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Abstract

Using a survey of and financial data for Japanese small- and medium-enterprises (SMEs), this paper examines the determinants of firms' use of the business support programs provided by the Japanese government during the COVID-19 pandemic and their effect. With respect to the determinants, we obtain the following three findings: First, firms were more likely to have obtained subsidized loans, grants, or subsidies the more their sales had fallen during the pandemic, suggesting that funds flowed to firms that were adversely affected by the pandemic. Second, the likelihood that firms obtained funds was higher if their credit scores were lower or if they were classified as "zombies" and/or "low-return borrowers" before the pandemic, suggesting that the government programs also helped firms that had been under-performing before the pandemic. Third, firms were more likely to receive funds if they had a stronger relationship with their main bank before, suggesting that bank relationships play an important role in firms' access to government programs. Regarding the causal effects, we obtain the following three findings: First, except for the subsidies for employment adjustment, the support programs increased the cash holdings of user firms. Second, subsidized loans from private financial institutions lowered exit rates, while none of the programs had a significantly positive effect on employment relative to non-users (or in absolute terms). Third, the credit scores and profit-to-sales ratio of firms that used the support programs decreased and the likelihood of such firms being a zombie and/or a low-return borrower increased. Overall, our findings provide a cautionary tale in that the business support programs produced mixed results in that they may have prevented business failures but have also helped to prop up firms that are not viable in the long run.

JEL classifications: D22, D25, L52

Keywords: COVID-19 business support programs, zombie firms, low-return borrowers, cash holdings

1. Introduction

To deal with the COVID-19 pandemic crisis, governments around the world have implemented various business support measures including a grace system for tax payment, subsidies, subsidized loans, and credit guarantees.[1] In the U.S., for example, the government provided small- and medium-sized enterprises (SMEs) with loans on preferable conditions through private sector lenders. In Japan, the government provided subsidized loan programs for SMEs, subsidies for employment adjustment, and other programs to prevent business failures and prevent a rise in unemployment.

While these business support programs likely have reduced business failures and unemployment, there are growing concerns that these programs may be supporting not only firms that were facing temporary liquidity shortages during the pandemic but also firms that are not viable in the long-run and are artificially being kept alive. If this is the case, the business support programs will retard economic restructuring, prevent the efficient allocation of resources, and ultimately lower aggregate productivity.

To examine these issues, this study addresses the following three sets of questions. First, what type of firms were more likely to obtain government support? Were firms that were more adversely affected by the pandemic and as such the main intended targets of the programs more likely to obtain support? Alternatively, have worse-performing firms before the pandemic been more likely to obtain government support? In other words, have so-called "zombie firms" – i.e., firms that were not viable without support from the government or banks before the pandemic – been more likely to obtain support than healthy firms? If so, such programs carry the risk of helping zombie firms to survive and slowing economic restructuring. Second, did programs reduce firm exit and increase employment? This question addresses whether programs achieved their goals of keeping businesses afloat and preventing an increase in unemployment. Third, did surviving firms that received support perform better than those that did not obtain support? Thus, while the first set of questions focuses on the determinants of the use of support, the second and third set of questions are concerned with the effects of support.

[1] See OECD (2020, 2021) for surveys of government financial support programs in OECD countries.

To answer these questions, focusing on Japan is useful for the following three reasons. First, the Japanese government provided various large-scale support programs to help firms cope during the COVID-19 pandemic. Second, the Japanese economy was already burdened with zombies once in the late 1990s and early 2000s, which has led to serious concerns about a recurrence of the "zombie problem" during the pandemic.[2] While in a number of other countries, the presence of zombie firms has become an important policy issue in recent years, especially since the start of the pandemic (see, e.g. Banerjee and Hofmann, 2020; El Ghoul, Fu, and Guedhami, 2021; Acharya et al., 2022), Japan still provides the best case study to examine the behavior of zombie firms, since Japan is the only country in which the presence and impact of zombie firms can be traced back for a considerable period. Third, we have rich data from a unique survey on Japanese firms that contain information on the use of each government support program.

Specifically, we use a survey of Japanese SMEs conducted by the Research Institute of Economy, Trade and Industry (RIETI) in November 2020.[3] The survey contains information on whether firms applied for and received support under each of the major business support programs in Japan including (1) the special loan program by government-affiliated financial institutions, (2) the special loan program by private financial institutions, (3) government grants and subsidies for business continuity, and (4) government subsidies for employment adjustment. We match data from the survey with firm-level data from the database of Tokyo Shoko Research (TSR), one of the largest credit research companies in the country, which contains information on firms' characteristics such as their credit score and financial data. Using this information, we identify zombie firms and low-return borrowers using the definitions provided in previous studies (Caballero, Hoshi, and Kashyap (2008) and Fukuda and Nakamura (2011) for zombie firms and Bank of Japan (2018) for low-return borrowers).

Employing the dataset, we start by conducting logit model estimations to examine what kind of firms were most likely to obtain funds from each support program. The results show that the more a firm's sales fell during the pandemic, the more likely it was to obtain funds from the support programs. This result indicates

[2] See Caballero, Hoshi, and Kashyap (2008) and Peek and Rosengren (2005) about the causes and consequences of zombies in Japan in the 1990s.
[3] See Uesugi et al. (2021) for details of the survey.

that firms severely affected by the pandemic were more likely to use the programs. At the same time, firms that had low credit scores before the pandemic were also more likely to obtain funds from the support programs. Moreover, using different criteria for zombie firms and low-return borrowers, we find that both zombies and low-return borrowers were more likely to use the programs. These results indicate that firms that already performed worse and may not have been viable without support from banks before the pandemic obtained funds from the programs. An additional finding is that firms were more likely to obtain funds if they had a stronger relationship with their main bank before the pandemic, suggesting that close relationships with a bank or banks plays an important role in firms' access to government programs.

Next, to examine the effects of programs on firms' liquidity position, firm exit, employment, and performance, we conduct propensity-score matching and difference in differences (PSM-DID) analyses over the period from 2019 (i.e., the year before the pandemic) to 2021 (in the midst of the pandemic). Our results show that, except in the case of subsidies for employment adjustment, firms that used the support programs experienced a larger increase in cash holdings relative to firms that did not use the programs. The results also indicate that the special loan program by private banks led to a lower likelihood of exit for user firms than for non-users, although the other three programs did not. On the other hand, none of the four programs, including the subsidies for employment adjustment, resulted in a significantly better performance in terms of employment among program user firms than among non-users. These results indicate that while the programs achieved the goal of ensuring the survival of firms, they did not have an impact on employment, since employment at non-user firms, like at user firms, remained largely unchanged. As for the performance of surviving firms, the results indicate that, for all programs, program users performed worse than non-users in terms of their credit scores, and for two of the programs (preferential loans from government-affiliated financial institutions and subsidies for employment adjustment), program users performed worse than non-users in terms of their profit-to-sales ratios. Moreover, for all programs, the increase in the likelihood of a firm being a zombie or low-return borrower based on at least one of the four criteria for zombie firms and low-return borrowers we employ was significantly larger for user firms than for non-users. These findings indicate

that the programs likely have the serious side effect of leading to a deterioration in surviving firms' performance at least in the short run, although the long-run effects are yet to be seen.

This study is closely related to the literature assessing COVID-19 business support programs.[4] Studies on the Paycheck Protection Program (PPP) in the U.S. obtain mixed results about its quantitative effects on employment and business survival. For instance, Granja et al. (2020) show that many firms used the loans to make non-payroll fixed payments and increased savings. Similarly, Chetty et al. (2020) find that the effects of the program were small. They showed that employment rates at small businesses (which were eligible for PPP assistance) increased by only 2 percentage points after the PPP was enacted relative to larger firms that were ineligible for PPP, implying a cost of $377,000 per job saved. On the other hand, Doniger and Kay (2022) find that the PPP was highly effective in preventing job losses particularly among the self-employed and at very small firms and that a ten-day delay in the approval of PPP loans resulted in a substantial and persistent increase in unemployment. Meanwhile, Bartlett and Morse (2020) show that the receipt of PPP funds increased firms' subjective survival probability by 20.5%, but only for microbusinesses.

Importantly, many studies on the PPP find that banks played an important role in mediating the use of programs by target firms. Granja et al. (2020) find that some funds initially flowed to regions that were less adversely affected by the pandemic and banks' participation in the PPP was determined by their ex-ante characteristics such as their labor capacity to process loans and whether they had a pre-existing relationship with the Small Business Administration. Similarly, Balyuk, Prabhala, and Puri (2021) show that although smaller firms were less likely to gain early PPP access, prior lending relationships between small banks and firms attenuated this effect, while Li and Strahan (2021) show that bank relationships help firms access PPP funds. Finally, Joaquim and Netto (2021) show both theoretically and empirically that banks distorted the allocation of PPP funds toward firms with more pre-pandemic debt and those less affected by the COVID-19 crisis.

[4] In addition to the studies that employ data on the actual use of specific programs, Gourinchas et al. (2020) construct a theoretical framework and use pre-pandemic firm-level data from 17 countries in 2017 to simulate that the failure rate of SMEs would increase by nearly 9 percentage points without government support.

Some studies assess business support programs other than the PPP. Boddin, D'Acunto, and Weber (2020) examine the government-guaranteed loans that the German government introduced during the pandemic and show that firms that applied for such loans were more likely to display zombie features before the pandemic.[5] In contrast, Bighelli et al. (2022) examine the government support in five EU countries (Croatia, Finland, Netherlands, Slovakia and Slovenia) during the pandemic and find that the pandemic support was distributed only marginally towards zombie and non-viable firms. Jibril, Roper, and Hart (2021) examine the effects of the UK's COVID-19 support measures on investment planning and employee well-being and find positive effects on both. Further, Fernández-Cerezo et al. (2021) examine the effects of and responses to the COVID-19 shock for Spanish firms and find that small, young, and less productive firms located in urban areas were more severely affected by the COVID-19 shock and were more likely to use support measures such as public-guaranteed loans, tax deferrals, and assistance to furloughed workers.

As for programs in Japan, Morikawa (2021), using a survey on the use of support programs, finds that firms that had lower productivity before the pandemic were more likely to use such programs. Using a different survey, Hoshi, Kawaguchi, and Ueda (2022) find that firms that had lower credit scores before the COVID-19 pandemic were more likely to apply for and receive subsidies and concessional loans. Further, using Caballero, Hoshi, Kashyap's (2008) criterion of zombie firms, they examine whether zombie firms were more likely to receive support and find no significant difference between zombies and non-zombies. Employing the same survey as this study, Uesugi et al. (2022) find that firms with lower pre-pandemic credit scores and firms that received government-guaranteed loans during the Global Financial Crisis were more likely to apply for the different programs.

In contrast with the above-mentioned studies that mostly examine how government support programs are provided to firms, we not only focus on the determinants of the use of the programs but also examine the impact on firms' ex-post performance. More specifically, we study the link between firms obtaining funds under the programs and firm exit as well as survivors' performance and employment. As far as we know, few

[5] Following Schmidt et al. (2020), Boddin, D'Acunto, and Weber (2020) define a zombie as a firm with negative returns on assets, a negative change in total assets (a proxy for investments), and debt servicing capacity below 5% measured as net income over loans and liabilities.

studies have examined these issues despite their importance given the concern that the programs allow inefficient or non-viable firms to survive. It should also be noted that, along with previous studies such as Granja et al. (2020) and Balyuk, Prabhala, and Puri (2021), we focus on the role of banks and use information on the closeness of firm-main bank relationships to examine the role of banks in whether firms obtained program funds.

Further, the paper is related to the literature on the behavior of zombies during the pandemic. Using multiple identification criteria for zombie firms, some recent studies have examined whether the number of zombie firms increased during the COVID-19 pandemic (Yamada et al. 2022) and whether zombie firms caused negative spillovers and distortions in the economy (Acharya et al. 2022). Some other studies examine whether zombie firms were more likely to receive COVID-19 government support than other firms using a single identification criterion for zombies (Boddin, D'Acunto, and Weber, 2020 for Germany and Hoshi, Kawaguchi, and Ueda, 2022 for Japan).

Our study, like Uesugi et al. (2022), Acharya et al. (2022), and Yamada et al. (2022), employs multiple criteria to identify zombie firms and examines not only if zombie firms are more likely to use government business support programs but also to what extent the ex-post performance of zombies that use these programs changes.

The remainder of the study is structured as follows. Section 2 provides a brief overview of COVID-related business support programs in Japan. Section 3 then describes our data, variables, and the empirical methodology, while Section 4 reports the results. Section 5 summarizes the findings and concludes.

2. Support programs for SMEs during the COVID-19 pandemic

The Japanese government has established a number of support programs to assist firms facing financial distress as a result of the pandemic. These programs include special-term loans, subordinated loans, grants, subsidies, moratoriums on debt repayment, a grace system for tax and social insurance fee payments, and the protection of small subcontractors. Some measures such as the grace system for tax payment and subordinated loans are available to firms of all sizes, while others target SMEs only. Among the measures designed for SMEs we specifically focus on special-term loans, grants, and subsidies, since the fiscal disbursements for these

measures were quite large. In the following subsections, we explain each of these measures in detail.

2.1. Special loan programs

The government has introduced two special loan programs related to COVID-19: a program for loans originated by government-affiliated financial institutions (GFIs) and another one for loans originated by private financial institutions and backed by government guarantees and subsidies.[6]

2.1.1. Loans by GFIs

In Japan, some of the GFIs extend loans on preferential terms to SMEs. The three GFIs in charge of these loans are the Japan Finance Corporation, the Shoko Chukin Bank, and the Okinawa Development Finance Corporation.

As part of the government's COVID-19 support measures, these GFIs have been extending low-interest rate unsecured loans to SMEs whose sales were negatively affected by the pandemic. The GFIs label these loans "special loans to deal with impact of the COVID-19 pandemic." For firms to be eligible for applying for these special-term loans their sales must have dropped by at least 5%. Firms approved for these unsecured loans receive a discount on the interest rate for the first three years.[7] Further, firms whose sales have been negatively affected the most qualify for "de facto interest-free" unsecured loans.[8] For firms to be eligible for these interest-free loans their sales must have dropped by at 5% in the case of micro sole proprietorships, 15% in the case of micro corporations, and 20% in the case of SMEs. Note that SMEs that are not eligible for these special loans with preferential terms can still apply for the normal loans provided by these GFIs.

2.1.2. Private bank loans backed by guarantees and subsidies

[6] There are several studies that examine the effectiveness of GFI and government-guaranteed private sector loans in Japan unrelated to the pandemic. See Uesugi, Sakai, and Yamashiro (2010) and Ono, Uesugi, and Yasuda (2013) for government-guaranteed private sector loans and Uesugi, Uchida, and Mizusugi (2016) and Ogura (2018) for GFI loans.

[7] The discount from the standard interest rate is 0.9 percentage points. Note that this standard rate is already 0.3 to 0.4 percentage points lower than the average interest rate set by private financial institutions. For a detailed comparison of GFI and private sector interest rates in Japan, see Uesugi, Uchida, and Iwaki (2020).

[8] These loans are interest-free for the first three years. They are called "de facto interest-free," because borrower firms first make interest payments to the government banks and then get reimbursed by the Organization for Small and Medium Enterprises and Regional Innovation (SMRJ), one of the government agencies in charge of implementing SME policies.

Private financial institutions have been extending unsecured SME loans with preferential terms in response to the pandemic. The government incentivizes private institutions to extend such loans by providing loan guarantees and subsidies for interest payments and guarantee fees. The coverage ratio of loan guarantees in each loan contract is 100% in most cases. Guarantee fees and interest payments are fully subsidized for all sole proprietorships as well as for SMEs whose sales dropped by at least 15%.[9] For SMEs whose sales dropped by between 5% and 15%, half of the guarantee fees are subsidized, but these firms receive no interest rate discount. The government called this program a "de facto zero-interest zero-collateral loan" program and promoted its use.[10] Note that SMEs that are not eligible for these guaranteed loans with preferential terms can still apply for the normal guaranteed loans.

A few additional remarks on these two special loan programs are in order. First, the GFIs started this special loan program in mid-March 2020, while private financial institutions started receiving applications from the beginning of May 2020. The difference in timing when each of the loan programs was first introduced may have led SMEs that were most seriously in need of liquidity to rush to the GFIs instead of private institutions. Second, when these special loans are extended, certain restrictions on the repayment of existing loans apply. The GFIs do not allow borrower firms to repay existing private bank loans using the newly provided special-term government bank loans. In contrast, in the special loan program by private financial institutions, firms under certain conditions are allowed to repay existing guaranteed loans with new special loans.[11] This difference in the treatment of existing loans may lead to a different degree of additionality (net increase in loans outstanding of borrower firms that use the special loan programs) between government loan users and users of private loans.

2.2. Grants and subsidies

In this subsection we focus on four different types of grants and subsidies to financially assist SMEs adversely

[9] Interest payments are subsidized for the first three years of a loan contract and guarantee fees are subsidized for the entire contract period.

[10] It is called as "de facto zero interest rate" program because in some cases SMEs make non-negative interest payments to a bank but are later reimbursed by the local government.

[11] Although the repayment of existing non-guaranteed private bank loans is prohibited in both the GFI and private sector special loan programs, it is possible that special loans are nevertheless used in this way. Examining the Emergency Credit Guarantee Program that the Japanese government introduced during the Global Financial Crisis, Ono, Uesugi, and Yasuda (2013) obtain evidence suggesting that some existing non-guaranteed loans may have been repaid using guaranteed loans from the program.

affected by the pandemic: (1) grants and subsidies for business continuity; (2) grants for rent payment; (3) subsidies for employment adjustment; and (4) financial support to businesses to compensate them for closures to comply with government anti-COVID measures. The first three were introduced by the central government, while the fourth was introduced by local governments. The details of these grants and subsidies are as follows.

(1) Grants and subsidies for business continuity: The government provides one-time grants of 2 million yen to corporations and 1 million yen to sole proprietorships to help them to continue operating. To be eligible, firms' monthly sales must have dropped by at least 50%. In addition, business continuity subsidies for micro businesses, consisting of a one-time payment of 1 million yen or 0.5 million yen, are provided to support specific activities such as a sales promotion to combat the impact of the pandemic.[12] There are no specific eligibility criteria for such subsidies other than firm size.

(2) Grants for rent payment: The government reimburses firms' rents up to an amount of 6 million yen for SMEs and up to 3 million yen for sole proprietorships. To be eligible, firms' monthly sales must have dropped by at least 50% or their three-month sales must have dropped by at least 30%.

(3) Subsidies for employment adjustment: While such subsidies are also available during normal times, the government augmented the scheme by increasing the subsidy coverage in response to the pandemic. The subsidies cover a firm's cost of paying furloughed workers.[13] For SMEs that do not lay off any employees, the subsidies pay 100% of the furlough payment, while for SMEs that lay off some employees 80% is paid.

(4) Support money provided by local governments: Local governments, especially those located in areas where infections were widespread such as Tokyo and Osaka, have spent substantial amounts compensating firms for revenues forgone due to closures at government request to prevent the spread of COVID. Such support has been provided since the central government first declared the State of Emergency in April 2020. Local governments have been reimbursed by the central government through grants for regional development. While the nature of these financial support schemes differs considerably across prefectures and cities, they generally provide payments to shops and restaurants in proportion to the duration of business closures.[14]

[12] Note that there are some other types of business continuation subsidies designed to support firms' activities unrelated to surviving the pandemic.
[13] In addition to furlough payments, the government also covers firms' expense for off-the-job training.
[14] For example, as "cooperation money," the Hokkaido prefectural government gave 300,000 yen to corporations,

Two additional points should be noted regarding these grants and subsidies. First, the start date of the various measures differs. The government started accepting applications for the grants for business continuity from May 1, 2020, and for the rent payment grants from July 14, 2020. The increase in the coverage of the employment adjustment subsidies to the level explained above was announced on April 23, 2020. Regarding the financial support provided by local governments, the Tokyo metropolitan government started accepting applications on April 23 and disbursing funds on May 7. Given these dates, we expect that the government received the largest number of applications for three of the grants and subsidies (namely, the grants for business continuity; the employment adjustment subsidies; and the financial support to compensate businesses for closure) in May 2020. In contrast, applications and disbursements may have lagged behind for the rent payment grants.[15] Second, among the four measures, the employment adjustment subsidies differ from the other three programs in that the amount of disbursement is proportional to firms' number of employees. In contrast, the amounts paid under the other three programs are fixed and do not depend on firms' number of employees.

2.3 Size of loans, grants, and subsidies provided during the pandemic

The amount of loans extended by GFIs and private financial institutions to SMEs during the pandemic is considerable. The total amount originated from the start of the pandemic to the end of June 2021 was 52.2 trillion yen, which is slightly less than 20% of the total amount of SME loans outstanding in Japan. Of the total, GFIs account for 16.3 trillion yen of loans, which include de facto interest-free unsecured loans and other unsecured loans. Meanwhile, private financial institutions provided 35.9 trillion yen of guaranteed loans, of which 23.4 trillion yen consisted of de facto zero-interest zero-collateral loans.

Moreover, the government has spent substantial amounts on grants and subsidies during the pandemic. Among the four policy measures, grants for business continuity accounted for the largest fiscal expenditure as of the end of June 2021, amounting to 5.5 trillion yen at the point when the program concluded. Employment adjustment subsidies accounted for the second largest amount, with spending of 2.9 trillion yen as of the end

200,000 yen to sole proprietorships, and 100,000 yen to restaurants that temporarily closed down or shortened their business hours during the States of Emergency in fiscal 2020.

[15] These predictions are actually consistent with what we found in the survey, which asked firms about the date that they applied for the grants and subsidies. In the survey, the largest numbers of firms applied for the three programs (the grants for business continuity, the employment adjustment subsidies, and the support money for business closure) in May, while most applications for rent payment grants were made in September or later.

of March 2021. Rent payment grants amounted to 0.9 trillion yen by February 15, 2021, when the government stopped accepting applications for such rants. Meanwhile, it is not clear how much local governments have spent on financial support programs. However, we can get an idea of the maximum amount spent on these programs by looking at the budget provided by the central government to local governments for regional development. Out of the total of 4.5 trillion yen provided by the central government in fiscal 2020, local governments spent 1.4 trillion yen on supporting local businesses. We conjecture that a substantial part of this amount was used to provide financial compensation to businesses for closures during the pandemic period.

While the government reports the total amount of these special-term loans, grants, and subsidies, there are no official statistics on the distribution of these support measures among the population of firms (such as the share of supported firms by sector or size categories). To investigate which firms received government support, we therefore use a unique firm survey that we describe in the next section.

3. Data, variables, and empirical approach

3.1. Data

The data used in this study are mainly taken from the "Survey on the Status of Firms during the COVID-19 Pandemic," which is an original firm survey conducted by the Research Institute of Economy, Trade and Industry (RIETI) in November 2020, and which we refer to as the "RIETI survey" hereafter. In addition, we use firms' financial data taken from the database of Tokyo Shoko Research (TSR), a major credit research firm in Japan. The RIETI survey was sent to 20,000 firms. The selection procedure for these firms was as follows. First, we selected firms that responded to one of the past RIETI surveys conducted in February 2008, February 2009, and October 2014, and that were operating as of November 2020. The number of these firms is 8,310. In addition, we chose 11,690 firms from the TSR database such that the industry composition of the sample firms was close to that of the 2016 Economic Census for Business Activity conducted by the Ministry of Internal Affairs and Communications, and the firm size distribution in terms of the number of employees was close to that of past RIETI surveys. We targeted corporations and did not include proprietorships. We think that the sample of the RIETI survey is fairly close to the distribution of Japanese corporations, although it is tilted toward larger firms compared to firms in the Economic Census.

The number of firms that responded to the RIETI survey is 4,718 for a response rate of 23.6%. The response rate is somewhat lower for firms in the real estate industry, accommodations, eating and drinking services, and for larger firms with more than 100 employees.[16] Among firms that responded, we exclude 25 firms for which we were unable to obtain information on their basic characteristics (e.g., their industry classification code). As a result, we have a maximum of 4,693 firms for the empirical analysis, although the number of observations differs depending on additional sample selection criteria and the number of missing observations for dependent variables we use in our estimations, which we explain below.

The RIETI survey asked about a variety of issues with respect to firms' business condition (such as the growth rate of sales) during the COVID-19 pandemic and how firms responded to the pandemic in terms of employment, investment, financing, and so on. Most importantly for the analysis in this study, the survey asked whether firms used the various business support programs outlined in Section 2 during the COVID-19 pandemic. In addition, we use financial data from the TSR database to examine the ex-post performance of firms that received business support. Specifically, we use financial data as of 2021 to construct the ex-post performance measures, which we explain in Section 3.3.2. Because the accounting settlement month for most Japanese firms is March, the financial data for 2021 of our sample firms are mostly those recorded in March 2021. For firms whose accounting settlement month falls into the latter half of 2021, we cannot obtain the necessary data. We exclude such firms from our sample in the ex-post performance analysis.

3.2. Key variables

In this subsection, we explain how we constructed the key variables for our analysis from the RIETI survey and TSR database. The definitions of variables used in our analyses and their data source are presented in Table 1.

3.2.1 COVID-19 business support programs

Using the RIETI survey, we construct dummy variables that identify whether firms received funds from one of the COVID-19 business support programs. The RIETI survey asked whether and when firms considered

[16] For a detailed comparison of the characteristics of firms contacted for the RIETI survey (20,000 firms) and firms that responded (4,693 firms), see Appendix A.

applying and actually did apply for support under any of the programs during the period from February to November 2020. In addition, the survey asked whether and when firms received funds from the programs. Table 2 shows the result of these questions. The survey listed eight business support programs: (1) the special loan program by GFIs, (2) other loan programs by GFIs, (3) the special loan program by private financial institutions, (4) other public guaranteed loan programs, (5) grants and subsidies for business continuity, (6) financial support to businesses to compensate them for closure to comply with government anti-COVID measures, (7) subsidies for employment adjustment, and (8) grants for rent payment. From this information, we construct $Obtained_i\_k$, a dummy variable indicating whether firm i obtained funds from program k. Table 2 shows that the most widely used programs in terms of the number of recipient firms are (3), (5), (7), and (1), i.e., the two special loan programs described in Section 2.1 and the two grants and subsidies programs described in Section 2.2. For the sake of brevity, we report the estimation results for these four programs.[17] Table 2 also shows that the number of firms that applied for but did not obtain funds is very small. This suggests that the use of the COVID-19 government support programs was mostly demand-driven as almost all the applications for the programs were approved.

3.2.2 Measures for firm performance and firm-bank relationships

Next, to investigate the characteristics of firms that received funds from the COVID-19 business support programs, we construct the following variables to measure the performance of respondent firms. First, to measure how firms were adversely affected by the COVID-19 pandemic, we use the minimum of the year-on-year monthly sales growth during the period February–November 2020, which we denote as $SmallestYoYRatio2020$. The RIETI survey asked firms about their gross sales in each month between February and August 2020 and in the period from September 2020 to the time that firms responded to the survey in 2020 in comparison with the same month/period in 2019. The survey asked firms to report the values of gross sales assuming that the values in 2019 were 100. For example, if a firm's year-on-year sales growth in February 2020 was −10 percent, the survey asked firms to report 90. The mean of gross sales in the RIETI survey was 101.6 in February, hit a bottom of 86.3 in May, and gradually recovered to 91.7 in the period from

[17] The estimation results for the other four programs are qualitatively similar to those for the four programs we report in this study.

September. Hoshi, Kawaguchi, and Ueda (2022) constructed a similar variable using their own firm survey and reported that the year-on-year sales growth rates were −0.2% in February, −14.1% in May, and −7.6% in September. The results here therefore are very similar to theirs.

Second, to examine whether obtaining funds from the business support programs is correlated with pre-pandemic firm performance, we use firms' TSR credit score in 2019 (i.e., before the COVID-19 pandemic), $Score2019$. TSR credit scores range from 0 to 100 points and a higher score indicates greater creditworthiness. TSR credit scores are widely used as a proxy for firms' performance in empirical studies (Miyakawa, Miyauchi, and Perez, 2017; Miyakawa and Shintani, 2020). They are also used by Hoshi, Kawaguchi, and Ueda (2022) in their analysis of COVID-19 business support programs. The mean of $Score2019$ for firms that responded to the RIETI survey is 52.0, which is lower than the mean (54.3) in Hoshi, Kawaguchi, and Ueda (2022).

In addition to firm performance measures, we create a variable which measures the closeness of firms' relationship with their main bank ($RelationshipExtent$) to investigate whether firm-bank relationships help firms gain access to government-subsidized lending.[18] We define firms' main bank as the bank accounting for the largest amount of loans outstanding to the firm or, if the firm has no loans outstanding to any bank, the bank with which the firm had the closest relationship as of 2019. We construct this variable by counting the number of choices to which a firm responded "yes" in a question in the RIETI survey regarding the qualitative characteristics of a firm's relationship with its main bank. The five choices are: (1) the bank recognizes your firm's unnoticed strengths; (2) the bank provides consultation services to your firm in addition to loans; (3) the bank provides useful information and assistance on managerial issues other than financing; (4) the bank points out your firm's managerial problems and gives advice on how to deal with them; and (5) the bank maintains a close relationship with your firm in general. Hence, $RelationshipExtent$ takes a value between 0 and 5. The mean of $RelationshipExtent$ is 1.8.

3.2.3 Alternative firm performance variables: dummies for zombie firms and low-return borrowers

As alternatives to the TSR credit score, which measures pre-pandemic firm performance, we construct dummy variables which represent whether firms received support from financial institutions and/or governments

[18] Li and Strahan (2021) found that firm-bank relationships were important for establishing firms' access to government subsidized lending.

before the COVID-19 pandemic. Specifically, we use the empirical strategies of Caballero, Hoshi, and Kashyap (2008) (hereafter CHK) and Fukuda and Nakamura (2011) (hereafter FN) to identify "zombie" firms and of the Bank of Japan (2018) (hereafter BOJ) to identify "low-return borrowers." The exact definitions of zombie firms and low-return borrowers are provided Table B1 in Appendix B.

CHK defined zombie firms as firms that survive thanks to subsidized credit from financial institutions and bond investors, where subsidized credit refers to the fact that such firms' interest payments are less than the minimum required interest payment (or equivalently, that the borrowing interest rate is lower than that charged to firms with the lowest credit risk). However, FN pointed out that using CHK's criterion suffers from two types of potential statistical error. The first potential error is that a healthy firm is incorrectly identified as a zombie even though it has not received any subsidized credit. To avoid this type of error, FN proposed using a "profitability criterion," which restricts zombies to those firms whose return on assets (ROA) is below the minimum required interest rate. The second potential error is that an unhealthy firm is incorrectly identified as a non-zombie even though it has received subsidized credit. For example, a firm may obtain "evergreening loans" at an interest rate above the minimum required interest rate. To avoid this second type of error, FN proposed using an "evergreen lending criterion" so that unprofitable and highly leveraged firms that increased their external borrowing are identified as zombies.[19]

Meanwhile, the BOJ defines low-return borrowers as firms whose financial conditions are relatively poor and for which the lending rates are set at levels that do not fully reflect the firms' credit risk. To identify low-return borrowers, the BOJ sets two criteria. The first, the ROA criterion (hereafter BOJ_ROA), requires that the firm's operating ROA is below the median of the distribution of all firms and its borrowing interest rate is lower than that for the most creditworthy firms in the ROA distribution (i.e., firms in the top 10 percentile). The second, the leverage criterion (hereafter BOJ_Leverage), requires that the firm's financial leverage (liabilities-to-total assets ratio) is above the median of the distribution of all firms and its interest rate is lower than that of creditworthy firms in the financial leverage distribution (i.e., firms in the bottom 50

[19] There may be another type of statistical error during the COVID-19 pandemic. Specifically, viable firms that used de-facto interest-free loans for temporary purposes may be erroneously classified as zombies during the pandemic. In terms of the two alternative criteria for defining zombies (i.e., CHK's and FN's criteria), we think that FN's criterion is less susceptible to this type of error as it also uses firms' profitability for identifying zombies.

percentile). While the BOJ defines low-return borrowers as the set of firms that meet either the ROA or the leverage criterion for two consecutive years, in this paper, we use these two criteria separately.

The BOJ argues that low-return borrowers are not necessarily zombie firms that cannot survive without subsidized credit. However, in our analysis, we use the BOJ's criteria for low-return borrowers as an alternative to CHK's and FN's criteria for zombie firms to identify firms that would struggle without favorable financing. The reasons are as follows. First, the BOJ's criteria are similar to those of CHK and FN since all of the criteria (CHK, FN, BOJ_ROA, and BOJ_leverage) identify firms that receive subsidized credit. Second, while the CHK and FN criteria define zombie firms based on whether the borrowing interest rate is below the minimum required interest rate, the BOJ defines low-return borrowers based on whether their borrowing rate is below that of firms with high profitability and creditworthiness in the same year. The difference between CHK's and FN's criteria using the minimum required interest rate and the BOJ's criteria using the borrowing rate of healthy firms may be important because the short- and long-term prime rates, which CHK's and FN's criteria are based on, may no longer be appropriate for calculating the minimum required interest rate. That is, the short- and long-term prime rates may not be "extremely advantageous for the borrower" (CHK). For example, in December 2019, the short- and long-term prime rates were 1.475% and 0.95%, respectively, while the average contract interest rates on newly issued loans by private banks were 0.67% for short-term loans and 0.73% for long-term loans and hence well below the prime rates.

Figure 1 shows the percentage share of zombie firms and low-return borrowers from 1990 to 2021 using the criteria just explained for firms that responded to RIETI surveys in the past (2008, 2009, and 2014) and the most recent one in 2020. The shares of zombie firms using the CHK and FN criteria increased during the period from 1990 to 1995–1996 and then declined until the mid-2000s. The share then began to rise again based on both criteria until 2009. From 2009 onward, developments in the share of zombie firms based on the CHK and FN criteria differ. In the case of the CHK criterion, the share of zombie firms continued to rise after 2009, reaching 37% in 2019 (i.e., before the onset of the COVID-19 pandemic). The share of zombie firms based on the CHK criterion in 2019 is comparable to that of the late 1990s, the period during which the problem of non-performing loans and excessive debt was most severe. In contrast, the share of zombie firms based on the FN criterion declined after 2009 and reached 11% in 2019, which is the lowest level in the past 30 years. The reason for the discrepancy between the zombie firm shares based on the two different criteria likely is the

first type of statistical error pointed out by FN, that is, that using the CHK criterion a larger number of healthy firms are incorrectly identified as zombies. Finally, in 2020–2021, during the COVID-19 pandemic, the share of zombie firms increased based on both criteria.

The share of low-return borrowers using the BOJ_ROA criterion is less volatile over time than the share of zombie firms using the CHK and FN criteria, while the volatility of the share of low-return borrowers using the BOJ_Leverage criterion is similar to that using the CHK and FN criteria. One point worth noting is that the shares of low-return borrowers based on the BOJ_ROA and BOJ_Leverage criteria increased during 2013–2016.[20] Meanwhile, the share of low-return borrowers based on the BOJ_ROA criterion in 2020 and 2021 was essentially the same as in 2019, while based on the BOJ_Leverage criterion it declined. These developments in 2020 and 2021 contrast with those in the share of zombie firms based on the CHK and FN criteria, which exhibited an increase during the COVID-19 pandemic.

3.3. Empirical approach

3.3.1. Determinants of the use of business support programs

We start by estimating a logit model to examine the characteristics of firms that obtained funds from one (or more) of the COVID-19 business support programs and investigate whether firms that were more adversely affected by the COVID-19 pandemic and firms that were financially unsound before the onset of the COVID-19 pandemic were more likely to obtain funds. In our estimations below, we restrict our sample to firms that met the eligibility criteria for each program, such as the extent of the decline in sales.[21] In addition, we restrict our sample to firms that considered applying for the programs before August 2020, i.e., firms that had sufficient time to obtain funds by the time the 2020 RIETI survey was conducted in November. As a result, the numbers of observations that are used for the following estimations are smaller than those in Table 2.

[20] BOJ (2018) explains that the increase in low-return borrowers during the period may be driven by the aggressive lending attitude of banks that face intensified lending competition among financial institutions.

[21] Specifically, based on our discussion in Section 2, we set the following sample selection criteria. First, we restrict our sample to firms those whose monthly sales in February–September 2020 declined by 20% or more year-on-year in the case of the special loan program by GFIs, 15% in the case of the special loan program by private financial institutions, 50% in the case of grants and subsidies for business continuity, and 5% in the case of subsidies for employment adjustment. Second, we restrict our sample to firms with no more than 300 employees (for the special loan programs by GFIs and private financial institutions) and no more than 20 employees (for the grants and subsidies for business continuity) as of 2020 or 2019.

Summary statistics of the variables used in our estimations are presented in Table 3. The means of the key variables presented in this table are somewhat different from those reported in Section 3.2 because of this sample selection procedure.

We estimate the following logit model as the baseline:

$$\Pr(Obtained_i\_k) = \psi\big(\alpha + \beta_1 SmallestYoYSalesRatio2020_i + \beta_2 Score2019_i + \mathbf{X_i}\boldsymbol{\gamma_{1i}} + \mathbf{Z_j}\boldsymbol{\gamma_{2j}}\big), \quad (1)$$

where $\psi(\cdot)$ represents the cumulative density function of the logistic distribution. $Obtained_i\_k$ is a dummy variable that represents whether firm *i* obtained funds from program *k* in 2020, and we focus on the following business support programs: the special loan program by GFIs ($Obtained\_GovLoan$), the special loan program by private financial institutions ($Obtained\_PrivateLoan$), grants and subsidies for business continuity ($Obtained\_GrantContinuity$), and subsidies for employment adjustment ($Obtained\_EmpSubsidy$).[22]

Next, we turn to the explanatory variables. $SmallestYoYSalesRatio2020$ captures the extent of the year-on-year decline in a firm's sales (specifically, it is defined as the smallest value obtained when calculating 100 minus the year-on-year rate of change in monthly sales for the months February to September 2020), and we expect the sign for $\widehat{\beta_1}$ to be negative, indicating that firms that experienced a larger drop in sales were more likely to obtain business support under one or more of the programs. Further, we expect poorly performing firms – i.e., firms with a low credit score ($Score2019$) – to be more likely to have obtained support, so that $\widehat{\beta_2}$ should be negative. Meanwhile, comparing the signs and marginal effect estimates of $\widehat{\beta_1}$ and $\widehat{\beta_2}$ allows us to examine whether the COVID-19 business support programs reached their intended targets – namely, firms negatively affected by the pandemic – or primarily went to firms that were already struggling without the pandemic.

Further, $\mathbf{X_i}$ denotes various firm-level control variables. Specifically, we the use the log of firms' sales ($lnSales$) and the log of firms' number of employees ($lnEmployees$) in 2019 to control for firm size,

[22] The estimation results are qualitatively very similar when instead we use dummy variables that represent whether firms *applied* for business support, presumably because the number of firms whose applications was declined is very small (see Table 2). For an examination of the determinants of whether firms applied for and/or were denied COVID-19 business support, see Uesugi et al. (2022).

and firms' current ratio in 2019 ($CurrentRatio$) to control for firms' liquidity position before the pandemic.[23] We expect that firms with a lower current ratio were more likely to experience a liquidity shortage and therefore more likely to obtain funds. Finally, $\mathbf{Z_j}$ represents prefecture-level variables to capture the effects of the COVID-19 pandemic on the prefecture in which a firm is located, where *j* denotes the prefecture. We use the increase in the share of people staying home rather than going out in prefecture *j* in May 2020 compared to January 2020 ($StayHome$). This variable is created by Takayuki Mizuno at the National Institute of Informatics (http://research.nii.ac.jp/~mizuno/). Similar to $SmallestYoYSalesRatio2020$, we expect that firms located in prefectures that were more severely affected by the pandemic to be more likely to have obtained funds.

As our second specification, we add $RelationshipExtent$ to Equation (1) and examine whether firm-bank relationships boosted the likelihood that firms obtained government-subsidized loans, grants, and/or subsidies. If close firm-bank relationships helped firms to gain access to the COVID-19 business support programs, the coefficient on $RelationshipExtent$ should be positive.

As our third specification, we estimate the following logit model:

$$\begin{aligned}\Pr(Obtained_{i\_}k) &= \psi\big(\alpha + \beta_1 SmallestYoYSalesRatio2020_i \\ &+ \beta_3 Zombie/LowReturn2019_i + \mathbf{Z_j}\boldsymbol{\gamma_{2j}}\big),\end{aligned} \tag{2}$$

where the dummy variable $Zombie/LowReturn2019_i$ represents whether firm *i* was categorized as a zombie firm or low-return borrower in 2019 using CHK's ($Zombie\_chk$) and FN's ($Zombie\_fn$) criteria for zombie firms and the BOJ's criteria ($LowReturn\_ROA$ and $LowReturn\_Leverage$) for low-return borrowers. Given that these variables to identify zombie/low-return firms are constructed from information on firms' ex-ante performance and dependence on external finance, we drop the explanatory variables on firms' characteristics before the pandemic. That is, we exclude $Score2019$, $lnSales$, $lnEmployment$, $CurrentRatio$, and $RelationshipExtent$ from Equation (2). Note that we keep the variables on the extent of firms' sales decline

[23] To check for the possibility that our results may be skewed because of the lower response rate for industries that were more affected by the pandemic (e.g., accommodation, eating and drinking services), we conduct logit estimations in which we include an industry dummy that takes one for firms belonging to the service or wholesale and retail industries. We find that the results are qualitatively similar to those reported in Table 4 below, although the statistical significance of the point estimates for some parameters differs somewhat.

during the pandemic ($SmallestYoYSalesRatio2020$) and on the extent of the prefecture-level shock ($StayHome$) in the estimation. If $\widehat{\beta_3}$ is significantly positive, this indicates that firms that received support from financial institutions before the pandemic were more likely to obtain funds from the COVID-19 business support programs and suggests that these firms repeatedly relied on assistance from financial institutions and/or the government.

3.3.2. Treatment effects of business support programs

Next, to examine the effectiveness of the COVID-19 business support programs in preventing business failures, a substantial increase in unemployment, and a deterioration in firms' performance, we conduct propensity score matching difference-in-differences (PSM-DID) analysis. The procedure is as follows. First, based on the logit estimations in the previous subsection, we attach a propensity score to each firm regarding the likelihood that it obtained COVID-19 support. The explanatory variables we employ are $SmallestYoYSalesRatio2020$, $Score2019$, $lnSales$, $lnEmployment$, $CurrentRatio$, and $StayHome$.[24] For each treatment observation (i.e., for each firm that obtained funds from a particular program), we identify matched observations from the subsample of firms that did not obtain funds. The matched observations are firms that have the "closest" propensity score to a particular treatment observation and are labeled control observations. There are several matching algorithms to find the "closest" control observations, and we employ 5-nearest matching as a baseline. Finally, we compare outcome variables for the treatment group and the control group to estimate the average treatment effect (ATE) using the difference-in-differences (DID) approach. That is, for each treatment and matched control firm, we take the differences in the performance variables from 2019 (before the pandemic) to 2021 (during the pandemic) to eliminate time-invariant firm-fixed effects. We then calculate the difference in these differences between the pairs of treatment and control observations and examine whether the mean of the DIDs is different from zero.

We estimate DIDs for the following outcome variables. First, to examine the effect of the COVID-19 business support programs on firms' liquidity position, we use the ratio of cash outstanding to total assets ($dCashRatio$) and the ratio of total liabilities to total assets ($dLeverageRatio$). Second, to examine whether

[24] The results of the PSM-DID estimations are qualitatively similar when we implement the logit model estimation with the industry dummy mentioned in footnote 23.

the programs reduced business failures and avoided unemployment, we use a dummy variable denoting whether a firm exited ($Exit$) and firms' number of employees ($dEmployment$). Note that we do not use the difference of $Exit$ because all our sample firms operated in 2019, so that $Exit$ was zero before the pandemic. Third, to examine the short-run effect of the programs on recipient firms' business performance, we use the credit score ($dScore$) and the net profit-to-sales ratio ($dProfitRatio$). In addition, to examine whether the government programs led to an increase in zombie firms and/or low-return borrowers, we employ dummy variables using the CHK, FN, BOJ_ROA, and BOJ_Leverage criteria ($dZombie\_chk$, $dZombie\_fn$, $dLowReturn\_ROA$, and $dLowReturn\_leverage$).

4. Results

This section presents the results of the empirical analyses based on the procedure outlined in the previous section. We start by showing the estimation results regarding the determinants of the likelihood that a firm obtained COVID-19 business support. We further show the results of estimations focusing on whether firms were zombie firms or low-return borrowers prior to the pandemic, using the related dummies instead of firms' pre-pandemic characteristics as explanatory variables. Finally, using the results of these estimates, we present the results of our PSM-DID estimation examining the treatment effects of the support programs.

4.1. Determinants of the likelihood of obtaining business support

4.1.1 Baseline results

Table 4 shows the estimation results of Equation (1). Each pair of columns presents the results for one of the four business support programs, i.e., interest-free unsecured government loans, interest-free unsecured private sector loans, grants and subsidies for business continuity, and subsidies for employment adjustment. The first column for each support program shows the results of the baseline specification, which does not include the firm-bank relationship variable ($RelationshipExtent$). The second column shows the results for the specification including $RelationshipExtent$ as an additional explanatory variable.

The baseline results produce two major findings. First, the estimates of the marginal effect associated with the extent of the change in sales amid the pandemic ($SmallestYoYSalesRatio2020$) are negative and significant for government loans and employment adjustment subsidies, while they are insignificant for the other two programs. The government used the extent of the drop in monthly sales amid the pandemic as an eligibility criterion for some programs, and we limited the sample for the estimations to firms that meet the criterion (see Section 3.3.1). This might be a reason why the variable for the change in sales during the pandemic does not seem to have any explanatory power. This is especially the case for grants for business continuity, for which stricter eligibility criteria applied. Further, it is interesting to note that the statistical significance of the marginal effect of $SmallestYoYSalesRatio2020$ differs between the government and private sector loan programs even though the eligibility criteria are very similar. The difference may be due to one or both of the following reasons. First, those firms most severely affected by the pandemic may have approached government banks first, since the GFI loan program started one and a half months earlier than the private sector bank program. The government loan program therefore may have played a greater role as a safety net during the pandemic than the private sector interest-free loan program. Second, private sector banks may have encouraged eligible but relatively well-performing firms to apply for private sector loans. Because the government reimburses the interest payments on these loans and provides credit guarantees, the interest-free loans are beneficial not only for borrower firms but also for the private banks that originate them. It should also be noted that consistent with the marginal effect estimates on $SmallestYoYSalesRatio2020$, the marginal effect estimates for the prefecture-level stay-at-home rate ($StayHome$) are also significantly positive for GFI loans and the employment adjustment subsidies. This result is consistent with the conjecture that the government loan program effectively worked as a safety net.

Second, for three out of the four programs, the marginal effect estimates for the credit score measured prior to the pandemic ($Score2019$) are negative and statistically significant. These results are consistent with the results reported by Hoshi, Kawaguchi, and Ueda (2022) in that the programs tended to be used by firms whose performance was weak already before the pandemic. However, the size of the effect differs to some

extent across programs. Specifically, the absolute value of the marginal effect is largest for government loans, while in Hoshi, Kawaguchi, and Ueda (2022), it was largest for private loans.[25]

4.1.2 Firm-bank relationships

Columns (2), (4), (6), and (8) in Table 4 show the estimation results when we include the variable for the closeness of firm-bank relationships ($RelationshipExtent$) as an additional determinant. In addition to confirming the baseline results, they indicate that the marginal effect estimates for the relationship variable are positive and significant except for grants for business continuity.

This indicates that firms with closer relationships with their lender banks were more likely to have obtained funds from the support programs. Both loans provided by GFIs and by private sector financial institutions were more likely to be used by firms with closer relationships with banks. This result is similar to the findings reported by Balyuk, Prabhala, and Puri (2021) and Li and Strahan (2021) for the PPP in the U.S. Regarding the size of the estimates, we find that the marginal effect is more than twice as large for private sector bank loans as for government loans. Since the variable measures the extent of a firm's relationship with the bank that had extended the largest outstanding amount of loans before the pandemic (or the bank with which a firm had the closest relationship in the case where firms did not have any loans outstanding), the result indicates that close bank-firm relationships provide greater encouragement to firms to use program loans in the case of private sector loans than government loans.

4.1.3 Zombie firms and low-return borrowers

Table 5 reports the estimation results of Equation (2). The table shows the results for each of the four business support programs when using the different criteria for zombie firms and low-return borrowers prior to the pandemic introduced earlier.

We obtain the following two major findings. First, we find that the marginal effect estimates for the zombie/low-return dummies are mostly positive and significant, although the estimated effect is weaker in the

[25] The difference between Hoshi, Kawaguchi, and Ueda's (2022) result and ours may stem from the different estimation methods being employed: Hoshi, Kawaguchi, and Ueda (2022) used a linear probability model, while we use a logit model and report marginal effects. Still, even when we employed a linear probability model in a different paper (Uesugi et al., 2022), in which we used applications to the programs as the dependent variable, the estimated coefficient was largest for government loans.

case of $Zombie\_chk$. In particular, in the case of employment adjustment subsidies, the marginal effect estimates for all the dummy variables for zombie firms/low-return borrowers, including $Zombie\_chk$, are positive and significant. This contrasts with the results obtained by Hoshi, Kawaguchi, and Ueda (2022, HKU), who, using the $Zombie\_chk$ criterion, examined whether zombies were more likely to have obtained government support than non-zombies and found no significant difference. The innovation of our empirical analysis is that whereas HKU use only the CHK criterion to identify zombies, we use multiple criteria to identify zombies and low-return borrowers and show that the marginal effect estimates for the zombie/low-return dummies are mostly positive, including those for the CHK-based zombie dummy. Second, we find that similar to the results in Table 4, the marginal effect estimates for $SmallestYoYSalesRatio2020$ are still negative and those for $StayHome$ still positive in most cases.[26]

4.1.4 Discussion

Summarizing the results obtained in Tables 4 and 5, we find that the various business support programs have been used by firms exhibiting relatively low performance prior to the pandemic. Such firms are not only firms with low credit scores but also firms that we identified as zombie firms or low-return borrowers. Controlling for firm performance prior to the pandemic as an important determinant of whether firms used the support programs, we further find that the extent to which firms' sales were negatively impacted by the pandemic was an important determinant of the likelihood that firms used GFI loans and employment adjustment subsidies, although we find no evidence of a link between the extent of the decline in firms' sales and the use of loans from private sector banks and business continuity grants. This suggests that even when the estimation sample is restricted to eligible firms whose sales fell substantially, we still observe a pattern whereby some of the support programs were more likely to be used by firms that were severely affected by the pandemic. We also find that the stay-at-home rate is positively associated with use of the programs.

[26] One difference is that for firms that obtained funds through private sector bank loans we find that the marginal effect of the change in sales is negative and significant, which is not the case in the results in Table 4 (columns (3) and (4)). This could be due to the omission of other firm characteristics such as $Score2019$ that proxy for firms' creditworthiness prior to the pandemic and have a negative association with the receipt of support. If this credit score is positively correlated with the change in sales amid the pandemic, the marginal effect of the change in sales in Table 5 might be underestimated due to omitted variable bias.

On the one hand, these results suggest that some of the support programs in Japan reached their intended targets. That is, firms that were severely affected by the pandemic were more likely to receive funds from the programs. This contrasts with Granja et al.'s (2020) finding for the U.S. that PPP funds tended to flow to regions that were less adversely affected by the pandemic. On the other hand, we also find that firms that had been underperforming or were classified as zombies or low-return borrowers before the pandemic also ended up being supported. This consistent with findings by Joaquim and Netto (2021) for the U.S., Boddin, D'Acunto, and Weber (2020) for Germany, and Morikawa (2021), Hoshi, Kawaguchi, and Ueda (2022), and Uesugi et al. (2022) for Japan.

Finally, intimate firm-bank relationships played a substantial role in mediating firms' access to the loan programs by GFIs and private banks and the employment adjustment subsidies. This finding is also consistent with studies which find that banks played an important role in mediating government support programs (Balyuk, Puri, and Prabhala 2021, Li and Strahan 2021).[27]

4.2. Treatment effects of obtaining business support

4.2.1 Main results

Table 6 summarizes the results of the treatment effect estimations, where the columns are for the different business support programs and the rows show the results for each of the outcome variables.

There are four notable findings. First, the treatment effect with regard to $dCashRatio$ is positive in the case of all four programs and insignificant only in the case of employment adjustment subsidies. This result indicates that the support programs generally increased firms' liquidity holdings.

Second, consistent with the increase in firms' liquidity holdings, all four programs are associated with an increase in $dLeverageRatio$. Specifically, the interest-free unsecured government loans and interest-free unsecured private loans raised firms' liquidity holdings and increased their reliance on external finance.

[27] As a robustness check, we construct a dummy variable that takes one if a firm used at least one of the four support programs and zero otherwise and conduct logit model estimations using the same set of explanatory variables as in Equations (1) and (2). While not shown here, the results indicate that the findings presented in the last few paragraphs also hold in these estimations. Specifically, firms whose sales were severely affected by the pandemic, firms that performed poorly before the pandemic, and firms that had a close relationship with their bank(s) were more likely to obtain support from the government.

The result that the leverage even of firms that used grants for business continuity and employment adjustment subsidies increased suggests that firms that obtained these grants and subsidies were more likely to use the loan programs as well.

Third, the results for $Exit$ show that the treatment effect is negative and significant for the private sector loan program: it decreases the probability of firms' exit by 0.6 percentage points. The point estimates for the other programs are negative but insignificant. The negative treatment effect in the case of private sector loans presumably is due to the fact that such loans improve firms' liquidity position.

Fourth, the results for $dEmployment$ are insignificant in the case of three of the programs and in fact negative in the case of the use of employment adjustment subsidies. Given that one of the objectives of the employment adjustment subsidies was to prevent layoffs and an increase in unemployment, we would have expected the treatment effect for $dEmployment$ to be positive. There are several possible explanations for our seemingly puzzling results. First, it is possible that even in the absence of the support measures, firms would not have laid off workers due to the strict regulations on laying off workers in Japan, particularly regular workers. Table 3 shows that the median of $dEmployment$ is zero, suggesting that the typical firm did not decrease employment during the pandemic.[28] Second, related to this, the results may be confounded by firms' reliance on non-regular employees. Suppose that firms with a higher share of non-regular workers decreased their employment more than firms less reliant on such workers during the pandemic. If firms with a higher share of non-regular workers were more likely to use employment adjustment subsidies, this would explain the negative treatment effect for $dEmployment$. In order to control for this possible confounding factor, we divide firms into those that are more and those that are less reliant on non-regular workers and conduct PSM-DID estimation for each subsample. The results are presented in Appendix Table C3 and show that the treatment effects turn insignificant for both subsamples, suggesting that this confounding factor does appear to play a role. Third, if there exists strong precautionary demand for cash among firms that used the support programs, this may have led these firms to increase their liquidity holdings and to reduce wage payments, resulting in a decline in employment. In sum, there are several possible explanations for the seemingly puzzling

[28] The insignificant treatment effects of the programs except for employment adjustment subsidies are consistent with the small employment effect found by Granja et al. (2020) and Chetty et al. (2020) for the PPP in the U.S.

result on the short-term impact of the subsidies. Note, however, that it is important to examine their long-term impact on employment, which is an issues we hope to examine in future research.

Finally, looking at firm performance variables such as the credit score *(dScore*) and profitability (*dProfitRatio*), the treatment effects are in many cases negative and significant. Moreover, in the case of the zombie firm and low-return borrower variables, the treatment effects are positive and significant in the majority of cases. Both sets of results – for the firm performance variables and the zombie/low-return borrower dummies – indicate that about one year after the outbreak of the pandemic the performance of firms that used the support programs was worse than at the start of the pandemic. Because our PSM-DID analysis controls for the impact of the pandemic on firms' sales and pre-pandemic characteristics, it is unlikely that treated firms were more severely affected by the pandemic than other firms. Moreover, although it is possible that the lower exit probability among firms in the treatment group (i.e., firms that used the programs) may have lowered the average performance of treated survivor firms, such a survivorship effect should be small given that the quantitative effects of the programs on firm exit are either insignificant or small in size. (The decline in the exit rate was 0.6 percentage points in the case of private sector loan program users and insignificant in the case of users of the other programs). We conjecture that firms that used the support programs and thereby increased cash holdings may not have made an effort to restore their financial soundness or to increase profits by restructuring their business.[29,30]

4.2.2 Subsample analyses

We conduct various additional analyses to further examine the treatment effect of the use of these business support programs. For this purpose, we split the sample into various subsamples to examine if the treatment effects differ depending on firms' pre-pandemic characteristics. Specifically, we create subsamples based on

[29] In other words, it is possible that the government's COVID-19 support programs may have given rise to moral hazard. Evidence of moral hazard in the context of government initiatives is provided, for example, by Kanz (2016), who examined the impact of a large debt relief initiative for households in India and found that debt relief reduced investment, lowered agricultural productivity, and generated moral hazard in the sense that beneficiaries were less concerned about the reputational consequences of future default.

[30] Following the logit model estimation explained in footnote 27, we implement PSM-DID estimations for the treatment effect of using at least one of the four support programs. While not reported here, the results indicate that firms' cash holdings and leverage ratio increased significantly, but no significant changes were observed for employment and firm exit. They further show that firms' ex-post performance deteriorated significantly.

firms' cash holdings, closeness of bank relationships, and whether firms are zombie firms/low-return borrowers.

We start by splitting the sample based on firms' cash-to-asset ratio, since pre-pandemic cash holdings may affect the behavior of support program users. That is, program users with small ex-ante cash balances may be keener to increase their cash holdings for precautionary purposes than firms that already have large cash holdings. Moreover, such firms may also be more likely to increase their loans outstanding to maintain their level of cash holdings rather than to decrease their cash holdings. Contrary to these conjectures, as shown in Appendix Table C1, we find significant positive treatment effects for $dCashRatio$ for firms with large cash balances. The effects are positive for three out of the four support programs. On the other hand, for $dLeverageRatio$ we generally find a positive treatment effect regardless of whether firms had high or low cash balances. Taken together, these results suggest that firms in a better liquidity position before the pandemic further increased their liquidity holdings by relying on external finance and that these firms may not have needed to use this liquidity because their cash flow improved or their demand for investment or working capital decreased. On the other hand, the results also suggest that firms in a poor liquidity position may have had to use their increased liquidity from the government programs because their cash flow deteriorated or their demand for investment or working capital increased.

Next, we split the sample in terms of the extent of firms' relationship with their bank. Specifically, we classify firms for which $RelationshipExtent$ takes a value greater than one as firms with a close relationship and firms with a value smaller than or equal to one as firms with a weak bank relationship. Close firm-bank relationships may have some impact on banks' loan supply to firms when firms use government loan programs. Previous studies on relationship lending suggest that banks that have close relationships with client firms tend to provide liquidity insurance when the firms are in financial distress (Bolton et al. 2016; Hoshi, Kashyap, and Scharfstein, 1990). In the context of our analysis, these findings mean that we would expect banks to be committed to helping firms to recover and maintain their loan exposure to these firms even when the firms receive funds from the support programs. Alternatively, studies such as Vogel and Adams (1997) and Ono, Uesugi, and Yasuda (2013) argue that banks may exploit close relationships with client firms and become opportunistic. If this is the case, we would expect banks to encourage underperforming client firms to use the government loan programs and decrease their loan exposure to them.

Close firm-bank relationships may also have affected the liquidity demand of firms using the support programs. That is, it is conceivable that firms with a close bank relationship may feel more secure about their access to financing in times of crisis and therefore do not feel the need to increase liquidity for precautionary purposes. In this case, firms with a close banking relationship may have been less likely to increase their cash holdings or borrowings when using the government support programs than firms without a close bank relationship.

The results of this analysis are presented in Appendix Table C2 and suggest that the changes in firms' leverage and cash holdings are consistent with either one or both of the following two explanations: that banks behaved opportunistically and that close bank relationships reduced firms' precautionary demand for liquidity. Unlike firms with less extensive bank relationships, the leverage and the cash holdings of firms with close bank relationships increased less when they used the government loan programs.

Finally, we split the sample into firms that were zombie firms and non-zombie firms before the pandemic and low-return borrowers and non-low-return borrowers before the pandemic using the different criteria outlined above. This aim of exercise is to understand why we obtain a positive treatment effect of the use of the government support programs on the probability of being a zombie or low-return borrower. We start by focusing on zombie firms before the pandemic and examine if zombie firms that used the government programs were more likely to remain zombies than those that did not use the programs. We then focus on the sample of non-zombies before the pandemic to examine if non-zombie firms that obtained government support were more likely to become zombies than those that did not obtain support. This allows us to identify which aspect – zombie firms remaining zombie firms or non-zombie firms turning into zombie firms – played a more important role in bringing about the positive treatment effect of government support on the likelihood of firms being zombies that we reported in the previous section. The results (not shown) indicate that there exist statistically significant treatment effects in both cases. More specifically, zombie firms that obtained government support were more likely to remain zombies than zombies that did not obtain support. In addition, non-zombies obtaining support were more likely to become zombies than non-zombie firms that did not. If anything, we find that the tendency for non-zombies to become zombies was somewhat stronger than that for

zombies remaining zombies, especially when we employ the FN criterion.[31] Note, however, that the results vary substantially across the programs and across the different zombie/low-return firm criteria.

Let us consider the finding that firms that used government support during the pandemic were more likely to end up as zombies than non-user firms, regardless of whether they were zombies before the pandemic. How serious a problem is this? If firms that used the support and became or remained zombies continued to be zombies for a long period after the pandemic, the government support programs will have been a substantial misallocation of resources. On the other hand, if they return to being non-zombies shortly after the pandemic, the fact that some of the firms that used government support temporarily became or remained zombies is less of a problem. To examine the extent to which zombie firms remain zombies, we construct a transition matrix regarding firms' transition from being zombies/low-return borrowers to non-zombies/non-low return borrowers and vice versa using data for the pre-pandemic period (from 2014 to 2019). Table 7 presents these transition matrices for the four different zombie firm/low-return borrower criteria.

The table shows the following. First, when we focus on zombie firms/low-return borrowers in 2019, the probability of zombie firms in 2014 remaining zombies in 2019 is higher than the probability of non-zombies in 2014 becoming zombies in 2019. For example, in the case of the CHK criterion, the former probability is 69%, while the latter is 22%. This difference holds for all the criteria of zombie firms/low-return borrowers used in Table 7. In this sense, we may say that whether firms are zombies/low-return borrowers is persistent. Given the definition that zombies are firms that are not viable without support by financial institutions, providing support to zombie firms is an inefficient policy and more targeted support to non-zombie firms is appropriate. Second, however, when we look at the extent to which zombie firms/low-return borrowers in 2014 became non-zombie firms/non-low-return borrowers in 2019, things look different. For example, when we look at the FN criterion, the probability that a zombie firm in 2014 became a non-zombie in 2019 is 71%, suggesting that most zombie firms stop being zombies sooner or later. Note, however, that this probability varies substantially across the criteria used. For example, the probability is merely 20% when we employ the BOJ_leverage criterion. In order to make more definitive inferences on whether more targeted business support

[31] Specifically, we find that the average treatment effects for non-zombies becoming zombies are significantly positive for all the programs except for GFI loans, while the average treatment effects for zombies remaining zombie are not significantly positive for any of the programs.

programs are desirable, we need to determine the appropriate definition of zombie firms, which we leave for future research.

5. Conclusion

Using a dataset that matches survey results and financial data for Japanese SMEs, this study examined the determinants of the use and effects of the business support programs provided by the Japanese government during the COVID-19 pandemic. With respect to determinants of the use of such programs by firms, our results indicate that while the programs provided support to firms that were adversely affected by the pandemic, they also benefited firms that were under-performing before the pandemic. Regarding the effects, our results indicate that while subsidized loans from private sector banks lowered exit rates, no program, including the subsidies for employment adjustment, had a significant effect on firms' employment. Moreover, the programs had the serious side effect of leading to a deterioration in surviving firms' performance at least in the short run, although the long-run effects are yet to be seen. Overall, our results suggest that we need to carefully examine the future performance of firms that used the business support programs during the pandemic.

In addition to investigating the long-run effects of the support program, several other issues remain for future research. First, while we examined the determinants of whether firms obtained funds from the programs (i.e., the extensive margin), due to data limitations we did not investigate the amount of funds firms obtained (i.e., the intensive margin). As Bighelli, Lalinsky, and Vanhala (2022) show for European countries, the determinants of the intensive margin may well differ from those of the extensive margin, and such differences may have important implications for the distributional efficiency and macroeconomic effects of the support programs. Second, it will be important to see whether firms that used the programs and became a zombie firm or low-return borrower will become healthy again or remain zombies or low-return borrowers in the future. Moreover, while we have shown that the number of zombies would have been smaller if the programs had not been provided, we need to further examine the welfare implications and aggregate effects of the programs. To do so, it would be useful to examine the effects of the programs on the allocation of resources such as labor and capital across surviving and exiting firms. As highlighted by Bloom et al. (2022), the usual

Schumpeterian process of creative destruction might not work during a large shock such as the current pandemic. In future research, we need to take such specific aspects of the pandemic into account.

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Table 1: Definitions of variables

This table presents the definitions of the variables used in our estimations (Tables 4–6). The sources are the "Survey on the Status of Firms during the COVID-19 Pandemic" conducted by the Research Institute of Economy, Trade and Industry (RIETI) in November 2020 and the database of Tokyo Shoko Research (TSR).

Variable name	Definition	Source
Variables on the use of business support programs		
Obtained_GovLoan	1 if a firm obtained an interest-free loan from a government-affiliated financial institution, and 0 otherwise.	RIETI survey
Obtained_PrivateLoan	1 if a firm obtained an interest-free unsecured loan from a private financial institution, and 0 otherwise.	RIETI survey
Obtained_GrantContinuity	1 if a firm obtained a business continuity grant, and 0 otherwise.	RIETI survey
Obtained_EmpSubsidy	1 if a firm obtained employment adjustment subsidies, and 0 otherwise.	RIETI survey
Explanatory variables		
SmallestYoYSalesRatio202	Smallest monthly sales ratio growth relative to the previous year for February through September 2020. It takes a value of 100 if the monthly sales amount is unchanged from the same month last year and 50 if it is half of the level a year earlier.	RIETI survey
Score2019	A firm's credit score in 2019 (ranging from 0 to 100) published by Tokyo Shoko Research (TSR), a credit research company	TSR
RelationshipExtent	Number of choices to which a firm responded "yes" regarding the qualitative characteristics of the relationship with its main bank. The five choices are: (1) the bank recognizes the firm's unnoticed strengths; (2) it provides consultation services to the firm in addition to loans; (3) it provides useful information and assistance on managerial issues other than financing; (4) it points out the firm's managerial problems and gives advice on how to deal with them; and (5) it maintains a close relationship with the firm in general.	RIETI survey
Zombie_chk	1 if the firm is classified as a zombie in 2019 according to Caballero, Hoshi, and Kashyap's (2008) criterion, and 0 otherwise. See Table B in the Appendix for a more detailed definition.	TSR
Zombie_fn	1 if the firm is classified as a zombie in 2019 according to Fukuda and Nakamura's (2011) criterion, and 0 otherwise. See Table B in the Appendix for a more detailed definition.	TSR
LowReturn_roa	1 if the firm is classified as an underperforming firm in 2019 according to the ROA criterion set by the Bank of Japan (2018), and 0 otherwise. See Table B in the Appendix for a more detailed definition.	TSR
LowReturn_leverage	1 if the firm is classified as an underperforming firm in 2019 according to the leverage criterion set by the Bank of Japan (2018), and 0 otherwise. See Table B in the Appendix for a more detailed definition.	TSR
lnSales	Log of a firm's sales in 2019. Winsorized at the upper 1 percentile.	RIETI survey
lnEmployment	Log of a firm's number of employees in 2019. Winsorized at the upper 1 percentile.	TSR
CurrentRatio	Outstanding amount of current assets / outstanding amount of liquid liabilities in 2019. Current assets include cash and deposits, accounts and bills receivable, and short-term securities, while liquid liabilities include accounts and bills payable, short-term loans and bonds, payments in arrears, and allowances for bonuses. Winsorized at the upper 1 percentile.	TSR
StayHome	Extent of the increase in the share of people staying at home rather than going out. 1- (number of people out of the home in May 2020 * their out of home hours in the month)/ (number of people out of the home in normal times * their out of home hours in normal times). The share is measured at the prefecture level.	Takayuki Mizuno's website (http://research.nii.ac.jp/~mizuno/)

Table 1: Definitions of variables (continued)

Variable name	Definition	Source
Ex-post outcome variables for the PSM-DID estimations		
dCashRatio	A firm's ratio of the outstanding amount of cash to total assets in 2021 minus the ratio in 2019. Winsorized at the upper and lower 1 percentiles.	TSR
dLeverageRatio	A firm's ratio of the outstanding amount of liabilities to total assets in 2021 minus the ratio in 2019. Winsorized at the upper and lower 1 percentiles.	TSR
Exit	1 if a firm in 2021 was bankrupt or suspended or shut down its business.	TSR
dEmployment	A firm's number of employees in 2021 minus that in 2019. Winsorized at the upper and lower 1 percentiles.	TSR
dScore	A firm's TSR credit score (0-100) in 2021 minus the credit score in 2019.	TSR
dProfitRatio	A firm's ratio of net profits to sales in 2021 minus the ratio in 2019. Winsorized at the upper and lower 1 percentiles.	TSR
dZombie_chk	Difference between the value of the dummy variable indicating whether a firm is categorized as a zombie in 2019 and 2021 based on Caballero, Hoshi, and Kashyap's (2008) criterion.	TSR
dZombie_fn	Difference between the value of the dummy variable indicating whether a firm is categorized as a zombie in 2019 and 2021 based on Fukuda and Nakamura's (2011) criterion.	TSR
dLowReturn_roa	Difference between the value of the dummy variable indicating whether a firm is categorized as a zombie in 2019 and 2021 based on the Bank of Japan's (2018) ROA criterion.	TSR
dLowReturn_leverage	Difference between the value of the dummy variable indicating whether a firm is categorized as a zombie in 2019 and 2021 based on the Bank of Japan's (2018) leverage criterion.	TSR

Table 2: Firms' take-up of COVID-19 business support programs

This table presents the numbers and percentage shares of firms that obtained and did not obtain funds from the COVID-19 business support programs and the percentage shares of firms that applied for but failed to receive funds ("rejection ratio").

	Obtained funds	Did not obtain funds			Number of respondent firms	Rejection ratio
		Considered but did not apply for the program	Applied but failed to obtain funds from the program	Neither considered nor applied for the program		
	a	b1	b2	b3	a+b1+b2+b3	(b2)/(a+b2)
1. Special loans by GFIs	1,076	31	25	2,625	3,757	
	28.6	0.8	0.7	69.9	100.0	2.3
2. Other loans by GFIs	383	15	19	3,057	3,474	
	11.0	0.4	0.5	88.0	100.0	4.7
3. Special guaranteed loans by	1,813	26	18	1,980	3,837	
private sector financial	47.3	0.7	0.5	51.6	100.0	1.0
4. Other guaranteed loans by	486	13	9	2,904	3,412	
private sector financial	14.2	0.4	0.3	85.1	100.0	1.8
5. Grants and subsidies for	1,638	30	7	2,153	3,828	
business continuity	42.8	0.8	0.2	56.2	100.0	0.4
6. Financial support to	634	7	7	2,862	3,510	
compensate for business closures	18.1	0.2	0.2	81.5	100.0	1.1
7. Subsidies for employment	1,383	14	6	2,297	3,700	
adjustment	37.4	0.4	0.2	62.1	100.0	0.4
8. Grants for rent payment	603	41	46	2,848	3,538	
	17.0	1.2	1.3	80.5	100.0	7.1

Table 3: Summary statistics

This table presents the summary statistics of the variables used in our estimations. See Table 1 for the definitions of variables. The sample in this table consists of firms for which we can estimate the logit regressions using Equation (1) for at least one of the eight programs that the RIETI survey asks about (see Table 2). We winsorize the following variables for the logit estimations at the upper 1 percentiles: lnSales, LnEmployment, and CurrentRatio. We also winsorize the following ex-post outcome variables for the PSM-DID estimations at the upper and lower 1 percentiles: dCashRatio, dLeverageRatio, dEmployment, and dProfitRatio.

Variable name	N	mean	sd	min	p25	p50	p75	max
Variables on the use of business support programs								
Obtained_GovLoan	1,849	0.266	0.442	0.000	0.000	0.000	1.000	1.000
Obtained_PrivateLoan	1,889	0.463	0.499	0.000	0.000	0.000	1.000	1.000
Obtained_GrantContinuity	1,863	0.361	0.480	0.000	0.000	0.000	1.000	1.000
Obtained_EmpSubsidy	1,832	0.353	0.478	0.000	0.000	0.000	1.000	1.000
Explanatory variables								
SmallestYoYSalesRatio202	2,063	58.152	27.362	0.000	40.000	60.000	80.000	120.700
Score2019	2,063	53.730	6.912	33.000	49.000	53.000	58.000	79.000
RelationshipExtent	2,063	2.102	1.576	0.000	1.000	2.000	3.000	5.000
Zombie_chk	1,908	0.372	0.483	0.000	0.000	0.000	1.000	1.000
Zombie_fn	1,908	0.114	0.318	0.000	0.000	0.000	0.000	1.000
LowReturn_roa	1,908	0.237	0.426	0.000	0.000	0.000	0.000	1.000
LowReturn_leverage	1,908	0.386	0.487	0.000	0.000	0.000	1.000	1.000
lnSales	2,063	11.503	1.664	4.159	10.404	11.459	12.588	15.826
lnEmployment	2,063	3.454	1.300	0.000	2.565	3.401	4.357	6.789
CurrentRatio	2,063	1.934	2.204	0.002	0.783	1.258	2.149	14.379
StayHome	2,063	0.338	0.093	0.167	0.274	0.318	0.374	0.505
Ex-post outcome variables for the PSM-DID estimations								
dCashRatio	1,379	0.045	0.101	-0.232	-0.007	0.030	0.092	0.425
dLeverageRatio	1,379	0.007	0.124	-0.432	-0.036	0.000	0.051	0.479
Exit	2,063	0.002	0.049	0.000	0.000	0.000	0.000	1.000
dEmployment	1,379	1.131	13.685	-50.000	-2.000	0.000	2.000	76.000
dScore	1,579	-0.354	2.362	-16.000	-2.000	0.000	1.000	14.000
dProfitRatio	1,379	-0.005	0.080	-0.397	-0.018	0.001	0.018	0.281
dZombie_chk	1,270	0.035	0.419	-1.000	0.000	0.000	0.000	1.000
dZombie_fn	1,270	0.048	0.418	-1.000	0.000	0.000	0.000	1.000
dLowReturn_roa	1,270	-0.009	0.459	-1.000	0.000	0.000	0.000	1.000
dLowReturn_leverage	1,270	-0.070	0.384	-1.000	0.000	0.000	0.000	1.000

Table 4: Determinants of whether firms obtained COVID-19 business support

This table presents the marginal effects of the baseline estimations on the determinants of whether firms obtained COVID-19 business support. The results are obtained using logit regression Equation (1). Figures in parentheses are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method: logit model estimation								
Dependent variable	Obtained_GovLoan		Obtained_PrivateLoan		Obtained_GrantContinuity		Obtained_EmpSubsidy	
Explanatory variables								
SmallestYoYSalesRatio2020	-0.002***	-0.002***	-0.001	-0.001	-0.002	-0.002	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Score2019	-0.016***	-0.014***	-0.011***	-0.009***	-0.005	-0.004	-0.005**	-0.004*
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)
RelationshipExtent		0.024***		0.055***		0.008		0.030***
		(0.008)		(0.008)		(0.014)		(0.007)
lnSales	0.010	0.003	-0.011	-0.026	-0.050**	-0.052**	-0.021	-0.030**
	(0.015)	(0.015)	(0.016)	(0.016)	(0.022)	(0.022)	(0.014)	(0.014)
lnEmp	0.044**	0.040**	0.028	0.018	-0.016	-0.020	0.111***	0.108***
	(0.017)	(0.017)	(0.018)	(0.018)	(0.034)	(0.035)	(0.015)	(0.015)
CurrentRatio	-0.022***	-0.021***	-0.014**	-0.013**	-0.005	-0.005	0.000	0.001
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
StayHome	0.436***	0.485***	-0.130	-0.039	0.341	0.350	0.387***	0.449***
	(0.133)	(0.133)	(0.145)	(0.144)	(0.232)	(0.232)	(0.126)	(0.126)
Number of observations	1,367	1,367	1,483	1,483	392	392	1,669	1,669
LRchi^2	111.63	120.55	51.29	93.45	21.21	21.55	113.25	129.00
Prob > chi^2	0.0000	0.0000	0.0000	0.0000	0.0017	0.0030	0.0000	0.0000
Pseudo R^2	0.0655	0.0707	0.0250	0.0455	0.0554	0.0563	0.0516	0.0587
Log likelihood	-796.1923	-791.7297	-1002.0808	-980.9992	-180.7468	-180.5741	-1041.8167	-1033.9421

Table 5: Determinants of whether firms obtained COVID-19 business support using the zombie firm/low-return borrower dummies as explanatory variables

This table presents the marginal effects of the baseline estimations on the determinants of whether firms obtained COVID-19 business support. The results are obtained using logit regression Equation (2). Figures in parentheses are standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method: logit model estimation								
Dependent variable:	Obtained_GovLoan				Obtained_PrivateLoan			
Dummy for zombie firms or low-return borrowers:	Zombie_chk	Zombie_fn	LowReturn_roa	LowReturn_leverage	Zombie_chk	Zombie_fn	LowReturn_roa	LowReturn_leverage
Explanatory variables								
SmallestYoYSalesRatio2020	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.001***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Zombie firm/Low-return borrower dummy	0.003	0.085**	0.109***	0.180***	-0.009	0.105***	0.087***	0.127***
	(0.025)	(0.035)	(0.026)	(0.022)	(0.026)	(0.038)	(0.028)	(0.024)
StayHome	0.514***	0.522***	0.523***	0.446***	-0.086	-0.079	-0.077	-0.122
	(0.127)	(0.127)	(0.127)	(0.125)	(0.139)	(0.138)	(0.138)	(0.138)
Number of observations	1,505	1,505	1,505	1,505	1,646	1,646	1,646	1,646
LRchi^2	29.37	35.20	45.57	90.20	9.38	16.82	18.49	34.80
Prob > chi^2	0.0000	0.0000	0.0000	0.0000	0.0246	0.0008	0.0003	0.0000
Pseudo R^2	0.0158	0.0189	0.0245	0.0486	0.0041	0.0074	0.0081	0.0153
Log likelihood	-914.2009	-911.2856	-906.1011	-883.7887	-1135.6419	-1131.9236	-1131.0861	-1122.9343

Table 5 (continued)

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Estimation method: logit model estimation								
Dependent variable:	Obtained_GrantContinuity				Obtained_EmpSubsidy			
Dummy for zombie firms or low-return borrowers:	Zombie_chk	Zombie_fn	LowReturn_roa	LowReturn_leverage	Zombie_chk	Zombie_fn	LowReturn_roa	LowReturn_leverage
Explanatory variables								
SmallestYoYSalesRatio2020	-0.002	-0.002	-0.002*	-0.002*	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Zombie firm/Low-return borrower dummy	-0.012	0.080	0.170***	0.035	0.065***	0.110***	0.130***	0.098***
	(0.044)	(0.059)	(0.054)	(0.042)	(0.023)	(0.033)	(0.025)	(0.022)
StayHome	0.392	0.388	0.415*	0.386	0.550***	0.568***	0.579***	0.530***
	(0.250)	(0.247)	(0.246)	(0.249)	(0.118)	(0.118)	(0.117)	(0.118)
Number of observations	403	403	403	403	1,830	1,830	1,830	1,830
LRchi^2	4.84	6.72	15.86	5.45	51.12	53.31	69.06	62.21
Prob > chi^2	0.1839	0.0815	0.0012	0.1417	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.0114	0.0159	0.0375	0.0129	0.0215	0.0225	0.0291	0.0262
Log likelihood	-209.0855	-208.1477	-203.5778	-208.7807	-1161.4190	-1160.3262	-1152.4516	-1155.8762

Table 6: Ex-post performance of firms that obtained funds from the COVID-19 business support programs

This table presents the average treatment effects of obtaining COVID-19 business support. The results are obtained using the PSM-DID estimation described in Section 3.3.2. Figures in parentheses are standard errors, while those in the rows labeled NOB are the number of observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

		Obtained_ GovLoan	Obtained_ PrivateLoan	Obtained_ GrantContinuity	Obtained_ EmpSubsidy
dCashRatio	Treatment effect	0.020**	0.021***	0.081***	0.010
	s.e.	(0.009)	(0.007)	(0.020)	(0.006)
	NOB	893	976	214	1,117
dLeverageRatio	Treatment effect	0.055***	0.023***	0.070*	0.039***
	s.e.	(0.010)	(0.008)	(0.036)	(0.008)
	NOB	893	976	214	1,117
Exit	Treatment effect	-0.003	-0.006**	-0.018	-0.001
	s.e.	(0.003)	(0.003)	(0.026)	(0.002)
	NOB	1,367	1,483	392	1,669
dEmployment	Treatment effect	0.502	-0.423	0.040	-1.897**
	s.e.	(0.705)	(0.746)	(0.613)	(0.870)
	NOB	893	976	214	1,117
dScore	Treatment effect	-0.916***	-0.322**	-0.627**	-1.057***
	s.e.	(0.180)	(0.156)	(0.251)	(0.138)
	NOB	1,038	1,128	283	1,283
dProfitRatio	Treatment effect	-0.024***	-0.008	-0.001	-0.022***
	s.e.	(0.006)	(0.005)	(0.016)	(0.005)
	NOB	893	976	214	1,117
dZombie_chk	Treatment effect	0.065*	0.048	-0.010	0.017
	s.e.	(0.035)	(0.031)	(0.079)	(0.032)
	NOB	823	902	182	1,028
dZombie_fn	Treatment effect	0.091**	0.068**	0.153	0.068**
	s.e.	(0.040)	(0.031)	(0.096)	(0.030)
	NOB	823	902	182	1,028
dLowReturn_roa	Treatment effect	0.105***	0.060*	0.108	0.107***
	s.e.	(0.039)	(0.034)	(0.097)	(0.031)
	NOB	823	902	182	1,028
dLowReturn_leverage	Treatment effect	0.049	-0.010	0.171**	0.013
	s.e.	(0.031)	(0.026)	(0.068)	(0.024)
	NOB	823	902	182	1,028

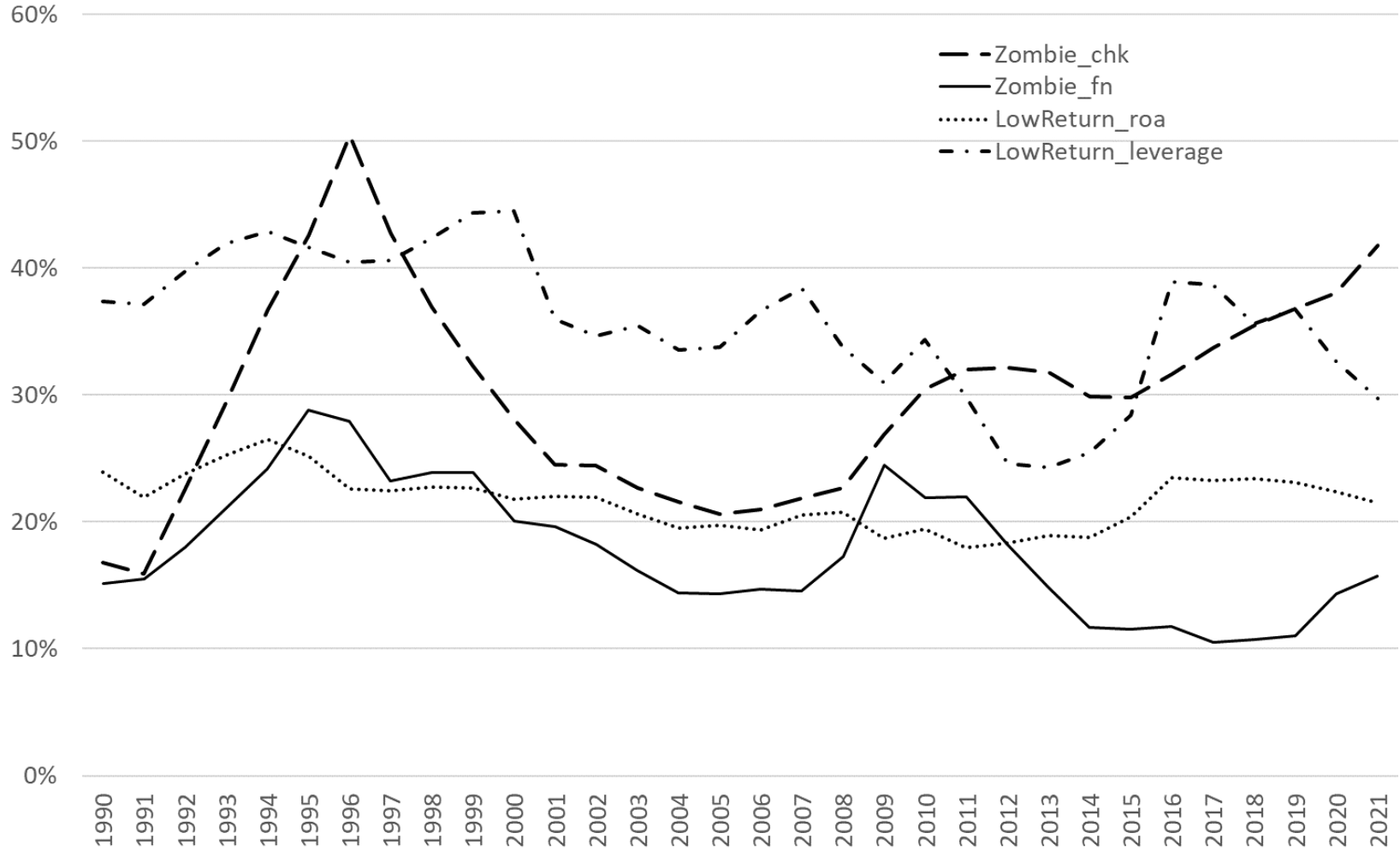
Table 7: Transition of zombie firms and low-return borrowers between 2014 and 2019

This table presents the transition of the number of firms that were classified as zombie firms or low-return borrowers between 2014 and 2019 using the four criteria explained in Section 3.2.3. Figures in parentheses represent the percentage shares of firms that were either non-zombie firms/non-low-return borrowers, zombie firms/low-return borrowers, or had exited in 2019 among firms that were non-zombie firms/non-low-return borrowers or zombie firms/low-return borrowers in 2014.

		2019				Share of Zombie firms /Low-return borrowers	
		Non-zombie firms /Non-low-return borrowers	Zombie firms /Low-return borrowers	Exit	Total	2014	2019
Criteria	**2014**						
Zombie_chk	Non-zombie firms	2,936	855	100	3,891	29.7%	36.7%
		(0.755)	(0.220)	(0.026)	(1.000)		
	Zombie firms	492	1,134	19	1,645		
		(0.299)	(0.689)	(0.012)	(1.000)		
Zombie_fn	Non-zombie firms	4,420	421	93	4,934	10.9%	10.5%
		(0.896)	(0.085)	(0.019)	(1.000)		
	Zombie firms	430	146	26	602		
		(0.714)	(0.243)	(0.043)	(1.000)		
LowReturn_roa	Non-low-return borrowers	3,684	756	94	4,534	18.1%	22.9%
		(0.813)	(0.167)	(0.021)	(1.000)		
	Low-return borrowers	492	485	25	1,002		
		(0.491)	(0.484)	(0.025)	(1.000)		
LowReturn_leverage	Non-low-return borrowers	3,188	890	89	4,167	24.7%	36.1%
		(0.765)	(0.214)	(0.021)	(1.000)		
	Low-return borrowers	271	1068	30	1,369		
		(0.198)	(0.780)	(0.022)	(1.000)		

Figure 1: Developments in the share of zombie firms and low-return borrowers

This figure presents the percentage shares of firms that were classified as zombie firms or low-return borrowers using the sample of firms that responded to at least one of the RIETI surveys conducted in 2008, 2009, 2014, and 2020.



Appendix A. Comparison of firms to which the RIETI survey was sent and firms that responded

To ensure that our results are robust, we examined the differences in characteristics of firms to which the survey was sent (entire sample) and firms that actually responded (respondent sample). First, looking at respondents' industry distribution shows that the wholesale and retail, construction, and manufacturing industries account for the largest number of firms, in that order, in both samples. Meanwhile, real estate and leasing as well as accommodations, eating and drinking services make up lower percentage shares in the respondent sample than the entire sample, suggesting that the response rate was lower among firms in industries that were severely affected by the pandemic. Second, in terms of firms' size, as measured by the number of employees, we find that the response rate is lower among small firms with 1–20 employees and larger firms with more than 100 employees than among firms in between. Third, in terms of firms' TSR credit score, the response rate is lower among firms with a score of 45 or less, indicating that the response rate was lower among firms with poor performance. Overall, the response rate is somewhat lower for firms that were more likely to be hit severely by the pandemic than firms that were less likely to be hit. This may result in a possible underestimation of the impact of the damage caused by the pandemic. However, the extent of underrepresentation of the groups of firms that were more likely to be severely damaged is rather small.

Table A1. Characteristics of firms in the RIETI survey and respondent firms

By industry

	Entire sample: Firms in the RIETI survey		Respondent sample: Firms that respondend to the RIETI survey	
	NOB	Share	NOB	Share
Agriculture, forestry, fishery, etc.	90	0.5	29	0.6
Construction	3,528	17.8	919	19.6
Manufacturing	3,022	15.2	863	18.4
Information and communications, transportation, etc.	1,115	5.6	270	5.8
Wholesale and retail	5,040	25.4	1,238	26.4
Real estate and leasing	1,967	9.9	325	6.9
Accomodations, eating and drinking services	1,259	6.4	205	4.4
Other living-related services	1,024	5.2	222	4.7
Other services	2,781	14.0	622	13.3
Total	19,826	100.0	4,693	100.0

By number of employees

	Entire sample: Firms in the RIETI survey		Respondent sample: Firms that respondend to the RIETI survey	
	NOB	Share	NOB	Share
1–20	8,796	44.4	2,060	43.9
21–50	4,970	25.1	1,335	28.5
51–100	2,239	11.3	582	12.4
101–300	2,651	13.4	556	11.9
301–	1,170	5.9	160	3.4
Total	19,826	100.0	4,693	100.0

By TSR credit score

	Entire sample: Firms in the RIETI survey		Respondent sample: Firms that respondend to the RIETI survey	
	NOB	Share	NOB	Share
–40	1,205	6.1	177	3.8
41–45	3,474	17.5	704	15.0
46–50	5,744	29.0	1,368	29.2
51–55	4,643	23.4	1,204	25.7
56–60	2,684	13.6	727	15.5
61–65	1,383	7.0	353	7.5
66–	679	3.4	159	3.4
Total	19,812	100.0	4,692	100.0

Appendix B Definitions of zombie firms and low-return borrowers

This appendix provides further details on the classification of zombie firms and low-return borrower firms introduced in Section 3.2.3. The detailed criteria are shown in Appendix Table B1 below. As outlined in the main text, two sets of criteria are used to define zombie firms and two sets of criteria to define "low-return borrowers," i.e., firms whose financial conditions are poorer than those of other firms and that are charged lower interest rates than their credit risk would warrant.

Table B1: Definitions of the Zombie and Low-return firms

Criterion	Definitions
Caballero, Hoshi, and Kashyap criterion for zombie firms (Zombie_chk)	Firms whose borrowing rates are lower than the minimum required interest rate. The borrowing interest rate and the minimum required interest rate are calculated as follows: Borrowing interest rate = Interests and discount charges / Outstanding amount of loans extended by financial institutions. Minimum required interest rate = Short-term prime rate * Share of short-term borrowings in the previous year + Long-term prime rate (average of past five years) * Share of long-term borrowings in the previous year. Note that the CHK criterion uses the lowest convertible bond interest rate (coupon rate) issued in the past five years when measuring the minimumu required interest rate. However, we do not use the convertible bond rate in the calculation of the minimum required interest rate because SMEs, which make up the majority of our sample, rarely issue corporate bonds.
Fukuda and Nakamura criterion for zombie firms (Zombie_fn)	Firms that meet either one of the following two conditions. (1) Profitability condition: Their borrowing interest rate is lower than the minimum required interest rate, and the ROA (pretax profit/total assets) is no larger than the minimum required interest rate. (2) Forbearance lending condition: The ROA (pretax profit/total assets) is no larger than the minimum required interest rate, the debt ratio (debt/total assets) is larger than 50%, and the year-on-year borrowing growth rate is positive.
BOJ_ROA criterion for low-return borrowers (LowReturn_roa)	Firms that satisfy the following two conditions for two consecutive years: (1) Their borrowing interest rate is lower than the average borrowing interest rate for the top 10% firms in terms of their ROA. (2) Their ROA (pretax profit/total assets) is lower than the median ROA for all sample firms.
BOJ_Leverage criterion for low-return borrowers (LowReturn_leverage)	Firms that satisfy the following two conditions for two consecutive years: (1) Their borrowing interest rate is lower than the average borrowing interest rate of firms in the bottom 50% in terms of their debt ratio. (2) The debt ratio (debt/total assets) is larger than the median debt ratio for all sample firms.

Appendix C PSM-DID Estimation results for subsamples

This appendix provides the detailed results of the subsample analyses presented in Section 4.2.2. In each of these analyses, we examine if the impact of the government support programs differed across subsamples. First, we split the sample in terms of firms' cash ratio, which proxies for firms' liquidity holdings. Second, we employ the variable *RelationshipExtent* and split the sample based on the value (no larger than one or larger than one). Third, we split the sample based on firms' dependence on non-regular employees and examine if the impact of the employment adjustment subsidies differs between the subsamples.

Appendix Table C1: Ex-post performance of firms that obtained COVID-19 business support (subsample analysis based on firms' cash ratio)

This table presents the average treatment effects of obtaining COVID-19 business support. The results are obtained using the PSM-DID estimation described in Section 3.3.2. and splitting firms into those whose cash-to-assets ratio is below and above the median. Figures in parentheses are standard errors, while those in the rows below are the number of observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Obtained _GovLoan	Obtained_ PrivateLoan	Obtained _GrantContinuity	Obtained _EmpSubsidy	Obtained _GovLoan	Obtained_ PrivateLoan	Obtained _GrantContinuity	Obtained _EmpSubsidy
	Firms with a large cash ratio				Firms with a small cash ratio			
dCashRatio	0.022	0.025**	0.065**	0.020*	0.014	0.005	0.054	-0.001
	(0.013)	(0.012)	(0.029)	(0.012)	(0.009)	(0.008)	(0.054)	(0.007)
	357	401	109	431	536	575	104	686
dLeverageRatio	0.077***	0.023*	0.071***	0.036**	0.033***	0.026**	0.015	0.038***
	(0.022)	(0.013)	(0.026)	(0.015)	(0.011)	(0.010)	(0.057)	(0.009)
	357	401	109	431	536	575	104	686
Exit	0.000	0.000	0.000	0.000	-0.007	-0.005	0.000	0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.006)	(0.000)	(0.003)
	357	401	109	431	536	575	104	686
dEmployment	0.263	-0.135	-0.692	-1.879*	1.044	0.010	1.975	-1.686
	(0.689)	(0.794)	(0.629)	(0.991)	(1.275)	(1.074)	(1.743)	(1.244)
	357	401	109	431	536	575	104	686
dScore	-0.666*	-0.149	-0.640	-0.983***	-0.542**	-0.230	-0.354	-1.087***
	(0.362)	(0.286)	(0.434)	(0.253)	(0.215)	(0.204)	(0.341)	(0.174)
	357	401	109	431	535	574	104	685
dProfitRatio	-0.010	-0.013	-0.024	-0.015	-0.024***	-0.007	0.055***	-0.022***
	(0.013)	(0.010)	(0.015)	(0.010)	(0.007)	(0.006)	(0.019)	(0.006)
	357	401	109	431	536	575	104	686
dZombie_chk	-0.041	-0.027	-0.028	0.006	0.097**	0.102***	0.126	0.003
	(0.069)	(0.048)	(0.073)	(0.055)	(0.038)	(0.035)	(0.295)	(0.036)
	324	365	93	393	499	537	87	635
dZombie_fn	0.017	0.065	0.196*	0.087**	0.101*	0.099**	-0.101	0.056
	(0.057)	(0.040)	(0.100)	(0.044)	(0.052)	(0.040)	(0.226)	(0.038)
	324	365	93	393	499	537	87	635
dLowReturn_roa	0.170***	0.064	0.146	0.101*	0.102**	0.109**	-0.048	0.117***
	(0.064)	(0.054)	(0.111)	(0.052)	(0.045)	(0.045)	(0.116)	(0.040)
	324	365	93	393	499	537	87	635
dLowReturn_leverage	0.016	-0.025	0.265***	0.036	0.076**	0.010	-0.041	0.004
	(0.049)	(0.040)	(0.092)	(0.039)	(0.036)	(0.034)	(0.046)	(0.031)
	324	365	93	393	499	537	87	635

Appendix Table C2: Ex-post performance of firms that obtained COVID-19 business support (subsample analysis based on the extent of firms' bank relationship)

This table presents the average treatment effects of obtaining COVID-19 business support. The results are obtained using the PSM-DID estimation described in Section 3.3.2. and splitting firms into those whose value of $RelationshipExtent$ (see Table 1 for the definition) is below and above the median. Figures in parentheses are standard errors, while those in the rows below are the number of observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Obtained _GovLoan	Obtained_PrivateLoan	Obtained _GrantContinuity	Obtained _EmpSubsidy	Obtained _GovLoan	Obtained_PrivateLoan	Obtained _GrantContinuity	Obtained _EmpSubsidy
	Firms with extensive relationship with main bank				Firms with less extensive relationship with main bank			
dCashRatio	0.013	0.012	0.031	0.008	0.042**	0.033***	0.130***	0.017
	(0.008)	(0.008)	(0.032)	(0.007)	(0.020)	(0.012)	(0.021)	(0.011)
	531	588	95	669	362	388	119	448
dLeverageRatio	0.039***	0.013	0.001	0.033***	0.067***	0.040***	0.102*	0.050**
	(0.012)	(0.010)	(0.007)	(0.009)	(0.017)	(0.014)	(0.057)	(0.020)
	531	588	95	669	362	388	119	448
Exit	-0.005	-0.006	0.007	0.002	0.001	-0.007	-0.027	-0.003
	(0.003)	(0.004)	(0.007)	(0.002)	(0.003)	(0.006)	(0.036)	(0.002)
	785	867	173	962	582	616	219	707
dEmployment	0.847	-0.340	0.194	-1.413	-0.587	0.140	-0.713	-1.500
	(1.075)	(0.905)	(0.633)	(1.081)	(0.982)	(0.999)	(0.772)	(1.302)
	531	588	95	669	362	388	119	448
dScore	-0.732***	-0.297	-0.329	-1.078***	-1.130***	-0.093	-0.907***	-0.993***
	(0.190)	(0.197)	(0.398)	(0.170)	(0.333)	(0.240)	(0.269)	(0.254)
	605	661	126	750	433	467	157	533
dProfitRatio	-0.013*	-0.012*	0.023	-0.022***	-0.040***	0.002	-0.014	-0.025**
	(0.008)	(0.006)	(0.021)	(0.006)	(0.013)	(0.009)	(0.026)	(0.011)
	531	588	95	669	362	388	119	448
dZombie_chk	0.058	0.060	-0.114	0.012	0.146**	0.035	0.084	0.033
	(0.043)	(0.042)	(0.138)	(0.037)	(0.072)	(0.049)	(0.111)	(0.051)
	497	551	84	624	326	351	98	404
dZombie_fn	0.080*	0.056	-0.088	0.096***	0.156**	0.120**	0.294**	0.053
	(0.047)	(0.035)	(0.148)	(0.035)	(0.075)	(0.049)	(0.123)	(0.050)
	497	551	84	624	326	351	98	404
dLowReturn_roa	0.142***	0.049	0.071	0.152***	0.107*	0.112**	0.163**	0.083*
	(0.048)	(0.042)	(0.151)	(0.039)	(0.060)	(0.048)	(0.074)	(0.044)
	497	551	84	624	326	351	98	404
dLowReturn_leverage	0.080*	-0.007	0.176	0.014	0.024	0.033	0.120*	0.062
	(0.041)	(0.038)	(0.173)	(0.031)	(0.043)	(0.034)	(0.065)	(0.041)
	497	551	84	624	326	351	98	404

Appendix Table C3: Ex-post employment of firms that obtained employment adjustment subsidies (subsample analysis based on dependence on non-regular employees)

This table presents the average treatment effects of obtaining the employment adjustment subsidies. The results are obtained using the PSM-DID estimation described in Section 3.3.2. and splitting firms into those whose share of non-regular employees is high or low. Figures in parentheses are standard errors, while those in the rows below are the number of observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Obtained_ EmpSubsidy	Obtained_ EmpSubsidy
	Firms with high share of non-regular employees	Firms with low share of non-regular employees
dEmployment	-1.367	-1.416
	(1.203)	(1.104)
	774	343