Natural Disasters, Bank Lending, and Firm Investment*

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Abstract

This paper investigates the effect of the lending capacity of banks on firms' capital investment. To overcome the difficulty in identifying the lending capacity of banks that are purely exogenous to firms, we utilize the natural experiment presented by the Great Hanshin-Awaji (Kobe) earthquake that occurred in Japan in 1995. Using a unique firm-level dataset that allows us to identify firms and banks in the earthquake-affected area and combining this with the information on bank-firm relationships as well as financial statements, we find that the investment ratio of firms located *outside* the earthquake-affected area but having a main bank *inside* the area was smaller than that of firms located *outside* the area and having a main bank *outside* the area. This result implies that the weakened lending capacity of damaged banks exacerbated borrowing constraints to their client firms' investment. We also find that the negative impact is robust to two alternative measures of bank damage, that is, damage to the headquarters and the damage to the branch network. However, while the impact of the former emerged immediately after the earthquake, that of the latter emerged with a one-year lag. This difference in the timing of the impacts suggests that there were two different channels through which damage to banks affected client firms: the first was through the impairment of banks' managerial capacity to originate loans, while the second was through the impairment of their risk-taking capacity.

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1. Introduction

Does the lending capacity of banks affect the activities of borrowing firms? A vast literature has tried to answer this question since the seminal work by Bernanke (1983). However, researchers are faced with an identification problem: while lending behavior affects borrowing firms' performance, the performance of borrowing firms itself has a significant impact on the way lenders extend loans. This paper tackles this problem by taking advantage of a natural experiment presented by a natural disaster that allows us to single out a pure exogenous shock to firms' financing from banks.

A natural disaster may obliterate information on borrowers' creditworthiness accumulated by disaster-hit banks and destroy their managerial capacity to originate loans, including the ability to screen and process loan applications. A natural disaster may also cause damage to borrowing firms located in the neighborhood of such banks, leading to the deterioration in the banks' loan portfolio and risk-taking capacity. In either case, a disaster reduces the damaged banks' lending capacity. Thus, for those firms that are not directly damaged by the disaster, damage to banks that they borrow from is an exogenous shock that may affect the availability and cost of external funds those firms can access. A natural disaster thus provides us a good laboratory for studying the effect of banks' lending capacity on borrowing firms' investment.

By utilizing this natural experiment aspect of a disaster, namely, the Great Hanshin-Awaji (Kobe) earthquake that hit the area around Kobe City and Awaji Island in western Japan in January 1995, this paper examines whether damage to banks had an adverse impact on the investment of borrowing firms that did not sustain any damage. To do so, we construct and use a unique firm-level data set compiled from various sources. The data set includes information on firms' main banks,[1] firm investment, and whether banks and firms were located inside or outside the earthquake-affected area, as well as the financial statements of firms and banks. Our sample consists of four groups of firm-bank matches between damaged/undamaged firms and their damaged/undamaged banks. By comparing undamaged firm-damaged bank matches with undamaged firms-undamaged bank matches, we are able to single out the effect of damage to banks on the investment of undamaged firms.

Our main findings can be summarized as follows. First, firms located *outside* the earthquake-affected area but transacting with a main bank located *inside* the area had a lower investment ratio than firms transacting with a main bank located *outside* the area. This result implies that the exogenous damage to banks' lending capacity has a significant effect on firm investment. Second, the finding above is robust to two alternative measures of bank damage, that is, damage to a bank's headquarters, which aims to capture the decline in a bank's managerial capacity to process

[1] Our data set includes information on the banks that firms transact with. Among those banks, we treat the bank that a firm regards as the most important as the firm's main bank. See Section 5 for more details.

loan applications at the back office, and damage to a bank's branch network, which aims to capture the decline in a bank's financial health and risk-taking capacity. Our finding implies that both of these transmission mechanisms played a role. However, we also find that while the impact of the former transmission mechanism emerged immediately after the earthquake, that of the latter emerged only with a one-year lag. This difference in the timing of the impacts implies that the effect of impaired managerial capacity emerged immediately after the earthquake, while that of the deterioration in bank health emerged only after some time.

This paper is closely related to, and contributes to, two strands of literature.[2] The first of these consists of studies on the effects of bank lending on firm activities (e.g., Bernanke 1983). Many of these studies suffer from the identification problem, which we can overcome here by taking advantage of the natural experiment presented by the Kobe earthquake. A notable study that does circumvent the identification problem by taking a different approach is that by Peek and Rosengren (2000), who, given the substantial penetration of U.S. lending markets by Japanese banks, use the collapse in real estate prices in Japan in the 1990s as a natural experiment to examine the impact of an exogenous loan supply shock on construction activity in the United States. However, their analysis is based on aggregate data. Our firm-level data which make it possible to identify firms' main bank allows us to more precisely identify the mechanism through which the lending capacity of banks affect the activities of borrowing firms.

Although our primary interest is in the impact of damage to banks on borrowers unaffected by the disaster, we also investigate the direct impact of the earthquake on damaged firms' investment behavior. Thus, the other strand of literature that our study is related to is that on the effects of natural disasters on corporate activities and the economy as a whole. Many of these studies use country- or region-level data and so are unable to clarify the effects on individual firms. Our firm-level data allow us to extract more information on the recovery from natural disasters by taking firm heterogeneity into consideration. Exceptions in the literature are the studies by Leiter et al. (2009) and De Mel et al. (2010), which use firm-level data to investigate the recovery of disaster-hit firms, but the uniqueness of our study rests on the fact that we investigate the negative impact of damage to banks on borrowers unaffected by the disaster as well as the recovery of disaster-affected firms.

The rest of the paper is structured as follows. Section 2 reviews the related literature in more detail. Section 3 then provides a brief overview of the Kobe earthquake. Next, Sections 4 and 5 respectively describe our data and methodology, while Section 6 presents the estimation results. Section 7 summarizes the results.

2. Literature Review

[2] See Section 2 for a more detailed literature review.

2.1 Bank Loans and Firm Activities

There is a vast literature that empirically examines the effects of bank lending on the real economy. In his seminal paper, Bernanke (1983), using aggregate data, showed that bank failures significantly reduced aggregate production in the US economy during the Great Depression. His study, however, has been challenged on the grounds that it does not separate loan supply shocks from shocks to loan demand. In other words, the observed relationship between bank failure and aggregate production may simply capture the fact that recession caused bank failure. For example, using US state-level data for the 1990-91 recession, Bernanke and Lown (1991) find no significant relationship between bank lending and employment growth after controlling for industry composition, suggesting that a credit crunch was not a major cause of the 1990-91 recession.

The present paper is also closely related to event studies examining the effect of bank failures on the market values of their client firms. For example, Slovin et al. (1993) were the first to analyze the share prices of firms with a lending relationship with a (de facto) failed US bank (Continental Illionis Bank). This was followed by studies by Bae et al. (2002), Yamori and Murakami (1999), and Brewer et al. (2003a). All of these studies find a significant effect of bank failure on the firm value of their borrowers.[3] Similarly, Yamori (1999), investigating the failure of a Japanese regional bank (Hyogo Bank) located in the Hanshin area affected by the Kobe earthquake, finds that the stock market did distinguish solvent banks from problem banks.[4] The advantage of these event studies is that they are able to clearly identify bank failure shocks using high-frequency (daily) data. However, they have limitations as well. First, event studies hinge on the assumption of market efficiency as well as rational behavior by market investors, which rules out a possible overreaction to bank failures. Second, such event studies cannot be applied to non-listed firms. This paper directly focuses on the real activities of firms, i.e., their investment behavior, and hence does not depend on the market efficiency/rationality assumptions. In addition, we also cover unlisted firms, most of which are small- and medium-sized firms, which are likely to be most affected by shocks from lending banks.

Several other studies directly investigate the effects of bank failure or weak bank health on client firms using firms' financial statement data.[5] For instance, Hori (2005) examines the profitability of firms that borrowed from a failed large Japanese bank (Hokkaido-Takushoku Bank) and finds adverse effects for those client firms with a low credit rating. Similarly, Minamihashi (2011) analyzes the failures of two long-term credit banks in Japan and finds that these failures significantly decreased investment at their client firms.[6] Finally, Gibson (1995, 1997) finds that

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[3] Note, however, that Brewer et al. (2003a) also find that the magnitude of these negative effects on the firm value of borrowers is not significantly different from that on all other sample firms.

[4] See also Brewer et al. (2003b).

[5] Using only bank balance sheet data, Woo (2003) and Watanabe (2007) find that weakly capitalized Japanese banks reduced their lending in 1997, when the Ministry of Finance started to require rigorous self-evaluation of loans.

[6] See also Fukuda and Koibuchi (2007).

client firms of Japanese banks with a low credit rating significantly reduced their investment during the 1994-95 period.[7,8] However, these studies suffer from the identification problem, because the direction of the causality between bank failure or weak bank health on the one hand and client firms' bad performance on the other is unclear.

To resolve this identification problem, Peek and Rosengren (2000), as mentioned above, examined whether state-level construction activity in the United States was affected by the deterioration in the health of Japanese banks through the lending from their US branches. They find that the deterioration in Japanese banks' financial health had a negative impact on construction activity in the United States, which provides evidence that the causality likely runs from bank lending capacity to firm activities.

The identification strategy employed in this paper is similar to that in Peek and Rosengren (2000), since we examine the effect of damage to banks on firms that are located *outside* the earthquake-hit area. However, we have the advantage of being able to capture the effects of the damage to banks more clearly because we use firm- and bank-level data rather than state-level aggregate data, as Peek and Rosengren (2000) do, which cannot control for firm and bank heterogeneity.

2.2 Natural Disasters and Economic Recovery

Another topic that has received considerable research interest concerns the economic consequences of, and recovery from, major natural disasters. Natural disasters cost lives and destroy infrastructure, buildings, and machinery (thus affecting labor and capital), disrupt the business operations of firms directly affected by the disaster, and impact on the operations of not directly affected firms through upstream and downstream supply linkages. However, destroyed capital is typically replaced and firms' output and productivity tend to eventually recover. Although the findings of empirical studies are not always consistent, cross-country empirical evidence on the factors determining the extent of economic recovery following a major disaster on balance suggests that the updating of technology and/or of the composition of production factors, as well as factor accumulation, all play a role (Skidmore and Toya 2002, Okuyama 2003, Kahn 2005, Stromberg 2007, Toya and Skidmore 2007, Crespo-Cuaresma et al. 2008, Sawada et al. 2011).

However, compared with the rich literature on the macroeconomic impact of natural disasters, studies exploring the firm-level impact of, and subsequent recovery from, natural disasters are relatively scarce. Notable exceptions are Leiter et al. (2009) and De Mel et al. (2010). The former, examining the capital accumulation, employment, and productivity growth of European firms

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[7] See also Nagahata and Sekine (2005).

[8] Also note that Peek and Rosengren (2005), using data of Japanese listed firms for the period 1993-1999, find that banks expanded loans to unprofitable firms during this period. See also Caballero et al. (2008) for such "zombie" lending practices by Japanese banks in the 1990s.

affected by floods, find that the accumulation of physical capital and employment growth are significantly higher in regions experiencing a major flood-event, and that the positive effect prevails for firms with a higher share of intangible assets. The latter conducted surveys of enterprises in Sri Lanka following the 2004 tsunami and examined their recovery from the disaster. They randomly provided grants to some of the sample enterprises and investigated the impact of the grants on their recovery, thus providing a natural experiment to examine the financial constraints affected enterprises faced. They find that direct aid had a significant positive impact on the profits of tsunami-affected enterprises in the retail industry (but not in the manufacturing industry). However, probably partly reflecting the fact that their study focuses on micro-enterprises, they do not investigate the role of borrowing from banks, which in developed economies are the main providers of funds. The uniqueness of our studies lies in the fact that we investigate the impact that damage to banks has on non-affected as well as affected borrowers.

In this context, it is also worth mentioning the study by Sawada and Shimizutani (2008), which focuses on financial constraints not of firms but of households. Examining the consumption of households affected by the Kobe earthquake, they find that household consumption was influenced by the amount of assets that households owned (and that could be used as collateral), suggesting that borrowing constraints played an important role in the wake of the disaster.

3. Summary of the Kobe Earthquake

The Kobe Earthquake occurred on January 17, 1995. The total loss originating from this major natural disaster is estimated to have been 9.9 trillion yen, including 630 billion yen in business sector losses.[9] Table 1 provides an overview of the estimated damage, including the number of casualties and the number of housing units destroyed, compiled by the Fire and Disaster Management Agency of the Government of Japan as of May 19, 2006. The table indicates that there were more than 6,000 casualties and about 100,000 housing units were completely destroyed. The table also shows that there is considerable variation in the number of casualties and the extent of damage sustained by municipalities across the earthquake-affected area.[10] Specifically, the damage, as measured in terms of the ratio of the number of casualties to the total population and the ratios of the number completely and partly destroyed housing units in the total number of housing units, is concentrated in certain specific areas of Kobe City, including its Higashinada-ward, Nada-ward, and Nagata-ward.[11,12]

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9 Data provided by Hyogo Prefecture (http://web.pref.hyogo.jp/wd33/wd33_000000010.html).

10 The figures on the losses of housing units are taken from <http://web.pref.hyogo.jp/pa20/pa20_000000006.html>. The table covers all cities and towns in Hyogo Prefecture as well as some in Osaka Prefecture (for a total of nine cities and five towns in the two prefectures together) which were included in the Act Concerning Special Financial Support to Deal with a Designated Disaster of Extreme Severity by the Government of Japan.

11 To calculate these ratios, we used data from the 1990 *Population Census* (Ministry of Internal Affairs and Communications, Government of Japan) and the 1993 Housing and Land Survey (Ministry of Construction).

12 The ratios of completely destroyed, partly destroyed, and completely or partly destroyed housing units in the table

To understand the characteristics of firms located in the earthquake-affected areas at the time of the earthquake, it is helpful to look at data provided by Teikoku Databank, one of the leading business credit bureaus in Japan. Teikoku Databank compiles a comprehensive firm-level database that stores information on firm characteristics such as their location as well basic financial variables. Because this database covers most of the firms in Japan, it provides a general idea of the characteristics of firms in the affected areas.

Table 2 presents the industry composition of firms in the earthquake-affected area and compares this with all firms in the Teikoku Databank data as of 1994. The table shows that in the affected area, wholesale and manufacturing account for a larger share of firms, and construction as well as retail and restaurants account for a smaller share of firms than in Japan as a whole.[13,14] Next, Table 3 shows a number of financial indicators for firms in the affected area and in Japan as a whole as of 1994. The figures indicate that firms in the area affected by the earthquake had a higher capital ratio and a lower profit ratio than the nation-wide average. It is important to take these characteristics into account when examining the impact of the earthquake on firms' capital investment, because they potentially affect firms' access to external finance.

The database of Teikoku Databank provides information on which banks firms transacted with. Table 4 summarizes the banks whose headquarters are in the earthquake-hit regions. We will refer to these banks in the earthquake-affected area, i.e., banks that have their headquarters in the area, as "regional lenders" in this section[15]. Finally, Table 5 shows the share of earthquake-affected firms that had a lending relationship with one or more of the regional lenders.[16] As can be seen, more than 80% of firms had such a relationship, meaning that the impact of damage to banks in the region on firms' access to bank lending is potentially substantial.

4. Data

4.1 Data sources

To construct our data set for the analysis of firms' capital investment around the time of the

should be treated with a degree of caution, because the Fire Defense Agency and the Ministry of Construction (Housing and Land Survey) use slightly different definitions. For example, the ratio of completely or partly destroyed housing units in Nagata-ku is more than 90%, which seems to be excessively high. For a limited number of cities and towns, we can use alternative survey data collected by the Architectural Institute of Japan, which covers around 80% of the housing in Japan. [If we use these data, the completely-, half- and completely or half-destroyed rates of Nagata-ku are 25.6%, 22.0%, and 47.6%, respectively.

13 These numbers are computed from the database provided by Teikoku Databank, in which firms from the agricultural, forestry and fishery industries tend to be underrepresented.

14 A more detailed comparison of various characteristics of firms damaged by the Kobe earthquake with the national averages using the same dataset can be found in Uchida et al. (2012).

15 Note that "regional lender" defined in this section is different from a "regional bank," which refers to a bank associated with Regional Banks Association of Japan or the Second Association of Regional Banks. "Regional lenders" include all the regional banks, Shinkin banks *(shinyo kinko* in Japanese) and credit cooperatives, which are small credit unions (*shinyo kumiai* in Japanese) whose headquarters are located inside the earthquake-affected area.

16 In the table, a firm is considered as having a transaction relationship with the regional lenders if at least one regional lender is listed in the Teikoku Databank dataset as the bank that a firm transacts with.

Kobe Earthquake, we mainly rely on two firm-level data sources. First, information on firms' capital investment and financial conditions is obtained from the *Basic Survey of Business Structure and Activities* (BSBSA: *Kigyo Katsudou Kihon Chosa* in Japanese) compiled by the Ministry of Economy, Trade, and Industry. The main purpose of this survey is to quantitatively gauge the dynamics of Japanese enterprises, including capital investment, exports, foreign direct investment, and investment in research and development. To this end, the survey covers the universe of enterprises in Japan with 50 or more employees and paid-up capital of 30 million yen or more. From this data source, we obtain firm-level data on capital investment and capital stock.[17]

Second, we rely on the firm-level database provided by Teikoku Databank that we described above. As mentioned, in addition to information on firm characteristics, the Teikoku Databank data provide a list of banks that each firm transacts with, where firms rank the banks in the order of importance to them. As it is customary to consider the top-listed bank as a firm's most important bank, we define this bank as the firm's *main bank*. Using this information on main bank identity, we further augment the data provided by Teikoku Databank with financial information on banks obtained from Nikkei NEEDS Financial Quest provided by Nikkei, Inc. (Nihon Keizai Shimbunsha) and two other, paper-based sources.[18] This augmented dataset is then merged with the first data set from the BSBSA.

4.2 Sample Selection

The central aim of this paper is to investigate how firms' capital investment was affected by the earthquake. We treat firms whose headquarters are located in the earthquake-affected area as "damaged firms" (treatment group). The earthquake-affected area is defined as the nine cities and five towns in Hyogo and Osaka prefectures that were included in the Act Concerning Special Financial Support to Deal with a Designated Disaster of Extreme Severity by the Government of Japan.[19] Corresponding to this, we choose only firms located in Hyogo and Osaka prefectures as the control group in order to reduce differences in unobserved characteristics that may stem from region-specific factors. To further control for demographic changes in the firm cohort and to control for other unobservable factors affecting firm investment, we also restrict our sample to firms that do not exit from the sample over the five years from the earthquake. To exclude outliers, we drop observations for which the dependent variable or one of the independent variables falls in either of the 0.5% tails. The observation period is three fiscal years following the earthquake (i.e., t = FY1995,

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[17] As an alternative, we tried using the change in capital stock plus depreciation to compute an indirect measure of capital investment. However, we found that investment measured in this way involved serious measurement errors.

[18] These two sources are the "Financial Statements of Shinkin Banks in Japan" and the "Financial Statements of Credit Cooperatives in Japan," edited by Financial Book Consultants, Ltd. (Kinyu Tosho Konsarutantosha).

[19] The nine cities and five towns consist of Toyonaka City, Kobe City, Amagasaki City, Nishinomiya City, Ashiya City, Itami City, Takarazuka City, Kawanishi City, Akashi City, Tsuna Town, Hokutan Town, Ichinomiya Town, Goshiki Town, and Higashiura Town. Since then, Goshiki Town has been merged into Sumoto City, while Tsuna, Hokutan, Ichinomiya, and Higashiura towns have been merged into Awaji City.

FY1996, and FY1997).[20] Following these steps, our dataset consists of 270 damaged firms and 1,250 undamaged firms. These 1,520 firms make up our sample firms for the empirical analysis in the following sections.[21]

Note that the number of observations in our estimation is smaller than that in the dataset originally obtained from Teikoku Databank. This is mainly due to the following reasons. First, to use the precisely measured capital investment data only stored in BSBSA data and various firm characteristics including bank relation stored only in the Teikoku Databank data, we match these two datasets. Mainly because the sample size of BSBSA is much smaller than that of the Teikoku Databank data, this matching substantially reduces the size of our sample. Second, keeping the fixed cohort of firms to create a balanced panel also reduces the sample.

5. Methodology and Variables

5.1 Regression

We estimate the following Tobin's Q-type investment equation, which is augmented by dummy variables indicating whether a firm or bank is located in the earthquake-affected area as well as proxies for firm financial constraints and bank lending capacity:

$$\begin{aligned}\frac{I_{it}}{K_{it-1}} &= \beta_0 + \beta_1 F\_SALEGROWTH_{it-1} + \beta_2 F\_DAMAGED_i + \beta_3 B\_DAMAGED_{it-1} \\ &+ \beta_4 F\_DAMAGED_i * B\_DAMAGED_{i,t-1} + \beta_5 F\_CONSTRAINTS_{i,t-1} \\ &+ \beta_6 B\_CAPACITY_{it-1} + \varepsilon_{it} \qquad for \;\; t = 1995, 1996, 1997. \qquad (1)\end{aligned}$$

The dependent variable is the capital investment ratio, which is defined as the ratio of investment during period *t* to the capital stock at the end of period *t*-1. Q theory predicts that this ratio is correlated with Tobin's Q and the ratio is consequently widely used in existing empirical studies on investment. Taking into account the possibility that the effects of the earthquake damage on investment change over time, we run a cross-sectional regression for each fiscal year.

5.2 Explanatory Variables

We use a proxy for Tobin's Q and a variety of additional variables that may affect investment, as explained below. For all the variables except for the time invariant ones, we use a one-year lag.

5.2.1 Proxy for Tobin's Q

Since most of our sample firms are not listed on stock exchanges, we cannot use Tobin's Q

[20] The financial year for most firms in Japan starts in April and ends in March, so that FY1995, for example starts in April 1995 and ends in March 1996. For these firms, the Kobe Earthquake on January 17, 1995 occurred in FY1994.

[21] The sample size slightly varies over the sample period since we drop outliers for each year.

defined as the ratio of the market value to the replacement cost of capital, which represents firms' investment opportunity. Therefore, as a proxy for firms' investment opportunity, we use the growth rate of firms' sales (*F_SALESGROWTH*) following studies such as Shin and Stulz (1998), Whited (2006), and Acharya et al. (2007). *F_SALESGROWTH* is expected to take a positive sign.

5.2.2 Damaged firm dummy

Damaged firms lose part or all of their physical capital, resulting in a large marginal product of capital, so that such firms should have greater demand for capital than undamaged firms. While unfortunately we have no way of ascertaining whether a firm actually did sustain damage, or the extent of damage firms sustained, as a result of the earthquake, we assume that firms in the affected area did sustain some damage. To capture the demand for capital for the purpose of recovery from the damage, we use *F_DAMAGED* which takes a value of one if the firm is located in the earthquake-affected area that we defined above. We predict that this variable has a positive association with the investment ratio.

5.2.3Damaged bank variables

Our main interest lies in the effects of damage to banks on borrowing firms' investment. To capture this, we include a proxy indicating whether a firm's main bank was a bank that sustained damage in the earthquake, *B_DAMAGED*. As above, we have no way of ascertaining whether, and to what extent, banks actually did sustain damage, so we focus on whether it was located in the earthquake affected area. For this purpose, we use two alternative variables as *B_DAMAGED*. First, *B_HQDAMAGED* is a dummy variable that takes a value of one if the headquarter of the bank is located in the earthquake-affected area. Because this variable focuses on the headquarters, it captures whether the managerial capacity to process loans is likely to have been impaired, including back-office operations, such as the ability to process applications for large loans or to manage the total risk of the entire loan portfolio of the bank.

Second, *B_BRDAMAGED* is the share of the main bank's branches located in the earthquake-affected area in its total number of branches. Compared to *B_HQDAMAGED*, this variable captures the likely damage to the main bank's branch network. It thus represents the likely damage to the main bank's ability to process applications for relatively small loans under branch managers' authority. It also captures the extent to which banks are exposed to damaged and possibly non-performing borrowers, which is likely to negatively affect their risk-taking capacity. Either kind of damage to banks – to their headquarters or to their branch network – is expected to diminish their lending capacity and thereby impose constraints on their borrowers. We therefore predict that each of these variables has a negative coefficient.

5.2.4 Interaction of damaged firms and damaged banks

In addition to *F_DAMAGED* and *B_DAMAGED*, we also add the interaction term of these variables as an explanatory variable. The aim is to differentiate the impact of damage to banks on damaged firms from that on undamaged firms. As mentioned earlier, what we are most interested in is the effect of damage to banks on undamaged borrowers, which is captured by the coefficient on *B_DAMAGED*. On the other hand, the effect of damage to banks on damaged borrowers is captured by the sum of the coefficients on *B_DAMAGED* and the interaction term of *B_DAMAGED* and *F_DAMAGED.* Since damaged firms are more likely to be financially constrained when their main bank is also damaged, the interaction term is expected to have a negative sign.

5.2.5 Firms' financial constraint

We also use a vector of other variables representing firms' financial constraints, *F_CONSTRAINTS.* More specifically, we use firms' size, which is represented by the natural logarithm of total assets (*F_LNASSETS*); their leverage, which is computed as the ratio of total liabilities to equity (*F_LEV*); their profitability, which is represented by the ratio of current income to total assets (*F_ROA*); and their liquidity, which is proxied for by the ratio of liquidity assets to total assets (*F_CASH*).

Recent studies, including Whited (2006), Bayer (2006), and Hennessy et al. (2007) consider financial friction as an important factor generating variations in firm investment. Firms with higher profitability (*F_ROA*), more liquidity (*F_CASH*), and a larger size (*F_LNASSET*) are less likely to be financially constrained. Note, however, that these firm characteristics could be also related to future profitability, as discussed by Abel and Eberly (2011) and Gomes (2001). In either interpretation of these variables, we expect that they have positive coefficients. On the other hand, since firms with higher leverage *(F_LEV*) are more likely to be financially constrained, we expect that *F_LEV* has a negative coefficient.

5.2.6 Banks' lending capacity

Finally, we also use a vector of variables representing the main bank's lending capacity, *B_CAPACITY*. More specifically, we control for the size, financial health, and profitability of the main bank for each firm. For size, we use the natural logarithm of the bank's total assets (*B_LNASSETS*). As proxies for the financial health and profitability of the main bank, we use the risk-unadjusted capital-asset ratio (*B_CAP*) and the ratio of operating profit to total assets (*B_ROA*), respectively. Banks with high profitability (*B_ROA*) and greater financial health (*B_CAP*) are less likely to be constrained by capital requirements and are thus more likely to provide loans to their client firms, which should therefore be more likely to carry out investments. Moreover, larger banks (*B_LNASSETS*) are able to diversify their loan portfolios and are hence likely to be less severely affected by the disaster. These variables are therefore expected to have a positive coefficient.

Note, however, that it has been widely argued (see, e.g., Ito and Sasaki, 2002; Shrieves and Dahl, 2003; Peek and Rosengren, 2005; Caballero et al., 2008) that during the 1990s, i.e., the period that we examine, Japanese banks manipulated their balance sheets and reported inflated profits and capital by, e.g., underreporting loan loss reserves, double-gearing subordinated debt with affiliated life insurance companies, and rolling over loans to non-performing borrowers. These studies suggest that such accounting manipulations are more likely to be observed for financially unhealthy banks. If these claims are correct, *B_ROA* and *B_CAP* may not capture true profits and capital, so that the coefficients on them may turn out to be insignificant.

5.3 Summary statistics and univariate analysis

Summary statistics for firm variables over our observation period are shown in Table 6(a). The three panels in Table 6(a) respectively correspond to the three fiscal years covered by our observation period. Moreover, each of the panels shows the summary statistics for the whole sample, the subsample of damaged firms (with *F_DAMAGED*=1), and the subsample of undamaged firms (with *F_DAMAGED*=0). As mentioned, all statistics are computed by excluding outliers (i.e., eliminating observations in either of the 0.5% tails).

As a preliminary analysis, Table 6(a) presents *t*-tests for the difference in means between the capital investment ratios of sample firms with *F_DAMAGED*=1 and *F_DAMAGED*=0. The results show that the difference is statistically significant in FY1996. The larger investment ratio for damaged firms implies that they significantly increased their investment, presumably to recover from damage after the earthquake. On the other hand, the financial characteristics of the main banks for damaged and undamaged firms do not systematically differ. For example, looking at FY1996, the capital ratio of damaged firms' main bank tends to be lower, while the ROA tends to be higher than in the case of undamaged firms' main bank. However, in FY1997, the differences are not statistically significant. In contrast, *B_HQDAMAGED* and *B_BRDAMAGED* are significantly higher for damaged firms in all three observation years. Whether and how the damage to firms and banks affects firms' capital investment is examined in the regression analysis below.

Next, Table 6(b) shows the summary statistics of bank characteristics over the three years. The upper three panels show the statistics for all main banks in our sample, for main banks for which *B_HQDAMAGED*=1, and for those for which *B_HQDAMAGED*=0, for each of the three years. In the lower panels, we classify banks according to whether their *B_BRDAMAGED* is greater than or smaller than the median value.[22] We find that the differences in the means of the bank characteristic variables between banks above and below the median in terms of *B_BRDAMAGED* are all

[22] The median is computed using banks with a positive value for *B_BRDAMAGE* only. Banks with a zero value for *B_BRDAMAGE* are classified as falling below the median.

statistically significant. Note that this does not necessarily mean that the financial conditions of damaged banks were worse than those of their undamaged peers. Although *B_CAP* tends to be higher for banks with a smaller *B_BRDAMAGED*, *B_ROA* for FY 1997 is higher for banks with a greater *B_BRDAMAGED* (0.014) than those with a smaller *B_BRDAMAGED* (0.006). Since the bank characteristic variables are potentially correlated with banks' capability to provide loans, we need to properly control for such characteristics in our empirical analysis. Table 7 summarizes the correlation coefficients among the firm and bank characteristics, from which we could confirm that we do not need to be worried about the multicollinearity problem.

6. Regression Results

6.1 Baseline results

The results of the baseline estimation are shown in Table 8. For each year, we report the results for two specifications: one using (1) *B_HQDAMAGED* and the other using (2) *B_BRDAMAGED* as the damaged bank variable (*B_DAMAGED*). We find that *F_SALESGROWTH*, the proxy of Q, takes a positive coefficient in all years for both of the *B_DAMAGED* variables, but is not statistically significant in any of the cases. *F_DAMAGED* takes positive coefficients for FY1996 and FY1997, which are significant for both of the *B_DAMAGED* variables (except for *B_BRDAMAGE* in FY1996), implying that the capital investment ratio of affected firms increased roughly one year after the earthquake as they sought to recover from the damage inflicted. The results for specification (1), for example, show that among firms that did not transact with a damaged main bank, the investment ratios of damaged firms in FY1996 were 3.6 percentage points higher and in FY1997 2.6 percentage points higher than those of undamaged firms.

Turning to the variables of our primary interests, we find that *B_DAMAGED* takes negative and significant coefficients for FY1995 (for specification (1)) or FY1996 (for specification (2)), implying that the investment ratio of firms that were not hit by the earthquake was adversely affected if their main bank was hit by the earthquake. Since damage to banks represents an exogenous financial shock for firms located outside the earthquake-hit area, this result strongly suggests that exogenous shocks to bank lending capacity affect client firm investment. The impact of damage to banks on undamaged firms is economically significant as well. In FY1995, the investment ratio of undamaged firms that transacted with a damaged main bank was 8.5 percentage points smaller than that of undamaged firms that transacted with an undamaged main bank.

An interesting finding is that the timing of the impact of damage to banks differs between *B_HQDAMAGED* (specification (1)) and *B_BRDAMAGED* (specification (2)). While the negative and significant impact of *B_HQDAMAGED* on client firm investment manifested itself immediately after the earthquake, i.e., in FY1995, the significant impact of *B_BRDAMAGED* manifested itself one year later, in FY1996. The difference might stem from what these variables respectively represent. That is, *B_HQDAMAGED* captures the impairment to banks' back-office operations at the headquarters, such as making decisions on whether to accept or reject applications for large loans, while *B_BRDAMAGED* reflects the damage to the main bank's ability to process applications for relatively small loans under branch managers' authority and loan portfolio losses caused by the deterioration in borrowers' financial conditions due to the earthquake. Our finding regarding the timing of the impact of the two different variables suggests that while impairment to headquarters operations had a direct and immediate impact on lending to client firms and hence their investment, impairment of banks' branch network and loan portfolios adversely affected lending and hence investment only with a delay.

Turning to the interaction term of *F_DAMAGE* and *B_DAMAGE*, this is not significant in any of the years in either specification. This suggests that damage to banks affected client firms' investment irrespective of whether a firm was damaged by the earthquake or not.

All the variables representing firms' financial constraints have coefficients with the expected signs, although the level of statistical significance varies across variables and years. *F_ROA* and *F_CASH* have significantly positive coefficients in all years in both specifications, while *F_LNASSET* has significantly positive coefficients only in 1996, and *F_LEV* has no significant coefficients.

Finally, the coefficients on the variables for banks' lending capacity have inconsistent signs over time and none of them is significant. These results are consistent with the view that banks' balance sheet variables do not reflect their true financial conditions.

6.2 Distinguishing by bank size

In the baseline estimation, we did not distinguish between banks of different sizes. However, compared with larger regional banks, Shinkin banks (*shinyo kinko* in Japanese) and credit cooperatives, which are small credit unions (*shinyo kumiai* in Japanese), are relatively small and the areas in which they operate tend to be more concentrated.[23] Consequently, it may be difficult for these banks to diversify their loan portfolios, which means that they are considerably more vulnerable if they are struck by an earthquake. To the extent that this is the case, firms transacting with a damaged Shinkin bank or credit cooperative as their main bank may have been affected more severely.

To take this possibility into account, we now let *B_HQDAMAGED* or *B_BRDAMAGED* interact with a small bank dummy, *SMALL*, which takes a value of one if a firm's main bank is either a Shinkin bank or a credit cooperative. The interaction term is expected to have a negative sign. Note that in this specification, we implicitly assume that damage to regional banks, which are relatively

[23] A more detailed description of the various types of banks in Japan, including regional banks and Shinkin banks, can be found in Uchida and Udell (2010).

large, have no significant impact on their client firms' investment

Table 9 shows the results. Regarding specification (1), the coefficients on *B_HQDAMAGE*SMALL* are statistically significant and negative both for FY1995 (as in the baseline case) and for FY1996 (unlike in the baseline case). The absolute value of the coefficient for FY1995 is larger than that in the baseline result. That is, in FY1995, the investment ratio of undamaged firms transacting with damaged Shinkin banks or credit cooperatives was 11.1 percentage points lower than that of undamaged firms transacting with undamaged (or damaged regional) main banks. These results are consistent with our prediction that firms whose main bank was a damaged Shinkin bank or credit cooperative was more severely affected than firms whose primary bank was a damaged regional bank. In the second specification using *B_BRDAMAGED*, the coefficient of the interaction term with *SMALL* is significant and negative for FY1996 (as in the baseline result). Note that all the other explanatory variables have similar coefficients as in the baseline results.

6.3 Excluding a sick bank

We have thus far interpreted the negative impact of damage to banks on the investment ratio as representing the severe borrowing constraint brought about by the damage to banks. However, an alternative interpretation is also possible. To be precise, among the earthquake-hit banks, there is a relatively large regional bank, Hyogo Bank, that failed in August 1995. A reported major reason for the failure was the expansion of real estate-related loans during the 1980s, which became non-performing when the land price bubble burst in the early 1990s, although damage from the earthquake may also have contributed to the failure. It is therefore possible that our *B_DAMAGED* variable partly picks up this "sick bank" effect associated with the failure of Hyogo Bank that has nothing to do with damage stemming from the earthquake.

To rule out the possibility that this "sick bank" effect has contaminated our results, we check the robustness of the results we have obtained so far by excluding those firms that transacted with Hyogo Bank as their main banks from our sample. Table 10 shows the results. All the variables take very similar coefficients to those in the baseline results. In particular, *B_HQDAMAGED* and *B_BRDAMAGED* take significantly negative coefficients for FY1995 and FY1996, respectively. Thus, we can confirm that our baseline results are not driven by the failure of Hyogo Bank.

7. Conclusion

This paper investigated the effect of the lending capacity of banks on firm investment. To overcome the difficulty in identifying lending capacity of banks that are purely exogenous to firms, we utilized the natural experiment presented by the Kobe Earthquake. Using a unique firm-level dataset that allows us to identify firms and banks in the affected area and combine this with information on bank-firm relationships and financial statements, we examined the impact that being in a transaction relationship with a bank in the affected area had on the investment of client firms that were not directly affected by the earthquake.

We found that the investment ratio of firms located *outside* the earthquake-affected area but having a main bank *inside* the area was smaller than that of firms whose main bank was outside the affected area. This result implies that the weakened lending capacity of damaged banks exacerbated borrowing constraints to their client firms' investment. In addition, we found that the negative impact is robust to two alternative measures of bank damage, that is, damage to the headquarters and the damage to the branch network. However, while the impact of the former emerged immediately after the earthquake, that of the latter emerged with a one-year lag. This difference in the timing of the impacts suggests that there were two different channels through which damage to banks affected client firms: the first was through the impairment of banks' managerial capacity to originate loans, while the second was through the impairment of their risk-taking capacity.

Tables

Table 1: Estimated damage of the Kobe earthquake

		No. of deaths	No. of housing units completely destroyed	No. of housing units partly destroyed	Death rate	Rate of housing units completely destroyed	Rate of housing units partly destroyed	Rate of housing units completely or partly destroyed
Regions in designated disaster area		**6,405**	**104,455**	**140,681**	**0.17%**	**16.50%**	**22.23%**	**38.73%**
Kobe City	Higashinada-ku	1,470	12,832	5,085	0.77%	50.50%	20.01%	70.51%
	Nada-ku	931	11,795	5,325	0.72%	54.13%	24.44%	78.57%
	Hyogo-ku	553	8,148	7,317	0.45%	35.55%	31.92%	67.47%
	Nagata-ku	917	14,662	7,770	0.67%	60.21%	31.91%	92.12%
	Suma-ku	401	7,466	5,344	0.21%	27.68%	19.81%	47.50%
	Tarumi-ku	25	1,087	8,575	0.01%	2.78%	21.95%	24.73%
	Kita-ku	13	251	3,029	0.01%	0.63%	7.67%	8.31%
	Chuo-ku	243	5,156	5,533	0.21%	33.39%	35.84%	69.23%
	Nishi-ku	9	403	3,147	0.01%	1.19%	9.28%	10.46%
Amagasaki City		49	5,688	36,002	0.01%	7.60%	48.07%	55.67%
Nishinomiya City		1,126	20,667	14,597	0.26%	31.30%	22.11%	53.41%
Ashiya City		443	3,915	3,571	0.51%	31.67%	28.89%	60.57%
Itami City		22	1,395	7,499	0.01%	4.39%	23.57%	27.96%
Takarazuka City		117	3,559	9,313	0.06%	9.12%	23.86%	32.98%
Kawanishi City		4	554	2,728	0.00%	1.56%	7.70%	9.26%
Akashi City		11	2,941	6,673	0.00%	5.51%	12.51%	18.02%
Sumoto City		4	203	932	0.01%	1.71%	7.83%	9.54%
Awaji City		58	3,076	3,976	0.11%	NA	NA	NA
Toyonaka City		9	657	4,265	0.00%	1.12%	7.27%	8.39%
Regions outside designated area		**22**	**445**	**3,427**	**0.00%**	**0.04%**	**0.30%**	**0.33%**

Note: "Regions outside designated areas" refers to regions that are in the Hyogo and Osaka prefectures but were not included in the Act Concerning Special Financial Support to Deal with a Designated Disaster of Extreme Severity by the Government of Japan. All the rates for these regions are the averages of all cities and towns in these regions. The Act Concerning Special Financial Support to Deal with a Designated Disaster of Extreme Severity by the Government of Japan included nine cities and five town. One of the towns has since been merged into Sumoto City, while the other four have been merged to form Awaji City. The table here shows the casualties and housing damage for the merged entities. The number of deaths and the numbers of destroyed housing units were completed by the Fire and Disaster Management Agency and are as of May 19, 2006. To calculate the rates, we used the data of the 1990 Population Census and the 1993 Housing and Land Survey.

Table 2: Industry composition in the earthquake-affected region

	Firm information			
	Earthquake-affected regions		Japan	
	No. of firms	Share	No. of firms	Share
Agriculture, forestry and fisheries	68	0.1	4,639	0.5
Mining	29	0.0	2,576	0.3
Construction	11,421	12.6	179,102	17.6
Manufacturing	18,291	20.1	186,654	18.3
Wholesale	28,987	31.9	217,107	21.3
Retail and restaurants	11,538	12.7	195,127	19.2
Finance and insurance	687	0.8	6,777	0.7
Real estate	5,206	5.7	45,666	4.5
Transportation and communication	3,249	3.6	35,730	3.5
Utilities	8	0.0	283	0.0
Services	11,346	12.5	145,097	14.2
Other	1	0.0	17	0.0
N.A.				
Total	90,831	100.0	1,018,775	100.0

Note: These numbers are computed from the database provided by Teikoku Databank.

Table 3: Financial conditions of firms in the earthquake-affected region

	Capital Ratio		Operating Profit / Sales	
	Earthquake-affected region	Japan	Earthquake-affected region	Japan
No. of firm	12,380	115,098	12,320	113,584
Mean	0.159	0.144	-0.016	0.120
Std. dev.	0.481	2.138	6.589	17.761
Median	0.153	0.148	0.015	0.016

Note: Capital ratio = Equity / Total Assest. We exclude outliers by discarding the top and bottom 0.5% of observations, respectively. These numbers are computed from the database provided by Teikoku Databank.

Table 4: Regional lenders

Prefecture	Name and type of financial institution		Loans outstanding (100 million yen)	No. of branches
Osaka	Suito Shinkin	Shinkin bank	1,720	19
	Howa Shinso	Credit cooperative	377	8
Hyogo	Hyogo Bank	Regional bank 2	27,443	147
	Hanshin Bank	Regional bank 2	8,772	80
	6 Shinkin (total)		19,752	192
	8 Shinso (total)		4,381	66

Note: This table provides information on banks whose headquarters are in the earthquake-affected region. We will refer to these banks in the earthquake-affected area, i.e., banks that have their headquarters in the area, as "regional lenders". Regional bank 2 means the member banks of the Second Association of Regional Banks. We define the regions struck by the Kobe earthquake as 8 cities and 5 towns in Hyogo prefecture including Kobe city as well as Toyonaka city in Osaka prefecture. Shinkin means Shinkin bank. Shinso means credit cooperative.

Table 5: Relationship with regional lenders

Firms which have relationship with one or more of the damaged banks	No. of firms	%
Yes	9,559	81.7
No	2,140	18.3
Total	11,694	100.0

Note: This table shows the share of earthquake-affected firms in our dataset that have a lending relationship with one or more of the regional lender. The observation period is FY1994.

Table 6(a): Summary statistics for sample firms

FY1995

	Whole sample			F_DAMAGED=1			F_DAMAGED=0			t-test for (F_DAMAGED=1) = (FDAMAGED=0)	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
F_INVESTMENTRATIO	1,515	0.140	0.239	268	0.159	0.271	1,247	0.135	0.232	-1.4698	0.1418
F_SALESGROWTH	1,514	0.005	0.108	263	-0.013	0.128	1,251	0.009	0.103		
F_LNASSETS	1,521	8.585	1.201	270	8.417	1.249	1,251	8.621	1.188		
F_LEV	1,507	6.346	11.437	265	5.041	9.739	1,242	6.624	11.752		
F_ROA	1,520	0.028	0.046	266	0.023	0.057	1,254	0.030	0.044		
F_CASH	1,524	0.633	0.165	269	0.618	0.169	1,255	0.636	0.164		
F_DAMAGED	1,530	0.176	0.381	270	1.000	0.000	1,260	0.000	0.000		
B_LNASSETS	1,530	24.121	1.126	270	24.184	1.096	1,260	24.108	1.133	-0.9845	0.3250
B_CAP	1,530	0.036	0.005	270	0.036	0.005	1,260	0.036	0.005	0.1109	0.9117
B_ROA	1,530	0.003	0.004	270	0.003	0.003	1,260	0.004	0.004	1.7436	0.0814
B_HQDAMAGED	1,530	0.010	0.102	270	0.030	0.170	1,260	0.006	0.079	-3.4100	0.0007
B_BRDAMAGED	1,530	0.078	0.093	270	0.112	0.137	1,260	0.071	0.079	-6.6456	0.0000

FY1996

	Whole sample			F_DAMAGED=1			F_DAMAGED=0			t-test for (F_DAMAGED=1) = (FDAMAGED=0)	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
F_INVESTMENTRATIO	1,536	0.142	0.226	269	0.165	0.246	1,250	0.137	0.219	-1.8619	0.0628
F_SALESGROWTH	1,521	0.021	0.111	267	0.023	0.139	1,254	0.020	0.104		
F_LNASSETS	1,538	8.612	1.195	270	8.444	1.240	1,251	8.650	1.182		
F_LEV	1,538	6.365	11.284	266	5.199	10.404	1,255	6.553	11.260		
F_ROA	1,536	0.030	0.043	264	0.027	0.049	1,255	0.031	0.042		
F_CASH	1,542	0.637	0.166	269	0.619	0.174	1,256	0.641	0.164		
F_DAMAGED	1,529	0.177	0.381	270	1.000	0.000	1,259	0.000	0.000		
B_LNASSETS	1,546	24.137	1.137	270	24.189	1.104	1,259	24.123	1.155	-0.8527	0.3940
B_CAP	1,546	0.032	0.006	270	0.031	0.006	1,259	0.032	0.006	1.7595	0.0787
B_ROA	1,546	0.007	0.008	270	0.009	0.010	1,259	0.007	0.007	-3.5598	0.0004
B_HQDAMAGED	1,546	0.004	0.088	270	0.026	0.159	1,259	0.004	0.063	-3.7261	0.0002
B_BRDAMAGED	1,546	0.077	0.088	270	0.109	0.133	1,259	0.070	0.074	-6.6258	0.0000

FY1997

	Whole sample			F_DAMAGED=1			F_DAMAGED=0			t-test for (F_DAMAGED=1) = (FDAMAGED=0)	
Variable	Obs.	Std. dev.	Std. Dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
F_INVESTMENTRATIO	1,541	0.136	0.201	269	0.150	0.206	1,250	0.134	0.201	-1.1648	0.2443
F_SALESGROWTH	1,531	0.034	0.098	267	0.023	0.125	1,247	0.037	0.091		
F_LNASSETS	1,536	8.639	1.195	269	8.466	1.237	1,245	8.678	1.185		
F_LEV	1,532	6.112	10.744	266	4.757	8.870	1,245	6.338	10.906		
F_ROA	1,537	0.034	0.039	265	0.031	0.042	1,250	0.036	0.038		
F_CASH	1,536	0.635	0.166	268	0.610	0.175	1,246	0.641	0.164		
F_DAMAGED	1,523	0.177	0.381	269	1.000	0.000	1,254	0.000	0.000		
B_LNASSETS	1,545	24.195	1.137	269	24.232	1.132	1,254	24.183	1.143	-0.6848	0.4935
B_CAP	1,545	0.032	0.006	269	0.031	0.005	1,254	0.032	0.006	1.0512	0.2933
B_ROA	1,545	0.003	0.003	269	0.003	0.003	1,254	0.003	0.003	-1.0966	0.2730
B_HQDAMAGED	1,545	0.009	0.095	269	0.026	0.159	1,254	0.006	0.075	-3.1967	0.0014
B_BRDAMAGED	1,545	0.078	0.090	269	0.109	0.134	1,254	0.071	0.077	-6.2947	0.0000

Note: All statistics are computed after eliminating outliers (i.e., dropping observations in either of the 0.5% tails). F_INVESTMENTRATIO is the ratio of firms' capital investment to one-period lagged fixed assets, F_SALESGROWTH is the growth rate of firms' sales, F_LNASSETS is the natural logarithm of firms' total assets, F_LEV is the ratio of firms' liabilities to equity, F_ROA is the ratio of firms' current profit to total assets, F_CASH is the ratio of firms' liquidity assets to total assets, F_DAMAGED is a dummy variable taking a value of one if the firm is located in one of the cities or towns identified as affected by the earthquake in the Act on Special Financial Support to Deal with a Designated Disaster of Extreme Severity, B_LNASSETS is the natural logarithm of the total assets owned by firms' main bank, B_CAP is the equity to assets ratio of firms' main bank, B_ROA is the ratio of operating profit to total assets of firms' main bank, B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of a firm's main bank are located in the earthquake-affected area, and B_BRDAMAGED is the ratio of the number of branches of a firm's main bank located in the earthquake-affected area to the total number of branches of that bank.

Table 6(b): Summary statistics for sample banks

FY1995	All Sample			B_HQDAMAGED=1			B_HQDAMAGED=0			t-test for (B_HQDAMAGED=1) = (B_HQDAMAGED=0)	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
B_LNASSETS	57	21.839	1.637	3	20.799	0.657	54	21.897	1.658	1.1341	0.2617
B_CAP	57	0.042	0.015	3	0.043	0.013	54	0.042	0.015	-0.1357	0.8926
B_ROA	57	0.010	0.015	3	0.005	0.003	54	0.010	0.002	0.5667	0.5732

FY1996	All Sample			B_HQDAMAGED=1			B_HQDAMAGED=0			t-test for (B_HQDAMAGED=1) = (B_HQDAMAGED=0)	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
B_LNASSETS	57	21.860	1.649	3	20.817	0.663	54	21.918	1.671	1.1287	0.2639
B_CAP	57	0.041	0.015	3	0.041	0.019	54	0.042	0.015	0.0774	0.9386
B_ROA	57	0.004	0.003	3	0.008	0.001	54	0.004	0.000	-2.4497	0.0175

FY1997	All Sample			B_HQDAMAGED=1			B_HQDAMAGED=0			t-test for (B_HQDAMAGED=1) = (B_HQDAMAGED=0)	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
B_LNASSETS	57	21.860	1.643	3	20.811	0.677	54	21.918	1.664	1.1389	0.2597
B_CAP	57	0.038	0.017	3	0.043	0.020	54	0.038	0.017	-0.4519	0.6531
B_ROA	57	0.009	0.014	3	0.004	0.003	54	0.009	0.014	0.6108	0.5438

Note: All statistics are computed after eliminating outliers (i.e., dropping observations in either of the 0.5% tails). B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of the bank are located in the earthquake-affected area. B_LNASSETS is the natural logarithm of the total assets owned by the bank, B_CAP is the equity to assets ratio of the bank, and B_ROA is the ratio of operating profit to total assets of the bank.

FY1995	B_BRDAMAGED>Med(+)			B_BRDAMAGED<Med(+)			t-test for (B_BRDAMAGED>Med(+)) = (B_BRDAMAGED<Med(+))	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
B_LNASSETS	22	22.704	1.388	35	21.295	1.442	-3.4609	0.001
B_CAP	22	0.035	0.007	35	0.046	0.016	2.8249	0.0066
B_ROA	22	0.013	0.004	35	0.008	0.002	-1.2947	0.2008

FY1996	B_BRDAMAGED>Med(+)			B_BRDAMAGED<Med(+)			t-test for (B_BRDAMAGED>Med(+)) = (B_BRDAMAGED<Med(+))	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	t-value	p-value
B_LNASSETS	22	22.730	1.437	35	21.313	1.551	-3.4511	0.0011
B_CAP	22	0.035	0.007	35	0.045	0.017	2.7122	0.0089
B_ROA	22	0.003	0.001	35	0.004	0.001	0.8137	0.4193

FY1997	B_BRDAMAGE>Med(+)			B_BRDAMAGE<Med(+)			t-test for (B_BRDAMAGED>Med(+)) = (B_BRDAMAGED<Med(+))	
Variable	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	t-value	p-value
B_LNASSETS	22	22.716	1.442	35	21.322	1.547	-3.3986	0.0013
B_CAP	22	0.031	0.010	35	0.043	0.017	2.69	0.0094
B_ROA	22	0.014	0.021	35	0.006	0.005	-2.0212	0.0481

Note: All statistics are computed after eliminating outliers (i.e., dropping observations in either of the 0.5% tails). B_BRDAMAGED is the ratio of the number of branches of the bank located in the earthquake-affected area to its total number of branches. Med(+) is the median of B_BRDAMAGED conditional on B_BRDAMAGED being positive. B_LNASSETS is the natural logarithm of the total assets owned by the bank, B_CAP is the equity to assets ratio of the bank, and B_ROA is the ratio of operating profit to total assets of the bank.

Table 7: Correlation matrix

(Obs.= 1,462)

FY1995		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
F_INVESTMENTRATIO	(1)	1.000											
F_SALESGROWTH	(2)	0.056	1.000										
F_LNASSETS	(3)	0.031	-0.009	1.000									
F_LEV	(4)	-0.052	0.033	0.029	1.000								
F_ROA	(5)	0.230	0.130	0.000	-0.125	1.000							
F_CASH	(6)	0.065	0.024	-0.029	0.059	0.046	1.000						
F_DAMAGED	(7)	0.031	-0.070	-0.060	-0.052	-0.046	-0.033	1.000					
B_LNASSETS	(8)	0.002	-0.019	0.182	-0.041	-0.038	0.051	0.027	1.000				
B_CAP	(9)	-0.015	-0.051	-0.055	0.069	0.011	-0.072	-0.004	-0.355	1.000			
B_ROA	(10)	-0.023	0.012	-0.055	-0.033	-0.026	0.018	-0.043	-0.216	-0.216	1.000		
B_HQDAMAGED	(11)	0.036	0.004	-0.052	0.000	0.025	-0.024	0.097	-0.250	0.054	0.028	1.000	
B_BRDAMAGED	(12)	0.029	0.016	-0.080	-0.028	0.051	-0.046	0.162	-0.238	0.022	-0.018	0.669	1.000

(Obs.= 1,482)

FY1996		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
F_INVESTMENTRATIO	(1)	1.000											
F_SALESGROWTH	(2)	0.052	1.000										
F_LNASSETS	(3)	0.085	-0.003	1.000									
F_LEV	(4)	-0.025	0.016	0.038	1.000								
F_ROA	(5)	0.133	0.214	-0.008	-0.158	1.000							
F_CASH	(6)	0.112	0.053	-0.021	0.060	0.062	1.000						
F_DAMAGED	(7)	0.055	0.000	-0.064	-0.033	-0.029	-0.054	1.000					
B_LNASSETS	(8)	-0.010	-0.028	0.180	-0.037	-0.004	0.054	0.019	1.000				
B_CAP	(9)	0.008	-0.008	-0.110	0.053	-0.043	-0.041	-0.044	-0.515	1.000			
B_ROA	(10)	0.045	0.009	0.048	-0.007	0.022	-0.061	0.093	0.020	-0.240	1.000		
B_HQDAMAGED	(11)	0.017	0.004	-0.052	0.005	0.009	-0.003	0.094	-0.217	0.053	-0.039	1.000	
B_BRDAMAGED	(12)	-0.023	0.036	-0.078	-0.047	0.034	-0.038	0.157	-0.202	-0.044	0.040	0.604	1.000

(Obs.=1,479)

FY1997		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
F_INVESTMENTRATIO	(1)	1.000											
F_SALESGROWTH	(2)	0.073	1.000										
F_LNASSETS	(3)	0.009	0.083	1.000									
F_LEV	(4)	0.010	-0.001	0.026	1.000								
F_ROA	(5)	0.173	0.201	0.012	-0.183	1.000							
F_CASH	(6)	0.065	0.104	-0.026	0.073	0.046	1.000						
F_DAMAGED	(7)	0.031	-0.057	-0.070	-0.054	-0.040	-0.077	1.000					
B_LNASSETS	(8)	0.006	0.000	0.181	-0.033	-0.012	0.065	0.011	1.000				
B_CAP	(9)	-0.024	-0.002	-0.078	0.055	0.009	-0.071	-0.024	-0.364	1.000			
B_ROA	(10)	-0.005	-0.028	-0.080	0.047	-0.014	0.007	0.030	-0.226	-0.095	1.000		
B_HQDAMAGED	(11)	0.024	-0.026	-0.075	0.074	-0.031	-0.003	0.084	-0.261	-0.146	0.154	1.000	
B_BRDAMAGED	(12)	0.004	-0.023	-0.099	-0.045	0.005	-0.030	0.158	-0.280	-0.136	0.140	0.627	1.000

Note: All statistics are computed after eliminating outliers (i.e., dropping observations in either of the 0.5% tails). F_INVESTMENTRATIO is the ratio of firms' capital investment to one-period lagged fixed assets, F_SALESGROWTH is the growth rate of firms' sales, F_LNASSETS is the natural logarithm of firms' total assets, F_LEV is the ratio of firms' liabilities to equity, F_ROA is the ratio of firms' current profit to total assets, F_CASH is the ratio of firms' liquidity assets to total assets, F_DAMAGED is a dummy variable taking a value of one if the firm is located in one of the cities or towns identified as affected by the earthquake in the Act on Special Financial Support to Deal with a Designated Disaster of Extreme Severity, B_LNASSETS is the natural logarithm of total assets owned by firms' main bank, B_CAP is the equity to assets ratio of firms' main bank, B_ROA is the ratio of operating profit to total assets of firms' main bank, B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of a firms' main bank are located in the earthquake-affected area, and B_BRDAMAGED is the ratio of the number of branches of a firm's main bank located in the earthquake-affected area to its total number of branches.

Table 8: Year-by-year cross-section regression for investment ratio

Dependent variable: F_INVESTMENTRATIO (t)	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED
	FY1995		FY1996		FY1997	
F_DAMAGED	0.0187	-0.0051	0.0362 **	0.0307	0.0261 *	0.0377 **
	(0.0155)	(0.0247)	(0.0159)	(0.0215)	(0.0143)	(0.0174)
B_DAMAGED (t-1) †	-0.0852 ***	-0.0895	0.0020	-0.1400 **	0.1299	0.0223
	(0.0251)	(0.0592)	(0.0453)	(0.0588)	(0.0930)	(0.0717)
F_DAMAGED	0.2843	0.3096	0.0393	0.1063	-0.1752	-0.1316
×B_DAMAGED (t-1) †	(0.2164)	(0.2462)	(0.1168)	(0.1357)	(0.1076)	(0.0988)
F_SALESGROWTH (t-1)	0.0669	0.0689	0.0378	0.0390	0.0761	0.0800
	(0.0588)	(0.0587)	(0.0562)	(0.0565)	(0.0499)	(0.0497)
F_LNASSETS (t-1)	0.0081	0.0079	0.0194 ***	0.0191 ***	0.0020	0.0018
	(0.0054)	(0.0054)	(0.0053)	(0.0053)	(0.0045)	(0.0045)
F_LEV (t-1)	-0.0004	-0.0005	-0.0002	-0.0002	0.0008	0.0009
	(0.0003)	(0.0003)	(0.0006)	(0.0006)	(0.0012)	(0.0012)
F_ROA (t-1)	1.1232 ***	1.1230 ***	0.6020 ***	0.6037 ***	0.8717 ***	0.8747 ***
	(0.1657)	(0.1662)	(0.1470)	(0.1469)	(0.1458)	(0.1456)
F_CASH (t-1)	0.0937 **	0.0922 **	0.1705 ***	0.1694 ***	0.0865 ***	0.0867 ***
	(0.0435)	(0.0436)	(0.0345)	(0.0344)	(0.0298)	(0.0297)
B_LNASSETS (t-1)	-0.0010	-0.0008	-0.0026	-0.0049	0.0013	-0.0017
	(0.0074)	(0.0078)	(0.0067)	(0.0070)	(0.0052)	(0.0055)
B_CAP (t-1)	-0.8434	-0.5128	1.4780	1.1814	-0.1939	-0.8531
	(1.4142)	(1.4517)	(1.3719)	(1.3536)	(1.0602)	(1.0037)
B_ROA (t-1)	-1.4450	-1.2480	1.2178	1.2190	-0.4129	-0.3761
	(1.7792)	(1.8257)	(1.4916)	(1.4824)	(1.6080)	(1.6146)
Constant	0.1347	0.1261	-0.0949	-0.0171	-0.0323	0.0579
	(0.2386)	(0.2475)	(0.2305)	(0.2372)	(0.1499)	(0.1562)
Obs	1,462	1,462	1,482	1,482	1,479	1,479
F	11.34	7.01	5.78	6.05	5.74	5.80
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.0741	0.0733	0.0518	0.0533	0.0545	0.0537
Root MSE	0.2304	0.2305	0.2174	0.2173	0.1988	0.1989
Industry dummies	yes	yes	yes	yes	yes	yes

Notes: Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The sample used for each estimation is the firm-level balanced sample from FY1995 to FY1999, which consists of the fixed cohort of firms surviving over the period. The number of observations varies over the years since outliers are dropped from the sample for each year. F_INVESTMENTRATIO is the ratio of firms' capital investment to one-period lagged fixed assets, F_SALESGROWTH is the growth rate of firms' sales, F_LNASSETS is the natural logarithm of firms' total assets, F_LEV is the ratio of firms' liabilities to equity, F_ROA is the ratio of firms' current profit to total assets, F_CASH is the ratio of firms' liquidity assets to total assets, F_DAMAGED is a dummy variable taking a value of one if the firm is located in one of the cities or towns identified as affected by the earthquake in the Act on Special Financial Support to Deal with a Designated Disaster of Extreme Severity, B_LNASSETS is the natural logarithm of total assets owned by firms' main bank, B_CAP is the equity to assets ratio of firms' main bank, B_ROA is the ratio of operating profit to total assets of firms' main bank, B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of a firms' main bank are located in the earthquake-affected area, and B_BRDAMAGED is the ratio of the number of branches of a firm's main bank located in the earthquake-affected area to its total number of branches.

† The B_DAMAGED variable is either B_HQDAMAGED or B_BRDAMAGED as indicated in the column heading.

Table 9: Year-by-year cross-section regression for investment ratio with small bank dummy

Dependent variable: F_INVESTMENTRATIO (t)	(1) B_DAMAGED = B_HQDAMAGED *SMALL	(2) B_DAMAGED = B_BRDAMAGED *SMALL	(1) B_DAMAGED = B_HQDAMAGED *SMALL	(2) B_DAMAGED = B_BRDAMAGED *SMALL	(1) B_DAMAGED = B_HQDAMAGED *SMALL	(2) B_DAMAGED = B_BRDAMAGED *SMALL
	FY1995		FY1996		FY1997	
F_DAMAGED	0.0189	-0.0090	0.0392 **	0.0457 **	0.0260 *	0.0371 *
	(0.0154)	(0.0282)	(0.0160)	(0.0207)	(0.0143)	(0.0172)
B_DAMAGED (t-1) †	-0.1110 ***	-0.0747	-0.0767 ***	-0.1777 ***	0.0552	-0.0487
	(0.0247)	(0.0696)	(0.0266)	(0.0614)	(0.1660)	(0.0720)
F_DAMAGED	0.4362	0.3637	-0.0537	-0.0344	-0.1479	-0.1092
×B_DAMAGED (t-1) †	(0.3198)	(0.3102)	(0.0394)	(0.1031)	(0.1699)	(0.0962)
F_SALESGROWTH (t-1)	0.0686	0.0702	0.0356	0.0390	0.0770	0.0802
	(0.0595)	(0.0592)	(0.0564)	(0.0562)	(0.0499)	(0.0498)
F_LNASSETS (t-1)	0.0086	0.0082	0.0193 ***	0.0190 ***	0.0017	0.0016
	(0.0053)	(0.0053)	(0.0053)	(0.0053)	(0.0045)	(0.0045)
F_LEV (t-1)	-0.0004	-0.0005	-0.0002	-0.0002	0.0009	0.0009
	(0.0003)	(0.0003)	(0.0006)	(0.0006)	(0.0012)	(0.0012)
F_ROA (t-1)	1.1228 ***	1.1208 ***	0.6043 ***	0.6082 ***	0.8721 ***	0.8764 ***
	(0.1658)	(0.1662)	(0.1471)	(0.1469)	(0.1460)	(0.1451)
F_CASH (t-1)	0.0954 **	0.0934 **	0.1710 ***	0.1690 ***	0.0861 ***	0.0859 ***
	(0.0433)	(0.0434)	(0.0345)	(0.0343)	(0.0298)	(0.0297)
B_LNASSETS (t-1)	-0.0007	-0.0007	-0.0039	-0.0059	-0.0011	-0.0024
	(0.0072)	(0.0075)	(0.0066)	(0.0068)	(0.0051)	(0.0053)
B_CAP (t-1)	-0.9597	-0.4912	1.5311	1.1580	-0.7729	-0.8886
	(1.4211)	(1.4265)	(1.3595)	(1.3384)	(1.0117)	(0.9939)
B_ROA (t-1)	-1.5220	-1.2204	1.1947	1.2352	-0.3989	-0.4024
	(1.7741)	(1.8067)	(1.4871)	(1.4792)	(1.6138)	(1.6105)
Constant	0.1270	0.1171	-0.0647	0.0095	0.0455	0.0846
	(0.2338)	(0.2403)	(0.2259)	(0.2314)	(0.1464)	(0.1516)
Obs	1,462	1,462	1,482	1,482	1,479	1,479
F	12.08	6.43	6.86	6.39	7.36	6.01
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.0763	0.0738	0.0527	0.0559	0.0535	0.0544
Root MSE	0.2302	0.2305	0.2173	0.2170	0.1989	0.1989
Industry dummies	yes	yes	yes	yes	yes	yes

Notes: Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The sample used for each estimation is the firm-level balanced sample from FY1995 to FY1999, which consists of the fixed cohort of firms surviving over the period. The number of observations varies over the years since outliers are dropped from the sample for each year. F_INVESTMENTRATIO is the ratio of firms' capital investment to one-period lagged fixed assets, F_SALESGROWTH is the growth rate of firms' sales, F_LNASSETS is the natural logarithm of firms' total assets, F_LEV is the ratio of firms' liabilities to equity, F_ROA is the ratio of firms' current profit to total assets, F_CASH is the ratio of firms' liquidity assets to total assets, F_DAMAGED is a dummy variable taking a value of one if the firm is located in one of the cities or towns identified as affected by the earthquake in the Act on Special Financial Support to Deal with a Designated Disaster of Extreme Severity, B_LNASSETS is the natural logarithm of total assets owned by firms' main bank, B_CAP is the equity to assets ratio of firms' main bank, B_ROA is the ratio of operating profit to total assets of firms' main bank, B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of a firms' main bank are located in the earthquake-affected area, and B_BRDAMAGED is the ratio of the number of branches of a firm's main bank located in the earthquake-affected area to its total number of branches.

† The B_DAMAGED variable is either (1) B_HQDAMAGED multiplied by SMALL, a dummy variable taking a value of one if a firm's main bank is either a shinkin bank or a credit cooperative, or (2) B_BRDAMAGED multiplied by SMALL, as indicated in the column heading.

Table 10: Year-by-year cross-section regression for investment ratio based on sample excluding firms that transacted with Hyogo Bank

Dependent variable: F_INVESTMENTRATIO (t)	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED	(1) B_DAMAGED = B_HQDAMAGED	(2) B_DAMAGED = B_BRDAMAGED
	FY1995		FY1996		FY1997	
F_DAMAGED	0.0188	-0.0080	0.0362 **	0.0297	0.0260 *	0.0360 **
	(0.0155)	(0.0252)	(0.0159)	(0.0215)	(0.0143)	(0.0174)
B_DAMAGED (t-1) †	-0.0864 ***	-0.0720	-0.0219	-0.1531 **	0.1526	-0.0044
	(0.0317)	(0.0661)	(0.0461)	(0.0602)	(0.1269)	(0.0751)
F_DAMAGED	0.3440	0.3371	0.0648	0.1201	-0.1975	-0.1070
×B_DAMAGED (t-1) †	(0.2401)	(0.2588)	(0.1165)	(0.1367)	(0.1371)	(0.1016)
F_SALESGROWTH (t-1)	0.0675	0.0688	0.0375	0.0391	0.0823	0.0800
	(0.0590)	(0.0588)	(0.0562)	(0.0565)	(0.0509)	(0.0497)
F_LNASSETS (t-1)	0.0082	0.0080	0.0194 ***	0.0191 ***	0.0019	0.0018
	(0.0053)	(0.0054)	(0.0053)	(0.0053)	(0.0045)	(0.0045)
F_LEV (t-1)	-0.0004	-0.0005	-0.0002	-0.0002	0.0007	0.0009
	(0.0003)	(0.0003)	(0.0006)	(0.0006)	(0.0012)	(0.0012)
F_ROA (t-1)	1.1305 ***	1.1243 ***	0.6026 ***	0.6041 ***	0.8701 ***	0.8753 ***
	(0.1665)	(0.1667)	(0.1470)	(0.1469)	(0.1461)	(0.1456)
F_CASH (t-1)	0.0915 **	0.0915 **	0.1711 ***	0.1695 ***	0.0875 ***	0.0864 ***
	(0.0437)	(0.0437)	(0.0346)	(0.0344)	(0.0298)	(0.0297)
B_LNASSETS (t-1)	-0.0008	0.0000	-0.0023	-0.0047	0.0010	-0.0021
	(0.0074)	(0.0076)	(0.0067)	(0.0069)	(0.0052)	(0.0054)
B_CAP (t-1)	-0.9136	-0.4306	1.3948	1.2499	-0.3090	-0.9310
	(1.4207)	(1.4399)	(1.4118)	(1.3429)	(1.0881)	(0.9992)
B_ROA (t-1)	-1.4633	-1.1633	1.2063	1.2410	-0.4319	-0.3747
	(1.7805)	(1.8197)	(1.4982)	(1.4829)	(1.6103)	(1.6153)
Constant	0.1343	0.1018	-0.0996	-0.0241	-0.0239	0.0736
	(0.2388)	(0.2439)	(0.2324)	(0.2344)	(0.1520)	(0.1533)
Obs	1,457	1,462	1,479	1,482	1,474	1,479
F	10.60	6.65	5.80	6.07	5.76	5.79
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.0757	0.0739	0.0517	0.536	0.0544	0.0536
Root MSE	0.2306	0.2305	0.2175	0.2172	0.1988	0.1989
Industry dummies	yes	yes	yes	yes	yes	yes

Notes: Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The sample used for each estimation is the firm-level balanced sample from FY1995 to FY1999, which consists of the fixed cohort of firms surviving over the period. The number of observations varies over the years since outliers are dropped from the sample for each year. F_INVESTMENTRATIO is the ratio of firms' capital investment to one-period lagged fixed assets, F_SALESGROWTH is the growth rate of firms' sales, F_LNASSETS is the natural logarithm of firms' total assets, F_LEV is the ratio of firms' liabilities to equity, F_ROA is the ratio of firms' current profit to total assets, F_CASH is the ratio of firms' liquidity assets to total assets, F_DAMAGED is a dummy variable taking a value of one if the firm is located in one of the cities or towns identified as affected by the earthquake in the Act on Special Financial Support to Deal with a Designated Disaster of Extreme Severity, B_LNASSETS is the natural logarithm of total assets owned by firms' main bank, B_CAP is the equity to assets ratio of firms' main bank, B_ROA is the ratio of operating profit to total assets of firms' main bank, B_HQDAMAGED is a dummy variable taking a value of one if the headquarters of a firms' main bank are located in the earthquake-affected area, and B_BRDAMAGED is the ratio of the number of branches of a firm's main bank located in the earthquake-affected area to its total number of branches.

† The B_DAMAGED variable is either B_HQDAMAGED or B_BRDAMAGED as indicated in the column heading.

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