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Local and Central Banks after a Natural Disaster:
Evidence from the Great Kanto Earthquake, 1923
Japan**

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The Bright and Dark Side of Financial Support from Local and Central Banks after a Natural Disaster: Evidence from the Great Kanto Earthquake, 1923 Japan

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Abstract

Natural disasters can seriously damage firms as well as the banks that they use independent of their size. However, it is small- and medium-sized firms in particular that will be affected by this because they tend to be financially constrained and thus greatly depend on these potentially damaged local banks for financing. In this paper, we focus on the Great Kanto Earthquake of 1923, which resulted in serious damage to small- and medium-sized firms and banks in Yokohama City, to investigate how effective the provision of loans by local banks, as well as the Earthquake Bills policy implemented by the Bank of Japan, was in helping firms recover. Using linked firm- and bank-level datasets, we find that larger local banks allowed damaged firms to survive and grow. The Earthquake Bills policy mitigated the negative impact of bank damage on firms and prevented credit crunch, although this deteriorated the balance sheet of local banks and resulted in financial instability and a banking crisis as a side effect.

Keywords: Great Kanto Earthquake, Building damage, Firm-bank relationship, Yokohama city, Earthquake bills, Bank of Japan

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1. Introduction

Small firms generally tend to be financially constrained and to be particularly vulnerable to external negative shocks. Credit sources dry up more quickly for small than for large firms in a crisis (Berger and Udell, 1998; OECD, 2012). In this regard, when natural disasters severely damage firms as well as local banks by causing many casualties, collapsed buildings, and business shutdowns, small- and medium-sized firms face higher probabilities of bankruptcy as a consequence. This arises because they are financially constrained and thus often find it difficult to finance their recovery. On the other hand, a surge of firms' credit demand for financing their survival and recovery deteriorates the balance sheet of their local transaction banks, also potentially damaged, thus resulting in financial crisis and instability. Therefore, the banking system and financial institutional development are arguably crucial in reducing constraints for small- and medium-sized enterprises (SMEs) (Beck et al., 2004; Beck and Demirguc-Kunt, 2006)² and reducing the propagation of negative shock impacts on small firms via the firm–bank relationship (Puri et al., 2011; Cotugno et al., 2013; Sette and Gobbi, 2014).

This paper addresses the question as to what extent financial constraints on small firms affect their survival and recovery after negative external shock, how their transaction banks could mitigate their financial constraints through bank lending, and whether central bank policies can help firms and banks survive and grow. The Great Kanto Earthquake in 1923 in Japan is an excellent case to study the potentially detrimental effects on smaller firms. As the most serious earthquake in Japanese history, more than one hundred thousand people died and assets as large as 35.5% of the gross national product (GNP) in 1922 were destroyed (Tokyo City Office, 1925; Ohkawa et al., 1974; Okazaki et al., 2019)³, where much of the human and physical damage was concentrated in Tokyo City and Yokohama City. Particularly in Yokohama City, many small firms and local banks were affected. In response, the Bank of Japan (BOJ) rediscounted bills issued by firms in the damaged areas from banks, the so-called “Earthquake Bills.” This provided liquidity and mitigated financial constraints for small firms. At the same time, the Earthquake Bills also helped insolvent banks and firms to survive, and thereby destabilized the banking system and financial markets, resulting in the financial crisis of 1927.

In addressing the issues at hand, this paper investigates firm survival and growth after the Great Kanto Earthquake with respect to firm–bank relationships and analyzes the pros and cons of the BOJ policy of discounting Earthquake Bills. We focus on Yokohama City for several reasons. At

² Around 39% of small firms face lack of financing as the main constraint to their growth (Beck et al., 2004).

³ Calculated using the amount of damage from Tokyo City Office (1925) and nominal GNP from Ohkawa et al. (1974).

the time, it was a modernized port city and had suffered much more serious damage due to the earthquake than Tokyo City. Compared with Tokyo City, Yokohama City was small and the credit market there was locally limited. Moreover, inside the city, there were many local small banks and many SMEs, and these local banks and SMEs were tightly linked. Furthermore, unlike today, the credit market was geographically segmented in Japan. Because almost all banks in Japan were locally operated, lending by their local transaction banks was crucial for SMEs' business. Under this circumstance, the earthquake damage intensified the negative impact on the financial constraints of the SMEs and local bank lending became a more crucial factor for survival.

Arguably, the case of the 1923 Earthquake and central bank policy is not just an interesting historical event to study, but can also provide timely lessons for today. More specifically, the Earthquake Bill policy implemented at the time is similar to the currently often employed credit easing policy as a nonstandard monetary policy instrument. For example, during the Global Financial Crisis of 2009, many central banks such as the FED (United States) and the ECB (Europe Union) purchased corporate bonds of specific sectors to stabilize the financial market. Such credit easing increased bank lending and promoted liquidity (Wang, 2016; Churm et al., 2018)⁴ and may have incentivized banks to lend money to SMEs to mitigate their financial constraints (Havrylchyk, 2016).

Our paper adds to the existing literature on three fronts. First, our study can be related to the banking literature. More specifically, some papers investigate the effect of bank failures on client firms. For instance, Slovin et al. (1993) analyze the stock prices of lending firms by the bank's de facto failure, and was followed by several other related studies (Bae et al., 2002). These all find a significantly negative effect of bank failures on the market values of client firms. Several other papers investigate the effects of bank failures or weak bank health on client firms, such as Fukuda and Koibuchi (2006) and Brewer III et al. (2003) which analyzed the failure of three long-term credit banks in Japan. However, these suffer from an identification problem in that the causality between bank failure and client firms' poor performance is unclear. To deal with the causality problem, the recent literature uses specific events as exogenous liquidity shocks. Khwaja and Mian (2008) is the seminal paper using firm-bank relationship data in this regard and find that firms with lending by banks with higher exposure to a liquidity shock tend to be more affected. Giannetti and Simonov (2013) investigate large listed firms to study the real effects of bank recapitalizations in Japan, while Chava and Purnanandam (2011) and Schnabl (2012), using the 1998 Russian sovereign default as a bank liquidity shock, examine a shock's transmission to the United States and an emerging market (Peru), respectively. In a paper much closer to ours,

⁴ Wang (2016) finds that the US credit easing and LSAP1 have a positive impact on lending by large banks.

Hosono et al. (2016) find that bank liquidity shocks after the Kobe earthquake negatively affect client firms' investment even in Japan. However, our study also differs from these studies in an important aspect. While all of the just mentioned studies specifically highlight the bank-lending channel, in reality, less lending due to external negative shocks is not only caused by banks' financial condition ("bank-lending channel") but also by firm size in that smaller firms in particular tend not to have alternative sources of credit ("firm-borrowing channel"). Thus, our value added is to investigate not only the lending channel but also the firm-borrowing channel by focusing on SMEs. More specifically, we explicitly investigate how SMEs were affected by tightened financial constraints as a result of the liquidity shock and how this might have been mitigated by BOJ policy.

Second, related to the above-mentioned firm-borrowing channel, our paper is related to SMEs and their financing. SMEs tend to be financially constrained and highly dependent on their transaction banks (Berger and Udell, 1998; Beck and Demirguc-Kunt, 2006). SMEs are more vulnerable to internal and external risks and disruptive shocks, which increases their dependency on credit demand from their transaction bank (Beck et al., 2005). Within our context, it should be noted that there were several local banks and the relationship between local banks and SMEs was traditionally long and tight in Japan (Boot, 2000; Uchida et al., 2008), which induces financial constraints in SMEs and segments bank market by region (Tsutsui and Kano, 2003). In general, such a setting is likely to have seen strong relationship banking (Petersen and Rajan, 1994, 1995) and caused a hold-up problem (Sharpe, 1990; Rajan, 1992). Thus, in this paper, we consider not only the bank-lending channel but also firm-borrowing channel using unique firm-level data that cover SMEs and their bank relationship in Yokohama City during the 1923 earthquake.

Third, while natural disasters can potentially have devastating impacts on local businesses, much of the existing literature on the economic impact of natural disasters has focused on macroeconomic, regional effects, households, or individuals⁵. In contrast, only a limited number conduct firm-level analysis. In this regard, it has been found that some businesses were permanently closed down if they were sufficiently affected by a natural disaster (Craioveanu and Terrell, 2016; Cole et al., 2019).⁶ Surviving firms experience losses (Boarnet, 1998; Tanaka, 2015), but there may be some surviving businesses that subsequently increase their production or boost their productivity (Leiter et al., 2009; Cole et al., 2019; Okazaki et al., 2019; Okubo and Strobl, 2021). A key, largely neglected aspect is whether businesses can survive a natural disaster

⁵ See the review by Karim and Noy (2016) and Noy and duPont (2018).

⁶ Craioveanu and Terrell (2016) found that firms damaged by Hurricane Katrina were less likely to survive, while Cole et al. (2019) discovered similarly for firms located in buildings damaged by the earthquake in Kobe City, Japan.

and can prevent production losses through access to financial funds, in particular, to loans. More specifically, Collier and Babich (2019) and Collier et al. (2019) showed that bank credit played an important role in financing businesses' recovery. In addition, younger and smaller firms were the most credit constrained after the event (Collier and Babich, 2019) but also benefited most from local lending (Cortes, 2014)⁷. With regard to natural disasters, the substantial demand for credit by damaged firms after such events, in turn, can put a substantial strain on the banking system (Klomp, 2016; Noth and Schuewer, 2017; Cortes and Strahan, 2017)⁸. In this regard, the ability of banks to serve as credit providers for affected firms is limited if they are damaged (Hosono et al., 2016; Koetter et al., 2020; Rehbein, 2018)⁹. Governmental or other financial aid can thus serve to circumvent the credit constraints faced by firms, although this is not always effective (Cole et al., 2017). In this vein, this paper investigates how damaged firms can finance enough in terms of keeping their business afloat, achieving recovery and growth as a consequence of the BOJ policy.

We bring together several unique datasets that allow us to investigate empirically the role of financial constraints and central bank policy in firm survival and ex post growth in Yokohama City after the earthquake. First, we collate damage data at the level of *Chome*, a small unit of an area within the city, as well as for individual firms. It should be noted in this regard that while the earthquake damage to firms and banks was huge, it was fairly heterogeneous across geographical spaces even within damaged areas. Second, we digitize unique data on firms as well as their transaction relationship with banks. More precisely, for Yokohama City, we compiled firm-level data in terms of survival and performance and linked this information to the balance-sheet information of banks with which each firm had a transaction relationship, before (1922) and after (1925) the earthquake. Finally, as noted above, just after the earthquake the government and the BOJ prepared a scheme for promoting the recovery by liquidity supply from the BOJ. Importantly, we collate information on the bank-level amount of the Earthquake Bills and link this to the banks involved in the firm–bank transaction relationship. This, thus, can be used as a measure indicating the extent to which each bank was supported by the BOJ credit. We combine all these data and undertake an econometric analysis of the role of firms' financial constraints, their banking relationships, and central bank policy in response to damage induced by the earthquake.

⁷ This is true for household recovery. See Sawada and Shimizutani (2008) regarding household consumption after the Kobe earthquake.

⁸ Klomp (2016), using a cross-country study covering 160 nations, found that natural catastrophes significantly affected both the liquidity and solvency of banks. This was confirmed by Noth and Schuewer (2017) and Cortes and Strahan (2017), using bank-level data for the US.

⁹ Rehbein (2018) after a large flood event in 2013 in Germany showed that damaged banks can even cause negative spillovers to undamaged firms who are their clients.

The remainder of the paper is organized as follows. Section 2 describes the historical background, focusing on the basic features of the Japanese financial system, the damage by the Great Kanto Earthquake, and its impact on the financial system. Section 3 explains the data and provides some descriptive statistics. Section 4 presents the econometric analyses. Section 5 discusses some implications of the BOJ policy. Section 6 presents the conclusion.

2. Background

2.1 Financial system in prewar Japan

The modern financial system in Japan dates back to the 1870s, just after the political regime change, the so-called Meiji Restoration. In this period, according to the National Bank Act of 1872, around 150 national banks, that is, private banks privileged to issue their own banknotes, were founded, while the Tokyo and Osaka Stock Exchanges were established in 1878. National banks were reorganized as ordinary banks after the foundation of the BOJ in 1882, and ordinary banks increased sharply in number to form a nationwide network of banking in the 1890s (Okazaki et al., 2005; Okazaki and Sawada, 2012). Although the stock exchanges listed just national bonds and stocks of themselves at first, the number of listed stocks increased in the late 1880s as many large joint-stock companies emerged in various industries, such as railways, marine shipping, and manufacturing (Tokyo Stock Exchange, 1928). In 1900, the ratio of the total paid-in capital of joint-stock companies rose to 24.6% of GNP. Figure 1 illustrates the long-term trends of the liabilities of the nonfinancial sector in Japan. More precisely, although the Japanese financial system is sometimes regarded as “bank-based” (Allen and Gale, 2000), i.e., raising funds from main banks, this view holds just for the postwar period (Okazaki and Okuno-Fujiwara, 1999; Hamao et al., 2009; Okazaki, 2016). In prewar Japan, the volume of funds raised from the stock market was almost as large as that from banks.

It is notable that patterns of corporate finance differed in firm size. Whereas large joint-stock companies with a capital no less than 10 million yen raised around 90% of funds from the stock and the bond markets, smaller firms and individuals relied for 60–70% of their funding from borrowing (Table 1). In addition, sources of borrowing depended upon firm size as well. Although the data are only for the early 1930s, Panels A and B of Table 2 show the sources of borrowing for establishments in Yokohama City by establishment size. Smaller establishments tended to rely on financial sources other than banks, including traders. Yet, even small- and medium-sized firms borrowed money from banks. For instance, factories with an average of 11.7 employees (those with capital from 10,000 to 50,000 yen) borrowed 26.9% of their money from banks, and commercial establishments in the same class of capital depended for 37.9% of their borrowing from banks. Thus, banks played a substantial role in the fund-raising of small- and medium-sized

firms in normal times, which implies that under the natural disaster, when networks of trades and trade credit are damaged, the role of banks is crucial.

Meanwhile, the banking system in prewar Japan had some distinctive features. First, it included numerous small banks. In 1922, just before the Great Kanto Earthquake, there were 1,799 ordinary banks, which had just 2.87 branches on average (Goto, 1970, pp. 86–87). 74.6% of these ordinary banks had capital smaller than one million yen. Later, a lower limit of bank capital was imposed by the Bank Law in 1928. Second, many of these banks had a close relationship with particular industrial firms (Kato, 1957). Okazaki et al. (2005) identified a tight bank–firm relationship by interlocking directors and found that 83.0% of ordinary banks in 1926 shared at least one director or auditor sent from their tightly connected industrial firms. Banks related to industrial firms tended to concentrate their loans on those firms, which would sometimes result in bank failures and bankruptcy (Bank of Japan, 1933; Kato, 1957; Okazaki et al., 2005).

2.2 Boom, depression, and damage by the Great Kanto Earthquake

The financial system in Japan with the features described above was vulnerable to fluctuations of the macroeconomy and external shocks, which resulted in the long financial instability after World War I. World War I was a springboard for the development of the Japanese economy. The average annual growth rate of real GNP was as high as 7.90% from 1914 to 1918, which was accompanied by an upgrade of the industrial structure. New industries, such as steel, machinery, and chemical industries developed rapidly, under the condition that imports from the Western countries declined. Whereas the ratio of heavy and chemical industries in the total manufacturing production was just 24.9% in 1914, it became 40.9% in 1918¹⁰. Meanwhile, commodity and asset prices soared. The wholesale price index increased 2.02 times from 1914 to 1918¹¹. In the same period, the average price of the stocks traded at the Tokyo Stock Exchange increased 1.81 times, while the average price of paddy fields went up 1.56 times¹². However, the expansion of the real economy came to an end when the war ended and international competition in the commodity markets restarted. Nevertheless, in 1919, commodity and asset prices again rose sharply by speculation under the easy financial conditions, but finally, in early 1920, commodity and asset markets collapsed, which was the start of the long depression until the early 1930s. The decline in commodity prices had a negative impact on industries, especially newly developed industries, which in turn made banks collect loans from firms in these industries. The circumstance that stocks and real estate were widely used as collateral for bank loans worsened the negative impact of the boom collapse

¹⁰ Calculated using the data from Shinohara (1972), pp. 142–143.

¹¹ Calculated using the wholesale price index of the Bank of Japan (1964, p. 76).

¹² Calculated using data from the Bank of Japan (1964, p. 88).

on the financial system because the collateral price declined sharply (Bank of Japan, 1933; Takahashi and Morigaki, 1993; Okazaki, 1997; Flath, 2000)¹³.

While the Japanese economy was facing the depression and instability of the financial system, the Great Kanto Earthquake hit Japan in 1923. The Great Kanto Earthquake is the most serious natural disaster that Japan has ever experienced. The number of dead and missing is estimated to be around 105 thousand, and 465 thousand buildings were completely burned or destroyed (Table 3). The total amount of physical damage was as large as 35.5% of Japan's GNP in 1922 (Okazaki et al., 2019)¹⁴. While it is probably better known that Tokyo City (under Tokyo Prefecture) was seriously damaged by the earthquake, the damage in Yokohama City (under Kanagawa Prefecture) was much more serious in a sense. More precisely, the percentages of deaths and missing relative to the population and the percentage of buildings totally burned or destroyed were both higher for Yokohama City than for Tokyo City (Table 3).

2.3 Impact on the financial system

It is well-documented that the Great Kanto Earthquake had a large negative impact on the financial system, not only in the Kanto region but also for Japan as a whole¹⁵. In addition to the direct damage to banks, burning of collateral, destruction of the equipment of borrowing firms, and deaths of borrowers sharply increased the nonperforming loans. The damage by the earthquake made the financial system even more fragile because it was already unstable due to the collapse of the economic boom during and just after World War I.

The government and BOJ actively intervened in the financial system to stabilize it after the earthquake. In this regard, on September 4, 1923, the government announced a moratorium for 30 days to prevent financial panic. Then, to prepare for the expiration of the moratorium, on September 27, the government legislated an act prescribing that the bill payables issued by firms in the damaged area, and discounted before September 1, would be rediscounted by the BOJ with recourse, and the government would compensate the losses of the BOJ incurred by this operation up to 100 million yen. The bills rediscounted by the BOJ were called "Earthquake Bills." The BOJ rediscounted Earthquake Bills from September 1923 to March 1924, amounting to 431

¹³ With respect of ordinary banks, the ratio of the loans with stocks and real estate as collateral was 33.8% and 10.1%, respectively (calculated using the data from Toyo Keizai Shinpo-sha, 1927, p. 13).

¹⁴ Calculated using the amount of damage from Tokyo City Office (1925) and nominal GNP from Ohkawa et al. (1974).

¹⁵ See Research Bureau of the Bank of Japan (1933), Imuta (1980), Bank of Japan (1983), Takahashi and Morigaki (1993).

million yen in total (239 billion yen or 2.72 billion US dollars at 2010 price)¹⁶. It is notable that the rediscount of Earthquake Bills concentrated on large Tokyo and Yokohama banks, which had already had transaction relationships with the BOJ (Ishii, 1980, p. 142; Bank of Japan, 1983, pp. 70–72, pp. 91–94). It is also well known in the context of Japanese financial history that a substantial part of Earthquake Bills was used for maintaining nonperforming loans generated by the boom during and just after World War I and its collapse in 1920 (Bank of Japan 1933, pp. 876–883; Bank of Japan, 1983, pp. 96–97; Takahashi and Morigaki, 1993, pp. 82–86)¹⁷. Because of the bad financial conditions of the firms that issued Earthquake Bills, it was difficult for the BOJ to collect loaned money from those firms and as a result, the due date was extended twice, from September 1925 to September 1926 and then to September 1927 (Bank of Japan, 1983, pp. 95–97).

Banks in Yokohama City were seriously damaged. Most of the headquarters and branches of banks in Yokohama City suffered from the earthquake (Yokohama Bank, 1980, pp. 65–66). One of the reasons why the damage to the banking system was serious and persistent in Yokohama City is the local financial market structure. The banking industry in Yokohama shared a basic feature with the whole Japanese banking industry in that it included many small- and medium-sized banks. Figure 2 illustrates the size distribution of ordinary banks for the whole of Japan and Yokohama City, in terms of capital. For all of Japan, 74.6% of ordinary banks had capital smaller than one million yen, where the lower limit of bank capital was imposed by the Bank Law in 1928. The distribution for Yokohama City is a little to the right of that of all of Japan, but still, 58.8% of banks had capital smaller than one million yen.

Table 4 breaks down the deposit and loans of banks in Yokohama City. Here, local banks refer to the banks headquartered in Yokohama City, and deposits and loans are those of bank headquarters and branches located in Yokohama City. Among local banks, Souda Bank, Yokohama Koshin Bank, Watanabe Bank, and Dai-ni Bank had large shares, and there were 11 smaller local banks at the end of 1922. In addition to these local banks, major banks headquartered in other prefectures, mainly in Tokyo City, had branches in Yokohama City. It is notable that there was a difference in the changes over time in the deposits and loans between these groups of banks. Large local banks

¹⁶ Inflated by the wholesale price index of the BOJ. We linked the index benchmarked in 1900 with the index benchmarked in 2005, in 1960.

¹⁷ The Bank of Japan (1933) writes, “The amount of the Earthquake Bills unsettled at the end of 1926 was 268 million yen, and the major reason for this huge amount of unsettled bills was decline in the capacity of repayment and financial difficulty of the borrowers because of the prolonged depression. The assets of large borrowers, such as Suzuki Co., businesses of Kuhara group, Kokusai Marine Shipping, and businesses of Murai group, depreciated extremely not only due to the earthquake damage but also due to the damage of the crisis in 1920. Thus, these firms needed fundamental restructuring, but they just temporized, and it was almost impossible for them to repay the Earthquake Bills.” (p. 883).

were seriously damaged by the earthquake. For example, for Souda Bank, one of the large local banks, the headquarters and eight of nine branches in Yokohama City and Tokyo City were burned down, and what is worse, the damage incurred a run by depositors (Yokohama City Office, 1976, pp. 749–750)¹⁸.

Despite the sharp decline in deposits, the loans of the large local banks increased from 1922 to 1924. This increase in loans was supported by the credit from the BOJ by Earthquake Bills (ibid., pp. 749–750; *Yokohama Maicho Shinbun*, July 23, 1924). The amount of special loans by Earthquake Bills to each bank is reported in the last column of Table 4. As stated above, rediscounting through the Earthquake Bills by the BOJ was concentrated in large banks. The impact of the BOJ credit on bank loans was substantial. Figure 3 illustrates the major items of the balance sheet of Souda Bank and clearly shows how the credit from the BOJ supported loans of Souda Bank when deposits declined.

Arguably, at least a part of the BOJ credit contributed to the recovery of Yokohama City. For example, Yokohama Koshin Bank, the second-largest local bank in Yokohama City, loaned a total of 1,080 thousand yen to small businesses for their recovery without collateral, cooperating with Yokohama City Office (Yokohama Bank, 1980, p. 67). Meanwhile, Yokohama Koshin Bank had Earthquake Bills of 1,152 thousand yen rediscounted by the BOJ. However, it is also true that a substantial amount of credit supplied by the BOJ through rediscount of Earthquake Bills was used for maintaining nonperforming loans. For instance, Souda Bank, the largest local bank in Yokohama City, had 8,018 thousand yen of Earthquake Bills rediscounted by the BOJ, but it had already had a large number of nonperforming loans before the earthquake because of its reckless loans to emerging businesses without secure collateral and to the businesses related to the Souda family (Bank of Japan, 1928, pp. 326–331; Bank of Japan, 1933, p. 906). Souda Bank was facing closure with a bank run during the Showa Financial Crisis in 1927. Table 5 shows the composition of its loans just before the closure. Out of the total loans, 23,667 thousand yen, 2,175 thousand yen (9.2%), and 7,369 thousand yen (31.1%) were to the firms owned by the Souda family and other related firms. Most of these loans were uncollectable (Bank of Japan, 1928, pp. 337–348). The case of Souda Bank indicates that the credit from the BOJ through rediscount of Earthquake Bills likely had a negative side effect in terms of continuing unsound related lending.

For smaller local banks, the damage by the earthquake was critical. Indeed, out of 12 smaller local

¹⁸ Another large local bank, Dai-ni Bank was also seriously damaged. With its office building, national bonds of a dozen million yen and raw silk bills of several million yen were burned, which incurred runs on its branches in other cities (Yokohama City Office, 1976, pp. 776–777).

banks listed in Table 4 for 1922, five banks disappeared from the record by the end of 1924. In this respect, it is notable that these smaller banks did not have or had a very small number of bills discounted by the BOJ (Table 4). The deposits of smaller local banks declined very sharply and did not recover, while the loans stagnated.

3. Data and Basic Statistics

3.1 Data

Our paper mainly exploits five data sources: (a) firm-level data concerning the firm–bank transaction relationship, (b) firm-level data with information on their damage, age, and asset values, (c) bank-level financial data, (d) bank-level Earthquake Bill data, and (e) a damage index at the *Chome* (small districts within towns) level.

(a) The unique firm-level data include the names of the banks with which each firm had a financial transaction relationship, and was obtained from *Dai Nihon Shoko-roku* (*Records on Commercial and Industrial Firms*) published annually by Dai Nihon Shoko-kai, an association of business firms. The data widely cover small- and medium-sized firms with no less than 30 yen for business tax per year¹⁹, including family firms and private firms in all industries: manufacturing, construction (e.g., carpenters), wholesale, retail shops (e.g., grocery shops, pharmacies, confectionaries), services (e.g., restaurants, cafés, inns), repair (house repair workshops and bicycle repair workshops), and transportation. The data contain each firm’s information such as firm name, firm owner name, address, industry, main product, business tax, and the names of the bank(s) that the firm mainly transacted with. The purpose of the business tax was to collect tax on a firm’s profits, but, in reality, was a pro forma standard tax. As shown in Table A1, the tax standards depended upon the category of business, i.e., sales and employees for wholesale and retail, capital and employees for manufacturing, transportation, printing, etc., and rental price of building and employees for inns, and so on. The tax was imposed based on these standards in the previous year (Fujisawa, 1923) and depended upon the category of business (Appendix Table A1). The standards and rates were different across business categories, but because the tax rate was fixed and the value of the standard for each firm was inspected every year, we can use the amount of business tax as a measure of firm scale. Our samples consist of all the firms in Yokohama City for which information on a bank transaction relationship is recorded in the 1922 and 1925 issues of *Dai Nihon Shoko-roku*. The sample of *Dai Nihon Shoko-roku* consists of 2,853 firms in Yokohama city in total in 1922 (before the earthquake). We drop all banking and financial companies, public utilities, transportation, land and real estates, stock companies, stock owners,

¹⁹ Compared with the data in the Statistical Yearbook of Tokyo Tax Bureau (1922 issue), we find that our samples account for 25% of all the firms that paid business tax in Yokohama City in 1922.

business conglomerates and individuals, leaving us with a sample size of 568 SMEs in the end. After combining other data sources as mentioned below, our sample size is reduced to 335 firms, which is our main (firm survival) estimation sample.

(b) Another firm-level data source is *Shoko Shinyo-roku (Records on Credit Statuses of Commercial and Industrial Firms)*, published annually by Tokyo Koshin-jo, one of the major credit bureaus. The data are based on credit investigations and widely cover small- and medium-sized firms, including family firms and private firms in all industries. The data record the owner's name, address, industry/business, founding year, and asset value of each firm²⁰. The asset value is recorded by rank category from A (larger than 3 million yen) to W (from 0 yen to 999 yen), as indicated in Appendix Table A2. We use the data for 1922 and 1925. In addition to the annual volumes, a special volume on the damage by the Great Kanto Earthquake was published, titled *Keihin Rinji Shoko Shinyo-roku (Special Volume for Tokyo and Yokohama Areas)* in March 1924. This volume provides information on firm-level damage by rank category from 1 (no or minor damage), 2 (small damage), 3 (intermediate level damage), 4 (large damage but able to resume business), 5 (serious damage, inducing bad profit and financial conditions) to 6 (enormous damage, i.e., too serious to quantify the level of damage). The samples in Tokyo and Yokohama are the same as those in the annual volumes (*Shoko Shinyo-roku (Records on Credit Statuses of Commercial and Industrial Firms)*). The firm-level data are matched with data (a) by firm owner name, firm address, and industry.

(c) The bank-level data for 1922 are taken from a special issue on banks of *Toyo Keizai Shinpo (Oriental Economist)*, while those for 1925 are taken from the *Yearbook of the Bank Bureau of the Ministry of Finance*. The former source provides the financial data of major ordinary and special banks, and the latter covers all ordinary and special banks²¹. For a few banks not covered by the former source, we supplemented the data from their business reports. For our purpose, we use financial data of those banks that had transaction relationships with firms in Yokohama City. Our bank samples include not only banks headquartered in Yokohama City but also those headquartered in other cities such as Tokyo and Osaka Cities because they had branches in Yokohama and transacted with firms there.

(d) The amount of Earthquake Bills rediscounted by the BOJ at the bank level is taken from the BOJ (1983, pp. 92–94). It captures the extent to which each bank had its damage mitigated by the

²⁰ Founding years for some firms are missing or approximate. Thus, we supplemented the data from Yokohama-shi Shoko Meikan and Yokohama-shi Kogyo Meikan.

²¹ *Yearbook of the Bank Bureau of the Ministry of Finance* started to provide bank-level financial data from the 1925 issue.

credit from the BOJ. A part of the Earthquake Bills was not repaid to the BOJ by the due date, where the ratio of the amount unpaid by the end of 1926 to the total Earthquake Bills of each bank is available in the BOJ (1983, p. 101). We use this ratio as a measure of the deterioration of the asset quality of a bank.

(e) Concerning the damage to firms and banks by the Great Kanto Earthquake, we construct a damage index calculated as the percentage of totally and half-collapsed buildings at the *Chome* level, where *Chome* is the smallest unit of a district in Japan, smaller than ward and town. The *Chome*-level damage index data are taken from Takahama et al. (2001) for Yokohama City, from Takemura (2003) for Tokyo City, and from Moroi and Takemura (2002) for other surrounding areas²². We use detailed address information of firms and headquarters/branches of banks to match each firm and bank with the damage index.

3.2 Firm–bank relationship

A unique feature of our dataset is that it contains information on the banks with which each firm transacted. Table 6 lists the banks in our dataset and the number of firms with which each bank had transaction relationships. We note that some firms transacted with multiple banks. Souda Bank, the largest local bank in Yokohama, had the largest number of client firms, and Yokohama Koshin Bank, the second-largest local bank, had the second-largest number (Tables 4 and 6). Among the banks headquartered in other cities, banks such as the Daihyaku (Tokyo), Sumitomo (Osaka), and Kawasaki (Tokyo) banks had many client firms in Yokohama. The total number of firm observations for 1925 was much smaller than that for 1922 due to the earthquake, but the shares of the banks in terms of the number of client firms were similar to those of 1922.

Table 6 reports the average size of the firms that each bank transacted with, where we measure the firm size in terms of the business tax. Concerning Yokohama City, it is found that the average firm size was substantially larger for nonlocal than for local banks. In particular, large urban banks, such as Mitsui, Dai-san, and Sumitomo, had bigger client firms. Meanwhile, for local banks, client firms of larger banks were bigger than those of smaller ones, but the difference was not substantial.

To see the relationship between bank size and firm size more comprehensively, Figure 4 plots it for 1922, where bank size (horizontal axis) is measured by its capital. Note that when firms transact with multiple banks, we use the average of their capital. First, bank and firm size are positively correlated, which is consistent with the view of a so-called “stratified financial

²² We are grateful to Dr. Takahama for providing us with the data.

structure,” i.e., transaction relationships between banks and firms were stratified and segregated by their size in prewar Japan, such that larger banks only transacted with larger firms, and vice versa (Imuta, 1980; Okazaki, 1993; Teranishi 2011). Second, however, there was still substantial variation in the size of banks for a firm of a certain size to transact with. This provides us with a good amount of variation to conduct regression analyses using bank size and firm size at the same time. Berger et al. (2005) similarly saw a positive size correlation but explained it by different roles between large and small banks, which is different reasoning from ours.

We also compare the average size of the firms with which each bank had transaction relationships, between the pre-earthquake and post-earthquake periods (Table 6). Overall, the number of firms decreased after the earthquake. However, some banks headquartered in Tokyo increased the average size of client firms. In particular, Dai-hyaku Bank and Dai-san Bank saw a sharp increase. On the other hand, many banks headquartered in Yokohama City slightly decreased or retained the average size of their client firms. This indicates that banks headquartered in Tokyo reduced the number of clients while keeping transaction relationships with large clients. In other words, banks headquartered in Tokyo reduced lending to small and medium enterprises after the earthquake. This is consistent with the evidence in the previous section.

3.3 Summary statistics

Summary statistics for the variables are provided in the top panel of Table 7. As can be seen, the rate of survival of firms in Yokohama City from 1922 to 1925 was 61.5%. The firm size, measured by the business tax, is on average around 360 yen, but with considerable variation. Their corresponding banks also vary substantially in terms of size measured by capital, with a mean of 110,275 yen²³. In terms of the damage in the *Chome* where the firms were located, one finds that the average firm damage rate was close to 67% with a standard deviation of 33%. Their banks, by contrast, were located in areas that were slightly more damaged, i.e., 70% on average, but again with considerable variation. Firm damage, a categorical variable ranging from 1 to 6, is 3.1 on average, i.e., intermediate level damage.

In terms of spatial dimension, the Appendix Figures provide maps of old Yokohama City on damage, number of firms, and number of banks (headquarters and branches) at the *Chome* level.

4. Econometric Model and Results

²³ In the data, the asset variable is categorical from 1 to 24. Each category defines the range of asset values.

4.1 Firm survival

We first investigate how local earthquake damage affected firm survival, where we measure earthquake damage by direct damage to a firm and damage at the regional level, i.e., *Chome*. The latter can be interpreted as capturing neighborhood infrastructure damage as well as damage to local transaction partners. We estimate the survival of firms by estimating the following linear probability model:

$$\begin{aligned} SURVIVAL_{it} = & \\ & \alpha_i + \beta_1 X_{it-1} + \beta_2 FDAMAGE_{it} + \beta_3 CDAMAGE_{it} + \beta_4 BDAMAGE_{it} \\ & + \beta_5 FSIZE_{it-1} + \beta_6 BSIZE_{it-1} + \beta_7 FSIZE_{it-1} \times FDAMAGE_{it} + \beta_8 FSIZE_{it-1} \times CDAMAGE_{it} \\ & + \beta_9 BSIZE_{it-1} \times BDAMAGE_{it} + \eta_i + \mu_i + \varepsilon_i, \end{aligned} \quad (1)$$

where *SURVIVAL* is an indicator variable that takes the value of 1 if firm *i* still exists after the earthquake (*t*), and **X** is a vector of firm *i*'s basic characteristics, such as firm age and asset values. *FDAMAGE* is the damage index of a firm, while *CDAMAGE* is the damage index in the *Chome* where firm *i* is located. *FSIZE* denotes the firm size. *BDAMAGE* is the damage index of the *Chome* where a firm's corresponding bank was located. We note that the bank damage index is average of the *Chome* damage for the corresponding bank's headquarters and branches located in Yokohama City. If the headquarter is outside Yokohama City, the *Chome* damage of the branches in Yokohama and headquarter in other cities are used in calculating mean. *BSIZE* is the size of the corresponding bank in terms of capital. We note that if a firm transacted with multiple banks, we use the average of the bank damage indices as well as bank size. η is a vector of sector dummies, and μ is a vector of ward dummies. Standard errors are clustered at the ward level. Although our smallest geographical unit is the *Chome*, almost all firms have transaction banks outside their *Chome* districts but within their ward. For this reason, we cluster standard errors at the ward level.

The results of estimating Equation (1) are reported in the first column of Table 8, first only using firm-level and *Chome*-level damage, alongside firm age, assets, and size as predictors. As can be seen, only firm size and asset are significant determinants of the probability to survive, where firms with greater size and more assets are less likely to exit. We next also included a firm's bank variables, namely bank size and the damage that the bank suffered from the earthquake (column (2)). While bank damage is significantly positive, bank size is not. Adding bank variables does not change the results on the other explanatory variables qualitatively, and only marginally lowers the significant coefficients on firm size and assets. In column (3), to allow the firm damage variables to depend on firm size, we interact the firm and regional variables with firm sales. Likewise, we let the impact of bank damage depend on bank size by interacting these variables

with each other. Accordingly, while this reverses the direct impact of firm size to be significantly negative, it results in a significant negative coefficient on *Chome* damage and a positive and significant coefficient on its interaction term with firm size. Thus, whereas damage in the *Chome* where the firm operates reduces the probability of firm survival after the earthquake, this negative effect is partially buffered by firm size. A plausible reason for this is that because our sample firms are SMEs, their business likely depends on transactions with local consumers and suppliers. Thus, the negative impact of *Chome* damage on firm survival reflects the damage of transaction partners and consumers in the same area. Firm damage on the other hand does not play a significant role in firm survival, neither directly nor through firm size.

In contrast to the *Chome*-damage variables, the variables representing the attributes of the banks that a firm transacted with are not significant. Thus, although one might expect that a larger bank with less damage could maintain a greater lending capacity to its client firms, this was not crucial for firm survival in Yokohama City just after the Great Kanto Earthquake. This could be because of the policy intervention by the BOJ, stated above, and we, thus, next include the variable representing the Earthquake Bill rediscounted by the BOJ, defined as the value of the Earthquake Bills that each bank had rediscounted by the BOJ, divided by the bank's capital, in column (4) of Table 8. We also include the interaction terms of *BOJ_bill* and *BDAMAGE*. However, neither the bank variables nor the *BOJ_bill* is significant, while the estimated coefficients on the *Chome*-damage variable and its interaction with firm size remain unchanged.

Given the importance of the firm scale effect for *Chome*-level damage found in columns (1)–(3), we explore whether firm size matters for the effects of bank damage and the BOJ bill, by interacting firm size with these variables in column (5). In this case, the bank variables are not significant, but the coefficient on the interaction term of the BOJ bill and firm scale is positive and statistically significant. This implies that the impact of the BOJ bill depends also on firm size. As stated above, although most of our sample firms are small- and medium-sized, even for these the relatively large ones tend to survive thanks to the rediscount policy by the BOJ. Concerning this, it is notable that neither the coefficient on the interaction term of the BOJ bill and bank damage, nor that on the interaction term of the BOJ bill and firm damage is significant. In other words, the positive effect of the BOJ's rediscount policy does not depend on bank damage or firm damage. This result is consistent with the contemporary criticism that nonperforming bills unrelated to the earthquake were included in the Earthquake Bills, and the BOJ used the earthquake as an excuse for rescuing unsound firms (Bank of Japan, 1983, pp. 95–96).

In column (6), we consider not only whether a BOJ bill was issued but also whether it mattered

if it was paid (*BOJ_bill_Paid*). Overall, the precision of the results improved. More specifically, the *BOJ_bill_Paid* is significantly positive and its interaction with bank damage is significantly negative. Hence, the *BOJ_bill_Paid* in itself increased the probability of survival but this is attenuated by bank damage. Furthermore, this attenuated effect is dampened by firm size. In other words, if a firm is larger, the BOJ bill positively affects its survival even if its bank is damaged. These findings suggest that the actual payment of the BOJ bill is an important determinant of whether a firm ceases to operate after an earthquake. In particular, relatively large firms tend to have their financial constraints reduced by BOJ bills.

As a final exercise, we further explore the possible intricacies of the role of the BOJ bill in firm survival. More specifically, we allow the effect to depend on the extent of damage in the *Chome* in which the firm was located because the BOJ bill policy was mainly targeted at firms in damaged areas. To investigate this, we add an interaction of *CDAMAGE* and *BOJ_bill_Paid* and an interaction of *CDAMAGE* and *BOJ_bill_Paid* and firm size to the last estimation. Column (7) reports the result. The interaction of *CDAMAGE* and *BOJ_bill_Paid* is significantly positive, and other variables are almost the same as before. Thus, the bill policy was more effective in seriously damaged areas and positively affected firm survival.

4.2 Firm growth

Next, we focus on the firms that survived from 1922 to 1925 to investigate whether the earthquake affected their post-survival growth by estimating the following linear model:

$$\begin{aligned} \Delta \log(Y_{t-1 \rightarrow t}) = & \alpha_i + \beta_1 X_{it-1} + \beta_2 FDAMAGE_{it} + \beta_3 CDAMAGE_{it} + \beta_4 BDAMAGE_{it} \\ & + \beta_5 FSIZE_{it-1} + \beta_6 BSIZE_{it-1} + \beta_7 FSIZE_{it-1} \times FDAMAGE_{it} + \beta_8 FSIZE_{it-1} \times CDAMAGE_{it} \\ & + \beta_9 BSIZE_{it-1} \times BDAMAGE_{it} + \eta_i + \mu_i + \varepsilon_i, \end{aligned} \quad (2)$$

where $\Delta \log(Y_{t-1 \rightarrow t})$ is the size growth of firm i proxied by its business tax paid, and the independent variables are the same as in Equation (1). The estimation results are reported in Table 9, where standard errors are clustered at the ward level.

Column (1) of Table 9 reports the result without bank terms and shows that only firm size is significant, where smaller firms tend to grow at a higher rate once they survive. Adding bank variables induces no substantial change (column(2)). In column (3), we allowed scale effects, both for firms and their banks, concerning the damage variables. Direct damage to a firm is significantly positive and its interaction with firm size is significantly negative. In other words, once a firm survives, a smaller firm with larger damage tends to experience higher growth. This

can be interpreted as creative destruction (Okazaki et al., 2019). The Bank variables are also significant, where both bank size and bank damage coefficients are significantly positive, while their interaction term coefficient is negative. That is, the direction and magnitude of the effect of bank damage on firm growth depend upon bank size, in that a larger bank tended to hinder the growth of its client firms if it was seriously damaged by the earthquake. Taken in context, this might be because banks needed some time for resuming their business to then provide credits to damaged, but surviving, firms to support their growth.

As in the case of firm survival, the firm scale effect is important for identifying the impact of earthquake damage. More specifically, while we find that firm-level damage is, contrary to not allowing for scale effect, now positive, this crucially depends on firm size. More specifically, the larger the firm the less growth-enhancing firm damage will be. This suggests that creative destruction is more likely to manifest itself in smaller damaged firms. A similar effect is found for bank damage in that while bank damage induces greater firm growth, this also depends on bank size. One may want to note that bank size also has an independent growth-enhancing impact.

Allowing for the bank variables' role in surviving firm growth to depend on the issuance of a BOJ bill does not change the significance of the bank-specific variables, as demonstrated in column (4). Similarly, this does not alter the scale-dependent firm-level damage roles, see column (5). As with firm survival, we next explored whether the impact of the bank covariates might depend on the size of the firm. This leaves only two significant variables, namely the bank size and the interaction term of firm size and the *BOJ_bill* variables. The negative impact of the latter means that firm size attenuates the impact of the BOJ bill, where if a firm is larger the impact of the BOJ bills on firm growth is smaller. Finally, we redefined the *BOJ_bill* in terms of being paid (*BOJ_bill_Paid*) in column (6), while adding interaction terms of *Chome* damage, *BOJ_bill_Paid*, and firm size in column (7) of Table 9. These changes, however, simply render the impact of the interaction term of the *BOJ_bill_Paid* with firm size insignificant, while the bank variables are significantly positive. This implies that the BOJ bill policy did not play a crucial role in firm growth, but bank-lending conditions were more crucial. On the bank side, because larger banks may have only been able to resume supplying lending in the medium term, although they could not help firms survive immediately after the earthquake due to their own damage, they eventually could mitigate the financial constraints of firms and thus promote firm growth through the bank-lending channel. In terms of firm size, smaller firms with serious damage tend to experience growth.

4.3 Robustness checks

We conducted several robustness checks. First, we use the subsample of single-bank firms. More specifically, at the time of the earthquake, Yokohama was a local and closed city where many small local banks had local clients with tight long-run relationships, and a substantial number of SMEs had only a single transaction bank. However, some firms had transactions with multiple banks. In this regard, the risk from bank shutdown or credit crunch for multiple-bank firms might be nonlinear in the sense that what matters to the firms is at least one bank is left standing. To explore such nonlinearity, we rerun our estimations only for single-bank firms. As shown in Table 10, results on survival and firm growth for this subsample are almost the same as for our full sample, although some additional bill policy variables now become significant in the survival estimation.

Our next robustness check is conducted on the subsample of firms with at least one bank headquartered in Yokohama City. The branches of major banks headquartered in other cities (Tokyo) were reluctant to loan in Yokohama City because after the earthquake the headquarters became cautious and withdrew funds from the branches in Yokohama City (*Yokohama Maicho Shinbun*, September 8, 1924). On the other hand, banks headquartered in Yokohama City left standing kept on their business in Yokohama City even though some branch offices shut down. In this sense, firms with at least one bank headquartered in Yokohama City tend to survive and grow and enjoy the benefit from the BOJ's rediscounted bill policy. Table 11 reports the results, which is a better result than the main estimation result. The magnitudes of the earthquake bill in survival estimation and bank size in growth estimation are larger.

We have thus far neglected the possibility that after the large-scale earthquake, the exit of some seriously damaged firms might have provided an opportunity for new entrants. However, according to the data, *Shoko Shinyo-roku*, the number of new entrants (all businesses such as manufacturing firms, commercial shops, services, banking, finance, real estate, transportation, private business, entrepreneurs, and individuals) did not sharply increase after the earthquake (Appendix Table A3). Regarding our sample, i.e., SMEs with bank transactions, the number of new entrants was very small (19 firms in our sample). Thus, firm exit caused by the earthquake was not replaced by new entrants. A major reason for the small entry is that the Japanese economy was facing the depression and instability of the financial system after World War I, as shown in Section 2.2, and thus new investment was stagnant even after the earthquake.

5. Implications: Lessons for Today

The case of the 1923 Earthquake was not just a unique historical event but can provide timely lessons for today. In particular, the Earthquake Bill policy is similar to the current credit easing

policy as a nonstandard monetary policy instrument. During the Global Financial Crisis of 2009, many central banks around the globe, such as the FED (United States), the ECB (Europe Union), and the BOJ, purchased commercial papers and corporate bonds of specific sectors to reduce credit uncertainty and stabilize the financial market. Such credit easing policy assumes central banks take specific private sectors' risk, and thus is very different from traditional monetary policy²⁴. However, as pointed out by some studies (Goodfriend, 2011), the credit easing policy involves some serious problems and concerns. The first concern is that such a credit policy is harmful to keeping the independence of the central bank and invades territories of fiscal authorities (Rajan, 2013). The second is that the credit policy is in danger of destabilizing the financial condition of the central bank by purchasing a risky asset. In particular, the credit policy sometimes involves financially fragile sectors such as SMEs, which negatively affects the policy impact.

One difference between the Earthquake Bill implemented during the 1923 earthquake and current credit easing policies is that the Earthquake Bill policy was more indirect, i.e., it rediscounted bills of private banks rather than purchased assets in the market. However, similar to the current policy, the rediscounted bills were biased toward some specific banks in damaged areas and thus it was specific client firms that particularly benefited from the policy. In particular, the Earthquake Bills helped many insolvent banks and firms to survive due to information asymmetry, and thereby destabilized the banking system and financial markets, resulting in the financial crisis of 1927. Therefore, this kind of policy intervention could be effective in mitigating financial constraints for SMEs in financial crises, but at the same time, there is a risk to distort resource allocation and incur a moral hazard.

6. Conclusion

The Great Kanto Earthquake of 1923 resulted in serious damage to firms and banks in Yokohama City. Focusing on this event, we explored the role of banks as well as the role of the central bank in the recovery of firms from the natural disaster. First, we find that a firm that had a transaction relationship with a damaged bank had a lower likelihood of survival and reduced growth, indicating that banks indeed played a role in a firm's post-earthquake performance. As a matter of fact, for the small- and medium-sized firms in our sample, we found that bank credit was

²⁴ Bernanke (2009) first called the FED's approach to supporting credit market as credit easing to distinguish it from quantitative easing. Goodfriend (2011) divides central bank operations into monetary policy and credit policy. While monetary policy contributes to a broad easing in financial conditions, credit policy facilitates financial conditions of specific sectors and/or regions that have difficulty in accessing credit, in other words, a kind of debt-financed fiscal policy. The credit policy is aimed at easing credit conditions and promoting allocation in the market by changing asset composition of the central bank.

essential for their survival and growth. Second, two factors mitigated the negative impact of bank damage on firms. For one, when the size of a damaged bank was larger, the negative impact was smaller. In terms of the other channel, liquidity supplied by the BOJ to banks also reduced the negative impact of bank damage. In this regard, the BOJ actively supplied liquidity by rediscounting the bills issued by firms in the damaged areas. This policy was effective in preventing the credit crunch from amplifying the damage by the earthquake. It should be noted, however, that this policy also had a negative side effect. A substantial number of the Earthquake Bills rediscounted by the BOJ were not repaid. We found that when a firm had a transaction relationship with a bank that had a larger proportion of rediscounted bills unpaid, the likelihood of firm survival was higher, but its growth rate was lower. This finding suggests that in such a case, the credit from the BOJ was used just to let insolvent firms survive, which is consistent with many anecdotes in Japanese financial history. More generally, our study shows that liquidity supply by the central bank for recovery from a shock like a natural disaster can have both positive and negative impacts. Finally, the case of the 1923 Earthquake was not just a unique historical event but can provide timely lessons for today. The Earthquake Bill policy is similar to the current credit easing policy. This kind of policy intervention could be effective in mitigating financial constraints for SMEs in financial crises, but at the same time, there is a risk to distort resource allocation and incur a moral hazard.

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Table 1 Composition of liabilities of non-financial sector by firm scale

		Total			Joint-stock companies with capital no less than 10 million yen			Other firms and individuals		
		Capital	Bond	Borrowing	Capital	Bond	Borrowin	Capital	Bond	Borrowing
Million yen	1915	1,480	278	2,728	...	...	...	...	...	...
	1920	6,679	542	8,332	...	...	...	...	...	...
	1925	9,129	1,761	11,397	5,018	1,761	609	4,111	0	10,788
	1930	11,847	3,013	12,434	6,863	3,013	1,124	4,983	0	11,310
	1935	14,089	3,442	12,683	8,320	2,900	734	5,769	542	11,949
	1940	26,353	6,824	25,457	16,355	4,700	3,153	9,997	2,123	22,304
%	1915	33.0	6.2	60.8	...	...	...	...	...	...
	1920	42.9	3.5	53.6	...	...	...	...	...	...
	1925	41.0	7.9	51.1	67.9	23.8	8.2	27.6	0.0	72.4
	1930	43.4	11.0	45.6	62.4	27.4	10.2	30.6	0.0	69.4
	1935	46.6	11.4	42.0	69.6	24.3	6.1	31.6	3.0	65.4
	1940	44.9	11.6	43.4	67.6	19.4	13.0	29.0	6.2	64.8

Source: Okazaki (2016).

Table 2 Sources of external finance for factories and commercial business offices in Yokohama City in 1933

A. Factories

Scale in terms of capital	Number of factories	Employees	Employees per factory	Sales	Sales per factory	Borrowing	Bank		Credit from transaction counterparts	Traditional financial institutions (pawn shop and mutual loan), and individuals
							1,000 yen	%		
	persons	persons	persons	1,000 yen	1,000 yen	1,000 yen	1,000 yen	%	1,000 yen	1,000 yen
Total	9,313	52,146	5.6	188,424	20.2	50,568	38,534	76.2	1,261	10,773
x<100 yen	801	1,334	1.7	379	0.5	38	0	0.0	3	35
100 yen ≤ x < 500 yen	2,494	5,134	2.1	2,670	1.1	185	14	7.6	42	129
500 yen ≤ x < 1,000 yen	1,878	4,741	2.5	3,520	1.9	206	25	12.3	36	144
1,000 yen ≤ x < 2,000 yen	1,714	4,818	2.8	5,269	3.1	336	37	11.1	85	214
2,000 yen ≤ x < 5,000 yen	1,430	5,433	3.8	7,749	5.4	579	92	15.9	120	367
5,000 yen ≤ x < 10,000 yen	447	2,616	5.9	4,740	10.6	368	61	16.6	101	206
10,000 yen ≤ x < 50,000 yen	372	4,365	11.7	12,208	32.8	982	264	26.9	224	494
50,000 yen ≤ x < 100,000 yen	72	1,833	25.5	5,434	75.5	692	296	42.8	106	289
100,000 yen ≤ x < 500,000 yen	65	2,889	44.4	17,864	274.8	2,234	1,139	51.0	224	871
500,000 yen ≤ x < 1,000,000 yen	10	1,382	138.2	8,085	808.5	744	534	71.8	81	130
1,000,000 yen ≤ x < 5,000,000 yen	18	4,572	254.0	45,201	2,511.2	5,211	4,993	95.8	218	0
5,000,000 yen ≤ x	12	13,029	1085.8	75,305	6,275.5	38,994	31,078	79.7	22	7,894

Source: Yokohama City Office (1937a).

Note: The figures of borrowing are the sum of the borrowing of the factories in each scale bin.

B. Commercial business offices

Scale in terms of capital	Number of offices	Employees	Employees per office	Sales	Sales per office	Borrowing	Bank		Other modern financial institutions	Credit from transaction counterparts	Traditional financial institutions (pawn shop and mutual loan), and individuals
							1,000 yen	%			
	persons	persons	persons	1,000 yen	1,000 yen	1,000 yen	1,000 yen	%	1,000 yen	1,000 yen	1,000 yen
Total	20,677	57,912	2.8	607,930	29.4	15,944	8,906	55.9	255	2,850	3,934
x<100 yen	2,482	3,742	1.5	1,141	0.5	63	1	2.1	2	12	48
100 yen ≤ x < 500 yen	4,937	8,804	1.8	6,572	1.3	422	22	5.3	13	133	253
500 yen ≤ x < 1,000 yen	4,170	8,380	2.0	9,765	2.3	550	55	10.0	17	191	286
1,000 yen ≤ x < 2,000 yen	3,758	8,356	2.2	13,904	3.7	832	90	10.8	19	344	380
2,000 yen ≤ x < 5,000 yen	3,044	8,237	2.7	26,465	8.7	1,322	193	14.6	56	509	564
5,000 yen ≤ x < 10,000 yen	1,070	3,819	3.6	18,086	16.9	922	196	21.3	23	314	389
10,000 yen ≤ x < 50,000 yen	903	5,340	5.9	61,456	68.1	2,352	891	37.9	68	766	628
50,000 yen ≤ x < 100,000 yen	150	1,529	10.2	47,966	319.8	1,358	501	36.9	3	438	417
100,000 yen ≤ x < 500,000 yen	124	2,728	22.0	85,649	690.7	2,302	1,539	66.8	52	144	568
500,000 yen ≤ x	39	6,977	178.9	336,927	8,639.2	5,821	5,418	93.1	0	0	403

Source: Yokohama City Office (1937b).

Note: The figures of borrowing are the sum of the borrowing of the business offices in each scale bin.

Table 3 Damage by the Great Kanto Earthquake

	Human damage			Physical damage		
	Number of death and missing	Population (thousand persons)	Percentage to the population	Number of buildings completely burnt or destroyed	Total number of buildings (thousand buildings)	Percentage to the total buildings
Total	104,619	11,743	0.89	464,909	2,284	20.4
Tokyo Prefecture	70,497	4,036	1.75	328,646	827	39.8
Tokyo City	68,660	2,265	3.03	305,146	483	63.2
Kanagawa Prefecture	31,859	1,379	2.31	115,353	274	42.1
Yokohama City	23,335	447	5.23	72,408	99	73.2
Other five damaged prefecture:	2,263	11,315	0.02	20,910	1,162	1.8

Note: Other five damaged prefectures are Chiba, Saitama, Shizuoka, Yamanashi and Ibaraki.

Source: Tokyo City Office (1925), pp.160-163.

Table 4 Deposit and loan by bank in Yokohama City

	1,000 yen						"Earthquake bills" discounted by BOJ
	Deposit			Loan			
	1922	1924	1926	1922	1924	1926	
Total	130,208	99,111	131,581	146,477	136,886	155,958	92,759
Local banks	63,970	45,024	72,562	65,313	66,995	79,248	20,953
Larger banks	49,639	39,443	66,285	50,417	53,818	63,679	19,711
Souda	22,596	12,507	14,671	12,737	12,970	14,309	8,018
Yokohama Koshin	14,244	16,231	31,360	5,377	12,731	17,729	1,152
Watanabe	6,408	5,826	12,036	8,638	9,186	8,385	-
Dai-ni	6,390	4,879	8,218	23,664	18,931	23,256	9,299
Smaller banks	14,331	5,581	6,277	14,896	13,177	15,569	1,242
Kanagawa	4,266	-	-	3,121	-	-	-
Hiranuma	3,527	1,767	2,293	2,940	2,464	2,190	-
Yokohama Wakao	2,380	2,262	2,554	3,815	8,360	11,274	1,015
Tobe	1,000	-	-	1,060	-	-	-
Toyo	904	-	-	1,343	-	-	-
Yokohama Boeki	850	427	340	1,024	533	450	80
Motomachi	678	242	235	560	396	344	32
Yokohama Shogyo	301	334	375	525	590	541	66
Okamaru	173	-	-	242	-	-	-
Yokohama	134	-	-	188	-	-	49
Joshin	119	549	480	78	834	770	-
Branches of non-local banks	66,238	54,087	59,019	81,164	69,891	76,710	71,806
Dai-ichi	14,828	8,822	9,007	15,117	13,030	13,207	-
Mitsui	12,432	10,970	11,786	20,122	20,644	17,546	-
Dai-san	9,527	-	-	9,251	-	-	-
Sumitomo	9,006	6,106	7,382	10,496	7,269	7,382	-
Dai-hyaku	7,955	4,153	8,262	11,924	5,387	7,754	7,926
Kawasaki	3,554	4,102	5,116	5,816	4,600	4,397	19,373
Shin'yu	3,289	2,123	2,029	3,036	3,067	2,852	-
Fujimoto Bill Broker	2,233	3,670	51	3,626	4,295	9,433	24,510
Jugo	1,436	3,037	4,451	218	750	1,122	19,704
Yasuda	977	8,526	7,478	618	9,614	12,751	-
Nihon Chuya	557	2,176	3,251	40	107	135	-
Kyoshin	241	165	0	690	905	0	293
Totsuka	205	237	206	211	223	131	-

Source: Monthly Bulletin of Yokohama Chamber of Commerce, various issues; Bank of Japan (1983), pp.92-93.

Note: The figures on Earthquake Bills are the amounts of the bills discounted by BOJ from September 29, 1923 to March 31, 1924.

Table 5: Composition of loan from Souda Bank as of 1927

	1,000 yen		
	Total	Uncollectable	Percentage
Total	23,667	16,263	68.7
Firms owned by Souda family	2,175	2,013	92.6
Other related firms	7,369	6,193	84.0
Others	14,124	8,067	57.1

Source: Research Bureau of the Bank of Japan (1933), p.340.

Table 6: Bank list in Yokohama city

Bank name	HQ location	Number of client firms		Average size of firms (business tax, yen)	
		1922	1925	1922	1925
Local banks		315	89	171.6	172.9
Larger banks		257	75	174.5	179.9
Souda	Yokohama	156	42	170.7	168.5
Yokohama Koshin	Yokohama	56	22	120.3	159.2
Watanabe	Yokohama	39	11	257.3	265.0
Dai-ni	Yokohama	6		238.8	
Smaller banks		58	14	158.6	135.2
Yokohama Boeki	Yokohama	5	1	332.0	184.0
Motomachi	Yokohama	8	1	69.3	82.0
Hiranuma	Yokohama	24	5	156.3	180.2
Okamaru	Yokohama	1			
Yokohama Shogyo	Yokohama	6		190.8	
Kyoshin	Yokohama	9	3	177.7	153.7
Tobe	Yokohama	4	2	59.0	72.5
Totsuka	Yokohama	1	2	96.0	60.0
Non-local banks		182	55	274.0	360.2
Dai-ichi	Tokyo	15	4	233.9	217.3
Mitsui	Tokyo	20	10	427.6	456.7
Dai-san	Tokyo	17	3	365.0	989.7
Sumitomo	Osaka	22	10	453.7	567.1
Dai-hyaku	Tokyo	40	9	271.5	317.7
Kawasaki	Tokyo	21	5	183.6	133.6
Yasuda	Tokyo	3	1	117.7	86.0
Hotoku	Tokyo	2	1	60.5	109.0
Kyoshin	Yokosuka	29	9	123.8	166.7
Hudo chochiku	Tokyo	1		67.0	
Teikoku Chozo	Tokyo	1		24.0	
Tomikura	Tokyo	2		72.0	
Sanju-hachi	Hyogo	1		1096.0	
Others		8	3	188.0	171.0

Table 7 Summary Statistics

variables	definition	mean	sd	min	max	Source
survival	Survival Indicator	0.614925	0.487341		0	1 A
sales growth	Firm sales growth	-1.03882	0.936348	-5.05306	2.116483	A
Age	Firm Age (ln)	3.097051	0.761821		0	5.402678 B
Asset	Capital Asset value (category 1-24)	8.955224	4.503601		1	24 B
FDamage	Firm damage (category, 1-6)	3.110448	1.265519		1	6 B
Cdamage	Chome Damage (share, 0-1)	0.6692	0.329538		0	1 C
FSize	Firm size: Taxes on Profits (yen)(ln)	5.149188	0.963459	2.302585	9.625228	A
Bsize	Bank size: Capital asset (yen)	10.77629	1.397029	6.659294	14.20987	D
Bank Damage	Bank Damage (share, 0-1)	0.701882	0.105629	0.137933	0.846726	C
BOJ bill	Earthquake Bills normalized by Capital Asset	0.047341	0.045295		0	0.330309 E
BOJ bill Paid	Paid Earthquake Bills normalized by Capital Asset	0.067499	0.081388		0	0.970332 E

data sources

A: Dai Nihon Shoko-roku (Records on Commercial and Industrial Firms)

B: Shoko Shinyo-roku (Records on Credit Statuses of Commercial and Industrial Firms)

C: Damage index by Takahama et al. (2001)

D: Yearbook of the Bank Bureau of the Ministry of Finance

E: BOJ (1983, pp. 92-94)

Table 8: Survival

	1			2			3		
	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t
Age	-0.0043	0.025	-0.17	-0.0046	0.026	-0.18	-0.0059	0.026	-0.22
Asset	0.0127	0.006	2.17 *	0.0125	0.006	2.08 *	0.0155	0.007	2.17 *
FDamage	-0.0111	0.014	-0.77	-0.0118	0.014	-0.83	-0.2149	0.116	-1.85
CDamage	0.0982	0.155	0.63	0.0997	0.164	0.61	-0.8504	0.336	-2.53 **
FSize	0.1347	0.027	5.01 ***	0.1316	0.026	5.15 ***	-0.1033	0.012	-8.6 ***
FDamage#Fsize							0.0407	0.022	1.85
CDamage#Fsize							0.1854	0.072	2.57 **
Bsize				0.0183	0.020	0.93	-0.0417	0.062	-0.67
BDamage				0.1828	0.067	2.71 **	-0.6567	0.917	-0.72
BSize#BDamage							0.0803	0.086	0.94
Sector		yes			yes			yes	
Ward		yes			yes			yes	
Observation		335			335			335	
R-sq		0.269			0.272			0.289	

	4			5			6			7		
	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t
Age	-0.0024	0.027	-0.09	0.0016	0.029	0.06	0.0062	0.030	0.21	0.0066	0.035	0.19
Asset	0.0157	0.008	2.02 *	0.0153	0.007	2.11 *	0.0148	0.006	2.35 **	0.0147	0.006	2.31 **
FDamage	-0.2170	0.116	-1.87 *	-0.2707	0.138	-1.96 *	-0.2021	0.108	-1.87	-0.2212	0.114	-1.94 *
CDamage	-0.8561	0.323	-2.65 **	-0.7298	0.393	-1.86	-0.7731	0.329	-2.35 **	-1.9503	0.481	-4.05 ***
FSize	-0.1063	0.013	-8.06 ***	0.0771	0.158	0.49	0.2111	0.330	0.64 **	-0.0031	0.179	-0.02
FDamage#Fsize	0.0411	0.023	1.8	0.0517	0.028	1.87 *	0.0386	0.021	1.85	0.0421	0.023	1.82
CDamage#Fsize	0.1848	0.065	2.86 **	0.1574	0.075	2.1 *	0.1690	0.064	2.65 **	0.3829	0.148	2.58 **
Bsize	-0.0664	0.298	-0.22	-0.0389	0.297	-0.13	-0.0346	0.164	-0.21	-0.0598	0.145	-0.41
BDamage	-1.1410	5.223	-0.22	0.0974	4.369	0.02	0.3466	2.228	0.16	-1.1511	2.791	-0.41
BSize#BDamage	0.0928	0.418	0.22	0.1659	0.423	0.39	0.2355	0.417	0.56	0.3390	0.406	0.84
BOJ_bill	17.218	81.4	0.21	3.3414	55.05	0.06						
BDamage#BOJ_bill	-29.129	111.1	-0.26	-57.815	94.48	-0.61						
BSize#BOJ_bill	-2.1395	7.110	-0.3	-3.1434	5.406	-0.58						
BDamage#BOJ_bill#Bsize	3.4433	9.629	0.36	8.5533	8.839	0.97						
FSize#BDamage#BOJ_bill				2.4847	7.517	0.33						
FSize#BOJ_bill				5.6316	1.726	3.26 ***						
Fsize#BDamage#BOJbill#Bsize				-0.8101	0.713	-1.14						
Fsize#BDamage				-0.1696	0.259	-0.66	-0.1515	0.124	-1.22	0.0545	0.485	0.11
Fsize#BDamage#Bsize				-0.0184	0.019	-0.95	-0.0323	0.039	-0.82	0.0830	0.251	0.33
BOJ_bill_PAID							27.460	8.488	3.24 ***	3.1578	10.50	0.3
BDamage#BOJ_bill_PAID							-50.181	26.450	-1.9 *	-23.742	29.98	-0.79
Bsize#BOJ_bill_PAID							-2.3804	2.098	-1.13	-1.7431	1.781	-0.98
BDamage#BOJ_bill_PAID#Bsize							3.8915	4.783	0.81	1.8780	4.021	0.47
Fsize#BDamage#BOJ_bill_PAID							2.8895	0.933	3.1 ***	-0.6863	3.050	-0.23
Fsize#BOJ_bill_PAID							0.0232	3.691	0.01	3.3021	1.290	2.56 **
Fsize#BDamage#BOJbillPAID#Bsize							-0.1754	0.462	-0.38	-0.0465	0.043	-1.07
CDamage #BOJ_bill_PAID										18.933	8.602	2.2 *
Fsize # CDamage # BOJ bill PAID										-3.4452	2.054	-1.68
Sector		yes			yes			yes			yes	
Ward		yes			yes			yes			yes	
Observation		335			335			335			333	
R-sq		0.293			0.313			0.3102			0.314	

Notes: (i) Standard errors clustered by Ward in parentheses, (ii) *** p<0.01, ** p<0.05, * p<0.10

BOJ_bill=Bill/Asset

BOJ_bill_PAID=(Bill*(1-Unpaid))/Asset

Table 9: Firm growth

	1			2			3		
	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t
Age	-0.0265	0.095	-0.28	-0.0286	0.089	-0.32	-0.0307	0.074	-0.41
Asset	0.0079	0.010	0.81	0.0065	0.007	0.9	-0.0144	0.012	-1.22
FDamage	-0.0839	0.049	-1.73	-0.0832	0.052	-1.61	0.4440	0.078	5.66 ***
CDamage	0.1667	0.176	0.95	0.1193	0.174	0.68	-0.8331	0.566	-1.47
FSize	-0.4164	0.052	-8.04 ***	-0.4193	0.047	-8.84 ***	-0.2647	0.089	-2.96 ***
FDamage#Fsize							-0.1080	0.021	-5.04 ***
CDamage#Fsize							0.1638	0.107	1.53
Bsize				0.1023	0.065	1.57	0.8945	0.188	4.76 ***
BDamage				0.1461	1.137	0.13	12.3381	3.369	3.66 ***
BSize#BDamage							-1.1170	0.257	-4.34 ***
Sector Dummy		yes			yes			yes	
Ward Dummy		yes			yes			yes	
Observation		203			203			203	
R-sq		0.2605			0.2748			0.346	

	4			5			6			7		
	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t	Coeff	Std err	t
Age	-0.0345	0.077	-0.45	0.0182	0.096	0.19	0.0167	0.100	0.17	0.0177	0.108	0.16
Asset	-0.0153	0.013	-1.16	-0.0136	0.006	-2.25 *	-0.0138	0.011	-1.3	-0.0139	0.012	-1.19
FDamage	0.4507	0.104	4.33 ***	0.1611	0.265	0.61	0.3793	0.111	3.41 ***	0.3814	0.146	2.61 **
CDamage	-0.9236	0.668	-1.38	-0.9946	1.077	-0.92	-1.7566	0.622	-2.82 **	-1.2263	1.638	-0.75
FSize	-0.2731	0.106	-2.58 **	0.8935	0.639	1.4	-0.0612	0.840	-0.07	0.0688	0.987	0.07
FDamage#Fsize	-0.1095	0.026	-4.17 ***	-0.0513	0.046	-1.12	-0.0942	0.027	-3.43 ***	-0.0946	0.036	-2.65 **
CDamage#Fsize	0.1851	0.127	1.46	0.2109	0.221	0.95	0.3484	0.134	2.61 **	0.2470	0.308	0.8
Bsize	1.3773	0.311	4.42 ***	0.9816	0.304	3.23 ***	1.0653	0.431	2.47 **	1.0658	0.472	2.26 *
BDamage	20.0821	4.773	4.21 ***	16.8732	9.096	1.85	11.2925	4.669	2.42 **	12.6375	7.382	1.71
BSize#BDamage	-1.7046	0.356	-4.78 ***	-0.4111	0.665	-0.62	-0.7737	0.639	-1.21	-0.8456	0.685	-1.23
BOJ_bill	65.7895	102.7	0.64	77.2164	110.03	0.7						
BDamage#BOJ_bill	-69.947	135.5	-0.52	-410.76	329.13	-1.25						
BSize#BOJ_bill	-4.6803	10.389	-0.45	4.8584	11.111	0.44						
BDamage#BOJ_bill#Bsize	4.5206	13.775	0.33	91.5555	75.688	1.21						
FSize#BDamage#BOJ_bill				22.3510	35.778	0.62						
FSize#BOJ_bill				-20.279	7.093	-2.86 ***						
Fsize#BDamage#BOJbill#Bsize				-6.0941	7.963	-0.77						
Fsize#BDamage				-0.4599	1.793	-0.26	0.7981	1.311	0.61	69.3271	85.101	0.81
Fsize#BDamage#Bsize				-0.1406	0.142	-0.99	-0.1042	0.041	-2.51 ***	-245.19	209.46	-1.17
BOJ_bill_PAID							55.2966	55.683	0.99	-3.5370	4.458	-0.79
BDamage#BOJ_bill_PAID							-224.22	179.88	-1.25	21.6627	17.757	1.22
Bsize#BOJ_bill_PAID							-3.5192	3.236	-1.09	35.1997	30.897	1.14
BDamage#BOJ_bill_PAID#Bsize							20.8272	16.648	1.25	-3.2934	13.587	-0.24
Fsize#BDamage#BOJ_bill_PAID							30.9039	27.526	1.12	-3.4173	2.083	-1.64
Fsize#BOJ_bill_PAID							-0.6753	10.988	-0.06	0.5181	1.775	0.29
Fsize#BDamage#BOJbillPAID#Bsize							-3.2326	2.148	-1.5	-0.0887	0.066	-1.35
CDamage #BOJ_bill_PAID										-9.4082	23.239	-0.4
Fsize # CDamage # BOJ bill PAID										1.7766	4.072	0.44
Sector Dummy		yes			yes			yes			yes	
Ward Dummy		yes			yes			yes			yes	
Observation		203			203			203			203	
R-sq		0.327			0.3723			0.305			0.372	

Notes: (i) Standard errors clustered by Ward in parentheses, (ii) *** p<0.01, ** p<0.05, * p<0.10

BOJ_bill=Bill/Asset

BOJ_bill_PAID=(Bill*(1-Unpaid))/Asset

Table 10: Firms with single bank

	Survival			Firm growth		
	Coeff	Std err	t	Coeff	Std err	t
Age	-0.0291	0.0390	-0.8	-0.2650	0.0706	-3.75 ***
Asset	0.0201	0.0077	2.62 **	-0.0293	0.0104	-2.81 ***
FDamage	-0.2584	0.1452	-1.8	0.4046	0.1892	2.14 *
CDamage	-2.6251	0.6563	-4 ***	-3.4444	1.3796	-2.5 **
FSize	-0.6052	0.3536	-1.7	-3.3877	1.5732	-2.15 *
FDamage#Fsize	0.0469	0.0317	1.48	-0.0851	0.0291	-2.93 ***
CDamage#Fsize	0.5098	0.1544	3.3 ***	0.6557	0.2677	2.45 **
Bsize	-0.3265	0.1571	-2.1 *	1.4050	1.1545	1.22
BDamage	-4.7330	3.6914	-1.3	-12.3013	26.4716	-0.46
BSize#BDamage	0.4733	0.2663	1.78	-0.6832	2.0226	-0.34
BOJ_bill_PAID	187.7757	50.8560	3.69 ***	-231.4822	563.25	-0.41
BDamage#BOJ_bill_PAID	-294.3454	64.4917	-4.6 ***	73.3553	1047.91	0.07
Bsize#BOJ bill PAID	-11.3416	0.6133	-18 ***	-25.6749	52.7450	-0.49
BDamage#BOJ_bill_PAID#Bsize	16.5545	3.9029	4.24 ***	60.9772	101.6009	0.6
Fsize#BDamage#BOJ_bill_PAID	17.1856	14.3061	1.2	-97.2653	54.9616	-1.77
Fsize#BOJ_bill_PAID	-3.7725	10.4727	-0.4	106.7340	27.4979	3.88 ***
Fsize#BDamage#BOJbillPAID#Bsize	-0.6654	0.7563	-0.9	-5.3173	5.9663	-0.89
Fsize#BDamage	0.2880	0.6029	0.48	6.8718	2.3505	2.92 ***
Fsize#BDamage#Bsize	0.0031	0.0413	0.07	-0.2362	0.1523	-1.55
CDamage #BOJ_bill_PAID	29.8954	8.2819	3.61 ***	10.8042	18.1039	0.6
Fsize # CDamage # BOJ bill PAID	-5.6104	1.7716	-3.2 ***	-0.8423	3.6133	-0.23
Sector Dummy		yes			yes	
Ward Dummy		yes			yes	
Observation		217			130	
R-sq		0.3594			0.5254	

Notes: (i) Standard errors clustered by Ward in parentheses, (ii) *** p<0.01, ** p<0.05, * p<0.10
This estimation limits the sample of firms with single transaction bank.

Table 11: Firms with (at least one) local banks

	Survival			Firm growth		
	Coeff	Std err	t	Coeff	Std err	t
Age	0.0340	0.0471	0.72	0.0227	0.0447	0.51
Asset	0.0215	0.0095	2.26 *	-0.0223	0.0100	-2.22 *
FDamage	-0.2558	0.1556	-1.64	0.4704	0.0338	13.93 ***
CDamage	-1.9935	0.3598	-5.54 ***	-1.2595	1.6045	-0.78
FSize	-0.6012	0.4920	-1.22	-3.5766	0.6276	-5.7 ***
FDamage#Fsize	0.0515	0.0321	1.6	-0.1100	0.0174	-6.33 ***
CDamage#Fsize	0.3899	0.1383	2.82 ***	0.2847	0.2893	0.98
Bsize	0.2171	0.2600	0.84	1.8917	0.9229	2.05 *
BDamage	1.0430	5.7969	0.18	2.5408	17.4925	0.15
BSize#BDamage	-0.1712	0.8316	-0.21	-2.4702	1.7569	-1.41
BOJ_bill_PAID	39.2616	14.479	2.71 ***	66.3991	141.43	0.47
BDamage#BOJ_bill_PAID	-72.5028	57.833	-1.25	-283.322	274.20	-1.03
Bsize#BOJ bill PAID	-5.3460	2.2329	-2.39 **	-12.9974	7.3965	-1.76
BDamage#BOJ_bill_PAID#Bsize	6.2432	7.1681	0.87	38.3078	21.3688	1.79
Fsize#BDamage#BOJ_bill_PAID	-0.8346	6.4906	-0.13	18.5913	29.6142	0.63
Fsize#BOJ_bill_PAID	4.3040	2.3383	1.84	15.2140	10.9995	1.38
Fsize#BDamage#BOJbillPAID#Bsize	0.0227	0.8631	0.03	-4.1539	2.2004	-1.89
Fsize#BDamage	0.3496	0.5083	0.69	4.3360	1.3478	3.22 ***
Fsize#BDamage#Bsize	-0.0060	0.1004	-0.06	0.0161	0.1261	0.13
CDamage #BOJ_bill_PAID	18.7627	9.5656	1.96 *	-3.5357	27.9245	-0.13
Fsize # CDamage # BOJ bill PAID	-3.3423	2.3176	-1.44	0.4995	4.6596	0.11
Sector Dummy		yes			yes	
Ward Dummy		yes			yes	
Observation		255			159	
R-sq		0.323			0.4713	

Notes: (i) Standard errors clustered by Ward in parentheses, (ii) *** p<0.01, ** p<0.05, * p<0.10

Appendix Table A1: Standard and business tax rate

Business category	Standard	Tax rate
Wholesale	Sales	0.08–0.11 %
	Employee	2.0 yen/person
Retail	Sales	0.2–0.3 %
	Employee	2.0 yen/person
Bank, insurance	Capital	0.4 %
	Employee	2.0 yen/person
Rental	Working capital	0.4 %
	Employee	2.0 yen/person
Manufacturing, printing	Capital	0.4 %
	Employee	2.0 yen/person
	Manual worker	0.5 yen/person
Transportation	Capital	0.4 %
	Employee	2.0 yen/person
	Manual worker	0.5 yen/person
Warehouse	Rental price	5.7 %
	Employee	2.0 yen/person
	Manual worker	0.5 yen/person
Railways	Revenue	1.4 %
	Employee	2.0 yen/person
	Manual worker	0.5
Contracting business	Revenue	0.3 %
	Employee	2.0 yen/person
	Manual worker	0.5 yen/person
Rental hall	Rental price	7.9 %
	Employee	2.0 yen/person
Restaurant	Rental price	8.0 %
	Employee	2.0 yen/person
Inn	Rental price	5.0 %
	Employee	2.0 yen/person
Agent, brokage, trust	Fee	2.1 %
	Employee	2.0 yen/person

Source: Fujisawa (1923), pp.178–180.

Appendix Table A2: Rank category of firm asset

Asset size	Rank category
Larger than 3,000,000 yen	A
2,500,000–3,000,000	B
2,000,000–2,500,000	C
1,500,000–2,000,000	D
1,000,000–1,500,000	E
750,000–1,000,000	F
500,000–750,000	G
400,000–500,000	H
300,000–400,000	I
250,000–3,00,000	J
20,000–300,000	K
150,000–200,000	L
100,000–150,000	M
75,000–100,000	N
50,000–75,000	O
35,000–50,000	P
20,000–35,000	Q
10,000–20,000	R
5,000–10,000	S
3,000–5,000	T
2,000–3,000	U
1,000–2,000	V
0–1,000	W

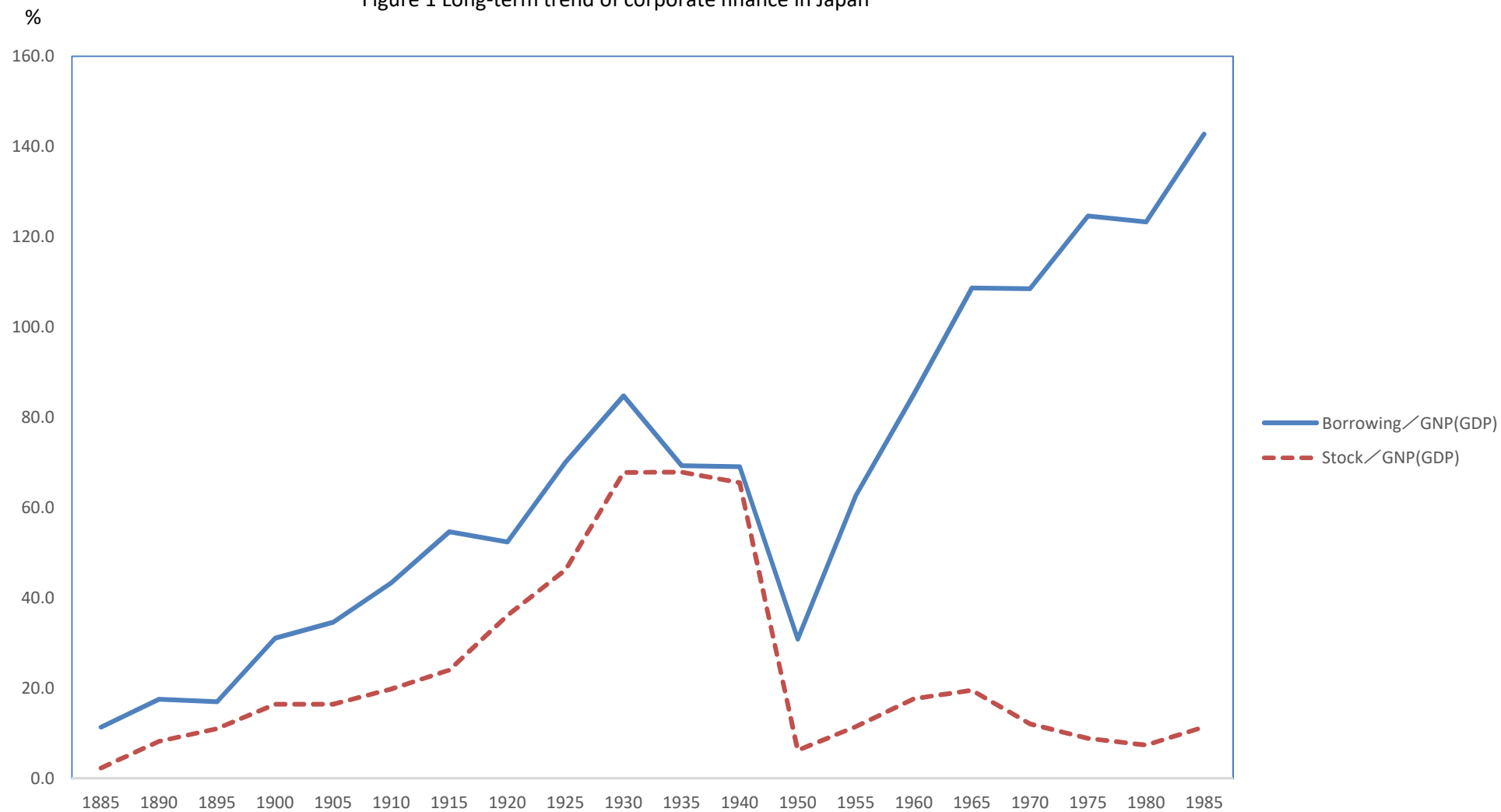
Source: Tokyo Koshinjo (1922, 1926)

Appendix Table A3: Number of new entrant

<u>year</u>	<u>entrant</u>
1917	98
1918	94
1919	73
1920	63
1921	56
1922	40
1923	77
1924	87
1925	48

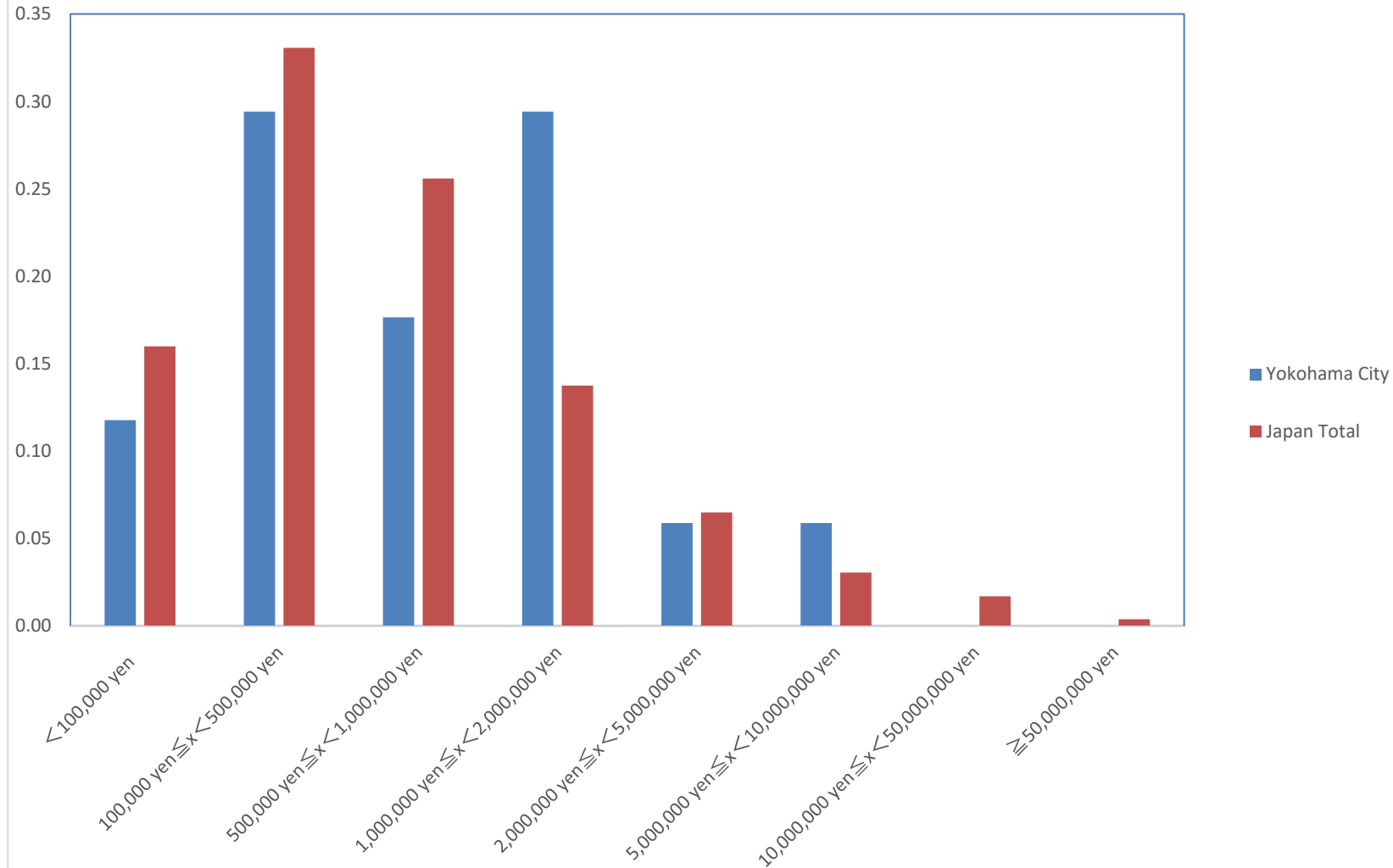
Source: Shoko Shinyo-roku (Records on Credit Statuses of Commercial and Industrial Firms)

Figure 1 Long-term trend of corporate finance in Japan



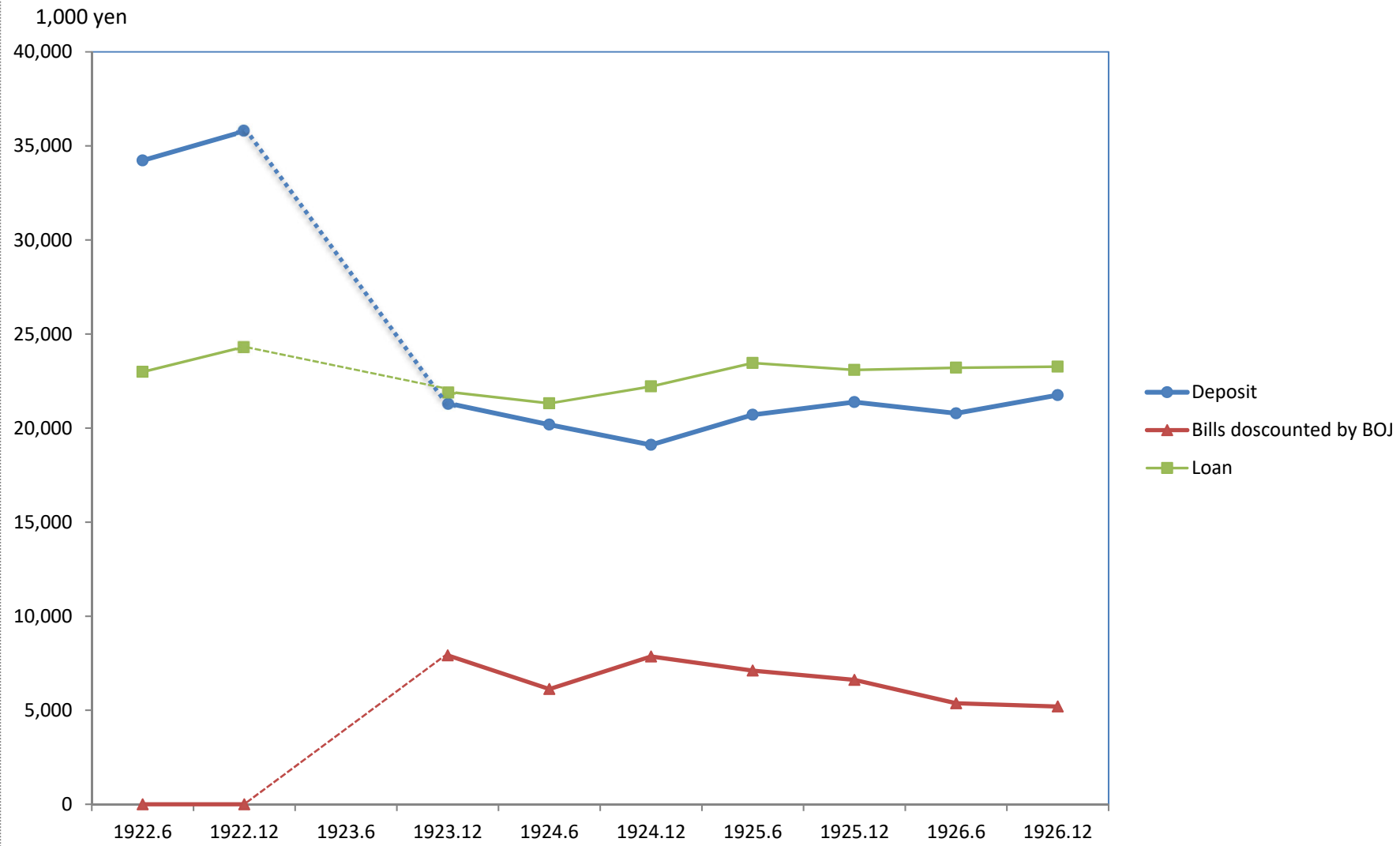
Source: Okazaki (2016).

Figure 2 Size distribution of ordinary banks in terms of capital in 1921



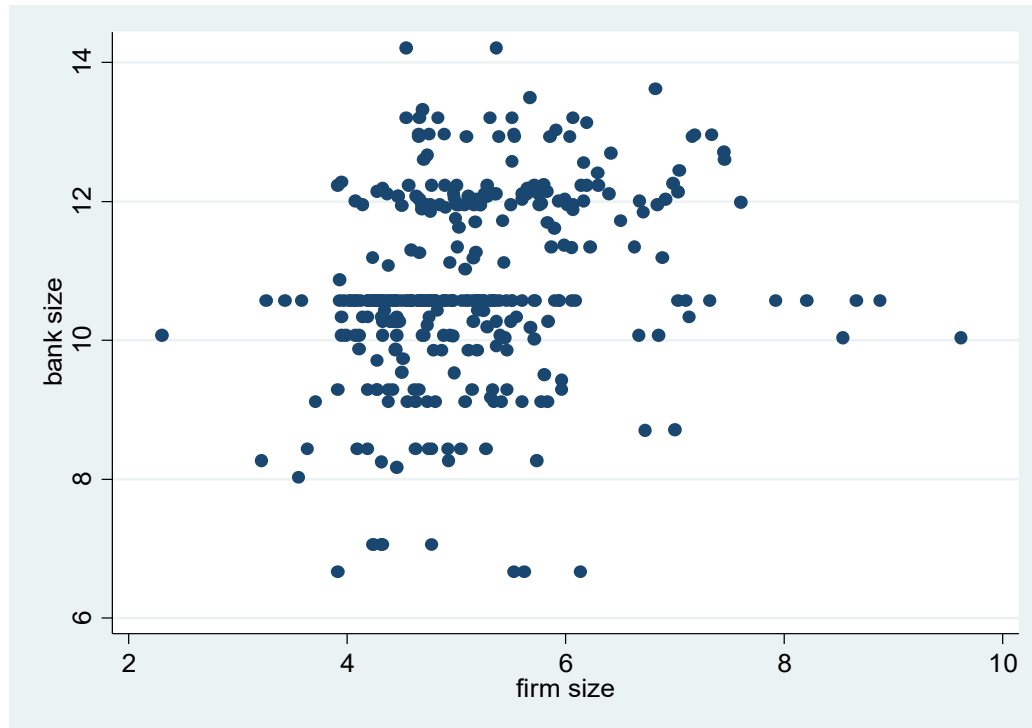
Source: Bank Bureau of Ministry of Finance ed., *Ginko Soran (Handbook of Banks)*, 1921 issue.

Figure 3 Balance sheet of Souda Bank



Source: Business Report of Souda Bank, various periods.

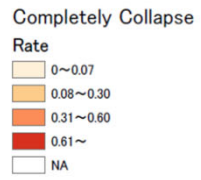
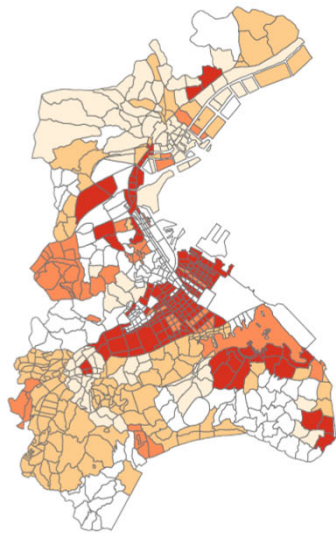
Figure 4: Relationship of bank size and firm size



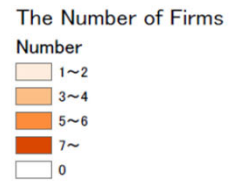
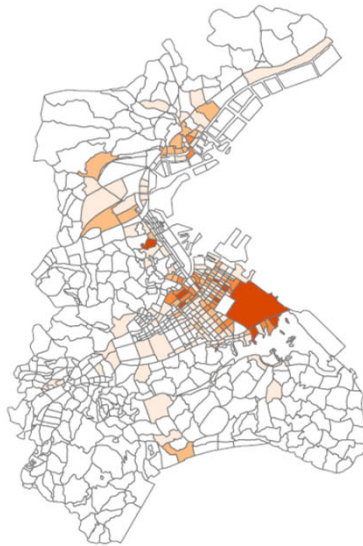
Bank size is measured by capital asset and firm size is measured by business tax (yen)
Both are taken log.
Source: our estimation data

Appendix Figures: Maps on old Yokohama city

Damage map



Number of firms(our sample)



Number of banks (headquarters and branch offices)

