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Great East Japan Earthquake and Risk Management for Small and Medium-Sized Enterprises —How Do Japanese SMEs Prepare against Natural Disasters?—

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Great East Japan Earthquake and Risk Management for Small and Medium-Sized Enterprises[#]

—How Do Japanese SMEs Prepare against Natural Disasters?—

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Abstract

We conducted a questionnaire survey regarding insurance and risk management of small and medium-sized enterprises (SMEs) all over Japan in 2014. Based on that survey, this research examined who prepared less against natural disasters before the 2011 Great East Japan Earthquake and how seriously Japanese SMEs with poor risk management were affected by the earthquake. We find that SMEs in a weaker financial condition tended to take fewer measures against earthquakes before the Great East Japan Earthquake. We also find that companies in a weaker financial condition tend to prepare less for earthquake risks even after the Great Earthquake. Furthermore, we find that direct damages from the Great East Japan Earthquake were more serious for SMEs with poor risk management than for those with sound risk management.

JEL Codes: G22, G31

Keywords: small and medium-sized enterprises (SMEs), earthquake insurance, risk management, natural disasters

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1. Introduction

In recent years, the number of natural disasters has increased worldwide, and large earthquakes have been occurring frequently in Japan. In the Great East Japan Earthquake, which occurred on March 11, 2011, approximately 20,000 people died or went missing, and the damage caused by the earthquake amounted to 16.9 trillion yen according to the estimation by the Cabinet Office of the Japanese Government. [1] As Yamori and Okada (2007) point out, an extremely important issue is how to use risk management methods, including insurance, to deal with earthquake risks for the economic agents in Japan, where there are many earthquake disasters. On the other hand, according to Swiss Re (2015), the reality is that insurance coverage for natural disaster damage in Japan is the lowest by far as compared to other countries, and many economic actors in Japan are not using insurance for earthquake risks. [2]

While the occurrence of natural disasters cannot be controlled, it is possible to reduce the economic impacts caused by them through several preparations, including seismic reinforcement works and post-disaster handling plans (or business continuity planning), which will enable prompt restoration. In fact, many large Japanese companies implement full risk management for natural disasters. For instance, many large companies have built major factories in multiple locations (including overseas), and they often designate a facility in a remote location that can assume headquarter functions in the case of an emergency.

However, it is often the case for small and medium-sized enterprises (SMEs) that the major factory also functions as the headquarters, and the companies are not large

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[1] Since the exchange rate of March 2011 was approximately 80 yen per US dollar, it was approximately 210 billion dollars. This exceeds the damage from Hurricane Katrina in the United States (about 70–130 billion dollars).

[2] For example, according to Swiss Re (2015), the penetration rate of earthquake insurance for corporate assets is very high in Chile and New Zealand, while that of Japan, the State of California, Mexico, and Turkey is extremely low.

enough to disperse factories in remote locations. For SMEs, the sources of revenue (a major market, for instance) are not geographically diversified as compared to those of large companies. Therefore, in many cases, major business partners (e.g., major purchasers) simultaneously suffer from damage caused by the same disaster due to their physical proximity. As a result, not only direct damage but also indirect damage, such as from the loss of sale contracts and suppliers, could become serious. In this way, since SMEs are more vulnerable to disaster risks than are large companies, it can be said that disaster-risk preparations would critically affect the fate of SMEs.

In this paper, the current situation regarding how SMEs utilize insurance against disaster risks will be examined first, using a questionnaire survey conducted by the authors. Second, we will examine how the difference in the financial health of SMEs before the Great East Japan Earthquake affected preparations for natural disasters. Third, we will examine how the experience of the Great East Japan Earthquake has affected corporate risk management activities. Last, we will see whether advance risk management eased the deterioration of financial conditions caused by the earthquake.

Major results are as follows. First, most companies have insurance that covers risks from fire, storm, and flood damage, but less than half of the companies use insurance for earthquake risks. Second, the more inferior the financial condition of the company was, the less prior risk management was conducted. Third, the experience of the Great East Japan Earthquake has promoted company risk management activities, but it was also discovered that the difference in financial conditions of the companies affected post-disaster handling measures. In other words, companies in an inferior financial condition were more vulnerable to disaster risks, but such vulnerable companies were less likely to be prepared for disaster risks. Therefore, in order to achieve a smooth revitalization from the massive earthquake disaster that is expected to strike in the near future, it is urgent to construct a support scheme that enables even vulnerable companies to revitalize rapidly after a disaster.

This paper is constructed as follows: We will briefly review the influence of the Great East Japan Earthquake on the management of SMEs and insurance utilization in Section 2. In Section 3, the data used in this paper will be introduced. In Section 4,

analysis results will be explained and discussed. Finally, challenges for the future will be summarized in Section 5.

2. Great East Japan Earthquake and utilization of earthquake insurance by SMEs

2.1 Previous research related to earthquake insurance in Japan

There is a limited amount of economic research related to earthquake insurance in Japan. For example, Yamori and Kobayashi (2002) analyzed the stock market immediately after the Great Hanshin Earthquake that occurred in 1995 and discovered that, unlike in the United States, the stock price of non-life insurance companies in Japan dropped significantly. Likewise, Takao et al. (2013) revealed that the stock price of non-life insurance companies in Japan significantly dropped after the Great East Japan Earthquake. These studies attempted to analyze the relationship between earthquakes and insurance providers (i.e., non-life insurance companies). On the other hand, not enough research has been conducted from the demand side. To fill this gap, this research will analyze the demand for insurance by SMEs from the standpoint of risk management activity against earthquakes.

2.2 Insurance usage by SMEs affected by the Great East Japan Earthquake

There are not many analyses of the impact of the Great East Japan Earthquake from the standpoint of corporate activities. One of the few attempts to do so is the Regional Industry Reconstruction Survey Research Project by the Graduate School of Economics and Management, Tohoku University. In this project, the Earthquake Reconstruction Research Center of the School conducted the “Factual Investigation of Companies Recovering from the Earthquake” annually, beginning in 2012.

This was a large-scale survey in which approximately 11,000 companies were surveyed, with approximately 5,700 companies submitting valid responses. The survey attempts to reveal the actual situation of disaster-affected companies with regard to their employment management, business investment, relocation, supply

chains, and financial arrangements. By using this survey data, Uchida et al. (2015) reported that only 2.1% of companies who did not obtain an additional loan from the bank "requested a new loan but were denied." Therefore, it seems unlikely that disaster-affected companies were discouraged from reconstructing due to financial restrictions. [3]

However, as Asai (2015) points out, for investments during normal conditions, the preferred sources for financial arrangements for SMEs are internal reserves (43.7%) and loans from financial institutions, such as banks and credit unions (51.8%). When restoration expenses are required due to damage caused by serious disasters (e.g., fire, earthquake and flooding), 58.6% of companies choose "purchasing insurance policy in advance" as the first means to acquire funds. This dramatically exceeds internal reserves (19.7%) and loans from financial institutions (18.7%). That is, it is indispensable to consider the role of insurance when considering financial arrangements for SMEs in the event of damage caused by natural disasters such as the Great East Japan Earthquake.

Based on the survey by Tohoku University, Nishiyama et al. (2014, 2015) indicated that the contract rate for earthquake insurance (or the specified earthquake risk contract) before the Great East Japan Earthquake was approximately 30% and increased to 40% after the earthquake (as of August 2013). Nishiyama et al. (2013) also showed that the companies who had purchased earthquake insurance before the earthquake had more than 50% of earthquake damage covered by insurance.

Thanks to contributions from the research team organized by Tohoku University, the role of insurance in the areas affected by the Great East Japan Earthquake can be analyzed. However, the occurrence of massive earthquakes in Japan is not limited to the Tohoku area, and a powerful earthquake that may bring heavy damage is expected to occur in the Pacific Ocean coastal areas. Moreover, there are great risks of

[3] Once a catastrophic disaster occurs, the debt-to-income ratio becomes enormous when a company wants to borrow new money from the bank. Therefore, many companies often hesitate to apply for new loans and give up on continuing the business.

volcanic eruptions, massive storms, and floods all over the country. Therefore, it is necessary to figure out how SMEs across Japan are preparing for natural disasters.

In this research using the results of questionnaires that we conducted in 2014, targeting not only the areas directly affected by the Great East Japan Earthquake but all areas of the country, we will analyze preparations against natural disaster damage by SMEs before and after the Great East Japan Earthquake.

2.3 Specified earthquake risk contact

The earthquake insurance mentioned in this research refers strictly to contracts for companies, not households.[4] With normal fire insurance for companies, neither fire damage caused by earthquakes nor direct damage caused by earthquakes, such as destruction and sinking, are covered. In order to get coverage for damage caused by earthquakes, it is necessary to purchase a specified earthquake risk contract in addition to fire insurance. Once firms purchase the specified earthquake risk contract, (a) fire caused by earthquakes or volcanic eruptions and damage caused by bursting or explosion, (b) damage from a tsunami caused by earthquakes or volcanic eruptions and damage caused by flooding or other water-related disasters, and (c) destruction, sinking, or outflow caused by earthquakes or volcanic eruptions are covered.

The earthquake risk contract is designed to provide customized coverage for every company.[5] Unlike the case with an earthquake insurance policy for a residential house, damage assessment for a company is not based on a three-step classification (i.e., total loss, half loss, or partial loss); rather, it is typical to compensate for actual damage. The insured company sets the deductible amount and payment limit before purchasing the insurance policy in consideration of the necessary insurance benefits and insurance costs. However, since the premium is expensive, there are few cases where the expected losses are fully covered by the specified earthquake risk contract.

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[4] Regarding public earthquake insurance for households in Japan, see Yamori et al. (2009), Naoi, Seko and Ishino (2012) and Jiang et al. (2013).

[5] Discussion in this paragraph is based on the findings of the Society for Natural Disaster Risk (2013).

Furthermore, many companies decide not to purchase any insurance coverage for earthquakes. As a result, earthquake insurance for companies is not as widespread as for residential houses.

For example, according to a press release from the East Japan Railway Company (JR East) after the Great East Japan Earthquake, JR East had purchased civil engineering structural insurance and a specified earthquake policy that would cover up to a compensation limit of 71 billion yen (with a 10-billion-yen deductible).[6] Although it suffered extraordinary losses costing more than 70 billion yen, it had received insurance compensation of only 24.2 billion yen as of March 2013. Furthermore, based on the fact that business profit dropped by more than 130 billion yen due to the Great East Japan Earthquake, earthquake insurance covered only a small part of the firm's actual damages.[7]

2.4 The situation of a specified earthquake risk contract after the earthquake

The "specified earthquake risk contract" for businesses (hereinafter, "specified earthquake policy") does not receive support from the Japanese government, and the insurance company must assume all risk.[8] Therefore, a situation sometimes occurred

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[6] Based on the company's financial reports for fiscal year ended in March of 2011. See the website for more details.
https://www.jreast.co.jp/investor/guide/pdf/201103guide3.pdf

[7] Additionally, JR East had purchased 260 million yen worth of earthquake insurance derivatives; however, since the requirements (an earthquake larger than a certain magnitude and whose seismic center is within 70 km of Tokyo Station) were not met as a result of the Great East Japan Earthquake, JR East did not receive money from the derivative contract.

[8] Some SMEs with fewer than 20 employees may use a house as an office or factory and may have purchased an earthquake insurance policy for an individual residence. The Japanese government is involved and supports earthquake insurance for individuals. The premium rate is publicly set. Therefore, it has different characteristics from the specified earthquake risk contract for private companies, and

in which “major non-life insurance companies stopped offering new contracts of the specified earthquake policy for earthquake insurance for businesses in March immediately after the earthquake” because “there was an increasing demand but they became cautious of enormous payout risks” (*Nihon Keizai Shinbun*, June 3, 2011).

In July 2011, the Tokio Marine and Nichido Fire Insurance Company took the lead and resumed offering earthquake insurance for businesses (*Asahi Shinbun*, July 7, 2011), but some insurance companies kept rejecting increased insurance demand for earthquakes for more than half a year. Companies that newly sought earthquake insurance policies ended up being uninsured (*Yomiuri Shinbun*, November 13, 2012). Thus, the market for earthquake insurance for businesses failed to function immediately after the Great East Japan Earthquake.

The background behind ceasing to offer new contracts is the problem of the reinsurance market onto which private insurance companies passed the earthquake risks. According to Society for Natural Disaster Risk research (2013), the payout of the specified earthquake risk insurance policy associated with the Great East Japan Earthquake was approximately 600 billion yen, and approximately 400 billion yen out of it could be recovered through reinsurance. Non-life insurance companies would reduce the impact of the Great East Japan Earthquake through reinsurance, but as a result, reinsurance companies began rejecting earthquake risk policies in Japan, and reinsurance contract renewals proceeded with difficulty. Since earthquake risks could not be reinsured, private insurance companies ceased to offer specified earthquake risk policies for businesses.

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caution is required not to consider them to be the same.

Since our survey was targeted only at companies with more than 20 employees, it does not include many of the companies that use a private residence as an office or factory. In fact, we asked the companies in the questionnaire about this issue, and only 3.9% of them said they used the residence of the business owner or an employee as an office or factory. Thus, the conclusion of this research will not be affected regardless of whether this fact is explicitly included.

3. Overview of corporate questionnaire used in the analysis

We created our own questionnaire, consisting of 41 questions.[9] The survey questionnaire was mailed to 3,500 companies at the end of January 2014.[10] The target was limited to small to mid-sized manufacturers across Japan (i.e., those with more than 20 and fewer than 299 employees).[11] We obtained responses from 909 companies (a response rate of 26.0%) by the end of February 2014.

Among 909 companies, 58 are in the Tohoku region, where the Great East Japan Earthquake hit. In other words, the remaining 854 companies are from areas not directly affected by the Great East Japan Earthquake.[12]

4. Analysis results

4.1 Insurance usage to prepare against disasters

4.1.1 Insurance as a countermeasure against risks and its relationship to business management

Our corporate questionnaire survey (hereinafter, “the survey”) gives examples of various risks and asks, “How much are they covered by purchasing insurance policies?” Table 1 indicates how well insured companies are against major risks.[13]

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[9] See Asai (2015) for details.

[10] The survey was outsourced to TEIKOKU DATABANK, a major credit research company in Japan.

[11] The reason the survey was limited to manufacturers is not that we are uninterested in non-manufacturers but that it is easier to grasp production facilities to be covered by non-life insurance in manufacturing businesses.

[12] They are 35 companies in the Hokkaido region, 243 in the Kanto region, 57 in the Koshinetsu region, 35 in Hokuriku region, 124 in the Tokai region, 188 in the Kinki region, 68 in the Chugoku region, 30 in the Shikoku region, and 69 in the Kyushu and Okinawa regions.

[13] Caution is required with regard to the degree of risk coverage, as it may contain

First, consider the “Overall” number listed in the first line for each risk. More than 60% of companies have “almost full coverage” for fire risks, and almost all companies are taking action against fire risks if “covered to some extent” is included. More than 80% of companies have insurance for storm and flood risks when “almost full coverage” and “covered to some extent” are combined.

In contrast, countermeasures against earthquake risks are extremely low. Less than 20% of companies have “almost full coverage,” and only a little over 40% of companies have any form of earthquake insurance even when “covered to some extent” is included. Thus, we can conclude that using insurance as a countermeasure against earthquake risks is not common among Japanese SMEs. [14]

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the subjective judgment of responders.

[14] Strictly speaking, specified earthquake risk policies that are currently sold do not cover 100% of the damage amount, so we must interpret the answer “almost full coverage” with caution. Namely, there are two types of specified earthquake risk policies for businesses: one type uses an “aggregate limit method” (in which an insurance company will pay for the damage, minus the deductible, if the damage is less than the limit amount), and the other uses a “reduced payout calculation method” (in which a percentage of the amount after the deductible has been subtracted from the damage amount will be paid out). For the aggregate limit method, except for the deductible, the total amount can be covered if the damage cost is a small amount, but once the damage cost exceeds the aggregate limit amount, it is only partially covered.

Table 1 Countermeasures against risks through purchasing insurance

		Almost full coverage	Covered to some extent	Not much covered	Hardly covered	Number of companies
Fire risks	**Overall**	**63.6%**	**33.5%**	**1.8%**	**1.1%**	**889**
	Company Segment I (49 points or less)	60.8%	36.0%	2.1%	1.1%	189
	Company Segment II (over 49, but 52 points or less)	58.2%	39.0%	1.1%	1.7%	177
	Company Segment III (over 52, but 55.5 points or less)	62.7%	34.3%	1.8%	1.2%	169
	Company Segment IV (over 55.5, but 60 points or less)	63.0%	33.9%	2.6%	0.5%	189
	Company Segment V (over 60 points)	73.9%	23.6%	1.2%	1.2%	165
Storm and flood risks	**Overall**	**44.4%**	**39.2%**	**9.8%**	**6.6%**	**878**
	Company Segment I	38.6%	45.1%	10.9%	5.4%	184
	Company Segment II	38.1%	42.6%	9.7%	9.7%	176
	Company Segment III	47.6%	37.5%	7.7%	7.1%	168
	Company Segment IV	44.1%	38.2%	12.9%	4.8%	186
	Company Segment V	54.9%	31.7%	7.3%	6.1%	164
Earthquake risks	**Overall**	**17.2%**	**27.5%**	**17.6%**	**37.6%**	**858**
	Company Segment I	18.2%	23.2%	20.4%	38.1%	181
	Company Segment II	15.8%	29.8%	18.1%	36.3%	171
	Company Segment III	16.0%	26.4%	17.2%	40.5%	163
	Company Segment IV	19.8%	24.7%	19.2%	36.3%	182
	Company Segment V	16.4%	33.3%	12.6%	37.7%	159

(Note 1) The insured situation against damage and loss of corporate assets caused by fire, storm and flood, and earthquake was queried.

(Note 2) Company segments I through V indicate responding companies that were classified into five categories depending on the “evaluation score” that indicated their financial health (provided by TEIKOKU DATABANK during the survey in 2014).

The second through fourth lines in each risk category in Table 1 indicate the results of insurance coverage situations depending on each company’s financial health. This research uses the evaluation score by TEIKOKU DATABANK for the responding company’s financial health. TEIKOKU DATABANK evaluated whether

“the company has healthy business operations, sufficient capacity to pay or can be a reliable business partner” and scored them out of a possible 100: the higher the score, the better their financial state. We split 909 companies into five groups based on their score and examine how each group purchases insurance for various risks. For convenience, the groups are named Company Segment I (49 points or less), Company Segment II (over 49, but 52 points or less), Company Segment III (over 52, but 55.5 points or less), Company Segment IV (over 55.5, but 60 points or less), and Company Segment V (over 60 points).

According to Table 1, Company Segment V, which includes companies in the healthiest financial condition, has the highest rate for “almost full coverage” for fire risks. However, even Company Segment II, which has the lowest rate for fire risks, is 58.2%, and it can be said that almost all companies have fire risk insurance coverage, if “covered to some extent” is included, regardless of their financial state.

As for storm and flood risks, unlike fire risks, 10 to 20% of companies are “not much covered” or “hardly covered.” Company Segment V has the highest rate for “almost full coverage,” which shows a tendency for good-standing companies to proactively use insurance as a countermeasure against disaster risks. However, it is notable that there is no significant difference depending on the company’s financial state if “covered to some extent” is included.

Finally, unlike the case with fire risks and with storm and flood risks, Company Segment V does not have the highest rate of “almost full coverage” for earthquake risks. Due to the nature of the specified earthquake insurance contracts, it seems reasonable to include “covered to some extent” for earthquake risks. When comparing the total of these two, Company Segment V more actively uses insurance for earthquake risks than Company Segment I. Therefore, it is possible to judge that, compared with the case of fire insurance, the financial state of a firm has a powerful effect on whether it purchases earthquake insurance.

Furthermore, if companies can deal with the risks by using the reserved capital or loan from financial institutions, the disasters won’t pose a significant problem for business operations. However, it can be expected that companies in a weakened financial state are lacking in such funds. Therefore, it should be expected for

companies in such a financial condition to have a higher rate of insurance coverage. Nevertheless, there is a tendency among companies in good standing to better prepare for risks by purchasing insurance. This demonstrates the possibility that the magnitude of earthquake damage would be predominant among financially weak companies. In other words, it indicates a strong possibility that companies that are already financially weak suffer catastrophic damage and extensive public assistance will be necessary.

4.1.2 Circumstances of purchasing a non-life insurance policy

We asked companies that have “almost full coverage” for fire, storm, and flood risks and companies that have “almost full coverage” or are “covered to some extent” for earthquake risks why they purchased an insurance policy for various risks. Table 2 indicates their reasons according to the company evaluation score category.

For any risk, low-scoring company segments have a higher rate of “requirement for loan by the bank.” For storm, flood, and earthquake risks, “opinions within your company (management and employees)” is low among low-scoring companies. It can be assumed that it is difficult for low-scoring companies to spontaneously implement far-seeing risk management. Therefore, even if such companies need insurance protection, it is conceivable that they tend not to take any specific actions unless proactive approaches come from outside of the company. For example, it is desirable for a financial institution that functions as a main bank to provide emphatic advice for risk management situations to SMEs. Tax accountants or CPAs can also play an important role for SMEs in this regard.

Table 2 Reasons for purchasing insurance (multiple answers)

		1. Requirement for loan by the bank	2. Request from the parent company	3. Request from stockholder	4. Recommended by the insurance agency	5.Recommended by tax accountant/CPA	6.Recommended by acquaintance, such as other companies in the same business	7.Opinions within your company (management and employees)	Number of respondents
Fire risks	Company Segment I	13.9 %	12.2 %	0.0%	57.4%	7.8%	6.1%	55.7%	115
	Company Segment II	12.6 %	11.7 %	1.9%	53.4%	11.7 %	3.9%	55.3%	103
	Company Segment III	10.4 %	15.1 %	0.9%	37.7%	5.7%	8.5%	66.0%	106
	Company Segment IV	4.2%	11.8 %	0.8%	39.5%	9.2%	2.5%	69.7%	119
	Company Segment V	4.9%	13.9 %	1.6%	46.7%	9.8%	3.3%	63.9%	122
Storm and flood risks	Company Segment I	14.1 %	14.1 %	0.0%	57.7%	9.9%	4.2%	50.7%	71
	Company Segment II	14.9 %	14.9 %	1.5%	52.2%	10.4 %	6.0%	53.7%	67
	Company Segment III	11.3 %	15.0 %	1.3%	35.0%	6.3%	10.0%	63.8%	80
	Company Segment IV	4.9%	11.0 %	0.0%	40.2%	9.8%	2.4%	68.3%	82
	Company Segment V	4.4%	14.4 %	2.2%	44.4%	7.8%	4.4%	65.6%	90
Earthquake risks	Company Segment I	9.3%	9.3%	0.0%	53.3%	13.3 %	6.7%	49.3%	75
	Company Segment II	11.5 %	11.5 %	0.0%	50.0%	14.1 %	5.1%	56.4%	78
	Company Segment III	10.1 %	10.1 %	1.4%	37.7%	8.7%	8.7%	65.2%	69
	Company Segment IV	2.5%	8.6%	1.2%	35.8%	13.6 %	3.7%	56.8%	81
	Company Segment V	3.8%	12.7 %	2.5%	45.6%	8.9%	5.1%	65.8%	79

(Note 1) “Others” and “don’t know” are omitted due to space constraints.

(Note 2) Fire, storm, and flood risks are calculated for companies that are “almost fully covered” by insurance. Earthquake risks target companies that are “almost fully covered” and “covered to some extent.”

4.2 Risk management before the earthquake

Because we could not obtain evaluation scores before the earthquake, we used the scores at the time of the survey in 2014 as a proxy variable of a company's financial state before the earthquake. Table 3 indicates the evaluation score calculated according to the implementation status of risk management, such as insurance, seismic strengthening, establishment of a business continuity plan (BCP), and confirmation of supply chains. [15]

First, "Overall" in Table 3 indicates the business behaviors of the entire body of responding companies. The number of firms that chose "Others" is small, but the average evaluation score was the highest. The comment section, not shown in this paper, suggests that these firms took extremely costly measures, such as "dispersal of production base" and "relocation." These measures would be applicable only when their financial state is in absolutely excellent condition. Therefore, it is understandable that the average evaluation score for them is high.

"Seismic strengthening" is chosen by relatively financially successful companies, as it requires construction costs. On the other hand, it is notable that the evaluation score of the company that selected "Nothing special" is the lowest among six answers. This indicates that relatively financially inferior companies tend not to take any countermeasures in advance. Financially inferior companies are expected to be vulnerable to negative impacts caused by natural disasters, and they are strongly encouraged to be more prepared for disruptive shock than other companies, but such countermeasures are not necessarily enacted.

[15] As the survey was conducted in 2014, we should acknowledge that only the companies that survived the effects of the Great Earthquake are respondents. In other words, since we don't know the circumstances of the companies that went bankrupt due to lack of preparation, it is possible that we are underestimating the earthquake damage for unprepared companies.

In order to show this point more clearly, the right side of Table 3 indicates that responding companies were divided into five categories based on the score that shows their financial state, as mentioned above, and sorted according to the risk management implementation status by each evaluation score class. The rate of "Nothing special" is more than 70% in company segments I and II, which are financially inferior, while the rate for the same in Company Segment V, which is in excellent financial condition, is around 60%. This proves that risk management significantly depends on the company's financial state.

With the exception of "establishment of business continuity plan," the selection rates of Company Segment V are the highest regarding three measures (e.g. seismic strengthening). As for "seismic strengthening," there is a significant difference at the 1% level (one-sided test) between company segments V and I.

Table 3 Company's financial state by risk management implementation status before the Great East Japan Earthquake

	Overall		By financial state				
	Evaluation score	Number of companies	Company Segment I	Company Segment II	Company Segment III	Company Segment IV	Company Segment V
1.Seismic strengthening (of office, store, and factory)	56.0	66	4.7%	7.2%	7.0%	6.1%	12.0%
2. Purchasing earthquake insurance (for office, store, and factory)	54.5	134	14.6%	10.6%	15.8%	15.3%	18.1%
3. Establishment of business continuity plan (BCP)	54.7	82	6.8%	10.0%	8.2%	11.2%	9.0%
4.Confirmation of supply chain	55.4	46	3.6%	4.4%	5.3%	5.6%	6.6%
5. Others	58.3	8	0.0%	0.0%	0.6%	3.1%	0.6%
6. Nothing special	53.9	607	71.9%	72.8%	66.1%	63.8%	60.2%
Score/number of companies	54.2	905	192	180	171	196	166

(Note 1) For the "Overall" section, the average evaluation score provided by TEIKOKU DATABANK was calculated for companies who responded that they implement each risk management.

(Note 2) For company segments I through V, based on the evaluation score, the "By financial state" section indicates the rate of companies among each company segment that chose each risk management measure.

4.3 Influence of the Great East Japan Earthquake on risk management activities

In this survey, we asked the respondents about "new risk management measures against earthquake after the Great East Japan Earthquake." We provided the following five choices: "seismic strengthening (of office, store, and factory)," "purchasing earthquake insurance (for office, store, and factory)," "establishment of business continuity plan (BCP)," "confirmation of supply chain," "others," and "nothing special." Based on the answers regarding each risk management option, we

divided respondents into three categories: “has been implemented since before the earthquake,” “began implementation after the earthquake,” and “not implemented.” [16]

Using the evaluation score provided by TEIKOKU DATABANK, Table 4 indicates a company’s financial health by the change in implementation of each risk management measure. When “began implementation after the earthquake” and “not implemented” are compared, the evaluation score of the company that “began implementation after the earthquake” is higher in any of the four risk management measures. There is a significant difference in the evaluation score for both of them for “confirmation of supply chain” and “establishment of business continuity plan (BCP).” This suggests that financially successful companies are proactively working on these two risk management methods after the Great East Japan Earthquake. [17]

Table 5 indicates the rate of companies that did not implement any countermeasures before the earthquake but newly implemented them after the earthquake. For example, the rate of new adoption of these countermeasures among the most financially inferior Company Segment I is 2.7 to 8.4%, while that of the most financially successful Company Segment V is 4.1 to 15.2%. In other words, the companies that belong to the low evaluation score category have a low rate of newly adopting countermeasures.

Summarizing the above, the more inferior the financial state of the company is, the fewer countermeasures are taken. Many companies began implementation of countermeasures after the earthquake, but the tendency is that financially inferior companies have not yet taken countermeasures, even after the earthquake.

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[16] Strictly speaking, there is a possibility that risk management that had been implemented was canceled after the earthquake. Since we cannot find out about that in this survey and it is unlikely that risk management was canceled after the Great Earthquake, we do not consider the possibility of cancellation of risk management.

[17] However, the evaluation score used in this research paper was available at the time the questionnaire survey was conducted. We must note that implementation of a high level of risk management after the earthquake may be boosting the evaluation score.

Table 4 Average evaluation score by risk management implementation status after the Great East Japan Earthquake

		Evaluation score	Degree
Seismic strengthening	Implemented before the earthquake	56.0	66
	Newly implemented after the earthquake	54.6	43
	Not yet implemented	54.0	796
Earthquake insurance	Implemented before the earthquake	54.5	134
	Newly implemented after the earthquake	55.1	51
	Not yet implemented	54.1	720
BCP	Implemented before the earthquake	54.7	82
	Newly implemented after the earthquake	55.4	109
	Not yet implemented	54.0	714
Supply chain	Implemented before the earthquake	55.4	46
	Newly implemented after the earthquake	55.7	59
	Not yet implemented	54.0	800

Table 5 Companies that newly implemented risk management after the Great East Japan Earthquake (classified by financial state)

	Company Segment I	Company Segment II	Company Segment III	Company Segment IV	Company Segment V
1.Seismic strengthening (of office, store, and factory)	2.7%	5.4%	6.9%	6.5%	4.1%
2. Purchasing earthquake insurance (for office, store, and factory)	4.9%	6.8%	6.3%	6.0%	9.6%
3. Establishment of business continuity plan (BCP)	8.4%	14.8%	11.5%	16.7%	15.2%
4. Confirmation of supply chain	3.2%	7.0%	8.6%	7.6%	8.4%
Number of companies	183	167	159	184	146

(Note) The table indicates the ratio of companies that newly implemented countermeasures after the earthquake, using the companies that did not implement them before the earthquake as a denominator.

4.4 Precautionary countermeasures and the earthquake's impact on business performance

In this paper, we focus on whether precautionary countermeasures alleviated the economic difficulties in SMEs after the Great East Japan Earthquake. To reveal this, in the survey, we asked, "How was your company affected by the Great East Japan Earthquake?" and asked companies to select an answer from among five choices: "deficit expanded," "turned from surplus to deficit," "hardly affected," "turned from deficit to surplus," and "surplus expanded." We defined the companies that chose "deficit expanded" and "turned from surplus to deficit" as deteriorated companies, and we focused on the share of deteriorated companies (i.e., downturn rate). Overall, among 860 responding companies, 57 of them (6.5%) chose "deficit expanded," and 77 (8.8%) chose "turned from surplus to deficit."

In order to see the effect of precautionary countermeasures, after classifying them by whether there was direct damage to the company assets, the earthquake's impact on company performance was examined in the company evaluation score category. The rate of deteriorated companies is used for the impact on company performance.

Looking at Table 6, when compared between the presence and absence of direct damage, the downturn rate of companies that had "presence of direct damage" is higher as a matter of course. However, the most important things are the following two aspects: First, the lower the evaluation score of the company is, the higher the downturn rate is. For instance, in case of "presence of direct damage," there is a difference of more than 50 percentage points in the downturn rate between company segments I and V. It is conceivable that preparedness contributes to a difference in the degree of performance deterioration even when firms were affected by damage in the same way. In case of "absence of direct damage," the difference between them is reduced to 15 percentage points, but it is clear that the financial health of Company Segment I had worsened more significantly.

Second, the lower the evaluation score of the company is, the more significant the difference in downturn rate is, depending on the presence and absence of direct damage. For example, among Company Segment I, the downturn rate with the "absence of direct damage" is 22.9%, while companies with the "presence of direct

damage" account for a high rate of 64.7%, a difference of more than 40 percentage points. On the other hand, the difference between them in the financially excellent Company Segment V is less than 5 percentage points. This could be because risk management for companies with a high evaluation score functions thoroughly even if direct damage has occurred, and they can keep the damage to the minimum, while companies with a low evaluation score do not implement sufficient risk management in advance to reduce damage. Thus, these companies leave their business operation to chance. It is often pointed out that SMEs in a deteriorated financial state do not have precise business management plans, but the same issue seems to exist in terms of risk management. [18]

Table 6 Financial state and company performance deterioration after the earthquake

		Company Segment I	Company Segment II	Company Segment III	Company Segment IV	Company Segment V
Absence of direct damage	Downturn rate	22.9%	12.0%	11.4%	9.6%	5.6%
	Number of companies	166	150	140	157	142
Presence of direct damage	Downturn rate	64.7%	48.0%	37.5%	16.7%	10.5%
	Number of companies	17	25	24	30	19

5. Conclusion

Using the data from questionnaires conducted from January to February 2014 regarding the insurance usage and risk management of SMEs, this research examined

[18] For instance, based on the questionnaire survey conducted in Yamori and Tsubuku (2015), the rate of "no management plan" is 17.1% among two-consecutive-term surplus companies, while that of two-consecutive-term deficit companies was 23.5%. On the other hand, when compared by business size, 30.6% of the companies with 10 or fewer employees have no management plan, while only 9.5% of companies with 51 or more employees have no plan.

their risk management implementation circumstances and their effects.

Quite a few companies took new countermeasures against earthquakes after the Great East Japan Earthquake. This is consistent with previous research on the demand for insurance. This is called a “wake-up call effect” in the literature. [19] In other words, experiencing catastrophic natural disasters makes people realize the risks, which results in increasing numbers of people who purchase insurance policies. Conversely, it means that people tend not to prepare for risks unless they experience a catastrophic disaster, which is consistent with the conclusion of this paper.

The importance of promoting awareness of the risks for SMEs is suggested in order to prevent panic after an earthquake has occurred. Although many companies have taken countermeasures after an earthquake, as noted in the proverb “vows made in storms are forgotten in calm,” the importance of preparedness seems to be easily forgotten even if the disaster was catastrophic. Therefore, we should emphasize the importance of promoting continuous awareness of disaster risks.

The most important finding of this research is that the more financially inferior the company was, the less risk management was implemented. Furthermore, it was revealed that the more financially inferior the company was, the fewer new risk management measures were implemented after the earthquake.

The premium for the specified earthquake insurance policy has no relation to credit risk, even for high credit risk companies that are financially inferior and have problems acquiring funds. That is to say, while premiums for earthquake insurance are affected by such factors as location and building structure, financially-weak companies can purchase earthquake insurance at the same price as highly credible companies do. Although financially inferior companies do not have enough money to purchase the insurance, purchasing earthquake insurance is a relatively inexpensive means to obtain capital.

A politically important issue is that the more financially inferior the company is, the less prepared it is for risks. Once a catastrophic disaster occurs, financially inferior companies suffer from major damage, as they are not fully prepared for

[19] See Yamori and Kobayashi (2002) and Shelor, Anderson, and Cross (1992).

disasters. Of course, it costs money for seismic strengthening and purchasing earthquake insurance, but risk management may be postponed due to poor judgment of the managers of SMEs.

Given the situation, proactive advice from financial institutions and external experts on the risk management of SMEs is necessary. In fact, many financial institutions have been addressing this issue. [20] Providing knowledge and support for SMEs that lack human resources are extremely important roles for financial institutions. Experts, such as tax accountants and CPAs, are also expected to enhance their skills to be able to provide advice on these matters.

Unless we provide support for SMEs, which lack human resources with expertise on seismic strengthening and risk management, it will be even harder to recover from catastrophic disasters. As shown by the fact that underwriting of earthquake insurance for businesses stopped after the Great East Japan Earthquake, compared to government-assisted earthquake insurance for residential houses, earthquake insurance for businesses is a commercially based product. In order to promote the purchasing of earthquake insurance for businesses, governmental involvement should be considered in the future. Grants and tax benefits for the implementation of seismic strengthening and for the establishment of business continuity plans should also be considered.

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[20] For instance, regarding the establishment of a business continuity plan (BCP), in January 2016, Hiroshima Bank began loan services that support disaster prevention measures and the establishment of a BCP that prepares a post-disaster early recovery plan for small to mid-sized companies (*Chugoku Shinbun*, January 13, 2016).

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