# Borrower Correlated Liquidity Demands and the Use of Minimum Liquidity Covenants in Loan Contracts

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## Abstract

Banks serve as important liquidity providers to the corporate sector. However, a bank's ability to provide liquidity is limited if many of its borrowers demand liquidity at the same time (i.e., correlated liquidity demands). We predict and find that a bank is more likely to include covenants that require a borrower to hold minimum liquidity (minimum liquidity covenants) in loan contracts when the borrower has higher correlated liquidity demands with the bank's loan portfolio. We further find that the effect of borrower-lender portfolio liquidity demand correlation on the use of minimum liquidity covenants is stronger when banks are more affected by the Liquidity Coverage Ratio regulations and when borrowers experience negative liquidity shocks in the COVID-19 pandemic. Lastly, we find that borrowers have lower liquidity risks after obtaining loans with minimum liquidity covenants, and that banks are better able to provide liquidity during COVID-19 when they use such covenants more extensively. Overall, our findings suggest that banks actively monitor their borrowers' liquidity to ensure their role as liquidity providers.

**Keywords**: Correlated Liquidity Demands; Minimum Liquidity Covenants; Lender Liquidity Monitoring; Liquidity Coverage Ratio Regulation

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## 1. Introduction

A primary role of banks is to provide liquidity to the corporate sector (Holmström and Tirole 1998; Kashyap et al. 2002). However, a bank may experience a liquidity crunch when many of its borrowers demand liquidity at the same time, particularly when the bank is in a liquidity shortage already (Holmström and Tirole 1998; Acharya et al. 2013).[1] Liquidity crunches in the banking sector driven by a shortage of wholesale money supply and sudden commitment drawdowns by borrowers, such as the 2008-2009 financial crisis, can result in profound and negative effects on the whole economy (Tirole 2011). After the financial crisis, banking regulators proposed and implemented the Liquidity Coverage Ratio (LCR) Regulations, aiming to promote proactive bank liquidity management and avoid similar liquidity shortage. Despite the importance of banks' role as liquidity providers, there is little evidence of whether and how banks manage their borrowers' correlated liquidity demands to mitigate future liquidity crunches. In this paper, we examine whether banks' monitoring of borrowers' liquidity depends on borrower correlated demands for liquidity.

To monitor borrowers' liquidity, banks can include covenants in loan contracts to ensure that borrowers have liquidity above a required threshold (minimum liquidity covenants hereafter).[2] Liquidity in the context of corporate liquidity management generally refers to the sum of on-balance sheet cash and undrawn credit lines (Almeida et al. 2014). While the use of

[1] While banks can diversify idiosyncratic borrower liquidity shocks, they are subject to potential correlated liquidity demands from borrowers. Such correlated borrower liquidity demands may arise when borrowers are exposed to the same economic shocks due to their economic links, such as belonging to the same industry or supply chain, locating in the same region, or sharing similar technologies (Foster 1981; Dellavigna and Pollet 2007; Cohen and Frazzini 2008; Acemoglu et al. 2012; Bloom et al. 2013; Feyrer et al. 2017). Moreover, recent studies show that banks tend to have loan portfolios concentrated in certain industries and regions, consistent with bank specialization (Dell'Ariccia et al. 1999; Winton 1999; Berger et al. 2017; Blickle et al. 2021; Duquerroy et al. 2022; Paravisini et al. 2022).

[2] Minimum liquidity covenants may be imposed either on a maintenance basis (i.e., required to be maintained periodically), or on an incurrence basis (i.e., triggered upon certain events, such as major investments and financing activities, dividend payments, etc.). See Appendix A for examples of minimum liquidity covenants.

minimum liquidity covenants as a liquidity monitoring mechanism is intuitive, the empirical evidence on this covenant is scarce perhaps due to it gaining popularity only after the financial crisis.[3] We find that such covenants were included in merely 4.4% of loans in 2006, and increased to 15.7% of loans in 2010 and 19.7% in 2020. We extract data on minimum liquidity covenants from loan contracts downloaded from firm SEC filings including 10K, 10Q, and 8Q. Compliance with such covenants is often tested more frequently, either anytime, daily, weekly, or monthly, than the quarterly testing of typical financial covenants.

We contend that a bank has a stronger incentive to monitor a borrower's liquidity when the borrower tends to request the bank to provide liquidity at the same time as the bank's other borrowers (i.e., higher correlated liquidity demands with the bank's lending portfolio). Speicifically, when facing liquidity shortage, a borrower may turn to its bank for liquidity by drawing down existing credit lines and requesting loan term concessions such as deferred payments. To the extent that such liquidity shortage is temporary and the borrower has good long-term fundamentals, the bank is likely to help this borrower survive the liquidity shortage (Brown et al. 2020). However, if the borrower demands liquidity at the same time when many other borrowers also need liquidity from the bank, such correlated liquidity demands put significant liquidity strains on the bank (Holmström and Tirole 1998). Therefore, the bank may not be able to provide liquidity in such a situation (Ivashina and Scharfstein 2010; Cornett et al. 2011; Acharya and Mora 2015), leading to heightened default risks of this borrowers. We thus expect that, to ensure that the borrower has a liquidity buffer to survive future liquidity shocks and avoid clustered borrower requests for commitment drawdowns, the bank may include a minimum liquidity covenant in loan contracts for borrowers with correlated liquidity demands with the bank's other borrowers.

[3] Another possibility is that the liquidity covenant is not covered in the DealScan database.

To capture correlated liquidity demands between the borrower and the bank's lending portfolio, adapting from Acharya et al. (2013), we use the stock returns co-movement between a borrower and other borrowers in its bank's lending portfolio just before the loan start date for this borrower. Stock returns may reflect the occurrence of economic shocks that could lead to changes in expected cash flows and potential liquidity needs (Acharya et al. 2013). Stock returns have a high frequency, which balances the conflicting demand for relevance (recent data) and high statistical power (a sufficient number of observations) in calculating demand correlations. Specifically, we use the regression coefficient by regressing the excess daily stock return of the focal borrower on the weighted average excess daily stock return (weighted by loan facility amount) of all borrowers in the lead lenders' lending portfolio. Higher return co-movement suggests that the borrower is more likely to experience economic shocks and need liquidity at the same time as other borrowers in the lender's portfolios.

We also construct several alternative measures to capture correlated liquidity demands. First, to mitigate the concern that stock returns may be affected by noise trading (Morck et al. 2000; Morck et al. 2013), we use operating cash flows to capture the occurrence of economic shocks and calculate the co-movement of quarterly operating cash flows between the borrower and the lead lender in the past five years as our liquidity demand correlation measure. Second, considering that we only observe stock return data for public borrowers but not the entire lending portfolio, we use the stock return co-movement between a borrower and its bank to capture correlated liquidity demands. The assumption is that bank returns likely capture the aggregate liquidity demands from its portfolio.

Consistent with our prediction, we find that loan contracts are more likely to use minimum liquidity covenants when borrowers have higher correlated liquidity demands with other borrowers in the lenders' portfolios. A one standard deviation increase in borrower-lending portfolio return co-movement is associated with 1.89 percentage points more use of

liquidity covenants. This is economically significant given the average of 7.3% of loans containing minimum liquidity covenants in the whole sample period. We find similar results using alternative measures of correlated liquidity demands. The results also hold when we control for borrower fixed effects, industry-year-quarter fixed effects, or lead lender-year-quarter fixed effects, suggesting that time-invariant borrower characteristics, or time-varying industry or lender characteristics are unlikely to explain our results.

To alleviate the concern that our borrower-lender portfolio liquidity demand correlation measure (stock return co-movement) simply captures borrowers' correlated liquidity demands with the market, we run a horseracing analysis that adds stock return correlations measured at the borrower-market level. We find that only the borrower-lender portfolio pair-level correlation loads, but not the market beta. This result shows the unique importance of individual borrower-lender portfolio liquidity demand correlation in inducing lenders' monitoring of borrowers' liquidity position.

A potential limitation of our measures of correlated liquidity demands is that these measures cannot distinguish between lenders' concerns about their own liquidity risk (or ability to provide liquidity to borrowers), and borrowers' long-term fundamental deteriorations (credit risk). To address this concern, we conduct several cross-sectional analyses to identify the effects of banks' concerns over *liquidity* on their use of minimum liquidity covenants. First, we exploit the change in banks' liquidity management incentives associated with the passage of LCR regulations. We expect that banks affected by LCR regulations to a greater extent are more incentivized to enhance their liquidity management practices. We focus on Standard LCR banks as the treated group and use other banks as the control group, and restrict our analyses to a narrow window of approximately three years before and after the LCR proposal date of

December 16, 2010, to have a clean sample pre and post the LCR regulation.[4] We find that Standard LCR banks with a higher reduction in exposure to undrawn commercial and industrial (C&I) loan commitment or a higher reduction in C&I on-balance-sheet loans are more likely to use minimum liquidity covenants after the proposal of LCR regulations. These results support our prediction that banks with stronger *liquidity* management incentives in C&I loans are more likely to monitor borrowers that may need liquidity at the same time as the lending portfolio.

Second, we test whether lenders are more likely to use minimum liquidity covenants to mitigate concerns over correlated liquidity demands when borrowers experience negative liquidity shocks. We expect that an increase in borrowers' liquidity demand driven by economy-wide liquidity shocks increases the saliency of liquidity risks for banks, incentivizing stronger lender monitoring. We exploit the COVID-19 pandemic as a setting that creates identifiable exogenous liquidity shocks in the economy (Acharya and Steffen 2020; Bosshardt and Kakhbod 2021; Li et al. 2020).[5] We define March 13, 2020 to December 31, 2020 as the COVID period, and define January 2014 to March 12, 2020 as well as January 2021 to the end of our sample period (June 2021) as the non-COVID period to mitigate the confounding effects from the financial crisis and the passage of LCR regulations examined above. We find that the effect of borrower-lender portfolio liquidity demand correlation is stronger for borrowers affected by COVID to a larger extent, measured as a stronger negative sentiment in conference calls (Hassan et al. 2023). This finding supports the prediction that lenders have a greater concern for liquidity demand by borrowers amid economy-wide liquidity shocks.

[4] We use the proposal date as the event date because prior research finds that banks reacted to the regulations by managing their liquidity holding at the proposal date (Yankov 2020). For the same reason, we do not conduct our analysis around the implementation date to avoid the anticipatory effect biasing our findings.
[5] See https://www.newyorkfed.org/newsevents/speeches/2021/log210811

We further document the consequences of imposing minimum liquidity covenants in loan contracts. We find that borrowers with minimum liquidity covenants have higher average returns during the 5% worst-performing days (in stock returns) after loan initiations. We find robust results using a Coarsen Exact Matched sample that controls for the differences between borrowers with and without such covenants (Iacus et al. 2012; Christensen et al. 2017). These findings suggest that borrowers reduce their liquidity risks due to lender liquidity monitoring, which in turn lowers their demand for bank liquidity and reduces their default probability should an actual liquidity shock occur. In addition, we find that lenders with more use of liquidity covenants before COVID are more willing to provide liquidity in the COVID period, consistent with the idea that such covenants help lenders avoid clustered liquidity demands and better serve as liquidity providers.

Lastly, we conduct several additional analyses to understand the unique role of minimum liquidity covenants compared with other financial covenants. Prior research often uses liquidity ratio covenants or cash flow (EBITDA) covenants to capture lender monitoring of borrower liquidity (Demiroglu and James 2010; Acharya et al. 2012; Ma et al. 2022; Isidro and Raonic 2023). However, these covenants have different focuses compared to minimum liquidity covenants. In addition, we observe a general decline in the use of both types over time, as opposed to an increasing trend of minimum liquidity covenants. Particularly, covenants on liquidity ratios focus on working capital, which includes current assets other than cash, such as accounts receivable and inventories that are not as liquid as cash and may require fire sales in economic downturns. Similarly, high EBITDA does not guarantee the absence of liquidity shortages. Moreover, neither liquidity ratio nor cash flow covenants consider credit lines. Nevertheless, we directly test whether these alternative covenants help address borrowers' liquidity problems. We find that neither liquidity ratio nor cash flow covenants reduce borrower liquidity risks after loan start dates. These results lend further support to our argument that

minimum liquidity covenants serve as a major mechanism for lenders to monitor borrower liquidity risks.

Our study makes two contributions. First, we contribute to the literature on bank liquidity management. Despite the theoretical insights that clustered borrower liquidity demands impose significant liquidity risks for banks, there is little empirical evidence on how banks proactively mitigate such risks (Holmström and Tirole 1998).[6] An exception is Acharya et al. (2013), who find that lenders are less willing to lend credit lines to borrowers with higher market beta. While their results suggest that lenders screen borrowers ex-ante to reduce potential liquidity constraints, we speak to whether lenders engage in ex-post liquidity monitoring to reduce borrowers' liquidity risks. Our Liquidity Coverage Ratio regulation analysis and results of consequences of using minimum liquidity covenants suggest that such covenants can be one effective liquidity management tool. We also extend their study by documenting the importance of correlated liquidity demands between the borrower and the lending portfolio as compared to that between the borrower and the market in affecting lenders' liquidity monitoring. Our study provides a distinct approach to examining how borrower-lender pair characteristics affect debt contracting.

Second, this paper adds to the literature on corporate liquidity management by studying the effect of lender monitoring. Most prior research on corporate liquidity management examines the effects of taxes and firms' own characteristics such as growth opportunities and corporate governance (Opler et al. 1999; Yun 2009; Lins et al. 2010; Almeida et al. 2014; Pinkowitz et al. 2016). Studies that examine the role of lenders document that lenders can provide liquidity to the corporate sector through credit lines but overlook the active role lenders play in influencing corporate liquidity management (Sufi 2009; Acharya et al. 2012; Brown et

[6] Recent studies find that banks cut lending and sell loans to maintain their liquidity during crises (Ivashina and Scharfstein 2010; Cornett et al. 2011; Irani and Meisenzahl 2017).

al. 2020). Using a novel dataset on minimum liquidity covenants, our paper suggests that lenders actively monitor borrowers' liquidity positions.

## 2. Literature Review and Hypothesis Development

### *2.1. Borrowers' Liquidity Management*

Liquidity risk captures the risk of having a liquidity crunch, that is, a short-term mismatch between *net* cash outflows and available liquid assets (Tirole 2011).[7] Considering that cash is the most liquid asset without discounting, earlier research on corporate liquidity focuses on cash. In a world without financing frictions, firms can raise cash immediately through external financing to cover surging short-term net cash outflows. In practice, however, firms facing financial frictions hold precautionary cash (Holmström and Tirole 1998; Almeida et al. 2004). While cash on balance sheet is a source of liquidity, it is costly because of the opportunity costs. Recent theoretical and empirical works suggest that credit lines serve as an alternative source of liquidity by allowing firms to draw down cash on short notice (Holmström and Tirole 1998; Almeida et al. 2004; Sufi 2009; Yun 2009; Lins et al. 2010; Brown et al. 2020). The notion of corporate liquidity thus has evolved to capture on-balance cash and cash equivalents and undrawn credit lines.

Several papers study firms' choice between cash holdings and credit lines.[8] Sufi (2009) finds that the lenders' willingness to lend credit lines depends on borrowers' level of cash flows. Therefore, firms with low existing or expected cash flows hold more cash instead of relying on credit lines. Yun (2009) shows that firms with weaker corporate governance are more likely to hold cash as liquidity management tools because credit lines are subject to bank monitoring

[7] Liquidity risk and credit risk are distinct but closely related. Borrowers with a positive long-term prospect may suffer from a short-term liquidity crunch and a short-term liquidity crunch may lead to long-term performance deterioration. Similarly, banks with low credit risks may experience a liquidity crunch. On the other hand, liquidity risks and credit risks may jointly result in defaults (He and Xiong 2012; Imbierowicz and Rauch 2014).

[8] A stream of literature focuses on corporate cash holdings and study the effects of firm characteristics and repatriation taxes. Opler et al. (1999) find that firms with more growth opportunities and riskier cash flows hold more cash. Several studies examine credit lines as a liquidity management device. Foley et al. (2007) show that repatriation taxes are an important factor explaining why U.S. multinational firms hold more cash. However, Pinkowitz et al. (2016) find U.S. multinational firms hold more cash because of their intensitve R&D activities.

and scrutiny. Based on surveys with CFOs, Lins et al. (2010) conclude that firms hold cash as insurance against negative cash flow shocks but use credit lines to seize future profitable opportunities.

*2.2 Banks' Liquidity Management*

After the great financial crisis, it became clear that banks themselves may also experience liquidity shortages and cannot meet corporate liquidity demands (Acharya and Mora 2015). This led to Dodd Frank Act to request banking regulators to implement liquidity requirements.[9] In December 2010, BASEL III introduced the Liquidity Coverage Ratio (LCR) rule that required banks with assets of $50 billion or over to hold enough high-quality liquid assets that can cover 30 days of expected cash outflows under stress scenarios.[10] The U.S. banking regulators proposed a similar rule in 2013 that was finalized in 2014. Yankov (2020) shows that Standard LCR banks experienced significant growth in its regulatory high-quality liquid assets (HQLA) after Basel III LCR proposal in December 2010. Roberts et al. (2019) find that LCR regulations reduce banks' liquidity gaps and fire-sale risks. Similarly, Stulz et al. (2022) show that banks hold more liquid assets after LCR regulations.

The financial crisis and the liquidity requirements also motivate research on bank liquidity management practices. Recent studies find significant variations in liquidity management across banks. Some banks reduce the balance of illiquid assets by cutting loans or selling loans. For example, Ivashina and Scharfstein (2010) show that banks exposed to

[9] In addition to the LCR requirement, Net Stable Funding Ratio (NSFR) requires banks to have the available amount of stable funding to exceed the required amount over a one-year horizon. Banks are required to publicly disclose their NSFR levels semi-annually beginning in 2023.

[10] Despite the importance of bank liquidity, there is no consensus on the measurement of bank liquidity risks. Existing studies measure bank liquidity risks under the framework of liquidity mismatch. A simple measure of aggregate liquidity mismatch is the difference between total liquid liabilities and total liquid assets, which does not consider the differences in liquidity among various assets and liabilities. Other papers focus on lending as a bank's main cash needs and deposits as its main funding source. For example, DeYoung and Jang (2016) suggest that liquidity mismatch can be proxied by the loan-to-deposit shortfall. Additionally, recent research assigns different liquidity weights to assets and liabilities. Based on the nature of assets and liabilities, Berger and Bouwman (2009) classify banks' balance sheet accounts into three categories liquid, semiliquid, and illiquid. Bai et al. (2018) create a more sophisticated weighting method based on a dynamic time-series model with data from the repo market and overnight wholesale trading.

unused credit lines have lower lending growth during the financial crisis. Similarly, Cornett et al. (2011) find that banks with less stable funding sources including wholesale and other short-term borrowing are less willing to lend during a crisis. Similarly, Irani and Meisenzahl (2017) find that banks sell loans to maintain liquidity during the great financial crisis. Other banks maintain liquidity during a crisis by attracting more deposits or obtaining government bailouts. For instance, Acharya and Mora (2015) show that banks increase deposit rates to attract deposits when they are exposed to credit line drawdowns during the financial crisis.

Despite the growing literature on how banks address liquidity crises, there is very little understanding of whether and how banks *pro-actively* manage liquidity risk to prevent future liquidity shocks. An exception is Acharya et al. (2013), who find that banks are less likely to grant credit lines to borrowers with higher correlated liquidity demands with the market, measured as the market return beta. The rationale is that banks manage their credit line granting decisions based on anticipated correlated draw-down behaviors from borrowers (Holmström and Tirole 1998).

In particular, aggregate borrower liquidity demands may significantly increase banks' net liquidity outflows and result in a bank liquidity crunch. First, undrawn credit lines are a major source of liquidity risks for banks (Meisenzahl 2015). When borrowers draw down credit lines, banks convert the off-balance sheet unused commitments into loans on their balance sheets and experience a liquidity outflow. Further, borrowers in liquidity crunches may request loan term concessions such as deferred payments, which reduces banks' cash inflows and result in higher liquidity risks. Consistent with banks managing their borrowers' liquidity demands, Acharya et al. (2013) find that borrowers with higher correlated liquidity demands with the market, measured as the market return beta, are less likely to acquire credit lines. This finding suggests that banks manage their credit line granting decisions based on anticipated drawn-down behaviors from borrowers (Holmström and Tirole 1998).

*2.3 Lender Liquidity Monitoring with Minimum Liquidity Covenants*

We argue that banks can manage their own liquidity risks affected by borrowers' liquidity demands by actively monitoring borrowers' liquidity. Specifically, we explore banks' use of minimum liquidity covenants in loan contracts that require borrowers' cash holdings and credit line availability to be above a threshold. These covenants help lenders ensure that borrowers have a minimum level of liquidity to weather potential liquidity shocks. In negative shocks, minimum liquidity is the first-order contracting metric to capture borrowers' ability to address liquidity shocks.[11] In addition, minimum liquidity removes the working capital components that are likely to be discounted when borrowers fire sell these assets in economic downturns.[12] Consistent with the "cash remains the king" observation, Acharya et al. (2012) find that cash has a stronger effect on bond spreads than other current assets. Further, minimum liquidity covenants involve minimal accounting discretion, unlike both working capital liquidity covenants and EBITDA covenants that rely on accrual numbers subject to manipulation, particularly in negative shocks. Finally, minimum liquidity covenants are often tested at a higher frequency, such as weekly and monthly, than the quarterly frequency for typical financial covenants. Therefore, minimum liquidity covenants help lenders ensure that borrowers have minimum liquidity in hand and have lower future liquidity demand for their banks in negative shocks.

We contend that lenders are more likely to include minimum liquidity covenants in loan contracts when they have stronger liquidity monitoring incentives. Specifically, we expect that this covenant is more likely to be used when borrowers have higher correlated liquidity demands with the lenders' lending portfolios. When a borrower demands liquidity when other

[11] In a normal period, EBITDA-based performance ratios convey information on borrowers' ability to generate long-term persistent cash flows which can help ensure future repayments. However, when borrowers face a negative shock, their EBITDA is likely severely and negatively impacted. Importantly, when borrowers' default risk is elevated, lenders' primary concern becomes cash availability to survive, regardless of EBITDA.

[12] For example, in the COVID-19 pandemic, borrowers may have difficulty in selling their inventory or collecting accounts receivable when their customers are also hit by the pandemic.

borrowers in the lenders' lending portfolio also demands liquidity, it poses a more significant liquidity strain on the lender. To build in a buffer to such potential liquidity strain, the lender may impose a minimum liquidity covenant requiring the borrower to have a minimum liquidity balance. However, the imposition of such minimum liquidity covenants is not without tension. Banks may develop expertise from repeated lending to correlated borrowers, which lowers the risk of adverse selection and moral hazard in lending to similar borrowers (Dell'Ariccia et al. 1999; Winton 1999; Berger et al. 2017; Blickle et al. 2021). Therefore, banks may perform less monitoring for correlated borrowers. We state our main hypothesis in the alternative form:

*Hypothesis: Loan contracts are more likely to include minimum liquidity covenants when borrowers have higher correlated liquidity demands with lenders' loan portfolios.*

2.3.1 Other Covenants Related to Liquidity

Existing studies often use other covenants to proxy for bank liquidity monitoring. Some papers focus on liquidity *ratio* covenants that require borrowers to have minimum levels of liquidity ratios such as current or quick ratios. There are two issues with using liquidity ratio covenants. First, the low frequency of liquidity ratio covenants in loan contracts can lead to an underestimation of banks' liquidity monitoring (Demiroglu and James 2010; Acharya et al. 2012). For example, Acharya et al. (2012) conclude that covenants restricting liquidity are unlikely to affect borrower liquidity by noting only 1.6% of their sample have liquidity *ratio* covenants. However, they completely overlook the covenants on cash and undrawn credit lines (minimum liquidity covenants). Second, liquidity ratios do not perfectly capture borrowers' liquidity as discussed earlier. Other studies use cash flow covenants as liquidity covenants (Ma et al. 2022; Isidro and Raonic 2023). While cash flows are a source of long-term corporate liquidity, cash flows do not reflect a firm's liquidity position and cannot distinguish between banks' monitoring of borrower long-term solvency and their monitoring of borrower liquidity position to address short-term liquidity shocks.

## 3. Sample Construction, Measurement, and Research Design

### *3.1 Sample Construction*

Our base sample is comprised of 21,933 unique loan facilities at the intersection of EDGAR loan contract filings and DealScan from 2002 to the second quarter of 2021. We remove facility amendments from our sample. We also remove borrowers in the financial services industry or loan facilities that are second lien. Because several loan facilities may belong to one single loan deal, and the use of minimum liquidity covenant is the same among different facilities within the same loan deal for almost all of the deals, we retain only the largest facility for each deal. Finally, after deleting observations with missing variables for our main analyses, we end up with 6,042 loan facilities. The above sample construction is detailed in Table 1. The final sample sizes for different tests differ due to further requirements on non-missing test variables and/or control variables. We winsorize all continuous variables at the 1% and 99% levels.

### *3.2 Extraction of Minimum Liquidity Covenants*

The information on minimum liquidity covenant is not readily available from commercial databases. Therefore, we extract such information directly from loan agreements filed by companies on EDGAR for loans in our sample with the following steps. First, we search whether a loan contract includes the word "liquidity." Second, within the sample that includes "liquidity," we search for the existence of a liquidity covenant within the covenant section. Specifically, we use keyword patterns for liquidity covenants developed from our manual read of a random sample of loan contracts. The list of keywords can be found in Appendix B.

### *3.3 Measurement for Borrower-Lender Portfolio Correlated Liquidity Demands*

Liquidity crunch in our setting represents the situation when an entity is not able to meet its liquidity needs in a timely manner. When hit by negative economic shocks, firms may

expect surging net cash outflows and thus have higher liquidity needs. Therefore, following Acharya et al. (2013), we use stock returns to capture the occurrence of economic shocks that result in changes in expected cash flows and liquidity needs. Empirically, stock returns have high data frequency, which increases statistical power in co-movement calculations.

We use the co-movement of stock returns between the focal borrower and all borrowers in the lead lenders' lending portfolio as of the date of the borrower's loan start date to capture whether the borrower and other borrowers in the lending portfolios tend to experience economic shocks and need liquidity at the same time (correlated liquidity demands). Specifically, our main measure *Beta LenderPortfolio* is captured by the coefficient when regressing the excess daily stock return of the focal borrower on the weighted average excess daily stock return (weighted by loan facility amount) of all borrowers in the lead lenders' lending portfolio, where the regression is performed over the one year before loan start date. When there are multiple lead lenders, we take the simple average of these coefficients. Excess stock return is defined as stock return over the Fama-French risk-free rate. *Beta LenderPortfolio* is in effect an adaptation of the traditional "systematic risk" beta measure for a borrower from the borrower-market pair level to the borrower-lender portfolio pair level.

We construct several additional measures to complement our main measure. First, to mitigate the concern that stock returns may be affected by factors other than changes in expected cash flows, such as changes in discount rates or noise trading, we construct a measure of cash flow co-movement *Beta OCF LenderPortfolio*. To calculate *Beta OCF LenderPortfolio*, we obtain the regression coefficients when regressing the borrower's quarterly operating cash flows on the lendering portfolio's average quarterly operating cash flows in the five years before loan start date. We then calculate the simple average of these coefficients on lead lenders' cash flows for all borrower-lead lender pairs. A five-year window balances between statistical power in regressions and the relevance of the data. Second, a potential limitation of our main

measure is that we only have stock data for publicly listed borrowers but not the entire lending portfolio. [13] To address this issue, we construct a measure of stock return comovement between a borrower and its lead lender (*Beta Leadlender*). While a bank's returns may be affected by other factors, they partially capture the liquidity demands from the entire lending portfolio.

*3.4 Research Design*

To test the effect of borrower-lending portfolio correlated liquidity demand on the use of minimum liquidity covenants, we estimate the following OLS model.

$$LiqCov = \beta_0 + \beta_1 \, Beta \; LenderPortfolio + Control \; Variables + Fixed \; Effects + \varepsilon \quad (1)$$

*LiqCov* is an indicator variable that equals one if the loan contract imposes a covenant on minimum liquidity, and zero otherwise. *Beta LenderPortfolio* is the co-movement in stock returns between the borrower and the lender's portfolio as discussed in Section 3.3. Control variables include basic borrower characteristics such as firm size, leverage, tangibility, market-to-book ratio, profitability, and a loss indicator. We further add the borrower's Altman Z-score (1968) and operating cash flow volatility to control for borrower credit risk and stand-alone liquidity risk.

In addition to borrower characteristics, we also control for loan deal/facility characteristics. We control for the size of the loan deal where the facility belongs to, and control for the maturity and security status for this particular facility, which is the largest first-lien facility in the deal. Moreover, based on the arguments in Acharya et al. (2013), the effects we examine can be heavily influenced by whether the loan deal includes a revolving credit line. Therefore, we control for an indicator for the existence of a revolver in the loan deal-date. Finally, we add various lender characteristics including lender total assets, Tier1 ratio, non-

[13] DealScan includes both private and public borrowers of syndicated loans. Public borrowers account for 48% of total loan amount of the U.S. syndicated loans.

performing loans, the gap between lender liquid liabilities and liquid assets, and lender total loan commitment (excluding credit card commitments). We further include calendar year-quarter of the loan facility start date, SIC two-digit industry, loan purpose, and lead lender fixed effects.[14] We cluster standard errors at the industry level.

## 4. Main Results

### *4.1 Descriptive Statistics*

Table 2 provides the descriptive statistics for the base sample used for the main tests. Panel A presents univariate statistics. The sample mean for *Beta LenderPortfolio* is 0.946. On average, the minimum liquidity covenant is present in 7.3% of loan facilities. Figure 1A shows that there is a significant growth in the use of such covenants during the sample period (based on the full sample of 21,933 facilities).[15] Less than 5.0% of the loan facilities used minimum liquidity covenants in every single year in and before 2006. However, its usage increased greatly around the end of the financial crisis, reaching 11.8% in 2009 and 15.7% in 2010. This is likely attributable to a heightened awareness for liquidity management at banking institutions due to the 08-09 financial crisis. The use of such covenants remains around 10% ever since the financial crisis and increases to 19.7% in 2020 potentially due to the liquidity concern in the COVID pandemic. We further find that when minimum liquidity covenants are included as a maintenance covenant, 32% of loans require compliance with these covenants any time, 20% require daily, weekly, or monthly compliance, and 48% require quarterly compliance (based on a small sample of 633 loan facilities not missing such testing frequency variable; untabulated). In Panel B of Table 2, we observe that banks with top use of minimum liquidity covenants tend to be regional banks or specialized lenders and may have more correlated lending portfolio as a result.

[14] Considering that a loan may have multiple lead lenders, we include indicators for each lead lender to control for lead lender fixed effects. Main results are similar if we restrict to loan facilities with only one lead lender.
[15] The trend line for our main regression sample is similar.

There is a known trend in the decline of the use of financial maintenance covenants in debt contracts, particularly for loan facilities targeted to attract institutional lenders (the so-called "covenant-lite" phenomenon) (Becker and Ivashina 2017; Berlin et al. 2020). In Figure 1B, we compare the trend in the use of minimum liquidity covenants and other liquidity covenants, including liquidity ratio covenants and cash flow covenants as used in prior research. We find that the trend for the usage of liquidity ratio covenants appears to move in the opposite direction as minimum liquidity covenants, with the trend lines evidently diverging from each other during the 08-09 financial crisis. For the years 2010 and after, only 2.3% of loan facilities on average contain a liquidity ratio covenant. We also display the trend for cash flow covenants and find a declining usage in the past two decades as well, consistent with the "covenant-lite" phenomenon.

Panel C of Table 2 presents the correlation table for the variables used in the main analyses. Our main measure of borrower-lender portfolio liquidity-demand correlation *Beta LenderPortfolio* is positively and significantly correlated with the use of minimum liquidity covenants. We also observe that minimum liquidity covenants are less used in firms with a healthier financial position (higher Z-score), larger firms, and more profitable firms. On the other hand, lenders are more likely to include minimum liquidity covenants for secured loans and loans with longer maturity.

*4.2 Main Results*

Panel A of Table 3 presents the main results using the stock return correlation measure *Beta LenderPortfolio* as the liquidity demand correlation measure. Column 1 presents the results without control variables or fixed effects, column 2 presents the results with control variables but without fixed effects, and column 3 presents the results with both control variables or fixed effects. Across all columns, we find that a higher borrower-lender portfolio liquidity demand correlation is associated with a greater likelihood that the loan contract includes a

minimum liquidity covenant. The economic magnitude is significant as well. In column 3, we find that a one-standard-deviation increase in *Beta LenderPortfolio* of 0.429 is associated with a 1.89% (i.e., 0.429 × 0.044) increase in the likelihood of the use of minimum liquidity covenants, a 26% of the unconditional sample mean of 7.3%.

Panel B of Table 3 presents results using additional liquidity risk co-movement measures, including *Beta OCFLenderPortfolio* and *Beta LeadLender*. Across both measures, we find a robust and positive association between borrower-lender portfolio liquidity demand correlation and the use of minimum liquidity covenants. These findings are consistent with our prediction that lenders' monitoring of borrowers' liquidity increases with the liquidity risk comovement between the borrower and the lenders' lending portfolio.

*4.3 Robustness Tests*

In Table 4, we carry out a series of robustness checks for the main analyses. First, to mitigate the concern that our borrower-lender portfolio correlation measure simply captures a borrower's systematic risk in general, we horse race the correlation in liquidity demand between the borrower and the lender portfolio with that between the borrower and the market. The coefficient on *Beta LenderPortfolio* remains positive and significant, while borrower-market return correlation does not load (column 1). Therefore, this suggests that the borrower-lender return correlation is the dominant force between the two. Second, we further control for borrower credit risks using credit ratings within the rated sample in addition to the Z-score control (column 2). We find that borrowers with higher credit risks (higher credit rating numeric grids) are more likely to use minimum liquidity covenants, consistent with stronger bank monitoring for riskier borrowers. More importantly, *Beta LenderPortfolio* remains positive and significant, supporting that correlated borrower liquidity demands capture lenders' concerns beyond typical credit risks. Further, we continue to find robust results with various higher-order fixed effects. Specifically, we show that our results are robust if we include

borrower fixed effects (column 3), industry-year-quarter fixed effects (column 4), or industry-year-quarter and lead-lender-year-quarter fixed effects (columns 5).[16] Overall, these findings suggest that omitted time-invariant borrower characteristics, and time-varying industry-level, or lender-level characteristics are unlikely to explain the positive relation between correlated borrower liquidity demand and the use of minimum liquidity covenants.

## 5. Identification of Liquidity Management

### *5.1 The Effect of Banking Liquidity Regulations*

Insufficient liquidity in the banking sector accelerated the 08-09 financial crisis. To safeguard the banking industry from future liquidity crunches, banking regulators have proposed and implemented Liquidity Coverage Ratio (LCR) regulations in the aftermath of the financial crisis. LCR regulations require banks to hold sufficient high-quality liquid assets (HQLA) to cover expected net cash outflows in the next 30 days under stress scenarios. These regulations incentivize banks to enhance their liquidity management practices. We predict that banks more affected by the LCR regulations are more likely to include minimum liquidity covenants in loan contracts to address the concern of borrower correlated liquidity demand.

Analyzing the effects of a regulation can be difficult because firms may start changing their behaviors pre-emptively right after regulation proposals, or only start changing their behaviors after the regulation takes effect. We utilize descriptive evidence from prior research to identify whether and when different banks start to change their liquidity management practices in response to liquidity regulations. Specifically, Yankov (2020) shows that Standard LCR banks experienced significant growth in its regulatory high-quality liquid assets (HQLA, a key component of the LCR calculation) after Basel III LCR proposal in December 2010, while Modified LCR banks experienced significant growth in HQLA after U.S. LCR proposal

[16] We restrict our analyses to loan facilities with only one lead lender when including lead-lender-year-quarter fixed effects.

in October 2013. It appears that Standard LCR banks started changing their liquidity management practices from the relevant proposal dates rather than implementation dates. To conduct our LCR analysis with clean difference-in-differences identification, we choose the Basel III LCR proposal in December 2010 as the treatment event and Standard LCR banks as the treatment banks, March 1, 2008 to September 2013 as the testing period, and all loan facilities with only one lead bank as the sample. Such a design ensures the testing period to end before the treatment to Modified LCR banks, and avoids issues associated with staggered difference-in-differences designs (Baker et al. 2022).[17]

Not all Standard LCR banks are affected by the regulation similarly. To capture banks' differing levels of liquidity management response to the LCR shock in its commercial & industrial (C&I) lending segment, we resort to ex-post changes in C&I undrawn credit line commitment and changes in total on-balance-sheet C&I loans (proxying for the reduction in "liquidity creation" to the economy) from 2010 to 2011 for each bank. For this LCR analysis, we restrict to loan facilities with one unique lead lender.[18] The triple-interaction research design is as follows:

$$LiqCov = \beta_0 + \beta_1\, Beta\ LenderPortfolio + \beta_2\, LCR + \beta_3\, Chg\ Lender\ Liquidity\ Mgmt \times LCR + \beta_4\, Beta\ LenderPortfolio \times Chg\ Lender\ Liquidity\ Mgmt + \beta_5\, Beta\ LenderPortfolio \times LCR + \beta_7\, Beta\ LenderPortfolio \times LCR \times Chg\ Lender\ Liquidity\ Mgmt + Control\ Variables + Fixed\ Effects\ (Including\ Lead\ Lender\ Fixed\ Effects) + \varepsilon \quad (2)$$

Table 5 presents the results of our LCR analysis. We find that Standard LCR banks that have a larger reduction in undrawn C&I credit line commitment and C&I loans after the

[17] We define Standard LCR based on its main criteria — size thresholds, and forgo other definition details such as foreign exposure, which can be more difficult to measure. Specifically, Standard LCR banks are banks with total assets greater than or equal to $250 Billion. In addition, our sample period of March 1, 2008 to September 2013 ensures equal length of pre and post window while ensuirng the post window ends before the treatment of Modified LCR banks.

[18] In our testing sample of 617 loan facilities, 535 belong to 9 unique treatment (Standard-LCR) banks and 82 belong to 11 unique control (not Standard-LCR) banks.

passage of LCR proposals are more likely to include liquidity covenants in loan contracts when borrowers have higher correlated liquidity demands with the lender's loan portfolios in the post-LCR-proposal period. These results suggest that banks' increased *liquidity* management incentives due to LCR regulations promote more bank monitoring of their borrowers' liquidity in response to correlated borrower liquidity demands.

*5.2 The Effect of the COVID-19 Pandemic*

We expect that lenders would strengthen their liquidity monitoring when borrower liquidity risk becomes more salient during negative economic shocks. We exploit the COVID-19 pandemic as a setting to test our prediction. The pandemic generated exogenous and broad liquidity shocks that affected almost all firms in the economy. To isolate the liquidity shock effects, we focus on a narrow window of COVID period, starting from March 13, 2020 when President Trump declared the pandemic to be a national emergency and ending at December 31, 2020. We restrict the sample period for the COVID analysis to be after 2014 to obtain a more recent subsample. We use a firm-level COVID sentiment measure developed by Hassan et al. (2023) to proxy for the extent to which borrowers are negatively exposed to COVID. In Table 6, we find that the effect of correlated liquidity demand during the COVID period is stronger for borrowers with a more negative COVID sentiment (net of positive sentiment), suggesting that lenders are more concerned about liquidity risks for borrowers that have higher liquidity demands driven by negative COVID exposures. This finding is consistent with the criticism that lenders tighten lending when the economy needs liquidity the most (Kapan and Minoiu 2021).

**6. Additional Analyses**

*6.1 The Consequences of Minimum Liquidity Covenants on Borrowers*

We further test the consequence of the use of minimum liquidity covenants on borrowers. To the extent that borrowers have a minimum level of liquidity as a buffer, they can

survive temporary liquidity shocks better. As a result, we expect that these borrowers have lower liquidity risks after loan initiations. In Table 7 column 1, using the sample of three years before and after loan start dates, we find that borrowers with minimum liquidity covenants in their loan contracts have lower tail risks after loan starts, as proxied by a less negative average stock return in the worst performing 5% days (in stock return) during a year.

We further use a Coarsen Exact Matching (CEM) sample to control for differences between borrowers with and without minimum liquidity covenants (Iacus et al. 2012; Christensen et al. 2017). Specifically, we match borrowers with such covenants and those without such covenants based on deciles of the borrower-lender portfolio co-movement level, borrower size and Z-score. We find robust results using a weighted CEM sample that assigns various weights to adjust for the different sizes of control firms (Table 7 column 2). Overall, this suggests that lender monitoring of borrower liquidity does induce changes in borrowers' liquidity risk profiles, corroborating our determinant tests.

*6.2 Minimum Liquidity Covenants versus Other Liquidity Covenants*

We further compare minimum liquidity covenants with other types of liquidity covenants including liquidity ratio covenants and cash flow covenants in addressing lenders' liquidity concerns. We first find that our measures of borrower-lender portfolio liquidity demand correlation do not have a positive and significant association with the use of liquidity ratio covenants and cash flow covenants (Online Appendix Table A1). Next, we test whether liquidity ratio or cash flow covenants help reduce borrower liquidity risks. In contrast to the effects of minimum liquidity covenants, we fail to find evidence that borrowers with liquidity ratio or cash flow covenants have more better worst 5% returns after loan starts (Table 7 columns 3 and 4). We further provide potential evidence of why liquidity ratio covenants become less popular after the financial crisis. Specifically, we examine the difference between cash and non-cash current assets in helping borrowers survive the 08-09 financial crisis (Online

Appendix Table A2). We find that cash, but not non-cash current assets, is associated with less extreme tail returns during the financial crisis. These results are consistent with the "cash remains the king" observation and supports the unique role of minimum liquidity covenants in mitigating borrower liquidity risks.

*6.3 The Consequences of Minimum Liquidity Covenants on Banks*

Lastly, we provide suggestive evidence of the effects of minimum liquidity covenants on bank liquidity management. To the extent that such covenants ensure that borrowers have a liquidity buffer to survive liquidity shocks, they help lenders mitigate liquidity crunches when aggregate liquidity shocks occur. As a result, lenders with more use of such covenants are more likely to serve as liquidity providers. Using the COVID pandemic as a setting of aggregate liquidity shocks, we find supportive evidence. Specifically, we find that banks with a higher percentage of outstanding loans with minimum liquidity covenants entering into COVID on March 13, 2020, have higher C&I loan and commitment growth (Table 8). This finding triangulates our argument that liquidity covenants help banks ensure their role as liquidity providers.

## 7. Conclusion

In this paper, we examine whether banks manage their liquidity risks by monitoring their borrowers' liquidity. While banks serve as a liquidity provider to the corporate sector, their ability to provide liquidity is constrained when many borrowers need liquidity at the same time. Borrowers that need liquidity when their banks' other borrowers also face liquidity crunches impose significant liquidity constraints on their banks and experience higher default risks during crises. Therefore, we predict that banks have higher incentives to monitor the liquidity of borrowers with higher correlated liquidity risks with other borrowers in their lending portfolios. We proxy for lender liquidity monitoring using novel data on minimum liquidity covenants that are specifically designed to monitor borrowers' liquidity. Consistent

with our prediction, we find that loan contracts are more likely to include minimum liquidity covenants when borrowers and lenders' portfolios have higher correlated liquidity demand. We further show that banks strengthen their liquidity monitoring when LCR regulations impose higher liquidity requirements on them and when banks and borrowers experience liquidity shocks in COVID. Ex-post evidence shows that liquidity covenants indeed help reduce borrowers' liquidity risks after loan initiations. Our paper thus highlights an important channel through which banks' liquidity management may affect the real economy.

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**Appendix A: Examples of Liquidity Covenants**

Example 1:
https://www.sec.gov/Archives/edgar/data/1730346/000119312520065065/d835025dex102.htm
Discussion on liquidity covenants:
*Minimum Available Liquidity. Permit Available Liquidity to be less than $10,000,000 as of the last Business Day of each calendar week, to be reported to the Lenders on not later than Wednesday of the following calendar week, with such reporting commencing on June 10, 2020 with respect to the June 5, 2020 testing date."*
Definition of liquidity:
*"Available Liquidity" means, as of any date of measurement thereof, the sum of (without duplication) (a) cash, cash equivalents and short term investments, in each case either (i) not subject to any Lien or (ii) subject to any Lien (A) created pursuant to the Collateral Documents or (B) arising under or in connection with cash management services in the ordinary course of business, then owned by the Borrower or any other Loan Party that would be reflected on a consolidated balance sheet of the Borrower at such time, (but excluding amounts held in any Project Escrow Account) plus (b) the amount by which the Aggregate Commitments in effect on such date exceed the Total Revolving Outstandings.*
*"Aggregate Commitments" means the Commitments of all the Lenders.*

Example 2:
https://www.sec.gov/Archives/edgar/data/1540729/000095014220000799/eh2000469_ex1001.htm
Discussion on liquidity covenants:
***"Minimum Liquidity**. Permit Liquidity at any time to be less than (i) prior to the Delayed Draw Funding Date, $20,000,000, and (ii) on or after the Delayed Draw Funding Date, $40,000,000."*
Definition of liquidity:
*"Liquidity" means, the sum of (i) the aggregate amount of cash and Cash Equivalents on the consolidated balance sheet of the Borrower and its Subsidiaries that is "unrestricted" in accordance with GAAP and (ii) at all times prior to the Delayed Draw Funding Date, the Delayed Draw Term Loan Commitment.*

Example 3:
https://www.sec.gov/Archives/edgar/data/896262/000119312519026458/d699024dex101.htm
Discussion on liquidity covenants:

*The Company may make any other Restricted Payment; provided, that, (x) no Default or Event of Default shall have occurred and be continuing at the time of such Restricted Payment or would result therefrom, (y) the Company shall have delivered to the Administrative Agent a Pro Forma Compliance Certificate demonstrating that, upon giving Pro Forma Effect to such Restricted Payment, the Consolidated Leverage Ratio is less than 2.00 to 1.0 and (z) Liquidity shall be greater than or equal to $50,000,000 upon giving effect to such Restricted Payment.*

Definition of liquidity:
*"Liquidity" means, as of any date of determination, the total of (a) availability under the Revolving Facility as of such date, plus (b) unrestricted cash and Cash Equivalents of the Borrowers as of such date, minus (c) the aggregate amount of payments due pursuant to*

*contractual settlement agreements, binding arbitration awards and judicial or administrative judgments or awards within twelve (12) months after the date of determination.*

Example 4:
https://www.sec.gov/Archives/edgar/data/1538849/000156459019010610/capl-ex101_6.htm
Discussion on liquidity covenants:
*the Liquidity of the Borrowers and their Restricted Subsidiaries shall not be less than $15,000,000 after giving effect to such Acquisition and any related incurrence or repayment, prepayment, repurchase or other discharge of Indebtedness*

Definition of liquidity:
*"Liquidity" means, as of any date of determination, the sum of (i) Accessible Borrowing Availability as of such date and (ii) all cash and Cash Equivalents held by the Borrowers and their Restricted Subsidiaries as of such date (other than any restricted cash or restricted Cash Equivalents that are not restricted in favor of the Secured Parties) on a consolidated basis.*

## Appendix B: Keywords for the Extraction of Minimum Liquidity Covenants

We develop the following lists of keywords:

List of number word: "less than", "greater than", "at least", "less of", "greater of", "more than", "exceed", "excess of", ">".

List of liquidity covenant word: "minimum+w/30+liquidity", "liquidity+w/30+covenant", "liquidity+w/30+test".

"+w/n" means search within n characters.

We use the following patterns to identify the existence of minimum liquidity covenants.

Pattern 1: "*number word* + w/300 + *liquidity covenant word*"

Pattern 2: "*verb word1* + w/150 + *liquidity* + *number word*"

Pattern 3: "liquidity + w/150 + *verb word2* + w/20 + *number word*"

Pattern 4: "giving + w/20 + effect + w/500 + liquidity + w/150 + *number word*"

Pattern 5: "giving + w/20 + effect + w/500 + *number word* + w/150 + liquidity"

Pattern 6: "liquidity + w/150 + giving + w/20 + effect + w/150 + *number word*"

Pattern 7: "liquidity + w/150 + pro + w/5 + forma + w/150 + *number word*"

Pattern 8: "liquidity + w/150 + *number word* + w/150 + pro + w/5 + forma"

**Appendix C: Variable Definitions**

| Variable | Definition | Data Source |
|---|---|---|
| *LiqCov* | An indicator equal to 1 if the facility's loan contract contains a minimum liquidity covenant, and 0 otherwise. A minimum liquidity covenant is defined as either a maintenance or incurrence covenant that requires a minimum balance in cash, cash equivalent, or undrawn credit line. | EDGAR |
| *Beta LenderPortfolio* | The regression coefficient when regressing the excess daily stock return of the focal borrower on the weighted average excess daily stock return (weighted by loan facility amount) of all borrowers in the lead lenders' lending portfolio, where the regression is performed over the one year before loan start date. When there are multiple lead lenders for the focal loan, we take the simple average of regression coefficients among all borrower-leadlender pairs. | Compustat; CRSP |
| *Beta OCF LenderPortfolio* | The regression coefficient when regressing the quarterly operating cash flow (OCF) of the focal borrower on the weighted average quarterly OCF (weighted by loan facility amount) of all borrowers in the lead lenders' lending portfolio, where the regression is performed over the five years before loan start date. When there are multiple lead lenders for the focal loan, we take the simple average of regression coefficients among all borrower-leadlender pairs. | Compustat |
| *Beta LeadLender* | The regression coefficient when regressing the excess daily stock return of the focal borrower on the excess daily stock return of the lead lender, where the regression is performed over the one year before loan start date.<br>When there are multiple lead lenders for the focal loan, we take the simple average of regression coefficients among all borrower-leadlender pairs. | Compustat; CRSP |
| *Z Score* | Altman (1968) Z-score, calculated as: Z = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (EBIT/total assets) + 0.6 (market value of equity/book value of total liabilities) + 0.999 (sales/total assets) | Compustat |
| *SP Rating* | Credit rating as assigned by S&P. "AAA" is coded as 1; "AA+" is coded as 2; "AA" is coded as 3…, the assigned numbers progressively increase by one for each credit rating grid to "CCC-" (coded as 19). Both "CC" and "C" are coded as 20; both "SD" and "D" are coded as 21. | Capital IQ |

| | | |
|---|---|---|
| *Beta Market* | The regression coefficient when regressing the excess daily stock return of the focal borrower on the excess daily stock return of the market, where the regression is performed over the one year before loan start date. | Compustat; CRSP |
| *Ln_FirmSize* | The natural log of (1 + total assets in millions) | Compustat |
| *Leverage* | Short term debt (dlc) plus long term debt (dltt), scaled by total assets | Compustat |
| *Tangibility* | Net PPE (ppent), scaled by total assets | Compustat |
| *MTB* | Book value of total liabilities plus market value of common shares (at - ceq + csho × prcc_f), scaled by total assets | Compustat |
| *Profitability* | Operating income before depreciation (oibdp), scaled by lagged total assets | Compustat |
| *Loss* | An indicator equal to 1 if the net income if below zero, and 0 otherwise. | Compustat |
| *OCF Volatility* | The standard deviation of quarterly operating cash flow (OCF) (scaled by total assets at the beginning of the quarter) in the five years prior to the loan facility start date. I require at least 12 non-missing scaled OCF for the calculation. | Compustat |
| *Ln_DealAmount* | The natural log of (1 + *DealAmount*), where *DealAmount* is the total amount of the loan deal in millions. | DealScan |
| *Ln_Maturity* | The natural log of (1 + *Maturity*), where *Maturity* is loan maturity in months | DealScan |
| *Secured* | An indicator variable equal to 1 if the facility is secured, and 0 otherwise | DealScan |
| *Pac_Revolver* | An indicator equal to 1 if the loan deal-date includes a revolver, and 0 otherwise. I use deal-date because sometimes a loan deal can span multiple years. | DealScan |
| *LCR* | The variable is constructed for the subsample of loan facilities with only one lead lender. The variable is defined as an indicator variable equal to 1 if the lead lender is a bank with total assets equal or greater than $250 Billion after December 16, 2010, and 0 otherwise. The LCR test as reported only utilizes the sub sample period of March 2008 to September 2013. | Y-9C Report |
| *Chg Lender C&I Commit (Low)* | *Chg Lender C&I Commit* is the change of lender's C&I loan commitments (scaled by total lender assets) from 2010 to 2011. *Chg Lender C&I Commit (Low)* is an indicator variable that equals 1 for the lower partition of the sample (and 0 otherwise), indicating banks that had larger decreases of C&I loan commitments from 2010 to 2011. | Y-9C Report |

| | | |
|---|---|---|
| *Chg Lender C&I Loans (Low)* | *Chg Lender C&I Loans* is the change of lender's C&I loan balance (scaled by total lender assets) from 2010 to 2011. *Chg Lender C&I Loans (Low)* is an indicator variable that equals 1 for the lower partition of the sample (and 0 otherwise), indicating banks that had larger decreases of C&I loans from 2010 to 2011. | Y-9C Report |
| *COVID* | An indicator variable equal to 1 if the time of loan start date is from March 13, 2020 (the date when National Emergency relating to COVID was declared) to December 31, 2020, and 0 for period from January 2014 to March 12, 2020 as well as January 2021 to the end of our sample period (June 2021) as the non-COVID period. | DealScan |
| *Net Negative COVID Sentiment (High)* | *COVID Net Negative Sentiment* is the COVID net negative sentiment measure as obtained from www.firmlevelrisk.com based on earnings conference call textual extraction (Hassan et al. 2023). We took the negative of "Covid_Net_Sentiment" measure in firmlevelrisk.com so that a more negative sentiment has a higher *COVID Net Negative Sentiment*. We obtain the *COVID Net Negative Sentiment* measure for earnings conference calls that take place between 3 months before loan start date and loan start date. *CovidNegSentiment (High)* is an indicator variable equal to 1 if it is in the high partition of the *COVID Net Negative Sentiment* variable, and 0 otherwise. | Hassan et al. 2023 |
| *WorstRet (Annual)* | The average stock return of the worst-performing 5% days (in stock returns) of the borrower for a given fiscal year | CRSP |
| *WorstRet (Full Crisis Period)* | The average stock return of the worst-performing 5% days (in stock returns) of the borrower in the financial crisis period (January 1, 2008 to June 30, 2009) | CRSP |
| *LiqRatioCov* | An indicator variable equal to 1 if the loan facility includes a liquidity ratio covenant (either current ratio or quick ratio), and 0 otherwise. We manually collect liquidity ratio covenants (both maintenance and incurrence covenants) from loan contracts in EDGAR fiings, and supplement this with the liquidity ratio maintenance covenants readily available from DealScan. | DealScan; EDGAR |

| | | |
|---|---|---|
| *CashFlowCov* | An indicator variable equal to 1 if the loan facility includes a cash flow maintenance covenant as collected by DealScan, and 0 otherwise. Cash flow maintenance covenants include covenants on Debt to Cash Flow, Senior Debt to Cash Flow, Interest Coverage Ratio, Cash Interest Coverage Ratio, Fixed Charge Coverage Ratio, and Debt Service Coverage Ratio. Note that DealScan does not collect incurrence financial covenants. | DealScan |
| *Lender LnAssets* | Log(1+ lender total assets), where lender total assets are in mllions. If there are multiple lead lenders, I calculate lender total assets as the simple average of all lead lenders' total assets. | Y9C Report |
| *Lender Tier1* | Lender's tier 1 ratio. If there are multiple lead lenders, I take the simple average of all lead lenders. | Y9C Report |
| *Lender NPL* | Lender's non-performing loan as scaled by gross total loans. If there are multiple lead lenders, I take the simple average of all lead lenders. | Y9C Report |
| *Lender Liquidity Gap* | Lender's liquid liabilities minus liquid assets, where liquid liabilities include large time deposits, foreign deposits, fed funds liabilities, repo liabilities, and trading liabilities, and liquid assets include cash, available-for-sale securities (other than MBS and ABS securities), fed funds assets, repo assets, and trading assets. If there are multiple lead lenders, I take the simple average of all lead lenders. | Y9C Report |
| *Lender Commitments* | Lender's off balance-sheet "unused commitments" (section 1 of Y9C schedule HC-L, but exclude credit card commitments according to Acharya and Mora (2015)). These commitments include C&I loan commitments, real estate loan commitments, home equity line, etc. If there are multiple lead lenders, I take the simple average of all lead lenders. | Y9C Report |

**Figure 1: Time Trend for the Use of Minimum Liquidity Covenants and Other Covenants**

**Figure 1A: Time Trend for the Use of Minimum Liquidity Covenants**

The figure presents the trend of the use of minimum liquidity covenants. The trend line is based on the full sample (21,933 facilities).

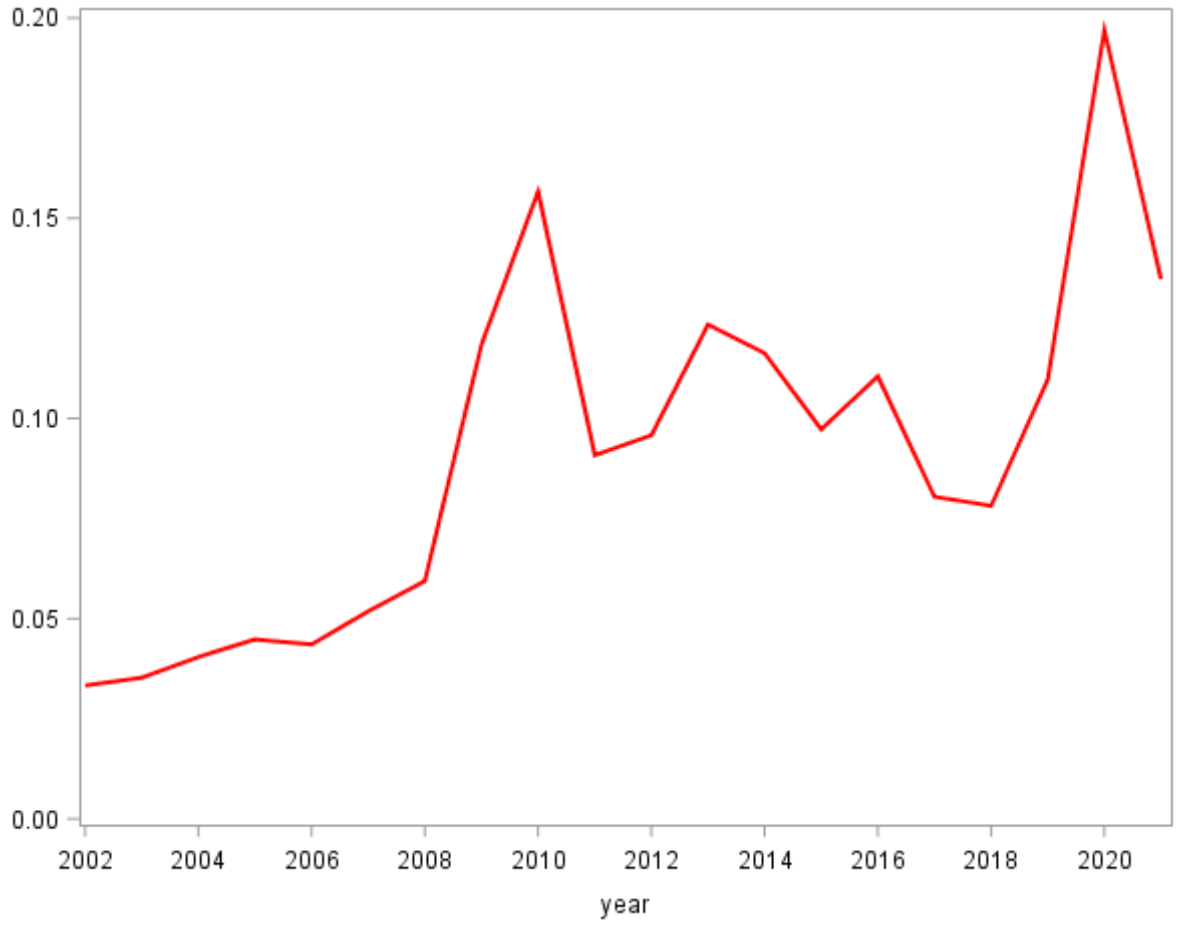

**Figure 1B: Time Trend of Minimum Liquidity Covenants and Other Covenants as a Comparison**

The figure presents the trend of the use of minimum liquidity covenants as compared to the use of other financial covenants, including liquidity ratio covenants (*LiqRatioCov*), cash flow maintenance covenants (*CashFlowCov*), which is also called performance covenants, and Capital Maintenance Covenants (*CapitalCov*). The trend lines are based on the full sample (21,933 facilities).

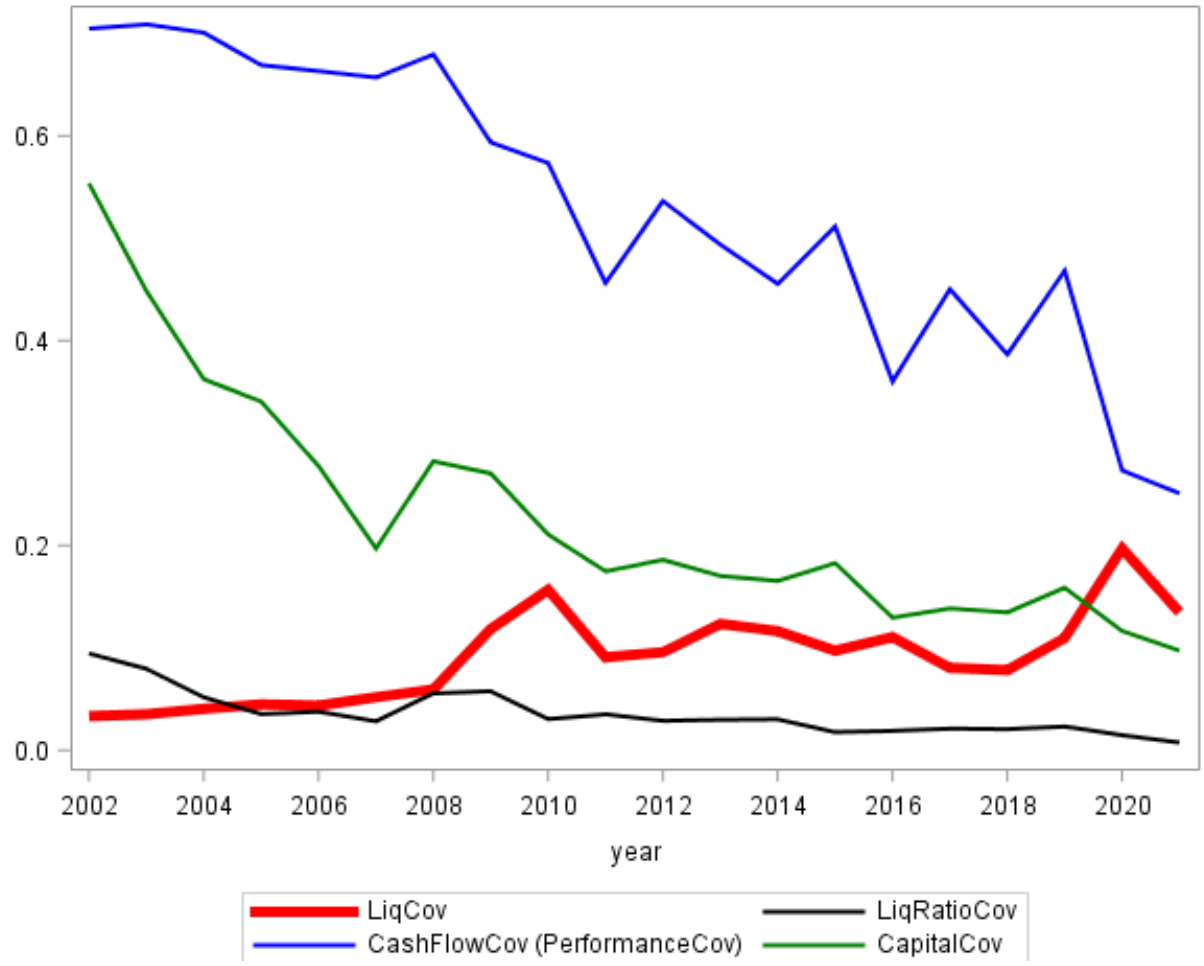

**Table 1: Sample Construction**

The table presents the sample construction process for the main analyses (Table 3 Panel A).

| **Sample construction process** | **# of Facilities** |
|---|---|
| DealScan loan facilities that can be matched to EDGAR loan agreement filings (1993 - 2021Q2) | 28,646 |
| Restrict to years 2002 and onwards | 21,933 |
| Remove financial industry borrowers | 18,811 |
| Remove second lien loan facilities | 18,615 |
| Retain only origination loan facilities (i.e., remove amendments) | 14,591 |
| Ensure not missing main dependent variable, main test variable, or main control variables, and not missing SIC industry classification | 8,468 |
| Keep only the largest facility (among the remaining facilities) for any given deal | 6,043 |
| Main specification when all fixed effects are imposed | 6,042 |

**Table 2: Descriptive Statistics**

**Panel A: Univariate Statistics**

Panel A presents univariate statistics for the main sample (Table 3 Panel A). Variable definitions are provided in Appendix C.

| Variable | N | mean | sd | p25 | p50 | p75 |
|---|---|---|---|---|---|---|
| *LiqCov* | 6,042 | 0.073 | 0.260 | 0.000 | 0.000 | 0.000 |
| *Beta LenderPortfolio* | 6,042 | 0.946 | 0.429 | 0.649 | 0.915 | 1.204 |
| *Beta OCF LenderPortfolio* | 5,733 | 1.038 | 0.676 | 0.615 | 0.962 | 1.386 |
| *Beta Leadlender* | 6,042 | 0.454 | 0.236 | 0.292 | 0.432 | 0.586 |
| *Z Score* | 6,042 | 3.394 | 2.763 | 1.728 | 2.897 | 4.370 |
| *Ln_FirmSize* | 6,042 | 7.618 | 1.687 | 6.417 | 7.544 | 8.773 |
| *Leverage* | 6,042 | 0.274 | 0.189 | 0.142 | 0.258 | 0.374 |
| *Tangibility* | 6,042 | 0.304 | 0.238 | 0.116 | 0.223 | 0.452 |
| *MTB* | 6,042 | 1.799 | 0.961 | 1.180 | 1.502 | 2.082 |
| *Profitability* | 6,042 | 0.145 | 0.091 | 0.092 | 0.135 | 0.189 |
| *Loss* | 6,042 | 0.195 | 0.396 | 0.000 | 0.000 | 0.000 |
| *OCF Volatility* | 6,042 | 0.029 | 0.023 | 0.014 | 0.022 | 0.034 |
| *Ln_DealAmount* | 6,042 | 5.882 | 1.403 | 5.017 | 5.994 | 6.909 |
| *Ln_Maturity* | 6,042 | 3.777 | 0.585 | 3.611 | 4.111 | 4.111 |
| *Secured* | 6,042 | 0.430 | 0.495 | 0.000 | 0.000 | 1.000 |
| *Pac_Revolver* | 6,042 | 0.855 | 0.352 | 1.000 | 1.000 | 1.000 |
| *Lender LnAssets* | 6,042 | 13.766 | 0.955 | 13.510 | 14.073 | 14.426 |
| *Lender Tier1* | 6,042 | 10.291 | 2.263 | 8.413 | 9.265 | 12.329 |
| *Lender NPL* | 6,042 | 0.025 | 0.021 | 0.010 | 0.016 | 0.034 |
| *Lender Liquidity Gap* | 6,042 | (0.050) | 0.104 | (0.109) | (0.036) | 0.020 |
| *Lender Commitments* | 6,042 | 0.263 | 0.084 | 0.202 | 0.252 | 0.308 |

**Panel B: The Use of Minimum Liquidity Covenants by Lead Lenders**

This panel presents the use of minimum liquidity covenants by lead lenders.

In first five lines, we list the % use of minimum liqiuidty covenants by the top5 lenders as ranked by the number of facilities they act as lead lenders. In the subsequent lines, we list the lenders with the use of minimum liquidity covenants in more than 20% of their loan facilities where they act as lead lenders.

| Total Lending Activity Ranking | # of Loan Facilities in the Sample | Lead Lender Name | % of Loans with LiqCov |
|---|---|---|---|
| 1 | 8,672 | BANK OF AMERICA CORP | 8% |
| 2 | 8,061 | JPMORGAN CHASE & CO | 8% |
| 3 | 4,998 | WELLS FARGO & CO | 9% |
| 4 | 3,800 | CITIGROUP INC | 7% |
| 5 | 1,812 | BARCLAYS PLC | 9% |
| 33 | 215 | SVB FINANCIAL GROUP | 24% |
| 42 | 112 | BANCO SANTANDER SA | 29% |
| 49 | 77 | LLOYDS BANKING GROUP PLC | 22% |
| 50 | 50 | CIT GROUP INC | 30% |
| 51 | 41 | HUNTINGTON BANCSHARES | 20% |
| 56 | 13 | ALLIANZ SE | 31% |
| 64 | 7 | APOLLO GLOBAL MGMT INC | 57% |

Note: because each loan facility can have multiple lead lenders, the sum of the above number of loan facilities exceed the total number of unique facilities they correspond to.

**Panel C: Correlation Table**

The table presents the correlation of dependent, independent, and control variables used in the main analyses (Table 3 Panel A)

| | *LiqCov* | *Beta LenderPortfolio* | *Z Score* | *Ln_FirmSize* | *Leverage* | *Tangibility* | *MTB* | *Profitability* | *Loss* | *OCF Volatility* | *Ln_DealAmount* | *Ln_Maturity* | *Secured* | *Pac_Revolver* | *Lender LnAssets* | *Lender Tier1* | *Lender NPL* | *Lender Liquidity Gap* | *Lender Commitments* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *LiqCov* | 1.000 | | | | | | | | | | | | | | | | | | |
| *Beta LenderPortfolio* | 0.087*** | 1.000 | | | | | | | | | | | | | | | | | |
| | (0.000) | | | | | | | | | | | | | | | | | | |
| *Z Score* | -0.032** | -0.029** | 1.000 | | | | | | | | | | | | | | | | |
| | (0.012) | (0.027) | | | | | | | | | | | | | | | | | |
| *Ln_FirmSize* | -0.073*** | 0.008 | -0.199*** | 1.000 | | | | | | | | | | | | | | | |
| | (0.000) | (0.512) | (0.000) | | | | | | | | | | | | | | | | |
| *Leverage* | 0.002 | 0.025* | -0.545*** | 0.203*** | 1.000 | | | | | | | | | | | | | | |
| | (0.885) | (0.052) | (0.000) | (0.000) | | | | | | | | | | | | | | | |
| *Tangibility* | -0.034*** | 0.052*** | -0.263*** | 0.145*** | 0.245*** | 1.000 | | | | | | | | | | | | | |
| | (0.009) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | | | | | | | | | | |
| *MTB* | -0.016 | -0.035*** | 0.626*** | -0.032** | -0.129*** | -0.209*** | 1.000 | | | | | | | | | | | | |
| | (0.218) | (0.007) | (0.000) | (0.014) | (0.000) | (0.000) | | | | | | | | | | | | | |
| *Profitability* | -0.075*** | -0.026** | 0.503*** | 0.023* | -0.083*** | 0.015 | 0.519*** | 1.000 | | | | | | | | | | | |
| | (0.000) | (0.047) | (0.000) | (0.078) | (0.000) | (0.232) | (0.000) | | | | | | | | | | | | |
| *Loss* | 0.084*** | 0.119*** | -0.320*** | -0.166*** | 0.185*** | 0.033** | -0.196*** | -0.469*** | 1.000 | | | | | | | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.011) | (0.000) | (0.000) | | | | | | | | | | | |
| *OCF Volatility* | 0.001 | -0.030** | 0.169*** | -0.358*** | -0.187*** | -0.173*** | 0.146*** | 0.053*** | 0.074*** | 1.000 | | | | | | | | | |
| | (0.934) | (0.018) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | | | | | | |
| *Ln_DealAmount* | -0.046*** | 0.055*** | -0.083*** | 0.781*** | 0.199*** | 0.043*** | 0.079*** | 0.151*** | -0.227*** | -0.276*** | 1.000 | | | | | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | | | | | |
| *Ln_Maturity* | 0.032** | 0.170*** | 0.038*** | -0.142*** | 0.033** | -0.005 | -0.020 | 0.073*** | -0.058*** | -0.018 | 0.089*** | 1.000 | | | | | | | |
| | (0.013) | (0.000) | (0.003) | (0.000) | (0.011) | (0.674) | (0.113) | (0.000) | (0.000) | (0.156) | (0.000) | | | | | | | | |
| *Secured* | 0.128*** | 0.112*** | -0.118*** | -0.416*** | 0.117*** | -0.050*** | -0.160*** | -0.174*** | 0.267*** | 0.179*** | -0.279*** | 0.191*** | 1.000 | | | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | | | |
| *Pac_Revolver* | 0.029** | -0.005 | 0.077*** | -0.208*** | -0.150*** | -0.034*** | -0.012 | 0.022* | 0.004 | 0.099*** | -0.096*** | 0.212*** | 0.077*** | 1.000 | | | | | |
| | (0.025) | (0.707) | (0.000) | (0.000) | (0.000) | (0.007) | (0.344) | (0.089) | (0.759) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | | | |
| *Lender LnAssets* | -0.016 | 0.174*** | 0.010 | 0.416*** | 0.093*** | -0.004 | 0.050*** | 0.095*** | -0.124*** | -0.215*** | 0.448*** | 0.072*** | -0.182*** | -0.110*** | 1.000 | | | | |
| | (0.218) | (0.000) | (0.438) | (0.000) | (0.000) | (0.770) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | | | | | |
| *Lender Tier1* | 0.105*** | 0.065*** | -0.047*** | 0.274*** | 0.102*** | -0.064*** | 0.094*** | -0.057*** | -0.011 | -0.155*** | 0.323*** | 0.011 | -0.096*** | -0.207*** | 0.307*** | 1.000 | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.391) | (0.000) | (0.000) | (0.385) | (0.000) | (0.000) | (0.000) | | | | |
| *Lender NPL* | 0.088*** | 0.072*** | -0.040*** | 0.049*** | 0.000 | 0.006 | -0.102*** | -0.020 | 0.004 | -0.060*** | 0.102*** | 0.054*** | -0.014 | 0.012 | 0.326*** | 0.372*** | 1.000 | | |
| | (0.000) | (0.000) | (0.002) | (0.000) | (0.991) | (0.664) | (0.000) | (0.114) | (0.732) | (0.000) | (0.000) | (0.000) | (0.272) | (0.336) | (0.000) | (0.000) | | | |
| *Lender Liquidity Gap* | -0.060*** | -0.080*** | 0.028** | -0.276*** | -0.108*** | 0.052*** | -0.104*** | 0.036*** | 0.022* | 0.152*** | -0.325*** | -0.008 | 0.083*** | 0.225*** | -0.369*** | -0.824*** | -0.208*** | 1.000 | |
| | (0.000) | (0.000) | (0.028) | (0.000) | (0.000) | (0.000) | (0.000) | (0.006) | (0.086) | (0.000) | (0.000) | (0.528) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | | |
| *Lender Commitments* | -0.032** | -0.114*** | 0.030** | -0.364*** | -0.102*** | 0.007 | -0.022* | -0.047*** | 0.078*** | 0.182*** | -0.398*** | -0.082*** | 0.137*** | 0.131*** | -0.741*** | -0.528*** | -0.457*** | 0.508*** | 1.000 |
| | (0.013) | (0.000) | (0.020) | (0.000) | (0.000) | (0.567) | (0.089) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | |

**Table 3: Main Analyses: The Effect of Borrower Correlated Liquidity Demand on the Use of Minimum Liquidity Covenants**

**Panel A: Main Analysis Using the Main Measure Beta LenderPortfolio**

The table presents the results of our main analysis using the main measure *Beta LenderPortfolio*. Columns 1 does not include control variables or fixed effects, column 2 includes control variables but not fixed effects, and column 3 includes control variables and fixed effects. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1)<br>*LiqCov* | (2)<br>*LiqCov* | (3)<br>*LiqCov* |
|---|---|---|---|
| *Beta LenderPortfolio* | 0.052*** | 0.043*** | 0.044*** |
| | (0.000) | (0.000) | (0.000) |
| *Z Score* | | -0.004 | -0.001 |
| | | (0.150) | (0.706) |
| *Ln_FirmSize* | | -0.006 | 0.000 |
| | | (0.283) | (0.952) |
| *Leverage* | | -0.039 | -0.016 |
| | | (0.390) | (0.742) |
| *Tangibility* | | -0.019 | -0.003 |
| | | (0.448) | (0.915) |
| *MTB* | | 0.012** | 0.010* |
| | | (0.048) | (0.088) |
| *Profitability* | | -0.107* | -0.133** |
| | | (0.058) | (0.032) |
| *Loss* | | 0.015 | 0.015 |
| | | (0.332) | (0.297) |
| *OCF Volatility* | | -0.349 | -0.083 |
| | | (0.109) | (0.617) |
| *Ln_DealAmount* | | -0.002 | -0.006 |
| | | (0.742) | (0.352) |
| *Ln_Maturity* | | -0.003 | 0.006 |
| | | (0.656) | (0.392) |
| *Secured* | | 0.055*** | 0.036*** |
| | | (0.000) | (0.000) |
| *Pac_Revolver* | | 0.024** | 0.039** |
| | | (0.050) | (0.017) |
| *Lender LnAssets* | | -0.010 | -0.013 |
| | | (0.108) | (0.288) |
| *Lender Tier1* | | 0.017*** | 0.005 |
| | | (0.001) | (0.571) |
| *Lender NPL* | | 0.622** | -0.458 |
| | | (0.023) | (0.590) |

| | | | |
|---|---|---|---|
| *Lender Liquidity Gap* | | 0.117 | 0.219* |
| | | (0.220) | (0.092) |
| *Lender Commitments* | | -0.031 | -0.157 |
| | | (0.631) | (0.285) |
| Constant | 0.023* | 0.045 | 0.188 |
| | (0.085) | (0.624) | (0.331) |
| Year-Quarter FE | No | No | Yes |
| Industry FE | No | No | Yes |
| Loan Purpose FE | No | No | Yes |
| Multi Leadlender FE | No | No | Yes |
| N | 6042 | 6042 | 6042 |
| Adjusted R-squared | 0.007 | 0.044 | 0.095 |

**Panel B: The Main Analysis Using Alternative Borrower Correlated Liquidity Demand Measures**

The table presents the results of our main analysis using alternative measures of borrower correlated liquidity demand. For each measure, we present the specification with control variables and fixed effects. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) | (2) |
|---|---|---|
| | *LiqCov* | *LiqCov* |
| *Beta OCF LenderPortfolio* | 0.016** | |
| | (0.045) | |
| *Beta Leadlender* | | 0.089*** |
| | | (0.000) |
| *Z Score* | -0.001 | -0.001 |
| | (0.625) | (0.630) |
| *Ln_FirmSize* | 0.002 | -0.000 |
| | (0.683) | (0.961) |
| *Leverage* | 0.006 | -0.015 |
| | (0.897) | (0.757) |
| *Tangibility* | -0.013 | -0.002 |
| | (0.672) | (0.947) |
| *MTB* | 0.008 | 0.010* |
| | (0.117) | (0.088) |
| *Profitability* | -0.196*** | -0.123** |
| | (0.002) | (0.036) |
| *Loss* | 0.021 | 0.016 |
| | (0.169) | (0.280) |
| *OCF Volatility* | -0.049 | -0.083 |
| | (0.782) | (0.620) |
| *Ln_DealAmount* | -0.008 | -0.005 |
| | (0.192) | (0.381) |
| *Ln_Maturity* | 0.007 | 0.006 |
| | (0.325) | (0.414) |
| *Secured* | 0.042*** | 0.038*** |
| | (0.000) | (0.000) |
| *Pac_Revolver* | 0.042** | 0.039** |
| | (0.011) | (0.017) |
| *Lender LnAssets* | -0.007 | -0.011 |
| | (0.560) | (0.352) |
| *Lender Tier1* | 0.001 | 0.005 |
| | (0.916) | (0.564) |
| *Lender NPL* | -0.327 | -0.358 |
| | (0.704) | (0.670) |

| | | |
|---|---|---|
| *Lender Liquidity Gap* | 0.220 | 0.219* |
| | (0.104) | (0.085) |
| *Lender Commitments* | -0.154 | -0.154 |
| | (0.311) | (0.298) |
| Constant | 0.173 | 0.164 |
| | (0.394) | (0.395) |
| Year-Quarter FE | Yes | Yes |
| Industry FE | Yes | Yes |
| Loan Purpose FE | Yes | Yes |
| Multi Leadlender FE | Yes | Yes |
| N | 5733 | 6042 |
| Adjusted R-squared | 0.090 | 0.096 |

**Table 4: Additional Controls and Stronger Fixed Effects**

The table presents the results when adding additional control variables (column 1 and 2) and using stronger fixed effects (column 3, 4, and 5). P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | *LiqCov* | *LiqCov* | *LiqCov* | *LiqCov* | *LiqCov* |
| *Beta LenderPortfolio* | 0.057** | 0.047*** | 0.031** | 0.041*** | 0.046** |
| | (0.023) | (0.001) | (0.017) | (0.001) | (0.049) |
| *Beta Market* | -0.012 | | | | |
| | (0.591) | | | | |
| *SP Rating* | | 0.007*** | | | |
| | | (0.009) | | | |
| *Z Score* | -0.001 | -0.001 | 0.004 | 0.001 | -0.003 |
| | (0.718) | (0.872) | (0.333) | (0.860) | (0.622) |
| *Ln_FirmSize* | 0.001 | -0.003 | -0.006 | 0.001 | 0.018 |
| | (0.922) | (0.626) | (0.577) | (0.880) | (0.101) |
| *Leverage* | -0.016 | -0.008 | 0.073 | -0.025 | -0.089 |
| | (0.740) | (0.872) | (0.158) | (0.546) | (0.181) |
| *Tangibility* | -0.003 | -0.031 | 0.140** | -0.034 | -0.092 |
| | (0.912) | (0.433) | (0.022) | (0.338) | (0.148) |
| *MTB* | 0.010* | 0.005 | -0.007 | 0.016* | 0.021 |
| | (0.091) | (0.633) | (0.529) | (0.082) | (0.147) |
| *Profitability* | -0.134** | -0.224** | -0.186** | -0.178** | -0.062 |
| | (0.026) | (0.044) | (0.049) | (0.020) | (0.629) |
| *Loss* | 0.015 | 0.011 | 0.006 | 0.008 | 0.012 |
| | (0.296) | (0.585) | (0.675) | (0.630) | (0.653) |
| *OCF Volatility* | -0.084 | 0.013 | 0.395 | -0.060 | 0.139 |
| | (0.614) | (0.966) | (0.274) | (0.798) | (0.663) |
| *Ln_DealAmount* | -0.006 | 0.003 | 0.005 | -0.004 | -0.006 |
| | (0.347) | (0.579) | (0.347) | (0.464) | (0.549) |
| *Ln_Maturity* | 0.006 | -0.004 | -0.001 | 0.009 | 0.008 |
| | (0.388) | (0.530) | (0.848) | (0.244) | (0.658) |
| *Secured* | 0.037*** | 0.028* | 0.018 | 0.043*** | 0.054** |
| | (0.000) | (0.068) | (0.155) | (0.001) | (0.013) |
| *Pac_Revolver* | 0.039** | 0.036** | 0.016* | 0.032** | 0.073** |
| | (0.017) | (0.031) | (0.086) | (0.011) | (0.033) |
| *Lender LnAssets* | -0.013 | -0.022 | 0.012 | -0.002 | |
| | (0.235) | (0.186) | (0.371) | (0.923) | |
| *Lender Tier1* | 0.005 | -0.008 | 0.014* | 0.005 | |
| | (0.557) | (0.254) | (0.057) | (0.629) | |
| *Lender NPL* | -0.452 | -0.788 | 0.073 | -0.044 | |
| | (0.597) | (0.447) | (0.902) | (0.955) | |

| | | | | | |
|---|---|---|---|---|---|
| *Lender Liquidity Gap* | 0.218* | 0.026 | 0.091 | 0.192* | |
| | (0.094) | (0.848) | (0.362) | (0.093) | |
| *Lender Commitments* | -0.161 | -0.239 | 0.164 | -0.070 | |
| | (0.276) | (0.191) | (0.278) | (0.689) | |
| Year-Quarter FE | Yes | Yes | Yes | | |
| Industry FE | Yes | Yes | | | |
| Loan Purpose FE | Yes | Yes | Yes | Yes | Yes |
| Multi Leadlender FE | Yes | Yes | Yes | Yes | |
| Firm FE | | | Yes | | |
| Industry-Year-Quarter FE | | | | Yes | Yes |
| Leadlender-Year-Quarter FE | | | | | Yes |
| Sample | Full Sample | Full Sample | Full Sample | Full Sample | One Leadlender Sub-sample |
| N | 6042 | 3285 | 5235 | 5092 | 1547 |
| Adjusted R-squared | 0.095 | 0.112 | 0.423 | 0.102 | 0.067 |

**Table 5: The Effect of Banking Industry Liquidity Coverage Ratio Regulations**

The table presents the triple interaction effects among the passage of Basel III LCR regulation, lead lender's liquidity risk management response strategies to LCR, and borrower correlated liquidity demand. Columns 1 captures *Chg Lender Liquidity Mgmt in response to LCR* with the extent of lender reduction in Commercial & Industrial (C&I) credit line commitments (scaled by total assets). Columns 2 captures *Chg Lender Liquidity Mgmt in response to LCR* with the extent of lender reduction in Commercial & Industrial (C&I) on balance-sheet loans (scaled by total assets). We perform the tests using the high-low indicator variable (as compared to the sample median) for both *Beta LenderPortfolio* and *Chg Lender Liquidity Mgmt in Response to LCR*. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| Dependent Variable = | LiqCov | |
|---|---|---|
| | (1) | (2) |
| Measure for *Chg Lender Liquidity Mgmt in Response to LCR* = | *Chg Lender C&I Commitment (Low)* | *Chg Lender C&I Loan (Low)* |
| *LCR* | -0.300** | -0.301** |
| | (0.012) | (0.017) |
| *Beta LenderPortfolio (High)* | 0.035 | 0.021 |
| | (0.556) | (0.712) |
| *Chg Lender Liquidity Mgmt × LCR* | -0.048 | -0.034 |
| | (0.546) | (0.659) |
| *Beta LenderPortfolio (High) × Chg Lender Liquidity Mgmt* | -0.018 | 0.007 |
| | (0.841) | (0.940) |
| *Beta LenderPortfolio (High) × LCR* | -0.127* | -0.119* |
| | (0.073) | (0.081) |
| *Beta LenderPortfolio (High) × LCR × Chg Lender Liquidity Mgmt* | 0.241* | 0.191* |
| | (0.056) | (0.087) |
| *Z Score* | -0.013* | -0.013* |
| | (0.087) | (0.086) |
| *Ln_FirmSize* | 0.037 | 0.040 |
| | (0.148) | (0.119) |
| *Leverage* | -0.270** | -0.271** |
| | (0.035) | (0.037) |
| *Tangibility* | -0.019 | -0.018 |
| | (0.856) | (0.866) |
| *MTB* | 0.052* | 0.054* |
| | (0.074) | (0.060) |
| *Profitability* | 0.262 | 0.252 |

| | | |
|---|---|---|
| | (0.131) | (0.141) |
| *Loss* | 0.069 | 0.069 |
| | (0.108) | (0.105) |
| *OCF Volatility* | -0.163 | -0.158 |
| | (0.729) | (0.731) |
| *Ln_DealAmount* | -0.033* | -0.034* |
| | (0.100) | (0.100) |
| *Ln_Maturity* | 0.067*** | 0.064*** |
| | (0.001) | (0.001) |
| *Secured* | 0.082*** | 0.082*** |
| | (0.006) | (0.006) |
| *Pac_Revolver* | 0.092*** | 0.095*** |
| | (0.009) | (0.007) |
| *Lender LnAssets* | -0.209 | -0.174 |
| | (0.289) | (0.387) |
| *Lender Tier1* | 0.006 | 0.009 |
| | (0.882) | (0.828) |
| *Lender NPL* | 2.497 | 2.663 |
| | (0.195) | (0.224) |
| *Lender Liquidity Gap* | -0.623 | -0.598 |
| | (0.289) | (0.341) |
| *Lender Commitments* | 1.533* | 1.468* |
| | (0.066) | (0.076) |
| Year-Quarter FE | Yes | Yes |
| Industry FE | Yes | Yes |
| Loan Purpose FE | Yes | Yes |
| Lead Lender FE | Yes | Yes |
| Sample | One Leadlender Sub-sample | One Leadlender Sub-sample |
| N | 617 | 617 |
| Adjusted R-squared | 0.170 | 0.166 |

**Table 6: The Effect of the COVID-19 Pandemic**

The table presents the effect of the COVID-19 pandemic. COVID period is defined as March 13, 2020 (declaration of National Emergency relating to COVID-19) to December 31, 2020. The testing period for Table 6 is from January 2014 to June 2021. We perform the tests using the high-low indicator variables (as compared to the sample median) for *Beta LenderPortfolio* and *Net Negative COVID Sentiment,* which is the net negative firm-specific COVID-related sentiment. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) |
|---|---|
| | *LiqCov* |
| *COVID* | -0.037 |
| | (0.577) |
| *Net Negative COVID Sentiment (High)* | 0.110* |
| | (0.097) |
| *Beta LenderPortfolio (High)* | 0.063*** |
| | (0.004) |
| *COVID × Net Negative COVID Sentiment (High)* | -0.059 |
| | (0.601) |
| *COVID × Beta LenderPortfolio (High)* | -0.039 |
| | (0.560) |
| *Net Negative COVID Sentiment (High) × Beta LenderPortfolio (High)* | -0.200 |
| | (0.119) |
| *COVID × Net Negative COVID Sentiment (High) × Beta LenderPortfolio (High)* | 0.398** |
| | (0.042) |
| *Z Score* | 0.006 |
| | (0.252) |
| *Ln_FirmSize* | -0.029*** |
| | (0.001) |
| *Leverage* | -0.016 |
| | (0.809) |
| *Tangibility* | 0.075 |
| | (0.228) |
| *MTB* | -0.023*** |
| | (0.007) |
| *Profitability* | -0.194 |
| | (0.357) |
| *Loss* | 0.032 |
| | (0.461) |
| *OCF Volatility* | 0.056 |
| | (0.913) |
| *Ln_DealAmount* | 0.008 |

| | |
|---|---|
| | (0.574) |
| *Ln_Maturity* | -0.026 |
| | (0.126) |
| *Secured* | -0.001 |
| | (0.970) |
| *Pac_Revolver* | 0.049 |
| | (0.105) |
| *Lender LnAssets* | 0.035 |
| | (0.384) |
| *Lender Tier1* | 0.029 |
| | (0.193) |
| *Lender NPL* | -0.752 |
| | (0.563) |
| *Lender Liquidity Gap* | 0.169 |
| | (0.474) |
| *Lender Commitments* | 0.669 |
| | (0.206) |
| Constant | -0.623 |
| | (0.400) |
| Year-Quarter FE | Yes |
| Industry FE | Yes |
| Loan Purpose FE | Yes |
| Multi Leadlender FE | Yes |
| N | 1323 |
| Adjusted R-squared | 0.155 |

**Table 7: The Effects of Minimum Liquidity Covenants on Borrowers**

The table presents the consequence of the use of minimum liquidity covenants on borrowers. *WorstRet (Annual)* is the average stock return of the worst-performing 5% days (in stock returns) of the borrower in a year. *LiqCov* is an indicator variable equal to 1 if the loan contract includes a minimum liquidity covenant. *Post* is an indicator variable equal to 1 for the years after loan initiations, and 0 otherwise. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | *WorstRet(Annual)* | | | |
| *LiqCov×Post* | 0.002** | 0.003** | 0.002** | 0.003** |
| | (0.028) | (0.015) | (0.026) | (0.016) |
| *LiqCov* | -0.001 | -0.000 | -0.001 | -0.000 |
| | (0.603) | (0.693) | (0.574) | (0.662) |
| *LiqRatioCov×Post* | | | -0.001 | 0.002 |
| | | | (0.644) | (0.521) |
| *LiqRatioCov* | | | -0.000 | -0.002 |
| | | | (0.894) | (0.378) |
| *CashFlowCov×Post* | | | -0.000 | -0.000 |
| | | | (0.455) | (0.985) |
| *CashFlowCov* | | | 0.001 | 0.001 |
| | | | (0.220) | (0.285) |
| *Post* | -0.000 | -0.001 | -0.000 | -0.001 |
| | (0.196) | (0.224) | (0.744) | (0.353) |
| *Beta LenderPortfolio* | -0.006*** | -0.007*** | -0.006*** | -0.007*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Z Score* | -0.000 | -0.000 | -0.000 | -0.000 |
| | (0.179) | (0.556) | (0.180) | (0.580) |
| *Ln_FirmSize* | 0.004*** | 0.005*** | 0.004*** | 0.005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Leverage* | -0.025*** | -0.029*** | -0.025*** | -0.029*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Tangibility* | -0.012*** | -0.011 | -0.012*** | -0.011* |
| | (0.010) | (0.101) | (0.010) | (0.094) |
| *MTB* | 0.004*** | 0.004*** | 0.004*** | 0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Profitability* | 0.011** | 0.020*** | 0.011** | 0.020*** |
| | (0.013) | (0.002) | (0.013) | (0.002) |
| *Loss* | -0.012*** | -0.011*** | -0.012*** | -0.011*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *CF Volatility* | -0.060*** | -0.062*** | -0.060*** | -0.063*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Ln_DealAmount* | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.266) | (0.129) | (0.281) | (0.133) |
| *Ln_Maturity* | 0.001*** | 0.001*** | 0.001*** | 0.001*** |

| | | | | |
|---|---|---|---|---|
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Secured* | -0.001** | -0.002** | -0.001*** | -0.002** |
| | (0.012) | (0.020) | (0.009) | (0.012) |
| *Pac_Revolver* | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.217) | (0.107) | (0.240) | (0.126) |
| Constant | -0.089*** | -0.131*** | -0.089*** | -0.130*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Borrower FE | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES |
| LoanPurpose FE | YES | YES | YES | YES |
| Lender FE | YES | YES | YES | YES |
| Sample | Unmatched | CEM Matched | Unmatched | CEM Matched |
| N | 31997 | 28262 | 31997 | 28262 |
| Adjusted R-squared | 0.720 | 0.714 | 0.720 | 0.714 |

**Table 8: The Effect of the Use of Minimum Liquidity Covenants on Lenders' Credit Provision Ability in the COVID Period**

The table presents the consequence of lenders' use of minimum liquidity covenants on their liquidity provision ability during COVID-19. *Pre-COVID %Loans with LiqCov* is the percentage of minimum liquidity covenants usage (loan amount weighted) as of a lender's March 13, 2020 lending portfolio, as proxied by all loans in our sample of 28,646 facilities that has a facility start date before March 13, 2020, and facility end date on or after March 13, 2020. All dependent variables are changes from 2019Q4 to 2020Q4, and measure the change in C&I loans, C&I loan commitments, and the sum of C&I loans and loan commitments. All changes are scaled by total assets as of 2019Q4. *Ln_Ave_Assets*, *Ave_Tier1*, and *Ave_NPL* are the averages of 2019Q4 and 2020Q4 balance of lender assets (log of average), tier1 ratio, and non-performing loans (scaled by gross total loans). No fixed effects are imposed due to the small sample size. No standard error clustering. P-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) | (2) | (3) |
|---|---|---|---|
| | *Chg C&I Loans* | *Chg C&I Commit* | *Chg C&I Loans & Commit* |
| | *(2019Q4 to 2020Q4)* | *(2019Q4 to 2020Q4)* | *(2019Q4 to 2020Q4)* |
| *Pre-COVID %Loans with LiqCov* | 0.109** | 0.039 | 0.148*** |
| | (0.010) | (0.148) | (0.002) |
| *Ln_Ave_Assets* | -0.007** | -0.003 | -0.009*** |
| | (0.019) | (0.120) | (0.003) |
| *Ave_Tier1* | 0.000 | -0.000 | 0.000 |
| | (0.761) | (0.731) | (0.945) |
| *Ave_NPL* | -0.114 | -0.314 | -0.428 |
| | (0.823) | (0.366) | (0.435) |
| Constant | 0.124** | 0.071** | 0.195*** |
| | (0.022) | (0.047) | (0.001) |
| Observations | 27 | 27 | 27 |
| Adjusted R-squared | 0.296 | 0.103 | 0.472 |

**Online Appendix**

**Table A1: The Effect of Borrower Correlated Liquidity Demand on the Use of Other Covenants**

The table presents the results of our falsification test of the effect of Borrower Correlated Liquidity Demand on the use of other covenants: liquidity ratio covenants and cash flow covenants. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| | (1) *LiqRatioCov* | (2) *CashFlowCov* |
|---|---|---|
| *Beta LenderPortfolio* | 0.006 | -0.009 |
| | (0.410) | (0.615) |
| *Z Score* | 0.004 | -0.003 |
| | (0.114) | (0.599) |
| *Ln_FirmSize* | -0.019 | -0.024* |
| | (0.138) | (0.061) |
| *Leverage* | -0.006 | -0.120 |
| | (0.801) | (0.112) |
| *Tangibility* | 0.041 | -0.025 |
| | (0.457) | (0.601) |
| *MTB* | 0.000 | 0.005 |
| | (0.988) | (0.758) |
| *Profitability* | -0.150* | 0.424*** |
| | (0.052) | (0.002) |
| *Loss* | -0.022*** | -0.018 |
| | (0.003) | (0.361) |
| *OCF Volatility* | 0.328** | -1.293*** |
| | (0.043) | (0.002) |
| *Ln_DealAmount* | 0.011 | 0.023** |
| | (0.386) | (0.043) |
| *Ln_Maturity* | -0.017** | 0.043*** |
| | (0.010) | (0.000) |
| *Secured* | 0.029* | 0.178*** |
| | (0.067) | (0.000) |
| *Pac_Revolver* | 0.006 | 0.104*** |
| | (0.500) | (0.003) |
| *Lender LnAssets* | -0.021** | -0.017 |
| | (0.027) | (0.507) |
| *Lender Tier1* | 0.008* | -0.004 |
| | (0.087) | (0.619) |
| *Lender NPL* | -0.484 | -0.360 |
| | (0.222) | (0.689) |
| *Lender Liquidity Gap* | -0.069 | 0.297* |

| | | |
|---|---|---|
| | (0.378) | (0.078) |
| *Lender Commitments* | -0.028 | -0.540** |
| | (0.746) | (0.014) |
| Constant | 0.362*** | 0.736* |
| | (0.002) | (0.093) |
| Year-Quarter FE | Yes | Yes |
| Industry FE | Yes | Yes |
| Loan Purpose FE | Yes | Yes |
| Multi Leadlender FE | Yes | Yes |
| N | 6042 | 6042 |
| Adjusted R-squared | 0.231 | 0.259 |

**Table A2: The Effect of Cash versus Non-Cash Current Assets on Liquidity Risks during the Financial Crisis**

Dependent variable *WorstRet (Full Crisis Period)* is the average stock return of the worst-performing 5% days (in stock returns) of the borrower during the full financial crisis period (January 1, 2008 to June 30, 2009), whereas the regressors are averages of the quarterly financial ratios/performance of the borrower for the quarters ending between Dec 31, 2007 and June 30, 2009. P-values are reported in parentheses. Standard errors are clustered at the borrower industry level. All variables are defined in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

| Dependent Variable= | (1) *WorstRet (Full Crisis Period)* | (2) *WorstRet (Full Crisis Period)* |
|---|---|---|
| *Cash-to-CurrentLiab Qtr Ave* | 0.002*** | 0.002*** |
| | (0.000) | (0.000) |
| *Receivables-to-CurrentLiab Qtr Ave* | -0.001 | -0.000 |
| | (0.615) | (0.874) |
| *OtherCurrentAssets-to-CurrentLiab Qtr Ave* | 0.001 | 0.002 |
| | (0.624) | (0.382) |
| *Ln_FirmSize Qtr Ave* | 0.007*** | 0.007*** |
| | (0.000) | (0.000) |
| *Leverage Qtr Ave* | -0.040*** | -0.044*** |
| | (0.000) | (0.000) |
| *MTB Qtr Ave* | 0.006*** | 0.006*** |
| | (0.000) | (0.000) |
| *Profitability Qtr Ave* | 0.027 | 0.047** |
| | (0.320) | (0.010) |
| *Tangibility Qtr Ave* | -0.011 | -0.009 |
| | (0.232) | (0.301) |
| *Loss Qtr Ave* | -0.060*** | -0.055*** |
| | (0.000) | (0.000) |
| *CF Volatility Qtr Ave* | -0.041*** | -0.034*** |
| | (0.000) | (0.000) |
| Constant | -0.137*** | -0.145*** |
| | (0.000) | (0.000) |
| Industry FE | No | Yes |
| Observations | 3456 | 3452 |
| Adjusted R-squared | 0.489 | 0.526 |