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Does Trade Credit Absorb Adverse Shocks?

Evidence on SMEs in Japan[†]

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Does Trade Credit Absorb Adverse Shocks?

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Abstract

The aim of this paper is to examine whether trade credit can help absorb adverse shocks to firms. When firms encounter exogenous adverse shocks, if relaxation of terms of credit payment to suppliers can hold back the level of firms' real activities, then they do not need to reduce their purchases from suppliers. We test this hypothesis by using data of SMEs (small- and medium-sized enterprises) from two corporate surveys taken in Japan after the Global Financial Crisis and COVID-19. We find that firms with extended payment periods are still likely to reduce their purchases from suppliers that indicates trade credit does not help to absorb adverse shocks.

JEL classification codes: G32, L14

Keywords: Trade credit, Shock, Transmission, Bank loans, Deep pocket

1. Introduction

In the turmoil of crisis events, such as the Global Financial Crisis (GFC) in the late 2000s or the worldwide spread of COVID-19 in and after 2020, firms suffer various adverse shocks, both real and financial, that lead to a shortage of funds. Consequently, firms try various measures to cope with such shocks. What type of measure and its success will determine what kind of material damages that they will actually suffer and their magnitude.

A provision of trade credit from suppliers is one of those measures. If firms could relax the terms of credit payments to suppliers, they can obtain additional credit from the suppliers to cope with a shortage of funds due to an adverse shock (real or financial). Specifically, the lengthening of the payment period or the increasing of the fraction of credit payments to the total payments can provide additional funding. To the extent that they obtain such relaxed credit from suppliers, firms could prevent a contraction in their real activities, such as production, investment, and employment. In this sense, additional credit from suppliers might play the role of a shock absorber.

The main objective of this paper is to examine whether trade credit actually plays the role of a shock absorber. To answer this question, we use two samples of small- and medium-sized enterprises (SMEs) that come from two corporate surveys in Japan that were conducted by the Research Institute for Economy, Trade and Industry (RIETI) after the Global Financial Crisis and COVID-19. From these surveys, we take advantage of the information on measures that SMEs actually took after the respective crises such as whether they obtained additional trade credit or reduced their purchases from suppliers.

Using information from these surveys, we conduct two analyses. In Analysis 1, we investigate whether trade credit plays the role of a shock absorber. To the extent that trade credit plays such a role, *the relaxation of the credit terms contributes to holding back the level of real activities*. We test this hypothesis by investigating whether firms that obtain additional trade credit from suppliers do not reduce their purchases. In this test, we first conduct a univariate analysis to examine a simple statistical association between the indicators of additional trade credit and reduced purchases. We also conduct a multivariate analysis, where we examine the same association after controlling for any effects of heterogeneity of firms (demand for trade credit) and suppliers (supply of trade credit) by using propensity score matching (PSM).

In Analysis 2, we analyze when, or under what circumstances, trade credit plays the role of a shock absorber. In our two samples, there are four types of firms depending on whether they obtained additional trade credit and on whether they reduced their purchases from suppliers. We run a multivariate regression to examine what determine the firms' type among these four. Our primary interest is on the selection of the type that obtained additional credit and did not reduce the purchases; the type for which trade credit played the role of a shock absorber.

Analysis 2 is important, because we can examine two important factors that could affect the role of trade credit as a shock absorber: the characteristics of suppliers (supply of trade credit) and the use of banks loans (supply of alternative financing). By focusing on suppliers' characteristics, we can examine the so-called deep pocket hypothesis. Firms are ordinarily connected with each other through a chain of transactional relationships, and if payments for their transactions are made on credit, the relationships are also connected

with the so-called credit chain (Kiyotaki and Moore 1997). This chain might work as a conduit through which a financial shock is transmitted from one firm to others. However, a large supplier with deep pockets (sufficient funds) might be able to stop the transmission by extending credit to its customers, and thereby absorb the shock (Meltzer 1960 and Kiyotaki and Moore 1997). We test this hypothesis by examining whether specific characteristics matter for the choice of the type of a firm for which trade credit plays the role of a shock absorber.

The use of bank loans is another important factor, because firms that could obtain emergency financing from banks might not have to rely on additional trade credit from suppliers. There has been a long debate on whether trade credit and bank loans are complements or substitutes, and some studies focus on this relation in a crisis period (e.g., Palacín-Sánchez et al. 2019 and Norden et al. 2021). We test whether additional borrowing from banks promote or impede the role of trade credit as a shock absorber by examining the effects of the use of bank loans.

From our analysis, we find that irrespective of whether we use the samples for the GFC and forthe COVID-19, the results are almost the same. First, we find from Analysis 1 that for many firms, trade credit does not play the role of a shock absorber, because majority of our sample firms do not obtain additional trade credit from the suppliers through relaxation of payment terms. In other words, terms of trade credit are rarely changed to respond to adverse shocks.

When we compare these majority of firms with the minority that did obtain additional credit, we find a statistically significant difference in the fraction of these that reduce their purchases. However, the direction of the difference is at odds with our hypothesis. That is,

firms that obtain more credit are more, not less, likely to reduce the amount of purchases. This finding rather suggests that these firms were hard-hit and needed to take both measures. The results from the PSM are qualitatively the same. These results are inconsistent with the hypothesis that trade credit plays the role of a shock absorber.

From Analysis 2, we find that the effects of the characteristics of suppliers and of the use of bank loans are different. As for the suppliers' characteristics, we find that the suppliers' size, the firms' dependence on the suppliers, or the strength of thee transactional relationships between them do not affect the selection of the type of (the small number of) firms that obtain additional trade credit from suppliers and do not reduce purchases (i.e., the case of the shock absorber). These results do not change even if we consider whether the firms' suppliers themselves suffer from adverse shocks, and the type of the shocks they suffer. These findings do not lend support to the deep pocket hypothesis.

As for loans from banks, in contrast, we find that additional financing from banks promotes the (small) likelihood that trade credit plays the role of a shock absorber. Specifically, we find that the likelihood that firms obtain additional trade credit from suppliers and do not reduce purchases is higher when they get relaxed terms of borrowing from banks. We also find that a new borrowing from banks promotes the likelihood in the case of the GFC.

We cannot perfectly identify the causal relationship behind these findings on bank loans, but to the extent that additional financing from banks precedes decisions on trade credit, our finding has an important policy implication: a policy measure to increase emergency lending from banks might have a beneficial secondary effect of promoting the role of trade credit as a shock absorber. There is some reason to believe that the causality actually run

in this direction. To respond to the two crises, the government of Japan implemented policy measures of sizable amount to increase credit availability of firms in the form of subsidies to loans by private banks, direct lending by government-affiliated banks, and credit guarantees.[1] These measures significantly increased the availability of cheap bank loans. As a matter of fact, more than half of our sample firms use bank loans to respond to the adverse shocks from the crises. Due to the increased availability of cheap bank loans, many firms might not have to rely on trade credit, or postpone the decision regarding trade credit after their decision on the use of bank loans.[2]

Trade credit is one of the primary sources of financing for SMEs, and there are already many studies on it, especially on the determinants of its use and its relation (substitutability or complementarity) to bank loans.[3] Among such studies, the present study specifically adds contribution to the literature on trade credit in a crisis period in the following senses. First, our Analysis 1 is related to studies to focus on the changes in the amount of trade credit in response to an economic crisis (Love et al. 2007 and Garcia-Appendini and Montoriol-Garriga 2013). Second, a part of our Analysis 2 that focuses on bank loans is related to studies on the relation between bank loans and trade credit in a crisis period (Palacín-Sánchez et al. 2019 and Norden et al. 2021), or those on the causal effect of credit (borrowing) constraint on the use or provision of trade credit (Casey and O'Toole 2014 and

[1] Government-affiliated banks such as the Japan Finance Corporation offered direct lending with low or zero interest rates, and the Credit Guarantee Corporations executed an emergency guarantee program.
[2] By focusing on banks in European countries during the Global Financial Crisis, Norden et al. (2020) find a similar effect of increased availability of bank credit due to bank bailout on more provision of trade credit.
[3] As for the determinants of the use of trade credit, see, for example, Giannetti, Burkart and Ellingsen (2011) and Klapper, Laeven and Rajan (2012) that sort out and test various theories on the determinants. As for the relation between trade credit and bank loans, see, for example, Danielson and Scott (2004), Bougheas et al. (2009), Atanasova and Wilson (2004), Molina and Preve (2012), and Lawrenz and Oberdorfer (2017) for empirical tests.

Norden et al. 2020). Different from these studies that all examine the determinants of trade credit in a crisis period, this paper more specifically focuses on the relaxation of trade credit terms to respond to adverse shocks and on its real outcome.

Third, closer to our study, there are some studies on the use of trade credit and its real outcome in a crisis period (Carbó-Valverde et al. 2016 and Lawrenz and Oberndorfer 2019).[4] These papers examine the relation between the amounts (levels) of firms' accounts payable and investment (and ROA in the latter study) in a crisis period, by also accounting for financial constraint that firms face. Their findings are that constrained firms that have a larger amount of accounts payable invest more, and that this effect is pronounced in a period of crisis. These findings are inconsistent with our findings that trade credit plays the role of a shock absorber for only a limited number of firms, and that bank loans promote the role.

Fourth, the other part of our Analysis 2 is related to studies on the deep pocket hypothesis (Boissay and Gropp 2008, Garcia-Appendini and Montoriol-Garriga 2013, and Lawrenz and Oberdorfer 2017). These studies find that an adverse shock to a firm is transmitted to its transaction partners through a credit chain, but the transmission is mitigated if there is a supplier with deep pockets. Although we do not directly analyze the transmission of shocks from accounts receivable to payable, our finding of no effect from supplier characteristics on the likelihood that firms get longer payment periods and do not reduce their purchases is inconsistent with the deep pocket hypothesis.

The inconsistency of our findings and those in the abovementioned studies might be

[4] Murfin and Njoroge (2015) also examine a real effect but in a normal period.

due to a difference in the analytical approach. Our approach is different because we use granular information obtained from corporate surveys. Specifically, we use information on measures that firms actually took to cope with financial shocks, while the abovementioned studies use the figures in firms' financial statements. Also, our focus is on the amount of purchases rather than investments as a real outcome, which makes more sense because in practice, trade credit (accounts payable) is used to raise working capital, and its link with purchases is closer than its link with investments.

However, the inconsistency might also be due to differences in the samples, especially in country-specific factors. For example, firms in Japan come from a different culture so they may have different risk preferences than firms in other developed economies. Also, SMEs and large firms are quite different. And, while trade credit is frequently used in Japan, firms in other countries might not necessarily depend on it.[5] Additionally, the nature of the shocks of the GFC and COVID-19 might differ across countries, and so their effects on trade credit might differ as well; the GFC was not a financial shock in Japan but a real shock imported through international trade.[6] Furthermore, the government of Japan implemented huge rescue packages to firms during the two crises, while the size and the variety of public support programs were different across countries, which might have affected firms' use of trade credit. However, these are speculations and need to be tested using data from different countries and crises. On balance, our findings call for more studies to dig deeper into the mechanisms behind the relation between trade credit and real outcomes in a period of crisis.

[5] See, for example, Demirgüç-Kunt and Maksimovic (2001, Figures 1 and 2) and Beck et al. (2008, Table 1).
[6] See Uchida and Udell (2019), for example. They report that the loss that financial institutions in Japan suffered was not huge, or was only temporarily and concentrated in a few of them.

The rest of the paper is composed as follows: In Section 2, we review the related studies and explain our contribution. Section 3 presents our data. In section 4, we establish our testable hypotheses and explain our empirical approaches and variables. Section 5 gives the results. Section 6 concludes the paper.

2. Related studies

2.1. Trade credit as a shock absorber

As explained in the introduction, the primary goal of this paper is to examine whether trade credit plays the role of a shock absorber for firms in a crisis period. There are many studies on the effect of a crisis on firms' financial constraints and their responses (e.g., Campello et al. 2010 and Campello et al. 2011), but studies to focus on the role of trade credit is limited. The present paper is closely related to this literature.[7]

The first strand of this literature focus on changes in the amount of trade credit in response to an economic crisis. Love et al. (2007) examine trade credit during the Asian currency crisis in 1997 and find that just after the shock, trade credit increased on both sides of firms' balance sheets. This increase indicates that suppliers temporarily extended payment periods for their customers. But they also find that the provision drastically decreased afterwards for several years, which means trade credit did not compensate for the decrease in bank loans. Garcia-Appendini and Montoriol-Garriga (2013) examine trade

[7] Relatedly, there are also studies to examine trade credit along business cycles or in response to monetary policy (e.g., Nielsen 2002, Choi and Kim 2005, Demiroglu et al. 2012).

credit of listed firms in the U.S., and find that during the period of the GFC, cash rich suppliers increased the provision of trade credit.[8] Different from these papers that focus on the amount of trade credit, we focus on the changes in the terms of trade credit after the crisis by using more detailed information from corporate surveys. Also, these papers do not investigate the real effect of trade credit as this paper does.

The second strand of the literature focus on the relation between bank loans and trade credit in a crisis period. Some of these studies focus on the mutual relationship of these sources of financing. Using sample covering 12 EU countries over the period from 2008 to 2014, Palacín-Sánchez et al. (2019) examine whether trade credit and bank loans are substitutes or complements, and find that the former holds, although they do not explicitly distinguish the crisis and non-crisis periods in their analysis. Norden et al. (2021) examine the extent of the substitution between the two sources for SMEs in Europe during the GFC, and find that the extent decreased during the GFC and that the size of the decrease depended on SMEs' credit quality. However, these studies do not focus on the real effect of trade credit.

Other studies to focus on the relation between bank loans and trade credit examine the causal effect of credit (borrowing) constraint on the use of trade credit. Using survey data from Europe after the GFC, Casey and O'Toole (2014) investigate whether firms that experienced credit constraint are more likely to use trade credit, and find that constrained firms relied on trade credit. Norden et al. (2020) also examine the credit constraint, but

[8] Although the focus is not on an economy wide shock, Amberg et al. (2021) investigate a similar effect of the sudden liquidity shortfall due to the fraud and failure of a cash-in-transit firm in Sweden, and find that affected firms responded by increasing cash holdings and account payables, and decreasing account receivables.

focus on the effect of its relaxation to the provision of trade credit. They find that borrowers of banks in European countries that received capital support after the GFC increased supply of trade credit—another channel of the causal effect. However, neither of these studies focus on the effect of trade credit use on real outcome as this paper does.

There are some studies on the use of trade credit use and its real outcome, and they constitute the third, and the most closely related strand of the literature. Carbó-Valverde et al. (2016) analyze the effect of trade credit (accounts payable) on the investment of SMEs in Spain for the period from 1994–2010, and find a positive effect for financially constrained firms during the GFC. Lawrenz and Oberndorfer (2019) also analyze the effect of trade credit (accounts payable, receivables, and net trade credit) on investment and ROA and find a positive effect for small firms during the GFC.

Different from these studies that focus on investment and ROA, we focus on a reduction in purchases as a real outcome. Our focus makes sense because in practice, trade credit is never used to finance long-term capital investment, and its effect on ROA is also indirect. Also, the two abovementioned studies examine the effect of the amounts (levels) of accounts payable, while we examine the effect of a relaxation (change) in trade credit terms as a response to adverse shocks, which could more appropriately capture the effect of the crisis.

The effect of the change in trade credit terms is the main focus in yet another strand of the literature, although they do not examine the effect during a crisis.[9] Barrot (2015) investigates the effect of an exogenous change in credit terms (shortening credit period)

[9] Murfin and Njoroge (2015) examine the association between the terms of trade credit that small suppliers provide to large customers and the suppliers' investments, but they do not examine the effect of the change in the terms.

due to a regulatory change in the French trucking industry, and finds that firms' supply of trade credit (accounts receivable) decreased due to the change, and their default probability also decreased. Using data for one large supplier and its customers in Chile between 2006 and 2011, Breza and Liberman (2017) examine the effect of a regulatory change to shorten the length of the payment period, and find that the change reduced the likelihood of trade. Barrot and Nanda (2020) examine the impact of shortening the payment period for small business contractors by the US government, and find a positive effect on the contractors' employment, together with a substantial crowd-out effect that reduces employment for other firms. The present study complements these studies in the sense that they focus on the real outcome of shortening payment period for firms as creditors (lenders), while we focus on the real effect of lengthening the payment period for firms as debtors (borrowers).

2.2. Deep pockets

In this paper, we also analyze whether the characteristics of suppliers affect the extent of the association between their provision of additional trade credit and the reduction in purchases by their customers. This analysis is closely related to the deep pocket hypothesis in the model of a credit chain (Meltzer 1960, Kiyotaki and Moore 1997). Empirical tests of this hypothesis find that an adverse shock is indeed transmitted through the credit chain (Boissay and Gropp 2008, Raddatz 2010, Jacobson and von Schedvin 2015).[10] And consistent with the hypothesis, some studies find that the transmission is mitigated by a

[10] In studies on customer-supplier relationships or a supply chain, they focus on the link with their financial conditions, but not on trade credit (e.g., Itzkowitz 2013, 2015, Lian 2017).

supplier with deep pockets (Boissay and Gropp 2008, Garcia-Appendini and Montoriol-Garriga 2013, Lawrenz and Oberdorfer 2017, and Murfin and Njoroge 2015). Our study is thus related to these studies.

To be more specific, using data on French firms for the period from 1998–2003, Boissay and Gropp (2008) find that the pass-on effect of adverse shocks from customers to suppliers is less likely to be observed when suppliers have more liquid assets, are large, and have a lower likelihood of bankruptcy—findings that support the deep pocket hypothesis. Using a matched sample of large US suppliers and their customers from 2005 to 2010, Garcia-Appendini and Montoriol-Garriga (2013) find that although the large suppliers' provision of trade credit decreased after the crisis, it increased if they were cash-rich.[11] By using data on SMEs and large firms in Germany from 2003 to 2010, Lawrenz and Oberdorfer (2017) obtain similar results for financially unconstrained suppliers. However, when they tease out the genuine size effect from financial conditions, they find that large firms do not redistribute credit to SMEs, which contradicts the deep pocket hypothesis in terms of firm size. Different from these studies that focus on the relation between the characteristics of suppliers and their supply of trade credit, we focus on whether the real effect of trade credit (as a shock absorber) depends on the characteristics of suppliers.[12]

As for the real effect, Murfin and Njoroge (2015) find that the effect of slower payments by large customers on lower investment of their smaller suppliers is more pronounced for

[11] Relatedly, the finding in Norden et al. (2020) that borrowers of banks that received capital support increased accounts receivable is also consistent with the deep pocket hypothesis.

[12] Using survey data from Japan after the GFC, Ogawa and Tanaka (2013) find that SMEs that incur demand shocks obtain help from suppliers. The likelihood of doing so does not vary with the length of customer-supplier relationships, but those with long relationships are less likely to obtain help from customers or banks.

suppliers that transact with financially constrained customers. But this paper focuses on the relation between the difference in payment terms and investment in a normal period, while we focus on the relation between lengthening (change) of payment terms to respond to a crisis and on the reduction in purchases. Also, as indicated above, our focus on the amount of purchases rather than investment is more appropriate because trade credit is used for short-term financing.

3. Data

3.1. GFC survey

We use two samples of SMEs obtained from two corporate surveys conducted in Japan after the two crises. The first sample is from the *Survey on Inter-firm and Firm-Bank Transactions during the Financial Crisis* that was conducted in February 2009 by the Research Institute of Economy, Trade, and Industry (RIETI) (hereafter the GFC survey).[13] The GFC survey comprised questions on the shocks that firms suffered from after September 2008 when Lehman Brothers failed, and the measures that they used to cope with the shocks.[14]

The questionnaire of the GFC survey was mailed to 5,979 target firms, and 4,103 of

[13] Uesugi et al. (2009) report the details of the survey, the summary statistics, and the survey questionnaire. Papers using data from this survey include Tanaka and Ogawa (2013) and Tsuruta and Uchida (2019).
[14] Lehman's failure was a landmark event in Japan because adverse effects of the financial crisis in the US and Europe was transmitted to Japan after the failure. The shocks due to the GFC are therefore commonly called the "Lehman shock" in Japan.

them responded (response rate of 68.6%).[15] Excluding firms that did not provide usable answers to the questionnaire, the survey garnered 4,095 firms. We further excluded firms that did not answer any of the questions about the measures they used to respond to the recession that are our main variables, or those for which any of the control variables used for the analysis were not available. As a result of this selection process, our sample for the baseline analysis consists of 3,469 firms. The number of observations is smaller in the regression analyses due to the non-availability of the dependent variables or the main independent variables.

3.2. COVID-19 survey

The second source of our data is the *Survey on the Status of Firms under the COVID-19 Pandemic* conducted in Japan in November 2020 by the RIETI (hereafter the COVID survey). The COVID survey aims to capture effects of the spread of the COVID-19 on corporate activities.[16] This survey comprises questions about the shocks that firms incurred, and the measures to cope with the shocks during the COVID-19 pandemic up to the survey date. As shown in Figure 1, November 2020 was at the beginning of the third wave of the infections in Japan.

[15] The 5,979 target firms were the respondents to a previous survey conducted by the RIETI in 2008, and the target of this 2008 survey was 17,018 firms that were chosen from the firms that had responded to past government surveys compiled by the Small and Medium Enterprise Agency of the Government of Japan.
[16] Uesugi et al. (2021) report the details of the survey, the summary statistics, and the survey questionnaire.

<<<Insert Figure 1 about here >>>

The questionnaire for this survey was mailed to 20,000 target firms, and 4,718 of them responded (response rate of 23.8%).[17] Excluding firms that did not provide important information such as their industry, we had 4,693 firms as our starting point. We eliminated firms that did not provide important information such as the number of employees, year of establishment, credit score, and the amount of borrowing. We further eliminated firms that did not answer any of the questions about the measures to respond to the recession that we used for our main variables. As a result of this selection process, our sample for the baseline analysis consisted of 3,767 firms, although the number of observations for regression analyses became smaller due to missing observations for some variables.

4. Methodology

4.1. Main hypothesis and main variables

Our main research question is whether trade credit plays the role of a shock absorber. To answer this question, we examine whether firms that obtain additional trade credit from suppliers reduce purchases from them. However, it is not easy to empirically answer this

[17] The target firms of the COVID-19 survey is the 8,310 respondents to three predecessor surveys by the RIETI (including the GFC survey and its predecessor), plus newly added 11,690 incorporated businesses (no sole proprietorships). These 11,690 firms were chosen from the corporate database of Tokyo Shoko Research, one of the largest corporate credit information providers, so as to make the resulting 20,000 target firms to have the same industry and employee-size distributions as those of the 2016 Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry), the most comprehensive corporate statistics in Japan.

question, because it implicitly presumes a causal relation from the provision of additional credit to the purchase amounts. In reality, firms might take various measures to cope with adverse shocks in an ad hoc manner, and causal relationships among them might not be clear.

To overcome this challenge, we focus on the outcome; that is, we take advantage of the two surveys that ask about the measures that firms actually took without considering their sequence. For the question on how firms responded to the crisis and the subsequent recession, the two surveys offer multiple options that firms could choose in relation to their customers, suppliers, and banks.

Among such options, we focus on the following in the GFC survey: "1. Reduced the quantity of purchases;" "3. Lengthened the duration of accounts payable;" "4. Lengthened the duration of promissory bills payable;" and "5. Increased the ratio of the amount of payments by accounts payable or promissory bills to the total amount of payments."[18,19] We define a variable REDUCE_PURCHASE to equal one if the firm chose option 1, and LENGTHEN_TC to equal one if the firm chose at least one of options 3–5. In the COVID survey, the options presented to firms were almost the same (with some differences, e.g., options 3 and 4 are integrated), and we can obtain the same information to define the two variables.

Thus, we establish the following testable hypothesis:

[18] Options 3 and 4 are separated because there are two commonly used methods to provide trade credit in Japan: one through ordinary accounts payable and the other though paper-based promissory bills. From a viewpoint of economic functions, they are essentially the same.

[19] The other options to choose on measures to suppliers are: "2. Decreased the price of goods to be purchased," "6. Explained to suppliers the difficulty of your company's situation," and "7. Did not take any particular measure."

Hypothesis 1: The fraction of firms that reduced their purchases is smaller among the firms that got an extended payment period from suppliers than among those that did not.

4.2. Analysis 1: Analysis of trade credit as a shock absorber

4.2.1. Simple univariate analysis

To test Hypothesis 1, we analyze the distribution or correlation of the two variables, which we label Analysis 1. We conduct two sub-analyses. In sub-analysis 1-1, we directly test the hypothesis by comparing the fraction of firms with REDUCE_PURCHASE = 0 among the firms that got LENGTHEN_TC = 1 and the same fraction among the firms that got LENGTHEN_TC = 0. Hypothesis 1 predicts that the former is higher than the latter, or equivalently, the mean of REDUCE_PURCHASE is smaller for firms that got LENGTHEN_TC = 1 than for those that got LENGTHEN_TC = 0. We thus conduct a t-test of the difference in means (or fractions) of REDUCE_PURCHASE between firms that got LENGTHEN_TC = 0 or = 1.

We also test Hypothesis 1 by checking the joint distribution of REDUCE_PURCHASE and LENGTHEN_TC. The hypothesis predicts that firms either get longer payment periods and do not reduce the amount of purchases ("LENGTHEN_TC = 1 and REDUCE_PURCHASE = 0"), or do not get a longer payment period and (have to) reduce the amount of purchases ("LENGTHEN_TC = 0 and REDUCE_PURCHASE = 1"). Also, the hypothesis predicts that we do not observe firms that got "LENGTHEN_TC = 0 and

REDUCE_PURCHASE = 0" or "LENGTHEN_TC = 1 and REDUCE_PURCHASE = 1." We thus check whether these are the cases by using a cross tabulation, and conduct a Chi-squared test on the independence of the two variables. We label this sub-analysis 1-2.

4.2.2. Univariate analysis after propensity score matching

However, sub-analysis 1-1 and 1-2 might suffer from a drawback, because they do not account for the heterogeneity among firms. For example, firms do not need to get a longer payment period or reduce their amount of purchases if they do not suffer any adverse shocks, or if they do suffer the shocks but can take other (more effective) measures. In such cases, firms would neither use a longer credit period nor reduce the amount of purchases, and so it might be natural to observe many firms with LENGTHEN_TC = REDUCE_PURCHASE = 0. Also, if firms suffer severe damages, they might take both measures, so we might also observe firms with LENGTHEN_TC = REDUCE_PURCHASE = 1.

To consider the heterogeneity among firms, we control for firm characteristics and other factors by using propensity score matching (PSM). Specifically, we run a probit model regression in which LENGTHEN_TC is the dependent variable, and firm characteristics or other factors are the independent variables from which we calculate the propensity score. Using the score, we construct an artificial control group of firms that got LENGTHEN_TC = 0 that are similar to those that got LENGTHEN_TC = 1 as the treatment group. Using this control group and the treatment group, we augment sub-analysis 1-1 and 1-2. That is, we compare the fraction of firms with

REDUCE_PURCHASE = 0 between the two groups (sub-analysis 1-1-PSM) and check the joint distribution of the two variables in a cross tabulation that uses the matched sample (sub-analysis 1-2-PSM).

4.3. Analysis 2: Analysis on the determinants of being a shock absorber

Analysis 1 examines *whether* trade credit plays the role of a shock absorber, and essentially it does so by testing whether we frequently observe the case where (LENGTHEN_TC, REDUCE_PURCHASE) = (1, 0) as opposed to the other cases. However, irrespective of how frequent we observe the case, it is also informative to know when, or under what circumstances, it occurs. We thus analyze the determinants of trade credit as a shock absorber.

In this analysis, we run a multinomial regression on the joint determination of LENGTHEN_TC and REDUCE_PURCHASE, which we label Analysis 2, where we construct a variable to indicate four cases: (LENGTHEN_TC, REDUCE_PURCHASE) = (0, 0), (1, 0), (0, 1) and (1, 1). Using this multinomial variable as a dependent variable, we estimate a multinomial logit model for the joint determination of LENGTHEN_TC and REDUCE_PURCHASE. This estimation facilitates the identification of factors (independent variables) that contribute to the selection of the above four cases, and we put our primary focus on factors that contribute to the selection of the case (1, 0).

4.4. Deep pockets

We use many variables to calculate the propensity score for Analysis 1 and as proxies for the determinants of trade credit as a shock absorber in the multinomial regression in Analysis 2. Among such variables, we put our primary focus on heterogeneity in terms of the characteristics of firms' suppliers. Whether trade credit is a shock absorber depends not only on the characteristics of the firms that obtain credit (debtors) but also on those that provide it (creditors, or suppliers). The deep pocket hypothesis predicts that only suppliers with more resources can provide emergency credit that could play the role of a shock absorber. We thus test the following hypothesis:

Hypothesis 2 (deep pockets): The case where firms get longer period of credit payment and do not reduce the amount of purchases is observed only for suppliers with specific characteristics.

To test this hypothesis, we use three variables. The variable S_LARGE is a dummy variable to indicate that a supplier is large, or its number of employee is larger than 300.[20,21] The variable S_PURCHASE is the ratio of the amount of purchases by the firm from the largest supplier to the total amount of purchases by that firm. The variable S_RELATION is the duration (years) of transactional relationships with the largest supplier. These variables are respectively proxies for suppliers that can absorb an adverse shock, those that

[20] We do not use a continuous variable for the number of employees because we only have categorical information.
[21] SMEs under the SME Basic Act in Japan are defined as firms with 300 million yen of capital stock or less and/or 300 or fewer regular employees.

the firms highly depend on, and those that have strong relationships with the firms and might have better information on their creditworthiness.

To the extent that such suppliers have deep pockets, we predict that these variables have positive effects on the selection of (LENGTHEN_TC, REDUCE_PURCHASE) = (1, 0) in the multinomial regression. This is our test of Hypothesis 2. On the other hand, even if the firms obtain additional trade credit, they might need to reduce their purchases if a shock is sufficiently large. In this case, these variables have a positive effect on the selection of (LENGTHEN_TC, REDUCE_PURCHASE) = (1, 1). However, firms that depend too much on specific suppliers might have little bargaining power over them, so S_PURCHASE and S_RELATION might also contribute to the selection of (LENGTHEN_TC, REDUCE_PURCHASE) = (0, 1) or (0, 0) in the multivariate model.

4.5. Bank loans and financial constraint

We also use indicators for measures that the firms use with banks to account for firm heterogeneity, because firms that could use other measures might not have to use an extended payment period or reduce their purchases. Among these measures, those with banks are of particular importance. As mentioned in section 2.1, there are many studies on the substitution or complementarity of bank loans and trade credit. Among such studies, those focusing on the role of trade credit in shock periods distinguish between financially constrained and unconstrained firms and find that the role only applies to constrained firms (e.g., Carbó-Valverde et al. 2016 and Lawrenz and Oberndorfer 2018). We thus establish the following hypothesis:

Hypothesis 3 (bank loans and financial constraints): The case where firms use longer payment periods and do not reduce their purchases is observed only for firms that do not borrow from banks to cope with adverse shocks.

We use the following dummies for emergency borrowing from banks as measures that firms actually took to cope with adverse shocks: M_BANK1 for borrowing from banks (the largest, the second-largest, and/or other private or government affiliated-banks) with or without a guarantee from the Credit Guarantee Corporations; M_BANK2 for relaxation of terms of incumbent borrowing from banks (extension of loan maturity by the largest, the second-largest, and/or other banks).[22] These dummies indicate the presence of financial support from banks, and should contribute to reducing the need for trade credit to play the role of a shock absorber. Thus, under Hypothesis 3, we predict that these variables have negative effects on the selection of (LENGTHEN_TC, REDUCE_PURCHASE) = (1, 0) in the multinomial regression.

However, when we interpret the results for M_BANK1 and M_BANK2, a caveat is in order. Similar to the two measures with suppliers that are of our primary interest, these measures with banks are also constructed from the survey questions on the outcome, or the measures they actually took, and we do not know their sequence. For this reason, we cannot interpret the results from a causality viewpoint. For example, a positive effect of these variables indicates that these measures with banks promote the use of a measure with

[22] The Credit Guarantee Corporations in Japan are government-affiliated institutions that provide corporate credit guarantees to firms for policy purposes.

suppliers, or vice versa. On the other hand, however, it is more likely that the causality goes from bank borrowing to trade credit, because of the massive amount of financial support for firms through policy measures implemented by the government of Japan. The government provided direct lending from government-affiliated banks with a low interest rate, subsidization of interest payments to private banks, and credit guarantees by the Credit Guarantee Corporations; firms should have used this cheap borrowing first before resorting to trade credit. And even if the direction was the opposite, a negative effect of these variables would at least indicate that bank loans and trade credit were substitutes for each other.

As for banks, we also use the natural logarithm of B_RELATION that represents the duration (years) of lending relationships between the firms and their largest lenders. Since the seminal studies by Petersen and Rajan (1994) and Berger Udell (1995), the duration has been frequently used in the literature on relationship lending as a proxy for strong bank-firm relationships through which banks accumulate soft information and produce benefits. We use B_RELATION to capture any beneficial effect from banks with close relationships, other than that captured by the two measures actually taken.

4.6. Other independent variables

We also use other variables as independent variables. First, firms that (need to) take measures to cope with adverse shocks must be firms that actually suffer from the shocks. We thus construct the following dummy variables from the survey to indicate that the firms suffer shocks: SHK_CUS_REAL1 for real shocks that firms suffer from customers'

business slump or bankruptcy, or an increase in unrecoverable claims to the customers; SHK_CUS_REAL2 for real shocks that firms suffer from their customers in the form of a reduction in sales or sales prices; SHK_CUS_FIN that firms suffer from their customers in the form of lengthening period of accounts receivable or promissory bills, or a decrease in payment by cash, from the customers; and SHK_SUP_REAL for real shocks that firms suffer from suppliers' business slump or bankruptcy. Using these variables, we control for firms that do not suffer adverse shocks, which are likely to choose (LENGTHEN_TC, REDUCE_PURCHASE) = (0, 0).

Finally, we use variables for firm characteristics: the natural logarithm of the number of employees (EMP), the natural logarithm of firm age (AGE), firms' credit score (SCORE) provided by the TSR, and the natural logarithm of the amount of borrowing (BORROW). We also use dummy variables for industry fixed effects. These variables capture firms' ex ante characteristics.

4.7. Descriptive statistics

Table 1 presents the descriptive statistics for the above variables for the GFC sample (row A) and for the COVID sample (row B). In the GFC sample, the fraction of firms that obtained extended credit periods is about 3.5%, and that of firms that reduced their purchases is 17.6%. In the COVID sample, only 1.4% of the sample firms got extended credit periods, and 6.0% of them reduce their purchases. As far as these variables are concerned, the shocks from the GFC were greater than those from COVID-19 (at least up to the taking of the COVID survey). However, the extended credit period is not a commonly

used measure in either sample.

<<<Insert Table 1 about here>>>

As for the variables for suppliers, 44.2% of the firms in the GFC sample transact with suppliers that are large in size (with more than 300 employees). The dependence on the largest suppliers in terms of the fraction of purchases is 35.0% on average, and the duration of transactional relationships with the suppliers is on average 27.4 years. In the COVID sample, 39.5% of the firms transact with large suppliers, the fraction of purchases from the suppliers is on average 36.6%, and the duration of transactional relationships with them is on average 29.4 years. These characteristics are comparable between the two samples.

Turning to the variables for firm characteristics, firms in the GFC sample have 134 employees and are 39 years old on average. The amount of borrowing is on average JPY 2.9 billion. In comparison, firms in the COVID sample are on average smaller in size, older, and borrow a smaller amount.

As for the shock incurred, the most common shock that firms in the GFC sample incurred was the adverse shock on their sales to customers (77.5%), and the next most was the one related to business slump or bankruptcy of customers (32.2%). Compared with these shocks, firms do not frequently suffer financial shocks from customers or real shocks from suppliers. In the COVID sample, the most common shock was the one on their sales to customers, but the fraction that experienced this shock was 53.7%, smaller than that for the GFC sample. The next most common shock was the one related to customers' business slump or bankruptcy (10.5%). Firms do not suffer financial shocks from customers or real

shocks from suppliers. On balance, firms in the COVID sample suffer less from shocks than those in the GFC sample, but their relative frequencies are qualitatively the same.

As for the measures with banks, 51.8% of the firms in the GFC sample borrow from banks (the largest, the second-largest, and/or other private or government affiliated-banks), but rarely obtain a relaxation of terms from banks (extension of loan maturity by the largest, the second-largest, and/or other banks). The average years of relationships with the largest banks is 25.98 years. In the COVID sample, firms that borrow from banks consist of about 40% of the sample, which is smaller than that in the GFC sample. The years of relationships are slightly longer.

Table 2 shows the frequency and percentage distributions for the number of observations by industry. In both samples, the fraction of manufacturing firms is the largest, followed by construction. The distributions are similar across the two samples, but the fraction of wholesale firms is larger in the GFC sample than in the COVID sample.

<<<Insert Table 2 about here >>>

5. Results

5.1. Results for Analysis 1

Tables 3 and 4 present the results for Analysis 1 in which we compare the distribution of REDUCE_PURCHASE depending on the value of LENGTHEN_TC for the GFC sample (Table 3) and the COVID sample (Table 4). In each table, Panel A shows the

fractions of firms with REDUCE_PURCHASE = 1 (its means) for the subsample with LENGTHEN_TC = 0 and 1, together with the differences in the fractions and the statistical significance of the differences based on t-tests on the difference in means (fractions). Panel B shows the cross tabulation of the two variables and the results for Chi-squared tests for independence of the two variables. In both panels, row (1) shows the results using the whole sample, and row (2) shows the results after propensity score matching. The results for the estimations of probit models to calculate the propensity score are in Tables A1 (GFC sample) and A2 (COVID sample) in the appendix.

<<<Insert Table 3 about here >>>

In Panel A of Table 3, row (1) shows that there is a difference in the fraction of firms that reduce their purchases that depends on whether they have extended trade credit. Also, the difference is statistically significant. However, the direction of the difference is at odds with Hypothesis 1. It indicates that firms with extended trade credit are *more*, not less, likely to reduce their purchases. Because this is a comparison without any conditioning, the results after propensity score matching are more important. The results in row (2) indicate that the fraction of firms with REDUCE_PURCHASE = 1 is again larger when LENGTHEN_TC = 1 than when it is zero. The difference is statistically significant.

The cross tabulation in Panel B of Table 3 provides more detailed information. Before the matching (rows (1)), LENGTHEN_TC equals zero for most firms, that is, they do not get an extended period of credit. And among such firms, the majority does not reduce their purchases. This means that most of the firms neither get extended credit periods nor reduce

their purchases. The fraction of firms that reduce their purchases is larger among firms with LENGTHEN_TC = 1, but they are the minority. The result of the Chi-squared test indicates that the distributions of the two variables are dependent in a statistically significant manner, but again, the direction of the dependence is opposite to the one predicted by Hypothesis 1. The difference in the likelihoods of REDUCE_PURCHASE = 1 between firms with LENGTHEN_TC = 0 and = 1 are smaller and are now comparable. Further, the propensity score matching (rows (2)) and the Chi-squared test do not reject the null hypothesis that the two variables are independent. However, these results are still inconsistent with Hypothesis 1.

The results for the COVID sample in Table 4 are mostly the same. In Panel A, the fraction of firms that reduced their purchases is larger when LENGTHEN_TC = 1 than when it = 0 in both rows (1) and (2). The difference in the fraction between the two columns is statistically significant. But again, the signs of the differences are the opposite to what Hypothesis 1 predicts. Also, the results from the cross tabulation in Panel B are consistent with those in Panel B of Table 3, with one difference being the result for the independence of the two variables in row (2) that is now statistically significant, but in the opposite direction to what Hypothesis 1 predicts. The shock that firms suffered might have been large enough, and they might have needed to reduce their purchases as well as to get a longer payment period.

<<<Insert Table 4 about here >>>

5.2. Results for Analysis 2

The results for Analysis 2 are shown in Tables 5 and 6. Table 5 is for the GFC sample and Table 6 is for the COVID one. In each table, Panel A shows the estimation results, and Panel B shows the marginal effects of the selected variables. Column [1] in these tables shows the results of a parsimonious specification without using the variables for suppliers, and column [2] shows those of a full specification with using them. We report both results to check their robustness because the use of the variables for suppliers reduces the number of observations. The results in columns [1] and [2] are qualitatively very similar in both tables. Columns [1] and [2] consist of sub-columns (i) through (iv) that indicate the selection of the four possible cases for REDUCE_PURCHASE and LENGTHEN_TC as indicated by the multinomial dependent variable. We set the case where both variables equal zero (column (i)) as the default case. Thus, the coefficients in columns (ii) through (iv) indicate the contribution of the independent variables to the choice of the corresponding cases relative to the case indicated in column (i).

<<< Insert Table 5 about here >>>

<<< Insert Table 6 about here >>>

5.2.1. Results for supplier characteristics

The results of our primary interest are those in columns (ii) that show when, or under what conditions, trade credit plays the role of a shock absorber (LENGTHEN_TC = 1 and

REDUCE_PURCHASE = 0). In column (ii), we are especially interested in the results for the variables for measures with suppliers and banks because they reflect the tests of Hypotheses 2 and 3.

As for the three measures with suppliers, we first find that in the GFC sample, they have no statistically significant effects. The size of the suppliers, the dependence on the suppliers, or the strength of the relationships with the suppliers does not affect the likelihood that firms get longer payment periods and do not reduce their purchases as measures to cope with adverse shocks. The results are almost the same for the COVID sample (Table 6) as well. The three variables do not have a statistically significant effect on the selection of case (ii), and the marginal effects are also insignificant. At least as far as these variables are concerned, supplier characteristics do not increase the likelihood that trade credit plays the role of a shock absorber. Thus, our findings do not lend support to the deep pocket hypothesis of Hypothesis 2.

We also find that supplier characteristics do not affect the selection of the other cases as well. In columns (iii) and (iv) of Table 5, the three variables for suppliers have no statistically significant coefficients or marginal effects. At the time of the GFC, suppliers' characteristics do not matter for whether firms take measures to cope with the shocks by using measures with their suppliers.

In the case of the COVID-19 shock, we find a negative effect of S_PURCHASE on the choice of (REDUCE_PURCHASE, LENGTHEN_TC) = (1, 0) (column (iii) of Table 6). As shown in Panel B, this negative effect is a mirror image of its positive effect on the choice of (0, 0). This result indicates that firms that rely on most of their purchases coming from the largest suppliers do not reduce their purchases (without also getting longer

payment periods) that are most likely from the largest suppliers.[23]

5.2.2. Results for bank loans

As for the variables on measures with banks, column (ii) of Table 5 shows that M_BANK1 and M_BANK2 have positive and statistically significant coefficients. In the case of the GFC, trade credit plays the role of a shock absorber when a firm borrows from banks or gets relaxed terms for borrowing from banks. The results are somewhat different in Table 6 as its column (ii) shows that although M_BANK_2 has a positive and statistically significant coefficient, the coefficient for M_BANK1 is negative and loses its statistical significance. In the case of the COVID-19 crisis, whether firms obtain new borrowing from banks does not matter as to whether trade credit plays the role of a shock absorber. Although the results are qualitatively different, they on balance indicate that the role of trade credit as a shock absorber takes place when firms obtain financial support from banks. This finding is inconsistent with Hypothesis 3 that predicts that trade credit plays its role only for financially constrained borrowers. Rather, our findings indicate that bank loans promote the role of trade credit as a shock absorber.

Our finding has some policy implications. To the extent that it reflects the fact that the provision of support from banks invites suppliers' extension of trade credit, a policy to promote emergency lending by banks will have a side effect of promoting the role of trade

[23] To check whether these results change depending on whether firms suffer shocks from their suppliers, we also conducted an additional analysis to interact the supplier variables with SHK_SUP_REAL. Unreported results indicate that the interaction terms rarely have statistically significant effects, and our main conclusion does not change.

credit from suppliers as a shock absorber. However, as mentioned in subsection 3.2.5, we cannot necessarily interpret the results in Analysis 2 as a causal relation, because we have no information on the sequence in which these measures were taken. However, regardless of which scenario holds, our results indicate that trade credit as a shock absorber might be complementary to financial support from banks.

This finding is inconsistent with the findings of other studies (e.g., Carbó-Valverde et al. 2016 and Lawrenz and Oberndorfer 2018) that indicate the substitutability of bank loans and trade credit. Although it is hard to identify the reason for this inconsistency, it might be due to a difference in the data sets with country-specific factors, or in the analytical approach. We cannot completely rule out the possibility that the results from other studies and ours are different due to country-specific factors. Anecdotal evidence that the number of corporate bankruptcies did not surge in Japan in the early periods of the crises indicates that backed by the huge rescue packages implemented by the government of Japan, firms could obtain sufficient funds from banks and did not have to rely on trade credit as the last resort. Our finding from Analysis 1 supports this view as well. In Table 1, the means of LENGTHEN_TC and REDUCE_PURCHASE are respectively 0.035 and 0.176 for the GFC sample and 0.014 and 0.060 for the COVID sample, which are significantly smaller than the mean of M_BANK1 of 0.518 for the GFC sample and 0.402 for the COVID sample. As far as our two samples are concerned, it is not suppliers but banks that provide emergency financing to firms. In this sense, trade credit does not play a significant role as a measure to cope with adverse shocks.

However, we cannot completely rule out the possibility that the differences in the results stem from differences in the analytical approaches. The most significant difference

between the other studies and ours is our granular information obtained from the corporate surveys. Furthermore, instead of using the amount of trade credit and investments from financial statements, we use information on whether firms received extended payment periods and whether they reduced their purchases as measures they actually took to cope with the adverse shocks of the two crises. Our focus on purchases as a real outcome makes sense, because trade credit in practice is used to raise working capital, and its link with purchases is closer than its link with investment. Because it is not very clear under what mechanisms trade credit affects investments, our findings call for more studies to dig deeper into the mechanisms behind the other findings.

5.2.3. Results for shocks and other measures

Turning to the variables other than those related to Hypotheses 2 and 3, we find in column (ii) that some variables have significant effects on the selection of the outcome of the shock absorber (LENGTHEN_TC = 1 and REDUCE_PURCHASE = 0). In Table 5, SHK_CUS _FIN has a positive and statistically significant coefficient, and credit score has a negative one. These results indicate that firms' suppliers might provide additional credit to play the role of a shock absorber to firms whose customers suffer default, or to less creditworthy firms.

The results are somewhat different in column (ii) of Table 6. Again, we find that SHK_CUS_FIN has a positive and statistically significant coefficient, and instead SHK_CUS_REAL2 has turned positive and significant. In the case of the COVID-19 crisis, trade credit played the role of a shock absorber for suppliers that suffered real shocks to

purchases from customers (reduction in sales or sales prices)

5.2.4. Other results

There are some notable results in the columns other than column (ii). In Table 5, a business slump or bankruptcy of customers (SHK_CUS_REAL1), real shock on sales to customers (SHK_CUS_REAL2), or real shock of business slump or bankruptcy of suppliers (SHK_SUP_REAL) contribute to the selection of REDUCE_PURCHASES = 1 and LENGTHEN_TC = 0. The latter two variables also have positive and statistically significant effects in Table 5 for the COVID sample. These findings indicate that firms that suffer real shocks tend to use a real measure with suppliers. Also, SHK_CUS _FIN has a positive and statistically significant coefficient in column (iv) in both Tables 5 and 6. Together with its positive effect in column (ii), firms that suffer a financial shock from their customers are more likely to lengthen payment terms to their suppliers. Altogether, these findings are consistent with the finding in Ogawa and Tanaka (2013) of the correspondence between the types (real versus financial) of shocks and types of measures.

As for the effect of M_BANK1 and M_BANK2, there are differences between Tables 5 and 6. Both variables have a positive and significant effect in columns (ii) through (iv) in Table 5, but only M_BANK2 has such an effect in columns (ii) and (iv) in Table 6. Support from banks are associated with measures with suppliers, but the manner of this association manifested itself differently between the two crises.

5.3. Industry differences

As an additional analysis, we focus on industry differences. It is natural to expect that firms that are more adversely affected by the crises are more likely to receive extended credit and to reduce purchases at the same time. And we expect that a non-negligible part of the differences in the extent of the shock incurred are likely to be industry dependent. Also, there should be industry differences in the practices of purchases and payments that might invite different responses to crises across industries. For these reasons it would be interesting to compare the effect of the shocks across industries. We thus conduct Analysis 1 by industry.[24]

As a preliminary analysis, we first compare the fraction of the firms that answered that they experienced some adverse shock. Table 7 shows the results.[25] Among the respondents to the GFC survey (Panel (A)), the fraction is high and more than 60% for many industries. Focusing on industries with a sufficient number of the observations, the fraction is especially high for Wholesale, Construction, and Manufacturing. It is also high for Transportations, although the number of the observations is small. In the case of the COVID-19 survey (Panel (B)), the fractions are on average lower than those in the GFC survey but are still high and exceed 50% for most industries. Panels (A) and (B) differ not only in terms of the average levels but also of the across-industry distribution of the

[24] We thank the anonymous referee for his/her suggestion to add this important analysis.
[25] Specifically, we report the fractions of the numbers of firms that experienced a business slump, a failure of customer firms, a reduction in sales, or a reduction in sales price in the GFC survey. And we report those with a business slump, failure, or default of customer firms, cancellation of orders by customers, request to ease terms of sales (e.g., a reduction of prices or amounts), or a reduction of sales to general consumers in the COVID-19 survey.

affected firms. The fraction is especially higher than 60% for Restaurants, Others, Retail, and Real Estate in Panel (B), although the numbers of observations were small for two of these industries.[26]

<<< Insert Table 7 about here >>>

After excluding the industries with a small number of observations, we then conduct Analysis 1 for seven industries. Tables 8 and 9 respectively report the results using the GFC and the COVID-19 samples. We first find that the baseline result that we obtained in subsection 5.1 is robust to the industry split. Despite some differences across industries on the extent of the shock suffered from the crises (Table 7), irrespective of which industry they belong to, firms with extended trade credit are more, not less, likely to reduce their purchases. In all industries, trade credit does not play the role of a shock absorber.

<<< Insert Table 8 about here >>>

<<< Insert Table 9 about here >>>

Second, we find that the results for Construction, Manufacturing, and Wholesale are on balance similar between Tables 8 and 9, and similar to those in Table 4. These findings are important because for construction firms, the fraction of affected firms is relatively high during the GFC, while low during COVID-19 (see Table 7). These findings might indicate

[26] Although the fraction is high, we do not focus on "Unknown," because it is hard to gain any meaningful insight from unknown industries.

that industry-specific factors rather than the extent of the incurred shocks mainly determined how firms responded to adverse shocks.

On the other hand, the results in the two tables are different for the Transportation and Retail industries.[27] During the GFC (Table 8), firms in the transportation industry tended to reduce purchases and lengthen accounts payable at the same time, while no such tendency was found during COVID-19 (Table 9). In contrast, retail firms tended to reduce purchases and lengthen accounts payable at the same time during COVID-19 (Table 9), but they showed no such tendency during the GFC (Table 8). These differences are not due to the difference in the extent of damages that the firms in these industries incurred, because the fraction of affected firms are relatively high for these industries in both panels (see Table 7).

Although it is hard to identify the exact cause of these differences in the results between the two crises for firms in the transportation and retail industries, it might be the case that the nature of the shock was different for these industries across the two crises and affected the measures that these firms could take in response to the crises. In the case of COVID-19, the lockdown forced firms in these industries to shrink their businesses.[28] On the other hand, firms in these industries also benefited from massive subsidies provided by the government. Although we do not have data to further identify whether these were actually the causes, more studies are needed to clarify the mechanism behind these industry differences.

[27] Here we do not focus on Information and Telecommunication and Real Estate, because no firms in these industries extended the duration of trade credit to respond to the COVID-19 shock (see Table 9).
[28] The situation might have been different for retail firms focusing on electric commerce.

6. Conclusion

In this paper, we examined whether trade credit contributes to absorbing adverse shocks to firms. By using data on SMEs obtained from two corporate surveys after the shocks from the Global Financial Crisis and the COVID-19, we tested whether the relaxation of trade credit terms contributes to holding back the level of real activities in terms of the reduction in purchases.

From our analysis, we do not find that firms that received longer payment periods were less likely to reduce the amount of purchases, which indicates that trade credit did not contribute to absorb adverse shocks. We also find that the (small) likelihood that trade credit plays the role of a shock absorber is neither increased nor decreased by the characteristics of its providers (i.e., suppliers), but emergency borrowing from banks increases the likelihood.

These findings are not consistent with the findings of other studies that take different analytical approaches or use different data to clarify the real effect of trade credit and its relation to bank loans in a period of crisis. As discussed in the introduction, our findings call for more studies to reconcile these different findings by digging deeper into the mechanisms behind the relation between trade credit and the real outcomes of firms in the period of crisis.

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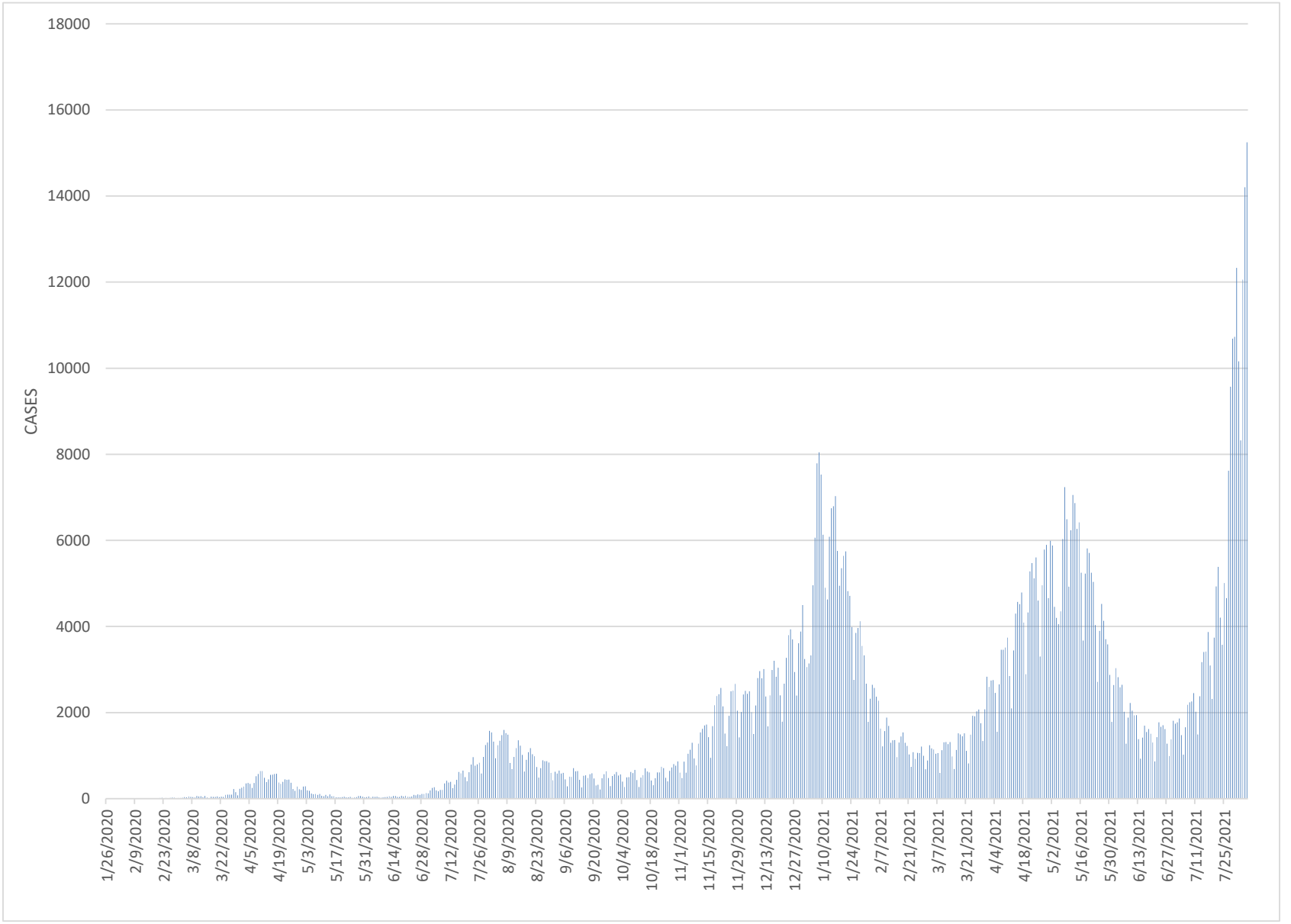
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Table (Editable version)

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Figure 1 Newly reported cases for COVID-19 infections



Source: Made by the authors using data available from the website coronavirus "Situation report," of the Ministry of Health, Labor and Welfare (https://www.mhlw.go.jp/stf/covid-19/kokunainohasseijoukyou_00006.html, accessed on August 6, 2021).

Table 1 Descriptive statistics

This table shows the descriptive statistics for the variables we use in this paper.

		(A) GFC Survey						(B) COVID-19 Survey					
Variable	Definition	Obs	Mean	Median	Std. Dev.	Min	Max	Obs	Mean	Median	Std. Dev.	Min	Max
Main variables													
LENGTHEN_TC	Dummy = 1 if the firm lengthened the sight [= duration] of accounts or promissory bills payables for the payment to any supplier or the firm increased the ratio of payments by promissory bills or on account to total payments to any supplier to cope with the recession.	3355	0.035	0.000	0.183	0.000	1.000	3767	0.014	0.000	0.119	0.000	1.000
REDUCE_PURCHASE	Dummy = 1 if the firm reduced the quantity of purchases from any supplier to cope with the recession	3355	0.176	0.000	0.381	0.000	1.000	3767	0.060	0.000	0.238	0.000	1.000
Variables for suppliers													
S_LARGE	Dummy= 1 if the largest supplier's number of employee is larger than 300	2106	0.442	0.000	0.497	0.000	1.000	2580	0.395	0.000	0.489	0.000	1.000
S_PURCHASE	The ratio of the amount of purchases from the largest supplier to the total amount of purchases.	2106	0.350	0.284	0.250	0.000	1.000	2580	0.366	0.300	0.271	0.000	1.000
S_RELATION	Duration (years) of transactional relationships with the largest supplier	2106	27.414	27.500	15.456	1.000	103.0	2580	29.431	28.000	17.679	0.000	130.0
Variables for shocks													
SHK_CUS _REAL1	Dummy for real shocks that firms suffer from customers' business slump or bankruptcy, or an increase in unrecoverable claims to the customers (GFC) Dummy= 1 if the firms suffered from customers' business slump or bankruptcy, or an increase in uncollectable claims to the customers (COVID) Dummy= 1 if the firms suffered from customers' business slump	3355	0.322	0.000	0.467	0.000	1.000	3767	0.105	0.000	0.307	0.000	1.000
SHK_CUS _REAL2	Dummy for real shocks that firms suffer from their customers in the form of a reduction in sales or sales prices to the customers (GFC) Dummy= 1 if the firm suffered from a decrease in sales or sales prices (COVID) Dummy= 1 if the firm suffered cancellation of sales to firms, was asked to ease terms of sales to firms, or suffered from a decrease in sales to consumers	3355	0.775	1.000	0.418	0.000	1.000	3767	0.537	1.000	0.499	0.000	1.000
SHK_CUS _FIN	Dummy for financial shocks that firms suffer from their customers in the form of lengthening period of accounts receivable or promissory bills, or a decrease in payment by cash, from the customers (GFC) Dummy= 1 if the firm suffered a shock in the form of an extension of the period of acccounts receivables or promissory bills receivables, or a decrease in sales by cash, from customers (COVID) Dummy= 1 if the firm suffered a shock in the form of an extension of credit period to customers	3355	0.132	0.000	0.338	0.000	1.000	3767	0.050	0.000	0.217	0.000	1.000
SHK_SUP_REAL	Dummy for real shocks that firms suffer from suppliers' business slump or bankruptcy (GFC) Dummy= 1 if the firm suffered from business slump or failure of its main or other suppliers (COVID) Dummy= 1 if the firm suffered from business slump of its suppliers	3355	0.105	0.000	0.306	0.000	1.000	3767	0.042	0.000	0.200	0.000	1.000
Variables for measures to banks													
M_BANK1	Dummy= 1 if the firm borrow from banks (the largest, the second-largest, and/or other private or government affliated-banks) with or without guarantee by the Credit Guarantee Corporations	3355	0.518	1.000	0.500	0.000	1.000	3767	0.402	0.000	0.490	0.000	1.000
M_BANK2	Dummy= 1 if the firm obtained relaxation of terms of incumbent borrowing from banks (extension of loan maturity by the largest, the second-largest, and/or other banks)	3355	0.038	0.000	0.192	0.000	1.000	3767	0.094	0.000	0.292	0.000	1.000
B_RELATION	Duration (years) of lending relationships between the firms and their largest lenders	2106	25.984	25.000	18.956	0.000	207.000	2580	29.431	28.000	17.679	0.000	130.000
Variables for firm characteristics													
EMP	Number of employee before the shock	3355	133.802	28.000	829.4	1.000	36123.0	3767	66.321	24.000	254.5	1.000	8507.0
AGE	Firms' age (years)	3355	39.451	39.000	17.4	8.000	120.0	3767	43.063	44.000	19.2	1.000	124.0
SCORE	Firms' score before the shock	3355	54.619	54.000	6.8	39.000	87.0	3767	51.326	51.000	6.7	30.000	79.0
BORROW	Firms' bank borrowings before the shock (million yen)	3355	2926.131	180.000	37814.8	0.000	1792273.0	3767	1052.600	87.000	14172.1	0.000	560486.0

Table 2 Distribution of observations by industries

This table shows the frequency and percentage distribution for the number of observations by industry.

	(A) GFC Survey		(B) COVID-19 Survey	
	No. of obs.	(%)	No. of obs.	(%)
Construction	772	23.01	796	21.13
Manufacturing	827	24.65	882	23.41
Information and Communications	89	2.65	91	2.42
Transportations	119	3.55	83	2.2
Wholesales	758	22.59	280	7.43
Retail	334	9.96	220	5.84
Real Estate	91	2.71	75	1.99
Restaurants	5	0.15	29	0.77
Other services	36	1.07	222	5.89
Others	324	9.66	447	11.87
(Unknown)			642	17.04
Total	3355	100	3767	100

Table 3 Fraction and cross-tabulation (GFC sample)

This table shows the average value of REDUCE_PURCHASE by LENGTHEN_TC and the cross-tabulations for LENGTHEN_TC and REDUCE_PURCHASE. *** denotes significance at the 1% level.

Panel A: Fraction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Difference
(1) Whole sample	0.170	0.342	0.171 ***
(2) PSM	0.179	0.359	0.179 ***

Panel B: Cross-tabulation

(1) Whole sample

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	2686	77	2763
	(80.06%)	(2.30%)	
REDUCE_PURCHASE= 1	552	40	592
	(16.45%)	(1.19%)	
	3238	117	3355

Pearson chi2(1) = 22.8296 Pr = 0.000

(2) PSM

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	55	50	105
	(37.67%)	(34.25%)	
REDUCE_PURCHASE= 1	13	28	41
	(8.90%)	(19.18%)	
	68	78	146

Pearson chi2(1) = 5.0647 Pr = 0.024

Table 4 Fraction and cross-tabulation (COVID sample)

This table shows the average value of REDUCE_PURCHASE by LENGTHEN_TC and the cross-tabulations for LENGTHEN_TC and REDUCE_PURCHASE. *** denotes significance at the 1% level.

Panel A: Fraction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Difference
(1) Whole sample	0.056	0.370	0.315 ***
(2) PSM	0.154	0.359	0.205 **

Panel B: Cross-tabulation

(1) Whole sample

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	3506	34	3540
	(93.07%)	(0.90%)	
REDUCE_PURCHASE= 1	207	20	227
	(5.50%)	(0.53%)	
	3713	54	3767

Pearson chi2(1) = 93.0376 Pr = 0.000

(2) PSM

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	31	25	56
	(41.33%)	(33.33%)	
REDUCE_PURCHASE= 1	5	14	19
	(6.67%)	(18.67%)	
	36	39	75

Pearson chi2(1) = 4.7937 Pr = 0.029

Table 5 Multinomial logit model: Parsimonious (GFC sample)

This table shows the estimation results for multinomial logit models for LENGTHEN_TC and REDUCE_PURCHASE. For more detailed definition of dependent and independent variables, see Table 1. ***, **, and * respectively indicate that the coefficient is statistically significant at the 1%, 5%, and 10% level. Robust standard errors are in parentheses.

Panel A: Estimation results for multinomial logit models

	[1] Parsimonious specification				[2] Full specification			
	(i)	(ii)	(iii)	(iv)	(i)	(ii)	(iii)	(iv)
REDUCE_PURCHASE =	0	0	1	1	0	0	1	1
LENGTHEN_TC =	0	1	0	1	0	1	0	1
LARGE	(benchmark case)				(benchmark case)	-0.5585	-0.1633	-0.1280
						(0.371)	(0.138)	(0.489)
S_PURCHASE						0.3247	-0.0118	-0.5803
						(0.645)	(0.259)	(0.903)
ln(S_RELATION)						0.3764	0.1080	0.2922
						(0.327)	(0.119)	(0.409)
M_BANK1		0.6701**	0.9011***	0.7522*		0.7655**	1.0099***	0.8492*
		(0.275)	(0.111)	(0.397)		(0.359)	(0.145)	(0.516)
M_BANK2		1.5692***	1.1783***	1.9845***		1.6833***	1.2126***	1.9411***
		(0.344)	(0.228)	(0.437)		(0.429)	(0.291)	(0.537)
ln(B_RELATION)						-0.2582	-0.0594	-0.0410
						(0.192)	(0.076)	(0.289)
SHK_CUS _REAL1		0.1496	0.2824***	0.3964		0.0672	0.2697**	-0.1486
		(0.263)	(0.105)	(0.356)		(0.332)	(0.132)	(0.445)
SHK_CUS _REAL2		0.3241	1.0595***	1.2832*		0.3957	0.9232***	1.7587*
		(0.347)	(0.161)	(0.746)		(0.475)	(0.204)	(1.057)
SHK_CUS _FIN		1.2955***	0.2694*	1.5757***		1.5463***	0.3174*	1.5882***
		(0.261)	(0.139)	(0.349)		(0.320)	(0.166)	(0.431)
SHK_SUP_REAL		0.3716	0.4541***	1.4906***		0.4021	0.5697***	1.4220***
		(0.362)	(0.144)	(0.370)		(0.447)	(0.176)	(0.470)
ln(EMP)		-0.0218	0.0751	0.1542		-0.0342	0.0211	0.3060
		(0.139)	(0.051)	(0.179)		(0.187)	(0.072)	(0.241)
ln(AGE)		-0.2260	-0.0009	-0.3386		-0.3700	-0.0617	-0.5532
		(0.233)	(0.105)	(0.315)		(0.370)	(0.154)	(0.513)
SCORE		-0.0938***	0.0019	-0.1151***		-0.1116***	0.0048	-0.1671***
		(0.022)	(0.009)	(0.032)		(0.030)	(0.012)	(0.041)
ln(BORROW)		0.0163	-0.0112	0.0143		0.0905	-0.0016	0.0204
		(0.078)	(0.027)	(0.106)		(0.116)	(0.045)	(0.156)
Industry Fixed Effects	Yes				Yes			
Observations	3,355				2,106			
Log Likelihood	-1855				-1136			

Panel B: Marginal effects of shock variables

	[1] Parsimonious specification				[2] Full specification			
	(i)	(ii)	(iii)	(iv)	(i)	(ii)	(iii)	(iv)
REDUCE_PURCHASE =	0	0	1	1	0	0	1	1
LENGTHEN_TC =	0	1	0	1	0	1	0	1
LARGE					0.0291	-0.0109	-0.0179	-0.0003
					(0.019)	(0.008)	(0.017)	(0.006)
S_PURCHASE					0.0008	0.0076	-0.0012	-0.0072
					(0.035)	(0.014)	(0.033)	(0.011)
ln(S_RELATION)					-0.0209	0.0071	0.0112	0.0026
					(0.016)	(0.007)	(0.015)	(0.005)
M_BANK1	-0.1235***	0.0096*	0.1091***	0.0049	-0.1391***	0.0106	0.1225***	0.0060
	(0.014)	(0.006)	(0.014)	(0.004)	(0.019)	(0.007)	(0.018)	(0.006)
M_BANK2	-0.1795***	0.0261***	0.1368***	0.0166***	-0.1856***	0.0277***	0.1409***	0.0170***
	(0.029)	(0.007)	(0.028)	(0.005)	(0.037)	(0.009)	(0.036)	(0.006)
ln(B_RELATION)					0.0114	-0.0051	-0.0063	0.0000
					(0.010)	(0.004)	(0.010)	(0.003)
SHK_CUS _REAL1	-0.0389***	0.0016	0.0340***	0.0033	-0.0322*	0.0004	0.0345**	-0.0027
	(0.014)	(0.005)	(0.013)	(0.004)	(0.018)	(0.007)	(0.017)	(0.005)
SHK_CUS _REAL2	-0.1407***	0.0012	0.1290***	0.0105	-0.1298***	0.0020	0.1104***	0.0174
	(0.021)	(0.007)	(0.020)	(0.008)	(0.027)	(0.010)	(0.026)	(0.013)
SHK_CUS _FIN	-0.0637***	0.0245***	0.0241	0.0151***	-0.0736***	0.0292***	0.0287	0.0158***
	(0.018)	(0.006)	(0.017)	(0.004)	(0.022)	(0.007)	(0.021)	(0.005)
SHK_SUP_REAL	-0.0705***	0.0045	0.0515***	0.0145***	-0.0850***	0.0042	0.0664***	0.0145**
	(0.019)	(0.007)	(0.018)	(0.004)	(0.024)	(0.009)	(0.022)	(0.006)

Table 6 Multinomial logit model: Parsimonious (COVID sample)

This table shows the estimation results for multinomial logit models for LENGTHEN_TC and REDUCE_PURCHASE. For more detailed definition of dependent and independent variables, see Table 1. ***, **, and * respectively indicate that the coefficient is statistically significant at the 1%, 5%, and 10% level. Robust standard errors are in parentheses.

Panel A: Estimation results for multinomial logit models

	[1] Parsimonious specification				[2] Full specification			
	(i)	(ii)	(iii)	(iv)	(i)	(ii)	(iii)	(iv)
REDUCE_PURCHASE =	0	0	1	1	0	0	1	1
LENGTHEN_TC =	0	1	0	1	0	1	0	1
LARGE	(benchmark case)				(benchmark case)	0.4366	0.2069	-0.7434
						(0.455)	(0.192)	(1.030)
S_PURCHASE						-1.3495	-0.7074**	0.4013
						(0.897)	(0.348)	(1.428)
ln(S_RELATION)						-0.1934	0.1114	0.0924
						(0.307)	(0.148)	(0.672)
M_BANK1		0.0698	0.4936***	0.4105		-0.3532	0.2055	0.2112
		(0.379)	(0.168)	(0.803)		(0.446)	(0.194)	(1.007)
M_BANK2		1.1705***	0.3826*	3.8630***		1.4134***	0.3734	4.2318***
		(0.424)	(0.204)	(0.866)		(0.491)	(0.248)	(1.082)
ln(B_RELATION)						0.3936	0.2089*	1.1110
						(0.364)	(0.118)	(0.753)
SHK_CUS _REAL1		0.5956	-0.0627	-1.1581		0.4555	-0.0372	-1.1542
		(0.439)	(0.219)	(0.792)		(0.517)	(0.248)	(0.968)
SHK_CUS _REAL2		1.4455***	1.8866***	13.8560		1.7116***	1.9165***	15.2675
		(0.512)	(0.259)	(533.069)		(0.650)	(0.295)	(1,277.417)
SHK_CUS _FIN		1.4239***	-0.2842	2.3465***		1.6152***	-0.2737	2.0054**
		(0.456)	(0.324)	(0.698)		(0.523)	(0.363)	(0.815)
SHK_SUP_REAL		-1.1364	1.6182***	4.1716***		-0.8011	1.4809***	4.4390***
		(1.065)	(0.231)	(0.789)		(1.081)	(0.270)	(1.022)
ln(EMP)		-0.2348	-0.0395	-0.0132		-0.3058	-0.0743	-0.1543
		(0.184)	(0.072)	(0.341)		(0.226)	(0.087)	(0.433)
ln(AGE)		0.5186	-0.0207	0.8024		0.1785	-0.2669	0.2673
		(0.375)	(0.119)	(0.553)		(0.514)	(0.168)	(0.762)
SCORE		0.0058	-0.0285*	0.0855		0.0017	-0.0281	0.0116
		(0.034)	(0.015)	(0.069)		(0.040)	(0.018)	(0.086)
ln(BORROW)		0.0586	-0.0510	-0.0890		0.0438	-0.0825*	0.3390
		(0.095)	(0.039)	(0.182)		(0.111)	(0.046)	(0.293)
Industry Fixed Effects	Yes				Yes			
Observations	3767				2,580			
Log Likelihood	-888.6				-645.1			

Panel B: Marginal effects of shock variables

	[1] Parsimonious specification				[2] Full specification			
	(i)	(ii)	(iii)	(iv)	(i)	(ii)	(iii)	(iv)
REDUCE_PURCHASE =	0	0	1	1	0	0	1	1
LENGTHEN_TC =	0	1	0	1	0	1	0	1
LARGE					-0.0120	0.0040	0.0110	-0.0030
					(0.011)	(0.004)	(0.010)	(0.004)
S_PURCHASE					0.0453**	-0.0119	-0.0357**	0.0023
					(0.020)	(0.009)	(0.018)	(0.005)
ln(S_RELATION)					-0.0042	-0.0019	0.0059	0.0003
					(0.008)	(0.003)	(0.008)	(0.002)
M_BANK1	-0.0241***	0.0002	0.0230***	0.0009	-0.0079	-0.0035	0.0108	0.0006
	(0.009)	(0.003)	(0.008)	(0.003)	(0.011)	(0.004)	(0.010)	(0.004)
M_BANK2	-0.0357***	0.0095**	0.0140	0.0123***	-0.0412***	0.0120**	0.0143	0.0148***
	(0.010)	(0.004)	(0.009)	(0.003)	(0.014)	(0.005)	(0.012)	(0.004)
ln(B_RELATION)					-0.0165**	0.0033	0.0095	0.0038
					(0.007)	(0.003)	(0.006)	(0.003)
SHK_CUS _REAL1	0.0008	0.0054	-0.0024	-0.0038	0.0011	0.0044	-0.0013	-0.0042
	(0.011)	(0.004)	(0.010)	(0.003)	(0.014)	(0.005)	(0.013)	(0.004)
SHK_CUS _REAL2	-0.1299	0.0097	0.0764	0.0438	-0.1494	0.0116	0.0842	0.0536
	(1.225)	(0.063)	(0.468)	(1.756)	(3.315)	(0.211)	(1.121)	(4.647)
SHK_CUS _FIN	-0.0036	0.0123***	-0.0165	0.0078***	-0.0047	0.0148***	-0.0174	0.0073**
	(0.016)	(0.004)	(0.015)	(0.002)	(0.019)	(0.005)	(0.019)	(0.003)
SHK_SUP_REAL	-0.0748***	-0.0115	0.0739***	0.0125***	-0.0790***	-0.0095	0.0734***	0.0150***
	(0.014)	(0.009)	(0.011)	(0.003)	(0.017)	(0.010)	(0.014)	(0.004)

Table 7 Fraction of firms that suffered some shocks

This table shows the fraction of firms that suffered some shocks from the GFC (Panel (A)) and from the COVID-19 (Panel (B)). Specifically, we report the fractions of the numbers of firms that experienced: Business slump or failure of customer firms, Reduction in sales, and/or Reduction in sales price (in the GFC survey); or Business slump, failure, or default of customer firms, Cancellation of orders by customers, Request to ease terms of sales (e.g., a reduction of prices or amounts), and/or Reduction of sales to general consumers (in the COVID-19 survey).

	(A) GFC Survey			(B) COVID-19 Survey		
	All	With shock	(%)	All	With shock	(%)
Construction	772	658	82.25	796	359	45.10
Manufacturing	827	696	81.98	882	456	51.70
Information and Telecommunication	89	68	75.28	91	48	52.75
Transportation	119	107	86.55	83	49	59.04
Wholesale	758	658	83.91	280	146	52.14
Retail	334	274	79.64	220	138	62.73
Real Estate	91	65	69.23	75	46	61.33
Restaurants	5	2	40.00	29	22	75.86
Other Services	36	22	61.11	447	224	50.11
Others	324	252	74.69	222	162	72.97
(Unknown)				642	449	69.94
Total	3355	2802	80.77	3767	2099	55.72

Table 8 Fraction and cross-tabulation (GFC sample)

This table shows the average value of REDUCE_PURCHASE by LENGTHEN_TC and the cross-tabulations for LENGTHEN_TC and REDUCE_PURCHASE when we limit the sample to those in some specific industries. *** and * respectively denote significance at the 1% and 10% level.

Panel A: Fraction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Difference
(1) Construction	0.094	0.234	0.140 ***
(2) Manufacturing	0.227	0.538	0.311 ***
(3) Information and Telecommunication	0.176	0.000	-0.176
(4) Transportation	0.155	0.667	0.511 **
(5) Wholesale	0.180	0.333	0.154 *
(6) Retail	0.200	0.222	0.022
(7) Real Estate	0.125	0.000	-0.125

Panel B: Cross-tabulation

(1) Construction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	657	36	693
	(85.10%)	(4.66%)	
REDUCE_PURCHASE= 1	68	11	79
	(8.81%)	(1.42%)	
	725	47	772

Pearson chi2(1) = 9.4514 Pr = 0.002

(2) Manufacturing

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	619	12	631
	(74.85%)	(1.45%)	
REDUCE_PURCHASE= 1	182	14	196
	(22.01%)	(1.69%)	
	801	26	827

Pearson chi2(1) = 13.4906 Pr = 0.000

(3) Information and Telecommunication

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	70	4	74
	(78.65%)	(4.49%)	
REDUCE_PURCHASE= 1	15	0	15
	(16.85%)	(0.00%)	
	85	4	89

Pearson chi2(1) = 0.8490 Pr = 0.357

(4) Transportation

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	98	1	99
	(82.35%)	(0.84%)	
REDUCE_PURCHASE= 1	18	2	20
	(15.13%)	(1.68%)	
	116	3	119

Pearson chi2(1) = 5.4720 Pr = 0.019

(5) Wholesale

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	607	12	619
	(80.08%)	(1.58%)	
REDUCE_PURCHASE= 1	133	6	139
	(17.55%)	(0.79%)	
	740	18	758

Pearson chi2(1) = 2.7687 Pr = 0.096

(6) Retail

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	260	7	267
	(77.84%)	(2.10%)	
REDUCE_PURCHASE= 1	65	2	67
	(19.46%)	(0.60%)	
	325	9	334

Pearson chi2(1) = 0.0270 Pr = 0.870

(7) Real Estate

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Total
REDUCE_PURCHASE= 0	77	3	80
	(84.62%)	(3.30%)	
REDUCE_PURCHASE= 1	11	0	11
	(12.09%)	(0.00%)	
	88	3	91

Pearson chi2(1) = 0.4266 Pr = 0.514

Table 9 Fraction and cross-tabulation by industry (COVID sample)

This table shows the average value of REDUCE_PURCHASE by LENGTHEN_TC and the cross-tabulations for LENGTHEN_TC and REDUCE_PURCHASE when we limit the sample to the firms in some specific industries. *** denotes significance at the 1% level.

Panel A: Fraction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	Difference
(1) Construction	0.023	0.200	0.177 ***
(2) Manufacturing	0.042	0.222	0.180 ***
(3) Information and Telecommunication	0.066	N.A	N.A
(4) Transportation	0.037	0.000	-0.037
(5) Wholesale	0.044	0.400	0.356 ***
(6) Retail	0.103	0.429	0.325 ***
(7) Real Estate	0.053	N.A	N.A

Panel B: Cross-tabulation

(1) Construction

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	768	8	776
	(96.48%)	(1.01%)	
REDUCE_PURCHASE= 1	18	2	20
	(2.26%)	(0.25%)	
	786	10	796

Pearson chi2(1) = 12.6438 Pr = 0.000

(2) Manufacturing

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	836	7	843
	(94.78%)	(0.79%)	
REDUCE_PURCHASE= 1	37	2	39
	(4.20%)	(0.23%)	
	873	9	882

Pearson chi2(1) = 6.8172 Pr = 0.009

(3) Information and Telecommunication

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	85	0	85
	(93.41%)	(0.00%)	
REDUCE_PURCHASE= 1	6	0	6
	(6.59%)	(0.00%)	
	91	0	91

Pearson chi2(1) = N.A

(4) Transportation

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	79	1	80
	(95.18%)	(1.20%)	
REDUCE_PURCHASE= 1	3	0	3
	(3.61%)	(0.00%)	
	82	1	83

Pearson chi2(1) = 0.0380 Pr = 0.846

(5) Wholesale

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	263	3	266
	(93.93%)	(1.07%)	
REDUCE_PURCHASE= 1	12	2	14
	(4.29%)	(0.71%)	
	275	5	280

Pearson chi2(1) = 13.1292 Pr = 0.000

(6) Retail

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	191	4	195
	(86.82%)	(1.82%)	
REDUCE_PURCHASE= 1	22	3	25
	(10.00%)	(1.36%)	
	213	7	220

Pearson chi2(1) = 7.1196 Pr = 0.008

(7) Real Estate

	LENGTHEN_TC = 0	LENGTHEN_TC = 1	
REDUCE_PURCHASE= 0	71	0	71
	(94.67%)	(0.00%)	
REDUCE_PURCHASE= 1	4	0	4
	(5.33%)	(0.00%)	
	75	0	75

Pearson chi2(1) = N.A

Table A1: Estimated Results of the Probit Estimation and Balancing Test (Global financial crisis)

This table presents estimates from the maximum-likelihood probit regressions with LENGTHEN_TC as the dependent variable. Definitions of variables are shown in Table . ***, **, and * respectively indicate that the coefficient is statistically significant at the 1%, 5%, and 10% level. Standard errors are in parentheses.

Panel A: Estimated Results of the Probit Estimation

	(1)
	LENGTHEN_TC
LARGE	-0.1719
	(0.1397)
S_PURCHASE	0.0065
	(0.2499)
ln(S_RELATION)	0.1437
	(0.1214)
M_BANK1	0.3094**
	(0.1385)
M_BANK2	0.7522***
	(0.1847)
ln(B_RELATION)	-0.0882
	(0.0761)
SHK_CUS _REAL1	0.0230
	(0.1274)
SHK_CUS _REAL2	0.2717
	(0.1916)
SHK_CUS _FIN	0.7249***
	(0.1300)
ln(EMP)	0.0432
	(0.0708)
ln(AGE)	-0.1864
	(0.1438)
SCORE	-0.0609***
	(0.0120)
ln(BORROW)	0.0318
	(0.0458)
Industry Fixed Efects	Yes
Observations	2103

Panel B: Difference in Variables for Matching Before and After Matching

		Mean			
Variable		LENGTHEN_TC = 1	LENGTHEN_TC = 0	t	p>t
LARGE	Unmatched	0.269	0.449	-3.140	0.002
	Matched	0.269	0.333	-0.870	0.386
S_PURCHASE	Unmatched	0.354	0.349	0.160	0.872
	Matched	0.354	0.331	0.550	0.584
ln(S_RELATION)	Unmatched	3.060	3.171	-1.460	0.145
	Matched	3.060	3.042	0.180	0.857
M_BANK1	Unmatched	0.744	0.523	3.830	0.000
	Matched	0.744	0.833	-1.370	0.172
M_BANK2	Unmatched	0.256	0.031	10.270	0.000
	Matched	0.256	0.269	-0.180	0.857
ln(B_RELATION)	Unmatched	2.778	2.847	-0.500	0.620
	Matched	2.778	2.807	-0.180	0.858
SHK_CUS _REAL1	Unmatched	0.410	0.343	1.220	0.222
	Matched	0.410	0.449	-0.480	0.630
SHK_CUS _REAL2	Unmatched	0.910	0.791	2.570	0.010
	Matched	0.910	0.872	0.770	0.444
SHK_CUS _FIN	Unmatched	0.462	0.135	8.090	0.000
	Matched	0.462	0.487	-0.320	0.750
ln(EMP)	Unmatched	2.908	3.439	-3.520	0.000
	Matched	2.908	3.057	-0.760	0.451
ln(AGE)	Unmatched	3.339	3.539	-3.250	0.001
	Matched	3.339	3.339	0.000	0.998
SCORE	Unmatched	48.564	54.565	-7.910	0.000
	Matched	48.564	49.859	-1.500	0.136
ln(BORROW)	Unmatched	4.829	4.836	-0.030	0.979
	Matched	4.829	4.907	-0.260	0.798
Manufacturing	Unmatched	0.192	0.257	-1.280	0.200
	Matched	0.192	0.179	0.200	0.838
Information and	Unmatched	0.026	0.024	0.080	0.935
Communications	Matched	0.026	0.051	-0.830	0.408
Transportations	Unmatched	0.026	0.026	0.000	0.998
	Matched	0.026	0.077	-1.450	0.148
Wholesales	Unmatched	0.167	0.253	-1.730	0.083
	Matched	0.167	0.141	0.440	0.660
Retail	Unmatched	0.103	0.107	-0.120	0.908
	Matched	0.103	0.026	1.970	0.050
Real Estate	Unmatched	0.013	0.017	-0.300	0.766
	Matched	0.013	0.000	1.000	0.319
Other services	Unmatched	0.038	0.085	-1.460	0.145
	Matched	0.038	0.013	1.010	0.314
Others	Unmatched	0.013	0.008	0.420	0.677
	Matched	0.013	0.000	1.000	0.319

Table A2: Estimated Results of the Probit Estimation and Balancing Test (COVID-19 shock)

This table presents estimates from the maximum-likelihood probit regressions with LENGTHEN_TC as the dependent variable. Definitions of variables are shown in Table . ***, **, and * respectively indicate that the coefficient is statistically significant at the 1%, 5%, and 10% level. Standard errors are in parentheses.

Panel A: Estimated Results of the Probit Estimation

	(1)
	LENGTHEN_TC
LARGE	0.0711
	(0.1714)
S_PURCHASE	-0.4342
	(0.3198)
ln(S_RELATION)	-0.0649
	(0.1225)
M_BANK1	-0.0452
	(0.1669)
M_BANK2	0.8949***
	(0.1760)
ln(B_RELATION)	0.1569
	(0.1297)
SHK_CUS _REAL1	0.2165
	(0.1862)
SHK_CUS _REAL2	0.7365***
	(0.2553)
SHK_CUS _FIN	0.9035***
	(0.1903)
ln(EMP)	-0.1249
	(0.0840)
ln(AGE)	0.1341
	(0.1811)
SCORE	0.0086
	(0.0148)
ln(BORROW)	0.0293
	(0.0438)
Industry Fixed Efects	Yes
Observations	2449

Panel B: Difference in Variables for Matching Before and After Matching

		Mean			
Variable		LENGTHEN_TC = 1	LENGTHEN_TC = 0	t	p>t
LARGE	Unmatched	0.359	0.396	-0.470	0.637
	Matched	0.359	0.308	0.470	0.636
S_PURCHASE	Unmatched	0.334	0.367	-0.760	0.446
	Matched	0.334	0.312	0.380	0.705
ln(S_RELATION)	Unmatched	3.178	3.233	-0.490	0.625
	Matched	3.178	2.675	3.000	0.004
M_BANK1	Unmatched	0.641	0.432	2.610	0.009
	Matched	0.641	0.513	1.140	0.258
M_BANK2	Unmatched	0.513	0.088	9.160	0.000
	Matched	0.513	0.538	-0.220	0.823
ln(B_RELATION)	Unmatched	3.466	3.231	1.550	0.121
	Matched	3.466	3.368	0.630	0.534
SHK_CUS _REAL1	Unmatched	0.333	0.103	4.630	0.000
	Matched	0.333	0.333	0.000	1.000
SHK_CUS _REAL2	Unmatched	0.923	0.541	4.770	0.000
	Matched	0.923	0.974	-1.020	0.311
SHK_CUS _FIN	Unmatched	0.359	0.048	8.760	0.000
	Matched	0.359	0.256	0.970	0.333
ln(EMP)	Unmatched	2.963	3.164	-0.950	0.345
	Matched	2.963	3.052	-0.280	0.780
ln(AGE)	Unmatched	3.702	3.668	0.380	0.702
	Matched	3.702	3.571	1.070	0.289
SCORE	Unmatched	49.538	51.547	-1.860	0.063
	Matched	49.538	49.410	0.080	0.940
ln(BORROW)	Unmatched	4.857	4.168	1.760	0.079
	Matched	4.857	5.273	-0.930	0.356
Manufacturing	Unmatched	0.205	0.268	-0.880	0.381
	Matched	0.205	0.205	0.000	1.000
Transportations	Unmatched	0.026	0.023	0.120	0.907
	Matched	0.026	0.051	-0.580	0.562
Wholesales	Unmatched	0.103	0.085	0.400	0.691
	Matched	0.103	0.026	1.390	0.170
Retail	Unmatched	0.128	0.064	1.620	0.106
	Matched	0.128	0.154	-0.320	0.749
Other services	Unmatched	0.077	0.066	0.280	0.776
	Matched	0.077	0.128	-0.740	0.462
Others	Unmatched	0.103	0.129	-0.490	0.624
	Matched	0.103	0.103	0.000	1.000
(Unknown)	Unmatched	0.231	0.125	1.970	0.049
	Matched	0.231	0.282	-0.510	0.610