Global syndicated lending during the COVID-19 pandemic

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March 2021

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Abstract

This paper examines the pricing of global syndicated loans during the COVID-19 pandemic. We find that loan spreads rise by over 11 basis points in response to a one standard deviation increase in the lender's exposure to COVID-19 and over 5 basis points for an equivalent increase in the borrower's exposure. This implies excess interest of about USD 5.16 million and USD 2.37 million respectively for a loan of average size and duration. The aggravating effect of the pandemic is exacerbated with the level of government restrictions to tackle the virus's spread, with firms' financial constraints and reliance on debt financing, whereas it is mitigated for relationship borrowers, borrowers listed in multiple exchanges or headquartered in countries that can attract institutional investors.

Keywords: Syndicated loans, Cost of credit, COVID-19, Pandemic

JEL classification: G01; G21; G29; G3.

1. Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease it causes (COVID-19) was first identified in December 2019 in Wuhan, China. It quickly spread across the globe evolving into a health pandemic and causing severe disruptions in economic activity. Bank lending during economic downturns has been a subject of intense scrutiny, with conventional wisdom at least since Bernanke (1983) suggesting that financial crises disrupt the credit allocation process, leading to restricted credit supply and higher borrowing costs. These conclusions are confirmed when considering the impact of the U.S. credit crunch and the resulting 2008-09 financial crisis: higher loan spreads driven by large bank losses during the crisis, with this interest rate premium mainly applied to borrowers that were more likely dependent on bank credit (see, e.g., Ivashina and Scharfstein, 2010; Santos, 2011; Kahle and Stulz, 2013). Given that, a natural question concerns the effect of the pandemic on the terms of bank lending. In specific, how the pricing of loans responds to the lenders' and borrowers' growing exposure to COVID-19? This paper seeks to answer this question by focusing on large corporate loan deals made in syndicated loan markets around the world.

The COVID-19 crisis bears some similarities to the 2008-09 crisis since both put a severe strain on global economies (through widespread bankruptcies, liquidity shortages, large losses, etc.), but unlike the former, where banks themselves suffered from losses, the latter constitutes an aggregate demand and supply shock for both lenders and borrowers. However, the 2008-09 crisis was a primarily endogenous process, as the events leading to the crisis were caused by the interaction of market participants and the weakness of the financial system. On the other hand, the ongoing crisis represents a purely exogenous shock to the global financial system and as such, its implications for the demand and supply of bank credit cannot be investigated only through the lens of endogenous risk.

In this study, we empirically investigate the impact of the COVID-19 crisis on the pricing of more than 4,000 syndicated loans granted from 77 lead lenders to 820 borrowers. We do so, by considering measures of the lenders' and borrowers' exposure to COVID-19 and quantifying their effect on all-in spread drawn (AISD), the primary price measure in the syndicated loan market. We concentrate on the 2019-2020 period, effectively contrasting the year of the pandemic with the year before. To measure each loan counterparty's exposure to COVID-19, we employ a text-based measure from Hassan, Hollander, van Lent and Tahoun (2020b). This measure reflects the risks to each company associated with the spread of the COVID-19 based on the word combinations referring to COVID-19 in the transcripts of the quarterly conference calls held by the company (adjusted for differences in transcript length).[1]

Importantly, we differentiate between the exposure of the lending bank and the exposure of the borrowing firm in order to distinguish supply-side risk from demand-side. The lender's exposure reflects the overall credit risk that the bank is exposed to arising from the bank's total lending operations and overall funding constraints. As such, it is an indication of the bank's risk aversion and ability to fund the loan that in turn shape loan supply. On the other hand, the borrower's exposure reflects demand-side forces, stemming from the firm-specific credit risk and the firm's ability to repay the loan. If supply-side forces exert a different impact (if any) relative to demand-side forces during the COVID-19 crisis, we expect an asymmetry in the response of loan spreads to each of the lender's and borrower's exposure measures.

Our baseline specification shows that a one standard deviation increase in the lender's exposure measure raises loan spreads by more than 11 basis points. Economically, this is a large effect, equal to a 6.6% higher AISD compared to the average in our sample. For a loan of average size and duration, this translates into USD 5.16 million of additional interest expenses

[1] This process for the calculation of each company's exposure is further described in Section 3; a detailed analysis is included in Hassan, Hollander, van Lent and Tahoun (2020b). The same methodology is employed for the construction of a firm-level measure of political risk and a firm-level measure of the impact of Brexit; see Hassan, Hollander, van Lent and Tahoun (2019) and Hassan, Hollander, van Lent and Tahoun (2020a) respectively.

for the borrowing firm. The equivalent response to the same increase in the borrower's exposure measure is less potent, amounting to 5 basis points or a 3% increase for the average AISD. The additional interest burden over the average loan's duration is approximately USD 2.37 million.

Several sensitivity tests show that these baseline findings are robust. The most important of these are the following. First, we use different sets of fixed effects (see, e.g., Delis, Hasan and Ongena, 2020) to control for alternative bank- and firm-side explanations of our findings and the macroeconomic environment in the lender's and borrower's countries. Second, we use specifications with different loan control variables to show that the results are not sensitive to a "bad controls problem." Third, we run a seemingly unrelated regression to account for the simultaneous setting of the price and non-price loan terms at loan origination. Fourth, the results are robust when using a Heckman-type model, to account for selection issues between lenders and borrowers (see Dass and Massa, 2011).

Consequently, we examine the differential role of the various containment and closure policies adopted at the national government level to contain the coronavirus' spread. In the presence of high restrictions where economic activity crashes and uncertainty soars, we expect banks to lower credit supply and firms to increase their demand for credit; all this should lead to a rise in loan spreads. We confirm this conjecture, as greater stringency is associated with higher loan spreads, confirming the disruptions caused by the pandemic to economic activity.

In addition to government containment policies, monetary policy authorities further embarked on new efforts (decreasing interest rates and purchasing public and private sector securities) to lower borrowing costs and stimulate lending. We find that the adjustment of the repo rate is able to affect the cost of loans for a given level of borrower's but not lender's exposure to COVID-19. Similarly, the conduct of open market purchases in the borrower's country eases the pressures on loan spreads stemming from the exposure of that country's firms.

Our examination also concerns whether firm financial constraints exacerbate the aggravating effect of COVID-19 exposure on loan spreads. Financially constrained firms effectively face an inelastic supply of external capital that is reinforced during turbulent periods: raising external capital quickly becomes ever more expensive, reflecting a steep supply curve (see Farre-Mensa and Ljungqvist, 2016). We find that financially constrained firms face higher borrowing costs relative to non-constrained; furthermore, borrowing costs rise with the firm's default risk. Hence, we reveal that the declining quality of the firms' balance sheets is a contributing factor to their increasing borrowing costs.

We further enhance our identification approach for supply-side and demand-side effects of lenders' and borrowers' exposure by looking into bank and firm heterogeneity with respect to financial health and performance. We hypothesize that the aggravating effect of lender's exposure should be more potent for larger and well capitalized banks, as these usually charge higher spreads (Dell'Ariccia, Laeven and Marquez, 2014; Dell'Ariccia, Laeven and Suarez, 2017). We confirm this hypothesis by interacting our lender's exposure measure with measures of bank size and capital adequacy. Besides highlighting relevant heterogeneity in the results, these models further enhance our identification of a supply-side mechanism driving our findings (see, e.g., Jimenez, Ongena, Peydro and Saurina, 2014). On the same line, we interact relevant firm indicators with our borrower's exposure measure and show that loans are less expensive for larger firms that rely more on equity financing and are listed on multiple stock exchanges.

We also find that institutional quality acts as a counterforce to the exacerbating effects of the pandemic. Firms headquartered in countries with a strong institutional environment that can attract institutional investors receive lower spreads for a given level of lender's and borrower's exposure to COVID-19. Even for exposed firms, we identify two strategies that help mitigate the adverse effect of the pandemic on their borrowing costs. The first concerns the formation of strong bank-firm relationships, which reduces the upward pressure on loan spreads

stemming from the bank's exposure. From a similar perspective, borrowing from a bank's subsidiary further minimizes information asymmetry due to the firm's exposure.

Finally, our study documents the implications for syndicate's structure, as usually the retention of larger share by the lead lender provides a positive signal to the syndicate members (see Sufi, 2007; Ivashina, 2009). However, in response to growing lender's exposure, the formation of a wider and less concentrated syndicate comes at the expense of higher spreads, as syndicate members require an additional compensation to partner with the exposed lead bank.

The rest of the paper proceeds as follows. Section 2 discusses the related literature and theoretical background. Section 3 presents the dataset and empirical specification. Sections 4-6 present and discuss the empirical results and Section 7 concludes the paper. An Internet Appendix provides additional summary statistics and several robustness checks.

2. Related Literature and Conceptual Framework

2.1 Related literature and contribution

Our work relates to several strands of the literature. We complement the studies on the implications of financial crises on bank lending behavior. Typically, during crises there is a drop in the supply of bank credit. This drop can stem from shocks to borrowers' collateral, which affect firms' ability to raise capital if agency and information problems are significant (see Bernanke and Gertler, 1989), or it can stem from shocks to bank capital, which affect the supply of bank loans if agency and information problems limit the ability of banks to raise additional capital (see Ivashina and Scharfstein, 2010; Cornett, McNutt, Strahan and Tehranian, 2011; Santos, 2011; Kahle and Stulz, 2013). Our study provides the first empirical investigation of the impact of this exogenous coronavirus shock on the pricing of bank loans. Our main differentiation, at least compared to the examination of the global financial crisis, is the channel

through which the current pandemic affects bank loan prices; we show that the deteriorating balance sheets of the borrowing firms is the major contributing factor to increasing loan spreads.

Our work further relates to recent studies on the impact of COVID-19 on firm financing choices and borrowing costs. During the coronavirus pandemic, firms heavily resorted to the use of lines of credit, by either arranging for new credit lines or drawing down on existing ones (see Acharya and Steffan, 2020; Li, Li, Macchiavelli and Zhou 2020). Moreover, the COVID-19 crisis exerted an adverse effect on the stock returns of firms with high levels of leverage or limited cash (see Albuquerque, Koskinen, Yang and Zhang, 2020; Ding, Levine, Lin and Xie, 202; Fahlenbrach, Rageth and Stulz, 2020). We complement these findings by documenting that firms generally face higher borrowing costs during the pandemic, which are aggravated by firm financial constraints and reliance on debt financing. We also highlight the easing effect of bank-firm lending relationships and the institutional attractiveness of the borrower's country.

Finally, our work concerns the impact of central bank open market operations on bank lending. The effects of asset purchase programs on asset prices are well documented, with evidence suggesting that they improve liquidity conditions and reduced default-risk premia; this is the case for interventions by the Federal Reserve during the U.S. credit crunch and the global financial crisis (see, e.g., Carpenter, Demiralp, Ihrig and Klee, 2015; Neely, 2015) and by the European Central Bank during the European sovereign debt crisis (see, e.g., Eser and Schwaab, 2016; Krishnamurthy, Nagel and Vissing-Jorgensen, 2018; Koetter, 2019). Moreover, as entering the COVID-19 crisis, corporate bond purchases by the Fed are also found to ease funding constraints for borrowing firms and improve financial stability (see Flanagan and Purnanandam, 2020). We provide evidence that (downward) adjustments to the repo rate and open market purchases in the borrower's country are a sufficient tool for easing the aggravating effect stemming from the borrower's exposure to COVID-19. On the other hand, operations in the lender's country are not able to contain the effect from the lender's exposure.

2.2. Hypotheses development

Our basic premise is that the COVID-19 crisis exerts a negative supply- and demand-side effect on bank loan spreads. Crises and consequent uncertainty shocks drastically change bank lending behavior as banks engage in precautionary liquidity hoarding and rebalance their portfolios toward safer assets; eventually available capital in financial markets dries up, leading to a restriction in credit supply and higher lending rates (see Caballero and Krishnamurthy, 2008; Giannetti and Laeven, 2012; Kahle and Stulz, 2013). These tight lending conditions are further reinforced by the transmission of shocks to bank capital both domestically and internationally, exacerbating bank capital constraints and the reduction in overall supply of bank credit (see Kashyap and Stein, 2000; Peek and Rosengren, 2000; Cetorelli and Goldberg, 2011).

However, the current pandemic also constitutes an unexpected demand shock. By dramatically decreasing revenues for most firms, prevents them from meeting their fixed expenses and service their current debt obligations. Although some firms respond by reducing capital expenditures and resorting to own funds, they still face the need to supplement internal funding with debt financing and rolling over existing debt (Fahlenbrach, Rageth and Stulz, 2020).

However, early evidence from the ongoing pandemic documents deteriorating liquidity conditions in the corporate bond market that limits the ability of firms to raise debt (see Kargar, Lester, Lindsay, Liu, Weill and Zúñiga, 2020).

In light of the above mechanisms, we expect that the negative credit supply shock stemming from the COVID-19 crisis is accompanied by an increase in the firm demand for credit, thereby leading to higher cost of loans. This forms our first hypothesis (H1):

H1: *Greater exposure to COVID-19 increases the spread on the loans granted (received) by the lender (borrower).*

We further expect central bank interventions to ease the pressure on loan spreads. Financial crises typically result in a drop in the value of assets in bank portfolios, thereby lowering their use as top-quality collateral in repurchase ("repo") agreements. As banks rely on repo agreements for short-term funding, any disruptions in the repo market (such as haircuts or withdrawal of agreements) prevent banks from rolling over their short-term borrowing (see Martin, Skeie and Thadden, 2014). Banks respond by cutting back on lending and/or charging higher interest rates; this was a typical feature of the U.S. credit crunch (see Brunnermeier, 2009; Ivashina and Scharfstein, 2010; Gorton and Metrick, 2012; Kahle and Stulz, 2013). However, the drop in asset values has further implications for firms, as they find it harder to obtain financing at competitive rates by pledging their assets as collateral (Caballero and Krishnamurthy, 2001; Gorton and Ordonez, 2014).

Through the conduct of reverse repo operations and asset purchases in the secondary market, central banks adjust the quantity and consequently the price and liquidity of securities available; this further changes the value of assets in bank and firm portfolios. In fact, recent evidence from the COVID-19 crisis reveals the effectiveness of the Fed's liquidity provision in stabilizing conditions in short-term funding markets (see Li, Li, Macchiavelli and Zhou, 2020), while its corporate bond purchases appear to have eased borrowers' funding constraints and improved financial stability (see Flanagan and Purnanandam, 2020). On the same line, the European Central Bank's interventions have ensured the smooth operation of the Euro Area repo market (Billio, Costola, Mazzari and Pelizzon, 2020).

Given the scale of central banks' response to the pandemic, we expect that central bank operations (in the form of adjustments to the repo rate and asset purchases) ease the aggravating effect of COVID-19 on the cost of bank loans. This in turn leads to our second hypothesis (H2):

H2: *Central bank operations contain – if not reverse – the increase in loan spreads.*

The ongoing pandemic has significantly stressed firm balance sheets by lowering the value of firm assets and consequently the value of collateral that firms can borrow against; a comparable decline in the value of firm equity translates to higher leverage, causing firms to face higher financing costs (see Kiyotaki and Moore, 1997; Brunnermeier and Oehmke, 2013; Kahle and Stulz, 2013). Moreover, the disruption in economic activity during the COVID-19 crisis and the resulting negative shock to aggregate demand, causes firms to further face liquidity shortages and the inability to cover operating expenses and costs of existing debt. Therefore, the deteriorating balance sheets of firms will be an opposing factor to the firms' quest for obtaining financing at competitive interest rates.

Given this, we conjecture that lenders will respond by accommodating the needs of financial constrained borrowers, nevertheless this will be at the expense of higher loan spreads. In other words, we expect the COVID-19 crisis to exert a balance sheet multiplier effect on firm borrowing costs. This leads us to form our third hypothesis (H3):

H3: *The increase in loan spreads is stronger for financially constrained borrowers relative to non-financially constrained borrowers.*

We further expect the upward adjustment of loan spreads (in response to increasing lender's exposure) to be contingent on the characteristics of the lending bank. Large banks have

introduced more structured and formal systems for loan approval, portfolio monitoring, capital adequacy analysis as well as profitability and loan pricing analysis (Treacy and Carey, 2000). Rising uncertainty, such as that during the coronavirus crisis, causes banks to engage in more heavy and costly monitoring to reduce credit risk in their loan portfolios. Hence, they can either reject the allocation of new loans or pass on costs to borrowers in the form of higher interest rates. Large and well capitalized banks often solve this risk-shifting problem by charging higher spreads (see Dell'Ariccia, Laeven and Marquez, 2014; Dell'Ariccia, Laeven and Suarez, 2017).

If this is a credible mechanism for setting loan spreads, we expect that the aggravating effect of lender's exposure is magnified for loans granted by large and well capitalized lenders. This in turn gives rise to our fourth hypothesis (Hypothesis 4):

H4: *The aggravating effect of COVID-19 exposure on loan spreads is magnified for larger and better capitalized lenders than smaller and less capitalized lenders.*

Although we expect banks to adjust loan spreads upward following a rise in the borrower's COVID-19 exposure, this response should be contingent on the nature and type of their borrowing counterparty. In this respect, the adjustment should be less sizable – or even reversed – for large borrowers with unrestricted access to alternative funding sources. Large firms have different structural characteristics and corporate governance schemes that lead them to react differently to the same economic shocks relative to smaller firms (Chan and Chen, 1991). In addition, large and sophisticated borrowers might operate more efficient credit risk departments that monitor the firm's credit risk exposure.

Large firms are often listed on multiple stock exchanges. A foreign listing gives the firm the incentive to provide higher quality financial information and places the company under scrutiny from reputable intermediaries (Lang, Raedy and Wilson, 2006; Shi, Magnan and Kim,

2012). The resulting higher disclosure standards combined with the dual pressures from both foreign and domestic stock exchanges makes cross-listed firms more adept at attracting alternative sources of financing (see Hillman and Wan, 2005). All this renders them less susceptible to adverse economic developments relative to single-listed borrowers.

Prior bank-firm relationships emerge as an additional mechanism for minimizing uncertainty regarding the firm's ability to repay the loan. Typically, these lending relationships convey information to banks that firms cannot credibly communicate to the capital markets (Kang and Stulz, 2000; Bharath, Dahiya, Saunders and Srinivasan, 2009). As such, firms can capitalize on such relationships in bad times and strengthen their bargaining power during the loan negotiation process (Bolton, Freixas, Gambacorta and Mistrulli, 2016).

In the presence of the above mechanisms, we will observe a reversal in the sign of the borrower's COVID-19 exposure for loans to large and continuous borrowers listed on multiple stock exchanges. This leads to our final hypothesis (Hypothesis 5) as follows:

H5: *The aggravating effect of the borrower's COVID-19 exposure is contained for larger and cross-listed borrowers with a previous lending relationship than smaller and first-time borrowers listed only domestically.*

3. Data and Empirical Methodology

We obtain data from multiple sources. We collect data on syndicated loan facilities (the unit of our analysis) from DealScan, which includes the most comprehensive and historical loan-deal information available on the global syndicated loan market. We focus on the period from 1 January 2019 to 31 July 2020, contrasting the year of the global pandemic with the year before. We drop all loans for which there is no conventional pricing (i.e., there is no spread) and this removes some very specialized credit lines. We match the loan facilities with bank-level and

firm-level COVID-19 exposure measures from Hassan, Hollander, van Lent and Tahoun (2020b). In a last round of data collection, we obtain bank- and firm-specific characteristics from Compustat, and additional macroeconomic and institutional (country-year) variables from several freely available sources. The number of loan facilities for our baseline specifications ranges from 2,979 to 4,117 depending on the controls and the set of fixed effects used. These 4,117 loans are granted by 77 lead lenders headquartered in 11 countries to 820 borrowers from 28 countries.[2] We provide variable definitions and sources in Table A1 of the Internet Appendix and basic summary statistics in Table 1. In Appendix Figure A1 we present the number of loans by borrower's country.

[Insert Table 1 about here]

3.1. Empirical model and key variables

The baseline form of our empirical model is:

$$Cost\ of\ credit_{lt} = a_0 + a_1 Bank\ COVID\text{-}19\ exposure_{bt} + \\ + a_2 Firm\ COVID\text{-}19\ exposure_{ft} + a_3 Controls_{kt} + u_{lt} \quad (1)$$

The outcome variable *Cost of credit* is the all-in spread drawn (*AISD*) of loan facility *l* originated at time *t*. This is the most widely used measure, denoting the spread over LIBOR, although a strand of the literature (e.g., Berg, Saunders, Steffen and Streitz, 2016) also highlights the importance of fees and the all-in spread undrawn (AISU). The vector a_0 denotes different types of fixed effects, described later. *Controls* is a vector of control variables of dimension k, and u is a stochastic disturbance.

[2] Consistent with relevant studies on the syndicated loan market we only include information on lead lenders (see, e.g., Santos and Winton, 2019; Delis, Hasan and Ongena, 2020).

Bank (Firm) COVID-19 exposure is the lender's (borrower's) exposure to COVID-19 from Hassan, Hollander, van Lent and Tahoun (2020b) based on the counting of word combinations referring to COVID-19 in quarterly earnings conference calls held by publicly listed companies. The company's exposure is calculated by parsing the available earnings call transcripts and counting the number of times the synonyms associated with COVID-19 are used. Consequently, this number is divided by the total number of words in the transcript to account for differences in transcript length.

The main coefficients of interest in Equation (1) are a_1 and a_2, which indicate the effect of lender's and borrower's exposure to COVID-19 respectively on the cost of credit. We expect a_1 and a_2 to be positive if greater exposure increases the lender's and borrower's default risk thus increasing the spread on syndicated loans. The lender's exposure reflects the overall credit risk that the bank is exposed to arising from the bank's total lending operations as well as the bank's funding constraints. It is therefore an indication of how the coronavirus crisis affects the bank's ability to fund the loan and the bank's risk aversion that shape loan supply.

On the other hand, the borrower's exposure refers to the firm-specific credit risk and the firm's ability to repay the loan. As such, we expect the lender's exposure to exert a stronger impact relative to the borrower's, if supply-side forces matter more for the determination of loan spreads relative to demand-side forces during the COVID-19 crisis. Reversely, the dominance of demand-side forces over supply-side forces will be reflected in the stronger impact of the borrower's exposure compared to the lender's.

In alternative specifications, we consider the first and second moments of our baseline measure. These are the components of the company's exposure to the COVID-19 outbreak. The first component reflects the company's sentiment regarding the pandemic, by counting the use of negative-tone words used in conjunction with discussions of COVID-19 (*Bank COVID-19 sentiment* and *Firm COVID-19 sentiment*). The second component reflects the pandemic-

stemming risk, by counting the use of synonyms for "risk" and "uncertainty" (*Bank COVID-19 risk* and *Firm COVID-19 risk*).

3.2. Validation of COVID-19 exposure measure

The COVID-19 exposure measure we employ is based on a general text-classification method and identifies the exposure of companies to an outbreak of an epidemic disease by counting the number of times the disease is mentioned in the quarterly earnings conference call that public listed firms host with financial analysts. This approach has been validated in the recent works of Hassan, Hollander, van Lent and Tahoun (2019, 2020a) in the context of measuring a company's exposure to political risk, Brexit, and to shocks such as the Fukushima nuclear disaster. We further show that the COVID-19 exposure measures correlate significantly with the realized volatility of the company (either bank or firm) stock returns. This in turn is a clear requirement for any valid measure of risk. We employ the following specification:

$$Realized\ volatility_{it} = a_0 + a_1 COVID\text{-}19\ exposure_{it} + a_2\, X_{it} + u_{it} \qquad (2)$$

The outcome variable *Realized volatility* is the realized stock return volatility of the company *i* in quarter *t* (either *Bank realized volatility* for bank *i* or *Firm realized volatility* for firm *i*) and *COVID-19 exposure* is the company's measure of exposure to COVID-19 (either *Bank COVID-19 exposure* or *Firm COVID-19 exposure*) described in Equation (1). The vector a_0 denotes different types of fixed effects, *X* is a vector of control variables (at the bank- or firm-level), and u is a stochastic disturbance. Throughout, we cluster standard errors by company (either bank or firm). We present results in Table 2, where we estimate separate regressions for our sample of banks (columns (1)-(3)) and firms (columns (4)-(6)).

[Insert Table 2 about here]

Column (1) shows the most parsimonious specification, where we regress *Bank realized volatility* on *Bank COVID-19 exposure* and a constant term. The coefficient on our exposure measure is positive and statistically significant at the 1% level, suggesting that a one standard deviation increase in the bank's exposure is associated with a 0.19 standard deviation increase (= (0.57 × 1.24) ÷ 3.80) in the bank's stock return volatility. A similar response is observed in column (2), when we additionally control for bank's size and in column (3), where we extend our set of bank-level controls. We replicate these estimations in columns (4)-(6) to examine the impact of our firm-level exposure measure on firm's realized stock return volatility. Based on specification (4), a one standard increase in *Firm COVID-19 exposure* raises *Firm realized volatility* by 0.09 standard deviations (= (1.04 × 0.23) ÷ 2.59); similar results are obtained in the remaining specifications.[3]

The sign and size of these responses are in line with those in the examination of economic policy uncertainty measures (see Baker, Bloom and Davis, 2016) or firm-level political risk and Brexit uncertainty measures (see Hassan, Hollander, van Lent and Tahoun, 2019 and Hassan, Hollander, van Lent and Tahoun, 2020a respectively). The conclusion from this validation exercise is that company transcripts with the highest COVID-19 exposure indeed center on the discussion of COVID-stemming risk and uncertainty. Even when controlling for time-series and cross-sectional variations (by including time and industry fixed effects where relevant), it appears that variations in our COVID-19 exposure measure line up intuitively with variations in aggregate company uncertainty. Consistent with these observations, *Bank COVID-19 exposure* (*Firm COVID-19 exposure*) correlates significantly with banks' (firms') stock return volatility.

3.3. Identification, controls, and fixed effects.

[3] In alternative specifications we include firm industry fixed effects and further estimate all specifications without a constant (not reported here for brevity).

A key aim of our empirical analysis is to identify the causal effect of COVID-19 on the *Cost of credit*. Given that, we want to ensure that our empirical tests are not driven by inappropriate identification assumptions. The key identifying assumption in our empirical strategy is that trends related to loan spreads are the same among less exposed and more exposed lenders (borrowers) in the absence of the COVID-19 crisis. Figure 1 presents the evolution of average loan spreads between lenders (borrowers) in the bottom and top tercile of our sample in terms of their *Bank COVID-19 exposure* (*Firm COVID-19 exposure*). In Panel A, we observe a parallel trend in the spreads of non-exposed and exposed lenders throughout 2019 (and a subsequent divergence entering 2020), which is an indicator that this assumption is reasonable. The same parallel trend in the pre-crisis period is observed for borrowers with low and high exposure (Panel B).

[Insert Figure 1 about here]

We are less concerned with simultaneity and reverse causality because a firm's exposure to the pandemic is determined before lenders make new loans. In our setting, the key problem is omitted-variable bias, especially when considering both loan counterparties' exposure to COVID-19. Consistent with related studies (e.g., Sufi, 2007; Ivashina, 2009; Delis, Hasan and Ongena, 2020), we control for the logarithm of the loan amount, the logarithm of loan maturity, the number of lenders in the syndicate, binary indicators for collateral and performance-pricing provisions, and the total number of covenants. We also conduct sensitivity tests without loan control variables to confirm that our model is not subject to a "bad controls" problem.

We further control for bank characteristics, such as bank size (*Bank size*), bank return on assets (*Bank ROA*) and bank capital (*Bank capital*); likewise, our set of firm-level controls includes firm size (*Firm size*), firm return on assets (*Firm ROA*) and firm leverage (*Firm leverage*). Following the relevant studies (e.g., Ivashina, 2009; Acharya, Eisert, Eufinger and Hirsch, 2019), we include the lags of our bank and firm controls. We additionally include

country-pair-year level variables, such as the difference in the GDP growth rate between the lender's country and the borrower's country (*GDP growth*) and their difference in GDP per capita (*GDP per capita*) to account for differences in the economic development and the macroeconomic environment between each country-pair.[4] We provide the exact definitions of these variables in Appendix Table A1 and summary statistics in Table 1.

To maintain a high level of variation in *Bank COVID-19 exposure* and *Firm COVID-19 exposure*, we initially consider a specification with a very simple set of fixed effects – namely year-, bank-, and lender's country-level effects – allowing us to estimate the coefficients on our COVID-19 exposure measures for the largest sample of banks and firms in our sample. These effects complement our bank-level characteristics and allow us to control for general bank-side explanations of our findings (such as differences in banks' financial soundness and corporate governance). They further control for differences in the macroeconomic environment of the lenders', thereby saturating the effect of our COVID-19 exposure measures on *AISD* from any country-level socioeconomic and political effects on bank lending.[5] We however adopt more restrictive fixed effects in subsequent specifications.

In this regard, through the fielding of firm fixed effects we control for firms' credit risk and performance and any residual firm-side effects not captured by our set of firm-level characteristics, while through firm's industry effects we control for characteristics common to the firm's industry that may affect firms within that industry equally. We further control for

[4] We identify the lender's and the borrower's country as the one in which the lender and the borrower respectively is located. In the event where a loan is provided by the parent bank's foreign affiliate or subsidiary, the lender's country is set as the country of the affiliate/subsidiary. Similarly, for firms receiving loans through their foreign subsidiaries we set the borrower's country as the country of the affiliate/subsidiary. For example, although Citibank (the parent bank) is headquartered in the U.S., for loans provided by Citibank International Plc, we set the lender's country as the UK. In sensitivity tests, we examine cases where the lending bank has an affiliate or subsidiary in the borrower's country, by identifying all banks' subsidiaries/affiliates in the borrower's country. Similarly, we further identify all firms' subsidiaries/affiliates in the borrower's country, although the number of these subsidiaries is relatively small.

[5] These are country factors affecting all banks and firms within a country. Several studies examine such macro effects on international bank lending (e.g., Delis, Hasan and Ongena, 2020 and the associated references) and in this study these effects are fully controlled for via the fixed effects.

forces stemming from the macroeconomic environment in the borrower's country through the inclusion of borrower's country effects. Finally, we include loan type and loan purpose fixed effects; the former are important since loan facilities include credit lines and term loans, which have fundamental differences in their contractual arrangements and pricing (see Berg, Saunders and Steffen, 2016), while the latter control for the purpose of the loan (e.g., corporate purposes, working capital, takeovers or acquisitions, debt repayment, etc.).

In alternative specifications, we further use bank × year and firm × year fixed effects. The former allow us to control for any time-varying supply (bank)-side explanations of our findings. These explanations include changes in banks' financial soundness, corporate governance, and bank loan supply. The regression still yields results on the main coefficients of interest because each lead bank originates multiple loan facilities within a given year and *Bank COVID-19 exposure* is identified within years. Fielding the model with these fixed effects essentially implies that any bank-year accounting data that potentially affect the cost of credit are redundant. Equivalently, the firm × year fixed effects allow us to control for any time-varying demand (firm)-side explanations of our findings, such as firm credit risk and firm loan demand. Similarly, to the bank × year effects, the model is identified because there are multiple loan facilities to the same firm within years.

4. The effect of Bank- and Firm-level COVID-19 exposure on the Cost of Credit.

4.1. Baseline results.

We begin our analysis by looking at *Bank COVID-19 exposure* and *Firm COVID-19 exposure*. In Table 3, we sequentially include different combinations of our set of bank- and firm-level exposure measures. This allows us to isolate the effect of lender's exposure from that of the borrower's and further identify whether the effect – if any – exerted by the exposure to the pandemic is lender- or borrower-driven. Table 3 reports the results including the coefficient

estimates and t-statistics obtained from standard errors clustered by bank.[6] Our preferred specification includes year, bank, and lender's country fixed effects. Given that we compare the year of the pandemic with the year before, we choose the respective set of fixed effects as they control to a reasonable extent for time-invariant bank characteristics and macroeconomic fundamentals without being overburdened by fixed effects, thereby allowing for sufficient variation in our variables of interest.

[Insert Table 3 about here]

In the first column of Table 3, we only include *Bank COVID-19 exposure*, while in column (2) we only include *Firm COVID-19 exposure*. The coefficient on either exposure measure is positive and statistically significant, ranging between 17.0 and 8.5 basis points in response to a one standard deviation increase in our measures (= 47.2 basis points × 0.37 and 14.9 basis points × 0.57 for the bank-level and the firm-level measure respectively). In column (3), both measures are included concurrently in the regression. Although either measure retains its positive and statistically significant value, interestingly, much of the effect of *Firm COVID-19 exposure* is picked up by *Bank COVID-19 exposure*. This reveals the relative dominance of the lender's exposure for the determination of loan spreads over the borrower's exposure; a one standard deviation increase in the former increases *AISD* by 11.1 basis points (= 30.8 basis points × 0.37), which is more than double the size of the relevant increase of 5.1 basis points (= 8.9 basis points × 0.57) stemming from the firm-level measure.

Based on specification (3), the main coefficients of interest, a_1 and a_2 point to an economically sizeable effect of bank- and firm-level COVID-19 exposure on loan spreads, equal to a 6.6% (= 11.1 basis points ÷ 167.2 basis points) and 3.0% (= 5.1 basis points ÷ 167.2 basis points) increase respectively for the average loan in our sample. Given that the average

[6] In the last row of each table, we report the number of banks and firms from which we obtain identification in the corresponding estimations.

loan size is USD 1,080 million, an increase in the bank's COVID-19 exposure is translated into approximately USD 1.2 million (= USD 1,088 million × 11.1 basis points) per year in additional interest, while an increase in the firm's exposure into USD 0.55 million (= USD 1,088 million × 5.1 basis points). For an average loan maturity of 4.3 years, the additional interest rises to USD 5.16 million and USD 2.37 million respectively over the loan's duration.[7]

To ensure that our estimates are not driven by potential collinearity between a) our bank- and firm-level COVID-19 exposure measures and b) our exposure measures and the set of bank- and firm-level controls, we estimate the variance inflation factor (VIF) values for each of the variables entering our specifications in Table 3 (see, e.g., Berger and DeYoung, 1997). Estimates in Appendix Table A2 show that across all specifications all variables have VIF value less than 3.2, while most of them have VIF value of 2 or less. These results indicate that our exposure measures and set of control variables are not collinear.[8]

In Table 4, we consider distinct sets of fixed effects: in column (1), we start with our less demanding specification, where we include bank fixed effects, while in column (2), we add year fixed effects. In column (3), we introduce lender's country fixed effects that control for general macroeconomic conditions in the bank's country, along with borrower's fixed effects that control for time-invariant firm traits. Specification (4) is even more demanding, as we add borrower's industry and borrower's country fixed effects, controlling for developments within the firm's industry and the macroeconomic environment in the borrowing firm's country respectively, while our last specification (column (5)), introduces loan type and purpose fixed effects that control for the different types and purposes of the loan facilities. Across all

[7] Assuming 4.3 annual payments and LIBOR as the discount rate, the increase in interest expense equals USD 4.9 million and USD 2.25 million for the average 12-month LIBOR rate of 1.97% during our sample period (for similar calculations, see Ivashina and Sun, 2011).

[8] The correlation coefficient between *Bank COVID-19 exposure* and *Firm COVID-19 exposure* is 0.57 indicating that although there is a moderate positive relationship between the two measures, these measures do not move hand in hand. Importantly, the correlation drops to 0.31 during 2020, pointing to a weak positive relationship between our baseline exposure measures. Similar correlation coefficients are observed for the remaining COVID-19 exposure measures (i.e., between *Bank COVID-19 sentiment* and *Firm COVID-19 sentiment* and between *Bank COVID-19 risk* and *Firm COVID-19 risk*).

specifications, the coefficients on *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are consistently positive and statistically significant at all conventional levels. Based on our estimates in Tables 3-4 and consistent with Hypothesis 1, we can infer that greater exposure of banks and firms to COVID-19 substantially increases the cost of loans, *ceteris paribus*.

[Insert Table 4 about here]

In Table A3 of the Appendix, we examine the sensitivity of our estimates to the "bad controls" problem by interchangeably excluding loan-level control variables from our specifications. Irrespective of the specifications used, the coefficients on our COVID-19 exposure measures retain their positive, statistically significant value, ranging between 9.7-11.4 basis points and 3.0-4.8 basis points per one standard deviation increase in the bank-level and the firm-level measure, respectively.[9] We further run a seemingly unrelated regression (SUR) model that accounts for the simultaneous setting of the price and non-price loan terms by the lending banks at the time of the loan origination (Gropp, Gruendl and Guettler, 2014). In this setting, we estimate a system of regressions, where in addition to *AISD*, several different loan terms, namely *Loan amount*, *Maturity*, and *Collateral*, and our COVID-19 exposure measures (*Bank COVID-19 exposure* and *Firm COVID-19 exposure*) are regressed on the same set of regressors in our baseline equation (including the *AISD*). Results in Appendix Table A4 confirm the robustness of our baseline OLS estimates.[10]

Moreover, in the first two columns of Appendix Table A5 we replicate our baseline specification by considering alternative COVID-19 exposure measures. These measures refer to the components of our principal measure and capture the negative sentiment (column (1)) and risk (column (2)) stemming from COVID-19. In either specification, the coefficients on

[9] The replacement (or addition) of *General covenants* with the number of financial covenants or net covenants leaves our results unchanged.
[10] For expositional purposes, we only report estimates from the regressions where the dependent variable is *AISD*. The estimates from the other equations in the model are available on request.

these measures are qualitatively and quantitatively similar with those from Table 3 and even exceed our baseline estimates, which appear to be more conservative.

In column (3), we replace our COVID-19 exposure measures with bank and firm realized stock return volatility. Again, higher volatility is associated with greater loan spreads: one standard deviation increase in *Bank realized volatility* (equal to 4.63) raises *AISD* by approximately 9 basis points, while the equivalent response to *Firm realized volatility* is 2.5 basis points. Finally, we employ a measure of country-wide uncertainty, such as the number of confirmed COVID-19 cases in the lender's and borrower's countries: estimates from column (4) show that a rise in the number of cases leads to a corresponding increase in spreads.[11]

Lastly, in Appendix Table A6, we control for the operation of the loan supply and loan demand channels by employing specifications with bank × year and firm × year fixed effects. We initially control for any time-varying supply-side explanations of our findings through the fielding of bank × year fixed effects (column (1)). We consequently replace bank × year effects with firm × year effects to control for within-year variation at the firm-level (column (2)).[12] In either specification, *Bank COVID-19 exposure* and *Firm COVID-19 exposure* exert a positive and statistically significant effect on *AISD*. Interestingly, the coefficients on both the bank- and firm-level exposure measures grow in size and significance when moving to the specification with firm × year fixed effects (column (2)). This in turn is an indication that our results are more susceptible to supply-side forces relative to demand-side forces.

The size and magnitude of the coefficients on the control variables in Tables 3-4 are in line with the prior works of Bae and Goyal (2009), Ivashina (2009), Cai, Eidam, Saunders and Steffen (2018) and Delis, Hasan and Ongena (2020). In particular, loan spreads decrease with loan amount and increase with maturity and collateral; also, they are more competitively priced

[11] In unreported regressions, we further use the number of confirmed deaths from COVID-19 or the fatality rate, i.e., the ratio of the number of deaths to the number of cases.
[12] By including firm × year fixed effects, we exclude from the regression all firms receiving only one loan facility within the year, hence the small drop in the number of observations.

when more lenders and covenants are included in the loan facility. The role of bank and firm characteristics is consisted with our anticipation: greater size is associated with decreasing *AISD*, while greater return on bank (firm) assets further increases (decreases) spreads.

Overall, results from our baseline estimations reveal that the lender's exposure to COVID-19 constitutes the main contributing factor to higher loan spreads, while the firm-specific credit risk stemming from the borrower's exposure also exerts a meaningful, although less potent effect. In what follows, we examine the role of government restrictions to contain the evolution of the COVID-19 pandemic, the central bank interventions targeting credit supply, and the financial constraints of firms that determine credit demand.

4.2. Government responses to COVID-19.

An implicit assumption in our identification strategy is that loans carry a higher interest rate following an increase in the lending bank's and borrowing firm's exposure to COVID-19. However, this exposure is not only a function of the bank's and firm's activities, but it could also be contingent on the domestic economic environment and conditions in which the loan counterparties operate. In response to the developing pandemic, national governments adopted various measures to limit the spread of the virus with a consequent impact on economic activity. If counterparties operate in economies with high restrictions where economic activity is essentially at a stand-still, we expect the demand for loans to increase as firms look for funding sources to cover fixed expenses. This is because higher stringency measures and economic restrictions increase the level of uncertainty and risk aversion domestically.

We expect banks and firms to be equally affected, since higher stringency exerts a supply-side and a demand-side effect, lowering the bank supply of credit and increasing the firm demand for credit, respectively. In such a case, we should observe a premium in loan spreads in the presence of greater restrictions over and above the premium observed following

a generic increase in each counterparty's exposure. To examine this contingency, we consider the stringency index of Hale, Angrist, Kira, Petherick, Phillips and Webster (2020) that captures variation in containment and closure policies in response to COVID-19 across countries.[13] We present results in Table 5, where we interact each of our bank- and firm-level exposure measures with the stringency index in the relevant counterparty's country. To allow for the direct interpretation of the coefficient estimates on both the interaction terms and the main terms, we mean-center the variables included in the interaction terms.

[Insert Table 5 about here]

Initially, we consider the degree of restrictions in the lender's country (column (1)). According to our estimates, loans from banks operating in countries with high stringency measures carry an additional interest rate premium (positive coefficient on *Bank COVID-19 exposure* × *Lender's stringency*). The additional cost amounts to approximately 2.7 basis points (= 0.306 basis points × 0.36 × 24.06) following a one standard deviation increase in our bank's exposure and stringency measures. What matters, is that this increase is independent of the higher interest rate charged following an increase in the bank's exposure to the pandemic: the latter is reflected on the coefficient on *Bank COVID-19 exposure*, which remains statistically significant and within the range suggested by our baseline estimates.

We consequently examine the level of stringency in the borrower's country (column (2)). Again, we find that greater government restrictions increase the cost of credit for borrowing firms with a higher exposure to COVID-19 (coefficient on interaction term). These firms receive loans with an additional 2.1 bps spread relative to firms in countries with lesser restrictions. This is almost 35% of the premium charged following an increase in the firm's COVID-19 exposure regardless of the restrictions adopted (coefficient on *Firm COVID-19*

[13] The index ranges from 0 to 100, with higher values reflecting higher stringency and concerns nine key areas: school closing, workplace closing, cancelled public events, restrictions on gatherings, close public transport, stay at home requirements, restrictions on internal movement, international travel controls, public information campaigns.

exposure). The positive differential effect of higher government restrictions on loan spreads is further confirmed in specification (3), where we consider both stringency measures. Specifically, spreads increase by 2.4 and 2.1 basis points in response to a one standard deviation increase in the lender's and borrower's stringency measures respectively (coefficients on interaction terms). More importantly, this response is over and above the generic increase attributed to a rise in the bank's and the firm's exposure to the pandemic (coefficients on main terms). Our analysis suggests that the level of restrictions adopted domestically, as well as on cross-border movements of goods and services, aggravated the increase in the borrowing costs of the exposed firms.

4.3. Central bank responses to COVID-19.

Having established the added importance of higher government restrictions during the COVID-19 pandemic, we now turn our focus to measures adopted at the monetary policy front. Major central banks, such as the ECB and the Fed, immensely expanded the scope of their repurchase agreement operations (both in terms of amount and maturity) to direct cash to the money markets. These served as precautionary backstop facilities to address liquidity needs and potential market dysfunctions that might hamper the smooth transmission of monetary policy. They were further accompanied by central bank purchases of private and public sector securities in the secondary market.[14]

Our approach in this subsection is two-fold: a) to examine whether central bank liquidity provisions mitigated the aggravating effect of bank- and firm-level exposure on loan spreads,

[14] The ECB initiated the Pandemic Emergency Purchase Programme (PEPP) in March 2020 in order to counter the serious risks to the monetary policy transmission mechanism and the outlook for the euro area due to the COVID-19 outbreak. Under this temporary asset purchase programme, private and public sector securities of €600 billion were scheduled to be purchased; on 4 June 2020, this amount was increased by an additional €750 billion to a total of €1,350 billion. The Federal Reserve initiated the Secondary Market Corporate Credit Facility (SMCCF), which was announced on 23 March 2020. This facility included the purchase of corporate bonds, with the first purchases being conducted on 16 June 2020.

and b) to identify the potential effect of outright central bank interventions in the form asset purchases. As such, we estimate specifications including the interactions between our bank- and firm-level exposure measures with the repo rate in either the lender's or borrower's country and indicators for the periods covering the conduct of central bank asset purchases. Since European and U.S. entities (banks or firms) dominate our sample and given the importance of the euro and the United States dollar for the functioning of global financial markets, we limit our analysis to the subsample of European and U.S. lenders. We present results in Table 6.

[Insert Table 6 about here]

According to our estimates, the level of repo rate in the lender's country is not able to contain the effect stemming from the bank's increasing exposure to COVID-19; the coefficient on *Bank COVID-19 exposure* × *Repo rate (lender)* in column (1) is not statistically significant at conventional levels. This stands in contrast to the repo rate in the firm's country, the decrease of which enables firms to reverse the increase in *AISD* resulting from their COVID-19 exposure: a one standard deviation decrease in *Repo rate (borrower)* saves firms that experience an increase in their exposure approximately 14.8 basis points off their spreads (coefficient on *Firm COVID-19 exposure* × *Repo rate (borrower)* in column (2)). This is in turn over 40% of the generic spread increase due to the firm's exposure to COVID-19 (coefficient on main term in column (2)). The easing capacity of the repo rate in the firm's country is further confirmed in specification (3), where the regression includes the simultaneous interaction of the bank- and firm-level exposure measures with the relevant repo rates in the bank's and firm's countries.

Specifications (4)-(6) examine the differential effect of central bank interventions. Again, only those interventions conducted in the borrower's country reverse the aggravating effect of COVID-19 on the borrowing costs of the country's firms. On the other hand, the period covering the central bank purchases in the lender's country is not associated with a statistically significant effect on the exposed banks' spreads. Our final specification (column (7)), examines

the differential effect exerted by the banks' participation in the Paycheck Protection Program (PPP).[15] If participating banks use the additional fee income to lower the interest rate spreads charged on conventional loans, this should reverse the aggravating effect of their COVID-19 exposure on *AISD*. Nevertheless, results from column (7) reveal that participation in the program does not exert a differential effect on the lending banks' spreads.[16]

We conclude that while central bank measures (either by affecting the repo rate or in the form of asset purchases) are not able to ease the pressures on loan spreads stemming from the lenders' exposure to the pandemic, they are nevertheless successful in containing the borrowing firms' exposure. This in turn provides partial support for Hypothesis 2.

4.4. Firm financial constraints.

Our next exercise concerns the role of financial constraints of the borrowing firms. Financially constrained firms have reduced access to credit or access to higher cost of credit, which deteriorates their performance prospects, especially during turbulent periods or when experience financial distress; the resulting deterioration in their fundamentals further increases default risk fueling a vicious cycle (see Bruche and González-Aguado, 2010; Campello, Graham and Harvey, 2010; Behr, Norden and Noth, 2013). Given that, we expect that higher constraints inflate borrowing costs for firms with greater exposure to the pandemic.

To examine this conjecture we interact our bank and firm COVID-19 exposure measures with a series of indicators reflecting the level of financial constraints and default risk of the borrowing firm. Our first indicator is a binary variable equal to one if the borrower's Whited and Wu (2006) index is in the top tercile of our sample and zero if the index is in the bottom tercile (see Farre-Mensa and Ljungqvist, 2016). Estimates in column (1) of Table 7 suggest that

[15] Under the Paycheck Protection Program the U.S. Federal government provided loans totaling USD 669 billion to small businesses at an interest rate of 1%.
[16] Since the PPP targeted small businesses, these are not included in our sample of borrowers. Due to this feature, we only examine the lending banks' participation in the program.

greater financial constraints raise loan spreads for exposed firms; furthermore, these constraints are priced equally by banks and firms for a given level of COVID-19 exposure, as the coefficients on both interaction terms are positive and statistically significant. Importantly, a firm's exposure to COVID-19 does not raise loan spreads unless the firm is in the top tercile of the index (negative and statistically significant coefficient on *Firm COVID-19 exposure*).

[Insert Table 7 about here]

In column (2), we replicate column (1) by replacing our financial constraints measure with an indicator based on the Kaplan and Zingales (1997) index (*Constrained (KZ index*)). Again, results confirm the positive effect of financial constraints on the borrowing costs of exposed firms. We further examine whether the effect of COVID-19 exposure varies according to the default risk of the borrowing firms. In column (3), we distinguish between high and low default risk firms based on the firms' Altman's (1968) Z-Score. Estimates reveal that default risk contributes to the rise in the exposed firms' borrowing costs on top of the banks' and firms' exposure to the pandemic (positive and statistically significant coefficients on both interaction and main terms). Overall, findings in this section provide support for Hypothesis 3 and our initial claim that COVID-19 has an adverse effect on firm balance sheets, rendering firms less attractive as borrowers. Banks in turn, respond to the increasing demand for loans from these cash strapped firms by offering loans at higher rates.

5. Analyzing the mechanisms.

Thus far, our analysis points to higher cost of loans in response to greater exposure of the lending banks and borrowing firms to the COVID-19 pandemic. In this section, we identify the mechanisms through which this exposure materializes into higher borrowing costs. By building on our findings, we examine whether the effect of this exposure on loan spreads varies across

different bank and firm types, and whether it is contingent on the ability of the borrower's country to attract investors or the formation of the syndicate.

5.1 Exploring the mechanisms: Lender fundamentals.

The present subsection considers alternative supply-side explanations of our findings and identifies certain bank traits that act as drivers of our results. To this end, Table 8 includes the interaction of our bank-level exposure measure with several bank characteristics reflecting the bank's size, profitability and capital adequacy. Specification (1) reveals that the effect of bank-level exposure on firm cost of credit is concentrated in large borrowers. According to column (2), a bank's COVID-19 exposure relates inversely to its return on assets, indicating that stronger bank performance acts as a counterforce to rising loan spreads. Specifically, banks achieving an additional 0.43% return on their assets can cut spreads by approximately 3.1 basis points, thereby reversing by 30% the generic increase due to the bank's exposure (coefficient on *Bank COVID-19 exposure* × *Bank ROA* and *Bank COVID-19 exposure* respectively).

[Insert Table 8 about here]

The next two specifications consider measures reflecting the bank's capital policy and solvency risk. Estimates from specification (3) point to a positive relationship between the bank's capital ratio and spreads. This is intuitive, as bank capital matters in the propagation of different types of shocks to lending, especially in the presence of regulatory capital constraints and imperfections in the market for bank fund-raising (Gambacorta and Mistrulli, 2004; Santos and Winton, 2009). Increasing capital by one standard deviation (or 2.28%) raises loan spreads by almost 2.0 bps or 18% on top of the increase attributed to the bank's exposure (coefficients on interaction term and main term respectively). Nevertheless, as column (4) suggests, the proportion of non-performing loans in their portfolio is not a material factor for loan spreads.

All specifications in columns (1)-(4) include the lagged values of our bank-level controls. However, growing exposure to the COVID-19 crisis may adversely affect key bank fundamentals. In fact, preliminary evidence from the coronavirus crisis documents the implications for bank portfolio composition and market power, which are further reflected on the health of their balance sheets (see Li, Strahan and Zhang, 2020; Tan, Martinez Peria, Pierri and Presbitero, 2020). To this end, in columns (5)-(8) we replicate the estimations of specifications (1)-(4) by replacing our lagged bank-level controls with their 3-year moving averages.[17] This should control for the impact of increasing COVID-19 exposure on bank balance sheets.[18] Turning to the results, these are fairly close to those from specifications (1)-(4). Overall, consistent with Hypothesis 4, the analysis in this section shows that the effect of the lender's exposure varies with the lending bank's size and capital base.

5.2 Exploring the mechanisms: Borrower fundamentals.

We further examine potential demand-side explanations relating to firm fundamentals and performance. We do so by interacting our firm-level COVID-19 exposure measure with a series of indicators reflecting the firm's size, profitability, capital structure and financing flexibility. We present results in Table 9, where we observe that larger firms enjoy a competitive advantage relative to smaller ones in reversing the aggravating effects of COVID-19 exposure on their borrowing costs (positive and statistically significant coefficient on the interaction term in column (1)). However, we don't observe the same when considering firm profitability, as the relevant interaction term in specification (2) enters with a non-statistically significant sign.

[Insert Table 9 about here]

[17] We are grateful to an anonymous referee for raising this issue.
[18] In alternative estimations, we further employ the 2-year moving average values for our set of bank controls or extend the lag of our baseline bank controls to 2 years.

We subsequently consider the firm's capital structure (specifications (3) and (4)). Although there is a non-statistically significant effect of firm leverage on the loan spreads of exposed firms (column (3)), we nevertheless observe a negative relationship between the firm's use of equity capital and spreads, as better capitalized firms face lower borrowing costs (column (4)). From a similar perspective, firms relying more on tangible assets reverse the higher loan spreads for a given level of exposure: as specification (5) suggests, increasing *Firm tangibility* by one standard deviation reverses almost 50% of the original spread increase due to their COVID-19 exposure (coefficients on interaction term and main term respectively). Similarly to Section 5.1, in Appendix Table A7 we replicate these estimations by replacing our lagged firm-level controls with their 3-year moving averages to control for the impact of growing COVID-19 exposure on firm balance sheets; results essentially confirm those from Table 9.

Finally, we examine the differential effect of the firm's listing status, since listing on a foreign stock exchange presents the issuing firm with an incentive to commit to providing higher quality financial information and exposes the company to further scrutiny of reputable intermediaries (Lang, Raedy and Wilson, 2006; Shi, Magnan and Kim, 2012). The dual pressures from both host and home countries' stock exchanges ensures that cross-listed firms provide credible information to market participants. This makes them more adept at attracting alternative financing sources, while their product market internationalization increases the likelihood that managers will issue forecasts, thereby minimizing information asymmetry about their future prospects and performance (Saudagaran, 1988; Hillman and Wan, 2005). For all these reasons, we expect that cross-listed firms are less sensitive to the aggravating effects of the pandemic relative to domestically listed companies. Indeed, estimates from column (6) suggest that the effect of *Firm COVID-19 exposure* on *AISD* is completely offset for cross-listed firms.

5.3. Exploring the mechanisms: Relationship lending.

Two potential sources of heterogeneity in the effect of bank- and firm-level COVID-19 exposure on loan spreads that can further help alleviate the negative implications of this exposure is the formation of lending ties and the utilization of bank and firm subsidiaries. Prior lending relationships allow lenders to acquire valuable information about the borrowing firm's operations and credit risk. It is therefore likely that firms with prior lending ties with their banks receive lower loan spreads relative to non-relationship borrowers. In this regard, relationship lending could reverse the negative repercussions from the banks' and firms' growing exposure to the pandemic. We test this hypothesis in Table 10, by interacting our variables of main interest with *Lending relationship*, a variable reflecting the existence of a prior lending relationship between the bank-firm pair over the previous 3-year period (see, e.g., Bharath, Dahiya, Saunders and Srinivasan, 2011; Dass and Massa, 2011).

[Insert Table 10 about here]

Estimates in column (1) show that relationship borrowers can save approximately 18.9 basis points or over 54% of the generic spread increase due to bank's exposure (coefficients on *Bank COVID-19 exposure* × *Lending relationship* and *Bank COVID-19 exposure* respectively); however, a prior relationship does not ease the aggravating effect of the firm's exposure on *AISD* (coefficient on *Firm COVID-19 exposure* × *Lending relationship*). The offsetting effect of relationship lending further increases with the size and magnitude of this relationship: the greater the number or the amount of loans between the given bank-firm pair during the previous 3-year period, the greater the interest rate savings for the borrowing firms (columns (2) and (3)). Overall, these estimates suggest that the resulting minimization of information asymmetry due to the formation of lending relationships is mainly of a supply side nature.

Consequently, we examine the role of subsidiaries. When the lending bank operates an affiliate or subsidiary in the borrower's country, it can gain access to important information

about the borrower's creditworthiness and operations. The bank is more accustomed to the domestic economic environment, while it can further remove part of macroeconomic risk if it can fund the loan through its affiliate/subsidiary by resorting to the domestic wholesale markets. We thus expect that borrowers resorting to lenders with subsidiaries in the borrower's country, minimize information asymmetry regarding the firm's credit risk and the domestic macroeconomic risk. Estimates in column (4) verify this conjecture as loans granted from banks with domestic subsidiaries carry an approximately 75% lower spread than the average loans directed to exposed firms (coefficients on *Firm COVID-19 exposure* × *Bank subsidiary* and *Firm COVID-19 exposure* respectively). Similar reasoning applies to firms operating subsidiaries in the lead bank's country: borrowers can communicate important information about their operations to the lender in order to reduce information asymmetry. However, as estimates in specification (5) reveal, this is not sufficient to lower spreads.

Altogether, largely consistent with Hypothesis 5, subsections 5.2 and 5.3 reveal that the effect of the borrower's exposure is contingent on the borrowing firm's size as well as its listing status, while prior transactions with the lending bank mainly reduce the upward pressure on spreads stemming from the lender's exposure.

5.4 Exploring the mechanisms: Institutional investors.

We subsequently examine whether the borrower's country ability to attract institutional investors relieves some pressure on loan spreads stemming from the lenders' and borrowers' exposure. Institutional quality is important in our context, since powerful institutions and the ability to attract institutional investors are largely considered a driving force shaping firm performance and borrowing costs (Qian and Strahan, 2007; Qi, Roth and Wald, 2010). In fact, their presence may reduce firm cost of credit as firms with greater proportions of institutional investors are likely to have lower agency costs due to better monitoring. This alleviates the need

for banks to engage in monitoring, thereby passing the savings to borrowing firms in the form of lower interest rates (Bhojraj and Sengupta, 2003; Dyck, Lins, Roth and Wagner, 2019). For these reasons, we expect that greater institutional investor involvement provides a positive signal to the lending banks, easing the aggravating effect of COVID-19 exposure on *AISD*.

We test this conjecture in Table 11, by interacting our measures of bank and firm COVID-19 exposure with several variables reflecting the level of institutional ownership in the borrower's countries. These variables concern the extent of firm disclosure intensity, the strength of legal rights and legal contracts. Across columns (1)-(3), we observe a negative differential effect of our institutional variables on *AISD* (coefficients on interaction terms). Importantly, we observe this differential effect for both exposed banks and firms. We additionally distinguish between countries in the top tercile of our sample in terms of institutional quality and protection and interact the relevant binary indicators with our exposure measures (columns (4)-(6)). Again, we find that the effect of *Bank COVID-19 exposure* and *Firm COVID-19 exposure* is considerably mitigated for countries in the top band of institutional scores. We conclude that countries with strong presence of institutional investors and strong institutional environment can contain somewhat the exacerbating effect of bank- and firm-level exposure on loan spreads.

[Insert Table 11 about here]

6. The role of syndicate structure

A potential channel through which the aggravating effect of COVID-19 exposure could manifest is syndicate structure, which operates via other lenders that join the lead bank in forming a syndicate. Since the exposure to the pandemic has both a supply-side and a demand-side nature, relating to the bank's and firm's exposure respectively, this manifestation takes two forms. The first is contingent on the lender's exposure. If syndicate members are unfamiliar

with the lead bank and/or concerned with the lead's pandemic exposure, this gives rise to an adverse selection problem wherein the lead bank must convince of its solid credit reputation. Being part of a more dispersed syndicate serves a certification effect, easing potential adverse selection and subsequent moral hazard concerns regarding the lead bank's fundamentals and risk exposure (see Sufi, 2007; Ivashina, 2009). In our setting, the addition of more lenders and the spread of loan shares across the syndicate would require a compensation (in the form of higher loan spreads) for the syndicate members. In other words, we expect the formation of a more dispersed syndicate to interact with *Bank COVID-19 exposure* in increasing *AISD*.

The second form relates to the borrower's exposure. This gives rise to a moral hazard problem for the informed lead bank because the informed lead's monitoring and due diligence effort is unobservable by the other syndicate members; to ensure diligence, the lead must retain a larger loan share to alleviate concerns that does not exert the necessary effort in due diligence and monitoring (see Sufi, 2007).[19] As such, we expect the formation of a more concentrated syndicate to lower spreads through its interaction with *Firm COVID-19 exposure*.

Below, we examine how syndicate structure helps alleviate the effect of the pandemic by interacting our bank- and firm-level exposure measures with several loan characteristics reflecting the size and structure of the syndicate. We present results in Table 12, with estimates from column (1) showing that an increase in the syndicate's number of lenders increases *AISD*. Specifically, including seven additional lenders in the syndicate (i.e., increasing *Number of lenders* by approximately one standard deviation) raises spreads by almost 5.6 basis points. Importantly, we observe this effect for the interaction of *Number of lenders* with *Bank COVID-19 exposure*, suggesting that the bank's exposure is a material concern for the syndicate members who require a premium for partnering with the exposed bank.

[19] Several other studies document that syndicate structure varies in regards to borrower attributes related to credit risk and transparency; see, e.g., Dennis and Mullineaux (2000), Lee and Mullineaux (2004) and Jones, Lang and Nigro (2005).

[Insert Table 12 about here]

Columns (2)-(3) feature the interaction of our exposure measures with the lead bank's loan share and syndicate concentration respectively. Both specifications confirm the spread premium required for the formation of a wider and less concentrated syndicate. According to column (2), decreasing *Bank share* by one standard deviation (or 11.2%) results in higher *AISD* by approximately 3.5 basis points (coefficient on *Bank COVID-19 exposure* × *Bank share*). This is further reflected in syndicate structure, with a decrease in the syndicate's Herfindahl index (i.e., the formation of a less concentrated syndicate) leading to an additional increase of similar magnitude in *AISD* (coefficient on *Bank COVID-19 exposure* × *Syndicate Herfindahl*).

Overall, across all specifications, the coefficients on our exposure measures remain positive and statistically significant, confirming the pandemic's aggravating effect on loan spreads. However, the bank's exposure is an additional consideration for syndicate members in their decision to join the syndicate. As a result, the formation of a wider and less concentrated syndicate requires the setting of a higher spread due to the lead bank's exposure.

7. Conclusions

This paper investigates the effect of the COVID-19 pandemic on the pricing of syndicated loans. We provide evidence of a rise in the cost of loans following an increase in the lending banks' and borrowing firms' exposure to COVID-19. We maintain that this increase is of a supply-side (primarily) and demand-side (secondarily) nature as loan spreads respond to both bank- and firm-level exposure.

Our baseline specification shows that a one standard deviation increase in our bank-level exposure measure raises loan spreads by over 11 basis points (or 6.6%), while the equivalent increase attributed to our firm-level measure is over 5 basis points (or 3%). This implies excess interest of about USD 5.16 million and USD 2.37 million respectively over the

duration of the average loan. These results persist in an array of sensitivity exercises and alternative estimation methods and are magnified by the level of government restrictions adopted at the national level to tackle the pandemic's outbreak. On the other hand, interventions at the monetary policy front are only effective in easing the pressures on loan spreads stemming from the borrower's rather than the lenders' exposure.

We further show that the effect of the pandemic is heterogeneous to the banks' and firms' financial health and performance. In specific, loans are more expensive when granted from larger, better capitalized but less-profitable banks. However, for larger and non-financially constrained firms that are listed on multiple stock exchanges and rely more on equity financing the aggravating effect of COVID-19 is much less potent, if at all present.

Our analysis reveals that institutional quality acts as a counterforce to the exacerbating effects of the pandemic. Firms in countries with strong institutional environment that can attract institutional investors receive lower spreads for a given level of lender's and borrower's exposure. Even for exposed firms, there are two strategies to mitigate the pandemic's adverse effects. The first concerns the formation of strong bank-firm relationships, which reduces the upward pressure on spreads stemming from the bank's exposure. Similarly, borrowing from a bank's subsidiary further minimizes information asymmetry due to the firm's exposure.

We finally document the implications for syndicate's structure. In response to growing bank exposure, the formation of a wider and less concentrated syndicate comes at the expense of higher spreads, as syndicate members require an additional compensation to partner with the exposed lead bank. Our results are a first step in understanding how varying exposure of loan counterparties to the COVID-19 pandemic affects loan pricing. An important extension would be the examination of the attendant consequences for the real economy.

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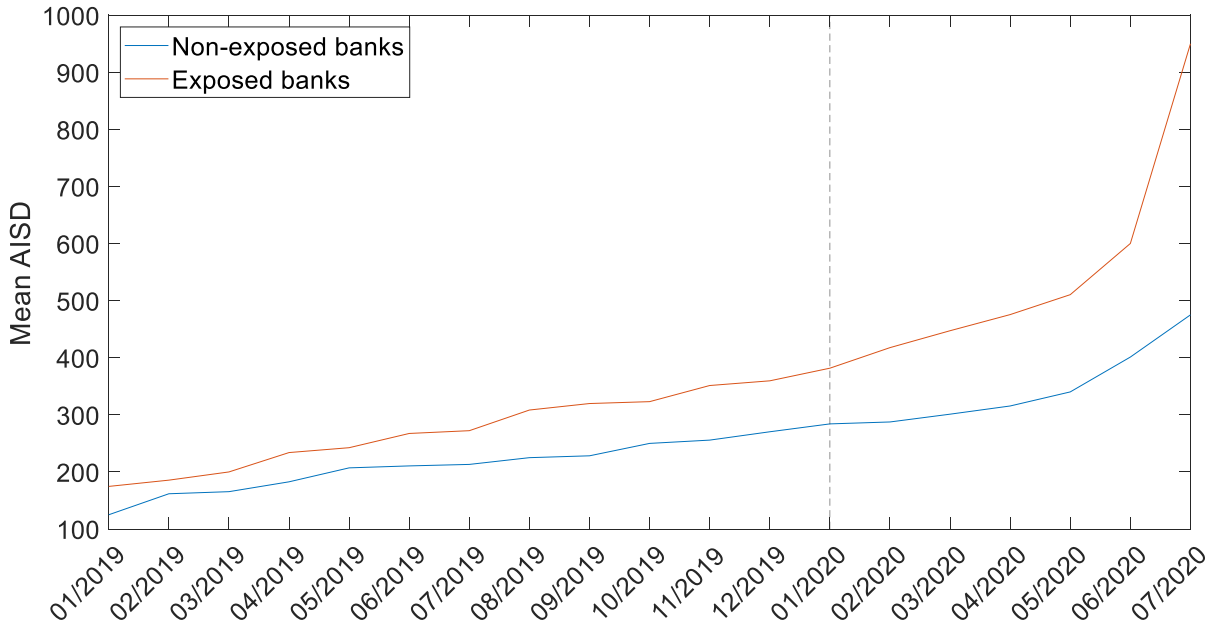
Figure 1. Average spreads for exposed vs non-exposed banks/firms

The figure reports the average *AISD* on all loans granted (received) in a given month by banks (firms) with high and low values of COVID-19 exposure. The average spread (in basis points) of loan facilities is depicted on the Y-axis and the corresponding month is depicted on the X-axis. Panel A reports the average spread for lenders with values of COVID-19 exposure on the bottom tercile of our sample (Non-exposed banks) versus lenders with values of COVID-19 exposure on the top tercile of our sample (Exposed banks). Panel B reports the average spread for borrowers with values of COVID-19 exposure on the bottom tercile of our sample (Non-exposed firms) versus borrowers with values of COVID-19 exposure on the top tercile of our sample (Exposed firms).

Panel A



Panel B

Table 1. Summary statistics

The table reports summary statistics (number of observations, mean, standard deviation, minimum and maximum values) for all variables used in the estimations of the main text. All variables are defined in Table A1.

	Obs.	Mean	Std. dev.	Min.	Max.
AISD	4,117	167.20	87.97	7.00	825.00
AISU	2,171	21.28	12.05	0.75	90.00
Bank COVID-19 exposure	4,117	0.10	0.36	0.00	2.56
Bank COVID-19 sentiment	4,117	0.05	0.18	0.00	1.09
Bank COVID-19 risk	4,117	0.00	0.04	0.00	0.63
Bank realized volatility	4,099	5.23	4.64	0.03	18.72
Bank COVID-19 exposure (firm-quarter)	290	0.26	0.57	0.00	3.52
Bank realized volatility (firm-quarter)	290	3.23	3.80	0.03	20.13
Firm COVID-19 exposure	4,117	0.16	0.57	0.00	6.58
Firm COVID-19 sentiment	4,117	0.07	0.26	0.00	2.65
Firm COVID-19 risk	4,117	0.01	0.05	0.00	0.81
Firm realized volatility	4,099	0.55	1.99	0.01	30.10
Firm COVID-19 exposure (firm-quarter)	849	0.46	1.04	0.00	8.32
Firm realized volatility (firm-quarter)	849	0.97	2.59	0.03	35.89
Loan amount	4,117	20.19	1.17	14.73	23.75
Maturity	4,117	3.81	0.60	1.10	5.48
Collateral	4,117	0.37	0.48	0.00	1.00
Number of lenders	4,117	12.89	7.40	1.00	48.00
Performance provisions	4,117	0.64	1.71	0.00	10.00
General covenants	4,117	0.74	1.01	0.00	4.00
Financial covenants	4,117	0.72	0.98	0.00	4.00
Net covenants	4,117	0.02	0.15	0.00	1.00
Bank share	4,117	11.98	11.12	1.02	100.00
Syndicate's Herfindahl	4,117	1,178.36	1,119.80	93.02	10,000.00
Relationship lending	4,117	0.73	0.45	0.00	1.00
Relationship lending number	4,117	0.15	0.18	0.00	1.00
Relationship lending amount	4,117	0.15	0.18	0.00	1.00
Bank subsidiary	3,565	0.13	0.33	0.00	1.00
Firm subsidiary	3,931	0.01	0.10	0.00	1.00
Bank size	4,117	14.16	0.88	10.95	14.83
Bank ROA	4,117	1.00	0.43	0.02	1.71
Bank capital	4,117	15.85	2.28	12.02	21.80
Bank NPLs	3,557	0.37	0.38	0.02	2.45
Firm size	4,117	9.12	1.68	4.37	17.48
Firm ROA	4,117	7.83	5.33	-45.83	39.27
Firm leverage	4,117	31.28	16.19	0.00	80.88
Firm equity	4,117	7.87	1.61	1.45	14.89
Firm tangibility	3,958	26.08	24.09	0.00	95.95
Cross-listed	2,336	0.02	0.12	0.00	1.00
GDP growth	4,117	-0.29	0.81	-6.83	2.40
GDP per capita	4,117	-697.78	10,372.45	-67,377.83	56,987.04
Lender's stringency	3,521	14.05	24.06	0.00	82.27
Borrower's stringency	3,521	8.81	15.36	0.00	97.35
Repo rate (lender)	3,278	1.75	0.86	0.01	2.48
Repo rate (borrower)	3,278	1.86	0.78	0.01	2.48
Constrained (WW index)	2,217	0.52	0.50	0.00	1.00

Constrained (WW index)	2,005	0.55	0.50	0.00	1.00
High default risk	2,390	0.50	0.50	0.00	1.00
Investor disclosure	4,117	7.43	0.73	0.00	10.00
Credit rights	4,117	10.38	1.85	1.00	11.00
Legal contracts	4,117	13.56	1.12	7.00	16.00

Table 2. COVID-19 exposure and realized volatility

The table reports coefficients and t-statistics [in brackets]. The dependent variable is denoted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank (specifications (1)-(3)) and by firm (specifications (4)-(6)). Different specifications include the regression of the lender's exposure measure on the realized volatility of the lenders' stock returns at the bank-quarter level (specifications (1)-(3)) and the regression of the borrower's exposure measure on the realized volatility of the borrower's stock returns at the firm-quarter level (specifications (4)-(6)). In specifications (1)-(3), *Bank realized volatility* is regressed on *Bank COVID-19 exposure* and associated bank controls (where relevant). In specifications (4)-(6), *Firm realized volatility* is regressed on *Firm COVID-19 exposure* and associated firm controls (where relevant). Specifications (1)-(3) include time and bank fixed effects and specifications (4)-(6) include time and firm fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) Bank realized volatility	(2) Bank realized volatility	(3) Bank realized volatility	(4) Firm realized volatility	(5) Firm realized volatility	(6) Firm realized volatility
Bank COVID-19 exposure	1.239***	1.275***	1.080***			
	[4.510]	[3.298]	[3.416]			
Bank size		7.132	3.815			
		[1.140]	[0.429]			
Bank ROA			-2.639			
			[-0.444]			
Bank capital			-0.606			
			[-0.656]			
Firm COVID-19 exposure				0.218***	0.232***	0.225***
				[4.777]	[3.626]	[3.653]
Firm size					0.840	0.781
					[1.064]	[0.797]
Firm ROA						-0.025*
						[-1.720]
Firm leverage						0.001
						[0.491]
Firm equity						0.001
						[0.001]
Firm tangibility						-0.001
						[-0.025]
Constant	2.906***	-88.197	-33.858	0.867***	-7.323	-6.324
	[40.690]	[-1.098]	[-0.275]	[41.453]	[-0.947]	[-1.054]
Observations	290	190	187	849	780	707
Adj. R-squared	0.630	0.622	0.628	0.620	0.625	0.636
Fixed effects	Y	Y	Y	Y	Y	Y

Table 3. Baseline results: Lender's exposure vs borrower's exposure

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different combination of the lender's exposure and the borrower's exposure measures. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Bank COVID-19 exposure	36.739***		30.836***
	[3.826]		[3.291]
Firm COVID-19 exposure		14.837***	8.924**
		[4.515]	[2.305]
Loan amount	-9.817***	-10.114***	-9.891***
	[-7.418]	[-7.478]	[-7.396]
Maturity	6.923**	6.832**	7.714***
	[2.732]	[2.741]	[3.096]
Collateral	54.680***	54.552***	54.832***
	[10.139]	[10.234]	[10.205]
Number of lenders	-0.696*	-0.668*	-0.673*
	[-1.820]	[-1.753]	[-1.775]
Performance provisions	-0.829	-0.715	-0.813
	[-1.402]	[-1.195]	[-1.360]
General covenants	-11.336***	-11.570***	-11.411***
	[-10.307]	[-10.102]	[-10.242]
Bank size	-453.214***	-403.763**	-397.289***
	[-3.303]	[-2.541]	[-3.045]
Bank ROA	146.238***	138.416**	131.013***
	[4.043]	[2.662]	[3.240]
Bank capital	-9.672	-8.366	-7.221
	[-1.309]	[-0.984]	[-0.992]
Firm size	-8.562***	-8.531***	-8.515***
	[-7.759]	[-7.640]	[-7.695]
Firm ROA	-2.593***	-2.565***	-2.583***
	[-12.791]	[-12.269]	[-12.608]
Firm leverage	0.030***	0.030***	0.030***
	[8.317]	[7.886]	[8.162]
GDP growth	-1.570	-1.423	-1.781
	[-0.362]	[-0.327]	[-0.409]
GDP per capita	0.001***	0.001***	0.001***
	[7.511]	[7.463]	[7.467]
Constant	6,849.892***	3,147.268	6,031.291***
	[3.536]	[1.671]	[3.270]
Observations	4,117	4,117	4,117
Adj. R-squared	0.313	0.309	0.315
Fixed effects	Y	Y	Y

Table 4. Different fixed effects

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different set of fixed effects, as given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank COVID-19 exposure	30.708***	30.681***	26.514***	21.098***	19.764***
	[3.124]	[3.273]	[3.392]	[2.988]	[2.852]
Firm COVID-19 exposure	11.388***	8.999**	3.882	6.241*	10.101***
	[2.806]	[2.301]	[1.499]	[1.808]	[3.572]
Loan amount	-10.021***	-10.023***	-1.485	-3.433**	-2.540
	[-7.333]	[-7.373]	[-1.084]	[-2.245]	[-1.537]
Maturity	6.945***	7.344***	6.604*	3.591	5.968
	[2.812]	[2.884]	[1.853]	[0.852]	[1.626]
Collateral	55.406***	55.201***	20.024**	5.019	-0.616
	[10.225]	[10.129]	[2.310]	[0.639]	[-0.067]
Number of lenders	-0.695*	-0.660*	-2.424***	-2.288***	-2.370***
	[-1.880]	[-1.765]	[-6.787]	[-4.531]	[-4.679]
Performance provisions	-0.772	-0.821	0.540	-0.575	-1.178
	[-1.247]	[-1.335]	[0.517]	[-0.488]	[-0.783]
General covenants	-11.543***	-11.407***	-21.785***	-18.020***	-12.304**
	[-10.203]	[-10.169]	[-4.749]	[-3.054]	[-2.106]
Bank size	-129.370**	-395.800***	-194.744**	-251.430***	-222.774***
	[-2.351]	[-2.962]	[-2.513]	[-3.377]	[-2.811]
Bank ROA	129.629***	126.205***	62.665**	61.479**	55.273**
	[2.881]	[3.028]	[2.112]	[2.386]	[2.269]
Bank capital	-4.131	-5.903	-2.886	-7.461**	-7.333**
	[-0.379]	[-0.777]	[-0.724]	[-2.149]	[-2.288]
Firm size	-8.427***	-8.437***	15.362	-2.851	0.179
	[-7.553]	[-7.643]	[0.841]	[-0.229]	[0.016]
Firm ROA	-2.608***	-2.604***	0.716	-4.169***	-6.166***
	[-12.859]	[-13.133]	[0.390]	[-3.340]	[-4.397]
Firm leverage	0.030***	0.030***	0.012	-0.104***	-0.102***
	[8.532]	[8.279]	[0.424]	[-3.631]	[-4.367]
GDP growth	-4.240	-4.207	-27.994***	-26.945***	-25.411***
	[-0.992]	[-0.989]	[-3.437]	[-4.322]	[-5.078]
GDP per capita	0.001***	0.001***	0.002*	-0.033***	-0.032***
	[7.835]	[7.951]	[1.726]	[-4.116]	[-4.936]
Constant	2,195.133***	5,996.662***	2,794.168**	3,923.729***	3,481.422***
	[2.795]	[3.171]	[2.561]	[3.814]	[3.158]
Observations	4,117	4,117	3,943	2,979	2,979
Adj. R-squared	0.313	0.314	0.781	0.793	0.800
Bank effects	Y	Y	Y	Y	Y
Year effects	N	Y	Y	Y	Y
Lender's country effects	N	N	Y	Y	Y
Firm effects	N	N	Y	Y	Y
Borrower's industry effects	N	N	N	Y	Y
Borrower's country effects	N	N	N	Y	Y
Loan type and purpose effects	N	N	N	N	Y

Table 5. Government restrictions

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interactions of the lender and borrower exposure measures with lender and borrower stringency measures by Hale, Angrist, Kira, Petherick, Phillips and Webster (2020). The lender's (borrower's) stringency measure is an index (0-100) that aggregates various measures of government responses to COVID-19 in the lender's (borrower's) country. In specification (1), *Bank COVID-19 exposure* is interacted with *Lender's stringency*, i.e., the stringency measure in the lender's country. In specification (2), *Firm COVID-19 exposure* is interacted with *Borrower's stringency*, i.e., the stringency measure in the borrower's country. In specification (3), *Bank COVID-19 exposure* is interacted with *Lender's stringency* and *Firm COVID-19 exposure* is interacted with *Borrower's stringency*. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Bank COVID-19 exposure	27.983***	30.419***	28.468***
	[3.272]	[2.922]	[3.384]
Firm COVID-19 exposure	11.494***	10.391***	11.415***
	[3.089]	[3.059]	[3.380]
Bank COVID-19 exposure × Lender's stringency	0.306**		0.284*
	[2.120]		[1.937]
Firm COVID-19 exposure × Borrower's stringency		0.240***	0.236***
		[2.945]	[2.987]
Observations	3,523	3,523	3,523
Adj. R-squared	0.316	0.316	0.320
Full set of controls	Y	Y	Y
Full interactions and main terms	Y	Y	Y
Fixed effects	Y	Y	Y

Table 6. Liquidity conditions and central bank interventions

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interactions of the lender and borrower exposure measures with the repo rates and indicators for central bank interventions in the form of public and private sector asset purchases. In specification (1), *Bank COVID-19 exposure* is interacted with *Repo rate (lender)*, i.e., the repo rate in the lender's country. In specification (2), *Firm COVID-19 exposure* is interacted with *Repo rate (borrower)*, i.e., the repo rate in the borrower's country. In specification (3), *Bank COVID-19 exposure* is interacted with *Repo rate (lender)* and *Firm COVID-19 exposure* is interacted with *Repo rate (borrower)*. In specification (4), *Bank COVID-19 exposure* is interacted with *Central bank intervention (lender)*, i.e., a binary variable equal to one for the period covering the conduct of asset purchases under the ECB's Pandemic Emergency Purchase Programme (PEPP) and the corporate bond purchases under the Federal Reserve's Secondary Market Corporate Credit Facility (SMCCF) in the lender's country, and zero otherwise. In specification (5), *Firm COVID-19 exposure* is interacted with *Central bank intervention (borrower)*, i.e., a binary variable equal to one for the period covering the conduct of asset purchases under the ECB's Pandemic Emergency Purchase Programme (PEPP) and the corporate bond purchases under the Federal Reserve's Secondary Market Corporate Credit Facility (SMCCF) in the borrower's country, and zero otherwise. In specification (6), *Bank COVID-19 exposure* is interacted with *Central bank intervention (lender)* and *Firm COVID-19 exposure* is interacted with *Central bank intervention (borrower)*. In specification (7), *Bank COVID-19 exposure* is interacted with *Bank PPP participation*, i.e., a binary variable equal to one if the lender participated in the U.S. Federal government's Paycheck Protection Program (PPP), and zero otherwise. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bank COVID-19 exposure	31.110**	36.676***	37.033**	50.063***	56.420***	56.424***	24.139**
	[2.684]	[2.884]	[2.733]	[6.075]	[6.241]	[6.242]	[2.499]
Firm COVID-19 exposure	11.164***	15.698***	66.942***	16.314*	16.279***	18.267*	9.276**
	[3.047]	[4.860]	[4.713]	[1.725]	[3.268]	[1.895]	[2.651]
Bank COVID-19 exposure × Repo rate (lender)	-7.147		-11.889				
	[-0.551]		[-0.841]				
Firm COVID-19 exposure × Repo rate (borrower)		31.790***	32.750***				
		[4.078]	[3.894]				
Bank COVID-19 exposure × Central bank intervention (lender)				-1.791		-2.043	
				[-0.164]		[-0.188]	
Firm COVID-19 exposure × Central bank intervention (borrower)					-58.196***	-58.197***	
					[-5.843]	[-5.844]	
Bank COVID-19 exposure × Bank PPP participation							-23.334
							[-0.908]
Observations	3,278	3,278	3,278	3,278	3,278	3,278	3,119
Adj. R-squared	0.315	0.320	0.319	0.315	0.321	0.320	0.299
Full set of controls	Y	Y	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y	Y

Table 7. Firm financial constraints and default probabilities

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interaction of the lender and borrower exposure measures with measures of borrower's financial constraints. In specification (1), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Constrained (WW index)*, i.e., a binary variable equal to one if the borrower's Whited-Wu index is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. In specification (2), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Constrained (KZ index)*, i.e., a binary variable equal to one if the borrower's Kaplan-Zingales index is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. In specifications (3) *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *High default risk*, i.e., a binary variable equal to one if the borrower's Altman's Z-score is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Bank COVID-19 exposure	34.762***	21.645***	21.555**
	[3.271]	[4.162]	[2.617]
Firm COVID-19 exposure	-7.863*	16.795***	26.005***
	[-1.906]	[3.110]	[3.604]
Bank COVID-19 exposure × Constrained (WW index)	20.494***		
	[2.948]		
Firm COVID-19 exposure × Constrained (WW index)	13.947**		
	[2.344]		
Bank COVID-19 exposure × Constrained (KZ index)		-11.395	
		[-1.182]	
Firm COVID-19 exposure × Constrained (KZ index)		19.053**	
		[2.606]	
Bank COVID-19 exposure × High default risk			29.546**
			[2.064]
Firm COVID-19 exposure × High default risk			24.581**
			[2.720]
Observations	2,217	2,005	2,390
Adj. R-squared	0.373	0.368	0.384
Full set of controls	Y	Y	Y
Full interactions and main terms	Y	Y	Y
Fixed effects	Y	Y	Y

Table 8. Lender characteristics

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interactions of the lender's exposure measure with a number of different lender characteristics. In specification (1), *Bank COVID-19 exposure* is interacted with *Bank size* i.e., the log of total bank assets. In specification (2), *Bank COVID-19 exposure* is interacted with *Bank ROA*, i.e., the return on total bank assets. In specification (3), *Bank COVID-19 exposure* is interacted with *Bank capital*, i.e., the ratio of bank capital to total assets. In specification (4), *Bank COVID-19 exposure* is interacted with *Bank NPLs*, i.e., the ratio of non-performing loans to total loans. In specifications (5)-(8), we replicate the estimations in specifications (1)-(4) by replacing each bank characteristic with its 3-year moving average value. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank COVID-19 exposure	39.950***	28.972***	30.584***	29.183**	28.412***	31.732***	30.611***	30.204***
	[9.860]	[4.481]	[5.064]	[2.598]	[3.344]	[3.980]	[3.615]	[2.873]
Firm COVID-19 exposure	8.105**	9.338**	9.084**	10.542**	10.528**	11.126***	11.281***	10.801***
	[2.377]	[2.476]	[2.409]	[2.618]	[2.730]	[2.872]	[2.865]	[2.821]
Bank COVID-19 exposure × Bank size	17.221***				13.603**			
	[5.288]				[2.295]			
Bank COVID-19 exposure × Bank ROA		-20.238**				-12.757**		
		[-2.043]				[-2.651]		
Bank COVID-19 exposure × Bank capital			2.432*				1.177*	
			[1.818]				[1.822]	
Bank COVID-19 exposure × Bank NPLs				0.041				-5.801
				[0.001]				[-0.149]
Observations	4,117	4,117	4,117	3,557	4,117	4,117	4,117	3,557
Adj. R-squared	0.318	0.316	0.316	0.309	0.314	0.313	0.313	0.309
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

Table 9. Borrower characteristics

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interactions of the borrower's exposure measure with a number of different borrower characteristics. In specification (1), *Firm COVID-19 exposure* is interacted with *Firm size* i.e., the log of total firm assets. In specification (2), *Firm COVID-19 exposure* is interacted with *Firm ROA*, i.e., the return on total firm assets. In specification (3), *Firm COVID-19 exposure* is interacted with *Firm leverage*, i.e., the firm leverage. In specification (4), *Firm COVID-19 exposure* is interacted with *Firm equity*, i.e., the log of firm equity capital. In specification (5), *Firm COVID-19 exposure* is interacted with *Firm tangibility*, i.e., the ratio of firm tangible assets to total assets. In specification (6), *Firm COVID-19 exposure* is interacted with *Cross-listed*, i.e., a binary variable equal to one if the borrower's common shares are listed on one or more foreign stock exchanges in addition to the borrower's domestic stock exchange, and zero otherwise. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Bank COVID-19 exposure	30.677***	29.782***	30.784***	30.118***	32.315***	32.392***
	[3.262]	[3.421]	[3.286]	[3.367]	[3.700]	[3.686]
Firm COVID-19 exposure	11.049**	10.641**	8.952**	11.821***	9.457**	8.919**
	[2.701]	[2.500]	[2.296]	[2.886]	[2.329]	[2.399]
Firm COVID-19 exposure × Firm size	-3.016**					
	[-2.629]					
Firm COVID-19 exposure × Firm ROA		1.358				
		[1.399]				
Firm COVID-19 exposure × Firm leverage			0.002			
			[0.567]			
Firm COVID-19 exposure × Firm equity				-3.880***		
				[-3.230]		
Firm COVID-19 exposure × Firm tangibility					-0.195**	
					[-2.609]	
Firm COVID-19 exposure × Cross-listed						-83.217**
						[-2.324]
Observations	4,117	4,117	4,117	4,117	3,958	2,336
Adj. R-squared	0.316	0.316	0.315	0.317	0.317	0.367
Full set of controls	Y	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y

Table 10. Lending relationships and subsidiary role

This table reports estimated coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. Estimation method used is OLS with standard errors clustered by bank. Different specifications include the interaction of lender and borrower exposure measures with lending relationship measures. In specification (1), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Relationship lending*, i.e., a binary variable equal to one for a prior lending relationship between the lender and the borrower during the previous 3-year period, and zero otherwise. In specification (2), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Relationship lending number*, i.e., the ratio of the number of prior loans between the lender and the borrower during the previous 3-year period to the total number of loans received by the borrower during the same period. In specification (3), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Relationship lending amount*, i.e., the ratio of the amount of prior loans between the lender and the borrower during the previous 3-year period to the total amount of loans received by the borrower during the same period. In specification (4), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Bank subsidiary*, i.e., a binary variable equal to one if the lender operates a subsidiary in the borrower's country, and zero otherwise. In specification (5), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Firm subsidiary*, i.e., a binary variable equal to one if the borrower operates a subsidiary in the lender's country, and zero otherwise. All specifications include year and bank fixed effects. Specifications (1)-(3) additionally include lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank COVID-19 exposure	34.842***	31.857***	31.915***	50.630*	31.092***
	[3.438]	[3.337]	[3.321]	[1.711]	[3.721]
Firm COVID-19 exposure	6.445	8.432**	8.328**	29.872**	7.267*
	[1.595]	[2.201]	[2.177]	[2.364]	[1.947]
Bank COVID-19 exposure × Relationship lending	-18.880**				
	[-2.565]				
Firm COVID-19 exposure × Relationship lending	12.080				
	[1.422]				
Bank COVID-19 exposure × Relationship lending number		-32.158**			
		[-2.662]			
Firm COVID-19 exposure × Relationship lending number		-6.735			
		[-0.386]			
Bank COVID-19 exposure × Relationship lending amount			-28.065**		
			[-2.334]		
Firm COVID-19 exposure × Relationship lending amount			-16.954		
			[-0.977]		
Bank COVID-19 exposure × Bank subsidiary				-23.280	
				[-0.744]	
Firm COVID-19 exposure × Bank subsidiary				-22.617*	
				[-1.882]	
Bank COVID-19 exposure × Firm subsidiary					-17.294
					[-0.263]
Firm COVID-19 exposure × Firm subsidiary					52.240
					[1.545]
Observations	4,117	4,117	4,117	3,565	3,931
Adj. R-squared	0.316	0.316	0.316	0.323	0.322
Full set of controls	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y

Table 11. The role of institutional investors

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interactions of lender and borrower exposure measures with a number of different borrower's country institutional investor characteristics. In specification (1), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Investor disclosure*, i.e., the extent of disclosure intensity index in the borrower's country. In specification (2), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Credit rights*, i.e., the strength of credit rights index in the borrower's country. In specification (3), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Legal contracts*, i.e., strength of legal contracts index in the borrower's country. In specification (4), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* is interacted with *High investor disclosure*, i.e., a binary variable equal to one if the borrower's country *Investor disclosure* is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. In specification (5), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* is interacted with *High credit rights*, i.e., a binary variable equal to one if the borrower's country *Credit rights* is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. In specification (6), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* is interacted with *High legal contracts*, i.e., a binary variable equal to one if the borrower's country *Legal contracts* is in the top tercile of the sample, and zero if it is in the bottom tercile of the sample. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Bank COVID-19 exposure	30.911***	32.252***	30.938***	31.559***	66.135***	69.768***
	[3.151]	[4.216]	[3.779]	[3.328]	[2.909]	[5.364]
Firm COVID-19 exposure	9.519**	7.704**	7.147**	6.597*	33.280***	13.226**
	[2.404]	[2.524]	[2.041]	[1.729]	[3.553]	[2.673]
Bank COVID-19 exposure × Investor disclosure	-13.756**					
	[-2.388]					
Firm COVID-19 exposure × Investor disclosure	1.699					
	[0.682]					
Bank COVID-19 exposure × Credit rights		-4.535**				
		[-2.182]				
Firm COVID-19 exposure × Credit rights		-3.287***				
		[-2.935]				
Bank COVID-19 exposure × Legal contracts			-6.784**			
			[-2.345]			
Firm COVID-19 exposure × Legal contracts			-2.827***			
			[-2.757]			
Bank COVID-19 exposure × High investor disclosure				-23.786*		
				[-1.899]		
Firm COVID-19 exposure × High investor disclosure				5.547		
				[1.014]		
Bank COVID-19 exposure × High credit rights					-35.363*	
					[-1.845]	
Firm COVID-19 exposure × High credit rights					-28.765***	
					[-3.019]	
Bank COVID-19 exposure × High legal contracts						-40.537***
						[-3.320]
Firm COVID-19 exposure × High legal contracts						-7.162*
						[-1.710]
Observations	4,117	4,117	4,117	4,004	3,828	4,039
Adj. R-squared	0.319	0.320	0.319	0.325	0.321	0.324
Full set of controls	Y	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y

Table 12. The syndicate's structure

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include the interaction of lender and borrower exposure measures with measures of the syndicate's structure. In specification (1), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Number of lenders*. In specification (2), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Bank share*. In specification (3), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are interacted with *Syndicate's Herfindahl*. All specifications include year, bank and lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Bank COVID-19 exposure	37.175***	32.438***	32.443***
	[4.326]	[3.583]	[3.617]
Firm COVID-19 exposure	9.133**	9.250**	9.314**
	[2.512]	[2.601]	[2.627]
Bank COVID-19 exposure × Number of lenders	2.094*		
	[1.898]		
Firm COVID-19 exposure × Number of lenders	0.176		
	[0.345]		
Bank COVID-19 exposure × Bank share		-0.879**	
		[-2.198]	
Firm COVID-19 exposure × Bank share		-0.067	
		[-0.492]	
Bank COVID-19 exposure × Syndicate's Herfindahl			-0.008**
			[-2.215]
Firm COVID-19 exposure × Syndicate's Herfindahl			-0.001
			[-0.421]
Observations	4,117	4,117	4,117
Adj. R-squared	0.317	0.316	0.316
Full set of controls	Y	Y	Y
Full interactions and main terms	Y	Y	Y
Fixed effects	Y	Y	Y

Internet Appendix

Abstract

This internet appendix includes additional information on the sample and empirical results. The first section includes the discussion of additional results and robustness checks. The second section includes descriptive information on the number of loans by country in our sample. The third section includes the definitions of variables employed. The fourth section reports (i) estimates from specifications with different controls, (ii) results from alternative estimation methods, (iii) results for AISU, (iv) estimates from Heckman regressions and (v) other sensitivity tests.

A.1 Additional results

This section includes the discussion of additional results and robustness checks. An extension of our empirical analysis relates to the role of loan fees, since we might expect that greater exposure to the pandemic increases the cost of loans through lower fees. However, data on fees is limited since several loan facilities are term loans that have limited fees. Nonetheless, in Appendix Table A8 we replicate Table 3 with *AISU* as the dependent variable. Across the first two specifications, we observe a statistically significant effect of *Bank COVID-19 exposure* and *Firm COVID-19 exposure* on *AISU* that amounts to 23.1 basis points and 15.1 basis points respectively per one standard deviation increase in either measure. Importantly, the specification including both measures (column (3)) points to the dominance of the bank-level measure over its firm-level counterpart; it thus appears that the increase of fees is primarily a result of greater exposure of the lending bank.

Further, to make sure that our inferences are not sensitive to the clustering (also given the multi-level and multi-country nature of our data), we also cluster standard errors by lender's country, borrowing firm, borrower's country, lending bank-borrowing firm pair, and lender's country-borrower's country pair (see Appendix Table A9). Results are similar to the baseline. Our OLS estimations, thus far, have assumed that all loans enter the model with equal weights. Normally, the different fixed effects in Table 4 provide a safeguard against cross-country variation. However, we acknowledge that the empirical specification might leave the analysis open to the critique that countries receiving fewer loans might affect our results disproportionately. We re-estimate our preferred model specification using weighted least squares and several different weights. The results in Appendix Table A10 are almost identical to our baseline.

Similarly, in Appendix Table A11 we estimate our baseline specification for different sub-samples. The first two specifications include observations from borrower's countries with

at least 100 loan facilities and 30 loan facilities respectively in our sample period, while in specification (3) we exclude observations from borrower's countries with less than 10 loan facilities;[20] results from this exercise assure us that our estimates are not sensitive to changes in the composition of our sample.

Our results could also be subject to a sample-selection bias, in the sense that the variables driving our findings might further determine the firm's decision to receive a loan from the particular bank. It may be, for instance, that firms within a certain country are the ones more likely to request a loan. To eliminate this potential selection bias from our estimates, we follow Dass and Massa (2011) and employ Heckman's (1979) two-stage model to calculate the probability of a firm entering into a loan deal. In the first stage, we run a probit model to estimate the firm's loan-taking decision. During this stage, we extend our loan sample to include all syndicated loan facilities available in Dealscan for our sample period. We calculate Heckman's lambda (inverse mills ratio) and include it as an additional control variable in the second-stage OLS estimation of specifications (1)-(3) of Appendix Table A12.

In line with Dass and Massa (2011), we assume that the borrower's decision to get a syndicated loan is a function of the key determinants of the decision to borrow. Consequently, we augment our probit regression with a set of loan-, bank- and firm-level characteristics; a set of annual weights for the number of loans to a firm (*Firm loans*) and the number of loans between a given bank-firm pair (*Bank-firm loans*); loan type and purpose, year, firm, and borrower's country dummies. We present results in columns (1)-(3) of Appendix Table A12 (Panels A and B). Probit estimates in Panel A, show that loans of greater amount are more likely to be granted, particularly if collateral is pledged and loan arrangements include pricing provisions and covenants. Larger firms with less reliance on debt are less likely to opt for loan financing. More importantly, estimates from the second-stage regressions (columns (1)-(3) of

[20] Figure A1 of the Appendix presents the number of loan facilities by borrower's country.

Panel B) confirm the strong positive impact of our exposure measures on *AISD* (as reflected in the coefficients on *Bank COVID-19 exposure* and *Firm COVID-19 exposure*).

Finally, we control for changes in the bank's and firm's fundamentals as well as differences in the economic environment in the lender's and borrower's countries. Specifically, we include additional bank controls (non-performing loans, equity capital), firm controls (equity, tangible assets, debt, retained earnings, sales, EBITDA), country economic controls (GDP, price level) and general economic controls (global stock price volatility). These variables should exhibit a strong correlation with our baseline set of fixed effects and control variables, to the extent that these variables change slowly over time. We do not use all indicators at once, due to their high pair-wise correlations. Again, results in Appendix Table A13 confirm our baseline estimates on the effect of our COVID-19 exposure measures on loan spreads.

Figure A1. Syndicated loans by country

The figure presents the aggregate number of loan facilities by borrower's country for our sample period. The number of loan facilities is depicted on the Y-axis and the corresponding borrower's country is depicted on the X-axis. The number of loan facilities for the USA is scaled by 0.1.

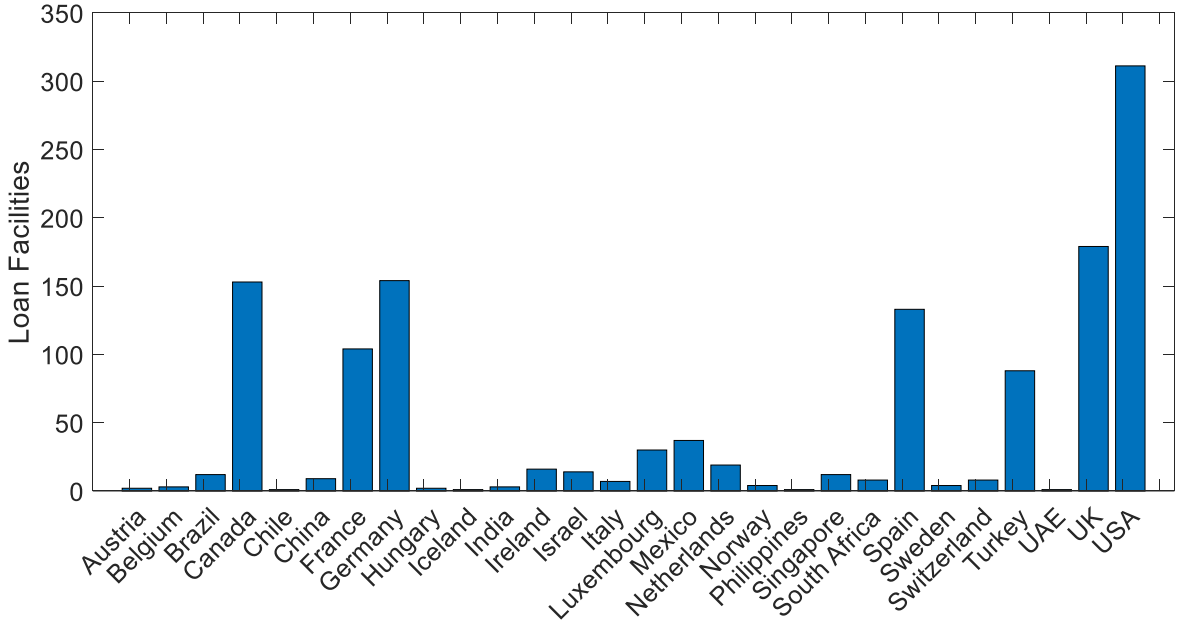


Table A1. Variable definitions and sources

Variable	Description	Source
A. Dependent variables in main specifications		
AISD	All-in spread drawn, defined as the sum of the spread over LIBOR plus any facility fee.	DealScan
AISU	All-in spread undrawn, defined as the sum of the facility fee and the commitment fee.	DealScan
B. Main explanatory variables: COVID-19 exposure		
Bank COVID-19 exposure	The lender's exposure to COVID-19. The calculation is based on the counting of word combinations referring to COVID-19 in quarterly earnings conference calls held by publicly listed companies. These transcripts are available from the Refinitiv Eikon database. The exposure is calculated by parsing the available earnings call transcripts and counting the number of times the synonyms associated with COVID-19 are used. Then this number is divided by the total number of words in the transcript to account for differences in transcript length. For a detailed definition of this procedure see Hassan, Hollander, van Lent and Tahoun (2020b). The variable *Firm COVID-19 exposure* is the equivalent measure for the borrower's exposure.	Hassan, Hollander, van Lent and Tahoun (2020b)
Bank COVID-19 sentiment	The first moment of the lender's exposure to COVID-19. The measure counts the use of negative-tone words used in conjunction with discussions of COVID-19. For a detailed definition of this procedure see Hassan, Hollander, van Lent, and Tahoun (2020). The variable *Firm COVID-19 sentiment* is the equivalent measure for the borrower's exposure.	Hassan, Hollander, van Lent and Tahoun (2020b)
Bank COVID-19 risk	The second moment of the lender's exposure to COVID-19. The measure counts the use of synonyms for "risk" and "uncertainty" used in conjunction with discussions of COVID-19. For a detailed definition of this procedure see Hassan, Hollander, van Lent, and Tahoun (2020). The variable *Firm COVID-19 risk* is the equivalent measure for the borrower's exposure.	Hassan, Hollander, van Lent and Tahoun (2020b)
C. Explanatory variables: Uncertainty measures		
Bank realized volatility	The realized volatility of the lender's stock returns in a given quarter. The variable *Firm realized volatility* is the equivalent variable for the borrower's stock returns.	Compustat
Lender's COVID-19 cases	The log of the number of confirmed COVID-19 cases in the lender's country as included in the Oxford COVID-19 Government Response Tracker (OxCGRT). The variable *Borrower's COVID-19 cases* is the equivalent variable for the number of cases in the borrower's country.	Hale, Angrist, Kira, Petherick, Phillips and Webster (2020)
D. Explanatory variables: Loan characteristics		
Loan amount	Log of the loan facility amount in USD.	DealScan
Maturity	Log of loan duration in months.	DealScan
Collateral	A binary variable equal to one if the loan is secured with collateral, and zero otherwise.	DealScan
Number of lenders	The number of banks involved in the syndicated loan.	DealScan
Performance provisions	A binary variable equal to one if the loan has performance pricing provisions, and zero otherwise.	DealScan
General covenants	The total number of covenants in the loan contract.	DealScan
Financial covenants	The number of financial covenants in the loan contract.	DealScan
Net covenants	The number of net covenants in the loan contract.	DealScan
Loan type	A series of binary variables indicating loan type (e.g., term loans, revolvers, etc.).	DealScan
Loan purpose	A series of binary variables indicating loan purpose (e.g., corporate purpose, debt repay, etc.).	DealScan
Bank share	The bank's share of the loan facility.	DealScan
Syndicate's Herfindahl	The Herfindahl index of the syndicate (a measure of the concentration of holdings within a syndicate). The Herfindahl index is calculated using each syndicate member's share in the loan. It is the sum of the squared individual shares in the loan and varies from zero to 10,000, with 10,000 being the Herfindahl when a lender holds 100% of the loan.	DealScan

Relationship lending	A binary variable equal to one for a prior loan facility between the lender and the borrower in the 3-year period before the loan facility's origination year, and zero otherwise.	DealScan
Relationship lending number	The ratio of the number of prior loan facilities between the lender and the borrower in the 3-year period before the loan facility's origination year to the total number of loans received by the borrower during the same period.	DealScan
Relationship lending amount	The ratio of the amount of prior loan facilities between the lender and the borrower in the 3-year period before the loan facility's origination year to the total amount of loans received by the borrower during the same period.	DealScan

E. Explanatory variables: Lender characteristics

Bank size	The log of total bank assets.	Compustat
Bank ROA	The return on total bank assets.	Compustat
Bank capital	The ratio of bank capital to total assets.	Compustat
Bank NPLs	The ratio of non-performing loans to total loans.	Compustat
Bank equity	The ratio of bank equity to total assets.	Compustat
Bank subsidiary	A binary variable equal to one if the lender operates a subsidiary in the borrower's country, and zero otherwise.	DealScan

F. Explanatory variables: Borrower characteristics

Firm size	The log of total firm assets.	Compustat
Firm ROA	The return on total firm assets.	Compustat
Firm leverage	The firm debt to total assets ratio.	Compustat
Firm equity	The log of firm equity capital.	Compustat
Firm tangibility	The ratio of firm tangible assets to total assets.	Compustat
Firm debt	The firm debt to equity ratio.	Compustat
Firm retained earnings	The ratio of firm retained earnings to total assets.	Compustat
Firm EBITDA	The log of firm EBITDA.	Compustat
Firm cash	The log of firm cash.	Compustat
Firm subsidiary	A binary variable equal to one if the borrower operates a subsidiary in the lender's country, and zero otherwise.	DealScan
Cross-listed	A binary variable equal to one if the firm's common shares are listed on one or more foreign stock exchanges in addition to the firm's domestic stock exchange, and zero otherwise.	Compustat; Firm disclosures

G. Explanatory variables: Lender's and borrower's country macroeconomic characteristics

GDP growth	The difference in annual GDP growth rate (%) between the lender's and the borrower's countries.	WDI
GDP per capita	The difference in annual GDP per capita in constant prices between the lender's and the borrower's countries.	WDI
GDP	The difference in annual GDP (USD million) between the lender's and the borrower's countries.	WDI
Inflation	The difference in annual inflation rate (%) between the lender's and the borrower's countries.	WDI

H. Explanatory variables: Lender's and borrower's country government restriction measures

Lender's stringency	The stringency index in the lender's country. The index captures variation in containment and closure policies in response to COVID-19. The index ranges from 0 to 100, with higher values reflecting higher stringency and concerns nine key areas: school closing, workplace closing, cancelled public events, restrictions on gatherings, close public transport, stay at home requirements, restrictions on internal movement, international travel controls, public information campaigns. For a detailed definition of this procedure see Hale, Angrist, Kira, Petherick, Phillips and Webster (2020). The variable *Borrower's stringency* is the equivalent index for the borrower's country.	Hale, Angrist, Kira, Petherick, Phillips and Webster (2020)

I. Explanatory variables: Lender's and borrower's country monetary policy measures

Repo rate (lender)	The monthly repo rate in the lender's country. The variable *Repo rate (borrower)* is the equivalent rate for the borrower's country. The variables are available for the Euro Area and the U.S.	FRBNY; EU data portal
Central bank intervention (lender)	A binary variable equal to one for the period covering the conduct of asset purchases under the ECB's Pandemic Emergency Purchase Programme (PEPP) and the corporate bond purchases under the Federal Reserve's Secondary Market Corporate Credit Facility (SMCCF) in the lender's country, and zero otherwise. The variable *Central bank intervention (borrower)* is the equivalent variable for the borrower's country. The variables are available for the Euro Area and the U.S.	ECB; Federal Reserve
Bank PPP participation	A binary variable equal to one if the lender participated in the U.S. Federal government's Paycheck Protection Program (PPP), and zero otherwise. The variable is available for the U.S.	U.S. SBA

J. Explanatory variables: Borrower's country institutional characteristics

Investor disclosure	The extent of disclosure intensity index (0-10) in the borrower's country. The index is constructed according to the DB06-14 methodology. The variable *High investor disclosure* is the associated binary variable equal to one if *Investor disclosure* is in the top tercile of our sample, and zero if it is in the bottom tercile.	FactSet
Credit rights	The strength of credit rights index in the borrower's country. The index is constructed according to the DB05-14 methodology. The variable *High credit rights* is the associated binary variable equal to one if *Credit rights* is in the top tercile of our sample, and zero if it is in the bottom tercile.	FactSet
Legal contracts	The strength of legal contracts index in the borrower's country. The index is constructed according to the DB05-14 methodology. The variable *High legal contracts* is the associated binary variable equal to one if *Legal contracts* is in the top tercile of our sample, and zero if it is in the bottom tercile.	FactSet

K. Explanatory variables: Global volatility measures

VIX	The Chicago Board of Exchange (CBOE) Volatility Index (VIX Index). The VIX index measures the implied volatility of options on the S&P 500.	Bloomberg; CBOE

Table A2. Variance inflation factors

The table reports values for variance inflation factors (VIF) from linear regression models. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS. Each specification includes a different combination of the lender's exposure and the borrower's exposure measures. The last row of the table denotes the mean value of all variance inflation factors in each specification. All specifications include year, bank and lender's country dummies.

	(1)	(2)	(3)
Bank COVID-19 exposure	1.08		1.58
Firm COVID-19 exposure		1.13	1.56
Loan amount	1.47	1.58	1.60
Maturity	1.20	1.34	1.37
Collateral	1.13	1.14	1.15
Number of lenders	1.43	1.43	1.42
Performance provisions	1.07	1.09	1.08
General covenants	1.16	1.15	1.16
Bank size	1.33	1.29	1.37
Bank ROA	2.55	3.18	2.8
Bank capital	2.35	2.47	2.44
Firm size	2.09	2.16	2.07
Firm ROA	1.09	1.10	1.10
Firm leverage	1.01	1.02	1.03
GDP growth	1.70	2.14	1.88
GDP per capita	1.32	1.26	1.31
Mean VIF	1.47	1.56	1.56

Table A3. Different loan controls

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Different specifications include different loan controls to show that the estimates on the terms *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are not overly sensitive to the loan controls used. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Bank COVID-19 exposure	28.487***	31.743***	29.220***	26.827**
	[2.822]	[2.966]	[3.309]	[2.545]
Firm COVID-19 exposure	4.700	6.266*	8.460**	5.316*
	[1.482]	[1.936]	[2.163]	[1.695]
Loan amount		-13.838***		
		[-7.597]		
Maturity		15.642***		
		[5.007]		
Collateral			58.361***	
			[10.038]	
Number of lenders			-1.307***	
			[-3.399]	
Performance provisions				-4.095***
				[-5.990]
General covenants				-11.356***
				[-8.031]
Bank size	-271.576**	-305.529***	-398.747***	-283.440**
	[-2.531]	[-2.748]	[-3.335]	[-2.477]
Bank ROA	107.676***	135.005***	107.190**	105.401**
	[3.048]	[3.598]	[2.503]	[2.606]
Bank capital	-8.658	-14.637*	-4.943	-4.860
	[-0.908]	[-1.930]	[-0.604]	[-0.474]
Firm size	-17.078***	-10.049***	-10.321***	-18.219***
	[-20.130]	[-11.196]	[-14.625]	[-22.052]
Firm ROA	-3.287***	-2.670***	-2.868***	-3.254***
	[-15.044]	[-13.079]	[-12.740]	[-15.793]
Firm leverage	0.042***	0.041***	0.031***	0.039***
	[8.823]	[9.717]	[7.382]	[9.169]
GDP growth	4.294	3.265	0.219	3.576
	[0.874]	[0.697]	[0.049]	[0.731]
GDP per capita	0.002***	0.001***	0.002***	0.002***
	[6.874]	[6.773]	[8.183]	[6.402]
Constant	4,213.225**	4,910.844***	5,887.025***	4,345.175**
	[2.706]	[3.106]	[3.478]	[2.618]
Observations	4,327	4,316	4,128	4,327
Adj. R-squared	0.185	0.215	0.288	0.209
Fixed effects	Y	Y	Y	Y

Table A4. Seemingly unrelated regressions

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is FGLS. Different specifications include a system of regression equations to control for the simultaneous determination of loan terms in each loan facility (only the estimates from the regressions where the dependent variable is *AISD* are reported). In each regression, the set of regressors is the same as in the regression for *AISD* (including *AISD* and excluding the variable that acts as regressand in the respective equation). In specification (1), two regression equations are estimated, where the dependents variable are *AISD* and *Bank COVID-19 exposure* respectively. In specification (2), three regression equations are estimated, where the dependent variables are *AISD*, *Bank COVID-19 exposure* and *Firm COVID-19 exposure* respectively. In specification (3), four regression equations are estimated, where the dependent variables are *AISD*, *Bank COVID-19 exposure*, *Firm COVID-19 exposure* and *Loan amount* respectively. In specification (4), five regression equations are estimated, where the dependent variables are *AISD*, *Bank COVID-19 exposure*, *Firm COVID-19 exposure*, *Loan amount* and *Maturity* respectively. In specification (5), six regression equations are estimated, where the dependent variables are *AISD*, *Bank COVID-19 exposure*, *Firm COVID-19 exposure*, *Loan amount*, *Maturity* and *Collateral* respectively. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively

	(1)	(2)	(3)	(4)	(5)
Bank COVID-19 exposure	31.664***	20.480***	19.855***	21.521***	21.516***
	[7.990]	[5.177]	[5.019]	[5.440]	[5.439]
Firm COVID-19 exposure	6.824***	17.329***	17.699***	18.828***	18.210***
	[2.723]	[6.941]	[7.089]	[7.542]	[7.294]
Loan amount	-10.048***	-10.157***	-19.975***	-20.374***	-19.033***
	[-8.121]	[-8.209]	[-16.275]	[-16.599]	[-15.510]
Maturity	8.903***	10.183***	12.983***	20.294***	12.307***
	[3.985]	[4.559]	[5.814]	[9.101]	[5.530]
Collateral	56.327***	56.196***	54.938***	53.278***	97.491***
	[22.178]	[22.127]	[21.632]	[20.980]	[40.399]
Number of lenders	-0.609***	-0.554***	-0.296	-0.289	-0.414**
	[-3.296]	[-2.998]	[-1.601]	[-1.566]	[-2.240]
Performance provisions	-0.532	-0.510	0.246	0.297	1.642**
	[-0.765]	[-0.733]	[0.354]	[0.428]	[2.365]
General covenants	-11.882***	-11.887***	-11.891***	-12.163***	-12.187***
	[-9.750]	[-9.755]	[-9.758]	[-9.981]	[-10.001]
Bank size	-2.954*	-3.163**	-2.799*	-2.686*	-1.924
	[-1.932]	[-2.069]	[-1.831]	[-1.757]	[-1.259]
Bank ROA	-11.993***	-12.547***	-12.450***	-12.813***	-6.591
	[-2.722]	[-2.848]	[-2.826]	[-2.908]	[-1.497]
Bank capital	0.376	0.437	0.573	0.489	0.190
	[0.478]	[0.555]	[0.729]	[0.622]	[0.242]
Firm size	-8.415***	-8.429***	-4.901***	-4.118***	-2.218**
	[-8.575]	[-8.590]	[-5.003]	[-4.204]	[-2.265]
Firm ROA	-2.613***	-2.593***	-2.203***	-2.191***	-1.938***
	[-11.587]	[-11.495]	[-9.772]	[-9.716]	[-8.599]
Firm leverage	0.032***	0.032***	0.032***	0.031***	0.025***
	[6.944]	[6.804]	[6.942]	[6.682]	[5.419]
GDP growth	-5.055***	-5.326***	-4.155**	-4.152**	-5.730***
	[-2.618]	[-2.758]	[-2.152]	[-2.150]	[-2.968]
GDP per capita	0.001***	0.001***	0.001***	0.001***	0.001***
	[10.603]	[10.398]	[8.613]	[8.941]	[7.964]
Constant	467.159***	465.724***	607.382***	581.000***	537.619***
	[15.387]	[15.340]	[20.061]	[19.192]	[17.765]
Observations	4,117	4,117	4,117	4,117	4,117
R-squared	0.302	0.303	0.292	0.288	0.244

Table A5. Alternative COVID-19 exposure and uncertainty measures

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes alternative COVID-19 exposure and uncertainty measures for the lender and the borrower. In specification (1), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are replaced by *Bank COVID-19 sentiment* and *Firm COVID-19 sentiment*, i.e., the first moment of the lender's exposure to COVID-19 and the borrower's exposure to COVID-19 respectively. In specification (2), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are replaced by *Bank COVID-19 risk* and *Firm COVID-19 risk*, i.e., the second moment of the lender's exposure to COVID-19 and the borrower's exposure to COVID-19 respectively. In specification (3), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are replaced by *Bank realized volatility* and *Firm realized volatility*, i.e., the realized stock return volatility of the lender and borrower respectively. In specification (4), *Bank COVID-19 exposure* and *Firm COVID-19 exposure* are replaced by *Lender's COVID-19 cases* and *Borrower's COVID-19 cases*, i.e., the log of the number of confirmed COVID-19 cases in the lender's country and the borrower's country respectively. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Bank COVID-19 sentiment	92.926***			
	[3.732]			
Firm COVID-19 sentiment	43.073**			
	[2.689]			
Bank COVID-19 risk		63.170***		
		[4.236]		
Firm COVID-19 risk		10.071**		
		[2.216]		
Bank realized volatility			1.932***	
			[3.161]	
Firm realized volatility			1.273**	
			[2.566]	
Lender's COVID-19 cases				3.938**
				[2.394]
Borrower's COVID-19 cases				3.182**
				[2.297]
Loan amount	-9.946***	-9.868***	-10.077***	-8.263***
	[-7.441]	[-7.508]	[-7.380]	[-6.279]
Maturity	5.506**	7.525***	5.170*	5.813**
	[2.179]	[2.961]	[2.029]	[2.463]
Collateral	54.530***	54.516***	53.214***	51.038***
	[10.176]	[10.082]	[10.086]	[11.278]
Number of lenders	-0.712*	-0.676*	-0.727*	-0.819**
	[-1.854]	[-1.776]	[-1.859]	[-2.290]
Performance provisions	-0.697	-0.869	-0.996	-0.959
	[-1.214]	[-1.455]	[-1.602]	[-1.653]
General covenants	-11.455***	-11.434***	-11.183***	-11.215***
	[-10.087]	[-10.311]	[-9.603]	[-9.375]
Bank size	-235.843*	-419.602**	-289.394**	-226.237*
	[-1.853]	[-2.657]	[-2.099]	[-1.760]
Bank ROA	46.128	106.855*	23.502	29.395
	[0.936]	[2.038]	[0.526]	[0.525]
Bank capital	7.428	-5.599	6.267	11.640
	[0.999]	[-0.664]	[0.938]	[1.289]
Firm size	-8.535***	-8.511***	-8.501***	-10.120***
	[-7.611]	[-7.734]	[-6.777]	[-14.488]
Firm ROA	-2.561***	-2.601***	-2.474***	-2.627***
	[-12.773]	[-12.618]	[-11.979]	[-12.830]
Firm leverage	0.029***	0.030***	0.028***	0.033***
	[7.662]	[7.782]	[6.493]	[8.387]
GDP growth	-1.145	-1.446	-1.260	-4.134
	[-0.266]	[-0.334]	[-0.286]	[-0.826]
GDP per capita	0.001***	0.001***	0.001***	0.001***

	[7.714]	[7.525]	[8.522]	[4.182]
Constant	3,612.269*	6,346.879***	4,424.595**	3,408.749*
	[1.989]	[2.813]	[2.241]	[1.849]
Observations	4,117	4,117	4,099	3,973
Adj. R-squared	0.306	0.313	0.302	0.309
Fixe effects	Y	Y	Y	Y

Table A6. Controlling for loan supply and loan demand

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different combination of fixed effects to control for the operation of the loan supply and loan demand channels. Specification (1) includes bank × year fixed effects to control for the operation of the loan supply channel. Specification (2) includes firm × year fixed effects to control for the operation of the loan demand channel. All specifications include lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Bank COVID-19 exposure	26.382**	30.092***
	[2.238]	[3.350]
Firm COVID-19 exposure	8.951**	15.358**
	[2.318]	[2.636]
Loan amount	-9.897***	-1.029
	[-7.504]	[-0.721]
Maturity	7.634***	9.158**
	[3.094]	[2.127]
Collateral	54.927***	13.209
	[10.229]	[1.652]
Number of lenders	-0.675*	-2.977***
	[-1.770]	[-8.555]
Performance provisions	-0.798	-1.725
	[-1.336]	[-1.065]
General covenants	-11.780***	-18.165***
	[-10.005]	[-3.891]
Bank size		-148.203***
		[-3.096]
Bank ROA		19.231
		[0.828]
Bank capital		1.902
		[0.584]
Firm size	-8.540***	
	[-7.821]	
Firm ROA	-2.593***	
	[-12.685]	
Firm leverage	0.029***	
	[8.302]	
GDP growth	-2.872	-21.563*
	[-0.653]	[-1.982]
GDP per capita	0.001***	0.002*
	[7.783]	[1.869]
Constant	424.582***	2,242.169***
	[21.461]	[3.317]
Observations	4,113	3,898
Adj. R-squared	0.317	0.801
Bank effects	N	Y
Bank × year effects	Y	N
Firm × year effects	N	Y

Table A7. Borrower characteristics (3-year moving averages)

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each of the specifications replicates the corresponding specification from Table 9 by replacing by replacing each firm characteristic with its 3-year moving average value. In specification (1), *Firm COVID-19 exposure* is interacted with the 3-year moving average value of *Firm size* i.e., the log of total firm assets. In specification (2), *Firm COVID-19 exposure* is interacted with the 3-year moving average value of *Firm ROA*, i.e., the return on total firm assets. In specification (3), *Firm COVID-19 exposure* is interacted with the 3-year moving average value of *Firm leverage*, i.e., the firm leverage. In specification (4), *Firm COVID-19 exposure* is interacted with the 3-year moving average value of *Firm equity*, i.e., the log of firm equity capital. In specification (5), *Firm COVID-19 exposure* is interacted with the 3-year moving average value of *Firm tangibility*, i.e., the ratio of firm tangible assets to total assets. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank COVID-19 exposure	28.117***	29.253***	30.123***	31.841***	31.590***
	[3.102]	[3.133]	[3.209]	[3.887]	[3.515]
Firm COVID-19 exposure	10.509**	10.641**	8.952**	11.821**	9.457**
	[2.441]	[2.742]	[2.407]	[2.232]	[2.109]
Firm COVID-19 exposure × Firm size	-2.544**				
	[-2.339]				
Firm COVID-19 exposure × Firm ROA		1.970			
		[1.092]			
Firm COVID-19 exposure × Firm leverage			0.002		
			[0.990]		
Firm COVID-19 exposure × Firm equity				-3.180**	
				[-2.337]	
Firm COVID-19 exposure × Firm tangibility					-0.155**
					[-2.437]
Observations	4,117	4,117	4,117	4,117	3,958
Adj. R-squared	0.315	0.315	0.314	0.316	0.316
Full set of controls	Y	Y	Y	Y	Y
Full interactions and main terms	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y

Table A8. Results for AISU

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISU* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. All specifications include year, bank and lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) AISU	(2) AISU	(3) AISU
Bank COVID-19 exposure	3.888***		3.511**
	[3.106]		[2.485]
Firm COVID-19 exposure		1.147**	0.515
		[2.583]	[0.876]
AISD	0.138***	0.141***	0.138***
	[20.960]	[22.094]	[20.986]
Loan amount	-0.042	-0.001	-0.038
	[-0.201]	[-0.004]	[-0.183]
Maturity	2.083***	1.945***	2.135***
	[5.433]	[5.659]	[6.008]
Collateral	3.669***	3.576***	3.670***
	[8.510]	[8.272]	[8.527]
Number of lenders	0.026	0.025	0.029
	[0.893]	[0.847]	[1.006]
Performance provisions	-0.029	-0.021	-0.030
	[-0.329]	[-0.222]	[-0.331]
General covenants	0.411**	0.389**	0.405**
	[2.740]	[2.554]	[2.704]
Bank size	1.182	2.715	3.384
	[0.008]	[1.094]	[0.153]
Bank ROA	13.784***	17.786**	12.617**
	[2.878]	[2.359]	[2.342]
Bank capital	-0.468	-1.325	-0.343
	[-0.483]	[-1.520]	[-0.348]
Firm size	-0.368*	-0.369*	-0.374*
	[-1.979]	[-1.943]	[-1.989]
Firm ROA	-0.097***	-0.089***	-0.097***
	[-3.430]	[-2.996]	[-3.391]
Firm leverage	0.000	0.000	0.000
	[0.651]	[0.539]	[0.682]
GDP growth	-0.465	-0.392	-0.458
	[-0.858]	[-0.725]	[-0.844]
GDP per capita	0.000***	0.000***	0.000***
	[2.863]	[2.873]	[2.858]
Constant	-12.515	-335.481	-59.132
	[-0.041]	[-1.186]	[-0.188]
Observations	2,168	2,168	2,168
Adj. R-squared	0.651	0.649	0.652
Fixed effects	Y	Y	Y

Table A9. Different clustering of standard errors

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS. The lower part of the table denotes the type of standard error clustering. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank COVID-19 exposure	30.836***	30.836***	30.836***	30.836***	30.836***
	[6.831]	[4.361]	[8.735]	[5.476]	[6.800]
Firm COVID-19 exposure	8.924**	8.924*	8.924**	8.924**	8.924**
	[2.633]	[1.693]	[2.108]	[2.339]	[2.520]
Loan amount	-9.891***	-9.891***	-9.891***	-9.891***	-9.891***
	[-7.838]	[-4.015]	[-4.007]	[-6.622]	[-7.558]
Maturity	7.714**	7.714	7.714	7.714**	7.714**
	[2.647]	[1.332]	[1.538]	[2.455]	[2.748]
Collateral	54.832***	54.832***	54.832***	54.832***	54.832***
	[7.081]	[9.237]	[6.971]	[16.647]	[7.142]
Number of lenders	-0.673	-0.673*	-0.673*	-0.673***	-0.673
	[-1.307]	[-1.653]	[-1.977]	[-2.870]	[-1.312]
Performance provisions	-0.813***	-0.813	-0.813	-0.813	-0.813***
	[-4.485]	[-0.704]	[-1.110]	[-1.404]	[-3.471]
General covenants	-11.411***	-11.411***	-11.411***	-11.411***	-11.411***
	[-10.442]	[-4.915]	[-10.480]	[-8.565]	[-9.630]
Bank size	-397.289***	-397.289***	-397.289***	-397.289**	-397.289***
	[-6.469]	[-2.724]	[-8.009]	[-2.519]	[-6.088]
Bank ROA	131.013***	131.013***	131.013***	131.013***	131.013***
	[5.078]	[3.283]	[9.253]	[3.008]	[5.040]
Bank capital	-7.221	-7.221	-7.221*	-7.221	-7.221
	[-1.686]	[-0.973]	[-1.961]	[-0.827]	[-1.709]
Firm size	-8.515***	-8.515***	-8.515***	-8.515***	-8.515***
	[-6.841]	[-3.407]	[-3.901]	[-5.595]	[-6.807]
Firm ROA	-2.583***	-2.583***	-2.583***	-2.583***	-2.583***
	[-18.074]	[-5.611]	[-7.545]	[-9.608]	[-18.587]
Firm leverage	0.030***	0.030**	0.030***	0.030***	0.030***
	[10.168]	[2.549]	[4.944]	[4.046]	[9.625]
GDP growth	-1.781	-1.781	-1.781	-1.781	-1.781
	[-0.392]	[-0.247]	[-0.355]	[-0.406]	[-0.376]
GDP per capita	0.001***	0.001***	0.001**	0.001***	0.001***
	[5.381]	[2.626]	[2.689]	[5.144]	[5.759]
Constant	6,031.291***	6,031.291***	6,031.291***	6,031.291***	6,031.291***
	[7.105]	[2.892]	[8.469]	[2.675]	[6.694]
Observations	4,117	4,117	4,117	4,117	4,117
Adj. R-squared	0.315	0.315	0.315	0.315	0.315
Fixed effects	Y	Y	Y	Y	Y
Clustering	Lender's country	Firm	Borrower's country	Bank-firm pair	Country-pair

Table A10. Weighted regressions

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different weight. In specification (1), we weight by the number of loans between the lender and the borrower to the total number of loans in our sample. In specification (2), we weight by the number of loans between the lender and the borrower's country to the total number of loans in our sample. In specification (3), we weight by the number of loans between the lender's country and the borrower's country to the total number of loans in our sample. In specification (4), we weight by the number of loans between the borrower and the lender's country to the total number of loans in our sample. All specifications include year, bank and lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Bank COVID-19 exposure	30.032***	30.819***	31.093***	30.573***
	[3.112]	[3.307]	[3.262]	[3.429]
Firm COVID-19 exposure	9.516**	8.933**	8.887**	10.115**
	[2.414]	[2.318]	[2.289]	[2.581]
Loan amount	-8.750***	-9.868***	-9.834***	-9.317***
	[-6.026]	[-7.441]	[-7.440]	[-6.596]
Maturity	7.472***	7.722***	7.641***	7.717***
	[2.990]	[3.081]	[3.078]	[3.132]
Collateral	53.875***	54.782***	54.650***	52.574***
	[9.624]	[10.320]	[10.032]	[9.219]
Number of lenders	-0.875**	-0.680*	-0.681*	-1.017***
	[-2.580]	[-1.764]	[-1.821]	[-2.966]
Performance provisions	-0.570	-0.821	-0.824	-0.538
	[-1.045]	[-1.377]	[-1.384]	[-0.943]
General covenants	-11.497***	-11.358***	-11.305***	-11.393***
	[-10.212]	[-10.616]	[-10.014]	[-10.211]
Bank size	-393.753***	-391.487***	-399.555***	-412.362***
	[-2.838]	[-3.022]	[-3.033]	[-3.254]
Bank ROA	125.604***	130.288***	129.841***	116.433***
	[3.062]	[3.252]	[3.207]	[2.891]
Bank capital	-7.239	-6.343	-6.634	-4.536
	[-0.990]	[-0.841]	[-0.937]	[-0.600]
Firm size	-8.877***	-8.585***	-8.653***	-9.172***
	[-7.702]	[-8.060]	[-7.685]	[-7.834]
Firm ROA	-2.505***	-2.578***	-2.579***	-2.505***
	[-12.387]	[-12.792]	[-12.681]	[-12.071]
Firm leverage	0.029***	0.030***	0.030***	0.029***
	[8.670]	[8.177]	[8.383]	[8.419]
GDP growth	-1.856	-2.043	-2.190	-2.171
	[-0.422]	[-0.482]	[-0.502]	[-0.500]
GDP per capita	0.001***	0.001***	0.001***	0.001***
	[7.588]	[7.284]	[7.505]	[7.866]
Constant	5,963.251***	5,937.899***	6,059.854***	6,208.628***
	[3.037]	[3.239]	[3.255]	[3.466]
Observations	4,117	4,117	4,117	4,117
Adj. R-squared	0.317	0.315	0.315	0.319
Fixed effects	Y	Y	Y	Y

Table A11. Different subsamples

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different subsample. In specification (1), we only include observations from borrower's countries with at least 100 loan facilities in our sample period, namely Canada, France, Germany, Spain, United Kingdom and United States of America. In specification (2), we only include observations from borrower's countries with at least 30 loan facilities in our sample period, namely Canada, France, Germany, Luxembourg, Mexico, Spain, Turkey, United Kingdom and United States of America. In specification (3), we exclude observations from borrower's countries with less than 10 loan facilities in our sample period, namely Austria, Belgium, Chile, China, Hungary, Iceland, India, Italy, Norway, Philippines, South Africa and Switzerland. All specifications include year, bank and lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Bank COVID-19 exposure	29.568***	31.857***	31.896***
	[3.444]	[3.207]	[3.217]
Firm COVID-19 exposure	7.595**	6.151**	6.257**
	[2.050]	[1.925]	[1.952]
Loan amount	-9.092***	-9.768***	-9.526***
	[-7.012]	[-7.572]	[-7.545]
Maturity	8.730***	8.770***	8.204***
	[3.644]	[3.774]	[3.641]
Collateral	50.771***	52.687***	53.716***
	[10.557]	[10.798]	[10.869]
Number of lenders	-0.940***	-0.589*	-0.537
	[-2.759]	[-1.835]	[-1.655]
Performance provisions	-0.566	-0.991*	-0.962*
	[-1.036]	[-1.699]	[-1.719]
General covenants	-11.457***	-11.267***	-11.156***
	[-10.090]	[-9.956]	[-10.073]
Bank size	-381.250***	-379.032***	-383.481***
	[-2.762]	[-2.816]	[-2.792]
Bank ROA	111.987**	122.450***	115.390**
	[2.526]	[2.892]	[2.610]
Bank capital	-1.711	-3.520	-2.327
	[-0.233]	[-0.459]	[-0.296]
Firm size	-8.710***	-8.474***	-8.715***
	[-9.564]	[-9.929]	[-10.236]
Firm ROA	-2.545***	-2.521***	-2.577***
	[-13.534]	[-13.328]	[-13.598]
Firm leverage	0.032***	0.030***	0.030***
	[8.139]	[8.088]	[8.467]
GDP growth	-12.805*	-5.869	-8.286**
	[-1.908]	[-0.876]	[-2.226]
GDP per capita	0.002***	0.002***	0.002***
	[13.217]	[8.890]	[10.349]
Constant	5,713.193***	5,710.765***	5,761.950***
	[2.926]	[2.989]	[2.966]
Observations	3,835	3,990	4,063
Adj. R-squared	0.326	0.323	0.323
Fixed effects	Y	Y	Y

Table A12. Heckman sample-selection model

The table reports coefficients and t-statistics (in brackets) from Heckman's (1979) sample-selection model. The dependent variable is in the second line of each panel and all variables are defined in Table A1. The estimation method in Panel A is maximum likelihood and in Panel B it is OLS with standard errors clustered by bank. Specifications (1)-(3) of Panel A report the estimates from the first-stage probit model for the determinants of the firm's loan-taking decision. All specifications in Panel A include loan type and purpose, year, firm and borrower's country dummies. Panel B reports the estimates of the second-stage OLS regression for the effect of the lender and borrower exposure measures on loan spreads. Each of the specifications in Panel B includes the inverse Mills ratio (Lambda) from the corresponding specification in Panel A. All specifications in Panel B include year, bank and lender's country fixed effects. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: The firm's loan-taking decision

	(1)	(2)	(3)
	Loan deal	Loan deal	Loan deal
Loan amount	0.068***	0.039***	0.034*
	[6.336]	[2.591]	[1.749]
Maturity	-0.013	0.031	0.125***
	[-0.673]	[1.135]	[3.685]
Collateral	0.084***	0.207***	0.118**
	[3.021]	[5.213]	[2.377]
Number of lenders	-0.003	0.002	0.002
	[-1.585]	[0.806]	[0.643]
Performance provisions	0.076***	0.161***	0.182***
	[8.851]	[10.991]	[8.912]
General covenants	0.212***	0.283***	0.326***
	[15.366]	[12.331]	[10.578]
Firm size	-0.105***	-0.061***	0.027
	[-13.072]	[-5.517]	[0.551]
Firm ROA	0.009***	-0.004	-0.007*
	[4.302]	[-1.131]	[-1.728]
Firm leverage	0.000**	0.000***	0.000**
	[2.127]	[4.653]	[2.511]
Firm equity			-0.047
			[-0.919]
Firm tangibility			-0.008***
			[-10.077]
Bank size		0.089***	0.067**
		[3.734]	[2.291]
Bank ROA		0.766***	0.339**
		[16.111]	[2.524]
Bank capital		-0.034***	-0.028
		[-3.652]	[-1.317]
Bank NPLs			-0.016
			[-0.279]
Firm loans			-363.796***
			[-6.027]
Bank-firm loans			2,047.922***
			[2.668]
Constant	776.014***	337.945***	460.804***
	[12.557]	[3.652]	[3.656]
Observations	18,664	8,043	5,326

Panel B: The effect of lender and borrower exposures on loan spreads

	(1) AISD	(2) AISD	(3) AISD
Bank COVID-19 exposure	30.990***	30.821***	32.303***
	[3.314]	[3.305]	[3.174]
Firm COVID-19 exposure	8.843**	8.922**	10.176**
	[2.304]	[2.312]	[2.643]
Loan amount	-9.256***	-9.809***	-8.204***
	[-7.098]	[-7.449]	[-6.242]
Maturity	7.222***	7.677***	7.723***
	[3.009]	[3.111]	[3.208]
Collateral	55.012***	55.242***	50.266***
	[10.062]	[9.860]	[9.910]
Number of lenders	-0.667*	-0.659*	-0.384
	[-1.789]	[-1.775]	[-1.068]
Performance provisions	-0.252	-0.564	0.488
	[-0.439]	[-0.952]	[0.851]
General covenants	-9.412***	-10.856***	-7.935***
	[-6.589]	[-7.278]	[-4.349]
Bank size	-396.003***	-396.576***	-377.429**
	[-3.013]	[-3.043]	[-2.700]
Bank ROA	127.453***	131.871***	141.106**
	[3.135]	[3.286]	[2.492]
Bank capital	-6.530	-7.116	-10.437
	[-0.899]	[-0.980]	[-1.194]
Firm size	-9.611***	-8.691***	-10.199***
	[-9.257]	[-8.346]	[-12.093]
Firm ROA	-2.463***	-2.578***	-2.616***
	[-12.200]	[-12.656]	[-14.421]
Firm leverage	0.031***	0.030***	0.034***
	[8.616]	[8.090]	[8.701]
GDP growth	-2.766	-2.013	-2.062
	[-0.660]	[-0.476]	[-0.751]
GDP per capita	0.001***	0.001***	0.001***
	[6.738]	[7.108]	[5.239]
Lambda	12.775**	4.558	23.291***
	[2.537]	[0.639]	[3.651]
Constant	5,988.470***	6,015.287***	5,730.724***
	[3.230]	[3.268]	[2.914]
Observations	4,117	4,117	3,412
Adj. R-squared	0.316	0.315	0.309
Fixed effects	Y	Y	Y

Table A13. Different bank-, firm- and macro-controls

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a different set of bank-, firm- and macro-level controls. All specifications include year, bank and lender's country fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively

	(1)	(2)	(3)	(4)	(5)	(6)
Bank COVID-19 exposure	30.277***	32.015***	32.288***	35.470***	31.727***	33.157**
	[2.916]	[3.592]	[3.194]	[3.345]	[3.352]	[2.412]
Firm COVID-19 exposure	10.268**	8.655**	9.398**	8.304*	8.953**	5.777*
	[2.665]	[2.178]	[2.292]	[1.870]	[2.360]	[1.836]
Bank size	139.410	-384.409***	-433.794***	-390.833**	-414.864***	-332.133***
	[0.676]	[-2.908]	[-3.303]	[-2.330]	[-3.172]	[-2.878]
Bank ROA	187.589***	141.220***	136.307***	166.548***	131.276***	109.874**
	[4.020]	[3.206]	[3.311]	[3.539]	[3.308]	[2.570]
Bank capital	-3.421	-8.638	-8.922	-11.270	-6.797	-3.738
	[-0.374]	[-1.147]	[-1.142]	[-1.284]	[-0.933]	[-0.523]
Firm size	-9.745***	-1.089	-7.904***	-22.105***	-9.039***	-8.589***
	[-11.389]	[-0.459]	[-7.006]	[-4.348]	[-8.405]	[-7.883]
Firm ROA	-2.630***	-2.346***	-2.374***	-3.746***	-2.583***	-2.580***
	[-13.579]	[-12.785]	[-8.808]	[-6.912]	[-12.959]	[-12.404]
Firm leverage	0.031***	0.014**	0.009**	0.026***	0.030***	0.030***
	[8.100]	[2.733]	[2.336]	[8.246]	[8.384]	[8.229]
GDP growth	-0.955	-2.078	-1.098	-1.054	-4.937	-1.299
	[-0.339]	[-0.470]	[-0.253]	[-0.229]	[-1.304]	[-0.294]
GDP per capita	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[5.877]	[7.435]	[7.764]	[4.768]	[6.787]	[7.422]
Bank NPLs	-152.498					
	[-1.057]					
Bank equity	-30.343*					
	[-1.979]					
Firm equity		-8.177**				
		[-2.602]				
Firm tangibility		0.261***				
		[5.000]				
Firm debt			0.592***			
			[5.381]			
Firm retained earnings			-169.988			
			[-0.367]			
Firm sales				-0.674		
				[-0.638]		
Firm EBITDA				15.342***		
				[3.020]		
GDP					0.000***	
					[3.458]	
Inflation					0.000	
					[1.458]	
VIX						1.020*
						[1.885]
Constant	-1,397.900	5,868.755***	6,570.023***	6,016.423**	6,059.854***	5,057.086***
	[-0.478]	[3.140]	[3.530]	[2.554]	[3.255]	[3.124]
Observations	3,557	3,958	4,033	3,814	4,117	4,117
Adj. R-squared	0.310	0.317	0.320	0.308	0.315	0.316
Fixed effects	Y	Y	Y	Y	Y	Y