No. DP 20-002

SSPJ Discussion Paper Series

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November 2020

Grant-in-Aid for Scientific Research (S) Gran Number 16H06322 Project

Service Sector Productivity in Japan

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Small Business under the COVID-19 Crisis:*

Expected Short- and Medium-Run Effects of Anti-Contagion and Economic Policies

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November 20, 2020

Abstract

This study makes a causal inference on the effects of anti-contagion and economic policies on small business by conducting a survey on Japanese small business managers' expectations about the pandemic, policies, and firm performance. We first find the business suspension request decreased targeted firms' sales by 10 percentage points on top of the baseline 8 percentage points decline due to COVID-19. Second, using a discontinuity in the eligibility criteria, we find lump-sum subsidies improved firms' prospects of survival by 19 percentage points. Third, the medium-run recovery of firms' performance is expected to depend crucially on when infections would end, indicating that stringent anti-contagion policies could complement longer-run economic goals.

Keywords: COVID-19, Causal inference, Manager's expectation, Business performance, Subsidy, Small business, Regression Discontinuity Design, Randomized controlled trial, Difference-in-Difference, Pandemic, Infection, Anti-contagion policies, Lockdown, Survey.
JEL Codes: D22, D80, D84, E17, E32, E66, I18, L50.

*This study is supported by Grants-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (grant numbers 18H00846, 19H00589, 18K18567, and 16H06322). We thank participants of seminars at Hitotsubashi University, The University of Tokyo, Keio University, RIETI, Kansai Labor Seminar, Tokyo Keizai University, Contract Theory Workshop, Hong Kong Japan Entrepreneur Association, METI, SMBC Nikko, Mitsubishi UFJ Research & Consulting, and Academist, for helpful comments. Kensei Nakamura, Yusuke Obata, and Rintaro Ono provided excellent research assistance. The latest version of the paper including the online appendix is in `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3634544`.

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1 Introduction

The coronavirus disease (COVID-19) pandemic, which started in early 2020, had already resulted in more than 34 million confirmed cases and one million deaths worldwide by September 2020. Large-scale social anti-contagion policies, such as the lockdown of cities, temporary closure of businesses, and prohibition of group gatherings, have been employed throughout the world to contain the spread of infection (Hsiang et al., 2020; Flaxman et al., 2020), through the reduction of people's movements and contact (Zhang et al., 2020). These anti-contagion policies inevitably have been accompanied by a deep recession in the world economy (OECD, 2020). This short-run trade-off between health and wealth (Glover et al., 2020) polarized society into two: those who wish to control the spread of the virus and those who emphasize the economic down-side (Allcott et al., 2020). In the longer run, however, anti-contagion policies could benefit both health and the economy (Jordà et al., 2020). At the same time, governments have introduced several economic policies to soften the economic damage of anti-contagion policies, such as massive injections of money into lending markets and the provision of direct subsidies to households and firms. To make the correct decisions under crisis, governments need to understand the short-run economic and epidemiological trade-off as well as the potential long-run benefits of anti-contagion and economic policies.

In this study, we perform a causal inference on the short-run effects of anti-contagion policies on the economy, the impacts of subsidies to firms to ease the economic damage, as well as the potential medium-run economic benefits of the anti-contagion policies. This study focuses on small businesses, which are most vulnerable to the economic crisis. We study this issue in the context of Japan, where the number of new infections surged from March to April 2020, followed by the declaration of emergency state, which led to the request for firms to suspend business temporarily and for individuals to stay at home. At the same time, the Japanese government introduced a series of new subsidy schemes to rescue small businesses. The Japanese case is unique in that the attempt to contain infections is closely tied to a longer-term economic goal, namely, the possibility of hosting the Tokyo Olympic Games. Thus, Japan's short-run stringent anti-contagion policies could lead to a longer-run economic goal, thereby providing an ideal case for evaluating the short-run tension between epidemiological and economic goals as well as the longer-run complementarity between these two goals.

First, we investigate how the emergency declaration and the business suspension request hurt the performance of small businesses. For identification of the causal effects, we use two alternative strategies: 1)

using the variation in local governments' suspension requests across areas and industries over time and 2) randomizing the survey dates to be either before or after the partial lifting of the emergency declaration to examine the impacts of this information on expected performance. Second, we study whether the subsidy schemes are expected help small businesses to survive and whether they changed their on-going decisions, such as those on investment and employment. We exploit a discontinuity in eligibility cutoff of each subsidy scheme to estimate the impacts using the regression discontinuity design. Finally, we quantify the medium-run economic impacts of successfully controlling SARS-Cov-2 infection, particularly, how much business performance would improve if the infections were contained quickly and if the situation could stabilize enough for Japan to host the Tokyo Olympics in 2021. In doing so, we use the variation in managers' beliefs about the timing of infection containment and quarterly sales in a difference-in-difference framework. As such, we contribute to the policy debate by uncovering part of the short-run and the medium-run effects of the Japanese version of anti-contagion and economic policies to tackle the COVID-19 crisis.

2 Data

We address these questions by conducting a survey amid the COVID-19 crisis, after the nationwide emergency had been declared, on the economic performance of small businesses and managers' expectations about the pandemic, policies, and their firms' future performance. We conducted the online survey in May 2020. The sampling frame consists of 28,169 individuals who were registered as top managers, the self-employed, or freelancers at Macromill, Inc., one of the largest market research companies in Japan. As our sample is not necessarily a representative of small business in Japan, in most of our analysis, the observations are weighted to match the number of small businesses in the Economic Census by 12 categories of employment size and sectors (see the Appendix for details about the weights). To capture the effects of the announcement on the partial lifting of the emergency declaration, which was expected when we designed the survey questionnaire, we randomly divided the sampling frame into two groups and sent the questionnaire on different dates. We sent out the questionnaires before the partial lifting of the emergency declaration (May 8) and after the partial lifting (May 15). They were sent at exactly the same time of the two date, and closed the collection when the sample size reached 6,000 in each wave. The survey duration was similar across groups: the survey was closed at midnight on May 9 and the early morning on May 17, respectively. We also demonstrate in the Appendix that basic characteristics of the firms are balanced across the groups.

The survey asked questions about the firm's business, including the realized and expected sales growth compared to the previous year, realized and expected employment and investment, and types of measures adopted to deal with the COVID-19 crisis. It also asked about the firm's expectations of COVID-19-related events: when the Japanese government's emergency declaration, which started on April 7, would be lifted in the whole country (asking for the most likely date, the earliest date, and the latest date); when the COVID-19 outbreak in Japan would be contained, that is, when the number of daily new infections would drop to zero for the first time in Japan; when mass vaccination against SARS-Cov-2 would become available in Japan, and how likely it would be that the Tokyo Olympics would be held in 2021. The survey also asked firms whether they expected to receive the subsides offered by the central and local governments. In the end, we collected answers from 12,364 respondents. Through data validation checks, we dropped respondents who entered inconsistent or unrealistic answers or were not top-managers of small businesses, the target group for our analysis, at the time of the survey. We focused on the remaining 6,135 small business managers. Table 1 summarize the data. In the following, the observations are weighted to match the number of firms in the Economic Census by categories of industry and firm size.

In addition, we gathered information on local governments' websites and the media to identify the industries that for which local governments requested business suspensions. The date, duration, and target facilities of the business suspension requests as well as the amount of suspension subsidy provided by local governments differ by prefectures. When an industry in a prefecture had at least one facility that was requested to be suspended, we regard the industry as being requested for suspension in the prefecture.

3 Causal Impacts of Anti-Contagion and Economic Policies

3.1 How Did the Emergency Declaration and Business Suspension Requests Affect Businesses?

Our evidence based on the Difference-in-Difference estimation shows that the emergency declaration and the requests to suspend business lowered realized and expected firm sales in the short run while it reduced the number of new infections.[1] In Japan, on April 7, the government declared the state of emergency until

[1]The analysis in the Appendix provides suggestive evidence that the business suspension requests reduced people's movements and daily new infections using the prefecture-level panel data. According to the estimate, the suspension request for 1 day resulted in a reduction of people's visits to retail and recreation places of 19 percentage points and to workplaces of 35 percentage points on the day and a reduction of new infections by 3–4% per day after 2 weeks. Interestingly, the moving average of the suspension status in the last 2 weeks is positively correlated with movements at recreation facilities and parks, indicating that people might have

May 6. Under the emergency state, local municipalities requested business suspension at targeted industries. On May 4, the government extended the emergency declaration to May 31, indicating that it could be lifted earlier depending on the situations. On May 13, the government indicated that the emergency declaration in 39 among 47 prefectures was expected to be lifted, and this decision was formalized on May 14. At the same time, the government announced guidelines for lifting the emergency declaration for the remaining areas, specified based on the number of new infections, tightness of medical capacity, improvement of preparedness of testing conditions. The declaration was lifted on May 25 in all remaining areas (see the Appendix for more details).

Using the variation in business suspension requests across industries and prefectures, we examine how much of the sales decline from March to April is the direct effect of the business suspension request and the indirect effect through the spontaneous change in people's behaviors. We restrict the samples to the business-to-consumer (B-to-C) service industries, because the business suspension requests were limited to these industries.

Consider the following model:

$$\Delta(\text{Sales})_{ijp} = \beta_1(\text{Suspension request})_{jp} + \beta_2(\text{Infection risk})_j + \beta_3\Delta(\text{New infections})_p + \epsilon_{ijp}, \quad (1)$$

where "$\Delta(\text{Sales})_{ijp}$" is the percentage-point change in year-to-year sales from March to April of firm i in industry j located in prefecture p; and "$(\text{Suspension request})_{jp}$" is an indicator that takes a value of 1 if industry j was subject to a business suspension request in April in prefecture p, and 0 otherwise; it captures the direct policy effect. "$(\text{Infection risk})_j$" captures the nature of infection risk of industry j, defined by the decline of people visits from February to March in the corresponding industry in the U.S (Benzell et al., 2020). The higher the decline of visits, the higher the increases in the infection risk measure. Because this measure reflects the changes in the corresponding industry in the U.S., it captures the universal riskiness feature of the industry. "$\Delta(\text{New infection})_p$" is the change in the total number of new infections in prefecture p from March to April, by which we control for the perceived infection risks in the prefecture.

Table 2 shows the panel regression results. We find that firm sales growth, defined as sales relative to the same month in the previous year, dropped by 8–9 percentage points from March to April regardless of business suspension status. The sales of firms that were subject to the business suspension requests

become tired of staying at home and started to go out.

additionally declined by 9–11 percentage points.

Next, by randomly assigning the timing of the survey to the firms, we find that firms' expectations significantly changed over just 1 week, from May 8 to 15, during which the emergency declaration was partially lifted in 39 prefectures and the government indicated clear guidelines for lifting the emergency in the remaining areas. Specifically, firms in the survey sent on May 15 expected the nationwide emergency declaration to end on average 4–5 days sooner than did firms in the survey sent on May 8. In addition, subjective uncertainty about the timing of the nationwide ending of the emergency declaration, measured by the difference between the earliest and the latest expected dates of ending, was significantly reduced for firms surveyed on the later date. These results are provided in the Appendix.

Among B-to-C service industries, our evidence using RCT shows that the expected year-to-year sales change in the second quarter (April–June) of 2020 improved by 7 percentage points on average over the week, but the effects were seen only among firms in industry-prefectures that were subject to business suspension requests. In addition, firms in business to business service or non-service industries significantly improved their investment forecasts over the week. Table 3 shows the estimation results based on this randomization of survey timing just before and after the government announcement.

Overall, the results reveal the magnitudes of a short-run trade-off between containing infection and sustaining economic performance for an anti-contagion policy. The facts that the sales already declined in March before the emergency state, it declined even among industries without business suspension request, and that the expected sales for the second quarter did not pick up among firms without business suspension requests after the partial lift of the emergency state, altogether indicate that people change behaviors independently of the government declaration and it affects business performance.

3.2 Can Subsidies Soften the Economic Damage of Anti-Contagion Policies?

We next identify the effects of two subsidy schemes: the business continuation subsidy and short-time work compensation, exploiting Regression Discontinuity Design.[2]

The business continuation subsidy grants up to JPY 1 million (≈ USD 10,000) to the self-employed and JPY 2 million (≈ USD 20,000) to small corporations, with limitations for the amount of the sales decline

[2]In addition to these subsidy schemes, some prefectures offered a business suspension subsidy for firms that suspended operations following their business suspension request. In the case of the business suspension subsidy, there is no eligibility cutoff policy to evaluate the policy using the regression discontinuity design. Therefore, we do not focus on this subsidy and leave the descriptive analysis in the Appendix.

from the last year. The eligibility criteria are as follows: 1) at least one month of year-to-year sales in 2020 declined more than 50%; 2) the firm has continued business operations since before 2019; and 3) its capital is below JPY 1 billion or it employs fewer than 2,000 employees in the case of corporations. The sales decline must be proven based on the sales ledger, which is the basis for the tax on profits. Therefore, it is highly costly for a firm to misreport numbers. The application process is simple: the eligible firm only needs to access the specific website and submit the form, the copy of its sales ledger, and its identity certificate. The transfer is usually made within 2 weeks of the application directly to the firm's bank account. The subsidy scheme was announced on April 8 and applications opened on May 1. By the end of June, more than 2 million applicants had applied for and received subsidies totaling JPY 3 trillion, which is equivalent to about 3% of the total national budget in Japan in 2019. According to our survey data, the subjective probability of receiving this subsidy by the end of June 2020 was 37% on average.

The short-time work compensation reimbursed part of the payment of the leave allowance up to JPY 8,330 per day per employee. This compensation was established in 1975 in response to exogenous and temporary recessions, such as oil shocks, under the premise that retaining the workforce was more efficient than reducing and reemploying workers for a temporary shock. Under normal economic conditions, to be eligible for the subsidy, the firm has to show that it has maintained employment either by giving leave, training, or reallocating the workplace during a recession. To be eligible for short-time work compensation, firms had to show that their year-on-year monthly sales had dropped below -10% for 3 consecutive months, in principle. In March 2020, the sales decline criterion was relaxed to a 10% decline in a single month, as for the COVID-19-induced sales decline. On April 1, in response to the growing COVID-19 shocks, the sales decline criterion was further relaxed to a 5% decline in a single month in 2020. The application process was slightly complicated. The manager first has to agree to the leave plan with the relevant labor union. The firm then has to grant leave to employees, and only after the leave period is over can it apply to the local labor office for the subsidy. The average subjective probability of receiving the subsidy by the end of June 2020 was 18% in our data.

To estimate the impact of these subsidies, we adopt a regression discontinuity design using the cutoff in the eligibility criteria. To be eligible for the business continuation subsidy, sales in at least one month should declined more than 50% relative to the same month of the previous year. Therefore, we can consider a fuzzy regression discontinuity design for identifying the local average treatment effect of the perceived probability of receiving the business continuation subsidy. We use the minimum of monthly sales (measured

as percentage change from the same month of the previous year) during January–April 2020 as the running variable with the cutoff point at the value of -50%. The treatment variable is the subjective probability of receiving the business continuation subsidy from the central government by the end of June 2020. We checked that the baseline employment, capital, and sales as of 2019 were all continuous at the threshold (for the results, see the Appendix).

Table 4 panel (a) shows the estimation results. The bias is corrected and the standard errors are robust to heteroskedasticity according to Calonico et al. (2014). The results suggest that a manager's prospect for survival until the end of 2020 improves by 19.8 percentage points if the manager's prospect of receiving the subsidy increases from 0 to 100%. This is a large effect given that the average subjective probability of continuing business until the end of 2020 is 82%. The subsidy did not affect the firm's quarterly investment and employment plans. We also find that the exogenously increased perceived probability of receiving the business continuation subsidy decreases temporary business suspension, establishment or section closure, and the adoption of working from home (results are shown in the Appendix). This may be because the business continuation subsidy enabled firms with liquidity to keep operating business amid the COVID-19 crisis. On the contrary, the effects on the adoption of new information technology, expansion of online sales, selection of suppliers, and introduction of new product and service are insignificant. The message from these results is that the subsidy enabled small business managers to maintain the current business, but it was not large enough to change employment or to initiate new business.

One possible concern for this analysis is the manipulation of the reported sales or the actual sales by the managers. In the current context, the manipulation of the reported sales would be limited. First, it is hard for the managers to misreport the sales to the government because they have to show their sales lodger, which is the basis for the tax calculation. Second, the managers have no incentive to misreport to us. Thus, the only way for them to manipulate the number is to actually delay the receipt of payment. However, the manipulation of the actual sales would be also limited. First, there was little time to plan this, because the announcement of the policy was at the end of March and we use data up to April. Second, delaying the receipt of cash should have been costly especially during the emergency state. As a robustness check, we also focused on the sample of business-to-consumer service sector, where the receipt of the money is likely to be when the transaction took place. Even though the statistical significance was lost, the sign and the magnitude of the effect of continuation subsidy was the same.

We similarly employ a regression discontinuity design to identify the effects of short-time work com-

pensation. In this analysis, we focus on samples with at least one employee at the end of 2019, because only firms with employees can benefit from the subsidy. We use the April sales decline as the running variable with the cutoff point at the value of -5%. The treatment variable is the subjective probability of receiving the short-time work compensation from the central government by the end of June 2020. As shown in panel (b) of Table 4, we find no statistically significant effects on the firm's business performance and their behaviors, including employee suspension (some of these results are shown in the Appendix). These results may indicate that this subsidy was not attractive enough for small business managers compared to the business continuation subsidy, for several reasons: there is additional paper work for the application and it is necessary to give leave to employees to receive the subsidy and to reimburse the leave allowance.

3.3 How would the Infection Containment Affect the Business in the Medium Run?

Finally, we find that the medium-term firm performance prediction in 2020 is affected to a large extent by infection containment and the possibility of hosting the Olympics by applying Difference-in-Difference strategy. This point is important to assess the potential dynamic complementality between the anti-contagion policies and future economic performance.

For the identification, we use the panel structure of quarterly sales and the variation in expected quarterly timing of infection containment across firms. More specifically, we treat the realized and expected firm sales growth across quarters in 2020 as quarter-firm level panel data and estimate the following equation:

$$\begin{aligned} Y_{it} =& a_i + f_t + \beta_1(\text{After zero new infection})_{it} + \beta_2(\text{After mass use of vaccine})_{it} \\ &+ \beta_3(\text{After zero new infection})_{it+1} + \beta_4(\text{After mass use of vaccine})_{it+1} \\ &+ \beta_5(\text{Prob Olympic})_i \times (Q3)_t + \beta_6(\text{Prob Olympic})_i \times (Q4)_t + \epsilon_{it}, \end{aligned} \tag{2}$$

where t $(= 1, .., 4)$ represents quarters in the calendar year of 2020, and Y_{it} is sales growth in quarter t relative to the same quarter in the previous year, which is the realized value for Q1 and the expected values for Q2–Q4. We control for the firm-specific constant unobserved growth rates by the firm-specific fixed effects a_i, and the unobserved expected macro-level shocks by the quarter-specific fixed effects f_t. "(After zero infection)$_{it}$" takes a value of 1 from the quarter when firm i expects zero infections to be achieved for the first time, and 0 otherwise. Similarly, "(After mass use of vaccine)$_{it}$" takes a value of 1 from the quarter when firm i expects mass vaccination to become available, and 0 otherwise. The key idea behind this equation is how managers

expect their sales to recover in response to the infection ending or vaccine use. The variation across managers in expectations about the timing of the events enables us to identify the expected effect of such events on performance. The sales recovery may not exactly start from the quarter of the event but somewhat earlier than that. For instance, a small-scale start of use of vaccine (not necessarily mass use) could be considered to be sufficient for improving firms' business condition. To allow such possibilities, we add "(After mass use of vaccine)$_{it+1}$," which takes 1 from the quarter prior to the quarter when mass vaccination to become available. "(After zero new infection)$_{it+1}$" is defined in a similar manner. We also examine the effect of the expectation about whether Japan will host the Olympics. In equation 2, "(Prob Olympic)$_i$" is manager i's subjective probability that Japan would host the Olympics in 2021. We interact this subjective probability with quarter dummies for Q3 and Q4.

The result shown in the first column of Table 5 indicates that firms' sales growth is expected to improve by 2.2 percentage points on average in the quarter when the number of new infections becomes zero in Japan, and further improve by around 2.4 percentage points on average in the quarter prior to the time when a vaccine to curb the spread of the virus starts to be used on a mass scale in Japan. In addition, firms that expect a 100% chance of hosting the Tokyo Olympic Games in 2021 forecast on average a 5.4-percentage point larger improvement in sales growth in the fourth quarter than do firms expecting no chance. This is surprising because few firms in our survey had or will have contract directly related to Olympic business. In summary, this result indicates large magnitudes of gain from infection containment in the medium run.

This result is robust to additionally controlling for general optimism/pessimism of the respondents about COVID-19-related outcomes that may also be correlated with sales growth expectations. To clarify this point, decompose the error term into an optimism/pessimism bias term (b_{it}) and the remaining term (u_{it}), i.e., $\epsilon_{it} = b_{it} + u_{it}$. The bias term appears only in the equations for future sales in $t = 2, 3, 4$, and it is zero for $t = 1$. If "After zero infection" or "After mass use of vaccine" is correlated with b_{it} (e.g., optimistic managers are more likely to expect higher growth and higher chance of having "After zero infection"), then not controlling for b_{it} will bias the estimate of β_1, even if we control for firm fixed effects. We cope with this possibility in three alternative ways.

We first consider the case in which b_{it} is constant across future quarters for each firm, that is, $b_{it} = b_i$. Then, one solution is to control for proxy variables of b_i only after Q2. As proxy variables of b_i, we use two variables: 1) the number of months until daily new infections become zero and 2) the number of months until a vaccine is used at mass scale. Note that, while these variables are used in the equation already, we now use

these variables to control for the overall *level* of expectations in all future quarters, rather than to capture the timing. These variables are interacted with a dummy variable that takes 1 during Q2–Q4 (future quarters) in the second column. The results change little. An alternative way to deal with the optimism/pessimism issue is to drop Q1 and to keep controlling for firm fixed effects, which would control for $b_i + a_i$ altogether. In this specification, we set the baseline quarter as Q2, and estimate the effect of COVID-19-related expectations on the sales growth in Q3 and Q4 relative to Q2. The results are shown in the third column. Again, the results are robust to this specification. Next, we consider the case in which the optimism-pessimism bias might not stay constant over quarters within firms but might vary across seasons. For example, since Christmas season is important for retail firms, these firms may hope, or expect optimistically, that infections will end by that time. To check such possibilities, we additionally control for industry-quarter fixed effects in the fourth column using the data for Q2–Q4. This does not alter the qualitative results, either.

4 Conclusion

We derive several important policy implications from these observations. First, stringent anti-contagion policies should be timely and contained to the short run. Based on a back-of envelope calculation, a business suspension request for a month reduces B-to-C service firms' monthly sales by around JPY 0.13 million (around USD 1,200) on average, relative to their average monthly sales of JPY 1.3 million (around USD 12,000). Second, their performance is influenced by people's voluntary behaviors to avoid infections: even without a suspension request, their sales would have dropped by JPY 0.1 million (around USD 1,000). Third, to effectively save small businesses suffering from the crisis by subsidies, the eligibility criteria and the application process should be simple. Based on a back-of-envelope calculation, without the business continuation subsidy, the nationwide number of surviving small business would have dropped from 3.63 million to 3.29 million and the number of employed in small businesses from 12.07 million to 11.01 million. Lastly, stringent anti-contagion policies do not necessarily contradict the longer-run economic goal. At the margin, the containment of infections is expected to increase quarterly sales by JPY 0.34 million: the longer the pandemic continues, the larger the loss of sales would accumulate. Finally, at least in the Japanese context, if infection could be controlled sufficiently to host the Tokyo Olympics, sales are expected to recover further by JPY 0.83 million on average in the fourth quarter (October–December) of 2020.

This study contributes to the literature in three ways. First, we identify the effects of anti-contagion

policies on firm performance, separately from other effects, such as consumers' behaviors to avoid infections, using a similar approach to that of Chernozhukov et al. (2020). There are increasing empirical studies about the effects of COVID-19 anti-contagion policies on people's movements and infection cases (Hsiang et al., 2020; Imperial College COVID-19 Response Team et al., 2020; Zhang et al., 2020; Fang et al., 2020; Chernozhukov et al., 2020; Goolsbee and Syverson, 2020). Among them, a study closely related to ours is that of Goolsbee and Syverson (2020) using cellular phone records in the U.S. and showing that legal shutdown orders explain only a small share of the overall reduction of consumer visits to businesses. Fairlie (2020) describes the performance of small business in the early stage of the pandemic. However, causal evidence of anti-contagion policies on business performance is still scarce. We contribute to this literature by examining the effects of anti-contagion policies on (realized and expected) employment, and investment, as well as sales.

Second, we identify the causal effects of subsidies related to the COVID-19 pandemic. Although governments worldwide have set up stimulus packages, such as direct payments to firms and households, compensation for laid-off workers, and the opening of credit lines, few studies have yet measured the effects of subsidies related to COVID-19 and identified the causal effects.[3] We estimate the effects of two types of subsidy schemes, which differ by nature and target, exploiting the cutoff policies in the eligibility criteria.

Third, our study contributes to literature on the effects of expectations and uncertainty exploiting the exogenous shock triggered by the COVID-19 pandemic. There is growing empirical literature on the expectations of firms' managers using survey data (e.g., Coibion and Gorodnichenko (2012) and Bloom et al. (2017)). Baker et al. (2020a)) show for the U.S. and U.K. that the outbreak of the COVID-19 pandemic has led to sharp increases in policy and economic uncertainty. Bartik et al. (2020) document the impacts of the COVID-19 crisis on small U.S. business, showing a positive association between expected duration of the crisis and business closure. To this body of literature, we newly provide causal evidence on how managers' sales and business continuation forecasts are affected by their expectations on government anti-contagion and subsidy policies and the infection containment.

There are several limitations to this study. First, the data are mostly about expectations rather than actual economic outcomes. By focusing on managers' expectations in this study, we answered important policy-

[3]Bartik et al. (2020) and Baker et al. (2020b) describe how firms and households responded to the 2020 Coronavirus Aid, Relief and Economy Security Act, which directed cash payments. Granja et al. (2020) studies how the Paycheck Protection Program, which offered guaranteed loans to small businesses that maintained employment, was distributed. De Marco (2020) studies a similar public credit guarantee scheme for small businesses to tackle the COVID-19 crisis in Italy.

relevant questions in the midst of ongoing crisis. However, the analysis should be followed up by further analysis using data on the realized economic outcomes. We aim to continue this survey on a quarterly basis throughout 2020. Second, the sample of this study was restricted to small businesses in Japan. Although we focused on small businesses because they seem to be the most vulnerable to the COVID-19-induced economic crisis and many economic support policies in Japan targeted them, an analysis covering larger firms as well as households is necessary to fully understand the economic impacts of the COVID-19 pandemic and the subsequent anti-contagion policies.

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Table 1: Summary statistics

	mean	sd	min	max
Number of employees	3.23	3.79	0	28
Number of employees: 0	0.24	0.43	0	1
Number of employees: 1	0.22	0.41	0	1
Number of employees: 2	0.13	0.33	0	1
Number of employees: 3	0.09	0.29	0	1
Number of employees: 4	0.07	0.25	0	1
Number of employees: 5-19	0.26	0.44	0	1
Industry: Business to Consumer service	0.52	0.50	0	1
Industry: Business to Business service	0.21	0.41	0	1
Industry: Non-service	0.27	0.44	0	1
Average age	55.68	9.64	21	89
Manager age: 20s	0.00	0.07	0	1
Manager age: 30s	0.04	0.21	0	1
Manager age: 40s	0.21	0.41	0	1
Manager age: 50s	0.40	0.49	0	1
Manager age: 60s	0.26	0.44	0	1
Manager age: 70s	0.08	0.27	0	1
male	0.89	0.31	0	1
realized sales growth in Jan 2020 compared to the last year	0.55	22.95	-100	200
realized sales growth in Feb 2020 compared to the last year	-2.37	26.80	-100	180
realized sales growth in March 2020 compared to the last year	-9.79	37.08	-100	160
realized sales growth in April 2020 compared to the last year	-17.57	46.64	-100	160
realized sales growth in 1Q 2020 compared to the last year	-3.87	24.19	-100	127
expected sales growth in 2Q 2020 compared to the last year	-19.01	46.58	-100	120
expected sales growth in 3Q 2020 compared to the last year	-11.99	42.10	-100	180
expected sales growth in 4Q 2020 compared to the last year	-7.99	41.37	-100	180
realized investment in Q1 is positive	0.30	0.46	0	1
realized disinvestment in Q1 is positive	0.05	0.23	0	1
expected investment in Q2 is positive	0.27	0.45	0	1
expected disinvestment in Q2 is positive	0.07	0.25	0	1
probability of business survival	82.41	24.50	1	100
probability of receiving the continuation subsidy	37.07	41.66	0	100
probability of receiving the short-time work compensation	17.99	32.53	0	100
probability of receiving the business suspention subsidy	18.12	32.91	0	100
probability of hosting olympic in 2020-2021	41.26	29.80	0	100
Observations	6108			

Note: The observations are weighted to match the number of firms in the Economic Census.

Table 2: Effects of the suspension requests on sales change from March to April

VARIABLES	(1) Sales change	(2) Sales change	(3) Sales change	(4) Sales change
Suspension request	-9.78***	-10.37***	-10.15***	-10.11***
	(1.84)	(1.98)	(1.96)	(1.95)
Infection risk	0.55	-1.39	-1.64*	-1.51
	(0.98)	(0.95)	(0.93)	(0.93)
New infection change Mar-to-Apr	-0.00	-0.00		
	(0.00)	(0.00)		
Education × Suspension request		9.30*	10.10*	10.10*
		(5.48)	(5.60)	(5.54)
Education		2.33	2.22	1.81
		(4.00)	(4.38)	(4.28)
Sales change Feb-to-Mar				0.04
				(0.02)
Constant	-8.98***	-8.65***		
	(0.83)	(0.81)		
Observations	3,230	3,230	3,230	3,230
Pref FE	NO	NO	YES	YES
Mean (Suspension request)	-17.83	-17.83	-17.83	-17.83
Mean (No suspension request)	-9.096	-9.096	-9.096	-9.096

Notes: This table uses the sample of firms in B-to-C service industries. The firm-specific fixed effects are controlled, because the dependent variable is the first difference from March to April. The sales change is measured in percentage points. "Suspension request" takes 1 if business suspension was requested of the firm's industry in April. The infection risk measure is from Benzell et al. (2020). "Education" is a dummy for education-support industry, which reportedly used online teaching to avoid business suspension. The third column controls for the prefecture fixed effects. The last column additionally controls for the sales change from February to March, when the infection cases were increasing but business suspension was not requested, to take into account the firm's sensitivity to the pandemic. Standard errors clustered at the prefecture level are in parentheses. The observations are weighted to match the number of firms in the Economic Census. *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 3: Expected firm performance by survey week

(a) B-to-C service industries

	(1)	(2)	(3)	(4)	(5)	(6)
	Expected sales growth Q2		Expected employment growth Q2		Expected investment Q2	
Later group	2.01		-0.32		0.005	
	(1.73)		(0.88)		(0.016)	
Later group × Suspension request		7.19*		-1.38		-0.039
		(4.27)		(2.47)		(0.036)
Later group × No suspension request		2.20		0.97		0.014
		(1.98)		(1.06)		(0.019)
Suspension request		-11.38***		-4.07**		0.077***
		(3.08)		(1.74)		(0.027)
Constant	-23.09***	-21.11***	-3.55***	-3.02***	0.228***	0.216***
	(1.32)	(1.20)	(0.64)	(0.58)	(0.012)	(0.011)
Observations	3,156	3,156	3,230	3,230	3,217	3,217

(b) Other industries (B-to-B service and non-service industries)

	(1) Expected sales growth Q2	(2) Expected employment growth Q2	(3) Expected investment Q2
Later group	-0.38	-0.56	0.049***
	(1.89)	(1.01)	(0.018)
Constant	-15.28***	-1.94**	0.237***
	(1.47)	(0.77)	(0.013)
Observations	2,815	2,878	2,869

Notes: Panel (a) shows the results from the sample of firms in B-to-C service industries, and panel (b) shows the results from the other industries (business to business service and non-service industries). "Later group" takes 1 if the firm was surveyed during May 15–17, and 0 if during May 8–9. "Suspension request" takes 1 if the firm is in industry-prefectures that were subject to business suspension requests in April or May, and 0 otherwise. "No suspension request" is defined by 1- "Suspension request." "Expected sales growth Q2" is the most likely expected sales growth in the second quarter (April–June) of 2020 relative to the same quarter in 2019, measured in percentage term. "Expected employment growth Q2" is measured by the log difference in the expected employment at the end of June 2020 and employment at the end of December 2019. "Expected investment Q2" is an indicator variable that takes a value of 1 if the firm plans to invest more than JPY 10,000, including investment already made, during Q2 2020, and 0 otherwise. The observations are weighted to match the number of firms in the Economic Census. Robust standard errors are in parentheses. *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 4: Effect of the probability of receiving the business continuation subsidy and short-time work compensation

(a) Business continuation subsidy

	(1) Survival probability	(2) Employment growth	(3) Investment	(4) Disinvestment
Subsidy probability	0.198*	0.000848	-0.141	-0.0532
	(0.116)	(0.00105)	(0.223)	(0.138)
Observations	5691	6108	6086	6081

(b) Short-time work compensation

	(1) Survival probability	(2) Employment growth	(3) Investment	(4) Disinvestment
Subsidy probability	-3.071	-0.00286	3.151	1.151
	(5.928)	(0.0121)	(5.558)	(1.553)
Observations	3148	3385	3374	3371

Notes: This table shows the estimation results based on the regression discontinuity design using the cutoff points of eligibility criteria for the subsidies. Survival probability is the probability of continuing business until the end of 2020 (measured in %). Employment growth is log(expected employment at end-June 2020 + 1) subtracted by log(employment at end-2019). Positive investment is a binary indicator of more than JPY 10,000 planned investment from April to June 2020. Positive disinvestment is a binary indicator of planned disinvestment. In panel (a), subsidy probability is the probability of receiving the business continuation subsidy (measured in %). In panel (b), subsidy probability is the probability of receiving the short-time work compensation (measured in %). Standard errors are in parentheses. *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$. The bias is corrected and the standard errors are robust to heteroskedasticity.

Table 5: Difference-in-difference for quarterly sales growth: COVID-19, vaccine, and Olympics

VARIABLES	(1) Sales growth Q1–Q4	(2) Sales growth Q1–Q4	(3) Sales growth Q2–Q4	(4) Sales growth Q2–Q4
After zero new infection	2.18***	2.47***	2.48**	2.29**
	(0.82)	(0.90)	(1.01)	(1.00)
After zero new infection (t+1)	-0.80	-0.53	-0.61	-0.46
	(0.76)	(0.82)	(0.87)	(0.87)
After mass use of vaccine	0.37	0.31	0.54	0.49
	(0.85)	(0.87)	(0.93)	(0.92)
After mass use of vaccine (t+1)	2.41***	2.33***	2.33**	2.32**
	(0.81)	(0.88)	(0.99)	(0.97)
P(Olympic) × Q3	3.15*	3.15*	2.58	3.42*
	(1.61)	(1.61)	(1.88)	(1.90)
P(Olympic) × Q4	5.37***	5.46***	4.92**	5.71**
	(1.81)	(1.83)	(2.23)	(2.25)
Observations	24,125	24,125	18,017	18,017
Firm FE	YES	YES	YES	YES
Quarter FE	YES	YES	YES	NO
Optimism proxiy	NO	YES	NO	NO
Industry-Quarter FE	NO	NO	NO	YES

Notes: This table uses the panel data of quarterly firm sales growth in Q1–Q4 or Q2–Q4 in 2020. Sales growth in Q1 is the realized value, while sales growth in Q2–Q4 is expectation by the business owner. The observations are weighted to match the number of firms in the Economic Census. Standard errors are clustered at the level of firms. "Mean Qk" (for k = 2, 3, 4) shows the mean of the expected sales growth in Q3 and Q4 in the sample (respectively).