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Abstract

Natural disasters seriously damage firms and banks. The ability to finance recovery is a key factor for damaged firms to survive and grow after the event. However, small- and medium-sized firms are financially constrained and largely depend on local banks. 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. The crucial solutions were the provision of loans by local banks as well as the Earthquake Bills policy implemented by the Bank of Japan. Using firm- and bank-level datasets, we find that larger local banks allowed damaged firms to survive and grow. The policy by the Bank of Japan 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

Natural disasters severely damage firms as well as local banks by causing many casualties, collapsed buildings, and business shutdowns. In particular, small- and medium-sized firms tend to be fragile, and face higher probabilities of bankruptcy as a consequence. This arises because many small- and medium-sized firms 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, resulting in financial crisis and instability. Therefore, the banking system and policy are arguably crucial in reducing the propagation of disaster impacts via the firm–bank relationship.

The Great Kanto Earthquake in 1923 in Japan is arguably a good example of the potentially detrimental effects on smaller firms. As the largest earthquake in Japanese history, more than one hundred thousand people died and assets as large as around 35.5% of gross national product (GNP) were destroyed, where much of the human and physical damage was concentrated in Tokyo City and Yokohama City. Particularly in Yokohama City, many small firms, as well as many local banks, were affected. In response, the Bank of Japan (BOJ) discounted bills issued by firms in the damaged areas from banks, so-called "Earthquake Bills." This provided liquidity and mitigated financial constraints for recovery in 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. Within this background, the current paper investigates firm survival and growth after the Great Kanto Earthquake with respect to firm–bank relationships and discusses the pros-and-cons of the BOJ policy of discounting Earthquake Bills.

Importantly, while natural disasters, such as earthquakes, can potentially have devastating impacts on local businesses by damaging their buildings, destroying infrastructure vital to their production, or even injuring or killing their employees, much of the existing literature on the economic impact of natural disasters has focused on macroeconomic or regional effects, or, if the microeconomic aspects were examined these tended to be in terms of households or individuals.[2] Of the few existing studies on businesses, 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. Thus, perhaps unsurprisingly, some businesses permanently close down if they were sufficiently affected by a natural disaster. However, for the survivors, the findings are rather mixed. On the one hand, some surviving firms seem to experience losses, as found by Boarnet (1996) and Tanaka (2015). In contrast, there may also be surviving businesses that subsequently increase their

[2] See the review by Karim and Noy (2016) and Noy and duPont (2018).

production or boost their productivity, as shown, for instance, by Leiter et al. (2009), Cole et al. (2019), and Okazaki et al. (2019).

One aspect that appears to play an important role in whether businesses can survive a natural disaster or are able to prevent production, productivity, and employment losses, is their access to financial funds, in particular, to loans. For instance, Elliott et al. (2019) found that firms increased their debt after damage from typhoons in China, while Collier and Babich (2019) and Collier et al. (2019) showed that bank credit played an important role in financing businesses' recovery. Moreover, negatively affected firms were often credit constrained after the shock: 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).[3]

The substantial demand for credit by damaged firms after a natural disaster (e.g., Berg and Schrader, 2012) in turn can put a substantial strain on the banking system. In this regard, 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 (2018) and Cortes and Strahan (2017), using bank-level data for the US. Perhaps unsurprisingly in this regard, the ability of banks to serve as credit providers for affected firms is limited if they themselves are damaged (Hosono et al., 2016; Koetter et al., 2019). Furthermore, as shown by Rehbein (2018) after the large flood event in 2013 in Germany, damaged banks can even cause negative spillovers to undamaged firms who are their clients. Of course, government or other financial aid can serve to circumvent the credit constraints faced by firms, although this is not always effective (Cole et al., 2017). In particular, it matters how damaged firms are able to finance enough in terms of keeping business afloat, achieving recovery, and/or new investment. While such financing might come from banks, industrial cooperatives, trade associations, transaction partners, or government subsidy and loans, from a policy perspective it is arguably important to understand the effectiveness of financing by local banks and the role of the central bank that supports local banks.

Our paper adds to the literature by showing how financial transactions with banks contribute to the survival and growth of firms after a devastating natural disaster and how policy measures affect the role of banks, focusing on the experience of Japan in the prewar period. The case of the Great Kanto Earthquake has the following three advantages for addressing these issues. First, while the earthquake damage to firms and banks was huge, it was heterogeneous across geographical space within damaged areas. Fortunately, the damage data are available at the level of *Chome*, a small unit of area within a city. Second, there are also unique data on firms as well as the transaction relationship between firms and banks available. More precisely, for Yokohama

[3] This is true for household recovery. Sawada and Shimizutani (2008) found that borrowing constraints were not able to maintain household consumption after the Kobe earthquake.

City, we have 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. That is, the BOJ rediscounted bills issued in the damaged areas from banks as the "Earthquake Bills." The bank-level amount of the Earthquake Bills is available and linked 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.

The remaining part 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 descriptive statistics. Section 4 presents the econometric analyses. Section 5 concludes by discussing the implications of the results of the paper in understanding the role of banks as well as the role of the policies by the government and the central bank.

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, as many large joint-stock companies emerged in various industries, such as railways, marine shipping, and manufacturing in the late 1880s, the number of listed stocks increased (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 diagrams 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 fund from main banks, this view holds just for the postwar period (Okazaki and Okuno-Fujiwara eds., 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.

However, it is notable that patterns of corporate finance differed in firm size in prewar

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

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 (Kato, 1957; Okazaki et al., 2005; Research Bureau of the Bank of Japan, 1933).

2-2 Damage by the Great Kanto Earthquake

The Great Kanto Earthquake in 1923 is the most serious natural disaster that has hit Japan in its history. The number of dead and missing is estimated to be around 105,000, and 465,000 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.[4] While it is probably more well 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).

In this paper, we use Nagoya City, which had almost the same population size as well as

[4] Calculated by the amount of damage from Tokyo City Office (1925) and nominal GNP from Ohkawa et al. (1974).

a similar industrial structure,[5] and did not suffer from the earthquake, as a control group to be compared with Yokohama City. Figure 2 shows the population in Yokohama City and Nagoya City. The earthquake had a persistent impact on Yokohama City. More specifically, the population of Yokohama City declined 21.1% from 1922 to 1923 and did not recover to its 1922 level until 1927. Meanwhile, the population in Nagoya City increased by 30.9% from 1922 to 1927. This difference in the population changes in the two cities is strongly suggestive of how serious and persistent the earthquake damage to Yokohama City was (Kanagawa Prefecture, 1982, pp. 13–14).

The damage to the economy of Yokohama City was serious as well. As shown in Okazaki et al. (2019), the number of workers at manufacturing factories in Yokohama City declined around 50% from 1921 to 1923 and did not exceed the level in 1921 until 1927. Here, to see the broader picture on the whole economy, we use the corporate statistics that cover all sectors, including commerce and services in addition to manufacturing. Because city-level statistics are not available, Figure 3 compares Kanagawa Prefecture, whose capital city is Yokohama, with Aichi Prefecture, whose capital city is Nagoya. The number of firms in Kanagawa Prefecture declined by 25.8% from 1921 to 1923 and did not recover to the level in 1921 until 1927. Meanwhile, the number of firms in Aichi Prefecture increased by 26.9% from 1921 to 1927 (Panel A of Figure 3). Panel B of Figure 3 compares firms in the two prefectures in terms of capital and shows that the situation was qualitatively the same.

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 whole (Bank of Japan, 1983; Imuta, 1980; Research Bureau of the Bank of Japan, 1933; Takahashi and Morigaki, 1993). 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 by the collapse of the economic boom during and just after World War I.

The government and the 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

[5] According to the population census for 1920, Yokohama was the sixth largest city with a population of 422,942, while Nagoya was the fifth largest city with a population of 429,997. Meanwhile, the fourth and seventh largest cities were Kyoto and Nagasaki, whose populations were 591,324 and 176,534, respectively (Statistical Bureau, Ministry of Internal Affairs and Communications, 2006).

issued in the damaged area, and discounted before September 1, would be rediscounted by the BOJ, 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 million yen in total. It is notable that the discount of Earthquake Bills concentrated on large Tokyo and Yokohama banks, which had already had transaction relationships with the BOJ (Bank of Japan, 1983, pp. 70–72, pp. 91–94; Ishii, 1980, p. 142). 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, 1983, pp. 96–97; Takahashi and Morigaki, 1993, pp. 82–86). Reflecting this and the damage by the earthquake, repayment of Earthquake Bills was delayed, 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). Panels A and B of Figure 4 compare the deposits and loans of ordinary banks between Yokohama City and Nagoya City. Figures report total deposit and loan in ordinary banks whose headquarters and branches were located in each city.[6] Deposits in Yokohama City sharply declined in 1923. In spite of its recovery afterward, the growth of deposits through the 1920s was substantially lower than that of Nagoya City. By contrast, loans in Yokohama City did not sharply decrease in 1923, but similar to deposits, the growth through the 1920s was much lower than that in Nagoya City.

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 the basic feature with the whole Japanese banking industry in that it included many small- and medium-sized banks. Figure 5 illustrates the size distribution of ordinary banks for the whole of Japan, Yokohama City, and Nagoya 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. The distribution for Nagoya City is substantially different from that of Yokohama. There were many large banks, and the proportion of banks with capital less than one million yen was just 33.3%. The difference in the distribution of bank capital between Yokohama City and Nagoya City is consistent with the difference in the structure of deposit and loan markets between the two cities as shown below.

Table 4 breaks down the deposit and loans of banks in Yokohama City. Here, local banks

[6] It does not include deposit or loan of the bank offices (headquarters and branches) outside Yokohama City.

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 by 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 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). 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 (ibid., pp. 776–777).

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 concentrated on large banks. The impact of the BOJ credit on bank loans was substantial. Figure 6 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. As indicated in Table 4, while Yokohama Koshin Bank had Earthquake Bills of 1,152,000 yen discounted by the BOJ, it played a role in financing recovery of the Yokohama economy. In detail, according to Yokohama Bank (1980, p. 67), Yokohama Koshin Bank loaned a total 1,080,000 yen to small businesses for their recovery without collateral, cooperating with Yokohama City Office. However, a substantial part of Earthquake Bills was used for maintaining nonperforming loans, as stated above. Concerning Souda Bank, most of its loans were already nonperforming before the earthquake, and although Souda Bank continued business relying on the credit from the BOJ, it was finally closed when faced 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, 23,667,000 yen, 2,175,000 yen (9.2%), and 7,369,000 yen (31.1%) were to firms owned by the Souda family and other related firms. Most of these loans were uncollectable. Therefore, the special loan from the BOJ through Earthquake Bills 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 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. On the other hand, 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).

3. Data and Basic Statistics

3.1 Data

Our paper mainly exploits four data sources: (a) firm-level data with firm–bank transaction relationship, (b) bank-level financial data, (c) bank-level Earthquake Bill data, and (d) damage index at the *Chome* (small districts within towns) level. First, we use unique firm-level data. The firm data include the name of the banks with which each firm had a financial transaction relationship. We obtained the data 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, including family firms and private firms over Japan in all industries: manufacturing, construction (e.g., carpenters), wholesale, retail shops (e.g., grocery shops, pharmacies, confectionaries), services (e.g., restaurants, cafés, hotels), repair (house repair workshops and bicycle repair workshops), and transportation. We use the data of the firms for all the sectors in Yokohama City (and Nagoya City for comparison) for 1922 and 1925. The data contain each firm's information such as firm name, address, industry, main product/business, business tax (if they have any), and the names of the bank(s) that the firm mainly transacted with. Our samples consist of all the firms in Yokohama City and Nagoya City for which information on bank transaction relationship is recorded in the 1922 and 1925 issues of *Dai Nihon Shoko-roku*.[7]

Second, the bank-level data for 1922 are taken from the 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 in Japan, and the latter covers all the ordinary and special banks.[8] For a few banks not covered by the former source, we supplemented the data from their business

[7] Firms with main banks account for around 10%-15% of all firms.
[8] *Yearbook of the Bank Bureau of the Ministry of Finance* started to provide bank-level financial data from the 1925 issue.

reports. For our purpose, we use financial data of those banks that had transaction relationships with firms in Yokohama City. Our sample includes not only banks headquartered in Yokohama City but also those headquartered in other cities such as Tokyo and Osaka Cities.

Third, the amount of Earthquake Bills discounted 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 credit from the BOJ. A part of the Earthquake Bills was not repaid to the BOJ by the due date. 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.

Finally, concerning the damage by the Great Kanto Earthquake, we construct a damage index calculated as the percentage of totally and half-collapsed buildings at the *Chome* level. *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 areas.[9] We note that the damage index reflects the direct damage by the earthquake, and does not reflect fire damage after the earthquake. Because the fire damage was enormous, and the fire spread over central Tokyo City and Yokohama City, there is likely to have been little spatial variation of the damage. We use detailed address information of firms and headquarters of banks to match each firm and bank with the damage index.

3.2 Firm–bank relationship

The uniqueness of our dataset is that it contains information on the names of the banks with which each firm transacted. Table 6 lists the banks in Yokohama City and Nagoya City in our dataset, and the number of firms with which each bank had transaction relationships. We note that some firms transacted with multiple banks. In Yokohama City, a part of the firms in the dataset for 1922 did not survive until 1925, and some firms changed their banks from 1922 to 1925. Many of the firms in Yokohama City transacted with local banks in Yokohama, but more than one-fourth of firms had transaction relationships with the branches of banks headquartered in other cities, mainly Tokyo City. In this sense, firm–bank relationships in Yokohama City were cross-prefectural border.

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 Daihyaku (Tokyo), Sumitomo (Osaka), and Kawasaki (Tokyo) Banks had many client firms. The total number of

[9] We are grateful to Dr. Takahama for providing us with the data.

firm observations in 1925 was much smaller than in 1922 due to the earthquake but the shares of banks were similar to those of 1922. Meanwhile, firm–bank relationships in Nagoya City had a different feature from Yokohama City. Namely, three large local banks, i.e., Aichi, Nagoya, and Meiji Banks, had dominant positions in client relationships. Although banks in other cities had some clients, their shares were very small.

Table 6 reports the average size of the firms that each bank transacted with. 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 banks than for local banks. In particular, large urban banks such as Mitsui, Dai-san, and Sumitomo, had bigger client firms. Meanwhile, with respect to local banks, client firms of larger banks were bigger than those of smaller banks, but the difference was not so substantial. This feature was common to Nagoya City. In particular, nonlocal banks had much larger client firms than local banks in Nagoya City.

To see the relationship between bank size and firm size more comprehensively, Figure 7 plots it for 1922 Yokohama, where bank size (horizontal axis) is measured by its capital. Note that if firms transact with multiple banks, we take the average of their capital. First, bank and firm sizes are positively correlated. This observation is consistent with the view of so-called "stratified financial structure," that is, 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). Second, however, there was still substantial variation in the size of banks for a firm of a certain size to transact with. This variation allows us to conduct regression analyses using bank size and firm size at the same time.

We also compare the average size of the firms with which each bank had transaction relationships between the pre-earthquake and post-earthquake periods. 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 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 greatly 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 ratio of survival of firms in Yokohama City from 1922 to 1925 was 37.5%. The firm size, measured by the business tax, is on average around 200 yen, but with considerable variation. Their corresponding banks also vary substantially in terms of size measured by capital, with a mean of

97,416 yen. In terms of the damage in the *Chome* where the firms were located, one finds that the average firm damage rate was close to 70% with a standard deviation of 31%. Their banks, by contrast, were located in areas that were slightly less damaged, i.e., 53% on average, but again with considerable variation.

In the lower panel, we show the data for our control city, Nagoya City. Here, one should note that over the same time period firm survival was about 20% higher than in Yokohama. The firms in Nagoya were also somewhat larger and the banks they transacted with were also slightly bigger.

4. Econometric Model and Results

4.1 Firm survival

We first investigate how local earthquake damage affected firm survival. We do so by estimating the following probit model:

$$\text{Prob}(\text{SURVIVAL}_{it}) = \Phi(\alpha_i + \beta_1 \text{FDAMAGE}_{it} + \beta_2 \text{BDAMAGE}_{it} + \beta_3 \text{FSIZE}_{it-1} + \beta_4 \text{BSIZE}_{it-1} + \beta_5 \text{FSIZE}_{it-1} \times \text{FDAMAGE}_{it} + \beta_6 \text{BSIZE}_{it-1} \times \text{BDAMAGE}_{it} + \varepsilon_i), \quad (1)$$

where SURVIVAL is an indicator variable that takes the value of 1 if firm i still exists after the earthquake (t), FDAMAGE is the damage index in the *Chome* where firm i is located, and BDAMAGE is the damage index of the *Chome* of its corresponding bank location. FSIZE denotes the firm size, while BSIZE is the bank size measured by the capital asset of the firm's corresponding bank. We note that if a firm transacted with multiple banks, we use the average of the bank damage indices as well as bank size. Standard errors are clustered at the *Chome* level.

The results of using just the Yokohama samples are reported in Table 8. The first column shows that in our basic specification, we observe no impact of either firm damage or bank damage on firms' closing down over the earthquake, while unsurprisingly, larger firms are more likely to survive. To explore whether firm exit depends on the firm and bank damage jointly, in the second column we include the interaction term, but this is also not statistically significant. We next allow for the effect of damage to be dependent on firm size and bank size. The result of this specification in the third column shows that size plays an important role. More specifically, while now both firm and bank damages significantly reduce the probability of firm survival, this is dependent on the size of the bank and firm. That is, the larger the size of a firm and the larger the size of the bank that a firm transacted with, the less there is a negative impact of bank damage and firm damage on firm survival. Taking at face value the coefficients suggests that a firm must have a

size of at least 82, which is about 41% of the mean size, to be able to buffer the earthquake damage. Similarly, a firm's bank must be of at least size 327,747, i.e., about two standard deviations above the mean size, to absorb the damage due to the earthquake.

Next, we examine the impact of liquidity supply by the BOJ on firm survival. To do so, we use bank-level Earthquake Bills discounted by the BOJ. As we saw in the previous section, the amount of Earthquake Bills substantially varied across banks. We add variables of the bank-level amount of Earthquake Bills to Equation (1) as follows:

$$\text{Prob}(\text{SURVIVAL}_{it}) = \Phi(\alpha_i + \beta_1 \text{FDAMAGE}_{it} + \beta_2 \text{BDAMAGE}_{it} + \beta_3 \text{FSIZE}_{it-1} + \beta_4 \text{BSIZE}_{it-1} + \beta_5 \text{FSIZE}_{it-1} \times \text{FDAMAGE}_{it} + \beta_6 \text{BSIZE}_{it-1} \times \text{BDAMAGE}_{it} + \beta_7 \text{EQBILL}_{it} + \beta_8 \text{EQBILL}_{it} \times \text{BDAMAGE}_{it} + \beta_9 \text{UNPAIDBILL}_{it} + \varepsilon_i), \quad (2)$$

where EQBILL is the value of Earthquake Bill discounted by the BOJ for firm i's corresponding bank, normalized by the bank size (capital). UNPAIDBILL stands for the ratio of the Earthquake Bills of firm i's corresponding bank unrepaid to the BOJ by the end of 1926, relative to its total Earthquake Bills. This variable captures the extent to which the bank's Earthquake Bills were used to maintain nonperforming loans. The last column in Table 8 reports the estimation results. The interaction term of EQBILL and BDAMAGE is significantly positive. This indicates that if a firm's corresponding bank had more Earthquake Bills rediscounted by the BOJ, the negative impact of the damage on the corresponding bank on the firm survival was smaller. The coefficient of UNPAIDBILL is also significantly positive. These results indicate that the BOJ's policy mitigated the negative impact of bank damage on firm survival.

4.2 Firm growth

Next, we focus on the firms that survived from 1922 to 1925. To see the growth of these surviving firms, we estimate the following linear model:

$$\Delta\log(Y_{t-1\to t}) = \alpha_i + \beta_1 \text{FDAMAGE}_{it} + \beta_2 \text{BDAMAGE}_{it} + \beta_3 \text{FSIZE}_{it-1} + \beta_4 \text{BSIZE}_{it-1} + \beta_5 \text{FSIZE}_{it-1} \times \text{FDAMAGE}_{it} + \beta_6 \text{BSIZE}_{it-1} \times \text{BDAMAGE}_{it} + \varepsilon_i, \quad (3)$$

where $\Delta\log(Y_{t-1\to t})$ is the growth of the sales of firm i, proxied by business tax and the independent variables are the same as in Equation (1). The estimation results are reported in Table 9, and again standard errors are clustered at the *Chome* level. Examining the first two columns, one finds that firm and bank damage, or allowing them to depend on each other, had no significant impact on sales growth. However, once we allow for the impact of damage to depend on firm size, we find that while firm damage reduces firm growth, this negative impact is smaller for larger firms.

Meanwhile, even if we allow for the impact of bank damage to depend on bank size, the conclusion that bank damage was irrelevant to the growth of surviving firms is unchanged.

In parallel to the survival estimation, the impact of the Earthquake Bills is on the firm growth specification:

$$\Delta\log(Y_{t-1\to t}) = \alpha_i + \beta_1 FDAMAGE_{it} + \beta_2 BDAMAGE_{it} + \beta_3 FSIZE_{it-1} + \beta_4 BSIZE_{it-1} + \beta_5 FSIZE_{it-1}\times FDAMAGE_{it} + \beta_6 BSIZE_{it-1}\times BDAMAGE_{it} + \beta_7 EQBILL_{it} + \beta_8 EQBILL_{it}\times BDAMAGE_{it} + \beta_9 UNPAIDBILL_{it} + \varepsilon_i. \quad (4)$$

The last column in Table 9 reports the estimation results. The interaction term of EQBILL and BDAMAGE is significantly positive. This means that Earthquake Bills mitigated the negative impact of the damage of a bank on the growth of the bank's client firms after the earthquake. Meanwhile, the coefficient of EQBILL is significantly negative, which implies that the lower quality of Earthquake Bills of a bank was associated with a lower growth of its client firms.

4.3 Robustness

This subsection is to show three estimations for robustness. The first robustness check is to add the sample of Nagoya City as an additional control group. The second one is to study the impact of the land adjustment policy, and the last one is to consider semipublic or special banks. Concerning the results of the analyses above, one should note that the control group consists of undamaged firms in Yokohama City. Potentially, however, these firms could be impacted indirectly via spillover effects, via input–output linkages and/or through damaged infrastructure in nearby localities, even if they themselves are unaffected directly. We thus introduce additional control group firms, i.e., firms in Nagoya City, which did not suffer from the earthquake. The first column in Table 10 reports the survival estimation results of the same probit model using the Yokohama and Nagoya samples. For firms and banks in Nagoya City, the damage variables are all zero. It is found that the results are qualitatively the same as those in Table 8. Likewise, we estimate the growth equation using Yokohama and Nagoya samples. The results also hold when we expand our control group to firms located in Nagoya City, as shown in the first column of Table 11.

Next, we compare the impact of the BOJ policy with that of another government policy. In addition to guaranteeing the Earthquake Bills rediscounted by the BOJ, the government designed and implemented the Plan for Reconstruction of the Imperial Capital (*Teito Fukkō Keikaku*). A reconstruction plan for Yokohama City was included in that plan at the request of the Yokohama City Council, where the central part of the plan was the recovery of infrastructure and land readjustment. Yokohama City Office had drawn up a plan for road improvement in June 1923,

that is, before the earthquake. The earthquake thus provided an opportunity to implement the plan, and by implementing the plan as a part of the reconstruction, roads in Yokohama were substantially improved (Yokohama City Office, 1976, pp. 111–112). Notably, the policy reduced the land size of targeted areas because of the expansion of roads and thus would downsize firms, resulting in fewer sales or exit. Column 2 of Table 10 reports the results. Overall, the land adjustment policy has a significant negative impact on firm survival, but this does not change our base results from Table 8. Similarly, as can be seen from the second column in Table 11, the policy negatively affects firm growth of surviving firms, but with no qualitative and little quantitative impact on our main results.

Finally, we control the impact of public or semipublic banks. There are two public banks in our sample, that is, Yokohama Specie Bank and Kanagawa Noko Bank. Yokohama Specie Bank was a special bank mainly for trade finance, while Kanagawa Noko Bank was a special bank, aimed at the development of agriculture and small- and medium-sized manufacturing businesses in Kanagawa Prefecture. We add the dummies representing these two special banks to control for their impacts on the survival and growth of firms in the last columns of Tables 10 and 11. We find that having a transaction with special banks has no significant impact on either aspect and does not noticeably change our baseline results.

5. 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 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. These findings imply that banks indeed played a role in firm post-earthquake performance. As a matter of fact, for small- and medium-sized firms in our sample, we found that bank credit was essential for their survival and growth. Second, there were two ways that 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 other words, larger banks were, not surprisingly, more resilient to the damage by the natural disaster. In terms of the other, liquidity supply by the BOJ to banks also reduced the negative impact of the 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 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 part of the Earthquake Bills rediscounted by the BOJ was not repaid. We found that when a firm had a transaction relationship

with the 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 make 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 the natural disaster can have both positive and negative impacts.

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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	Borrowing	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		Traders	Traditional financial institutions and individuals
		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 ye	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).

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	Traders	Traditional financial institutions and individuals
		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).

Table 3 Damage by the Great Kanto Earthquake

	Human damage		Physical damage	
	Number of death and missing	Percentage to the population	Number of buildings completely burnt or destroyed	Percentage to the total buildings
Total	104,619	0.89	464,909	20.4
Tokyo Prefecture	70,497	1.75	328,646	39.8
Tokyo City	68,660	3.03	305,146	63.2
Kanagawa Prefecture	31,859	2.31	115,353	42.1
Yokohama City	23,335	5.23	72,408	73.2
Other five damaged prefectur	2,263	0.02	20,910	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

	Deposit			Loan			"Earthquake bills" discounted by BOJ
	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 aomounts 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 and Nagoya cities

Yokohama

Bank name	HQ location	Number of client firms 1922	Number of client firms 1925	Average size of firms (business tax, yen) 1922	Average size of firms (business tax, yen) 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

Nagoya

Bank name	HQ location	Number of client firms	Average size of firms (business tax, yen)
Local banks		**485**	**157.0**
Meiji	Nagoya	150	161.4
Aichi	Nagoya	136	164.2
Nagoya	Nagoya	186	152.8
Murase	Nagoya	6	118.7
Ito	Nagoya	6	74.0
Meiji Chozo	Nagoya	1	0.0
Non-local banks		**45**	**520.6**
Dai ichi	Tokyo	3	101.7
Mitsui	Tokyo	7	699.1
Sumitomo	Osaka	8	351.4
Ju-go	Tokyo	1	102.0
Mitsubishi	Tokyo	2	144.5
Oumi	Osaka	11	375.5
Yamaguchi	Osaka	4	184.0
Souda	Yokohama	1	65.0
Ju-roku	Gifu	5	358.8
Hyaku-go	Mie	1	355.0
Others		2	3974.0

Table 7 Summary Statistics

	Definition:	Mean	Std. Dev.
Yokohoma:			
SURVIVAL	Survival Indicator	0.375	0.485
FDAMAGE	Firm Damage (share)	0.694	0.312
BDAMAGE	Bank Damage (share)	0.531	0.331
BSIZE	Capital asset (yen)	97416	163619
FSIZE	Taxes on Profits (yen)	198.91	376.07
EQBILL	Earthquake Bills normalized by Capital Asset	0.15	0.359
UNPAIDBILL	Unpaid Earthquake Bills relative to Earthquake Bills (percentage)	10.975	13.6
PBANK	Dummy for Public Banks	0.061	0.24
SUB	Dummy for Land Adjustment Subsidy Areas	0.697	0.46
Nagoya :			
SURVIVAL	Survival Indicator	0.578	0.495
FDAMAGE	Firm Damage (share)	0	0
BDAMAGE	Bank Damage (share)	0	0
BSIZE	Capital asset (yen)	125952	60403
FSIZE	Taxes on Profits (yen)	248.56	411.13

Table 8: Probability of Firm Survival (Yokohama samples)

	(1)	(2)	(3)	(4)
FDAMAGE	0.316	1.053	-2.651***	-2.241*
	(0.277)	(0.771)	(0.811)	(1.149)
BDAMAGE	-0.216	0.737	-1.614***	-0.78
	(0.154)	(0.891)	(0.618)	(1.450)
FDAMAGE X BDAMAGE		-1.29		
		(1.213)		
FDAMAGE X FSIZE			0.601***	0.528**
			(0.162)	(0.240)
BDAMAGE X BSIZE			0.127**	-0.0152
			(0.055)	(0.117)
FSIZE	0.627***	0.642***	0.273**	0.320*
	(0.089)	(0.086)	(0.133)	(0.186)
BSIZE			-0.0865	-0.118
			(0.100)	(0.166)
EQBILL				-10.58
				(7.190)
EQBILL X BDAMAGE				13.91**
				(5.955)
UNPAIDBILL				0.0217***
				(0.004)
Observations	330	330	330	320
PseudoR2	0.172	0.178	0.182	0.2

Notes: (i) Regression of firm sales (ii) Standard errors clustered by Ward in parentheses, (iii) *** p<0.01, ** p<0.05, * p<0.10, (iv) Includes sectoral (12) and ward (6) dummies.

Table 9: Firm Sales (Yokohama samples)

	(1)	(2)	(3)	(4)
FDAMAGE	0.137	0.205	-3.897**	-4.293***
	(0.125)	(0.764)	(1.384)	(1.002)
BDAMAGE	0.0926	0.174	1.568	-0.584
	(0.207)	(1.003)	(1.899)	(1.272)
FDAMAGE X BDAMAGE		-0.119		
		(1.257)		
FDAMAGE X FSIZE			0.772**	0.840**
			(0.292)	(0.212)
BDAMAGE X BSIZE			-0.139	0.0368
			(0.176)	(0.109)
FSIZE	-0.201	-0.203	-0.703***	-0.747***
	(0.132)	(0.130)	(0.153)	(0.110)
BSIZE			0.0541	-0.0205
			(0.055)	(0.033)
EQBILL				-1.703
				(1.506)
EQBILL X BDAMAGE				6.578*
				(2.797)
UNPAIDBILL				-0.0175***
				(0.003)
Observations	129	129	129	129
PseudoR2	0.365	0.365	0.426	0.475

Notes: (i) Regression of firm sales (ii) Standard errors clustered by Ward in parentheses, (iii) *** p<0.01, ** p<0.05, * p<0.10, (iv) Includes sectoral (12) and ward (6) dummies.

Table 10: Probability of Firm Survival (Robustness Checks)

	(1)	(2)	(3)
FDAMAGE	-4.053***	-2.614***	-2.651***
	(0.468)	(0.664)	(0.813)
BDAMAGE	-1.295*	-1.761***	-1.614***
	(0.786)	(0.553)	(0.616)
FDAMAGE X FSIZE	0.863***	0.615***	0.601***
	(0.104)	(0.124)	(0.162)
BDAMAGE X BSIZE	0.0988	0.140***	0.127**
	(0.068)	(0.054)	(0.054)
BSIZE	0.0388	0.247**	0.273**
	(0.071)	(0.107)	(0.131)
FSIZE	-0.0618	-0.101	-0.0868
	(0.088)	(0.093)	(0.102)
SUB		-0.233**	
		(0.090)	
PBANK			0.0246
			(0.232)
Sample	Yokohama & Nagoya	Yokohama	Yokohama
Observations	495	320	320
PseudoR2	0.17	0.189	0.188

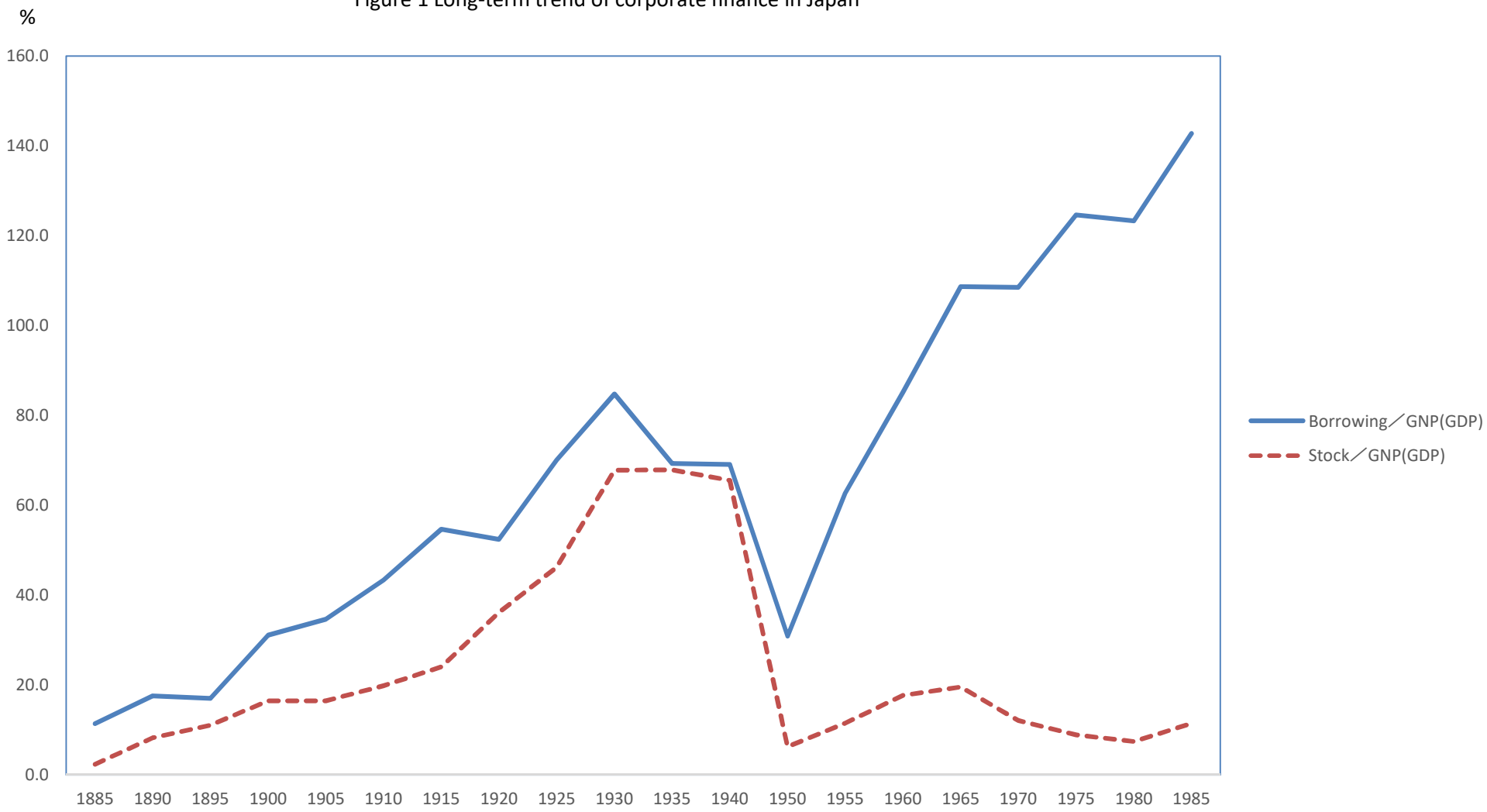
Notes: (i) Probit regression of firm survival (ii) Robust standard errors in parentheses, (iii) ** p<0.01, * p<0.05, * p<0.10, (iv) Includes sectoral (12), ward (6) dummies, Nagoya dummy, Nagoya dummy interacted with FSIZE, as well as Nagoya dummy interacted with sectoral dummies.

Table 11: Firm Sales (Robustness Checks)

	(1)	(2)	(3)
FDAMAGE	-1.942*	-4.074**	-3.868**
	(0.935)	(1.092)	(1.362)
BDAMAGE	1.026	1.731	1.636
	(1.550)	(1.554)	(1.895)
FDAMAGE X FSIZE	0.404*	0.838**	0.768**
	(0.192)	(0.230)	(0.290)
BDAMAGE X BSIZE	-0.0799	-0.155	-0.146
	(0.141)	(0.145)	(0.176)
BSIZE	-0.490***	-0.773***	-0.701***
	(0.101)	(0.144)	(0.148)
FSIZE	0.0502	0.0419	0.0546
	(0.068)	(0.047)	(0.055)
SUB		-0.337	
		(0.249)	
PBANK			0.258
			(0.129)
Sample	Yokohama & Nagoya	Yokohama	Yokohama
Observations	223	129	129
PseudoR2	0.58	0.439	0.43

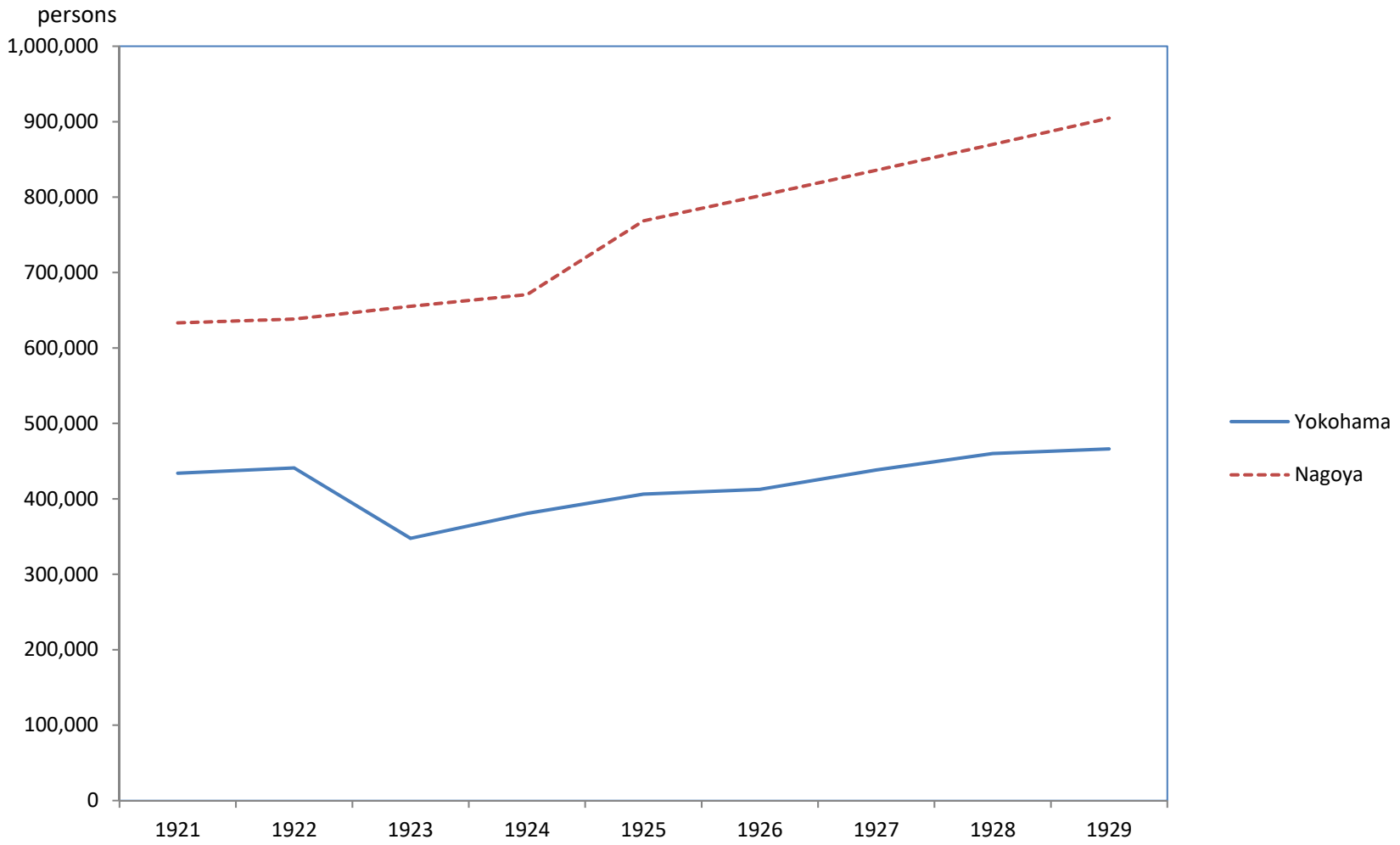
Notes: (i) Regression of firm sales (ii) Robust standard errors in parentheses, (iii) ** p<0.01, * p<0.05, * p<0.10, (iv) Includes sectoral (12), ward (6) dummies, (iv) In column (1) we also include a Nagoya dummy, Nagoya dummy interacted with FSIZE, as well as Nagoya dummy interacted with sectoral dummies.

Figure 1 Long-term trend of corporate finance in Japan



Source: Okazaki (2016).

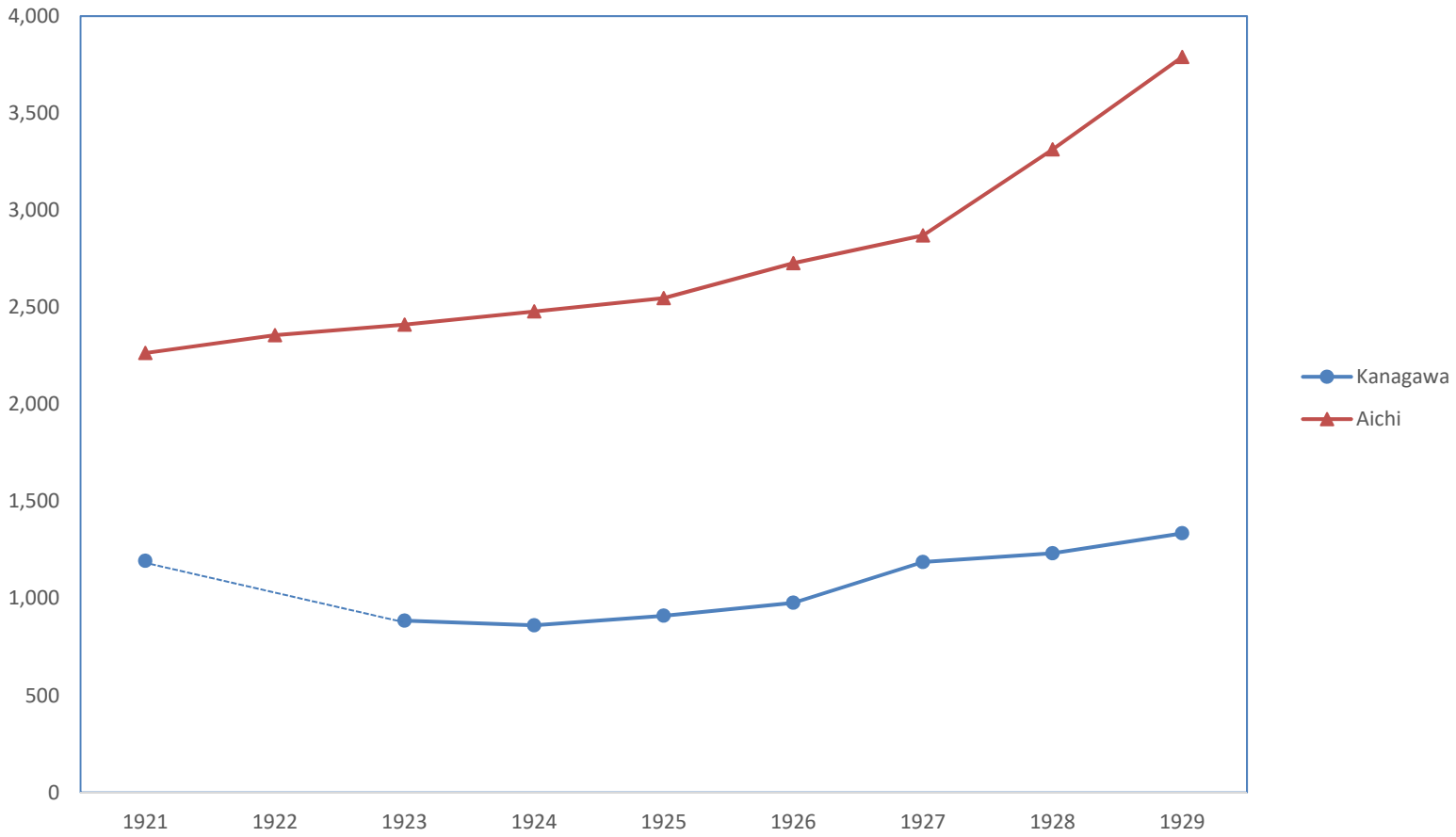
Figure 2 Population of Yokohama City and Nagoya City



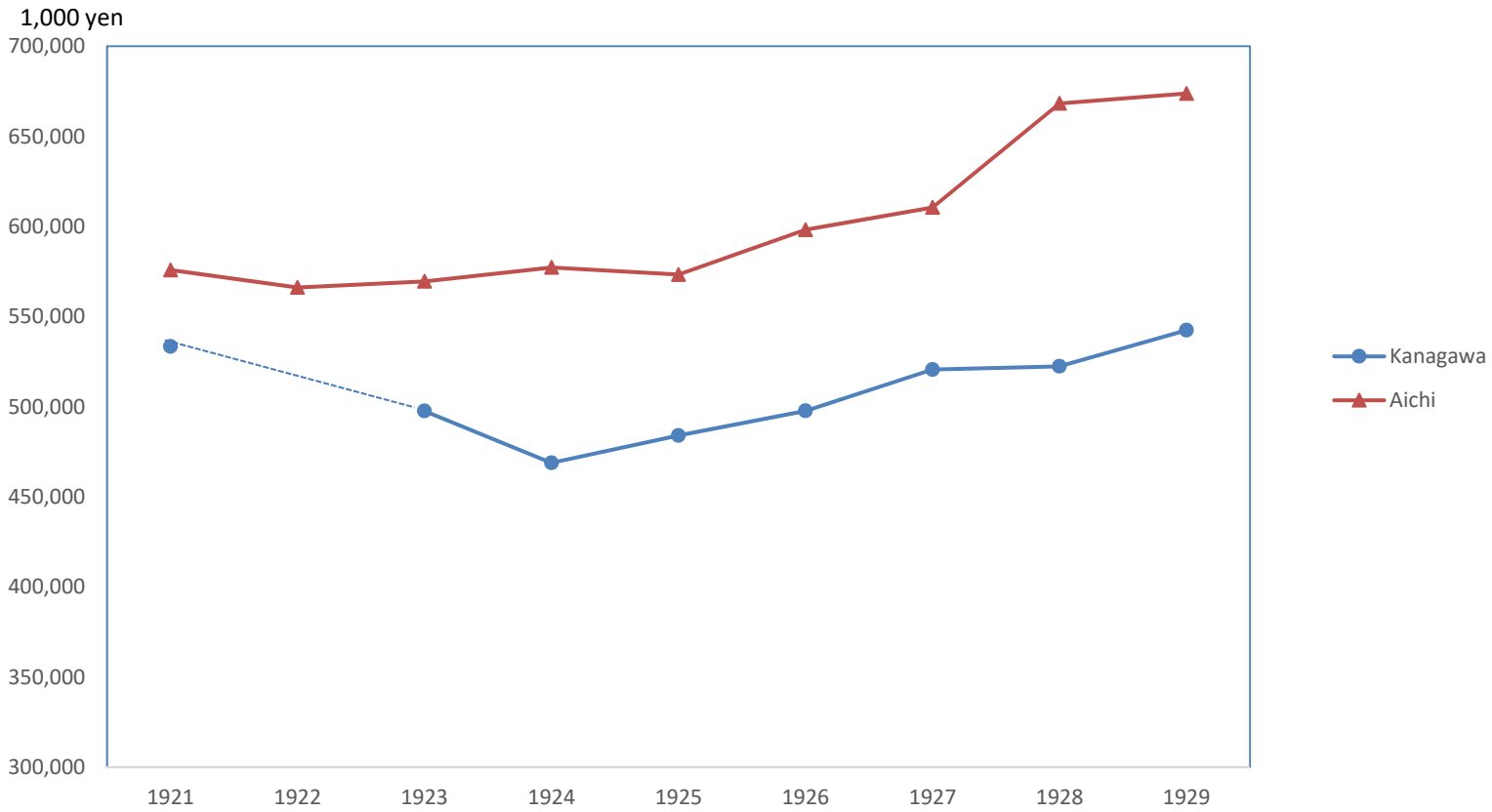
Source: Statistical Yearbook of Kanagawa Prefecture, various issues; Statistical Yearbook of Nagoya City, varisous issues.

Figure 3 Firms in Kanagawa Prefecture and Aichi Prefecture

A. Number of firms

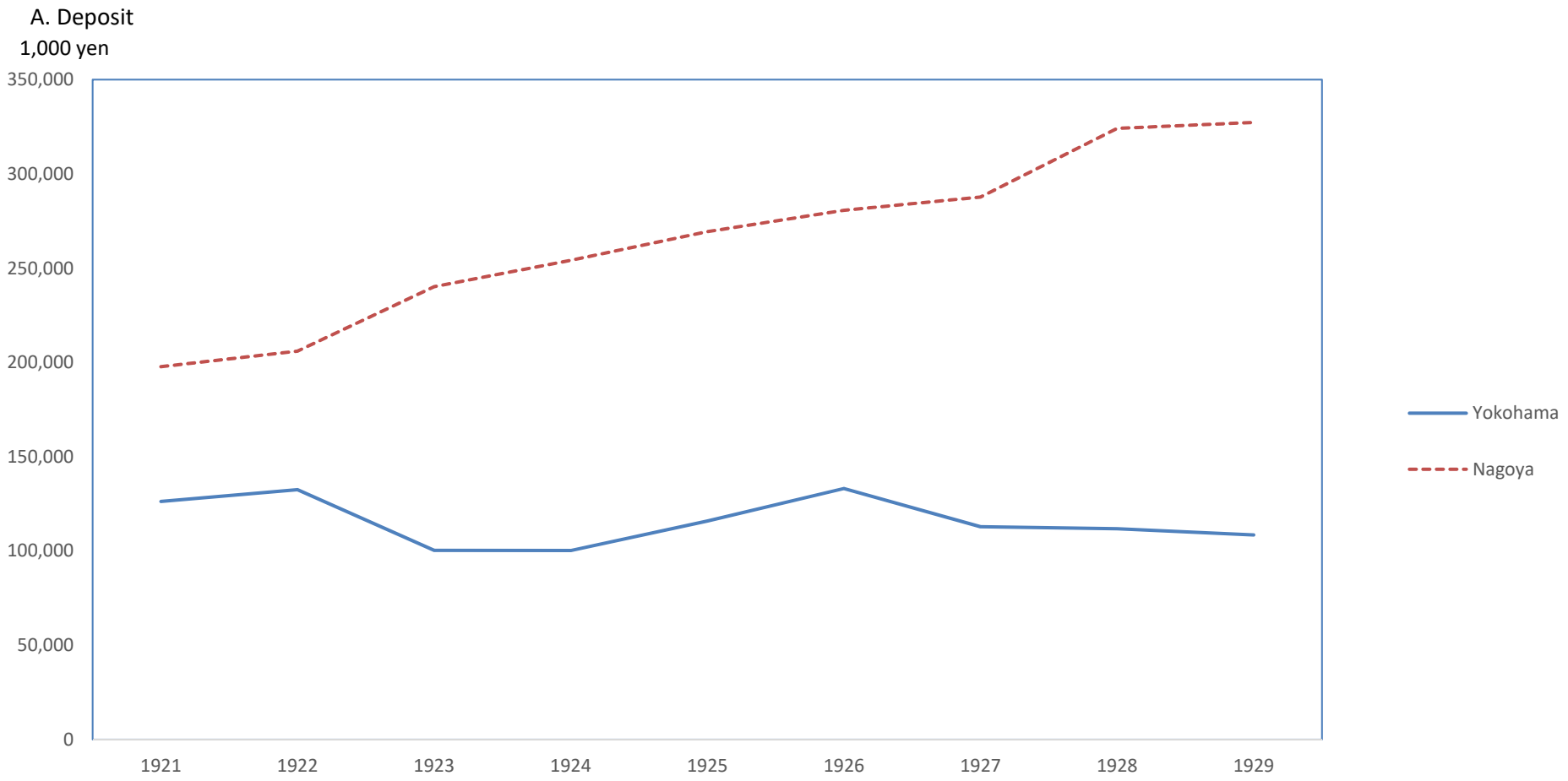


B. Capital

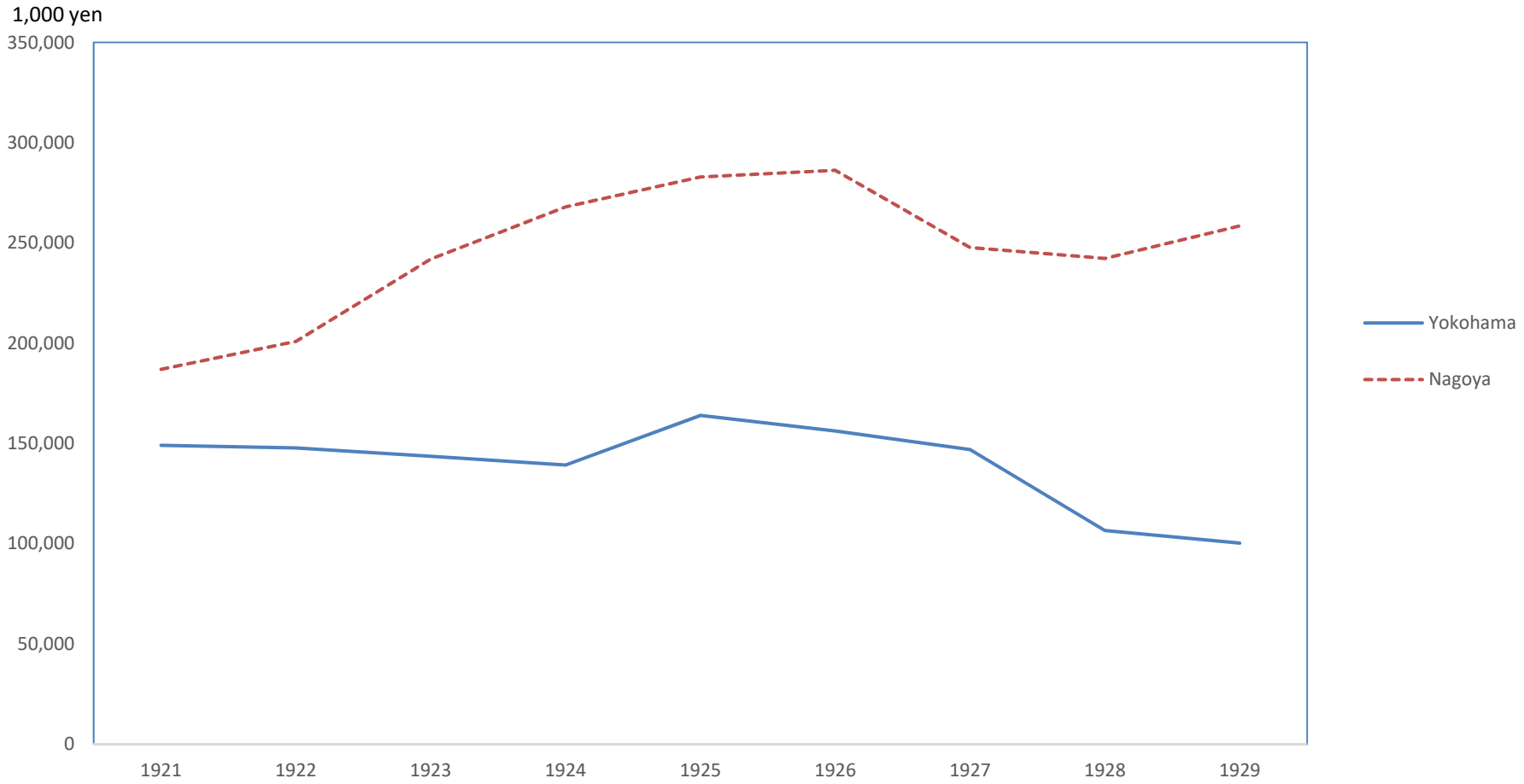


Source: Ministry of Commerce and Industry ed., *Kaisha Tokei-hyo (Corporate Statistics*), various issues.

Figure 4 Deposit and loan of ordinary banks in Yokohama City and Nagoya City

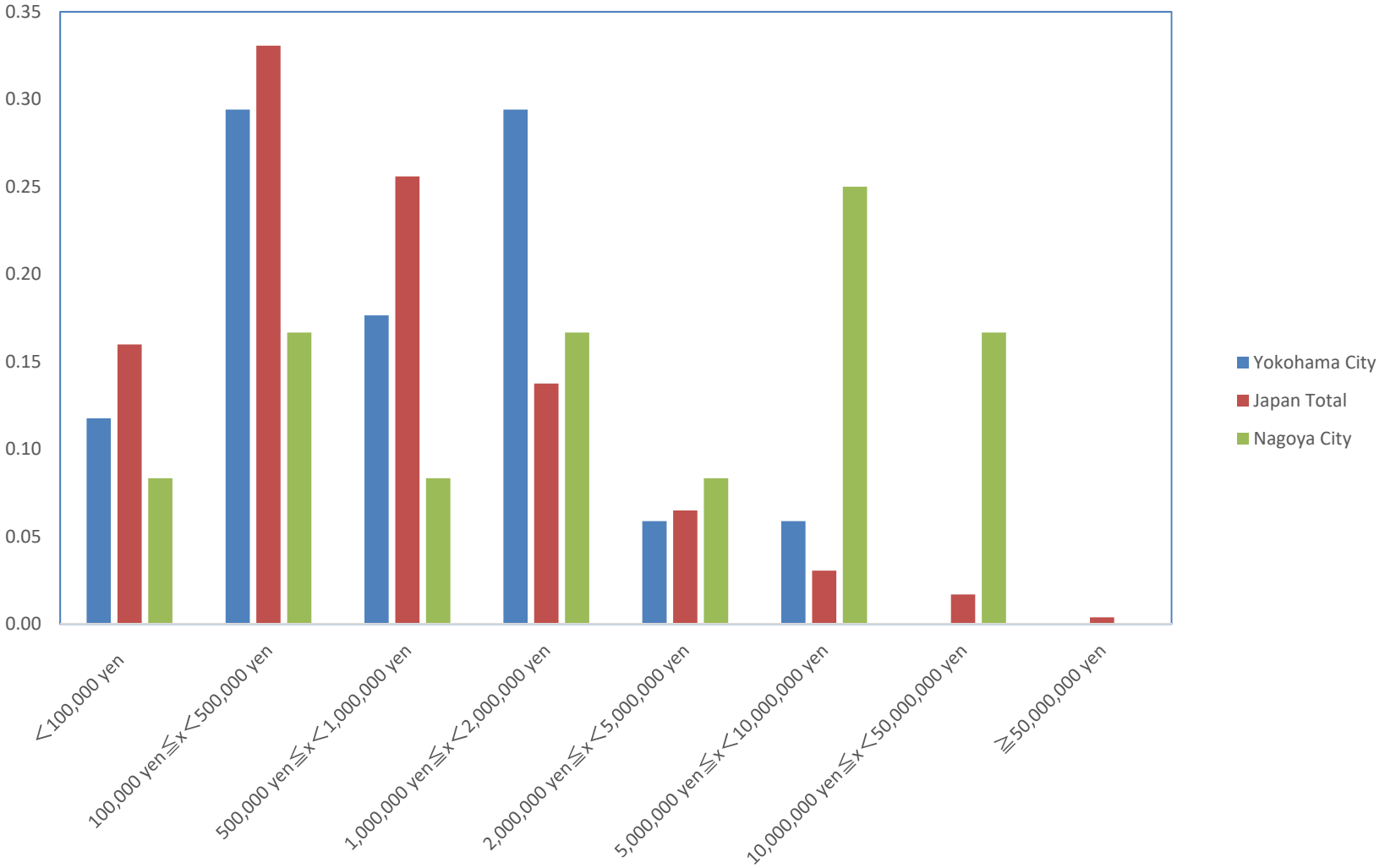


B. Loan



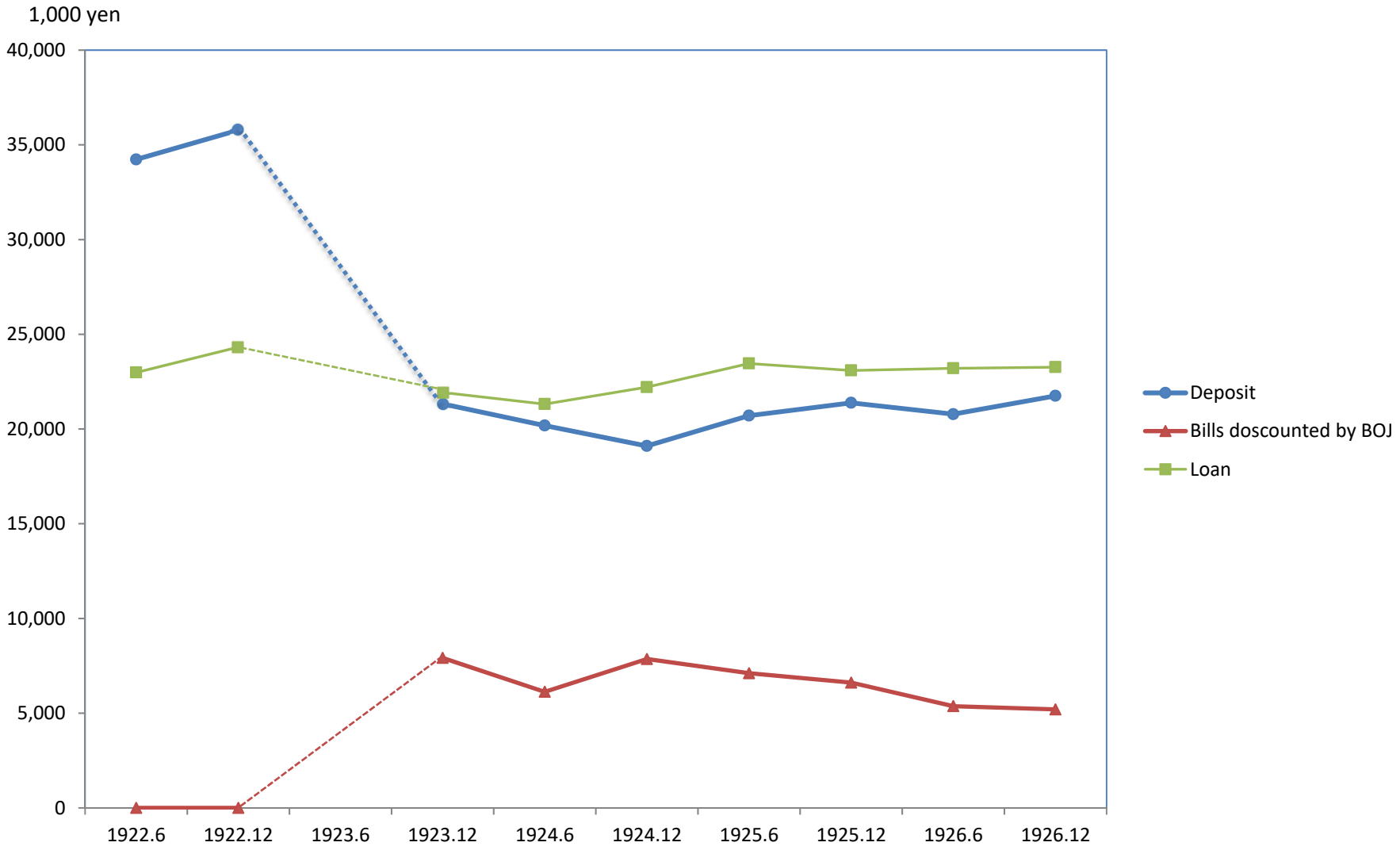
Source: Yokohama Chamber of Commerce, Yokohama Shogyo (Shoko) Kaigisho Geppo (Monthly Bulletin of Yokohama Chamber of Commerce), various issues; Osaka Ginko Shukaijo, Osaka Ginko Tsushinroku (Bulletin of Osaka Ginko Shukaijo), various issues.
Note: Deposits and loans of the headuarters and branches of ordinary banks, located in Yokohama City and Nagoya

Figure 5 Size distribution of ordinary banks in terms of capital in 1921



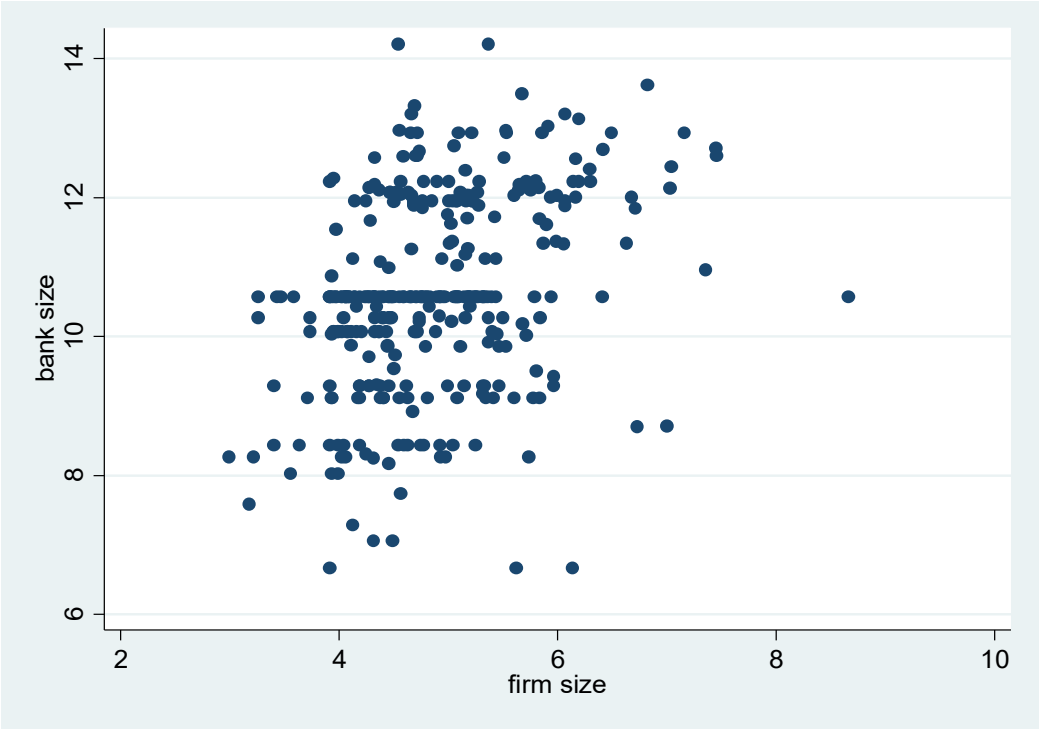
Source: Bank Bureau of Ministry of Finance ed., *Ginko Soran (Handbook of Banks)*, 1921 issue.

Figure 6 Balance sheet of Souda Bank



Source: Business Report of Souda Bank, various periods.

Figure 7: 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