POSTDISASTER SUBSIDIES FOR SMALL AND MEDIUM FIRMS

INSIGHTS FOR EFFECTIVE TARGETING

Yuzuka Kashiwagi

NO. 597

October 2019

ADB ECONOMICS WORKING PAPER SERIES

ASIAN DEVELOPMENT BANK

ADB

ADB Economics Working Paper Series

Postdisaster Subsidies for Small and Medium Firms: Insights for Effective Targeting

Yuzuka Kashiwagi

No. 597 | October 2019

Yuzuka Kashiwagi (yuzu-26@akane.waseda.jp) is a PhD student of the Graduate School of Economics at Waseda University and a research fellow of the Japan Society for the Promotion of Science (JSPS).

This paper was prepared as background material for the *Asian Development Outlook 2019* theme chapter on "Strengthening Disaster Resilience."

The author would like to thank Benno Ferrarini, Masayuki Morikawa, Ilan Noy, Yasuyuki Sawada, Hiromichi Tanoue, Yasuyuki Todo, and Eiichi Tomiura for their helpful comments, and the Small and Medium Enterprise Agency for their help in collecting data.

Financial support from JSPS is gratefully acknowledged. The opinions expressed and arguments employed in this paper are the sole responsibility of the author and do not necessarily reflect those of the JSPS; Research Institute of Economy, Trade and Industry; Waseda University; or any institution with which the author is affiliated.

ASIAN DEVELOPMENT BANK

6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
www.adb.org

ISSN 2313-6537 (print), 2313-6545 (electronic)
Publication Stock No. WPS190485-2
DOI: http://dx.doi.org/10.22617/WPS190485-2

Note:
In this publication, "$" refers to United States dollars.

The ADB Economics Working Paper Series presents data, information, and/or findings from ongoing research and studies to encourage exchange of ideas and to elicit comment and feedback about development issues in Asia and the Pacific. Since papers in this series are intended for quick and easy dissemination, the content may or may not be fully edited and may later be modified for final publication.

CONTENTS

TABLES AND FIGURE

TABLES

FIGURE

ABSTRACT

This paper examines the effect of capital subsidies after great disasters on the recovery of small and medium-sized enterprises (SMEs) using propensity score matching estimations. The estimates show that capital subsidies were effective for the recovery of the performance of SMEs in the retail sector. However, in manufacturing and other service sectors, it finds no significant difference between the recovery of SMEs with and without the subsidy. Utilizing firm-level supply chain data, it further explores the mechanism behind the heterogeneity across sectors. The results suggest that the heterogeneity comes from variations in the degree of private support across sectors rather than variations in supply chain disruption.

Keywords: disasters, enterprise recovery, microeconomic impact of aid, supply chains

JEL codes: L10, Q54, R10

I. INTRODUCTION

Natural disasters are often unanticipated costly events for businesses. To repair or reinstall what disasters destroy, firms that survive are often saddled with loans. Because it is difficult for many local firms to either cover the total cost by themselves or prepare for such rare unpredictable events in advance to reduce the cost, the government often intervenes after disasters. For example, the Government of Japan provided a capital subsidy known as the Group Subsidy to help small and medium-sized enterprises (SMEs) recover from the damage caused by the Great East Japan Earthquake in 2011. The United States Small Business Administration and Farm Service Agency also provided disaster assistance to businesses affected by declared disasters. Among the developing countries, Sri Lanka, for example, introduced relief aid to local businesses that suffered from the tsunami (Dickson and Kangaraarachchi 2006).

However, the reconstruction cost is too enormous for the government budgetary resources to absorb, and thus, natural disasters deteriorate the government's financial conditions (Benali, Abdelkafi, and Feki 2018). The cost of disasters for the government is likely to continue growing, considering the increasing frequency and severity of disasters (Altay and Ramirez 2010), and the political motivations inherent in subsidies (Garrett and Sobel 2003). Further, some warn that the repeated application of government support may crowd out private coping and private support of individual firms and increase the costs incurred by the government (Nakazawa 2018). On the other hand, government support is essential, especially for the most vulnerable firms that cannot expect much private support. Therefore, it is important to discuss the effective targeting of government support to disaster-hit firms.

A small number of quantitative studies examine the process of enterprise recovery (De Mel, McKenzie, and Woodruff 2012; Hsu et al. 2018). Even fewer studies investigate the effect of public or private support, although there is a large body of literature on how households cope with disasters (Skoufias 2003, Sawada and Takasaki 2017). With regard to public support for firms, De Mel, McKenzie, and Woodruff (2012) provide firm-level evidence from a randomized control trial in a developing country that suggests that the capital subsidy is effective in the retail sector but not in other sectors in the short and medium run. They note that disruptions in supply chains may be potential contributors to this difference, but they do not test this hypothesis due to data limitations. Regarding private support, Todo, Nakajima, and Matous (2015) use firm-level data in Japan and find that private support through supply chains is helpful for resuming performance. However, their study does not examine the alternate or supplemental relationship with public support.

In this paper, I examine the impact of the subsidy, or public support, on firms hit by the Great East Japan Earthquake and explore the mechanism behind sectoral heterogeneity. I first estimate the impact of the capital subsidy on the recovery of disaster-hit firms in Japan in the medium run and investigate the heterogeneity of the impact across sectors. Consistent with De Mel, McKenzie, and Woodruff (2012), I find a substantial impact of the subsidy on the retail sector, but I do not observe any difference between the recovery of firms with and without the subsidy in manufacturing and other service sectors. Because I have supply chain information of firms in Japan, I further investigate the mechanism that causes the sectoral difference. The results suggest that the heterogeneity comes from variations in the degree of private support across sectors rather than variations in supply chain disruption.

The findings contribute to several strands of literature. First, as mentioned above, a small number of papers examine the impact of the relief subsidy on firms' recovery. Hence, the finding is new

to the research on enterprises in developed countries. In addition, coupled with the study in a developing country by De Mel, McKenzie, and Woodruff (2012), this study contributes to the relief aid literature by providing the methodological implication that the impact on retailers may need to be estimated separately.

Second, based on supply chain information, the results identify the potential mechanism explaining why the relief subsidy is effective only for some sectors. Previous research has not examined this issue due to the lack of supply chain data. The conclusion adds to the discussion on the mechanism and provides important implications for policy makers who consider the provision of relief support for firms.

Finally, this paper also informs policy making by evaluating, with quantitative analysis, some postdisaster policies already in use. For example, the Group Subsidy was a scheme to support SMEs that suffered from natural disasters and was distinctive in that it was provided not to firms but to voluntarily made groups of firms. It was introduced in 2011 and has been reapplied in Japan to this day. However, few empirical evaluations of this policy have been made by researchers. In this paper, I provide some empirical evidence of the impact of this policy.

The paper is organized as follows. Section II describes the Great East Japan Earthquake and the related subsidy. Section III describes the data. Section IV describes the estimation strategy. Section V presents the estimates. Section VI offers concluding remarks.

II. BACKGROUND

A. The Great East Japan Earthquake and the Impact on Firms

The Great East Japan Earthquake occurred on 11 March 2011 and several prefectures in Japan directly suffered from it. The magnitude of the earthquake was 9.0, the fourth-largest earthquake in the world since 1900. The earthquake also triggered a large tsunami and nuclear accidents in the Fukushima Daiichi Nuclear Power Plant. The economic loss from this disaster was huge, at ¥16.9 trillion or approximately $212 million (Cabinet Office of Japan 2011).[1] A total of 99.9% of firms located in the disaster-hit area were SMEs (Small and Medium Enterprise Agency of Japan 2012). A survey of 2,117 firms in the disaster-hit area conducted by the Research Institute of Economy, Trade and Industry suggests that 1,376 plants were destroyed because of the earthquake and 115 plants were partially destroyed by the tsunami (Wakasugi and Tanaka 2013). Approximately 50% of them restarted business within 3 months, and most of the firms that successfully continued business after the disaster restarted their business within 1 year (Teikoku Databank 2016).

But how did firms cope with the Great East Japan Earthquake? According to the Cabinet Office of Japan (2016), only around 20% of SMEs in the disaster-hit area were insured. Thus, although Runyan (2006) documented that insurance was the key factor of recovery in the United States context, that coping strategy was not available for most of the SMEs that suffered from the Great East Japan Earthquake. Instead, many firms utilized public and private support from the government and other firms. The government helped firms with their finances through the provision of subsidies, loans and guarantees, and the system for consultations. In particular, to help firms restore and reconstruct

[1] $1 = ¥109.307 (as of 26 May 2019).

their facilities, the government created the Group Subsidy, which is the most popular public support for severely affected SMEs, as I will explain in detail in the next subsection. In contrast, firms outside the disaster-hit area provided a variety of voluntary support, such as sending needed machines and products (Yoshida 2011). The substantial effect of support from supply chain partners is quantitatively confirmed by Todo, Nakajima, and Matous (2015).

B. Group Subsidy

The Group Subsidy, hereafter the subsidy for simplicity, has been provided by the Japanese government through the Small and Medium Enterprise Agency under the Ministry of Economy, Trade and Industry, and prefecture governments to groups of SMEs in the areas damaged by the earthquake, which include Aomori, Chiba, Fukushima, Hokkaido, Ibaraki, Iwate, Miyagi, and Tochigi prefectures. More specifically, this subsidy program targets SMEs that form groups to recover from damages caused by the Great East Japan Earthquake and play an important role in employment and economic activities in the region. The program subsidizes 75% of the costs to repair or restore the capital goods of SMEs destroyed by the earthquake and the subsequent tsunamis (Small and Medium Enterprise Agency of Japan 2011). More than 95% of subsidies are provided to groups in the four most affected prefectures, namely, Aomori, Fukushima, Iwate, and Miyagi.

A notable feature of this policy is that subsidies are provided not to individual firms but to groups of firms. Groups are formed voluntarily among firms linked through supply chains, in the same industrial park, in the same commercial area, and in the same industry, for example. This policy measure was developed because public money could not be used to restore private properties of individual firms even in the case of natural disasters but could be provided to groups of firms for regional recovery. Although groups are primarily made of SMEs, non-SMEs can also become members as coordinators. Besides, some reported that many applicant firms got subsidies; only 5% of firms answered that they had applied but failed, in the survey by the National Conference of the Association of Small Business Entrepreneurs (Nakazawa 2018, The National Conference of the Association of Small Business Entrepreneurs 2013). In the group level, Iwate Prefectural Office (2018) reports that groups of firms in Iwate faced competition with an acceptance rate of 37% to get the subsidy during the first year of the implementation, but 83% of applicant groups got subsidies during the following year. Thus, once firms successfully formed groups, it was not very difficult to get subsidies.

The first round of subsidies was announced in June 2011, 3 months after the earthquake, and granted in August 2011 (Small and Medium Enterprise Agency of Japan 2011). As of December 2018, more than 7 years after the earthquake, the program had continued to provide subsidies to SMEs. The amount of subsidies provided by this policy is extremely large; by 2018, a total of ¥504 billion (approximately $4.6 billion) had been provided to 705 groups of firms damaged by the Great East Japan Earthquake.

III. DATA

A. Data Source

This study utilizes firm-level data collected by Tokyo Shoko Research (TSR). The TSR data contain corporate information, such as each firm's location, sales, and number of employees, and information on suppliers and customers. The TSR data include the identification number of each supplier and client, and based on the data, I can identify networks of firms through supply chains in Japan. The TSR data are commonly used in the economics literature. Regarding enterprise resilience against natural disasters, Carvalho et al. (2014) and Todo, Nakajima, and Matous (2015) examined the negative and positive effects of supply chains during the Great East Japan Earthquake.

Specifically, I utilize the TSR data licensed to the Research Institute of Economy, Trade and Industry for the years 2011, 2012, and 2014. Because most corporate information is collected 1 year before the year of licensing, the data cover detailed corporate information in the fiscal years 2010, 2011, and 2013. In addition, because the TSR data include information about sales during the previous year, data on sales for the fiscal years 2009 and 2012 are available. The TSR data for 2010 contain 1,161,096 firms and 4,971,671 supply chain links.

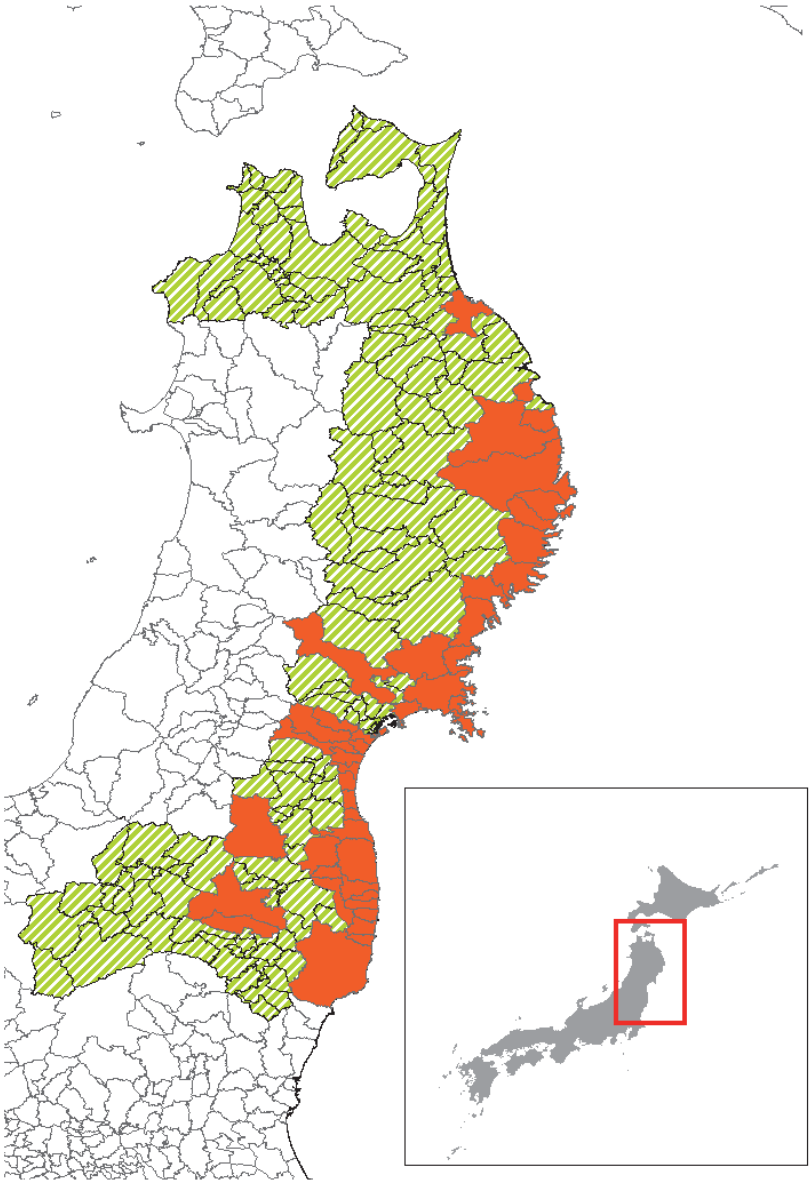
B. Identification of the Disaster Areas and Subsidized Firms

I assume that firms in the disaster-hit areas were directly damaged by the disasters, following previous literature such as Barrot and Sauvagnat (2016). I identify the disaster areas using three government documents on the severely affected areas: the Act on Special Financial Support to Deal with the Designated Disaster of Extreme Severity, Article 41-2, issued on 28 April 2011 by the Ministry of Land, Infrastructure, Transport, and Tourism; tsunami-flooded areas identified originally by the Ministry of Land, Infrastructure, Transport, and Tourism and provided by the Center for Spatial Information Science at the University of Tokyo; and the conceptual diagram of restricted areas around the Fukushima Daiichi Nuclear Power Plant provided by the Ministry of Economy, Trade and Industry. The disaster areas I identified include four prefectures, Aomori, Fukushima, Iwate, and Miyagi, and are plotted in the figure on page 5.

Further, I identify firms that received the subsidies using lists of recipient firms provided by the four prefecture governments in the disaster areas. Because only the prefecture of each recipient firm, rather than its address, is available in the lists, I identify recipient firms in each prefecture in the TSR data using their names, prefecture, and corporate classifications, and where the corporate classification is placed in the corporate name.[2] In the TSR data, the ratio of disaster-hit firms that can be exactly identified by this set of variables to the entire TSR sample of disaster-hit firms is approximately 98%. In the matching process of subsidized firms, for firms in Fukushima prefecture, I find a small percentage of firms, each of which is matched with more than one firm in the TSR data using the set of variables above. In these cases, I choose firms in the TSR data that can be classified as SMEs according to the definition of the Small and Medium Enterprise Agency of Japan (2018) because the subsidies were primarily provided to SMEs. Despite these efforts, I still cannot exactly identify 27 subsidized firms in Fukushima in the TSR data. I have dropped these firms from the sample, which account for 0.7% of the total remaining sample.

[2] For firms in Iwate prefecture, cities can be identified. I use city names for firms in Iwate, when multiple firms are matched using only firm names, prefectures, or corporate classifications, and when the classification is placed in the corporate name.

Disaster Areas and Disaster-Hit Prefectures



Note: The four disaster-hit prefectures, Aomori, Fukushima, Iwate, and Miyagi, are highlighted with lighter and darker shades, but the latter are the officially defined disaster areas.
Source: Author.

Following this matching process, I match 50.3% of subsidy recipients on the list with firms in the TSR data. One reason for the relatively low match ratio is that many subsidy recipients on the list are presented as persons' names rather than companies' names. I presume that these enterprises represented by persons' names are most likely microenterprises that are operated by a single person or a family. As I will explain later, I evaluate the impact of the subsidy by comparing the performance of

the subsidy-recipient firms with that of the nonrecipients whose characteristics are similar. Thus, the estimate should be interpreted as the impact on firms excluding family owned microenterprises. Another reason for the relatively low match ratio is that the TSR data cover approximately 53% of all firms in Japan, as the coverage of microenterprise is not complete (Carvalho et al. 2014).

Although the subsidies were provided to SMEs in eight prefectures, as presented in section II, the disaster areas officially defined above are in only four of the eight prefectures, that is, Aomori, Fukushima, Iwate, and Miyagi. Therefore, when I estimate the direct effect of the subsidies on recipient firms in the disaster areas, I ignore recipients in the four prefectures outside the disaster areas, namely, Chiba, Hokkaido, Ibaraki, and Tochigi.

C. Construction of Variables and Samples

I mainly use data from two time periods, 2010 and 2013. Accordingly, as primary outcome variables, I use sales and the number of workers in 2013. As I will explain later in detail, I will employ propensity score matching (PSM) estimations. The covariates in the pre-earthquake period for matching include sales, the number of workers, firm age, and the number of transaction partners in 2010. These variables are taken directly from the TSR data and I take the log of them. In addition, the covariates contain dummy variables for firms that were hit by the tsunami and were forced to evacuate due to the accident in the Fukushima Daiichi Nuclear Power Plant after the tsunami, and a variable that indicates the geographical proximity of the disaster-hit SMEs. These variables are constructed from geographic information on the officially identified tsunami-hit areas and evacuation areas as well as the number of disaster-hit SMEs located within 1 kilometer of each firm.

I focus on SMEs in disaster-hit areas. I follow the Small and Medium Enterprise Agency of Japan's (2018) definition of SMEs. For the wholesale sector, firms with ¥100 million ($914,853) or less in paid-in capital or 100 or fewer employees are categorized as SMEs. For retailers, the criteria of either ¥50 million ($457,427) or less in paid-in capital or 50 or fewer employees must be satisfied. For other service industries, firms with ¥50 million or less in paid-in capital or 100 or fewer employees are categorized as SMEs. For other sectors, firms that have paid-in capital of less than ¥300 million ($2,744,561) or fewer than 300 employees are defined as SMEs. Because the subsidies were primarily provided to the secondary and tertiary industries, I have dropped entities in agriculture, forestry, and fishery, as well as public entities such as governments, academic institutions, schools, and political and religious institutions.

IV. ESTIMATION STRATEGY

I estimate the direct effect of the subsidies on the recovery of firms from earthquake damages by sector. In these estimations, I focus on SMEs in the officially defined disaster-hit areas (see section III.B) and examine possible differences in changes in sales and employment from the pre-earthquake to the postearthquake periods between firms with and without the subsidies.

There are two potential issues that may bias the estimates. First, the subsidies were not provided randomly to SMEs in the disaster-hit areas but were provided to groups of SMEs. Second, unobservable firm attributes, such as managers' ability and preferences, may be important factors of both firm growth and receipt of the subsidies. These two econometric issues generate biases due to endogeneity.

To correct for such endogeneity biases, I employ a PSM procedure with a difference-in-differences (DID) estimation used by Blundell and Costa Dias (2000). This method can correct for biases due to an endogenous selection of recipients by the PSM approach and biases due to unobservable firm attributes by the DID estimation. It is often used in policy evaluation using nonexperimental data, such as Görg, Henry, and Strobl (2008), who estimate the effect of grant support to firms on their exporting activity. I further incorporate an analysis of variance (ANCOVA), which is found by McKenzie (2012) to be more efficient than fixed effects and DID estimations.

More specifically, I first run a logit model to examine factors that determine the subsidy program participation of SMEs in the disaster areas.[3] I do so using pre-earthquake firm attributes and disaster types, such as sales, the number of workers, firm age, the number of transaction partners, the number of disaster-hit SMEs located within 1 kilometer (all of the above are in logs), an evacuation area dummy, a tsunami-affected area dummy, and prefecture dummies.

In this first stage, I divide SMEs in the disaster areas into strata at the sector level. Although the data include industry classification codes of TSR at the three-digit level, the number of subsidized firms in the sample for direct effects, approximately 1,100, is too small for us to divide them into detailed industry classifications, even at the two-digit level. Therefore, I classify firms into four sectors: the manufacturing industry; other secondary industries (construction, electric, gas, and mining); the wholesale and retail industry; and the other industries.

Next, using the estimates from the logit model for each sector, I calculate the propensity score, or the predicted probability of participating in the subsidy program given the pre-earthquake attributes. Then, I match each participant firm in the program in each stratum with a nonparticipant with a propensity score closest to that of the participant. One notable issue in this matching process is that firms' fiscal-year-end months vary substantially. If the fiscal-year-end month is different between two particular firms, their sales and sales growth in the pre-earthquake period are defined as occurring in different time periods and thus, may capture different economic shocks. To avoid matching two firms with similar sales or sales growth because of different economic shocks, I match firms within the same sector and with the same fiscal-year-end month. I impose a common support, that is, I drop firms whose propensity score is outside the overlap of the two distributions of participants and nonparticipants. In addition, I set the caliper of the difference in the propensity score at 0.05, matching two firms only when the difference between their propensity scores is less than 5%.

After matching, I check whether treatment firms (recipients of the subsidies in the disaster-hit area) and matched controls (nonrecipients in the disaster-hit area) are balanced in terms of pre-earthquake attributes and types of disasters suffered by firms, that is, whether they were also hit by the tsunami, or the nuclear power plant accident, besides the earthquake, using *t*-tests. The results for the entire sample are reported in Table 1. The results for subsamples by sector used in the benchmark estimation suggest similarly well-balanced results, which are available from the author upon request.

[3] To consider the spatial autocorrelation, I also consider a spatial lag logit model instead of simple logit. However, the results of the subsidy's effect on firm performance are similar.

Table 1: Balancing Test for the Whole Sample

Variable		Mean			
		Treated	Control	Difference	
Sales (¥1,000, in logarithm, 2010)	Unmatched	12.3520	11.5610	0.7910	***
	Matched	12.2320	12.2800	−0.0480	
Number of workers (in logarithm, 2010)	Unmatched	2.5649	1.9211	0.6438	***
	Matched	2.4729	2.5324	−0.0595	
Firm age (in logarithm)	Unmatched	3.4231	3.1688	0.2543	***
	Matched	3.3875	3.4053	−0.0178	
Dummy for tsunami-hit areas	Unmatched	0.4325	0.0654	0.3672	***
	Matched	0.3384	0.3224	0.0159	
Dummy for evacuation areas	Unmatched	0.0365	0.0040	0.0325	***
	Matched	0.0266	0.0275	−0.0009	
Number of supply chain partners (in logarithm)	Unmatched	2.1914	1.8769	0.3145	***
	Matched	2.1400	2.1344	0.0056	
Number of damaged SMEs located within 1 kilometer (in logarithm)	Unmatched	3.9558	4.2893	−0.3335	***
	Matched	3.9631	3.9038	0.0593	

SMEs = small and medium-sized enterprises.
Note: The statistical significance of the difference is indicated by *** p<0.01, ** p<0.05, and * p<0.1.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

Finally, using the matched sample, I run the following ordinary least squares estimation:

$$\ln Y_{it_2} = \beta_0 + \beta_1 \ln Y_{it_0} + \beta_2 Subsidy_{it_1} + D_i\delta + \varepsilon_i, \quad (1)$$

where Y_{it}, $Subsidy_{it}$, and D_i denote an outcome variable, the dummy variable for receipt of the subsidy, and dummy variables of firm i in time t, respectively. I experiment with several sets of dummy variables, such as sector dummies, prefecture dummies, and fiscal-year-end dummies. The time t_0 represents the pre-earthquake year, 2010; t_1 represents the year of receipt of the subsidy, either 2011 or 2012; and t_2 represents the postearthquake year, 2013. The outcome variables are the log of sales and the number of workers. Because I take a log of the outcome variables and incorporate the lagged outcome variables as independent variables, following the ANCOVA analysis of McKenzie (2012), I can rewrite equation (1) as

$$\ln Y_{it_2} - \ln Y_{it_0} = \beta_0 + (\beta_1 - 1)\ln Y_{it_0} + \beta_2 Subsidy_{it_1} + X_{it_0}\delta + \varepsilon_i \quad (2)$$

Therefore, I am essentially estimating the effect of the subsidies on the growth rate of sales and employment, taking into account fixed effects included in and convergence represented by $\ln Y_{it_0}$. When I estimate equation (2) assuming $\beta_1 = 1$ or conduct DID estimations, I obtain similar results. Therefore, I rely on the ANCOVA analysis.

In the benchmark estimations, I separate the sampled firms into four different sectors to examine whether industry affects the effect of the subsidies. The four sectors are the retail sector; the manufacturing sector; other secondary industries (construction, electric, gas, and mining); and other service industries, similar to the approach in De Mel, McKenzie, and Woodruff (2012). The difference between my approach and theirs is the category "other secondary industries." Because the sample includes many firms in this sector, I add this category in the study.

V. RESULTS

A. Baseline Results

I begin the analysis by first reporting the estimates of equation (1) by sector, which are presented in Table 2. Columns (1) and (2) of panel (I) report the impact of the subsidy on sales of disaster-hit firms in the retail sector. The estimates of the impact are close to zero and statistically insignificant, suggesting no difference between the sales recovery of firms with and without the subsidy. In contrast, the impact of subsidies on the employment of disaster-hit firms in the retail sector is substantial, 14% higher for receivers, and statistically significant, as shown in columns (3) and (4) of panel (I). This implies that the subsidy is effective for the recovery of employment in the retail sector.

Table 2: Effect of Group Subsidy on Recovery of Disaster-Hit Firms by Sector

	(1) Sales in 2013	(2) Sales in 2013	(3) Employment in 2013	(4) Employment in 2013
(I) Retail sample				
Subsidies	0.00345	7.29e-05	0.137***	0.135***
	(0.0538)	(0.0539)	(0.0460)	(0.0457)
Observations	316	316	316	316
Adjusted R^2	0.906	0.906	0.877	0.879
(II) Manufacturing sample				
Subsidies	−0.0271	−0.0282	0.00762	0.00234
	(0.0540)	(0.0543)	(0.0454)	(0.0455)
Observations	428	428	428	428
Adjusted R^2	0.862	0.862	0.853	0.855
(III) Other secondary industries sample				
Subsidies	0.192***	0.189***	0.0667**	0.0649**
	(0.0472)	(0.0468)	(0.0270)	(0.0264)
Observations	706	706	706	706
Adjusted R^2	0.773	0.776	0.857	0.861
(IV) Other service industries sample				
Subsidies	−0.0239	−0.0225	−0.0128	−0.0112
	(0.0420)	(0.0419)	(0.0283)	(0.0283)
Observations	764	764	764	764
Adjusted R^2	0.869	0.868	0.903	0.903

continued on next page

Table 2 *continued*

	(1) Sales in 2013	(2) Sales in 2013	(3) Employment in 2013	(4) Employment in 2013
Lagged outcome	YES	YES	YES	YES
Prefecture fixed effect	NO	YES	NO	YES
Industry fixed effect	NO	YES	NO	YES
Fiscal-year-end fixed effect	NO	YES	NO	YES

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables and lagged outcome variables are taken in logarithm. The variable "Subsidies" is a dummy that is 1 if the firm received the subsidy.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

Panels (II), (III), and (IV) of Table 2 report the impact of the subsidy on the manufacturing industry, other secondary industries, and other service industries, respectively. They suggest that the subsidy also had positive and significant impacts on the sales and employment of other secondary industries (construction, electric, gas, and mining), while it did not differentiate the recovery of the manufacturing and other service industries with and without the subsidy. The sectoral difference between retail and manufacturing and/or services is similar to the findings by De Mel, McKenzie, and Woodruff (2012), who assess the effect of access to capital on microenterprises in a developing country. I will explore the source of this variation in subsection V.C.

B. Robustness

Table 3 presents a series of robustness checks. Firstly, I add predisaster sales growth rate into equation (1) and repeat the estimation by sector. The results are shown in columns (1) and (2) of Table 3. I find a positive and significant effect of the subsidy only for the retail and other secondary industries, consistent with the baseline estimation results in Table 2.

Secondly, some may be concerned about bias due to the nuclear power plant accident in Fukushima. Although the sample becomes a bit too small for some panels, I still find a similar result by restricting the sample to firms that are not located in Fukushima and do not have multiple plants as shown in columns (3) and (4) of Table 3. One exception is the effect on the employment of other secondary industries. Little impact for firms outside Fukushima may possibly come from the different amount of private support between firms in Fukushima and others due to the nuclear power plant accident in Fukushima.

Table 3: Robustness Check 1—Different Covariates or Sample, 2013

	(1)	(2)	(3)	(4)
	Extra Control	Extra Control	Single-Plant Firms Outside Fukushima	Single-Plant Firms Outside Fukushima
	Sales in 2013	Employment in 2013	Sales in 2013	Employment in 2013
(I) Retail sample				
Subsidy	−0.0346	0.119**	−0.0642	0.171**
	(0.0554)	(0.0482)	(0.0643)	(0.0729)
Sales growth 2009–2010	−0.127	0.0690		
	(0.116)	(0.0745)		
Observations	276	276	190	190
Adjusted R^2	0.919	0.885	0.898	0.786
(II) Manufacturing sample				
Subsidy	−0.0198	0.0205	−0.133	−0.0596
	(0.0574)	(0.0449)	(0.0994)	(0.0797)
Sales growth 2009–2010	−0.00217	0.170		
	(0.159)	(0.126)		
Observations	377	377	140	140
Adjusted R^2	0.852	0.865	0.769	0.781
(III) Other secondary industries sample				
Subsidy	0.168***	0.0659**	0.125**	0.0202
	(0.0491)	(0.0279)	(0.0603)	(0.0320)
Sales growth 2009–2010	−0.241***	0.0590		
	(0.0848)	(0.0387)		
Observations	610	610	462	462
Adjusted R^2	0.785	0.869	0.758	0.876
(IV) Other service industries sample				
Subsidy	−0.0289	−0.0207	−0.0760	−0.0175
	(0.0487)	(0.0289)	(0.0586)	(0.0435)
Sales growth 2009–2010	−0.0927	0.161**		
	(0.195)	(0.0666)		
Observations	658	658	394	394
Adjusted R^2	0.864	0.910	0.866	0.885
Lagged outcome	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES
Fiscal-year-end fixed effect	YES	YES	YES	YES

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables and lagged outcome variables are taken in logarithm. In each panel, I run the same set of estimation equations for different samples.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

Thirdly, I check if firms with different fiscal years capture different economic shocks, which bias the results. To minimize bias, I carefully match firms that received the subsidy to those that did not but have the same fiscal year end, and I include fiscal-year-end dummies; however, some may still be concerned about the bias caused by the difference. Because the sample of 316 firms is too small to separate into several subsamples, I test the difference between the early group and the late group. I make a dummy variable that is zero if the fiscal year end is from March 2013 to October 2013 and 1 if it is later than October 2013. Then, I create an interaction term with the subsidies dummy and estimate the effect of the difference in the fiscal year end. Although the evidence for the other secondary industries is not strong, at least for the retail and manufacturing and/or other service sectors, the results in columns (1) and (2) of Table 4 suggest that the difference by the fiscal year end is not significant and that the baseline result is robust: only for retailers can I find a positive and significant effect for both the single-term coefficient of the subsidy and the joint effect, while there is no effect on the manufacturing sector and other service industries at any period. Thus, the main findings hold.

Finally, columns (3) and (4) of Table 4 investigate whether there is a diminishing effect by the timing of receipt, because most of the firms that successfully continued business after the disaster restarted their business within a year and thus, the provision of the subsidy in 2012, more than 1 year after the disaster, may be too late. Because the sample of firms that received the subsidy in 2011 is small, I can separately test the impact of the subsidy only based on the sample of firms that received the subsidy in 2012 and the matched firms. Even applying this restriction, I still observe a substantial positive effect, implying that the possibility of underestimation due to differences in the timing of receipt is considerably low.

Table 4: Robustness Check 2—Effect of Timing of Aid Receipt and Fiscal Year End

	(1) Sales in 2013	(2) Employment in 2013	(3) Sales in 2013	(4) Employment in 2013
(I) Retail sample				
Subsidies	−0.00987	0.113**		
	(0.0659)	(0.0535)		
Subsidies x Fiscal end from Sep to Feb	0.0322	0.0718		
	(0.118)	(0.105)		
Subsidies received in 2012			0.0450	0.196***
			(0.0709)	(0.0612)
Observations	316	316	192	192
Adjusted R^2	0.906	0.879	0.915	0.882
P-value (joint effect)	0.818	0.0394		
(II) Manufacturing sample				
Subsidies	−0.0185	−0.0292		
	(0.0732)	(0.0596)		
Subsidies x Fiscal end from Sep to Feb	−0.0252	0.0817		
	(0.105)	(0.0888)		
Subsidies received in 2012			0.0612	0.0952
			(0.0897)	(0.0740)
Observations	428	428	152	152
Adjusted R^2	0.861	0.855	0.882	0.880
P-value (joint effect)	0.568	0.436		

continued on next page

Table 4 *continued*

	(1) Sales in 2013	(2) Employment in 2013	(3) Sales in 2013	(4) Employment in 2013
(III) Other secondary industries sample				
Subsidies	0.177***	0.0323		
	(0.0623)	(0.0330)		
Subsidies x Fiscal end from Sep to Feb	−0.0264	0.0804		
	(0.109)	(0.0675)		
Subsidies received in 2012			0.237***	0.0864***
			(0.0516)	(0.0275)
Observations	612	612	572	572
Adjusted R^2	0.768	0.857	0.773	0.868
P-value (joint effect)	0.0951	0.0531		
(IV) Other service industries sample				
Subsidies	−0.0382	0.0263		
	(0.0538)	(0.0398)		
Subsidies x Fiscal end from Sep to Feb	−0.00428	−0.129*		
	(0.0926)	(0.0681)		
Subsidies received in 2012			0.00686	−0.0362
			(0.0583)	(0.0356)
Observations	482	482	408	408
Adjusted R^2	0.906	0.915	0.867	0.913
P-value (joint effect)	0.571	0.0673		
Lagged outcome	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES
Fiscal-year-end fixed effect	YES	YES	YES	YES

Feb = February, Sep = September.
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables and lagged outcome variables are taken in logs. The variable "Subsidies" is a dummy that is 1 if the subsidy is received in Japan's fiscal year 2011 or 2012 (i.e., by mid-March 2013). The variable "Fiscal end from Sep to Feb" is a dummy that is 1 if the firm's fiscal end is sometime between September 2013 and February 2014 and zero if the firm's fiscal end is sometime between March 2013 and August 2013. In each panel, I run the same set of estimation equations for different samples.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

C. Mechanism

Thus far, the analysis has focused on evaluating the impact of the subsidy on the recovery of firms in disaster-hit areas, and it has found robust heterogeneity across sectors. I next explore the potential mechanisms underlying these results.

(1) Constraints from Supply Chain Disruption

Enterprise recovery, especially sales, reflects both firms' own recovery and supply chain recovery. Even if a particular company in a disaster-hit area restores what it needs for normal operation, its performance will be limited without normal supply and demand. Tables 5 and 6 investigate this possibility by looking at network structures and the negative impact coming from supply chain disruption, respectively, using the same sample as Table 1, that is, the matched sample that is not divided by sector.

Table 5: Possible Mechanism 1—Impact of Supply Chain Disruption (1)

Network Structural Difference across Sectors (Whole Matched Sample)

	(1) OLS	(2) OLS	(3) Logit	(4) Logit	(5) OLS	(6) OLS
	No. of Links Outside Disaster Areas	No. of Links Within Disaster Areas	Existence of Suppliers in Tsunami-Hit Areas	Existence of Customers in Tsunami-Hit Areas	No. of Suppliers in Tsunami-Hit Areas	No. of Customers in Tsunami-Hit Areas
Retail dummy	−0.265***	−0.329***	−0.0379	−1.170***	0.121***	−0.163***
	(0.0539)	(0.0546)	(0.239)	(0.236)	(0.0348)	(0.0289)
Other service	−0.181***	0.00467	0.173	−0.574***	0.111***	−0.0584**
	(0.0432)	(0.0459)	(0.168)	(0.173)	(0.0275)	(0.0234)
Other secondary	−0.269***	0.598***	0.368**	0.770***	0.0767***	0.194***
	(0.0428)	(0.0441)	(0.168)	(0.171)	(0.0280)	(0.0272)
Observations	2,258	2,258	2,258	2,258	2,258	2,258
Adjusted R^2	0.369	0.378			0.327	0.354
Chi^2			762	813.3		
Controls (number of suppliers and/or customers)	NO	NO	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES	YES	YES

OLS = ordinary least squares.

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables in columns (1), (2), (5), and (6) are taken in logarithm after adding 1.

Source: Author's own using data from Tokyo Shoko Research (2011–2014).

In Table 5, I observe how differently firms are linked with other firms by sector. The baseline category in this table is the manufacturing sector. Estimates in column (1) of Table 5 indicate a negative effect of nonmanufacturing sector dummies with statistical and economic significance, suggesting that firms in the manufacturing sector are approximately 20%–25% more connected to firms outside the disaster area than others. In column (2) of Table 5, I find that retailers have the weakest connection with firms in the disaster-hit area, which may imply that the lower potential of exposure to supply chain disruption enables retailers to fully enjoy the effect of subsidy.

In the remaining columns, I check which types of disruption are more likely to occur in the manufacturing and service sectors. Here, I focus on the links with firms in tsunami-hit areas, which most likely take a longer time to recover. However, I confirm that the tendency does not change even if I also consider other disaster areas. The results of columns (3)–(6) of Table 5 suggest that the possibility of having suppliers in tsunami-hit areas does not differ or is even smaller for manufacturing, but manufacturing and other service industries tend to have more potential to be exposed to demand shocks by customers in tsunami-hit areas.

To investigate whether demand shocks explain the sectoral heterogeneity of the impact of the subsidy, in Table 6, I examine the impact of supply chain disruption in the short and medium run. For the short-run impact, I use the log of sales and employment in 2011, while medium-run variables are the same as the main outcome variables, that is, performance in 2013. As in columns (1) and (3) of

Table 6, I find a negative propagation of disaster shocks from customers in tsunami-hit areas to firms in disaster-hit areas, while no negative propagation from suppliers can be observed.

Table 6: Possible Mechanism 1—Impact of Supply Chain Disruption (2)

Propagation of Negative Shocks from Firms in Tsunami-Hit Areas to Their Suppliers and/or Customers within Disaster-Hit Areas (Whole Matched Sample and/or Manufacturing Sector Sample)

	(1) All Firms	(2) All Firms	(3) Manufacturing	(4) All Firms	(5) All Firms	(6) Manufacturing
	Sales in 2011	Sales in 2013	Sales in 2013	Employment in 2011	Employment in 2013	Employment in 2013
No. of customers in tsunami-hit areas	−0.0490**	0.0138	−0.0334	−0.0462**	0.0181	−0.0418
	(0.0215)	(0.0307)	(0.0660)	(0.0185)	(0.0211)	(0.0479)
No. of suppliers in tsunami-hit areas	0.0236	0.155***	0.180**	0.0115	0.00667	0.00234
	(0.0196)	(0.0301)	(0.0764)	(0.0143)	(0.0201)	(0.0589)
Controls (no. of suppliers and/or customers)	YES	YES	YES	YES	YES	YES
Lagged outcome	YES	YES	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	NO	YES	YES	NO
Fiscal-year-end fixed effect	YES	YES	YES	YES	YES	YES
Observations	2,198	2,258	428	2,248	2,258	428
Adjusted R^2	0.937	0.859	0.866	0.946	0.886	0.856

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables, explanatory variables, and lagged outcome variables are taken in logarithm.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

In columns (2) and (5) of Table 6, I test whether the negative propagation effect persists. The results suggest that there is no persistent impact in the medium run, consistent with the finding of Barrot and Sauvagnat (2016) and Kashiwagi, Todo, and Matous (2018) that the negative propagation effect of natural disasters diminishes within 1 year, using natural disasters in the United States as an exogenous shock. Even if I limit the sample to the manufacturing sector, I do not observe any negative impact of supply chain disruption on firms' performance in 2013. Therefore, supply chain disruption is not likely to be the source of the small impact of the subsidy in some sectors.

(2) Private Support

A possible alternative explanation is that the different degrees of private support across sectors differentiate the impact of the subsidy. For example, the manufacturing sector may be more sensitive to physical damage to their facilities than the retail sector. Speaking in extremes, many retailers can run their business in front of their disaster-destroyed store, while manufacturing sectors often need to restore their facilities to reopen their business. Considering that private support from other firms partly aims to mitigate negative propagation effects from damaged firms through supply chains, private support may provide only what is necessary to run their business, and thus, retailers may receive much less support in terms of restoring physical capital. Then, retailers must restore a large part of their

facilities using other sources, such as loans and public aid, while manufacturers want to obtain public support to repair much smaller problems, such as cracked wall surfaces. Repairing cracked wall surfaces is important but may not be critical to firms' performance in the short and medium run or their expectations of their own future growth prospects.

I explore this alternative explanation by reestimating equation (1) but with proxy variables of private support. The proxy variables include the log of the number of interfirm links within disaster areas and outside these areas plus 1, following Todo, Nakajima, and Matous (2015).[4] Columns (3) and (6) of Table 7 contain the main estimation results of this table. As reported in column (3) of Table 7, for sales, the number of links within disaster areas indicates a substantial positive effect throughout all sectors, implying that partner firms within disaster areas helped the sales recovery of disaster-hit firms. This result is consistent with the finding of Todo, Nakajima, and Matous (2015). I interpret this result as partner firms providing information and lending some machinery or tools that are needed to recover sales. However, the subsidy shows a significant positive effect only for other secondary industries, which are the ones that benefited from the reconstruction demand. These results imply that firms had already received enough support to recover sales before the subsidy was provided.

Table 7: Possible Mechanism 2—Impact of Private Support versus Impact of Public Support

	(1) Sales in 2013	(2) Sales in 2013	(3) Sales in 2013	(4) Employment in 2013	(5) Employment in 2013	(6) Employment in 2013
(I) Retail sample						
Subsidies	7.29e-05		0.00933	0.135***		0.138***
	(0.0539)		(0.0550)	(0.0457)		(0.0471)
No. of links within disaster areas (in logarithm)		0.0808**	0.0813**		0.0152	0.0205
		(0.0390)	(0.0402)		(0.0351)	(0.0353)
No. of links outside disaster areas (in logarithm)		0.00161	0.00183		0.0188	0.0211
		(0.0395)	(0.0393)		(0.0320)	(0.0314)
Observations	316	316	316	316	316	316
Adjusted R^2	0.906	0.907	0.907	0.879	0.875	0.878
(II) Manufacturing sample						
Subsidies	−0.0282		−0.0510	0.00234		0.00555
	(0.0543)		(0.0545)	(0.0455)		(0.0466)
No. of links within disaster areas (in logarithm)		0.140***	0.144***		0.0125	0.0120
		(0.0373)	(0.0373)		(0.0272)	(0.0283)
No. of links outside disaster areas (in logarithm)		0.0202	0.0181		0.102**	0.102**
		(0.0461)	(0.0470)		(0.0474)	(0.0477)
Observations	428	428	428	428	428	428
Adjusted R^2	0.862	0.866	0.866	0.855	0.858	0.858

continued on next page

[4] I checked the identification strategy with a placebo test; that is, I estimate the coefficient of the proxies on sales growth in 2010 by controlling sales growth in 2009 and adding the same set of dummies. However, the results suggest no significant effects of these proxies at the 5% significance level, indicating the validity of the parallel trend assumption.

Table 7 *continued*

	(1) Sales in 2013	(2) Sales in 2013	(3) Sales in 2013	(4) Employment in 2013	(5) Employment in 2013	(6) Employment in 2013
(III) Other secondary industries sample						
Subsidies	0.189***		0.161***	0.0649**		0.0585**
	(0.0468)		(0.0463)	(0.0264)		(0.0264)
No. of links within disaster areas (in logarithm)		0.276***	0.265***		0.0592**	0.0546**
		(0.0362)	(0.0364)		(0.0233)	(0.0234)
No. of links outside disaster areas (in logarithm)		−0.0491	−0.0366		−0.00780	−0.00391
		(0.0330)	(0.0333)		(0.0197)	(0.0197)
Observations	706	706	706	706	706	706
Adjusted R^2	0.776	0.785	0.789	0.861	0.861	0.862
(IV) Other service industries sample						
Subsidies	−0.0225		−0.0251	−0.0112		−0.00947
	(0.0419)		(0.0413)	(0.0283)		(0.0280)
No. of links within disaster areas (in logarithm)		0.125***	0.125***		0.0439**	0.0441**
		(0.0310)	(0.0311)		(0.0199)	(0.0200)
No. of links outside disaster areas (in logarithm)		0.0449	0.0442		0.0486**	0.0483**
		(0.0317)	(0.0317)		(0.0190)	(0.0189)
Observations	764	764	764	764	764	764
Adjusted R^2	0.868	0.873	0.873	0.903	0.905	0.904
Lagged outcome	YES	YES	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES	YES
Fiscal-year-end fixed effect	YES	YES	YES	YES	YES	YES

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Outcome variables and lagged outcome variables are taken in logarithm. The variable "Subsidies" is a dummy that is 1 if the subsidy is received. In each panel, I run the same set of estimation equations for different samples.
Source: Author's own using data from Tokyo Shoko Research (2011–2014).

In contrast, column (6) of Table 7 suggests that either the subsidy or the links with firms outside the disaster area has a substantial positive impact on the employment level in 2013. This implies that support from outsiders, including government and firms located far away, helps restore facilities that are expensive or face excessive demand after the disaster and helps reduce damaged firms' monetary burden for restoring them. If firms worry about the repayment of loans received to restore facilities and they already have the minimum number of employees to operate, they may hesitate to hire extra employees. Thus, to recover the employment level, firms must have positive prospects of their own business. As described at the beginning of subsection V.C.2 (this section), because retailers are less likely to receive enough support for restoring physical capital, they benefit only from the subsidy. The impact on other secondary industries can be interpreted similarly. In contrast, because the manufacturing sector and other service industries received enough support from other firms, additional support by the government had a limited impact. The positive sign of the coefficient of private support from firms within the disaster areas on the employment level in the other

secondary industries and services may imply that for sectors that need some basic repairing but do not need massive restoring, not only support from outsiders but also relatively small support within disaster areas can contribute to their complete recovery.

For reference, I again show the estimation results of equation (1) in columns (1) and (4) of Table 7, which are the same as those in columns (2) and (4) of Table 2. They show the effect of the subsidy on sales and employment by sector and suggest that the significant positive effect of the subsidy appears only for the retail and other secondary industries. Similarly, columns (2) and (5) of Table 7 show that the size of the coefficients of private support is similar between with- and without-subsidy variables in the estimation equations. To summarize all the findings in Table 7, the subsidy has a significant impact only when private support is not enough, and retailers and firms in other secondary industries tend to lack private support.

VI. CONCLUSION

This paper investigates the heterogeneity in the impact of government support for SMEs in the recovery from disasters and explores the mechanism behind it. To this end, I use a rich firm-level dataset on Japanese firms that contains information on their supply chain and basic attributes. I employ an estimation strategy that combines a PSM procedure with an ANCOVA estimator to address the potential selection problem inherent in an analysis of government support's effect on firm performance. The results suggest that government support is effective only in the retail and other secondary industries. This is consistent with previous findings from a developing country. Unlike the study of developing countries, I have well-covered supply chain data, and thus, I can further explore possible mechanisms behind sectoral heterogeneity

I discuss two possible mechanisms. First, disruptions in supply chains may limit the recovery of firms, even if the firms themselves successfully restore their facilities. Second, private support from other firms, which was provided prior to the subsidy, was enough for some sectors; thus, for them, the impact of the subsidy was limited. I find evidence for the latter. As retail and other secondary industries rely less on their facilities for operation than other industries, and in the short run can operate even with damages to their facilities, other firms, which provide support to avoid the negative propagation effect from the disaster-hit firms, may offer less support to these sectors. However, in the long run, firms in these sectors also need to fix the damages to their facilities. Without the subsidy, these costs can squeeze the management of these firms. This may be why the subsidy had a positive impact on these sectors. Today, the frequency and the severity of disasters are increasing. In addition, the scope of public support for recovery also tends to be expanded in many countries. Therefore, I believe that the knowledge on how public support might be more effectively provided is valuable in the era of increasing disasters.

REFERENCES

Altay, Nezih, and Andres Ramirez. 2010. "Impact of Disasters on Firms in Different Sectors: Implications for Supply Chains." *Journal of Supply Chain Management* 46 (4): 59–80. doi: 10.1111/j.1745-493X.2010.03206.x.

Barrot, Jean-Noël, and Julien Sauvagnat. 2016. "Input Specificity and the Propagation of Idiosyncratic Shocks in Production Networks." *The Quarterly Journal of Economics* 131 (3): 1543–92.

Benali, Nadia, Ines Abdelkafi, and Rochdi Feki. 2018. "Natural-Disaster Shocks and Government's Behavior: Evidence from Middle-Income Countries." *International Journal of Disaster Risk Reduction* 27: 1–6. https://doi.org/10.1016/j.ijdrr.2016.12.014.

Blundell, Richard, and Monica Costa Dias. 2000. "Evaluation Methods for Non-Experimental Data." *Fiscal Studies* 21 (4): 427–68.

Cabinet Office of Japan. 2011. *Chiiki no keizai 2011*. Edited by Government of Japan Cabinet Office. Tokyo.

———. 2016. *Saigai risk eno keizaitekina sonaenikannsuru gennjyo*. Edited by Government of Japan Cabinet Office. Tokyo.

Carvalho, Vasco M., Makoto Nirei, Yukiko Saito, and Alireza Tahbaz-Salehi. 2014. "Supply Chain Disruptions: Evidence from the Great East Japan Earthquake." Unpublished paper.

De Mel, Suresh, David McKenzie, and Christopher Woodruff. 2012. "Enterprise Recovery Following Natural Disasters." *The Economic Journal* 122 (559): 64–91. doi: 10.1111/j.1468-0297.2011.02475.x.

Dickson, Keith, and Rajitha Kangaraarachchi. 2006. "Sri Lankan Experiences of Post-Tsunami Small Business Survival and Recovery." Belfast: British Academy of Management Annual Conference, 1–19 September.

Garrett, Thomas A., and Russell S. Sobel. 2003. "The Political Economy of FEMA Disaster Payments." *Economic Inquiry* 41 (3): 496–509. doi:10.1093/ei/cbg023.

Görg, Holger, Michael Henry, and Eric Strobl. 2008. "Grant Support and Exporting Activity." *The Review of Economics and Statistics* 90 (1): 168–74.

Hsu, Po-Hsuan, Hsiao-Hui Lee, Shu-Cing Peng, and Long Yi. 2018. "Natural Disasters, Technology Diversity, and Operating Performance." *The Review of Economics and Statistics* 100 (4): 619–30. doi: 10.1162/rest_a_00738.

Iwate Prefectural Office. 2018. "Group Subsidies (saitaku-jyokyo)." http://www.pref.iwate.jp/sangyoushinkou/shougyou/18613/index.html.

Kashiwagi, Yuzuka, Y. Todo, and P. Matous. 2018. "International Propagation of Economic Shocks through Global Supply Chains." WINPEC Working Paper. Tokyo: Waseda Institute of Political Economy.

McKenzie, David. 2012. "Beyond Baseline and Follow-Up: The Case for More T in Experiments." *Journal of Development Economics* 99 (2): 210–21.

Nakazawa, Kosuke. 2018. *Daisaigai de Hisaishitahiuga "toku" wo suru seihu no sienseido*. Shinken Press.

The National Conference of the Association of Small Business Entrepreneurs. 2013. *Hisaichi Kigyo no Jittai to Youbouchosa Report*. Tokyo.

Runyan, Rodney C. 2006. "Small Business in the Face of Crisis: Identifying Barriers to Recovery from a Natural Disaster1." *Journal of Contingencies and Crisis Management* 14 (1): 12–26. doi:10.1111/j.1468-5973.2006.00477.x.

Sawada, Yasuyuki, and Yoshito Takasaki. 2017. "Natural Disaster, Poverty, and Development: An Introduction." *World Development* 94: 2–15. https://doi.org/10.1016/j.worlddev.2016.12.035.

Skoufias, Emmanuel. 2003. "Economic Crises and Natural Disasters: Coping Strategies and Policy Implications." *World Development* 31 (7): 1087–102. http://dx.doi.org/10.1016/S0305-750X(03)00069-X.

Small and Medium Enterprise Agency of Japan. 2011. *Chusho Kigyo tou Gurupu Shisetsu tou Hukkyu Seibi Hojo Jigyo ni Tsuite* (Report on Subsidies for the Recovery of Facility of Groups of Small and Medium-Sized Enterprises). Tokyo: Government of Japan. http://www.chusho.meti.go.jp/earthquake2011/download/110805EqSeibiSaitaku-0.pdf.

———. 2012. *White Paper on Small and Medium Enterprises in Japan* (Japanese). Tokyo: Government of Japan.

———. 2018. *White Paper on Small and Medium Enterprises in Japan*. Tokyo: Government of Japan.

Teikoku Databank. 2016. *Shinsai 5 nen jiten de, zenntai no 3 wari, 1400 sya ga kyuhaigyo* (Japanese). https://www.tdb.co.jp/report/watching/press/pdf/p160302.pdf.

Todo, Yasuyuki, Kentaro Nakajima, and Petr Matous. 2015. "How Do Supply Chain Networks Affect the Resilience of Firms to Natural Disasters? Evidence from the Great East Japan Earthquake." *Journal of Regional Science* 55 (2): 209–29. doi: 10.1111/jors.12119.

Wakasugi, Ryuhei, and Ayumu Tanaka. 2013. *Determinants of the Reconstruction Period from the Great East Japan Earthquake: Evidence from Manufacturing Firms in Tohoku* (Japanese). Tokyo: Research Institute of Economy, Trade and Industry.

Yoshida, Kosaku. 2011. *Higashinihon Daishinsai kara Mananda. "Kyouso kara Kyocho e" to iukoto*. In *Tokeigakusya Yoshida Kosaku (Prof.) no Tokeiteki Shikojyutsu*. Tokyo: Nikkei Business Online.

Postdisaster Subsidies for Small and Medium Firms

Insights for Effective Targeting

This paper explores the effect of postdisaster capital subsidies on the recovery of small and medium-sized enterprises (SMEs) and how policy makers could target public support more effectively. It examines the effects of government subsidies provided to SMEs after the Great East Japan Earthquake of 2011. It finds that these were effective in the retail sector but made no significant difference in the manufacturing and other service sectors. The results suggest that this difference arose from variations in the degree of private support across sectors rather than from variations in supply chain disruption.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

ADB

ASIAN DEVELOPMENT BANK
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org