The Value of Bank Relationships: Evidence from the COVID-19 Crisis[*]

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Abstract

We investigate how firm–bank relationships affect firms' stock performance during the COVID-19 crisis. Using Japanese firms' data, we find that the COVID-19 outbreak caused a sharp drop in the stock performance of both the firms with more concentrated bank relationships and those with less concentrated ones in the early spring of 2020. However, the first group of firms outperformed the second group after the rebound of stock prices, following the Japanese central bank's policy announcement in response to the COVID-19 crisis. The bank relationship effects were more evident for smaller firms and persisted throughout 2020. The results are robust when we consider the other factors, including firms' financial flexibility, dependence on international trade, and ownership structure. Our results highlight the importance of bank relationships for sudden liquidity shocks. Especially, the concentration of bank relationships is valuable during the recovery process.

JEL classification codes: G14, G21, G32
Keywords*:* Bank relationships, COVID-19, stock performance, financial constraints, monetary policy

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Abstract

We investigate how firm–bank relationships affect firms' stock performance during the COVID-19 crisis. Using Japanese firms' data, we find that the COVID-19 outbreak caused a sharp drop in the stock performance of both the firms with more concentrated bank relationships and those with less concentrated ones in the early spring of 2020. However, the first group of firms outperformed the second group after the rebound of stock prices, following the Japanese central bank's policy announcement in response to the COVID-19 crisis. The bank relationship effects were more evident for smaller firms and persisted throughout 2020. The results are robust when we consider the other factors, including firms' financial flexibility, dependence on international trade, and ownership structure. Our results highlight the importance of bank relationships for sudden liquidity shocks. Especially, the concentration of bank relationships is valuable during the recovery process.

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1. Introduction

The COVID-19 outbreak adversely affected firms' revenues. Firms worldwide experienced a large drop in sales and increased their liquidity to survive the unprecedented crisis. An increasing number of studies have found that the negative effect of the public health crisis on firm performance varies according to firm characteristics, including financial flexibility, ownership structure, governance structure and firms' exposure to international trade (Fahlenbrach, Rageth, and Stulz 2021; Amore, Pelucco, and Quarato 2022; Ding et al. 2021; Barry et al. 2022; Takahashi and Yamada 2021). For example, Fahlenbrach, Rageth, and Stulz (2021) observed that firms with more cash and less debt (pre-crisis financial flexibility) experienced lower drops in stock returns during the crisis. Cash holdings were highly valuable during the crisis and increased as future uncertainty increased (Acharya and Steffen 2020; Bates, Kahle, and Stulz 2009; DeAngelo, Gonçalves, and Stulz 2018). Other studies showed that firms first approached banks for liquidity and built up cash after the COVID-19 outbreak (Acharya and Steffen 2020; L. Li, Strahan, and Zhang 2020). Bank liquidity provision is especially important for a firm's sudden liquidity shortage—not only for smaller firms but also for larger firms. Despite the evidence that firms first resort to banks for prompt liquidity to ease the concern about corporate failure, the effect of bank relationships on firms' stock performance during such sudden liquidity shocks of COVID-19 has been unexplored.

In this paper, we study the value of bank relationships during the COVID-19 crisis. Different from other financial shocks, the COVID-19 crisis had serious impacts on almost all industries and both small and large firms. Due to the unpredictable nature of the COVID-19 health crisis for both firms and banks, and their relationship, it provides an ideal-experiment setting to examine the effect of bank relationships on firm value. We first examine whether firms' pre-pandemic bank dependence affected their stock

performance during the crisis. Next, we investigate whether the structure of bank relationships matters. Banking literature says that the ex-ante close bank relationships mitigate the informational asymmetry problems and contribute to the immediate supply of credit (Diamond 1984, 1991). Banks' monitoring of firms intensifies as the concentration of bank relationships increases because the free-ride problems are less likely (Diamond 1984; Carletti, Cerasi, and Daltung 2007). Moreover, the agency problems associated with holding too much cash are mitigated. Some studies found that firms with close bank relationships were granted credit, including government-supported loans in larger amounts, and more quickly so than firms with non-relational banks during the COVID-19 crisis (Li, Strahan, and Zhang 2020; James, Lu, and Sun 2021). We investigate whether pre-shock concentrated bank relationships helped firms perform better during the crisis. To examine the value of bank relationships, data on firms' stock performance and their bank relationships are needed. Japanese firms are ideal subjects of investigation for this purpose for two reasons. First, Japanese firms disclose their loan amounts from each bank, enabling us to measure the structure of bank relationships, such as their concentration. Second, Japan has a well-developed bank loan market. Among the listed firms with positive outstanding debts, almost 80% rely on bank loans for debt financing. This is an ideal setting to examine the value of bank relationships during the sudden liquidity shock. Our findings about the role of bank relationships during the unprecedent non-financial crisis provide an important lesson for bank loan-dependent economies, such as those of European and Asian countries.

To investigate how the stock performance's reaction to the COVID-19 crisis differs according to the firms' bank dependence and bank relationships, we use the cumulative stock returns from February 3 to March 13, 2020. The Bank of Japan (BOJ) held a monetary policy meeting on March 16, 2020 and announced that it would expand

its monetary easing policy by introducing the Special Funds-Supplying Operations to facilitate corporate financing regarding COVID-19. Under this program, the BOJ supported banks—so that they could meet the massive liquidity demand by firms—and bought corporate bonds. We also examine the market reaction to the BOJ's policy announcement, similar to the US market reaction to the announcement of the US Federal Reserve Board's (FRB's) monetary policy, as studied by Fahlenbrach, Rageth, and Stulz (2021).

Our cross-section analysis reveals that firms' stock returns fell as their number of bank relationships increased during the stock market collapse period (February 3 to March 13, 2020), whereas firms with concentrated bank relationships recovered to a greater extent than those with diverse bank relationships, following the BOJ's monetary policy meeting held on March 16. Firms' ex-ante cash holdings had no significant effect, contrary to the previous findings that firms' financial flexibility played an important role during the COVID-19 crisis (Fahlenbrach, Rageth, and Stulz 2021).

Next, we employ the difference-in-difference analysis and investigate the value of bank relationships from January 15 to December 30, 2020. By including the firm-fixed and day-fixed effects, we can overcome the omitted variable bias. We find that firms with concentrated bank relationships and firms with large main bank loan shares outperformed those with diverse bank relationships or small main bank loan shares after the rebound of stock prices. These results were mostly similar when firms' loan dependence (loan/debt) was controlled for. We also find that smaller firms benefited from the concentration of their bank relationships during the recovery period from March 17 to December 30, 2020.

We conduct several robustness checks. Although the COVID-19 crisis is unpredictable, we conduct a matching analysis and compare the stock performance between firms with close bank relationships and those without such relationships. We

confirm that concentrated bank relationships are valuable. We also control for the effect of financial flexibility, ownership structure, and firms' exposure to international trade during the crisis and the post-crisis periods and obtain robust results for bank relationship variables. Our results highlight the important role of bank relationships, which provide access to immediate financing to firms.

Our study contributes to a growing body of literature on the role of bank relationships in a crisis and over the business cycle (Beck et al. 2018; Schäfer 2019; Sette and Gobbi 2015). Bolton et al. (2016) theoretically examine whether relational banks provide client firms with liquidity at higher interest rates in good times but at lower interest rates in bad times. The authors confirm their prediction using the Italian firm–bank data. The countercyclical effect of relationship lending is also reported by Beatriz, Coffinet, and Nicolas (2022). Gobbi and Sette (2014) stress the effect of concentrated bank relationships on firms' access to credit in times of financial crisis. Our findings are in line with the above-cited studies showing that concentrated bank relationships are valuable in times of sudden shortage of liquidity. Due to the high cost of keeping bank relationships, firms decreased their bank loan dependence and increased their cash holdings after the 2008 global financial crisis (Almeida, Campello, and Weisbach 2011). However, our study reveals the importance of keeping bank relationships as buffers against liquidity shortage.

Our study is also related to the literature on the value of bank loans. Some studies show that the value of bank loans observed in the 1980s diminishes during later periods; however, bank relationships still matter during times of economic uncertainty (e.g., Paige Fields et al. 2006). A recent study shows that banks' certification of borrowers plays a key role in alleviating informational asymmetry and easing the market concern during the economic turmoil. Bank loan announcements have had a positive impact on borrowers'

stock returns during the 2008 global financial crisis and the COVID-19 crisis (C. Li and Ongena 2015; Tampakoudis, Noulas, and Kiosses 2022). On the other hand, few studies report the opposite results (e.g., Godlewski 2014). Others find evidence that the positive effect of loan issuance on stock performance during the 2008 global financial crisis is larger than that of bond issuance (Gasbarro et al. 2017; Fungáčová, Godlewski, and Weill 2020).

We also study the firms' choice of financing between bank loans and bonds at the time of the COVID-19 crisis. Acharya and Steffen (2020) found that AAA-rated firms reached out to capital markets after the US FRB's policy announcement, and middle-rated firms approached banks. In our study, bank-dependent firms showed higher returns after the introduction of the BOJ's COVID-19 operations. Our results indicate that firms prioritize speed and prefer bank loan over bond financing in the face of a sudden liquidity shortage. Ex-ante bank relationships help firms obtain liquidity promptly. Stock markets evaluate this immediate liquidity supply. Our results are consistent with another study's finding that banks played an important role as liquidity suppliers to firms, especially during the liquidity shocks caused by the COVID-19 crisis (Li et al. 2020).

Other studies explored the stock market reactions to the COVID-19 crisis. A couple of studies found that firms with more exposure to global supply chain networks and to international trade were affected more negatively (Ding et al. 2021; Ramelli and Wagner 2020), while another study observed that firms with ex-ante financial flexibility were less affected (Fahlenbrach, Rageth, and Stulz 2021). This study investigates the effect of ex-ante bank relationships on firms' stock reactions to COVID-19 liquidity shocks.

2. BOJ's monetary policy to overcome the COVID-19 crisis and support bank

lending

The first case of COVID-19 infection in Japan was reported on January 15, 2020. After the WHO announcement that COVID-19 could be characterized as a pandemic[1], stock prices fell sharply on March 13, 2020 in the Tokyo stock market. The BOJ held a monetary policy meeting on March 16, 2020, four days earlier than initially scheduled in response to the collapse of the Tokyo stock exchange market. The BOJ decided to introduce the Special Funds-Supplying Operations to facilitate corporate financing regarding the COVID-19 outbreak. Under these operations, the BOJ supported banks by providing short-term loans at 0% interest rate against corporate debts as collaterals. Furthermore, the BOJ offered banks various incentives for lending; for example, banks that expanded their lending could avoid the negative interest rate payment on their deposit accounts at the BOJ. Banks that applied for the COVID-19 operations were also given an interest rate that was similar to that of the targeted longer-term refinancing operations (TLTROs) introduced by the European Central Bank. Therefore, under these operations, banks could avoid the negative interest rate payment[2] and receive the positive interest rate payment (subsidy) when they expanded their lending.[3] After the introduction of the BOJ's COVID-19 operations, bank lending increased almost seven-fold, from 0.3 billion yen in March 2020 to 21 billion yen at the end of June 2020.

Firms tried to hold cash to overcome the immediate liquidity shortage by increasing their short-term debts. Although the bond market operated properly, in contrast to the situation during the 2008 global financial crisis, the demand for short-term

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[1] Virtual press conference on COVID-19 – 11 March 2020, WHO
who-audio-emergencies-coronavirus-press-conference-13apr2020.pdf

[2] BOJ introduced negative interest rate policies in January 2016.

[3] The BOJ released this statement on March 16, 2020: Enhancement of Monetary Easing in Light of the Impact of the Outbreak of the Novel Coronavirus (COVID-19).

financing was high. Furthermore, banks' financial status (capital ratio) was relatively sound after the 1997/1998 banking crisis in Japan and the 2008 global financial crisis. Therefore, banks could meet the growing demand for cash once the BOJ provided them with favorable conditions for lending.

3. Testing the hypotheses

First, we consider firms' choice of financing between bank loans and bonds during the period of liquidity shocks. The theoretical literature states that high-quality or high-rated firms prefer bond financing over bank loans (Diamond, 1991). However, the issuance of long-term debt is time-consuming and less favorable for the immediate needs of liquidity. Ex-ante bank relationships mitigate the information asymmetry problems and help banks supply immediate liquidity to their client firms. Therefore, bank-dependent firms have faster access to liquidity, which in turn lowers the probability of corporate failure. Moreover, information asymmetry is larger in crisis periods than normal periods (C. Li and Ongena 2015). Banks' certification of borrowers eases the market concern during the economic turmoil and leads to a positive effect on firm stock performance (C. Li and Ongena 2015; Fungáčová, Godlewski, and Weill 2020). We hypothesize this as follows:

H1. Bank-dependent firms experienced lower drops in stock returns during the COVID-19 crisis.

Next, we consider the effect of bank relationships on firm performance. Both the theoretical and the empirical literature shows that the concentration of bank relationships has an opposing effect on firm credit availability and firm value, especially during the shocks. On one hand, the concentration of bank relationships motivates banks to monitor firms because the free-ride problems are less likely (Diamond 1984; Carletti, Cerasi, and

Daltung 2007). Moreover, the agency problems associated with holding too much cash are mitigated because of the intense monitoring by banks, leading to a high evaluation of firms. Gobbi and Sette (2014) found that firms with concentrated bank relationships experienced a smaller drop in credit availability compared with firms with multiple bank relationships during the 2008 global financial crisis.

On the other hand, the concentration of bank relationships is costly because banks that have informational monopoly hold up borrowers by tightening credit terms (Rajan 1992). Some researchers find that firms with concentrated bank relationships have lower returns because of hold-up problems. In other studies, it is argued that multiple bank relationships are beneficial at a time of financial crisis. For example, firms can tap alternate sources of credit if one bank declines to offer credit (Detragiache, Garella, and Guiso 2000). The COVID-19 crisis differs from those of other financial crises, including the 1997/1998 banking crisis in Japan and the 2008 global financial crisis. Banks' financial status greatly improved after the global financial crisis. Furthermore, as explained in Section 2, the central banks provide liquidity to support banks in extending credit to firms (BOJ 2020). It is thus less likely for a financial sector to experience difficulty in supplying liquidity. Therefore, the benefits of concentrated bank relationships possibly outweighed those of diverse bank relationships during the non-financial (COVID-19) crisis. Firms with concentrated bank relationships were more likely to obtain loans during the non-banking crisis, leading to higher stock returns compared with firms with diversified bank relationships. We hypothesize this as follows:

H2. Firms with concentrated bank relationships experienced lower drops in stock returns during the COVID-19 crisis.

Moreover, banks are more likely to extend credit to firms with concentrated bank relationships because they can enjoy the rents when firms recover. Bolton et al. (2016)

show that compared with transaction banks, relational banks charge higher interest rates in good times but lower rates in bad times so that client firms can survive a business cycle. They also find that firms associated with relational banks obtain more credit and are more likely to survive in bad times than firms with transaction banks. We hypothesize this as follows:

H3. Firms with concentrated bank relationships recovered faster in their stock performance than firms with diverse bank relationships after the COVID-19 crisis.

Previous studies reveal that close bank relationships mitigate the financial constraints of firms. Therefore, we formulate this hypothesis:

H4. Concentrated bank relationships have a more profound effect on financially constrained firms.

However, the benefits of multiple bank relationships possibly outweigh their costs as the uncertainty of the COVID-19 crisis continues. Banks are reluctant to extend loans to firms whose default risk increases as the pandemic continues. Thus, firms with multiple bank relationships can obtain loans from other banks if their main banks are reluctant to extend further loans. We hypothesize this as follows:

H5. The effect of concentrated bank relationships diminishes as the uncertainty of the COVID-19 crisis continues.

4. Data and variables

Our sample consists of firms listed in Japanese stock markets in fiscal years 2018 and 2019. We have obtained the firms' financial data, stock price data, the firms' loans from the financial institutions' data, and the banks' financial data from Nikkei's Financial QUEST database. We exclude the financial industry and the utility industries. We also exclude firms without debts. Our total sample consists of 2415 firms. Among these, 2402

firms had bank loans at the end of fiscal year 2018 (March 2019). We match the firm–bank loan data with the firms' financial data. Our final sample for the analysis of bank relationships and stock performance comprises 1122 firms.

4.1 Bank relationship variables

To capture the concentration of bank relationships, we use three measures: the Herfindahl–Hirschman index (HHI) of bank loans, the largest bank's loan share, and the logarithm of (1 + the number of trading banks). The HHI is calculated as $\sum_j (Loan_{ij}/Totalloans_i)^2$, where $Loan_{ij}$ represents the total value of the loans extended by bank j to firm i, and $Totalloans_i$ signifies the total outstanding value of the bank loans to firm i. The target banks include city, regional, second-tier regional, and trust banks, as well as credit associations and credit cooperatives. The high value of the HHI means that the bank relationships are concentrated. We expect the HHI to have a positive effect on stock performance because the monitoring intensity becomes stronger as the concentration of bank relationships increases.

The main bank gathers soft information about firms over time, which is not verifiable in nature and is not easily transferred to other non-relational banks. The larger the main bank loan share is, the more motivated the main bank will be to gather soft information. We use the largest bank loan share of the total bank loans as the second variable.

The third variable is the number of trading banks. We use the logarithm of (1 + the number of trading banks) to explore the non-linear effects. The expected sign for this variable is negative because banks are discouraged from monitoring firms due to free-rider problems and higher agency costs for firms associated with many trading banks.

We control for firms' dependence on bank loans by including the bank loan-to-debt ratio. Some firms hold a borrowing capacity for commitment lines. Firms with such borrowing capacity can obtain bank loans faster than other normal borrowing because they can avoid the normal procedure of the screening process before lending by banks. We expect a positive sign for the borrowing capacity variable because it serves as a substitute for cash holdings.

4.2 Other control variables

We include the cash-to-net total assets and debt-to-total assets ratio to control for financial flexibility. Following the formula used by Fahlenbrach et al. (2021), we include the book-to-market ratio, ln (total assets), and gross profit-to-total assets ratio as control variables. We also add the investment ratio and selling, general, and administrative expenses-to-total sales ratio (SGA/sales) as proxies for fixed costs. Firms with higher fixed costs face difficulties in cutting spending, even their revenue diminishes. We include the cost of goods sold-to-total sales ratio (COGS/sales) as a proxy for varying costs. Firms' characteristics besides stock returns are based on the value at the end of the fiscal year 2018. We include three-digit industry dummies to control for industry heterogeneity.

Table 1 presents the summary statistics. The definition of variables is shown in Appendix. The statistics in Panel A show the stock performance of the whole sample. The mean of the firms' cumulative stock return during the period of the stock market collapse from February 3 to March 13, 2020 is -31.5%. The standard deviation is 12.2%, suggesting variations among firms. Panel B in Table 1 shows the descriptive statistics of the total sample of the firms with debts (the sample firms used in Table 3). Panel C consists of firms with firm–bank loan data. The mean value of a main bank loan share is 43.5%. Panel D shows the industry distribution. The service industry has a relatively

higher concentration of bank relationships.

Panel A in Table 2 shows the comparison of the summary statistics by bank dependence. It also reports t-test differences by bank dependence. Bank-dependent firms are those with bank loan-to-interest-bearing debt above 90%, constituting 80.5% of the total 2431 firms. Table 2 reveals that bank-dependent firms have more cash holdings and less debts compared with bank-independent firms and thus have higher financial flexibility. They are smaller and have more short-term debts but less long-term debts than bank-independent firms. They also have more commitment lines. Panel B in Table 2, consisting of firms with bank loans, reports the mean differences of each variable between firms with high HHI and those with low HHI. Firms with high HHI (main bank loan share, number of bank relationships) are defined as firms with bank relationship variables above the 70th percentile of the sample distribution. Firms with low HHI are those with bank relationship variables below the 70th percentile of the sample distribution. Panel B in Table 2 reveals that firms with more concentrated bank relationships (high HHI) have more cash holdings and less debts compared with firms with less concentrated bank relationships (low HHI). The t-test of mean differences is significant at the 1% level. Moreover, high-HHI firms are more profitable, growing, and smaller than low-HHI firms. They have higher fixed costs of SGA/sales. However, the investment ratio and the facility undone-to-asset ratio are not significantly different between the two groups of firms. These differences remain the same when we substitute the bank relationship variables with the main bank loan share and ln (number of bank relationships).

5. Results

First, we investigate whether the firms' stock reactions to the COVID-19 crisis

from February 3 to March 13, 2020 and to the BOJ's announcement on the Special Funds-Supplying Operations (released on March 16) differ by the firms' bank dependence.[4] We conduct a cross-section analysis. The dependent variables are the cumulative raw stock returns for the shock period (Model 1) and stock returns on March 17 for the recovery day (Model 2). Table 3 shows the results. We define bank-dependent firms as those with loan-to-interest-bearing debts greater than 90%. COVID-19 has a large negative shock on the stock performance of firms with high leverage, consistent with previous studies' findings (Fahlenbrach, Rageth, and Stulz 2021; Ramelli and Wagner 2020). However, its effect is irrelevant to the firms' bank dependence (Model 1), although bank-dependent firms recover to a greater extent than bank-independent firms on the stimulus day (Model 2). The coefficient of bank dependence is positive and highly significant ($p < 0.05$). Firms with higher cash holdings also recover to a greater extent ($p < 0.05$). Regarding the results on other control variables, firms with high fixed costs, proxied by SGA/sales, recover more on the stimulus day. It may capture the effect of the government's employment adjustment subsidy to firms.

Next, we explore whether firms' bank relationships have differential effects on firm performance. Figure 1 shows the trends of the cumulative daily log returns by bank relationships. High HHI (number of bank relationships) refers to firms with HHI above the 70th percentile of the sample distribution. Figure 1.A reveals that the mean differences of stock returns between firms with high HHI and firms with low HHI are small during the collapse periods; however, they increase after the spring of 2020. Figure 1.B shows a similar trend, suggesting that the concentration of bank relationships is valuable for the recovery process.

[4] March 13, 2020 was a Friday, and the Japanese stock market was closed on March 14 and 15, 2020.

We proceed to explore whether the value of concentrated bank relationships holds by using a multivariate analysis. Table 4 shows the cross-section results for firms with bank loans. Panel A shows that firms with high HHI recover to a greater extent than firms with low HHI ($p < 0.01$, Model 4), although the concentration of bank relationships has a positive but insignificant effect on stock returns during the collapse period from February 3 to March 13, 2020 (Model 1). In Panel B, we substitute the bank relationship variables with level variables. Firms with large main bank loan shares experience smaller drops in stock returns than firms with small main bank loan shares during the collapse period. The coefficient of the main bank loan share is significant at the 5% level (Model 2). When we substitute the main bank loan share with the number of bank relationships, it has a significant negative effect ($p < 0.05$, Model 3). A one-standard-deviation decrease in the main bank loan share decreases the cumulative stock returns by 0.076 standard deviation in Model 2. Regarding the effect of leverage, a one-standard-deviation increase in the debt-to-asset ratio decreases the cumulative stock returns by 0.065 standard deviation in Model 2. The economic impact of a main bank loan share is relatively large compared with that of leverage. Firms with concentrated bank relationships exhibit higher returns on March 17, the stimulus day ($p < 0.01$, Model 4). We obtain similar results when we alternate a bank relationship variable with the main bank loan share in Model 5. The effect of the concentration of bank relationships is relatively large. A one-standard-deviation increase in the concentration of bank relationships (a main bank loan share) increases the stock returns by 0.113 (0.074) standard deviation. These results support H2 and H3.

Our results are mostly similar when we exclude service industry meaning that our results are not driven by industry with highly concentrated bank relationships.

Alternatively, we use the cumulative excess stock returns, similar to the method

used by Fahlenbrach et al. (2021). We define the daily excess stock return as ln (1 + daily return minus risk-free rate). We obtain the risk-free rate on the one-year treasury bill from the Ministry of Finance. We obtain similar results.[5]

5.1 Difference-in-difference analysis

We conduct a difference-in-difference analysis, similar to the method used by Neukirchen et al. (2022) and Amore, Pelucco, and Quarato (2022). By constructing the panel data and including the firm-fixed and day-fixed effects, we can overcome the omitted variable bias. We use the daily returns from January 15 to December 30, 2020 and estimate the following equation:

$$Return_{it} = \beta_1 Shock_t \times Relationship_i + \beta_1 Postshock_t \times Relationship_i + \mu_i + \theta_t + \varepsilon_{it}, \quad (1)$$

where μ_i denotes the firm-fixed effects, and θ_t represents the trading day effects. $Shock_t$ takes the value of one from February 3 to March 16 and zero otherwise. $Postshock_t$ takes the value of one from March 17 onward. Table 5 presents the results.

Model 1 shows the baseline results. Standard errors are clustered at the firm level. The stock returns fall during the shock but rebound in the post-shock period. Firms with concentrated bank relationships recover more than those with less concentrated ones. The interaction term of a post-shock dummy and HHI is positive and significant ($p < 0.05$). The results remain mostly the same when we alternate the bank relationship variables with a main bank loan share (Model 2). The effects of HHI during the post-shock period remain the same when we control firm-fixed effects in Model 4 and further control both firm- and day-fixed effects in Model 7, where standard errors are two-way clustered at

[5] The results are available from the authors on request.

the firm and the day levels.

The assumption for the usage of the difference-in-difference analysis is that firms with strong bank relationships and other firms with mostly similar characteristics have parallel trends of stock performance prior to the COVID-19 shock periods. We estimate a similar regression in Equation (1) for the period from January 15 to March 16, 2020. Instead of the shock dummy, we include the pre-shock dummy, which takes the value of one prior to February 3 and zero from February 4 to March 16. We also include its interaction term of the bank relationship variables and the pre-shock dummy. As presented in Table 6, the results show that the coefficients of the interaction terms are insignificant, indicating the absence of a diverging trend prior to the COVID-19 shock periods.

5.2 Financial constraints

In previous studies, it is argued that financially constrained firms perform worse during the COVID-19 crisis because of their inability to raise funds from external sources (e.g., Fahlenbrach, Rageth, and Stulz 2021). However, close bank relationships mitigate the firms' financial constraints. We assume that firms with concentrated bank relationships are able to obtain credit during the crisis. Previous studies regard small and young firms as financially constrained (e.g., Hadlock and Pierce 2010). We include the interaction terms of the measures of financial constraints, bank relationship variables, and the shock (post-shock) dummy. Table 7 reveals that small firms have lower stock performance than large firms during the shock period; however, small firms with concentrated bank relationships recover to a greater extent than large ones during the post-shock period. The triple interaction terms of the post-shock dummy, HHI, and ln (assets) are significantly negative ($p < 0.1$).

6. Robustness

6.1 Endogeneity concern (matching analysis)

Although the COVID-19 crisis is unpredictable, we cannot rule out the possibility that firms' stock performance and bank relationships are determined endogenously. To overcome this endogeneity bias, we employ entropy balancing, similar to the method used by Neukirchen et al. (2022). We first compare the stock returns between firms with more concentrated bank relationships and other firms. High HHI (high loan share) refers to firms with HHI (the main bank loan share) above the 70th percentile of the sample distribution. Likewise, a high number of bank relationships refers to firms whose numbers of bank relationships are above the 70th percentile of the sample distribution. We match firms with concentrated bank relationships with those that have similar characteristics, such as debt-to-asset ratio, cash holdings ratio, firm size, ROA, book-to-market ratio, SGA/sales and COGS/sales. Table 8 reports the average treatment effect on the treatment group. The results confirm that firms with concentrated bank relationships have higher returns during the shock and the rebound periods. These results also support the findings shown in Table 4.

6.2 Bank dependence and the effects of bank relationships

The effects of bank relationships might vary, depending on the firms' reliance on bank loans. To check this possibility, we include the loan/debt and its interaction terms with the bank relationship variables and the shock (post-shock) dummy in

Equation (1). The triple interaction terms are insignificant; however, the interaction term of the bank concentration measure and the post-shock dummy is still significant.[6]

6.3 Financial flexibility

Previous studies have found that firms with high levels of cash holdings and low levels of debt (financial flexibility) are less affected by the COVID-19 crisis (Fahlenbrach, Rageth, and Stulz 2021; Barry et al. 2022; Ding et al. 2021). Our bank relationship measure might capture the effect of financial flexibility. As shown in Panel B, Table 2, firms with high HHI have higher financial flexibility than other firms. To rule out this possibility, we add the interaction terms of cash holdings and the shock (post-shock) dummy and those of leverage and the shock (post-shock) dummy. Table 9 shows the results. The coefficient of the cross-term of the cash ratio and the post-shock dummy is also significant ($p < 0.01$) in Models 1 and 2, suggesting that firms with more cash show higher returns after the shock period. Our results on the effect of HHI during the post-shock period remain the same, and robustness is confirmed ($p < 0.05$).

6.4 Ownership structure

In previous studies, it is argued that firms' ownership structure affects their resistance to the COVID-19 crisis (Amore, Pelucco, and Quarato 2022; Takahashi and Yamada 2021). There is a possibility that our bank relationship variables based on the borrowing share capture the effect of bank ownership. In Japan, each bank is allowed to own stock shares up to 5% of the total shareholdings. Banks are relatively stable

[6] The results are available from the authors on request.

shareholders, along with other corporations, which may contribute to the decreased stock price volatility during the COVID-19 crisis. To control for bank ownership, we include the interaction terms of the shock (post-shock) dummy and bank ownership variables. The results are presented in Models 3 and 4 in Table 9. During the shock period, bank ownership has a significant positive effect on stock return; however, its positive effect is insignificant during the post-shock period. The coefficients of the interaction terms of the shock dummy and bank ownership variables are positive and significant ($p < 0.01$, Model 3). The results for the concentrated bank relationships during the post-shock period remain the same, positive and significant at the 5% level. Model 4 controls other ownership structures. During the shock period, bank ownership and government ownership have a positive and significant effect; however, the effect is insignificant during the post-shock period. In contrast, foreign ownership has a positive effect during the post-shock period. We confirm the robust results for the concentration of bank relationships.

6.4 Firms' exposure to COVID-19: international trade and labor intensity

Previous studies find that firms that are more dependent on international trade and on workers in teamwork-incentive jobs and those in jobs requiring physical contact are more negatively affected by COVID-19 (Fahlenbrach, Rageth, and Stulz 2021; Ramelli and Wagner 2020). In this section, we explore whether the bank relationship effect remains even if we consider firms' level of COVID-19 exposure and dependence on international trade. We measure firms' dependence on international trade by overseas sales/ total sales. Following the method used by Fahlenbrach, Rageth, and Stulz (2021), we measure firms' exposure to COVID-19 by labor intensity, defined as the number of total employees/total sales. Table 10 presents the estimation results. Firms that depend

on international trade have a lower return during the shock and the post-shock periods. The coefficients of the interaction terms of the shock (post-shock) dummy and overseas sales ratio are negative and significant ($p < 0.05$, Model 3). The effect of HHI remains the same, positive and significant during the post-shock period ($p < 0.05$). Furthermore, the triple interaction terms of the post-shock dummy, HHI, and overseas sales ratio are positive and significant ($p < 0.1$, Model 3), implying that firms that depend more on international trade benefit from their close relationship with banks.

Models 4 to 6 present the results when we replace firms' exposure measure by labor intensity. The bank relationship effect remains during the post-shock period. The interaction terms of the post-shock dummy and HHI are positive and significant. Firms with a high level of labor intensity have a higher return during the post-shock period (Model 6); however, the triple interaction terms are insignificant.

6.5 Effects of bank relationships during different time periods

In this subsection, we separate the year 2020 into four time periods and compare the effects of bank relationships during these different time windows. The first period is February 3–March 16, the second is March 17–May 25 (the state of emergency lasted from April 7 to May 25), the third is May 26–October 30, and the fourth is November 1–December 30. The base period covers January 15–February 2. Table 11 shows the results. All models include firm-fixed effects. Models 1 to 3 show the baseline results. Standard errors are clustered at the firm level. The results show that stock returns fall during the first period of February 3–March 16 but rebound largely during the second period. They continue to rise modestly through the third and the fourth periods compared with the second. The coefficients of the third- and the fourth-period dummies are smaller and positive and significant compared with those of the second one. Bank relationship

variables, such as HHI and main bank loan share, have a positive and significant effect during the second and the third periods. The coefficients of the interaction terms of the second period and the bank relationship in Models 1 and 2 are larger than those of the third, indicating that the concentration of bank relationships plays a significant role in the recovery process after the COVID-19 liquidity shocks. It also suggests that the effect of bank relationships on stock returns decreases gradually in the latter period of 2020. The results remain almost the same when we control for day-fixed effects in Models 4–6 and use the firm–day clustered standard errors in Models 7–9.

7. Conclusions

The COVID-19 outbreak caused sudden liquidity shocks to corporations worldwide. Evidence shows that firms dashed for cash immediately after the outbreak. A growing body of literature has investigated which firms obtained liquidity and from where it was sourced (e.g., Acharya and Steffen 2020; L. Li, Strahan, and Zhang 2020). Some researchers argue that firms with ex-ante financial flexibility outperformed others during the crisis (Fahlenbrach, Rageth, and Stulz 2021). In this study, we focus on firms' bank relationships. We investigate how the firms' stock performance during the COVID-19 crisis varied, depending on their bank loan dependence and bank relationships. Our results indicate the importance of bank relationships for sudden liquidity shocks. Especially, the concentration of bank relationships is valuable during the recovery process.

The values of the bank loans observed in the 1980s have been diminishing over recent periods; however, bank relationships still matter during times of economic downturn (Paige Fields et al. 2006). With the recent increase of economic uncertainty, our results imply that maintaining bank relationships as a buffer for sudden liquidity

shortage is important, along with sound financial health. We find that the economic significance of bank relationships is greater than that of leverage. Our findings also indicate the importance of central banks' quick support for the financial sector in order to meet the massive short-term liquidity demand from the corporate sector.

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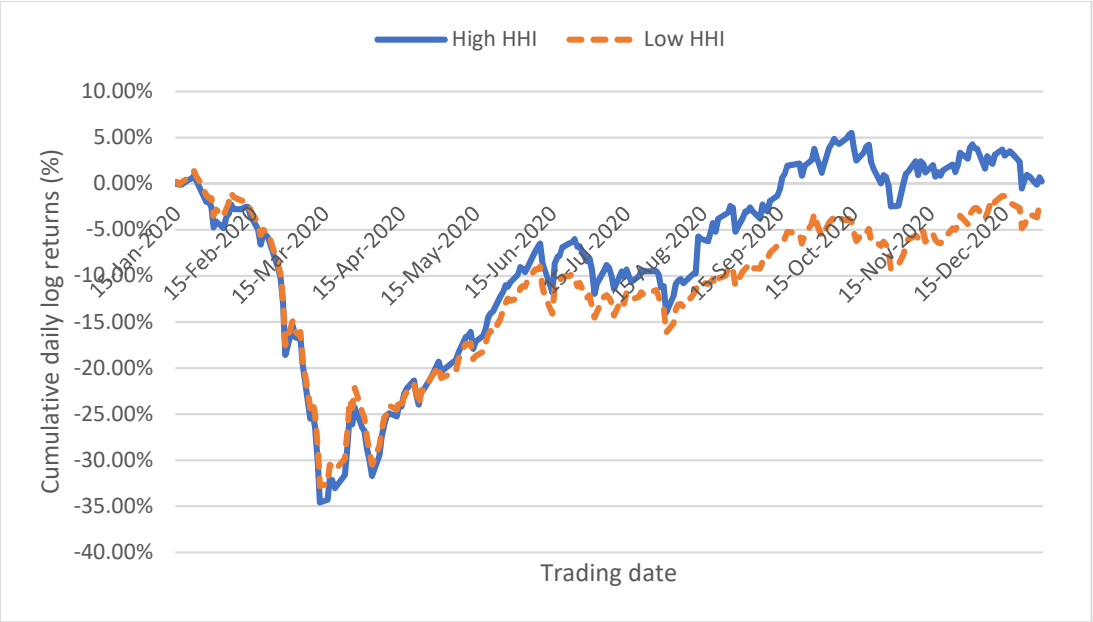
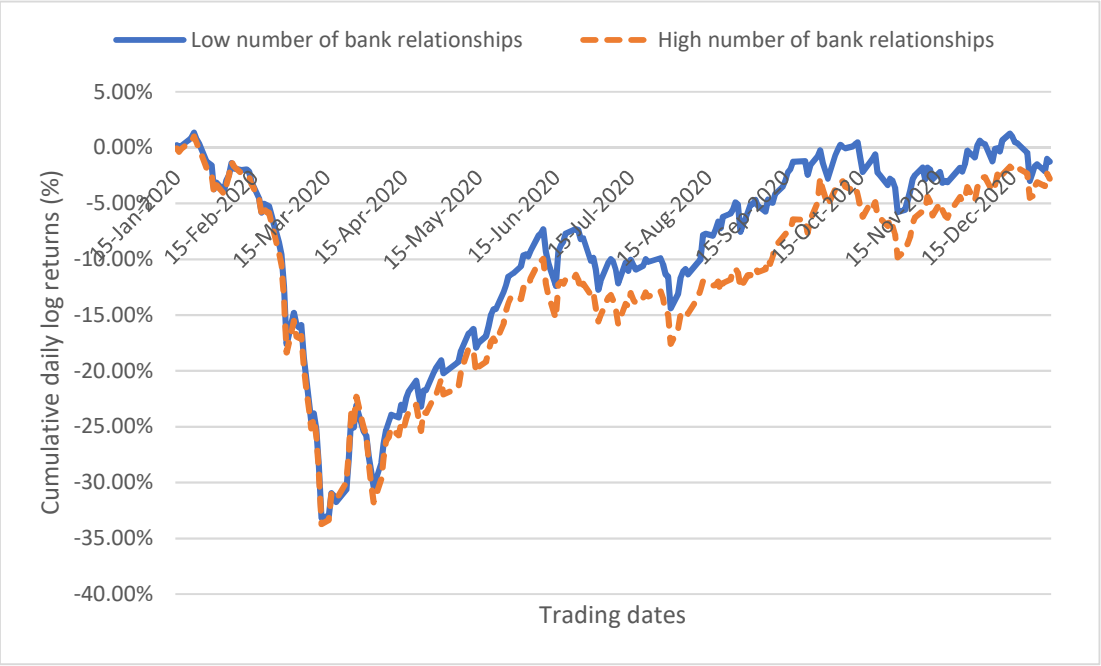
Figure 1. Stock returns of firms, by bank relationships, from January 15 to December 30, 2020

A. Cumulative stock returns, by the Herfindahl–Hirschman index (HHI)



B. Cumulative stock returns, by the number of bank relationships



This figure shows the trends of the cumulative daily log returns by bank relationships. High HHI

refers (number of bank relationships) to firms with HHI (number of bank relationships) above the 70th percentile of the sample distribution.

Table 1. Summary statistics

Panel A. Stock performance (%)	mean	sd	p25	p50	p75
Cumulative daily return, Feb 3- Mar 13	-31.488	12.203	-39.474	-31.621	-24.069
Cumulative daily excess return, Feb 3- Mar 13	-27.758	12.795	-36.133	-27.893	-19.971
Daily return, Mar 17	0.034	0.048	0.002	0.034	0.064
Daily return, Jan 15- Dec 30	0.014	3.780	-1.408	0.000	1.278
Cumulative daily return, Jan 15- Dec 30	-10.531	36.988	-27.129	-13.826	-1.136
Cumulative daily excess return, Jan 15- Dec 30	9.673	50.793	-12.584	1.061	20.485
Panel B. Firm characteristics in fiscal year 2018					
Cash/net assets	0.293	0.489	0.067	0.152	0.306
Debt/assets	0.484	0.184	0.345	0.478	0.624
ROA	0.054	0.065	0.021	0.038	0.063
Book to market ratio	0.977	0.694	0.444	0.834	1.363
Investment/assets	0.011	0.036	-0.003	0.002	0.016
SGA/sales	0.252	0.227	0.116	0.185	0.312
COGS/sales	0.691	0.214	0.612	0.754	0.841
ln(market value of equity)	9.903	1.758	8.602	9.580	10.966
Facility undone/assets	0.042	0.085	0.000	0.000	0.052
Short-term debt/assets	0.312	0.143	0.208	0.297	0.400
Long-term debt/assets	0.171	0.137	0.064	0.139	0.252
Borrowing facility/asset	0.058	0.111	0.000	0.000	0.075
Number of firms	2431				
Panel C. Bank relationship variables (only firms with bank loan)					
HHI	0.361	0.276	0.161	0.282	0.488
Main bank loan share	0.435	0.231	0.276	0.379	0.542
ln (1+number of bank relationships)	1.837	0.586	1.386	1.792	2.197
Number of firms	1122				

Panel D. Industry distribution	Number of firms	Mean of HHI	Median of HHI
Fisheries	5	0.190	0.090
Mining	1	0.153	0.153
Construction	79	0.308	0.250
Manufacturing	492	0.335	0.262
Information and communications	11	0.347	0.282
Transport	55	0.206	0.136
Wholesale and retail trade	189	0.354	0.273
Real estate	52	0.231	0.129
Services	238	0.506	0.432

This table shows the summary statistics of the variables used in the regression analysis. The sample consists of the non-financial firms listed on the Japanese stock market in the fiscal years 2019 and 2020. Firms without debt are excluded. Panel A shows the stock returns of firms from January 15 to December 30, 2020. Panel B shows the summary statistics of the firms' characteristics used in the regression analysis presented in Table 3. Panel C presents the summary statistics of the bank relationship variables, where the samples include only those firms with firm–bank loan data. Panel D shows the sample industry distribution and the mean (median) value of HHI in each industry.

Table 2. Summary statistics by bank relationships

Panel A. Comparison of summary statistics by bank dependence			
	Bank-independent firms	Bank-dependent firms	t-statistic of mean difference
Firm characteristics			
Cash/net assets	0.247	0.304	-0.058**
Debt/assets	0.525	0.474	0.051***
ROA	0.051	0.055	-0.004
Book-to-market ratio	0.841	1.01	-0.169***
Investment/assets	0.011	0.011	0
SGA/sales	0.237	0.256	-0.018
COGS/sales	0.687	0.692	-0.005
ln (market value of equity)	11.231	9.581	1.650***
Facility undone/assets	0.036	0.044	-0.007*
Short-term debt/assets	0.287	0.318	-0.031***
Long-term debt/assets	0.237	0.155	0.082***
Borrowing facility/asset	0.044	0.061	-0.018***
N	474	1957	

Panel B. Comparison of summary statistics by HHI			
	HHI below the 70th percentile	HHI above the 70th percentile	t-statistic of mean difference
Bank relationship variables			
HHI	0.210	0.718	-0.508***
ln (1 + number of bank relationships)	1.955	1.556	0.400***
Main bank loan share	0.326	0.691	-0.364***
Firm characteristics			
Cash/net assets	0.233	0.422	-0.189***
Debt/assets	0.515	0.404	0.112***

ROA	0.047	0.061	-0.014***
Book-to-market ratio	1.118	0.932	0.186***
Investment/assets	0.012	0.012	0.000
SGA/sales	0.214	0.277	-0.063***
COGS/sales	0.723	0.667	0.056***
ln (market value of equity)	9.657	9.421	0.236**
Facility undone/assets	0.040	0.046	-0.006
Short-term debt/assets	0.327	0.286	0.041***
Long-term debt/assets	0.188	0.119	0.069***
Borrowing facility/asset	0.057	0.057	0.000
N	789	333	

This table shows the summary statistics by bank relationships. Panel A shows the mean differences of firm characteristics by bank dependence. The sample consists of firms with positive outstanding debts. Bank-dependent (bank-independent) firms are those with bank loan-to-interest-bearing debts above (below) 90%. Panel B shows the mean differences of firm characteristics by HHI. The samples are limited to firms with outstanding bank loans, divided by HHI above the 70th percentile of the sample distribution and by HHI below the 70th percentile of the sample distribution. *p < 0.1, **p < 0.05, ***p < 0.01

Table 3. Bank dependence and firms' performance: basic results

	(1)	(2)
	All firms	
Dependent variable:	Cumulative log return from Feb 3 to Mar 13, 2020	Return from Mar 16 to Mar 17, 2020
Bank dependence	0.018	0.007**
	(0.006)	(0.003)
Cash/net assets	0.020	0.005**
	(0.005)	(0.002)
Debt/assets	-0.064***	-0.006
	(0.015)	(0.006)
ROA	-0.011	-0.019
	(0.040)	(0.017)
Book to market	0.175***	-0.004*
	(0.005)	(0.002)
Investment/assets	-0.004	-0.070**
	(0.066)	(0.027)
SGA/sales	-0.032	0.024***
	(0.017)	(0.007)
COGS/sales	-0.004	0.021***
	(0.018)	(0.007)
ln(market value of equity)	0.247***	0.004***
	(0.002)	(0.001)
Facility undone/assets	-0.001	0.003
	(0.028)	(0.012)
Industry dummy	Yes	Yes
Prefecture dummy	Yes	Yes
N	2431	2415
R-squared	0.222	0.098

This table shows the cross-section estimation results of firms' stock performance. The dependent variables in Column 1 are the firms' cumulative daily log returns from February 3 to March 13, whereas those in Column 2 are the daily returns from March 16 to March 17. Bank dependence takes the value of one when the firms' loan-to-interest-bearing debts are greater than 90% and zero otherwise. The independent variables are from the fiscal year 2018 (March 2019). Three-

digit industry-fixed effects and prefecture-fixed effects are included. Standard errors are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 4. Bank relationships and firms' performance

Panel A						
	(1)	(2)	(3)	(4)	(5)	(6)
	Firms with bank loans					
Dependent variable:	Cumulative log return from Feb 3 to Mar 13, 2020			Return from Mar 16 to Mar 17, 2020		
High HHI	0.048			0.011***		
	(0.008)			(0.004)		
High main bank loan share		0.064**			0.004	
		(0.008)			(0.004)	
High number of bank relationships			-0.039			-0.002
			(0.008)			(0.004)
Cash/net assets	-0.014	-0.016	-0.016	0.005	0.005	0.005
	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)	(0.004)
Debt/assets	-0.076**	-0.074**	-0.081**	0.022**	0.016	0.015
	(0.023)	(0.023)	(0.023)	(0.011)	(0.011)	(0.011)
ROA	-0.059*	-0.062*	-0.060*	-0.052*	-0.051*	-0.050*
	(0.066)	(0.066)	(0.066)	(0.030)	(0.030)	(0.030)
Book to market	0.170***	0.166***	0.168***	-0.004	-0.005	-0.004
	(0.007)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)
Investment/assets	-0.026	-0.027	-0.026	-0.140***	-0.138***	-0.137***
	(0.091)	(0.091)	(0.091)	(0.042)	(0.042)	(0.042)
SGA/sales	-0.095*	-0.096*	-0.095*	0.027*	0.028*	0.028*
	(0.032)	(0.032)	(0.032)	(0.015)	(0.015)	(0.015)
COGS/sales	-0.036	-0.035	-0.037	0.029**	0.030**	0.030**
	(0.030)	(0.030)	(0.030)	(0.014)	(0.014)	(0.014)
ln(market value of equity)	0.190***	0.193***	0.189***	0.005***	0.005***	0.005***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
Facility undone/assets	0.045	0.047	0.047	0.009	0.010	0.010
	(0.042)	(0.042)	(0.042)	(0.020)	(0.020)	(0.020)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	1122	1122	1122	1112	1112	1112
R-squared	0.300	0.301	0.299	0.175	0.169	0.168
Panel B						
HHI	0.049			0.020***		
	(0.014)			(0.007)		
Main bank loan share		0.077**			0.016**	
		(0.017)			(0.008)	
ln(1+number of bank relationships)			-0.074**			0.001
			(0.007)			(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	1122	1122	1122	1112	1112	1112
r2	0.299	0.302	0.302	0.177	0.172	0.168

This table shows the cross-section estimation results of firms' stock performance. The sample consists of firms with bank loans in the fiscal year 2018. The dependent variables in Columns 1–3 are the firms' cumulative daily log returns from February 3 to March 13, whereas those in Columns 4–6 are the daily returns from March 16 to March 17. The bank relationship variables in Panel A are dummy variables, whereas those in Panel B are level variables. High HHI (main bank loan share, number of bank relationships) refers to firms with bank relationship variables above the 70th percentile of the sample distribution. The independent variables are from the fiscal year 2018 (March 2019). Three-digit, industry-fixed effects and prefecture-fixed effects are included. Standard errors are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 5. Difference-in-difference results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank relationship variables	HHI	Main bank loan share	ln (1+number of bank relationships)	HHI	Main bank loan share	ln (1+number of bank relationships)	HHI	Main bank loan share	ln (1+number of bank relationships)
Shock	-0.010***	-0.011***	-0.010***	-0.010***	-0.011***	-0.010***			
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)			
Post shock	0.004***	0.004***	0.005***	0.004***	0.004***	0.005***			
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)			
Bank relationship	-0.002**	-0.002**	0.000						
	(0.001)	(0.001)	(0.000)						
Shock*bank relationship	0.001	0.001	-0.000	0.001	0.001	-0.000	0.001	0.001	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Post shock*bank relationship	0.002**	0.002**	-0.000	0.002**	0.002**	-0.000	0.002**	0.002**	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Industry dummy	Yes	Yes	Yes	No	No	No	No	No	No
Firm fixed effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	No	No	No	No	No	No	Yes	Yes	Yes
N	258721	258721	258721	258721	258721	258721	258721	258721	258721
r2				0.017	0.017	0.017	0.172	0.172	0.172
Standard error clustered	Firm	Firm	Firm	Firm	Firm	Firm	Firm-day	Firm-day	Firm-day

This table shows the estimation results of firms' stock performance from January 15 to December 30, 2020. The dependent variable is the daily simple return. Shock takes the value of one from February 3 to March 16 and zero otherwise. Post-shock takes the value of one from March 17 to December 30, 2020 and zero otherwise. We include industry-fixed effects in Models 1–3, firm-fixed effects in Models 4–6, and firm-fixed effects and day-fixed

effects in Models 7–9. Standard errors are clustered at the firm level in Models 1–6 and at the firm–day level in Models 7–9. They are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 6. Parallel trends

	From Jan 15 to Feb 2		From Jan 15 to Mar 16	
	(1)	(2)	(3)	(4)
Pre-shock			0.010***	
			(0.000)	
HHI	0.000	0.000	0.000	
	(0.000)	(0.000)	(0.000)	
Pre-shock*HHI			-0.000	-0.000
			(0.001)	(0.001)
Industry dummy	Yes	Yes	Yes	No
Firm fixed effects	No	No	No	Yes
Day fixed effects	No	Yes	No	Yes
N	14416	14416	46559	46559
R-squared	0.0092	0.1167	0.0223	0.396

This table shows the estimation results of firms' stock performance from January 15 to March 16, 2020. The dependent variable is the daily simple return. The pre-shock dummy takes the value of one prior to February 3 and zero from February 4 to March 16. Standard errors are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 7. Financial constraints

Proxies for firm financial constaint	ln (asset)	ln (1+ firm age)
	(1)	(2)
Shock ×HHI	-0.000	0.010
	(0.006)	(0.006)
Shock ×Firm financial constraint	0.001***	0.002***
	(0.000)	(0.001)
Shock×HHI×Firm financial constraint	0.000	-0.002
	(0.001)	(0.002)
Post shock ×HHI	0.009**	0.007*
	(0.004)	(0.004)
Post shock×Firm financial constraint	0.000	-0.001**
	(0.000)	(0.001)
Post shock×HHI×Firm financial constraint	-0.001*	-0.002
	(0.000)	(0.001)
Controls	Yes	Yes
Firm fixed effects	Yes	Yes
Day fixed effects	Yes	Yes
Standard error clustered	Firm-day	Firm-day
N	258721	258721
R-squared	0.172	0.170

This table shows the estimation results of firms' stock performance from January 15 to December 30, 2020. The dependent variable is the daily simple return. Shock takes the value of one from February 3 to March 16 and zero otherwise. Post-shock takes the value of one from March 17 to December 30, 2020 and zero otherwise. Standard errors are clustered at the firm–day level and enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 8. Matching analysis

Panel A			
Dependent variable	Cumulative log return from Feb 3 to Mar 13, 2020		
Model	(1)	(2)	(3)
Bank relationship variables	High HHI	High main bank loan share	High number of bank relationships
Average treatment effect of treated	0.011	0.017*	-0.021***
	(0.009)	(0.009)	(0.007)
Number of firms	1122	1122	1122
Panel B			
Dependent variable	Return from Mar 16 to Mar 17, 2020		
Model	(4)	(5)	(7)
Average treatment effect of treated	0.012**	0.007	0.006
	(0.005)	(0.005)	(0.004)
Number of firms	1112	1112	1112

This table shows the differences in stock performance between firms with concentrated bank relationships (the treatment group) and other firms with mostly similar characteristics (the control group). High HHI (main bank loan share, number of bank relationships) refers to firms with bank relationship variables above the 70th percentile of the sample distribution. Panel A shows the results of the cumulative stock returns from February 3 to March 13, 2020. Panel B reports the results of the raw stock returns from March 16 to March 17, 2020. Entropy matching is employed. Standard errors are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 9. Firms' financial flexibility and ownership structure

	(1)	(2)	(3)	(4)
	Financial flexibility		Ownership structure	
Shock	-0.009***			
	(0.001)			
Post shock	0.002***			
	(0.001)			
Shock*HHI	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Shock* cash/ net assets	-0.001*	-0.001*		
	(0.001)	(0.001)		
Shock* debt/ assets	-0.003*	-0.003		
	(0.001)	(0.002)		
Shock* bank owner			0.781***	0.663**
			(0.216)	(0.278)
Shock* corporation				-0.021
				(0.054)
Shock* foreign				0.179
				(0.313)
Shock* government				611.689***
				(216.191)
Post shock* HHI	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Post shock* cash/ net assets	0.002***	0.002***		
	(0.000)	(0.001)		
Post risis* debt/ assets	0.002	0.002		
	(0.001)	(0.001)		
Post shock* bank owner			0.168	-0.064
			(0.180)	(0.234)
Post shock* corporation				-0.010
				(0.045)
Post shock* foreign				0.527**
				(0.264)
Post shock* government				-91.579
				(145.580)
Other controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Day fixed effects	No	Yes	Yes	Yes
N	258721	258721	258721	258721
r2	0.018	0.172	0.172	0.172
Standard error clustered	Firm	Firm-day	Firm-day	Firm-day

This table shows the estimation results of firms' stock performance from January 15 to December 30, 2020. The dependent variable is the daily simple return. Shock takes the value of one from February 3 to March 16 and zero otherwise. Post-shock takes the value of one from March 17 to December 30, 2020 and zero otherwise. Standard errors are clustered at the firm level in Model 1 and at the firm–day level in Models 2–4. *p < 0.1, **p < 0.05, ***p < 0.01

Table 10. Firms' exposure to COVID-19: international trade and labor intensity

Measure of exposure	Overseas sales/ total sales			Total employees/ total sales		
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.010***			-0.010***		
	(0.000)			(0.000)		
Post shock	0.004***			0.004***		
	(0.000)			(0.000)		
Shock*HHI	0.001	0.001	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Shock* exposure	-0.015*	-0.015**	-0.025**	-0.002	-0.001	-0.001
	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.012)
Shock* HHI* exposure			0.030			-0.001
			(0.026)			(0.024)
Post shock* HHI	0.002**	0.002**	0.002**	0.002**	0.002**	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Post shock* exposure	-0.007	-0.007	-0.019**	0.007	0.007	0.016*
	(0.007)	(0.005)	(0.009)	(0.006)	(0.006)	(0.010)
Post shock* HHI* exposure			0.034*			-0.021
			(0.020)			(0.017)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	No	Yes	Yes	No	Yes	Yes
N	258721	258721	258721	258721	258721	258721
R2	0.017	0.172	0.172	0.017	0.172	0.172
Standard error clustered	Firm	Firm-day	Firm-day	Firm	Firm-day	Firm-day

This table shows the estimation results of firms' stock performance from January 15 to December 30, 2020. The dependent variable is the daily simple return. Shock takes the value of one from February 3 to March 16 and zero otherwise. Post shock takes the value of one from March 17 to December 30, 2020 and zero otherwise. Models 1–3 shows the results when firms' exposure to COVID-19 is measured by their dependence on international trade (overseas sales / total sales) and Models 4–6 shows the results when firms' exposure to COVID-19 is measured by labor intensity defined as number of total employees/total sales. Standard errors are clustered at the firm level in Models 1 and 4 and at the firm–day level in Models 2, 3, 5, and 6. They are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Table 11. Difference-in-difference results, by different phases

Bank relationship variables	(1) HHI	(2) Main bank loan share	(3) ln(1+number of bank relationships)	(4) HHI	(5) Main bank loan share	(6) ln(1+number of bank relationships)	(7) HHI	(8) Main bank loan share	(9) ln(1+number of bank relationships)
First	-0.010***	-0.011***	-0.010***						
	(0.000)	(0.000)	(0.001)						
Second	0.007***	0.007***	0.010***						
	(0.000)	(0.000)	(0.001)						
Third	0.002***	0.002***	0.004***						
	(0.000)	(0.000)	(0.001)						
Fourth	0.004***	0.004***	0.003***						
	(0.000)	(0.000)	(0.001)						
First*bank relationship	0.001	0.001	-0.000	0.001	0.001	-0.000	0.001	0.001	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Second*bank relationship	0.004***	0.004***	-0.001*	0.004***	0.004***	-0.001*	0.004***	0.004***	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Third*bank relationship	0.002**	0.002**	-0.000	0.002**	0.002**	-0.000	0.002**	0.002*	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Fourth*bank relationship	-0.000	-0.000	0.001**	-0.000	-0.000	0.001**	-0.000	-0.000	0.001*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Industry dummy	No	No	No	No	No	No	No	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	258721	258721	258721	258721	258721	258721	258721	258721	258721
R-squared	0.021	0.021	0.021	0.170	0.169	0.169	0.172	0.172	0.172
Standard error	Firm	Firm	Firm	Firm	Firm	Firm	Firm-day	Firm-day	Firm-day

This table shows the estimation results of firms' stock performance from January 15 to December 30, 2020. The dependent variable is the daily simple return. First takes the value of one from February 3 to March 16 and zero otherwise. The second takes the value of one from March 17 to May 25 and zero otherwise. The third takes the value of one from May 26 to October 30, and the fourth takes the value of one from November 1 to December 30, 2020. We include firm-fixed effects in Models 1–3 and include firm-fixed effects and day-fixed effects in Models 4–9. Standard errors are clustered at the firm level in Models 1–6 and at the firm–day level in Models 7–9. They are enclosed in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

Appendix. Definitions of variables

	Definition
Dependent variable	
Cumulative daily return, Feb. 3–March 13	Cumulative daily log return from Feb. 3 to March 13, 2020
Cumulative daily excess return, Feb. 15– March 13	Daily excess return is defined as the ln (1 + return-risk free rate)
Daily return, Jan. 15–Dec. 30	Daily raw return
Bank relationship variables	
HHI	Herfindahl–Hirschman index (HHI) of bank loans
ln (1 + number of bank relationships)	Logarithm of (1+ number of trading banks)
Main bank loan share	Largest bank loan/total bank loan
Firm characteristics	
cash/net assets	Cash /(total assets - cash)
debt/assets	Debt/(total assets)
ROA	Return on assets
Book-to-market ratio	Book value of equity/market value of equity
Investment/assets	Change in tangible fixed assets/total assets
SGA/sales	Selling, general, and administrative expenses/total sales
COGS/sales	Costs of goods sold to total sales
ln (market value of equity)	Logarithm of (market value of equity)

Facility undone/assets	Borrowing capacity for commitment lines/total assets
Short-term debt/assets	Short-term debt/assets
Long-term debt/assets	Long-term debt/assets
Borrow facility/asset	Commitment lines/total assets