RESEARCH DIGEST

Research Digest is a clear and concise summary of main points and issues with policy implications that have been raised in RIETI discussion papers.

UESUGI Iichiro

UESUGI Iichiro is FF at RIETI and concurrent Associate Professor at Institute of Economic Research, Hitotsubashi University. He obtained his Ph.D. in economics from University of California, San Diego in 2000. He specializes in financial intermediation, small businesses, interfirm networks, and Japanese economy.
Selected publications include: "The Effectiveness of Public Credit Guarantees in the Japanese Loan Market" (with SAKAI Koji and Guy M. YAMASHIRO), *Journal of the Japanese and International Economies*, Vol.24, No.4, pp.457-480, 2010; "Firm Age and the Evolution of Borrowing Costs: Evidence from Japanese Small Firms" (with SAKAI Koji and WATANABE Tsutomu) *Journal of Banking and Finance*, Vol. 34, No. 8, pp.1970-1981, 2010.

Natural Disasters and Firm Dynamics

A key to restoration and rebuilding after the Great East Japan Earthquake is the rebirth and rebuilding of industries in the areas affected by the disaster. The question is how to go about revitalizing companies in the disaster areas? In searching for ways to that end, it is essential to obtain a grasp of the impact of such a disaster on corporate activities.

The Great Hanshin-Awaji Earthquake in 1995 is important from this standpoint. Analyzing its impact on corporate activities (referred to as "firm dynamics") should give us useful clues on how to revive industries following the Great East Japan Earthquake.

A research group led by Faculty Fellow UESUGI Iichiro, making use of corporate data compiled by Teikoku Databank, Ltd., analyzed trends in corporate bankruptcies, relocations, and capital investment in the area impacted by the Great Hanshin-Awaji Earthquake. From this analysis many insights were gained, including that (1) the bankruptcy rate inside the affected area was lower than that outside the area; (2) following the quake, the rate of corporate relocations from the affected area rose sharply; and (3) capital investment in the affected area did not grow immediately after the quake but instead a year later. The research results are compiled and published as RIETI's Policy Discussion Paper series PDP 12-P-001.

—What kinds of issues did you have in mind when you undertook this research project?

UESUGI: The Great East Japan Earthquake involved not only the quake itself but also a multiple tsunami and a nuclear power plant accident, causing the most destructive human and property damage since World War II. Realizing the immense difficulties faced by the affected areas, I had a strong desire to contribute as an economist to the recovery and rebuilding efforts. Around that time, RIETI President FUJITA Masahisa requested me to take up a research project related to earthquake disasters, and I became involved in this project.

Looking for Clues from the Great Hanshin-Awaji Earthquake on How to Rebuild Industry after the Great East Japan Earthquake

—Why did you decide to analyze the Great Hanshin-Awaji Earthquake instead of the Great East Japan Earthquake?

UESUGI: The rebuilding of local industry is necessary for recovery in the affected areas. Efforts by the individual companies are of utmost importance, but support by government measures from infrastructure provision to deregulation so as to create demand is also essential. We asked subsequently what should be done so that effective government policies may be devised and implemented. To answer that question, we needed knowledge concerning three points: (1) how the business environment has been changed by the disasters, (2) what action companies have taken to address those changes, and (3) the factors hindering corporate activities. A year after the Great East Japan Earthquake, however, such data has yet to be compiled. Without it, we could not gain sufficient insight.

As such, we decided to focus on the Great Hanshin-Awaji Earthquake that occurred on January 17, 1995.

PDP: 12-P-001 | Natural Disasters and Firm Dynamics
UESUGI Iichiro
http://www.rieti.go.jp/jp/publications/pdp/12p001.pdf

Enough time has passed since that event so that a fair amount of data has been compiled, which can be used for carrying out economic analysis. If we can clarify how firm dynamics changed after that quake, we should be able to obtain clues for rebuilding industry in the areas affected by the Great East Japan Earthquake.

—Was there any prior research in this area?

UESUGI: While searching for papers, we found a number of prior studies estimating the cost of damage to industry from the disasters, but we could not find any examples using company-level data to conduct detailed analyses of the medium-term changes in firm dynamics. This means that there is much significance to clarifying the impact of the disasters using micro-level corporate data.

Impact on Bankruptcies, Relocation, and Capital Investment Analyzed Using Corporate Data

— How did you handle the research?

UESUGI: This study was part of RIETI's Research on Efficient Corporate Financing and Inter-firm Networks project, which is being carried out by 15 participants including myself as the project leader. Our study was conducted by me and six other members: UCHIDA Hirofumi (Kobe University), UCHINO Taisuke (RIETI), ONO Arito (Mizuho Research Institute), HAZAMA Makoto (Hitotsubashi University Graduate School of Economics), HOSONO Kaoru (Gakushuin University), and MIYAKAWA Daisuke (Development Bank of Japan).

In the early stages, we met around once a month to discuss the framing of issues and research methodologies. As a result of these discussions, after clarifying the differences between the Hanshin and East Japan disasters, we decided to analyze three aspects of the Hanshin quake: (1) its impact on the continued existence or bankruptcy of companies, (2) the impact on company relocation, and (3) corporate capital investment after the disaster. Focusing particularly on the role of financial institutions, we investigated whether the bankruptcy, relocation, and fixed assets recovery by the affected companies were impacted if the financial institutions themselves suffered damage in the quake.

We spent time analyzing the data, and I wrote up the results, presenting them on September 18, 2011 at a special session of the Japan Society of Monetary Economics on "The Great East Japan Earthquake and Small Business Lending." This paper, the joint work of the seven authors, was then completed with a different title along with significant revisions to the contents and published as PDP 12-P-001.

—What kind of data did you use in the research?

UESUGI: Teikoku Databank stores a vast amount of corporate data on more than one million companies. We used a dataset created as part of a joint project by Hitotsubashi University and Teikoku Databank based on the Teikoku database. As of 1994, the project had compiled information on approximately 94,000 firms, of which around 19,000 were located in the area affected by the Great Hanshin-Awaji Earthquake. Additional use of financial data was possible for around 12,000 firms (of which around 2,000 were in the affected area), and they were the starting point for our analysis of bankruptcies and capital investment. Since we did not need detailed financial data to analyze relocation, all of the approximately 94,000 firms in the database were used as our basic sample.

The actual number of sample firms differed, however, for such reasons as the availability of variables used for each analysis. Estimating capital investment functions, in particular, the variables for fixed assets and so on, required data for both the current year and the previous year as well, so the number of sample firms used was about 8,500.

High Bankruptcy Rate among Quake-affected Firms with Banks in the Affected Areas

—What kinds of insights did you obtain from your analysis of bankruptcies?

UESUGI: It is generally assumed that when there is a devastating earthquake, the number of bankruptcies

rises. Among the factors for this are that companies become unable to stay in business due to damage to fixed assets such as factories, shops, and machinery as well as to their inventories, and the business activities of their clients stagnate, making it difficult for them to conduct sales and procure goods. Upon investigating whether bankruptcies actually rose due to the earthquake disaster, we discovered that the failure rate of companies in the affected area was always lower than for those outside the area. The rate was consistently between 0.3 and 0.9 percentage points lower in the former compared to the latter.

It is possible, however, that in evaluating the impact of a quake disaster on bankruptcies, more can be learned from looking at the changes than from the level of bankruptcies. Using only the bankruptcy rates prior to the quake as our benchmark, starting from 1991, we tried to compare the changes in bankruptcy rates thereafter inside and outside the affected areas, but again found that the rates in the former were more often lower than the latter.

—What did your analysis reveal?

UESUGI: We found three noteworthy points. The first is that the bankruptcy rate was not meaningfully affected by the degree of damage suffered. Bankruptcies did not increase and a greater degree of damage from the disaster did not necessarily lead to bankruptcy, apparently due to the use of credit guarantee programs and other support measures for quake-affected firms.

Second, damage to a firm's financial institution increased the likelihood of bankruptcy, regardless of whether the firm was inside or outside the affected area. This trend in particular did not appear before the quake but instead after it. For firms located in the disaster area, it seems that the bankruptcy rate went up for such reasons as the inability of their banks to provide funds when the bank itself suffered damage in the quake.

Third, when comparing the absolute values of marginal effect for the capital adequacy ratio, return on assets, and cash to debt ratio inside and outside the disaster area, we did not find that the figures inside the affected area were larger than those outside the area. We assumed that, due to the quake, uncertainties would increase and the effect of companies' soundness on bankruptcy rates would grow, but in reality that was not necessarily the case.

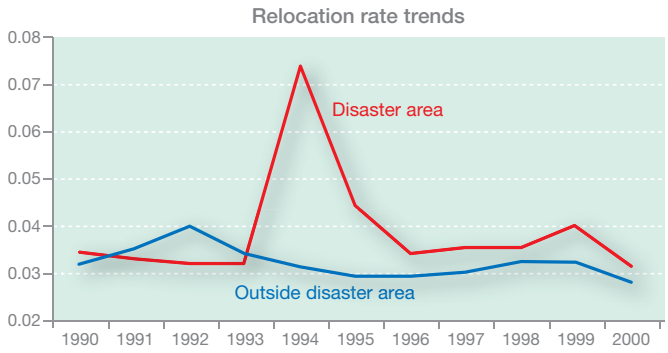
The Disaster Increased Company Relocation, but Mostly to the Near Vicinity

— In what ways did the disaster impact company relocation?

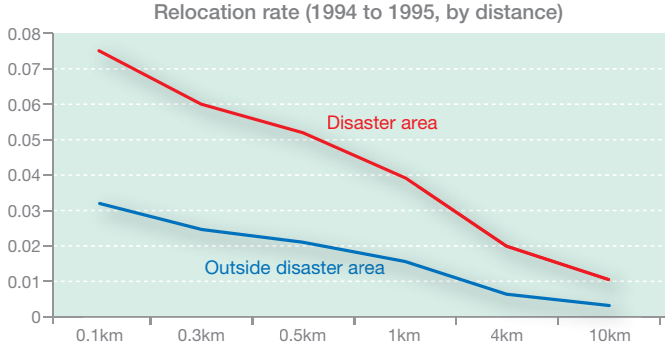
UESUGI: When a disaster strikes, some companies are forced to relocate to another area. We investigated the extent to which the quake increased the number of companies relocating and the factors causing them to do so. We also analyzed the impact on industry agglomeration relocation before and after the quake, and how the performance of industry agglomerations and individual companies changed after the quake.

When comparing the relocation rates inside and outside the disaster area, we found a large increase in the relocation rates of companies in the disaster area after the quake, well above the corporate relocation rates outside the area during the same period (Figure 1). The relocation rate from 1994 to 1995 was 7.4% inside the disaster area and just 3.1% outside.

Figure 1: Relocation rate



Note 1: Relocation rate is the number of companies relocating during the period from year *t* to *t+1* divided by the total number of companies in a year.
Note 2: Relocation is defined as movement of the head office by 0.1km or more.



Note 1: Relocation is defined as movement of the head office by 0.1km or more.

It must be noted carefully, though, that many companies relocated over short distances. Using a longer minimum distance in the definition of relocation would have lowered the relocation rate greatly. Short-distance

moves cannot really be considered as relocation and are not regarded as separation from the industry agglomeration. The relocation distance must therefore be looked at carefully, especially when talking about the impact of relocation on industry agglomerations.

—What changes were observed in industry agglomerations in the disaster area?

UESUGI: The area affected by the Great Hanshin-Awaji Earthquake includes heavily populated regions such as Kobe, which contains many industry agglomerations. Figure 2 shows the results of calculating the degree of industrial agglomeration in each of the districts based on office and company statistics for 1994 and selecting the top 10 districts and industries. Nagata-ku in Kobe is home to rubber and leather goods manufacturers, Chuo-ku hosts water transport industry and transport-related service industry companies, and Nishinomiya has many companies producing Japanese sake and other beverages.

Figure 2: **Districts and industries with a high degree of agglomeration in the disaster area prior to the quake (top 10 districts and industries)***

	Great Hanshin-Awaji Earthquake		
Rank	District	Industry	1994 Level
1	Nagata-ku	Rubber products manufacturing	0.0550
2	Higashinada-ku	Heat supply	0.0346
3	Nagata-ku	Leather, leather goods, fur manufacturing	0.0305
4	Chuo-ku	Water transport	0.0292
5	Chuo-ku	Transport-related services	0.0286
6	Amagasaki-shi	Technology R&D	0.0229
7	Itami-shi	Air transport	0.0229
8	Chuo-ku	Government, economics, cultural entities	0.0199
9	Toyonaka-shi	Heat supply	0.0188
10	Nishinomiya-shi	Beverages, tobacco, livestock feed manufacturing	0.0183

	Great East Japan Earthquake		
Rank	District	Industry	2009 Level
1	Hachinohe-shi	Fisheries (except aquaculture)	0.0244
2	Aoba-ku	Electrical	0.0204
3	Kesennuma-shi	Fisheries (except aquaculture)	0.0196
4	Aoba-ku	Ancillary financial services, etc.	0.0186
5	Aoba-ku	Health and sanitation	0.0165
6	Aoba-ku	School education	0.0148
7	Iwaki-shi	Fisheries (except aquaculture)	0.0134
8	Miyako-shi	Fisheries (except aquaculture)	0.0130
9	Miyako-shi	Aquaculture	0.0122
10	Aoba-ku	Broadcasting	0.0121

Note: Percentage of employees in industry *j* in district *r* out of the total number of employees nationwide in industry *j*

Data: From the editions for each year of the Establishment and Enterprise Census and Economic Census published by the Statistics Bureau, Ministry of Internal Affairs and Communications

By investigating the kinds of changes the disaster caused in districts and industries with high degrees of agglomeration, we observed that the higher the degree of industrial agglomeration in 1994, the greater the degree of its drop through 1996. This result would seem to indicate that the more heavily concentrated the districts and industries were in the disaster area, the greater the tendency for such agglomeration to be lost after the disaster.

We also analyzed the kinds of subsequent performance differences emerging between the companies in the disaster area that relocated and those that did not, but the results we obtained showed no significant effects on performance.

One Year after the Quake, Capital Investment by Affected Companies Grew

—What features did you find in capital investment trends by firms affected by the disaster?

UESUGI: In the case of companies before the quake operating with optimal capital stock and with no change in the business environment after the quake, it would be expected for them to increase their capital investment immediately, and in proportion to the extent of damage to their fixed assets. Many companies, however, faced funding constraints, and the amount of increased capital investment for recovering damaged fixed assets would likely differ from one company to another.

We therefore compared companies inside and outside the disaster area from 1993 to 1999 regarding how their capital investment trended before and after the quake, and how each item on their balance sheet changed in relation to changes in fixed assets. Up to 1995 when the earthquake struck, capital investment both inside and outside the disaster affected area had continued to decline, with the average falling to negative territory in 1995. Then in 1996, while capital investment by firms in the disaster area rose, it continued to trend negative among companies outside the area.

What these trends suggest is that companies that suffered damage to their fixed assets or other damage spent more aggressively than companies outside the affected area, not immediately after the quake but from 1995 to 1996. Looking at the financing patterns of quake-affected firms in 1996, they dealt with the in-

crease in fixed assets by dipping into their savings to a limited extent through borrowing and raising capitalization. There was a clear difference between firms in the affected area, which increased their borrowing, and those outside the area, whose borrowing declined.

As for the funding constraints owing to damage to a company's bank, not all of the companies in the sample were impacted. However, if we limit the sample to companies in the disaster area whose collateral value appears to have suffered from the damage to their fixed assets, this had the effect of reducing the amount of increase in their capital investment.

— How do you think the insights gained from this research can be used for recovery and rebuilding from the Great East Japan Earthquake?

UESUGI: It is true that there are major differences between the Great East Japan Earthquake and the Great Hanshin-Awaji Earthquake. The East Japan disaster caused widespread damage over areas of relatively low population, whereas the Hanshin quake was a direct hit on a heavily populated area. Another big difference is the nuclear plant accident that accompanied the East Japan disaster. There are also differences in the business performance of companies in the affected areas up to the time of the disasters.

Still, much of the insight obtained in this research can be used in the recovery and rebuilding efforts following the Great East Japan Earthquake. One important thing we learned, for example, is that firms doing business with financial institutions located in a disaster affected area tend to have higher bankruptcy rates. The Great Hanshin-Awaji Earthquake hit an area with many city banks and other financial institutions that were potential suppliers of funding, and would seem to have had weaker funding constraints than other areas. In spite of this situation, our studies indicated that there were funding constraints mainly due to the lending side. On the other hand, the areas affected by the Great East Japan Earthquake had fewer potential funding suppliers, so that the firms in need of borrowing may face much stronger funding constraints than those at the time of the Hanshin disaster. Considering this situation, we believe there is a particular need this time for public capital injections and other government measures to maintain the soundness of affected financial institutions so that companies can readily receive funding from their banks.

What needs to be kept in mind at the same time is that the average business performance of companies hit by the Great East Japan Earthquake was below that of the nationwide average. This is a major difference from the Great Hanshin-Awaji Earthquake, where the affected companies had been enjoying business performance at the same level as that of the national average. In disaster areas, it is very important to achieve the recovery and rebuilding of highly profitable companies. I believe we have to be careful, however, about blindly handing out new loans to companies without closely examining the likelihood of repayment. This could end up worsening the problem of providing funds even to those to whom they should not be provided.

— What are your insights regarding relocation?

UESUGI: In the case of the Great Hanshin-Awaji Earthquake, the relocation rate went up, but most of the relocations were over short distances. In contrast, it appears that the Great East Japan Earthquake will force many companies to move longer distances away, such as those that were located in areas where tsunami damage is expected again in the future, or in areas that had to be evacuated due to the nuclear plant accident. In such cases where it is difficult to obtain the external benefits of industry agglomerations, it will be necessary to discuss the needs of those companies and whether any effective policy measures can be taken. What may be necessary for the companies relocating far away are aggressive steps to create mechanisms for maintaining their existing clients while developing new ones.

— What kind of research do you plan to undertake in the future?

UESUGI: I would like to focus on the changes in firm dynamics due to the Great East Japan Earthquake, including the impact on the efficiency of the Japanese economy as a whole. Of particular interest here is company relocation. It is expected that this disaster will cause many companies to move away from their agglomerations. I would like to analyze the resulting changes in their performance, and whether they are maintaining their relationships with their existing clients. In the case of the Great Hanshin-Awaji Earthquake, we did not have detailed company data that included client information, but we are now able to utilize the Teikoku Databank data. By analyzing in detail the changes in the activities of relocating companies, we should be able to obtain insights of use for the rebuilding efforts.