Liquidity Insurance vs. Credit Provision: Evidence from the COVID-19 Crisis *

Tumer Kapan† Camelia Minoiu‡

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Abstract

We exploit the unexpected and sizeable corporate credit line draw-downs in the early phase of the COVID-19 pandemic as a bank balance sheet shock and examine the impact on banks' lending decisions. We show that banks with larger ex-ante credit line portfolios—and hence higher risk of draw-downs—tightened lending standards on new C&I loans and curtailed the supply of large syndicated loans since March 2020. Banks with greater ex-ante exposures to firms in sectors more affected by the outbreak (such as airlines, hotels, and oil & gas) had even slower loan growth than other banks with similar total exposures. Furthermore, among participants in the Payroll Protection Program (PPP), banks with higher credit line exposures deployed fewer PPP loans. Our findings suggest that tension may arise between banks' providing liquidity insurance to firms via access to corporate credit lines and sustaining the supply of credit during crises, with important implications for monetary policy and financial stability policies.

Keywords: corporate credit line draw-downs, bank loan supply, syndicated loans, Senior Loan Officer Opinion Survey (SLOOS), Payroll Protection Program, COVID-19

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†International Monetary Fund, tkapan@imf.org.

‡Federal Reserve Board, camelia.minoiu@frb.gov.

1 Introduction

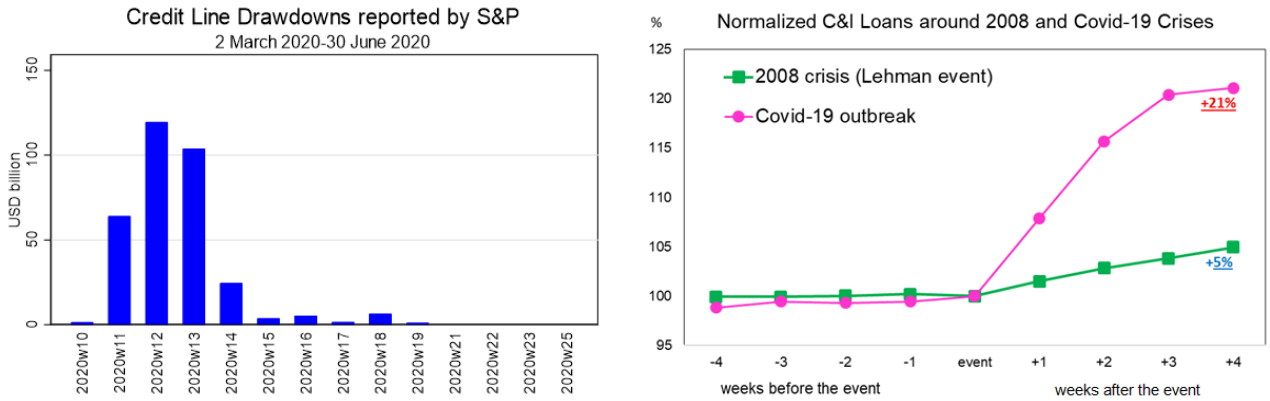
The COVID-19 pandemic brought to the fore the banking system's fundamental function of liquidity insurance (Acharya, Almeida, Ippolito and Perez-Orive, 2018b; Santos and Viswanathan, 2020). In March 2020, non-financial firms experienced sudden and sharp revenue declines amid widespread lockdowns related to the spread of the coronavirus (see Figure 1(a)). As this cash flow shock coincided with disruptions across major funding markets, firms drew down significant amounts from their pre-existing credit lines at banks to access cash, up to almost 70% of total capacity (Acharya and Steffen, 2020). Unexpected credit line draw-downs—an early manifestation of crisis impact on the banking system (Berrospide and Meisenzahl, 2015)—create both liquidity and capitalization pressures for banks. In this paper, we examine the impact of the substantial increase in credit line utilization on banks' lending decisions and discuss policy implications for stress testing and bank risk monitoring.

Motivation. We start from the observation that credit line draw-downs created unprecedented liquidity pressure for banks. Credit line draw-downs in March 2020 exceeded the peak utilization levels observed during the global financial crisis by a factor of four. As shown in Figure 1(b), in the four weeks following Lehman Brothers' failure in September 2008, C&I lending at U.S. commercial banks grew by 5%, while in the four weeks starting March 11 2020, it grew by 21%.[1] Despite its unprecedented magnitude, banks were able to meet this increase in liquidity demand, effectively providing liquidity insurance to firms in distress (Li, Strahan and Zhang, 2020). Strong central bank action, including bank access to central bank

[1]Credit line draw-downs received significant attention in the media, which emphasized their unexpected nature and unprecedented scale. A financial executive remarked that "we've seen an unprecedented flight to liquidity, no one ever thought the whole market would draw their credit lines at once" and noted that "most companies are drawing down almost all of their allotted facilities, even those that had never tapped them before" (Financial Times, March 27 2020). Some banks encouraged their corporate clients "to raise as much money as they could before the pandemic's true cost is factored in by investors" (Financial Times, May 31, 2020). The credit line draw-downs occurred against the backdrop of many years leading to the COVID-19 crisis that had witnessed solid growth of credit line issuances amid low interest rates. As the Financial Times further wrote: "Back when the world was awash with liquidity, lenders would offer low-cost revolving credit facilities—akin to a credit card—as a perk to win other business. The banks believed that most would never be used in full; such was the stigma of large companies drawing them." (March 25, 2020).

credit facilities, coupled with higher deposit supply (Gatev, Schuermann and Strahan, 2009), may have cushioned the liquidity drain effect of the draw-downs. However, their impact on bank capital is likely long-lived and may affect banks' attitudes towards risk-taking during a crisis, impairing their ability to carry out further financial intermediation.

Figure 1: **Credit Line Draw-downs During Covid and Historically**



(a) Credit Line Draw-downs by Listed Firms

(b) Normalized C&I loans: Lehman vs. Covid-19

The chart on the left depicts weekly corporate credit line draw-downs as reported primarily by listed firms (in USD billion). The chart on the right depicts the historically large credit line draw-downs during the COVID-19 crisis compared the Lehman event. In the four weeks starting with 9/17/2008 (Lehman event) C&I lending at US domestic banks grew by 5% vs. 21% in the four weeks starting on 3/11/2020 (COVID-19 crisis). Source: Federal Reserve Board's "Assets and Liabilities of Commercial Banks in the United States"—H.8 data release; S&P Global Market Intelligence, Leveraged Commentary and Data (LCD), drawing mainly on 8-K regulatory filings with the SEC.

Research Questions. In this paper we exploit the COVID-19 pandemic as an empirical laboratory to shed light on the tension that may arise between the provision of liquidity insurance to firms through access to bank credit lines on the one hand, and the sustained supply of credit during a crisis on the other hand. Specifically, we examine the link between the bank balance sheet pressures caused by corporate credit line draw-downs and banks' subsequent credit provision. We study this link across different credit markets—including syndicated lending to large and middle-market firms and small business lending—and in samples of both global and U.S. banks.

We ask the following questions: What is the impact of bank's ex-ante credit line exposures

on their lending decisions vis-a-vis corporate borrowers? What is the impact on loan supply—both intensive and extensive margin—and on the standards and terms (such as spreads, covenants, and collateral requirements) of new commercial loans? What are the effects and on the likelihood of participation in government-sponsored credit support programs? We also examine the role of heterogeneity in borrower vulnerability to the COVID-19 shock, which triggered massive reductions of internally generated funds (and, commensurately, a rise in firms' demand for external funding). Did banks with greater ex-ante exposure in their credit line portfolios to borrowers with higher expected revenue shortfall curtail loan volumes and tightened lending standards and terms more than other banks?

Results. We have three main results. First, we show that global banks with high ex-ante credit line exposures (measured at 2019 year end) curtailed the supply of new syndicated loans in 2020:Q2. On the intensive margin, using the empirical identification strategy of Khwaja and Mian (2008), we show that more exposed banks supplied lower average lending volumes to the same borrower; on the extensive margin, we show that more exposed banks had lower probability of renewing loans falling due in 2020:Q2 and were less likely to establish new lending relationships. These results are *stronger* for banks with greater ex-ante credit line exposures to firms in sectors *more affected by the pandemic* (such as airlines, hotels, and oil producers). Second, we examine banks' responses to the April and July 2020 Senior Loan Officer Opinion Surveys (SLOOS) conducted by the U.S. Federal Reserve Board, and show that more exposed banks tightened the standards and terms of new commercial loans, especially in 2020:Q2, while controlling for bank-level self-reported demand for loans. Third, we turn to the U.S. Department of the Treasury's Payroll Protection Program (PPP) and show that among PPP lenders, more exposed banks made fewer small business loans under this program, despite the fact that PPP loans are forgivable and carry low risk for the lender.

Literature Review. Our paper contributes to a large literature on banks as conduits of shocks to the real economy. Most of this literature takes financial shocks as the start-

ing point—for instance, bank funding shocks (De Haas and Van Horen, 2012b; Schnabl, 2012; Ivashina and Scharfstein, 2010; Khwaja and Mian, 2008) or asset-side shocks (Hale, Kapan and Minoiu, 2020; Ongena, Tümer-Alkan and Von Westernhagen, 2018; Popov and Van Horen, 2015; De Haas and Van Horen, 2012a; Puri, Rocholl and Steffen, 2011)—and traces their impact to the provision of credit and the performance of bank-dependent firms. We contribute to this literature by studying the effects of a *real sector shock* that exogenously raised the corporate sector's demand for bank liquidity, causing large off-balance sheet exposures to turn into loans unexpectedly. As loans carry much higher risk weights than the corresponding credit lines, unexpected draw-downs reduce capital ratios and can change the risk makeup of existing borrowers, potentially putting pressure banks. As a result, a real shock can become a financial shock that reverberates back to the real sector. Specifically, we show that weak corporate balance sheets contribute to the contagion by putting pressure on banks through credit line draw-downs.

Our paper also adds to the literature on the effects of financial crises, where a growing number of studies center on the COVID-19 shock. Our paper is closely related to Acharya and Steffen (2020) who examine the link between firms' financing decisions during the COVID-19 crisis and capital pressures on bank balance sheets. This study shows that firms in the BBB rating category, at the lower end of the investment-grade rating distribution, extensively drew down their bank credit lines to boost cash reserves (while triple-A rated firms retained access to the corporate bond market).[2] Our paper takes a step further and examines the effects of credit line draw-down risk on banks' lending decisions—both the standards and terms on new commercial and industrial (C&I) loans as well as the supply of loans.

In the analysis of large syndicated loans, we draw-down risk to vary with borrower characteristics following studies such as Halling, Yu and Zechner (2020), who link corporate characteristics (including size, market-to-book ratio, profitability, tangibility, and leverage) to firms' ability to secure external capital; and Ramelli and Wagner (2020) who show that

[2]According to S&P Leveraged Commentary and Data, 41% of corporate revolver draw-down volume was driven by BBB-rated public firms and 9% was driven by A-rated firms, during March-June 2020.

corporate debt and cash holdings are important drivers of equity market valuations during the crisis. Our analysis focuses on heterogeneity in borrowers' expected revenue shortfall—a measure of the likelihood of draw-downs—triggered by the lockdowns and economic decline associated with the pandemic. The paper thus underlines the role of corporate financial strength during downturns by showing that weak firm financials—in the form of low liquidity buffers to mitigate temporary revenue shortfalls—can contribute to a shock being spread to financial intermediaries, and potentially back to the real sector.

We organize the remainder of this article in the following way. Section 2 describes the empirical hypotheses and mechanisms, the data and our empirical design. Section 3 discusses the construction of the bank-level measures of exposure to credit line draw-downs. Section 4 presents our empirical results and Section 5 discusses the mechanisms behind our baseline results. Section 6 concludes.

2 Hypotheses, Empirical Identification, and Data

2.1 Hypotheses and Mechanisms

Testable Hypotheses. We develop two hypotheses. First, (H1) we posit that higher ex-ante credit line exposures (CLE) would reduce banks' capacity to extend new loans once unexpected draw-downs start, leading them to curtail new lending even as they meet the draw-down demand; and to tighten the standards and terms of new loans (e.g., spreads, covenants, collateral requirements, etc.). Second, heterogeneity in banks' credit line portfolios should play a significant role in bank loan supply to the extent that it affects the likelihood of draw-downs. We hypothesize that (H2) banks with greater exposures to borrowers that were more vulnerable to the COVID-19 shock (such as airlines, hotels, and energy sector) and hence were more likely to draw down revolvers, would reduce loan supply more.

Mechanisms. The key mechanisms by which credit line draw-downs can make banks more cautious in their lending decisions include an immediate reduction in capital ratios,

and potential for future losses and capital erosion, hence higher risk aversion. As banks experience balance sheet pressures and the threat of future such pressures, they decide to pull back from risk-taking. Below we discuss in detail how these threats manifest, with potential implications for credit provision.

When a credit line is drawn, the new loan needs to be funded. If there is no immediate increase in funding, the bank may need to meet the higher funding need by adjusting its portfolio allocation, e.g., by reducing other lending or selling liquid assets. Credit line draw-downs are therefore a liquidity drain on banks. More importantly, off-balance sheet credit exposures are significantly less capital-intensive than on-balance sheet loans. To illustrate, a credit revolver with less than one year maturity has a credit conversion factor of 20%. That is, the off-balance sheet short-term credit line only takes 20% of the risk weight of its on-balance sheet loan counterpart. When a short-term credit line is drawn and becomes an on-balance sheet loan, the risk-weighted asset on the exposure increases five-fold.[3] If credit line utilizations exceed banks' expected utilization levels substantially, banks can experience significant unexpected declines in capital ratios.

Through the increase in risk weights, the above mechanism explains the impact of credit line draw-downs on regulatory capital ratios. But draw-downs also affect the simple leverage ratio (common equity/assets) owing to the increase in the size of the balance sheet, assuming the bank does not immediately adjust common equity with a fresh capital raising. Importantly, bank regulatory capital and leverage ratios come under pressure as draw-downs materialize even if the bank has sufficient liquidity to meet the draw-down demand.[4] Therefore, even if banks withstand a surge in corporate credit line draw-downs, this leaves their balance sheets weakened and less able to generate new credit.

[3]The credit conversion factor for credit lines for with one year or longer maturity is 50%, which means that the risk weighted asset on the exposure will double when it is drawn.

[4]Acharya, Almeida, Ippolito and Perez-Orive (2018a) show that being able to access their credit lines is crucial for firms. Bank restrictions on the usage of credit lines during the global financial crisis (for instance, by raising spreads or shortening maturities) had real effects for borrowing firms. Berrospide and Meisenzahl (2015) show that firms with access to credit lines—especially smaller and more financially constrained firms—were better able to maintain capital expenditure during the global financial crisis.

2.2 Data

We assemble data on banks' lending decisions from three sources:

- Loan-level data from Refinitiv Dealscan, a global database of syndicated C&I loans to large and middle-market firms (ranging in size between USD 100,000 and 50 billion).
- Bank-level data with individual bank responses from the April and July 2020 Senior Loan Officer Opinion Survey (SLOOS) administered by the U.S. Federal Reserve Board.
- Loan-level data on small business lending (for loans smaller than USD 150,000) extended through the Payroll Protection Program (PPP) during April-June 2020.

We also use data on bank balance sheets from Fitch Connect (Fitch Solutions) and the U.S. Call Reports, information on borrowers' sectoral classifications from S&P Global Market Intelligence, financial market data including stock market returns for each sub-industry from Bloomberg, and public data on U.S. commercial banks' C&I lending from the Federal Reserves' H.8 data release.

Identification. To take the testable hypotheses to the data we exploit cross-sectional variation in pre-crisis bank exposure to credit line draw-downs—a measure that we call credit line exposures (CLE) and describe in detail below. Identification of the effects of this measure on bank credit hinges on its being uncorrelated with bank unobservables (for instance, its ability to predict the economic outlook and to adjust to the shock, its internal risk management practices, and managerial talent) and post-shock developments. To decouple the exposure measure from banks' balance sheet adjustments following the shock, we compute it before the crisis. Furthermore, we need to carefully control for loan demand in order to convincingly separate loan supply from demand effects. We adopt a different identification strategy in each dataset we analyze, as made possible by the granularity level of the data and available controls; and discuss each strategy prior to presenting the results.

3 Bank Exposure to Credit Line Draw-Downs

To establish an empirical link between banks' exposure to credit line draw-down risk and lending decisions, we need a measure of *potential* exposure to draw-downs once the outbreak begins and unexpected draws start, that is, measured ex-ante. As discussed above, we opt for this measure because realized, ex-post draws could be contaminated by macro developments after the outbreak, such as declines in economic activity and credit demand, and would therefore be partially endogenous.

To measure credit line exposure, we construct bank-level credit line portfolios using detailed microdata on financial contracts from DealScan's global database of syndicated C&I loans. Focusing on the syndicated loan market allows us to capture the vast majority of credit line draw-downs. (For the largest U.S. banks, for instance, we capture almost 90% of all credit line draw-downs.) We measure ex-ante CLEs at the bank level, for a large number of lenders in the global syndicated lending market using data on individual credit lines that were outstanding on bank balance sheets at the end of 2019—just before the pandemic.

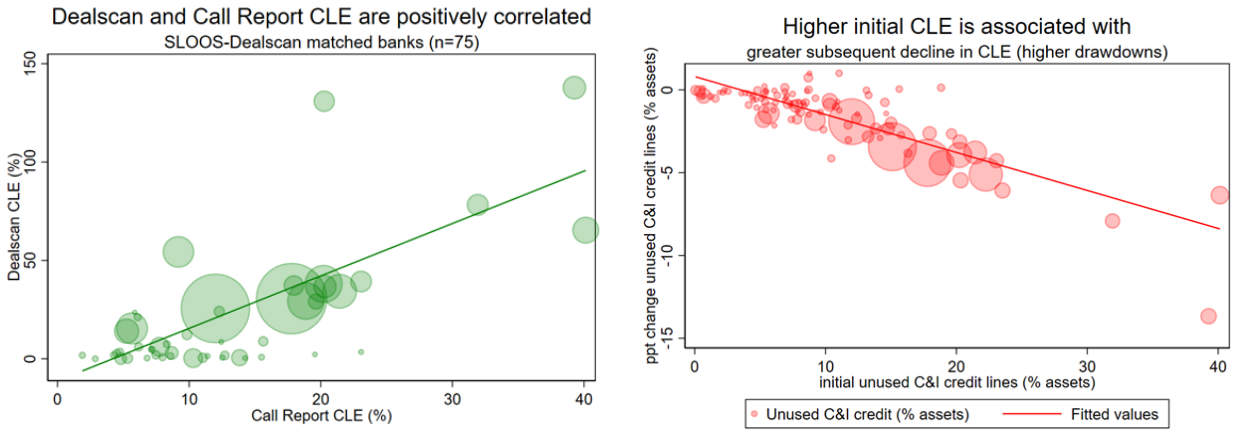
Ex-ante bank CLEs (% assets) are sizeable and show significant variation across banks. The median CLE-to- asset ratio at end-2019 is 8% for global systemically important banks (GSIBs) and 3.3% for other banks, with variation across countries as well: U.S. banks have CLEs of 14.7% on average, compared to 9.1% in Japan, 7.3% in the UK, 4.7% in France, and less than 1% for Chinese banks. Furthermore, there is a great deal of variation in CLEs across the datasets we employ in the regression analysis (Dealscan for syndicated lenders, SLOOS respondents, and PPP lenders).

Our CLE measure may be subject to two potential concerns related to its measurement. The first may be that it is constructed from data in Dealscan, which only captures credit lines originated through syndicated loan deals and thus misses bilateral loan contracts. Furthermore, in Dealscan we only observe the credit line at origination and do not know how much has been utilized; in other words, we do not have information on the off vs. on-balance sheet split of the credit line. To alleviate these concerns, we need to compare our CLE measure

based on Dealscan with an independent measure that is accurate—ideally from regulatory filings—even if available for a subset of banks. Such a measure exists for U.S. banks in the U.S. Call Report under the name "undrawn C&I credit commitments." In Figure 2(a) we correlate the Dealscan- and Call Report-based CLE measures (both in % of total assets) and find that they are strongly positively correlated.

It is also important to show that our ex-ante measure of exposure to credit line draw-down risk is correlated with ex-post draw-downs. Since we do not observe actual draw-downs at the bank level in Dealscan, once again we focus on U.S. banks, for which we have both initial CLEs in 2019:Q4 as well as subsequent draw-downs computed as the percentage point change in CLEs (between 2019:Q4 and 2020:Q1). Figure 2(b) shows that higher initial CLEs are associated with larger subsequent draw-downs in the sample of more than 500 banks with non-zero off-balance sheet C&I loan commitments in the Call Reports.

Figure 2: **Validating the Bank Credit Line Exposure Measure**



(a) Dealscan vs. Call Report-based CLE

(b) Ex-ante CLE vs ex-post draws

The left chart shows the link between CLEs computed as undrawn C&I credit commitments (% assets) in 2019:Q4 from the Call Reports and CLEs (% assets) computed from Dealscan (outstanding as of March 2020). Sample: 75 matched banks between Dealscan and SLOOS. The right chart shows the link between ex-ante CLEs measured as the unused C&I credit lines (% assets) in 2019:Q4 and the change in this variable between 2019:Q4 and 2020:Q1, capturing the actual draws over the period. In both charts, bubble size increases with bank size. Sample: 506 banks that have non-zero unused credit commitments. Source: Call Report, Refinitiv Dealscan.

4 Results

4.1 Results from syndicated loans

Using loan-level data on syndicated deals extended during 2019 and 2020 for 30 global systemically important banks (G-SIBs), we carry out intensive and extensive margin analyses of loan supply adjustment by banks with differential exposure to corporate credit lines.

For identification of loan supply effects on the intensive margin, our empirical approach is to compare loan growth from at least two different banks with varying CLEs to the same individual firm, across all firms that borrowed in the syndicated loan market in the second quarter of 2020 compared to all the quarters of 2019. Holding the borrower fixed in this empirical setup allows us to control for borrower-level changes in loan demand between the two periods, as discussed in Khwaja and Mian (2008). Controlling for credit demand with borrower fixed effects is crucial in our setting as the COVID-19 outbreak was accompanied by significant changes in credit demand. According to the Federal Reserve's July 2020 SLOOS on Bank Lending Practices, for the second quarter of 2020, U.S. banks reported weaker demand for C&I loans from borrowers of all sizes.

The results are reported in Table 1, where the dependent variable is the growth rate of average loan volume between the before-shock period (the year 2019) and the after-shock period (2020:Q2). The unit of observation is given by bank-firm pairs in a lending relationship both before and after the COVID-19 shock. To avoid contaminating the results with loan dynamics early in the year, right around the start of the pandemic, we drop all loans originated in 2020:Q1.[5] In column 1 we regress loan growth on ex-ante credit line exposures and bank controls including size (log-assets), Tier 1 capital ratio, ROA and loan-to-asset ratio. All bank-level variables as measured pre-crisis at 2019 year end. Column 2 repeats the specification but adds borrower fixed effects. In column 3 we unpack the baseline estimate for U.S. vs non-U.S. banks, and the last column examines borrower heterogeneity.

[5]The results are robust to assigning loans originated in January and February to the before-shock period and loans originated in March to the after-shock period.

The results in columns 1-2 show a negative link between ex-ante bank exposure to draw-downs, consistent with our hypotheses that draw-downs create balance sheet pressures, leading to capital erosion and an increase in banks' risk aversion. In column 1 the coefficient estimate on CLE is larger in absolute value than in column 2, suggesting that demand weakened in 2020:Q2, as documented by the July 2020 SLOOS for U.S. banks. This estimate is economically significant, indicating that one percentage point (ppt) increase in CLE ratio induces a 2 ppt decline in the loan growth rate. Translating this estimate to standard deviations, a 5.7 ppt increase in CLE (representing one st. dev.) leads to loan growth rate decline of close to 12 ppts. This negative effect is slightly larger for U.S. banks (column 3).

Table 1: **Results from syndicated loans: Intensive margin**

	(1)	(2)	(3)	(4)
Credit line exposure (CLE)	-3.5721***	-2.0808**		
	(0.995)	(1.006)		
CLE × U.S. bank			-3.8927***	
			(1.061)	
CLE × Non-U.S. bank			-2.7110*	
			(1.387)	
CLE × High Average Excess Return				-1.8698**
				(0.834)
CLE × Low Average Excess Return				-2.2507**
				(0.862)
Bank controls	yes	yes	yes	yes
Borrower (country-industry) fixed effects		yes	yes	yes
Observations	1,949	1,797	1,797	1,797
R-squared	0.020	0.669	0.670	0.669

Dependent variable is the growth rate of average lending volume in the after-shock period (2020:Q2) vs. before-shock period (2019). The sample includes all bank-firm pairs for which firms borrow from at least two banks both before and after the shock. The sample contains 30 GSIBs and 267 borrowers (defined as country-industry clusters, similar to Hale, Kapan and Minoiu (2020) and Acharya, Eisert, Eufinger and Hirsch (2019)). Bank controls include: size (log-assets), Tier 1 capital ratio, ROA, and loan-to-asset ratio (coefficients not shown). Industries are based on 3-digit SIC classification. Standard errors clustered on bank. Sources: Refinitiv's Dealscan, Fitch Connect, S&P, Bloomberg.

In column 4 we test our hypotheses involving borrower heterogeneity by exploiting variation in ex-post likelihood of credit line draw-downs owing to differences in borrowers' expected revenue shortfall. This measure captures firms' vulnerability to the COVID-19 shock, which triggered massive reductions of internally generated funds. We define it using data

on excess equity market returns earned between the peak and the trough of the U.S. equity market during the first phase of the crisis (between February 19 and March 23, 2020). During this period, the S&P 500 index had a peak-to-trough decline of 34% amid a broad-based sell-off in equities as the COVID-19 became a global pandemic, with significant variation across sectors. We use S&P stock market sectoral indices to obtain excess equity returns[6] and calculate the average excess return for each bank's credit line portfolio based on its exposures to each sub-industry. The average excess return is a proxy for the revenue shock likely to be experienced by the firms and their demand for external funds, which ultimately affects the demand for liquidity experienced by banks.[7]

The estimates in column 4 show that borrower heterogeneity was an important determinant of banks' responses to credit line draw-downs: banks with greater exposures in their credit line portfolios to firms in sectors more affected by the COVID-19 outbreak (such as airlines, hotels, and oil & gas) reduced the growth rate of loans *to a given borrower*, thus cutting back the supply of new syndicated loans more than other banks. Coefficient estimates indicate that for a bank with the median value of excess return (–5.4%), one ppt increase in ex-ante CLE-to-asset ratio leads to a decline in loan growth rate of 2.6 ppts. However, this effect more than doubles to 5.5 ppts, for a bank that had large unused credit commitments to highly vulnerable industries, with an average excess return of –8.4% (in the bottom 10th percentile of the distribution).[8]

We subject these results to a number of robustness checks. We show that they are largely

[6]To implement this calculation, we manually match borrower industry codes given by the 4-digit SIC classification in DealScan to the S&P sub-industries.

[7]The median GSIB bank has CLEs with excess return of -5.4%. U.S. banks have an excess return of -5.1% due to sizeable exposures to the energy sector yet generally diversified credit line portfolios; the same figure is -8.2% for Chinese banks, which are heavily exposed to energy, automobiles, and hotels, restaurants & leisure sectors.

[8]The specification in column 4 of Table 1 also addresses a potential concern that bank's CLEs are correlated with their expected losses from overall credit portfolio (future NPLs). If this correlation were positive, then we would incorrectly attribute the tightening of loan supply to credit line exposures rather than future expected credit losses. The specification speaks to this worry because even if higher ex-ante CLEs were correlated with higher expected losses from overall credit portfolio, the interaction of CLEs with the average excess equity return cannot be correlated with such credit losses as equity returns during the panic phase of the COVID crisis were completely unexpected.

invariant to several key methodological choices, including more fine-grained fixed effects for credit demand (at the individual firm level instead of country-industry cluster level), defining CLEs on a shorter-time time window to address the potential worry that they were largely drawn before the pandemic, controlling for bank exposures to the energy sector that was experiencing a decline even before the pandemic, and defining the before-shock period as 2019:Q2 or any other quarters in 2019.

In results not reported, we also examine the link between bank ex-ante CLEs and loan growth in a larger sample of 102 syndicated lenders, comprising a richer diversity of bank business models and balance sheet capacity outside the group of GSIBs. In those regressions, the coefficient estimate on CLEs is negative but imprecisely estimated in the full sample of banks, yet strongly statistically significant in the subsample of GSIBs, suggesting stronger effects for larger banks and echoing the findings of Li, Strahan and Zhang (2020), who document a greater increase in liquidity demand in 2020:Q1 at the largest U.S. banks, which serve larger borrowers and are the main issuers of corporate credit lines.

Next we examine the link between ex-ante CLEs and the extensive margin of loan supply, in particular the probability of renewing due loans and starting new lending relationships. The results are shown in Table 2. In columns 1-2 we examine the probability of loan renewal for bank-firm pairs in a lending relationship involving a loan falling due in 2020:Q2. Column 3 examines the probability of new relationship formation (compared to existing relationships formed through syndicated lending in the previous five years). As in the previous regressions, we control for bank size (log-assets), Tier 1 regulatory capital ratio, ROA, and loan-to-asset ratio. The sample contains 30 GSIBs and the regressions are at the bank-firm level. As seen in columns 1-2 of Table 2, higher bank CLEs are associated with a lower probability of loan renewal in 2020:Q2 for those loans falling due that quarter, especially if the maturing loan is a credit line. One ppt increase in the CLE ratio leads to 0.3% lower renewal probability and 0.17% lower probability of lending to a completely new borrower. Interpreting the estimates in terms of st. dev. moves, an increase in the CLE ratio by one st. dev. (or 5.7 ppts) reduces

the probability of loan renewal by 1.7% (or about 14% of the mean) and that of new lending relationship by close to 1% (or 9% of the mean).

Table 2: **Results from syndicated loans: Extensive margin**

	(1)	(2)	(3)
	Probability of loan renewal	Probability of renewal of credit line with credit line	Probability of new relationship formation
Credit line exposure (CLE)	-0.0016***	-0.0030**	-0.0017***
	(0.000)	(0.001)	(0.001)
Bank controls	yes	yes	yes
Observations	5,989	4,191	20,228
R-squared	0.002	0.005	0.161

Columns 1-2 examine the probability of loan renewal for bank-firm pairs in a lending relationship involving a loan falling due in 2020:Q2. Column 3 examines the probability of new relationship formation (compared to existing relationships formed in the previous 5 years). Bank controls include size (log-assets), Tier 1 capital ratio, ROA, and loan-to-asset ratio (coefficients not shown). The sample contains 30 GSIBs and the regressions are at the bank-firm level. Standard errors clustered on bank. Sources: Refinitiv's Dealscan, Fitch Connect, S&P, Bloomberg.

Overall, these results suggest that banks with higher ex-ante CLEs reduced the supply of large corporate loans relatively more in the second quarter of 2020. These findings are similar to the seminal work of Ivashina and Scharfstein (2010) who showed that banks more vulnerable to credit line draw-downs during the 2007-2008 financial crisis cut back their lending to a greater extent.

4.2 Results from Senior Loan Officer Opinion Survey on Bank Lending Practices

In this section we turn to U.S. banks, for which detailed information on banks' lending standards to businesses and households is collected by the Federal Reserve Board's Loan Officer Opinion Survey (SLOOS) on a quarterly basis. The SLOOS is a comprehensive and valuable source of information on whether and why banks change their lending standards and the terms of new loans, as well as perceived changes in loan demand. To study the link

between bank ex-ante exposures to credit line draw-downs and the likelihood that banks tightened lending standards and the terms of loans, we assemble bank-level responses to the April and July 2020 surveys, and match the SLOOS respondents with Dealscan to obtain their credit line exposures. We have a sample of 75 domestic respondents to the two surveys, with the smallest bank at about USD 2 billion in assets and comprising all the large banks, covering close to three quarters of outstanding C&I loan volume. Aggregated indexes of lending standards derived from bank-level responses to the SLOOS have strong predictive power for future lending and economic activity (Bassett, Chosak, Driscoll and Zakrajšek, 2014; Berrospide and Edge, 2010)—a testament to the high quality of the data.[9]

To examine changes in lending standards of C&I loans, we create a dummy variable that takes value 1 for those banks that reported a considerable or somewhat tightening in lending standards in response to the question "*Over the past three months, how have your bank's credit standards for approving applications for C&I loans or credit lines other than those to be used to finance M&As to large and middle-market firms and to small firms changed?*." To examine changes in the terms of new C&I loans, we similarly create dummy variables that take value 1 for those banks reporting a considerable or somewhat tightening in the terms of lending, according to the following question: "*For applications for C&I loans and credit lines that your bank is willing to approve, how have the terms of those loans changed over the past 3 months?*." Finally, we control for C&I loan demand at the bank level with a dummy variable for responses indicating a considerable or somewhat weakening of loan demand,in relation to the following question: "*Apart from seasonal variation, how has demand for C&I loans changed over the past 3 months? (Please only consider funds actually disbursed as opposed to requests for new or increased lines of credit.)*."

We link CLEs to the probability of tightening standards on C&I loans during the second

[9]Bassett, Chosak, Driscoll and Zakrajšek (2014) discusses the ways in which the design of the survey incentivize truthful responses and reduce strategic behavior by banks in the hope of influencing regulatory or monetary policies. Respondents to the survey are informed that the individual responses are treated confidentially and are not available to Federal Reserve System staff that directly supervise and regulate commercial banks. To date there is no evidence that these responses systematically relate to capital regulation (see, e.g., Bassett and Covas (2013)).

quarter of 2020 in a set of bank-level regressions estimated as linear probability models. The results are reported in Table 3. Similar to the syndicated loan regressions, we control for bank size (log-assets), Tier 1 capital ratio, ROA, and loan-to-asset ratio, all measured, like the CLEs, at 2019 year end. In columns 1-3 we focus on lending standards vis-a-vis large and middle-market firms, and in columns 4-6 on standards vis-a-vis small firms. For each firm size category, we estimate regressions in the pooled sample of bank responses across the two surveys and then separately for the first and second quarters (that is, April and July survey, respectively). Across most specifications, we find that higher CLEs are associated with greater likelihood of reporting tighter standards on C&I loans, across surveys and to both large and small firms. The only exception is that CLEs are not statistically significantly associated with tighter lending standards to large firms in 2020:Q2 (column 3).

Table 3: **Results from bank-level survey responses: Lending standards**

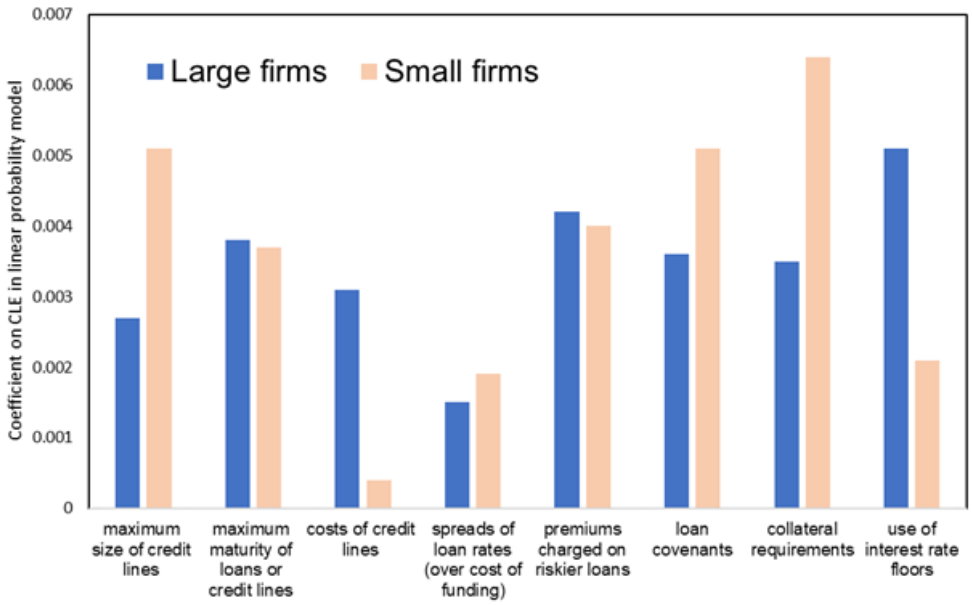
	(1)	(2)	(3)	(4)	(5)	(6)
	To Large Firms			**To Small Firms**		
	Pooled	April	July	Pooled	April	July
Credit line exposure (CLE)	0.0028**	0.0043**	0.0016	0.0054***	0.0057***	0.0052***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Demand control	yes	yes	yes	yes	yes	yes
Bank controls	yes	yes	yes	yes	yes	yes
Observations	94	45	49	89	43	46
R-squared	0.081	0.218	0.077	0.410	0.346	0.528

The dependent variable is a dummy variable taking value 1 if the bank responded "somewhat tightened" or "considerably tightened" in response to the questions about changes in lending standards on C&I loans in the last three months. The sample contains 75 SLOOS respondents matched to Dealscan. These regression results weighted by bank size. Standard errors clustered on bank. Source: April and July 2020 Senior Loan Officer Opinion Survey of the U.S. Federal Reserve Board, Refinitiv's Dealscan, Call Report.

The estimates in Table 3 are economically significant. Looking at the estimates in columns and 1 and 4, where we pool responses across banks, we find that one ppt increase in CLE ratio leads to 0.28% increase in probability of reporting tighter standards in the first two quarters of 2020. Turning to the estimates by firm size, and translating to one st. dev. moves, a 19 ppt increase in CLE (one st. dev.) raises the likelihood of tightening standards on C&I loans to large firms by 5.3% (or 9% of the mean); and to small firms 10% (or 17% of

the mean). In results not reported, we find that these estimates are generally stronger and more robust for larger banks, which are more likely to offer credit lines to large firms.

Figure 3: **CLEs and Tightenig of Terms on C&I Loans**



The chart shows estimated coefficients on CLE in linear probability models (with the same regression specification as in Column 1 of Table 3) linking the probability of reporting tighter terms of lending to ex-ante bank CLEs. Source: April and July 2020 Senior Loan Officer Opinion Survey of the U.S. Federal Reserve Board, Refinitiv's Dealscan, Call Report.

The SLOOS also collects detailed information on banks' decisions regarding the terms of approved C&I loans, including the maximum size of credit lines, maximum maturity, loan spreads, premia charged on riskier loans, covenants, collateral requirements, and the use of interest rate floors. Using the same approach as above, we run linear probability models of that link the likelihood of tightening loan terms to bank CLEs. For brevity we report the coefficient estimates on CLEs in models that are otherwise identical to the specification in column 1 of Table 3. As seen in Figure 3, higher CLEs are associated with greater likelihood of reporting tighter terms of lending. Furthermore, with few exceptions, the impact of CLEs on tightening likelihoood is generally stronger vis-a-vis small borrowers, and notably so in

the case of maximum size of credit lines, covenants and collateral requirements. This result is consistent with recent studies of the credit line channel of macroeconomic shocks by which banks that experience larger drawdowns (from large firms) restrict term lending more—an externality onto smaller firms (Greenwald, Krainer and Paul, 2020).

4.3 Results from Payroll Protection Program

Finally, we study the impact of banks' credit line draw-downs risk on the willingness to extend loans in a government credit support program. For empirical evidence we turn to the Payroll Protection Program (PPP), a large and innovative small business lending program deployed in the early stages of the COVID-19 crisis. The program granted forgivable loans to small businesses with fewer than 500 employees with the aim of keeping workers on payroll during the crisis. A total of USD 521 billion were lent out between April 3 and June 30 2020, the period over which we examine the data.

The PPP is an excellent opportunity to examine the effects of credit line exposures on bank loan supply because loans granted under this program are forgiven if the borrower presents documentation that it complied with the rules of the program. In principle PPP loans are risk free from the perspective of the bank, which receives origination fees in addition to the 1% loan interest rate. However, in reality PPP loans carry some risk. For instance, if the borrower fails to comply with the required documentation for forgiveness, the loan will remain on the lenders' balance sheet. Other reasons why PPP loans are not entirely risk-free include the complexity of the application process for forgiveness and uncertainty about the final rules of the program, the lack of clarity on whether specific loans can be written off (e.g., loans with poor initial self-certification or underwriting errors may not qualify for full loan forgiveness), some fraud risk, and audit risk.[10]

We collected data from the U.S. Small Business Administration (SBA) website on loan-level information for small loans (less than USD 150,000), which account for 86.5% of all

[10]See PPP loans for billions have fraud risk, Oversight Panel Says (Bloomberg, September 17, 2020).

loans and 27.2% of total lending volume. Although data on larger loans (above the USD 150,000 threshold) are also publicly available, we focus on small loans because we observe the individual loan amount. Given the lack of identifiers for PPP lenders other than their name—itself not consistently recorded—we match close to 5,000 PPP lenders with identifiers in Dealscan manually and carefully cross-check each matched bank with the FDIC BankFind database for insured depository institutions; in ambiguous cases we use information on the geography of the bank's PPP lending to make an accurate matching decision. We obtain a match for nearly 400 banks that account for USD 343 billion of total PPP lending volume. The final sample comprises a large and diverse array of banks ranging from small community banks (with less than USD 1 billion in assets) to large systemically-important banks. For the regression analysis we aggregate the loan-level data at the bank-borrower state-industry-week level, where industries are given by 3-digit NAICS classification. This approach is needed to average out recording errors that are apparent in the loan-level data and have been widely flagged in the financial media.[11]

We estimate several specifications in our fine-grained PPP lending data using as dependent variable the loan amount (log). The sample comprises 384 banks lending to small firms in all states and territories across 107 NAICS-3 industries. This degree of granularity enables us to carefully control for loan demand with a wide range of interacted fixed effects, including borrower state×week fixed effects, borrower industry×week fixed effects, and even triple interacted borrower state×industry×week fixed effects. This last set of demanding fixed effects allow unobserved loan demand to vary across locations and industries every week during the deployment of the program. Similar to previous regressions, we include the following bank-level controls, all measured in 2019:Q4: bank size (log-assets), Tier 1 capital ratio, loan-to-asset ratio. Additionally, we control for loan loss provisions and net interest margins to make sure the results are not driven by bank provisioning practices or

[11] See PPP data errors raise questions about effectiveness of stimulus in the Los Angeles Times (July 13, 2020) and Small business coronavirus relief loan database contains some big errors, firms say at CNBC (July 6, 2020).

past profitability. Standard errors are double clustered on bank-week.

Table 4: **Results from the Payroll Protection Program: Intensive margin**

	(1)	(2)	(3)
Credit line exposure (CLE)	-0.0026***	-0.0026***	-0.0028***
	(0.001)	(0.001)	(0.001)
Bank controls	yes	yes	yes
Bank entity type dummies	yes	yes	yes
Borrower state	yes	yes	yes
Borrower industry	yes	yes	yes
Borrower state×week		yes	yes
Borrower industry×week		yes	yes
Borrower state×industry×week			yes
Observations	255,286	255,260	245,123
R-squared	0.297	0.320	0.374

Data is at the bank-state-industry-week level, for 384 banks lending to firms in all states and territories, and in 107 industries (NAICS-3). Dependent variable: Log(loan amount). Bank controls include size (log-assets), Tier 1 capital ratio, loan-to-asset ratio, loan loss provisions, and net interest margins (coefficients not shown). Standard errors are double clustered on bank and week. Source: U.S. Small Business Administration's PPP loan data, Refinitiv's Dealscan, Fitch Connect.

The results reported in Table 4 show that higher ex-ante CLEs are systematically associated with smaller PPP loan volumes across all specifications. The estimated coefficients for CLEs are remarkably stable across demand controls, echoing the finding by Granja, Makridis, Yannelis and Zwick (2020) that the significant heterogeneity across banks in terms of PPP loan granting seems unrelated to differences in underlying loan demand. The coefficient estimate in column 3 indicates that one ppt increase in the CLE ratio leads to 0.14% lower PPP lending volumes; therefore, a 35 ppt (one st. dev.) increase in CLE reduces PPP loan volumes by close to 5%. Given that the average loan volume at bank-state-industry-week level is USD 262,000, this implies a reduction of USD 13,000.[12] Overall, these results speak to the powerful negative effect of bank exposures to credit line draw-down risk even in the context of a government credit program with very low risk of lending.

[12]In specifications not shown, these results are robust to additionally controlling for loan demand with borrower-level employment (proxied by the self-reported number of jobs retained). We chose not to employ this variable in the baseline specifications because it has been widely flagged as mismeasured and prone to misreporting, taking value 0 for a significant number of loans although PPP loans are premised on safeguarding at least 75% of payroll.

5 Mechanisms

6 Discussion and Conclusions

In this paper we explore the tension that may arise between banking system's fulfillment of its fundamental function of liquidity insurance and that of credit provision during a crisis. We exploit the sudden and large corporate credit line draw-downs that occurred in the early phase of the COVID-19 pandemic as a shock to bank balance sheets and willingness to take risk to empirically examine this tension. We start by constructing a measure of ex-ante exposure to the risk of draw-downs and examine its impact on banks' lending decisions. For empirical tests, we assemble data from three key sources: Refinitiv's Dealscan for syndicated lending during 2019-2020, the April and July 2020 SLOOS surveys for banks' responses to questions about changes in lending standards on commercial loans, and the Payroll Protection Program (PPP) loan-level data on bank participation in government credit programs.

Our results document a close link between the size of banks' corporate credit line portfolios and their willingness to supply new credit during the crisis. We show that banks with larger ex-ante credit line exposures tightened lending standards (vis-a-vis both large and small firms) and the terms of new C&I loans (especially vis-a-vis small firms). They also curtailed the supply of large syndicated loans in 2020:Q2. Banks with greater ex-ante exposures to firms in sectors more affected by the pandemic exhibited even slower loan growth than other banks with similar total exposures. Furthermore, among the PPP lenders, banks with higher credit line exposures deployed fewer PPP loans to borrowers, despite the low risk of lending through this program.

Our findings suggest that tension may arise between banks' providing liquidity insurance to firms while continuing their credit intermediation function during crises, with important implications for monetary policy and financial stability policies. The buildup of off-balance sheet credit exposures in the banking system deserves close monitoring by regulatory authorities and stress testing experts. In light of the substantial credit line utilization rates in

March 2020, especially in sectors severely hit by the pandemic, the "stressed" draw-down assumptions used in the Basel 3 liquidity coverage ratio (LCR) calculation—which assumes a 10% draw-down of the undrawn portion of existing credit lines—might need to be tightened.

Furthermore, market participants and policymakers alike have issued warnings about the potential financial stability risks associated with the build-up of excessive corporate leverage against the backdrop of a long period of extremely low interest rates across advanced economies (Alfaro, Asis, Chari and Panizza, 2019). Former chair of the Federal Reserve, Janet Yellen, expressed worries "for many years about this build-up in corporate debt" and leading U.S. public agencies warned that excessive corporate leverage could amplify a downturn leading up to the current crisis.[13] The IMF's October 2019 Global Financial Stability Report argued that the "challenge facing policymakers is addressing corporate vulnerabilities before the next downturn." However, since the global financial crisis, the regulatory agenda has focused mostly on reducing leverage of the banking system and limiting household indebtedness. The results of this paper support those warnings and suggest that more attention needs to be paid to the rise of corporate leverage and the importance of corporate balance sheet flexibility during times of stress.

[13]See Crisis exposes flaws in US financial stability regime (Central Banking, May 28, 2020).

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