,t}, \tag{5}$$

where the dependent variable is the percent change in the total volume of *committed* bank loans to firm i between periods t and $t+3$, and the main explanatory variable is the firm-level measure of crowding-out risk.[4] $\mathbf{X_{i,t}}$ consists of the same control variables as in (1), with one exception: I replace the investment-grade indicator variable with the probability of default (PD) assigned by each bank to its borrowers.[5] The crowding-out hypothesis implies that we

[4]To be precise, the difference between the loan measures used in the estimations of (1) and (5)—$Y_{i,t}^{L}$ and $Y_{i,t}^{L'}$, respectively—is that the former only includes outstanding loans, while the latter also includes undrawn portions of credit lines. The reason for using different loan measures is that I use (5) to assess potential loan supply effects, which are best captured by a measure of the total borrowing capacity granted to firms.

[5]In case a firm borrows from multiple banks, I construct a weighted firm-level PD, where the weights are given by each bank's share in the total committed lending to the firm.

should observe $\beta < 0$, i.e., that firms that borrowed from more exposed banks saw their access to bank loans deteriorate following the contraction of the commercial-paper market.

I estimate (5) on a sample consisting of all firms that (i) were *not* active on the commercial-paper market in February 2020, and (ii) had a bank loan with a committed amount of at least 100,000 SEK at the outset of the COVID-19 pandemic. Since the majority of Swedish non-financial firms borrow from only one bank at a given point in time, it will typically be the case that $\xi_{i,t}$ takes the same value for all firms that share the same main bank. I therefore cluster the standard errors at the main-bank level when estimating (5). As before, t and $t + 3$ correspond to February and May 2020, respectively. Similarly to the estimation of (1), I exclude observations for which $\left(Y^{L'}_{i,t+3} - Y^{L'}_{i,t}\right) / Y^{L'}_{i,t} > 1$ to limit the influence of outliers.

3.3 Data sources and sample characteristics

The empirical analysis is based on two main data sets. The first is the debt securities database SVDB, collected and maintained by Statistics Sweden on behalf of Sveriges Riksbank, the central bank of Sweden. SVDB contains detailed monthly data on all debt securities issued by Swedish companies, both domestically and abroad. For each security, I observe the identity of the emitting company and the outstanding amount, as well as a number of contract characteristics, including the currency in which the debt is denominated and the initial and remaining maturity. SVDB also comprise information on the credit ratings assigned by the major rating institutes.

The second data set is the credit register KRITA, also collected and maintained by Statistics Sweden on behalf of Sveriges Riksbank. KRITA is the Swedish part of ESCB's pan-European credit register AnaCredit—which it follows closely in terms of data structure and variable definitions—and contains detailed monthly data on the universe of loans extended by 18 Swedish monetary financial institutions to Swedish companies. KRITA also contains firm-level financial accounts data and demographic information about borrowers, such as location, legal form, and industry classification. The reporting institutions jointly account for 95 percent of the outstanding volume of bank loans to Swedish companies, which makes KRITA close to a census of corporate loans in Sweden. The banks not included in KRITA are small banks, for example local savings banks, which do not serve firms as large as commercial-paper issuers. Hence, the missing five percent of corporate loans does not affect the first part of the empirical analysis at all, and should at most have a negligible impact on the second part.

I merge SVDB and KRITA unambiguously by means of the unique identifier (*organisationsnummer*) belonging to every Swedish firm, and by doing so obtain a complete, high-frequency picture of the evolution of corporate debt at the firm level. Descriptive statistics for all variables used in the empirical analysis are provided in Table 1; the statistics in Panel A concern the sample of firms that were active on the commercial-paper in February 2020, used in the estimation of (1), and the statistics in Panel B the sample of firms that were not active on the market in February 2020, used in the estimation of (5).[6]

4 Main Results

4.1 The insurance value of commercial-paper backup lines

I assess how the commercial-paper market contraction affected the growth and composition of firms' debt using specification (1), which models a firm's overall access to funds, as well as its choice between different funding sources, as a function of its exposure to the commercial-paper market contraction, measured as the share of a firm's total outstanding debt in February 2020 that consisted of commercial paper maturing between March and May 2020. The results are reported in Table 2.

The coefficient estimate reported in column (1) shows that there is no statistically significant effect of a higher exposure to the commercial-paper market contraction on firms' overall ability to raise debt; to get a sense of the magnitude of the coefficient, note that a 10 percentage points higher ratio of maturing commercial paper to total credit is associated with an increase of 1.2 percent in total outstanding credit ($0.1 \cdot 0.120 = 0.012$). Columns (2)-(4) demonstrate, however, that a higher exposure is significantly associated with a shift in debt composition, from commercial paper towards bank loans. More specifically, of the (statistically insignificant) increase of 1.2 percent in total credit, –4.3 percentage points is due to commercial paper, 4.5 to bank loans, and 1.1 to corporate bonds; the estimates are statisti-

[6]Note that the sample in Panel A—which is used in the estimation of (1)—only comprises 57 firms, although 91 non-financial firms were active on the commercial paper in February 2020, as noted in Section 2. The difference is due to the sample screens specified in Section 3.1. The majority of issuers excluded from the final sample are dropped because they are owned by entities in the public sector.

Table 1: Descriptive statistics

	Mean	SD	p10	Median	p90	Obs.
A. Firms active on the commercial-paper market						
$Y_{i,t}^{CPdue}/Y_{i,t}^{T}$	0.212	0.204	0.000	0.160	0.546	57
$\left(Y_{i,t+3}^{T} - Y_{i,t}^{T}\right)/Y_{i,t}^{T}$	0.029	0.206	–0.152	0.000	0.318	57
$\left(Y_{i,t+3}^{CP} - Y_{i,t}^{CP}\right)/Y_{i,t}^{T}$	–0.094	0.187	–0.305	–0.042	0.030	57
$\left(Y_{i,t+3}^{CB} - Y_{i,t}^{CB}\right)/Y_{i,t}^{T}$	0.012	0.124	–0.042	0.000	0.000	57
$\left(Y_{i,t+3}^{L} - Y_{i,t}^{L}\right)/Y_{i,t}^{T}$	0.111	0.213	–0.014	0.052	0.301	57
$\left(Y_{i,t+3}^{CLpre} - Y_{i,t}^{CLpre}\right)/Y_{i,t}^{T}$	0.055	0.213	–0.014	0.000	0.225	57
$\left(Y_{i,t+3}^{OtherL} - Y_{i,t}^{OtherL}\right)/Y_{i,t}^{T}$	0.056	0.122	–0.003	0.003	0.191	57
$\left(Y_{i,t+3}^{L'} - Y_{i,t}^{L'}\right)/Y_{i,t}^{T}$	0.125	0.212	–0.015	0.067	0.360	57
$\bar{r}_{i,t+3} - \bar{r}_{i,t}$	0.001	0.007	–0.006	0.000	0.005	51
$InitialMaturity_{i,t}$	124.9	46.8	68.3	123.1	168.7	57
$IG_{i,t}$	0.316	0.469	0.000	0.000	1.000	57
$CovidExp_{j(i)}$	–0.069	0.150	–0.250	0.015	0.031	57
$Liabilities/TA_{i,t}$	0.597	0.208	0.348	0.594	0.905	57
$\ln TA_{i,t}$	23.61	1.41	22.39	23.72	25.00	57
$\ln Age_{i,t}$	3.570	0.938	2.079	3.526	4.654	57
B. Firms not active on the commercial-paper market						
$\xi_{i,t}$	0.034	0.023	0.011	0.034	0.069	91,579
$\left(Y_{i,t+3}^{L'} - Y_{i,t}^{L'}\right)/Y_{i,t}^{L'}$	–0.010	0.138	–0.079	–0.002	0.000	91,579
$PD_{i,t}$	0.028	0.100	0.000	0.006	0.045	91,579
$CovidExp_{j(i)}$	–0.071	0.125	–0.256	–0.083	0.029	91,579
$Liabilities/TA_{i,t}$	0.672	0.242	0.325	0.703	0.973	91,579
$\ln TA_{i,t}$	15.62	1.65	13.68	15.51	17.67	91,579
$\ln Age_{i,t}$	2.517	0.897	1.386	2.565	3.555	91,579

This table provides descriptive statistics for all variables used in the empirical analysis. Periods t and $t+3$ correspond to February 2020 and May 2020, respectively. The statistics in Panel A concern the firms that were active on the commercial-paper in February 2020 and the statistics in Panel B the firms that were not. A firm is defined as having been active on the commercial-paper market in February 2020 if it had paper outstanding at some point between February 2019 and February 2020. See sections 3.1 and 3.2 for exact definitions of the variables.

Table 2: The effect of the commercial-paper market contraction on the growth and composition of firms' debt

	Total credit and its components				**Bank loans**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Total credit	Commercial paper	Corporate bonds	Bank loans	Pre-comm. credit lines	Other loans
$Y_{i,t}^{CPdue}/Y_{i,t}^{T}$	0.120	–0.434***	0.107	0.446***	0.507***	–0.061
	[0.146]	[0.114]	[0.086]	[0.140]	[0.138]	[0.088]
$InitialMaturity_{i,t}/30$	–0.019	–0.013	–0.009	0.003	0.006	–0.003
	[0.021]	[0.017]	[0.013]	[0.021]	[0.020]	[0.013]
$IG_{i,t}$	0.012	–0.003	0.058	–0.043	–0.020	–0.023
	[0.076]	[0.059]	[0.044]	[0.073]	[0.072]	[0.046]
$CovidExp_{j(i)}$	–0.151	–0.154	–0.105	0.108	0.122	–0.013
	[0.204]	[0.159]	[0.119]	[0.196]	[0.193]	[0.123]
$Liabilities/TA_{i,t}$	0.002	0.034	0.002	–0.034	0.127	–0.161*
	[0.139]	[0.108]	[0.081]	[0.133]	[0.131]	[0.084]
$\ln TA_{i,t}$	0.019	0.030	0.003	–0.014	–0.006	–0.007
	[0.024]	[0.019]	[0.014]	[0.023]	[0.023]	[0.015]
$\ln Age_{i,t}$	0.040	0.002	0.024	0.014	0.016	–0.002
	[0.033]	[0.026]	[0.019]	[0.032]	[0.031]	[0.020]
Estimation period	February 2020-May 2020					
Observations	57	57	57	57	57	57
R^2	0.118	0.348	0.171	0.243	0.267	0.095

This table reports estimation results for the model specified in (1). Periods t and $t+3$ correspond to February 2020 and May 2020, respectively. The estimation sample is comprised of all firms that were active on the commercial paper and had at least outstanding one credit line from a bank in February 2020. See section 3.1 for exact definitions of all variables used in the estimations. Standard errors are reported in square brackets. ***, **, and * denote statistical significance at the ten, five, and one percent levels, respectively.

cally significant for commercial paper and bank loans, but not for corporate bonds.

Next, I assess whether the increased bank lending to exposed firms occurred through drawdowns on pre-committed credit lines or through newly granted loans. To this end, I further decompose the contribution of bank loans to the total effect (β^L) into the parts accounted for by changes in the outstanding amount on pre-committed credit lines and other loans, respectively, by estimating (1) with, in turn, $\Delta Y^{CLpre}_{i,t+3}/Y^T_{i,t}$ and $\Delta Y^{OtherL}_{i,t+3}/Y^T_{i,t}$ as dependent variable. The results of this exercise, reported in columns (5) and (6) of Table 2, confirms that the increase in bank loans to firms more exposed to the commercial-paper market contraction is fully accounted for by drawndowns on pre-committed credit lines. In fact, the contribution of pre-committed credit lines to the total effect is larger than the overall contribution of bank loans, because the point estimate for other loans is negative, though statistically insignificant. This demonstrates that firms exposed to the commercial-paper market contraction were able to offset its effects by drawing down their pre-committed credit lines.

The validity of the results presented so far hinges, as discussed above, on the assumption that firms' exposure to the commercial-paper market contraction is as good as randomly assigned conditional on observed covariates—put differently, the exposure needs to be uncorrelated with unobserved factors that affected the growth and composition of firms' debt during the early phase of the pandemic. Recall that the sample only comprises firms with outstanding commercial paper; hence the assumption is that the amount of commercial paper falling due early in the pandemic is as good as randomly assigned *among firms with outstanding paper*. In what follows, I undertake two validation checks to corroborate the plausibility of this assumption.

First, I assess whether the inclusion of the set of covariates $\mathbf{X_{i,t}}$ in specification (1) affects the estimates of β^k. I do this by estimating a bivariate version of (1) and comparing the resulting estimates with the corresponding estimates from the baseline specification. The idea is that unobserved covariates are less likely to generate bias in the estimates of interest if a set of relevant observed covariates do not meaningfully alter those same estimates (Altonji, Elder and Taber, 2005; Oster, 2019). The results from the bivariate specification, reported in Table 3, show that the exclusion of the control variables meaningfully lowers R^2 in the regressions—in the specification with corporate bonds as dependent variable, for example, from 0.17 to 0.02—but that the coefficient estimates are quite similar to the baseline esti-

Table 3: Validation exercise I: Baseline regression without control variables

	Total credit and its components				**Bank loans**	
	(1) Total credit	**(2)** Commercial paper	**(3)** Corporate bonds	**(4)** Bank loans	**(5)** Pre-comm. credit lines	**(6)** Other loans
$Y_{i,t}^{CPdue}/Y_{i,t}^{T}$	0.078	–0.485***	0.074	0.488***	0.511***	–0.022
	[0.135]	[0.105]	[0.081]	[0.124]	[0.123]	[0.081]
Estimation period	February 2020-May 2020					
Observations	57	57	57	57	57	57
R^2	0.006	0.281	0.015	0.219	0.239	0.001

This table reports estimation results for a bivariate version of the model specified in (1)—i.e., one in which the covariates in $\mathbf{X_{i,t}}$ have been excluded. Periods t and $t+3$ correspond to February 2020 and May 2020, respectively. The estimation sample is comprised of all firms that were active on the commercial paper and had at least outstanding one credit line from a bank in February 2020. See section 3.1 for exact definitions of all variables used in the estimations. Standard errors are reported in square brackets. ***, **, and * denote statistical significance at the ten, five, and one percent levels, respectively.

mates. This speaks in favor of the assumption that firms' exposure to the commercial-paper market contraction is as good as randomly assigned.

Second, I run a set of placebo regressions that are identical to the main regressions, but in which the time period is shifted back to the three-month period immediately preceding the pandemic—i.e., I regress the change in total debt and its components between October 2019 and January 2020 on the share of a firm's total outstanding debt in October 2019 that consisted of commercial paper maturing between November 2019 and January 2020. The estimated coefficients from the placebo regressions, reported in Table 4, are all statistically and economically insignificant, which demonstrates that exposure to maturing commercial paper affected neither the volume nor the composition of debt in a period when the commercial-paper market functioned normally.

4.2 Banks' response to drawdowns on commercial-paper backup lines

The previous section demonstrated that firms exposed to the commercial-paper market contraction were able to fully offset its effects by drawing down pre-committed credit lines. This

Table 4: Validation exercise II: Placebo regressions

	Total credit and its components				**Bank loans**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Total credit	Commercial paper	Corporate bonds	Bank loans	Pre-comm. credit lines	Other loans
$Y_{i,t}^{CPdue}/Y_{i,t}^{T}$	0.067	0.087	–0.008	–0.012	0.057*	–0.070
	[0.149]	[0.089]	[0.082]	[0.056]	[0.033]	[0.066]
$InitialMaturity_{i,t}/30$	0.008	–0.011	0.005	0.014	–0.007	0.021**
	[0.023]	[0.014]	[0.013]	[0.009]	[0.005]	[0.010]
$IG_{i,t}$	0.088	–0.027	0.071*	0.044	–0.012	0.057*
	[0.075]	[0.045]	[0.041]	[0.028]	[0.016]	[0.033]
$CovidExp_{j(i)}$	–0.250	–0.314**	–0.011	0.075	0.024	0.051
	[0.202]	[0.121]	[0.111]	[0.077]	[0.045]	[0.090]
$Liabilities/TA_{i,t}$	–0.019	–0.067	0.051	–0.003	–0.004	0.001
	[0.144]	[0.086]	[0.079]	[0.055]	[0.032]	[0.064]
$\ln TA_{i,t}$	0.010	0.011	–0.007	0.006	0.003	0.003
	[0.025]	[0.015]	[0.013]	[0.009]	[0.005]	[0.011]
$\ln Age_{i,t}$	–0.027	–0.018	–0.005	–0.004	–0.010	0.006
	[0.032]	[0.019]	[0.018]	[0.012]	[0.007]	[0.014]
Estimation period	October 2019-January 2020					
Observations	57	57	57	57	57	57
R^2	0.073	0.192	0.072	0.141	0.135	0.176

This table reports estimation results for the model specified in (1) when periods t and $t+3$ correspond to October 2019 and February 2020, respectively. The estimation sample is comprised of all firms that were active on the commercial paper and had at least outstanding one credit line from a bank in February 2020. See section 3.1 for exact definitions of all variables used in the estimations. Standard errors are reported in square brackets. ***, **, and * denote statistical significance at the ten, five, and one percent levels, respectively.

suggests that backup lines of credit offer efficient liquidity insurance to commercial-paper issuers. For this to be the case, however, it also needs to be shown that banks did not penalize these firms for the drawdowns by reducing loans volumes or increasing loan rates.

To assess how the credit-line drawdowns induced by the commercial-paper market contraction affected the quantity and price of bank loans, I undertake a two-stage least squares estimation in which the first-stage regression is the baseline specification in (1) with

$\Delta Y^{CLpre}_{i,t+3} \equiv \left(Y^{CLpre}_{i,t+3} - Y^{CLpre}_{i,t}\right)/Y^{T}_{i,t}$ as dependent variable, and the second stage regression is

$$\Delta Y_{i,t+3} = \alpha + \beta \cdot \widehat{\Delta Y^{CLpre}_{i,t+3}} + \gamma^{\mathbf{k}} \cdot \mathbf{X_{i,t}} + \varepsilon_{i,t}, \tag{6}$$

where $\widehat{\Delta Y^{CLpre}_{i,t+3}}$ are the fitted values from the first-stage regression and the set of controls variables is the same as in (1). I consider two dependent variables. The first is the change in the total volume of committed bank loans to firm i between periods t and $t+3$, scaled by firm i's total debt in period t, $\left(Y^{L'}_{i,t+3} - Y^{L'}_{i,t}\right)/Y^{T}_{i,t}$. The second is the change between periods t and $t+3$ in the weighted average interest rate across all bank loans held by firm i, $\bar{r}_{i,t+3} - \bar{r}_{i,t}$, where each loan is weighted by the committed amount. Under the hypothesis that banks lowered the quantity and increased the price of loans to firms that drew down credit lines in response to the commercial-paper market contraction, we should observe $\beta < 0$ in the first case and $\beta > 0$ in the second case.

The results are reported in Table 5. Consider first column (1), which reports the results for the estimation of (6) with the change in the committed amount of bank loans as dependent variable. The estimated coefficient is 0.98, which implies that banks *increased* the committed amount of lending by one SEK for every SEK of credit-line drawdowns induced by the commercial-paper market contraction. Put differently, banks replenished firms' credit limits so that the undrawn amount available via credit lines did not decline as a consequence of the drawdowns. Consider next column (3), which reports results when the dependent variable is the change in the average interest rate on the firm's bank loans. The coefficient here is a precisely estimated zero, which shows that banks did not increase loan rates for firms drawing down credit lines following the commercial-paper market contraction.[7] The estimates in columns (2) and (4), finally, show that little changes if one reruns the estimations without control variables.

The results reported in Table 5 imply that banks did not penalize firms for drawing down their backup lines of credit to offset the decline in the supply of market-provided liquidity; on the contrary, banks appear to have actively worked with the borrowers to help them offset the adverse effects of the shock. The finding that banks increase credit-line limits after drawdowns triggered by exogenous aggregate liquidity shocks is consistent with Brown, Gustafson

[7] The lower number of observations in columns (3) and (4) are due to missing data on loan rates for six of the firms in the sample.

Table 5: The effect of drawdowns on the size and price of credit lines

	Change in committed amount		**Change in interest rate**	
	(1)	**(2)**	**(3)**	**(4)**
$\Delta \widehat{Y^{CLpre}_{i,t+3}}$	0.978***	1.038***	0.000	–0.001
	[0.164]	[0.176]	[0.007]	[0.009]
Estimation period	February 2020-May 2020			
Control variables	Yes	No	Yes	No
Observations	57	57	51	51
First-stage F-statistic	13.439	17.257	13.946	17.560

This table reports estimation results for the two-stage least squares model specified in (6). Periods t and $t+3$ correspond to February 2020 and May 2020, respectively. The estimation sample is comprised of all firms that were active on the commercial paper and had at least outstanding one credit line from a bank in February 2020. The dependent variable is $\left(Y^{L'}_{i,t+3} - Y^{L'}_{i,t}\right)/Y^{T}_{i,t}$ in columns (1) and (2), and $\bar{r}_{i,t+3} - \bar{r}_{i,t}$ in columns (3) and (4). Standard errors are reported in square brackets. ***, **, and * denote statistical significance at the ten, five, and one percent levels, respectively.

and Ivanov (2021), who document the same finding in the context of exogenous idiosyncratic liquidity shocks. In contrast to my findings, however, Brown, Gustafson and Ivanov (2021) find that banks increase loan rates after drawdowns induced by idiosyncratic shocks. One possible explanation for the different results in this regard is that commercial-paper issuers have particularly strong bargaining positions vis-à-vis the banks due to their size and credit-worthiness, and therefore could resist any attempt by the banks to raise rates.

4.3 Crowding-out effects of drawdowns on commercial-paper backup lines

I test the crowding-out hypothesis by means of specification (5), which models the supply of bank loans to firms not active on the commercial-paper market as a function of the firm-level measure of crowding-out risk developed in section 3.2. Recall that this measure is constructed first at the bank level—by instrumenting each bank's actual lending to commercial-paper issuers during the early phase of the pandemic with its pre-determined exposure to the market contraction—and then at the firm level by weighing the bank-level measure across all banks lending to a given firm.

Before presenting the estimation results, it is instructive to consider some descriptive statistics regarding the measures of crowding-out risk. The banks' exposure to maturing commercial paper was non-trivial at the outset of the pandemic: when aggregating across all banks in the data, the ratio of maturing commercial paper issued by the banks' borrowers to the stock of outstanding loans to non-financial firms was 5.6 percent. In the cross-section of banks, the corresponding mean, minimum, and maximum values are 3.2 percent, 0 percent, and 17.4 percent, respectively. Hence, there is substantial variation across banks in the degree to which they were exposed to the commercial-paper market contraction via their borrowers. The actual lending increase to commercial-paper issuers was somewhat smaller, however, which implies that the instrumented change in lending to issuers is also smaller: more specifically, the mean, minimum, and maximum values of $\xi_{b,t}$ in the cross-section of banks are 1.8 percent, 0.7 percent, and 6.7 percent, respectively.

Now, consider the estimation results in Table 6. The coefficient for $\xi_{i,t}$ reported in column (1)—obtained when estimating (5) on the full sample of firms—is a fairly precisely estimated zero; to get a sense of the magnitude of the coefficient, note that a move from the minimum to the maximum value of $\xi_{i,t}$ (0.7 percent to 6.7 percent) is associated with a 0.2 percent reduction in the volume of committed bank loans ($-0.028 \cdot 0.06 = -0.002$). This implies that banks more exposed to the commercial-paper market contraction did not reduce loan supply to firms not active on the commercial-paper market relative to less exposed banks.

Could more exposed banks still have contracted loan supply to some specific categories of firms, even though they did not do so in general? To assess this possibility, I undertake a cross-sectional heterogeneity analysis, in which I estimate (5) on subsamples of firms defined by age and size, respectively. More specifically, I construct the age split by dividing firms into young and mature, with 10 years as the cutoff, and the size split by assigning SMEs to one group and large firms to the other. The idea is that young and small firms would have been more likely targets than older and larger firms in case the more exposed banks actually attempted to contract loan supply, on account of their weaker bargaining positions vis-à-vis the banks. The results of the cross-sectional heterogeneity analysis, reported in columns (2)-(5), show, however, that the estimated effects of the measure of crowding-out risk are close to zero and statistically insignificant in all subsamples under consideration. Hence, the overall result does not appear to mask any interesting cross-sectional heterogeneity in the effects.

Table 6: The effect of drawdowns by commercial-paper issuers on lending to firms not active on the commercial-paper market

		By firm size		**By firm age**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	All firms	SME	Large	Young	Old
$\xi_{i,t}$	–0.028	–0.028	–0.046	–0.076	0.010
	[0.093]	[0.092]	[0.270]	[0.118]	[0.075]
$PD_{i,t}$	–0.040***	–0.039***	–0.064	–0.027	–0.050***
	[0.012]	[0.013]	[0.040]	[0.017]	[0.008]
$CovidExp_{j(i)}$	0.014	0.013	0.063	0.030**	–0.001
	[0.009]	[0.008]	[0.104]	[0.011]	[0.009]
$Liabilities/TA_{i,t}$	0.011***	0.012***	–0.022	0.019***	0.005*
	[0.003]	[0.003]	[0.026]	[0.005]	[0.003]
$\ln TA_{i,t}$	0.003***	0.003***	–0.011	0.004***	0.002***
	[0.001]	[0.001]	[0.009]	[0.001]	[0.000]
$\ln Age_{i,t}$	0.002**	0.002**	0.004	0.003	0.001
	[0.001]	[0.001]	[0.008]	[0.002]	[0.001]
Estimation period	February 2020-May 2020				
Observations	91,579	90,433	1,146	40,824	50,755
R^2	0.003	0.003	0.007	0.005	0.002

This table reports the results of the estimation of the model specified in (5). The dependent variable is the percent change in the total volume of committed bank loans between February and May 2020. The estimation sample is comprised of firms that were not active on the commercial-paper market in February 2020 but had bank loans with a total committed amount of at least 100,000 SEK. See sections 3.1 and 3.2 for exact definitions of all variables used in the estimations. Standard errors cluster-adjusted at the main-bank level are reported in square brackets. ***, **, and * denote statistical significance at the ten, five, and one percent levels, respectively.

In sum, the cross-sectional evidence in Table 6 demonstrates that the increase in lending to firms exposed to the commercial-paper market contraction did not crowd out lending to other firms.

5 Additional Results

5.1 Factors enabling banks to accomodate the drawdowns

What enabled the banks to honor the drawdowns on commercial-paper backup lines without having to contract lending to other borrowers? As discussed in the introduction, Gatev and Strahan (2006) posit that banks' advantage in providing liquidity insurance to non-financial firms stems from a positive correlation between credit-line drawdowns and deposit inflows—i.e., from the tendency of investors to place their funds in deposit accounts at banks during times of market stress, which provides the banks with the funding necessary to meet the drawdowns just at the right time.

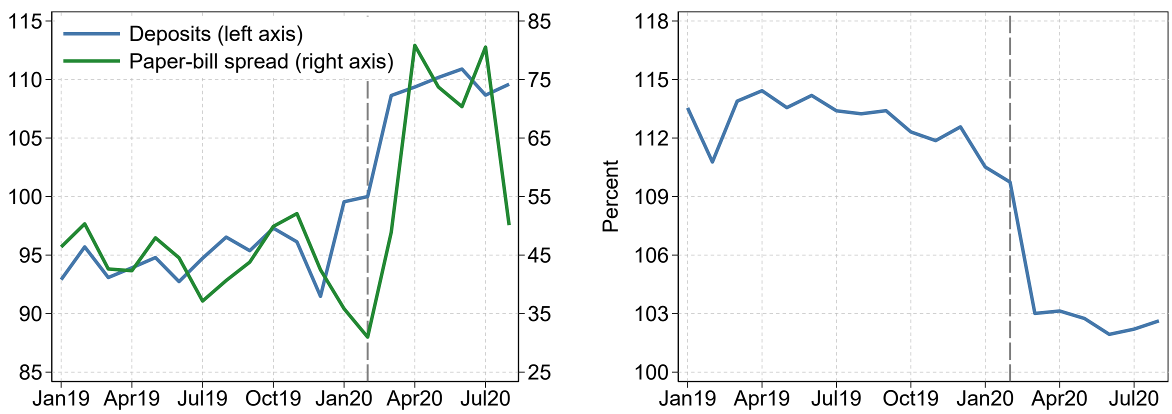
Figure 2 provides suggestive evidence that this is precisely what happened during the COVID-19 pandemic in Sweden: the volume of deposits in the banking sector started to increase sharply right before the conditions on the commercial-paper market began to deteriorate and then remained high throughout the early phase of the pandemic (left panel). The growth in deposits was in fact larger than the growth in lending, which led the aggregate loan-to-deposit ratio in the banking sector to fall early in the pandemic, despite the marked increase in corporate lending (right panel). Hence, the liquidity of the banking sector if anything improved during the early phase of the pandemic.

The other possible constraint on a bank's ability to accommodate synchronized credit-line drawdowns is capital: large drawdowns increase banks' risk-weighted assets and may thus lead to binding capital constraints when banks are thinly capitalized and unable to raise new equity (see, e.g., Greenwald, Krainer and Paul, 2020). This was not a concern during the COVID-19 pandemic in Sweden, however; on the contrary, the banks were well-capitalized already at the outset and then further strengthened their capital positions during the course of the pandemic. The left panel of Figure 3 shows that the average CET1 ratio for Swedish banks was 16 percent at the end of 2019, whereas the average of the minimum regulatory CET1 ratios for the same banks—as determined by the Swedish Financial Services Authority

Figure 2: Bank deposits around the onset of the pandemic

A. Deposits and the paper-bill spread

B. Loan-to-deposit ratio



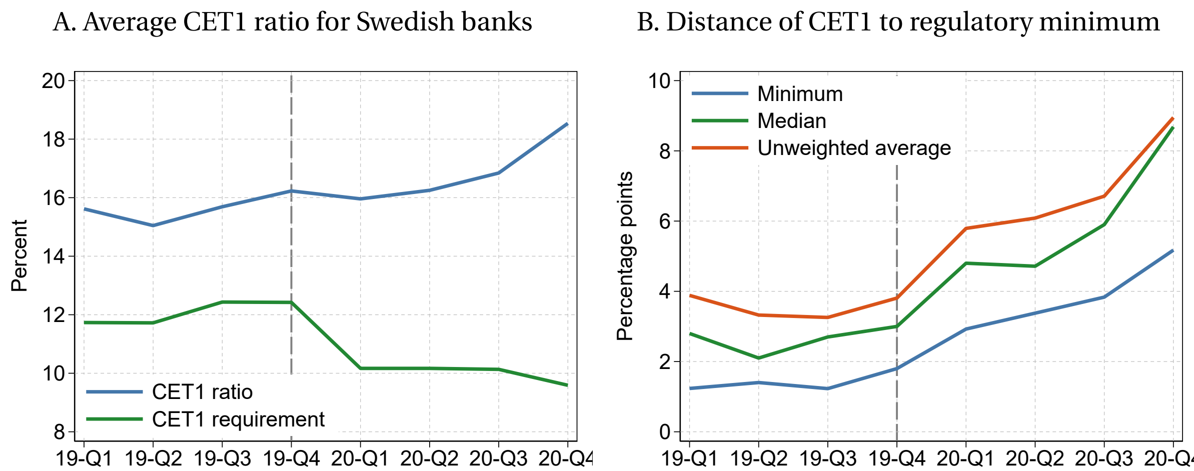
The left panel shows the development of the paper-bill spread (green line; right axis) and the volume of deposits in the banking system (blue line; left axis), the latter indexed with February 2020 as base period; see the notes to Figure 1 for the definition of the paper-bill spread. The right panel shows the aggregate loan-to-deposit ratio in the Swedish banking sector, measured in percent. The loan-to-deposit series exhibits seasonality in the form of a sharp increase every December; this seasonality has been removed by means of a fixed-effects regression.

(FSA)—was just above 12 percent. Hence, the banks had a fairly wide margin to the regulatory requirements at the outset of the pandemic. The margin then widened even further, initially because the regulatory minimum CET1 ratios were lowered but later also because the banks' capital buffers increased.[8]

In Panel B of Figure 3, I further corroborate the claim that banks were well-capitalized by computing the difference between each bank's actual CET1 ratio and its regulatory minimum level and then plotting the minimum, median, and average differences across banks. The figure shows that not only were the median and average distances to the regulatory requirement substantial throughout the early phase of the pandemic—the minimum level was as well. The bank closest to its regulatory minimum was two percentage points above it at the outset of the pandemic, and almost four percentage points above it by the end of the second quarter of 2020. Hence, not only the liquidity but also the capital positions of the banks improved during the early phase of the pandemic; consequently, neither capital nor liquidity

[8]The regulatory minimum CET1 ratios were lowered by the FSA through a reduction of the required countercyclical capital buffer from 2.5 percent to zero percent. The increase in actual CET1 ratios mainly occurred because the banks did not pay dividends during 2020, following "strong recommendations" from the Swedish FSA and the European Systemic Risk Board not to do so.

Figure 3: Banks' CET1 ratios versus regulatory requirements around the onset of the pandemic



The left panel shows the unweighted averages of the actual CET1 ratios (blue line) and the regulatory minimum CET1 ratios (green line) for Swedish banks over the period 2019Q1-2020Q4. The regulatory CET1 levels are bank-specific and determined on a quarterly basis by the Swedish Financial Services Authority. The right panel shows the minimum, median, and average distances, measured in percentage points, between the actual and required CET1 ratio for each bank. The sample consists of all banks for which the FSA determines CET1 requirements on a quarterly basis.

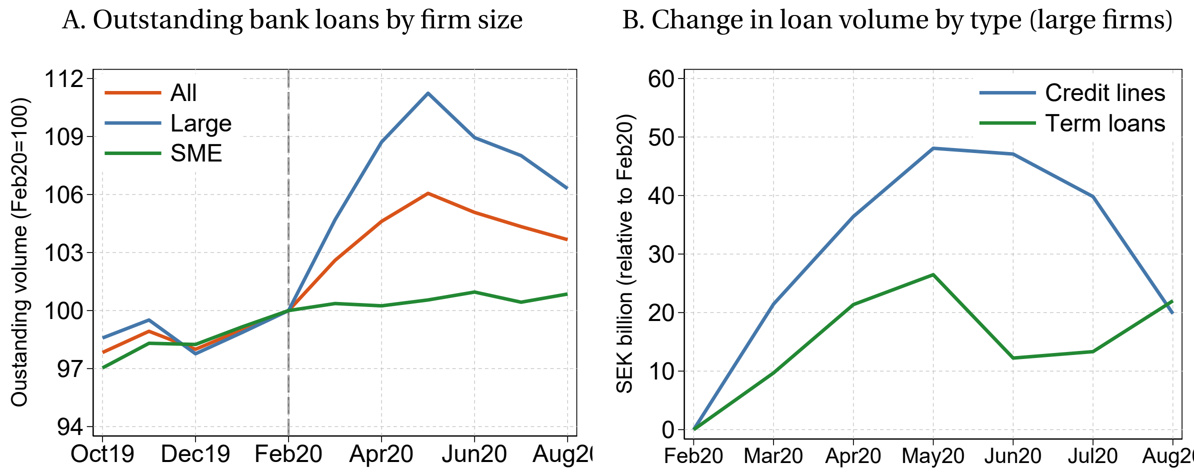
constraints prevented the banking sector from accommodating the increased loan demand from commercial-paper issuers without reducing lending to other firms.

5.2 The aggregate importance of drawdowns on backup lines

The final set of results concern the distinctive aggregate patterns in bank lending early in the COVID-19 pandemic, and the role of commercial-paper backup lines in accounting for them. More specifically, Figure 4 displays three striking features of bank lending to non-financial firms after the onset of the pandemic: namely, that lending increased overall, but that the entire increase went to large firms and predominantly occurred through drawdowns on credit lines. These patterns were observed not only in Sweden, but also in other countries (see, e.g., Chodorow-Reich et al., 2021, and Greenwald, Krainer and Paul, 2020 for the U.S.).

In Panel A of Figure 5, I show that the overall increase, as well as the gap between large firms and SMEs, all but disappears once one considers total debt (the sum of bank loans, commercial paper, and corporate bonds) instead of bank loans in isolation. This implies that

Figure 4: Bank lending to non-financial firms around the onset of the pandemic



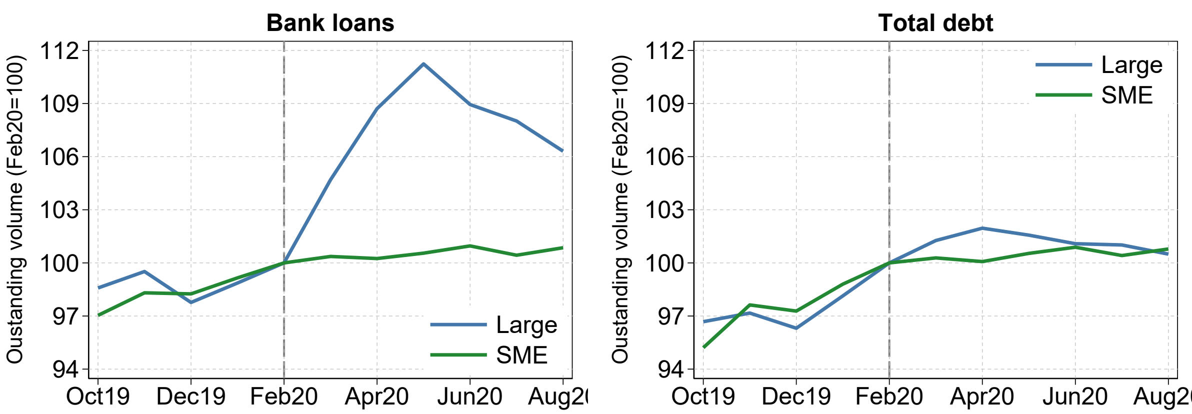
Panel A shows how the aggregate amount of outstanding volume of bank loans developed around the onset of the COVID-19 pandemic for all firms, as well as for large firms and SMEs separately. The numbers refer to the aggregate volume of debt in the respective group of firms at each point in time, indexed with February 2020 as base period. Panel B shows how the two components in total loans—credit lines and term loans—changed for large firms during the same period. The numbers are the changes in the respective loan type relative to February 2020, measured in billions of SEK.

the cause of the distinctive patterns in bank lending was not an overall increase in credit flowing to large firms, but rather the substitution of bank loans for market funding on the part of large firms. Consider next Panel B of Figure 5, which plots the same series as Panel A, but for firms active and not active, respectively, on the commercial-paper market. We see that bank lending to non-issuers did not increase at all after the onset of the pandemic, but that it did so dramatically for issuers. However, there is no difference in the growth of total credit across the two groups, which, again, demonstrates that the difference in bank lending was due to a change in the composition of debt on the part of commercial-paper issuers, rather than to an overall increase in credit. In sum, this demonstrates that banks' liquidity provision to commercial-paper issuers via backup lines of credit can be an important driver of the developments in credit aggregates.

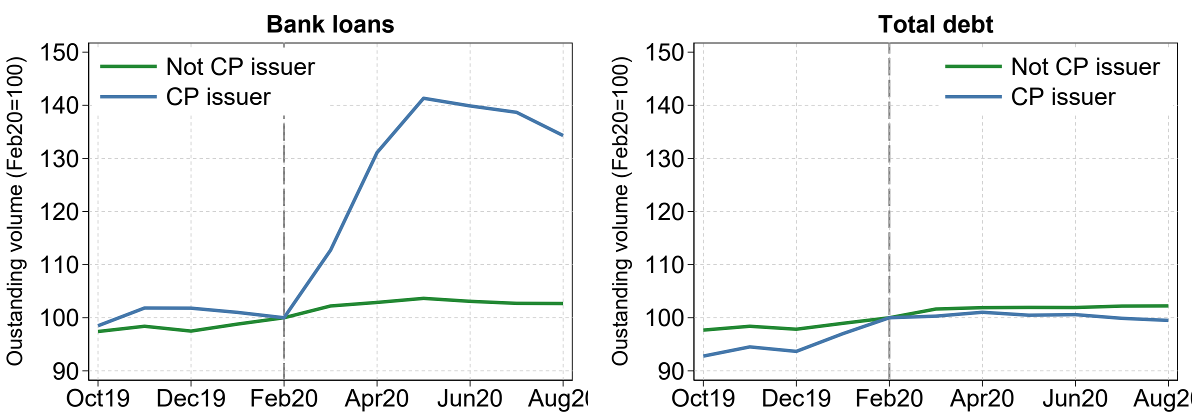
One important implication of this finding has to do with the question of whether tightened financial constraints for SMEs exacerbated the COVID-19 pandemic. The large gap between bank loans flowing to large firms and SMEs has frequently been taken as evidence that the latter were unable to obtain the credit they needed and therefore faced particularly tight

Figure 5: Bank loans and total credit by firm size and commercial-paper market access

A. By firm size



B. By commercial-paper market access



This figure shows how the aggregate volumes of outstanding bank loans and total debt developed around the onset of the COVID-19 pandemic for large firms versus SMEs (Panel A) and for firms with versus without access to the commercial-paper market (Panel B). Total debt is the sum of outstanding bank loans, corporate bonds, and commercial paper. The numbers refer to the aggregate volume of debt in each group of firms at each point in time, indexed with February 2020 as base period.

financial constraints early in the pandemic. This conclusion is evidently not valid here.[9]

[9]This does not necessarily imply that tightened financial constraints for SMEs were not an issue, only that an oft-cited fact—the gap in loans flowing to large firms and SMEs—does not support such a proposition.

6 Concluding Remarks

This paper has shown that firms exposed to the sharp contraction of the commercial-paper market early in the COVID-19 pandemic in Sweden were able to fully offset the decline in market-provided liquidity by drawing down pre-existing credit lines from banks. The drawdowns did not lead banks to reduce the committed volume or increase the price of loans to commercial-paper issuers—on the contrary, banks increased their credit-line limits to ensure that the drawdowns did not deplete their liquidity buffers—nor did it crowd out lending to other firms. The willingness and ability of banks to accommodate the drawdowns by the commercial-paper issuers is likely explained by strong initial capital and liquidity positions together with large deposit inflows following the onset of the pandemic, in line with Gatev and Strahan's (2006) deposit-hedge hypothesis. My findings thus demonstrate that credit lines can provide efficient insurance even against aggregate liquidity shocks, as long as the banking system is liquid and well-capitalized. The results imply that banks acted as a stabilizing force in the COVID-19 pandemic by helping to alleviate the adverse effects of a shock occurring in a different part of the financial system. This stands in stark contrast to the Great Recession, where banks on the contrary were a key source of instability in many countries (see, e.g., Acharya and Mora, 2015, and Ippolito et al., 2016).

References

Acharya, Viral, Heitor Almeida, Filippo Ippolito, and Ander Perez Orive. 2020. "Bank lines of credit as contingent liquidity: Covenant violations and their implications." *Journal of Financial Intermediation*, 44(C): 100817.

Acharya, Viral V., and Nada Mora. 2015. "A Crisis of Banks as Liquidity Providers." *Journal of Finance*, 70(1): 1–43.

Almeida, Heitor. 2021. "Liquidity Management During the Covid-19 Pandemic." *Asia-Pacific Journal of Financial Studies*, 50(1): 7–24.

Altonji, Joseph G., Todd E. Elder, and Christopher R. Taber. 2005. "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools." *Journal of Political Economy*, 113(1): 151–184.

Boyarchenko, Nina, Richard K. Crump, Anna Kovner, and Deborah Leonard. 2021. "The Commercial Paper Funding Facility." Federal Reserve Bank of New York Staff Report No. 982.

Brown, James R., Matthew T. Gustafson, and Ivan T. Ivanov. 2021. "Weathering Cash Flow Shocks." *Journal of Finance*, 76(4): 1731–1772.

Chodorow-Reich, Gabriel, and Antonio Falato. 2022. "The Loan Covenant Channel: How Bank Health Transmits to the Real Economy." *The Journal of Finance*, 77(1): 85–128.

Chodorow-Reich, Gabriel, Olivier Darmouni, Stephan Luck, and Matthew Plosser. 2021. "Bank liquidity provision across the firm size distribution." *Journal of Financial Economics*, forthcoming.

DBRS. 2012. "Commercial Paper Liquidity Support Criteria for Corporate NonBank Issuers." Dominion Bond Rating Service (DBRS). YPFS Documents No. 148.

Gatev, Evan, and Philip E. Strahan. 2006. "Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market." *Journal of Finance*, 61(2): 867–892.

Greenwald, Daniel L., John Krainer, and Pascal Paul. 2020. "The Credit Line Channel." Federal Reserve Bank of San Francisco Working Paper No. 2020-26.

Hill, Andy. 2021. "The European Commercial Paper and Certificates of Deposit Market." International Capital Market Association Technical report.

Ippolito, Filippo, José-Luis Peydró, Andrea Polo, and Enrico Sette. 2016. "Double bank runs and liquidity risk management." *Journal of Financial Economics*, 122(1): 135–154.

Kapan, Tumer, and Camelia Minoiu. 2021. "Liquidity Insurance vs. Credit Provision: Evidence from the Covid-19 Crisis." Working paper.

Kashyap, Anil K., Raghuram Rajan, and Jeremy C. Stein. 2002. "Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-taking." *Journal of Finance*, 57(1): 33–73.

Li, Lei, Philip E Strahan, and Song Zhang. 2020. "Banks as Lenders of First Resort: Evidence from the COVID-19 Crisis." *Review of Corporate Finance Studies*, 9(3): 472–500.

Oster, Emily. 2019. "Unobservable Selection and Coefficient Stability: Theory and Evidence." *Journal of Business & Economic Statistics*, 37(2): 187–204.

Roberts, Michael, and Amir Sufi. 2009. "Renegotiation of financial contracts: Evidence from private credit agreements." *Journal of Financial Economics*, 93(2): 159–184.

Saidenberg, Marc R., and Philip E. Strahan. 1999. "Are Banks Still Important for Financing Large Businesses?" *Federal Reserve Bank of New York: Current Issues in Economics and Finance*, 12(5): 1–6.

Santos, João A. C, and S. Vish Viswanathan. 2020. "Bank Syndicates and Liquidity Provision." NBER Working Paper No. 27701.

Stojanovic, Dusan, and Mark D. Vaughan. 1998. "The commercial paper market: who's minding the shop?" *The Regional Economist*, Apr: 5–9.

Sufi, Amir. 2009. "Bank Lines of Credit in Corporate Finance: An Empirical Analysis." *Review of Financial Studies*, 22(3): 1057–1088.

Sveriges Riksbank. 2020. "Purchases of commercial paper." Annex A to Monetary Policy Minutes, 26 March 2020. Available at: https://www.riksbank.se/globalassets/media/nyheter–pressmeddelanden/pressmeddelanden/2020/bilagor/200326/annex-a-to-the-minutes–purchases-of-commercial-paper.pdf.

Wollert, Stephan. 2020. "Swedish corporate bonds during the coronavirus pandemic." Sveriges Riksbank Staff Memo.

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