

# Micro-aspects of Monetary Policy in Pre-war Japan: Lender of Last Resort and Selection of Banks

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## Abstract

The central bank as the Lender of Last Resort (LLR) is faced with a trade off between the stability of the financial system and the “moral hazard” of banks. In this paper we explore how this trade off was dealt with by the Bank of Japan (BOJ) in the pre-war period, and how LLR lending by the BOJ affected the financial system. In particular, this paper focuses on the following two stylized facts of Japanese financial history. First, the BOJ actively intervened in the market as the LLR under the unstable financial system in the 1920s. Second, in this period, the financial market worked well to sort out inefficient banks through failures.

In providing an LLR loan, the BOJ adopted the policy of favoring those banks that had an already established transaction relationship with the BOJ. At the same time, the BOJ was selective about which banks it would enter into a transaction relationship with. That is, the BOJ chose the banks it would conduct transactions with based on criteria that included profitability, liquidity, quality of assets, and the personal assets of directors. Furthermore, the BOJ did not hesitate to suspend transaction relationships with those banks whose performance declined.

This policy enabled the BOJ to act as the LLR without impairing the function of the market to sort out inefficient banks. Whereas the transaction relationship with the BOJ affected a bank's survivability, the effect was not across the board. That is, the transaction relationship did not increase the survivability of a bank directly, but it increased the influence of profitability and liquidity on survivability, especially in a period of financial crisis. This implies that the BOJ bailed out only those transaction counterparts that were profitable and prudent when the financial system was especially unstable. It is suggested that through concentrating LLR lending on its transaction counterparts, the BOJ could successfully bail out only those banks which were illiquid but solvent, and thereby avoided the moral hazard that the LLR policy might otherwise have incurred.

## Micro-aspects of Monetary Policy in Pre-war Japan: Lender of Last Resort and Selection of Banks

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## Introduction

Since Bagehot [1873], the central banks of many countries have come to adopt the role of Lender of Last Resort (LLR), and we have rich store of theoretical and empirical literature on LLR (Bordo 1990; Goodhart 1985; Goodhart and Huang 2005; Miron 1986, among others). According to the “classical view” of LLR, the Central Bank should prevent illiquid but solvent banks from failing by lending money to them at a penalty rate (Bordo 1990, p.19). The fact that LLR has been effective in preventing bank panics is well established (Bordo 1990; Butliewicz 1995; Miron 1995). On the other hand, as Goodhart [1985] argues, it is difficult for the Central Bank to discern between solvent and insolvent banks. Therefore, the Central Bank as the LLR is faced with a trade off between the stability of the financial system and the moral hazard of banks (Cordella and Yayati 2003).

In this paper we explore how this trade off was dealt with by the Bank of Japan (BOJ) in the period before the Second World War, and how LLR lending by the BOJ affected the financial system. As described in the next section, the financial system became unstable in 1920s Japan, and the BOJ actively played the role of LLR. We explore how the BOJ selected the banks to be bailed out and what implications that the BOJ's policy had.

In the literature on Japanese financial history, Ehiro [2000] and Ito [2003] review the role of the BOJ as the LLR in this period. As they point out, the LLR loan by the BOJ was a major policy tool for stabilizing the financial system in the 1920s. In another strand, Yabushita and Inoue [1993] found that the probability of bank closure under the financial crisis in 1927 was negatively correlated with the profitability and the ratio of risky assets of a bank. Okazaki[2002] and Okazaki, Sawada and Yokoyama [2005] confirmed the result using the data covering wider range of bank exits. Yabushita and Inoue interpreted the above result that the bank closures occurring during the financial crisis of 1927 were not contagious<sup>1</sup>. In the context of this paper, it suggests that the LLR loans by the BOJ successfully prevented financial crises from becoming contagious. Also, the negative correlation between bank performance and bank closure suggests that the LLR loans did not impair the selection mechanism of the market, by bailing out insolvent banks. In other words, it is suggested that the BOJ could deal with the above trade off fairly well.

In order to understand how this occurred, it should be noted that the BOJ was

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<sup>1</sup> Korenaga et al [2001] reexamined their proposition discriminating two waves of bank closures in 1927 to find that the second wave was contagious, while the first wave was not. It is important to explore how the LLR loan by the BOJ affected on these attributes of the bank closures.

selective in its provision of LLR loans, and that LLR loans were crucial for banks (Ishii 1980). Ishii [1980] pointed out that those banks which had already had transaction relationships with the BOJ were the main recipients of LLR loans, and those banks, in turn, were basically large-sized ones<sup>2</sup>. Referring to this fact, in this paper, I will examine how the BOJ selected its transaction counterparts, using the internal documents of the BOJ and bank-level quantitative data.

The BOJ archives hold the original documents on the individual openings and closings of transaction relationships with private banks in the pre-war period. We look at how the BOJ evaluated the banks which applied to open a transaction relationship, and how it made the decision to approve or reject such applications. On the other hand, *Nihon Ginko Enkakushi (The History of the BOJ)* contains comprehensive records on the individual transaction relationships between the BOJ and private banks. Based on these materials, we constructed a database of the transaction relationships, and matched it with a database of the financial data of individual banks. Using the dataset, we econometrically analyze the determinants of the transaction relationship between the BOJ and private banks. Also, we investigate how the transaction relationships with the BOJ impacted on the financial system. Specifically, we analyze the effects of the relationship on bank performance and bank failure, thereby elucidating the institutional background of the non-contagious attribute of the financial crisis that Yabushita and Inoue [1993] found.

The paper is organized as follows. In section 2 we provide a brief history of the Japanese banking sector and the policies of the financial authorities. Section 3 describes basic characteristics of transaction relationships between the BOJ and private banks. In section 4 and 5, we analyze the determinants of the transaction relationship and its implications. Section 6 concludes the paper.

## 2. Historical background

The period from the 1920s and early 1930s is one of the major epochs in the financial history of Japan. Since the passing of the National Bank Act in 1872 and the Bank Act in 1890, the banking industry in Japan grew rapidly with many new entrants. In 1900, the number of ordinary banks reached a peak of 1890, when a shake out started (Figure 1). This shake out was accelerated by the impact of the boom during the First World War and its sudden end. Due to the high economic growth and

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<sup>2</sup> Following Ishii [1980], Shiratori [2003] argues that the BOJ's selective stance was based on its policy of maintaining the value of the currency in preparation for the return to the gold standard.

loose monetary policy during the war, bank deposits increased sharply, which brought about a substantial change in the balance sheet of the banking sector (Figure 2, 3). Before that, whereas the average ratio of equity to total liabilities was as high as 25%, it dropped to become 15 to 20% in the 1920s. On the other hand, many banks lent out large amounts to the new industries that developed during the war boom, and a substantial part of these loans became non-performing after the war, due to the return of international competition and the depression.

In addition, since the end of the 1910s, many banks expanded branch networks (Figure 2). The basic initial cause was the agreement among major banks in 1918 on the deposit interest rate. As a result of the agreement, the spread between deposit interest rate and loan interest rate increased, which had the effect of stimulating competition among banks in their efforts to collect deposits (Tsurumi 1981, p.77; Okazaki 1993, p.304). As indicated by the average number of branches, branch banking had been underdeveloped until then, which had limited interregional competition in the banking industry. On the other hand, in the 1920s, due to the expansion of branch banking, fierce interregional competition developed.

The change in the balance sheet as well as the level of interregional competition led to the financial system becoming unstable in the 1920s. We measure the instability of the financial system by the interest rate spread between the risky debt and safe debt (Bernanke 1983; Stock and Watson; Mishkin 1991). Specifically, we use the interest rate spread between the average bank loan rate and government bond rate (Shikano 1993; Okazaki 1993). Figure 4-a shows the long-term time series of the interest rate spread. Before the First World War, we can identify four spikes of interest rate spread, in 1900, 1904, 1907 and 1913. They correspond to four episodes of bank panic (Akashi and Suzuki 1957; Nagaoka 1971; Oshima 1952). During these panics, the spread rose to exceed 4%. Just after the War, the spread went up sharply, which reflects the bank panic that occurred in 1920 (Oshima 1952; Takeda 1983). It is notable that in the 1920s, the spread stayed around 4%, which is close to the level in the bank panics before the War, which suggests that the financial system was continuously unstable over this period. At the same time, it is also noteworthy that we cannot observe the individual impacts of the bank panics in 1922, 1923 and 1927 (Oshima 1955; Takahashi and Morigaki 1993; Takeda 1983). On the other hand, those panics are captured by the deposit data. Figure 4-b shows the semi-annual data of the difference between the growth rates of postal saving deposits and bank deposits. Here, bank deposits refer to the deposits in the all banks in Japan<sup>3</sup>. With respect to the 1920s, the

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<sup>3</sup> It includes the deposit of the Special Banks and the banks in Korea and Taiwan, and

panics in 1920, 1922, 1923 and 1927 are captured by the spikes in the diagram. In particular, it is confirmed that the panic in 1927 was serious and its impact continued for a long time. We will discuss below the reason why individual panics were not reflected in the interest rate spread.

Under the prolonged financial instability in the 1920s, shake out of banks proceeded rapidly. The number of ordinary banks, which was 1799 in 1922, had dropped to 424 by 1936. Out of the gross decrease of 1514 in this period<sup>4</sup>, 970 were due to mergers, and the other 544 were due to failures and voluntary liquidations (Figure 1). One of the basic reasons why so many mergers took place was the merger promotion policy adopted by the Ministry of Finance. Since the 1890s, the Ministry of Finance had the intention of promoting bank mergers to stabilize the financial system, but no specific measures were taken until the 1920s. In 1920, through a revision to the Bank Act, the procedure for effecting bank mergers was made easier than it was for mergers between non-banking companies. In 1923, the Ministry of Finance issued a notification placing restrictions on the establishment of new branches, which spurred major banks to acquire smaller banks in order to expand branch networks. Finally, the Bank Law in 1927 gave the government a powerful means of promoting bank mergers. That is, the Bank Law obliged an ordinary bank to have capital of not less than one million yen by 1932, and many banks could not meet this criterion without merging with other banks (Goto 1970; Bank of Japan 1986, p.512; Okazaki 2002; Sawada and Okazaki 2004). As a result of bank mergers, branch banking grew substantially.

The Ministry of Finance's promotion of mergers can be regarded as a structural policy to stabilize the financial system by creating a concentrated market structure with branch banking. Meanwhile, the Bank of Japan actively played the role of LLR through giving "Special Loans" to private banks facing financial crises. Special Loans included loans based on the special laws passed to cope with emergencies (Act of Loss Compensation due to Earthquake Bill Discount passed in 1923, Law of the Bank of Japan Special Loan and Loss Compensation passed in 1927, and Law of the Loan to the Taiwan Bank passed in 1927), and other emergency loans provided at the discretion of the BOJ, skipping the ordinary due process and conditions that would normally have to be met (Ito 2003, p.171). In the 1920s, Special Loans as a proportion of the total domestic loans provided by the BOJ climbed to exceed 90% (Table 1).

The lending pattern of the BOJ indicates that the BOJ actively intervened in

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does not include the deposit of the BOJ.

<sup>4</sup> There were 139 new entries in this period, most of which were due to mergers into new banks.

the financial market as the LLR in the 1920s. The diagram in Figure 5 refers to the increase in domestic loans from the BOJ compared with the same quarter in the previous year. As shown in Figure 5, the lending pattern of the BOJ was strikingly different before and after the First World War. Before the War, lending by the BOJ did not necessarily increase when bank panics occurred. In particular, the lending by the BOJ seems to be negatively associated with the interest rate spread. In other words, the BOJ was not active as the LLR before the First World War. On the other hand, we observe sharp spikes in BOJ lending in 1920, 1922, 1923 and 1927. It has been assumed that active intervention by the BOJ is the basic reason why clear spikes in the interest rate spread cannot be found in the 1920s. In playing the role of LLR, the BOJ tended to favor those banks with which it already had transaction relationships when it came to providing Special Loans (Ishii 1980). Table 2 indicates the composition of Special Loans based on the Law of the Bank of Japan Special Loan and Loss Compensation. As shown here, the proportion of banks which had already had transaction relationships was as high as 95.0%.

### **1. Transactions between the BOJ and private banks**

The Bank of Japan started transactions with private banks just after its establishment in 1882 (The Bank of Japan 1982, p.328). The transactions included current deposits, current account transfers, overdrafts accounts, correspondent accounts, discounts and loans. Table 1 summarizes the level of BOJ transactions with private banks. Until the end of the nineteenth century, the major instrument the BOJ used to provide credit to private banks was the time loan, and after that discounting became dominant. This was basically because the stamp tax rate on bills became lower than it was for deeds, due to the revision of the Stamp Act in 1899 (Ishii 1999, p.194; Sugiyama and Kawakami 1965). Whereas correspondent accounts increased to 240 in 1900, they declined after that because their function was replaced by current account transfers (The Bank of Japan 1913a). Consequently, in the 1920s and 1930s, discounts and current deposits were the major tools used by the BOJ in its transactions with private banks.

The BOJ had internal rules prescribing the procedure that had to be followed when opening a transaction with a private bank. First, the private bank which wished to open a transaction relationship with the BOJ filed an application to the Business Bureau of the headquarters of the BOJ or a branch of the BOJ. If the Business Bureau or the branch judged that the applicant bank was eligible, it sent the application to the Governor of the BOJ. Then the Examination Department of the

headquarters examined the application, and if the Examination Department judged that the applicant bank was eligible, the Governor proposed the opening of transaction at the Director Meeting<sup>5</sup>.

First, we identify the ordinary banks which had transaction relationships with the BOJ. The basic data can be obtained from the tables “Change in the Correspondents”, which Ishii[1980] used<sup>6</sup>. The information in these tables includes the date on which each headquarters or branch of the BOJ opened and closed a transaction relationship with the headquarters or branch of a bank by kind of transaction, namely, current deposit, discount etc. Data from September 1923, with respect to the headquarters of the BOJ, and data from January 1909, with respect to the BOJ’s branches, are available. As to the relationships which started before September 1923 or January 1909, the dates of the starts are recorded as “before September 1923” or “before January 1909.” The data on the headquarters are limited because the documents were lost in the fire that followed the Great Kanto Earthquake of 1923. Using this source, we compiled a comprehensive database of the BOJ’s transaction relationships from 1923 to 1942.

Then we matched this database with the comprehensive database of ordinary banks from 1925 to 1936. The latter database was compiled from various issues of the Yearbook of the Bank Bureau issued by the Ministry of Finance. Table 2 shows the number of ordinary banks which had transaction relationships with the BOJ. The number declined sharply from 253 in 1925 to 148 in 1932, and after that the downward trend was less marked. While this movement corresponds to the decline in the total number of ordinary banks, as the latter trend was sharper, the proportion of the ordinary banks which had transaction relationships with the BOJ went up from 16.5% in 1925 to 31.4% in 1936, but still they were the minority in terms of the number (Imuta[1980] and Ishii[1980]). On the other hand, in terms of the amounts of deposits and loans, the BOJ correspondent banks had a large share. Their share of the total deposits and loans of the ordinary banks was higher than 90% in 1935 (Table 3).

Next, the ordinary banks are classified according to a couple of criteria into several groups to compare the ratios of BOJ correspondents between the groups. Table 4 shows the results where we classify banks by deposit scale. With respect to the years 1925, 1930 and 1935, we find a clear positive correlation between deposit scale and the

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<sup>5</sup> The Bank of Japan, *Nippon Ginko Enkakushi (History of Bank of Japan)*, series 1-volume 2, p.403, series 2-volume 3, p.1, pp.524-525. *Nippon Ginko Enkakushi* is an unpublished series of volumes on the BOJ History edited by the BOJ.

<sup>6</sup> *Nippon Ginko Enkakushi (History of Bank of Japan)*, *op cit.*, series 2-volume 3 and series 3-volume 3.



ratio of BOJ correspondents. For example, in 1925, whereas all of the ordinary banks whose deposits were not smaller than 100 million yen had transaction relationships with the BOJ, only 2.3% of banks whose deposits were less than one million yen, even though they represented more than 50% of the banks, had transaction relationships with the BOJ. The shares of the BOJ correspondents in each deposit scale group did not change substantially over time. This implies that the rise of the share of the BOJ correspondents in Table 2 basically reflects the change in the distribution of bank scale over the ten-year period.

Table 5 shows the result where we classify the banks by the area in which they were located, namely urban or non-urban areas. The urban area includes the seven prefectures, Tokyo, Osaka, Kyoto, Kanagawa, Aichi, Hyogo and Fukuoka. In this case, the proportion of BOJ correspondents was not substantially different between the two areas. However, if we add the criterion of bank scale taking into account the discrepancy in the scale distribution between the two areas, we find some differences (Table 6). With respect to the small banks whose total deposits came to less than five million yen, the proportion of BOJ correspondents was substantially higher in non-urban areas. This fact suggests that the BOJ used different standards when deciding which banks they were prepared to transact with. Finally, we examine the difference in the proportion of BOJ correspondents between the prefectures where the headquarters or branches of the BOJ were located and the prefectures where they were not, as suggested by Imuta [1980]. At the end of 1925, in addition to the headquarters in Tokyo, the BOJ had fifteen branches in fourteen prefectures, namely, Osaka, Fukuoka, Aichi, Hokkaido, Kyoto, Fukushima, Hiroshima, Ishikawa, Niigata, Nagano, Kumamoto, Akita, Shimane and Okayama<sup>7</sup>. After that, BOJ branches were established in Hyogo prefecture in 1927, and in Ehime prefecture in 1932 (The Bank of Japan[1986]). We find that the proportion of BOJ correspondents was much higher in prefectures with BOJ headquarters or branches (Table 7). To control for the difference in the scale distribution, classification by deposit scale is added in Table 8. It is confirmed that the proportion of BOJ correspondents was higher in the prefectures with BOJ headquarters or branches, with respect to each class of deposit scale.

#### **4. How did the BOJ select transaction counterparts ?**

Using the database of BOJ correspondents, we can identify the name of the ordinary banks which opened and closed transaction relationships with the BOJ as well as the year these events took place. The numbers of openings and closings in each

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<sup>7</sup> In Hokkaido, the BOJ had two branches in the cities of Otaru and Hakodate.

year from 1926 to 1936 are shown in Table 9. Eighteen ordinary banks opened transaction relationships with the BOJ during this period, while 162 ordinary banks closed them. For 123 banks of these 162 banks, the close year and the year they exited from the banking industry were the same. We can infer that they closed transaction relationships with the BOJ as a result of their exits. The other 39 banks continued business at least until the end of the next year following the close. We regard these 39 cases as the closing of transactions with the BOJ in a narrow sense, namely closing of transactions not due to exits. The fact that so many closings occurred is worth noting in itself. Whereas the emergency loans by the BOJ were concentrated on the banks which had transaction relationships with BOJ, as Ishii[1980] stressed, a bank could not necessarily survive, even if it had a transaction relationship with the BOJ.

As mentioned in section 1, the documents on the individual openings and closings of transaction relationships are held at the BOJ archives. In particular, the documents on the openings contain a rich store of information, as the openings had to be approved at a director's meeting. From these documents we can see why the private banks wanted to have transaction relationships with the BOJ, and how the BOJ screened the applications from the private banks. The private banks wanted to have transactions with the BOJ basically so that they could raise and apply funds flexibly. By borrowing funds from the BOJ in the case of a liquidity shortage, they could cope with the volatility in the financial market including seasonality, which in turn enabled them to expand the opportunities for fund application.

While the BOJ recognized the situation the private banks were in, it paid attention to the following conditions when approving their applications. The first one was the soundness of the bank's financial condition in terms of profitability and the riskiness of the portfolio. Second, and related to the first point, the BOJ took into account the composition of the directors and their personal financial status. The third condition was the bank's scale and position in the local financial market. The BOJ placed considerable emphasis on whether the bank was one of the major banks in the area, and if it contributed to financing local industries. Finally, the BOJ took into account whether there were alternatives for these banks for raising fund for transactions apart from the BOJ.

Next, we quantitatively examine how those conditions affected the choice of transaction counterparts by the BOJ. Taking into account the above observations, we assume the following function for the BOJ when choosing a counterpart.

$BOJT_{it}=1$ , if  $BOJT_{it}^*>0$ , and 0, otherwise

where

$$BOJT_{it}^* = \beta' (\mathbf{X}_{it-1}, \mathbf{Z}_{it-1}) + u_{it}$$

Hence

$$\text{Prob}(BOJT_{it}=1) = F[\beta' (\mathbf{X}_{it-1}, \mathbf{Z}_{it-1})] \quad (1)$$

$BOJT_{it}$  is a dummy variable which equals 1 if bank  $i$  had a transaction relationship with the BOJ in year  $t$ , and 0, otherwise.  $\mathbf{X}_{it}$  is a vector of the attributes of the bank  $i$  in year  $t$ , and  $\mathbf{Z}_{it}$  is a vector of the attributes of the area where bank  $i$  was located, in year  $t$ . As the attributes of a bank, we focus on scale, profitability, riskiness of the portfolio and liquidity, referring to the above case studies. Scale is measured by the log value of the asset (LNASSET). In addition to this, we use the ranking of the assets in the prefecture in each year, normalized by the number of ordinary banks in the prefecture (ASSETRANK). Profitability is measured by the return on asset (ROA). Riskiness of the portfolio is measured by the loan deposit ratio (LDR), while liquidity is measured by the reserve ratio (RESERVE). We compute RESERVE by (cash+deposit to other banks)/deposit. As the variable on the attributes of the area, we use URBAN, which is a dummy variable which equals 1 if the prefecture where the headquarters of the bank was one of Tokyo, Kanagawa, Aichi, Kyoto, Osaka, Hyogo and Fukuoka, the prefectures of the seven largest cities, and 0, otherwise. Because the BOJ gave priority to those banks which had difficulty accessing the central financial market, as we have seen, we expect that the coefficient of URBAN will be negative. Also, we use a dummy variable BOJBRANCH, which equals 1 if there was a branch of the BOJ in the prefecture where the headquarters of the bank was located, and 0, otherwise. As Imuta[1980] pointed out, we anticipated that the probability of a bank forming a transaction relationship with the BOJ was higher for those banks which had their headquarters in the prefectures where a branch of the BOJ was located. Then the baseline equation to be estimated is,

$$\begin{aligned} \text{Prob}(BOJT_{it}=1) = & F(\beta_0 + \beta_1 \text{LNASSET}_{it-1} + \beta_2 \text{ASSETRANK}_{it-1} + \beta_3 \text{ROA}_{it-1} + \beta_4 \text{LDR}_{it-1} + \beta_5 \text{RESERVE}_{it-1} \\ & + \beta_6 \text{URBAN}_{it-1} + \beta_7 \text{BOJBRANCH}_{it-1}) \end{aligned} \quad (2)$$

First, we estimate equation (2), using the samples of all the ordinary banks which existed in the period from 1926 to 1936. As there were many exits as well as entries of banks in this period, the dataset is an unbalanced panel made up of 8296 observations. The observations where  $BOJT=1$  are 1863. The result is shown in Table

10. In column (a), the coefficients of the scale variables, LNASSET and ASSETRANK have expected signs and are statistically significant. That is, not only the absolute scale of an asset but also its relative rank in the prefecture are positively associated with the probability of forming a transaction relationship with the BOJ. The coefficient of ROA is positive and statistically significant, as expected. On the other hand, the coefficient of LDR is positive and significant. In other words, riskiness of the portfolio was positively associated with the probability of becoming a correspondent of the BOJ, which is contrary to our expectations based on the case studies.

This result might reflect the reverse causality that those banks which had transaction relationships with the BOJ could adopt and implement aggressive fund application policies. Although we use variables with a one-year lag as the regressors, if the regressors have serial correlations, it is possible that they correlate with the error term. We will discuss this issue later. Concerning the variables related to the aerial attributes, the coefficient of URBAN is negative and significant, while the coefficient of BOJBRANCH is positive and significant. As we expected, the probability of becoming a correspondent of the BOJ was lower for those banks in urban areas, as these banks had good access to the central financial market, and it was higher for the banks in the prefectures where BOJ's branches were located.

In column (b) we add the interaction term of LNASSET and URBAN to see the difference of the scale effects between urban areas and other areas. The coefficient of the interaction term is positive and statistically significant, which implies that the effect of the scale on the probability of forming a transaction relationship with the BOJ was higher in urban areas. The coefficient of URBAN is still negative and significant. As a result, for smaller banks, the probability of becoming a BOJ transaction counterpart was higher if they were located in a non-urban area, whereas for larger banks it was higher if they were located in an urban area. The threshold asset level where the sign of the net effect of being located in the urban area changes is 37.59 million yen. This scale is between 48th and 49th largest out of 1420 ordinary banks in 1926, and between 43rd and 44<sup>th</sup> largest out of 423 ordinary banks in 1936. These results are consistent with the observation in Table 6.

So far, we have focused on the state of transaction relationships between the BOJ and an ordinary bank in each year. Alternatively, we can focus on the number of openings and closings of transaction relationships in each year. These analyses are useful to deal with the possible endogeneity problem in the results reported in Table 10. First, we analyze the determinants of opening transaction relationships between the

BOJ and ordinary banks. For that purpose, we take the 6413 bank-years, whose BOJT in the previous year is 0, as the samples. Out of them, there were 18 events of opening transaction relationships. Then, we make a dummy variable  $BOJTO_{it}$ , which equals one if bank  $i$  opened a transaction relationship with the BOJ in year  $t$ , and 0, otherwise, and regress it to the same independent variables as the baseline regression in Table 10, using a logit model. In column (c), the coefficient of LNASSET is positive and statistically significant. Also, the coefficient of ASSSETRASNK is negative, though the statistical significance is not high. Those banks whose asset scales were large had a higher probability of opening a transaction relationship with the BOJ. The coefficient of ROA is negative, but the statistical significance is low. It is notable that the coefficient of LDR is negative and statistically significant, unlike the result in Table 10. In the literature on the Japanese financial system covering this period, LDR has been regarded as an index showing the unsoundness of a bank's assets (Imuta 2002, pp.65-83; Teranishi 1982, pp.311-327). This result is consistent with the observation of the case studies in the previous section.

Next we analyze the determinants of closing transaction relationships between the BOJ and ordinary banks. In this case, we focus on the 1883 bank-year, whose BOJT was 1 in the previous year. Out of them, 39 banks closed transactions with the BOJ due to reasons other than exit. We make a dummy variable  $BOJTC_{it}$ , which equals 1 if a bank  $i$  closed a transaction relationship with the BOJ in year  $t$ , and 0, otherwise, and regress it to the same independent variables as in Table 11. The result is reported in Table 12. The coefficient of LNASSET is negative and statistically significant, which implies that there was a higher probability of small banks closing a transaction relationship with the BOJ. The coefficient of ROA is negative and statistically significant. Also, the coefficient of RESERVE is negative and statistically significant. The results concerning profitability and liquidity are significant because this implies that the BOJ closed transaction relationships with those correspondents whose profitability declined and whose portfolio became risky, and did not persevere in trying to rescue them by maintaining the transaction relationship.

## **5. Effects of transactions between the BOJ and private banks**

As we have seen, by opening transaction relationships with the BOJ, private banks hoped to increase the flexibility of fund application, and the BOJ chose them selectively based on specific criteria including scale, profitability and riskiness of the portfolio. Then, the next question is how transaction relationships with the BOJ actually affected the performance of the private banks and thereby the performance of

the financial system itself. We hypothesize that a transaction with the BOJ reduced the liquidity risk for a bank, which enabled it to apply funds more aggressively than otherwise. And, as a result, they should have been able to earn higher profits. In this section, we examine this hypothesis.

For this purpose, it is essential to deal with the endogeneity of transaction relationships between the BOJ and private banks. We can use equation (1) in the previous section to do this. That is, we estimate the following treatment effect model (Green 2000, p.933).

$$\Pi_{it} = \gamma \mathbf{W}_{it} + \delta \text{BOJT}_{it} + e_{it} \quad (3)$$

where

$\text{BOJT}_{it} = 1$ , if  $\text{BOJT}_{it}^* > 0$ , and 0, otherwise

$\text{BOJT}_{it}^* = \beta' (\mathbf{X}_{it-1} + \mathbf{Z}_{it-1}) + u_{it}$

$\Pi_{it}$  is a performance measure of bank  $i$  in year  $t$ .  $\mathbf{W}_{it}$  is a vector of exogenous variables affected on  $\Pi_{it}$ .  $\text{BOJBRANCH}$  is an exogenous variable which is included in equation (1), but not in equation (3). We hypothesize that a transaction relationship with the BOJ enabled a bank to apply funds more aggressively, and thereby enhanced profitability. In order to examine this hypothesis, we first look at the effect of  $\text{BOJT}$  on the variables in the bank's portfolio, namely ratios of loans to total assets ( $\text{LOAN}$ ) and the ratio of securities to total assets ( $\text{SECURITIES}$ ). In the regression, we control for the log value of asset ( $\text{LNASSET}$ ), the number of branches ( $\text{BRANCH}$ ), prefecture dummies, and year dummies.  $\text{BRANCH}$  is taken from the various issues of the Yearbook of the Bank Bureau of the Ministry of Finance. The results are reported in Table 13. As we expected, the coefficients of  $\text{BOJT}$  are positive and statistically significant for both  $\text{LOAN}$  and  $\text{SECURITIES}$ , which implies that a transaction relationship with the BOJ led to a bank raising the proportion of interest earning assets.

Next we use  $\text{ROA}$  as  $\Pi$ . In the literature on banking, scale, portfolio and market competition are considered to be the basic determinants of profitability. By  $\text{LNASSET}$  and  $\text{BRANCH}$ , we capture the scale factor. Portfolio is captured by  $\text{LOAN}$ ,  $\text{SECURITIES}$  and  $\text{RESERVE}$ . In order to measure the degree of competition, we make a variable  $\text{C3}$ .  $\text{C3}$  refers to the concentration ratio in terms of the number of headquarters and branches in each prefecture in each year, namely, (number of branches of the three largest banks in each prefecture in terms of branch

number+3)/(number of headquarters and branches of all the banks in each prefecture)<sup>8</sup>. Branches are counted in the prefectures where those branches themselves were located, and not in the prefectures where their headquarters were located. The location data on branches are obtained from various issues of the Handbook of Banks (*Ginko Soran*) edited by the Bank Bureau of the Ministry of Finance (Okazaki, Sawada and Yokoyama 2003). In addition, we control for the prefecture specific effects and year specific effects which are not captured by those basic variables, using prefecture dummies and year dummies.

Estimation results are reported in Table 13. In order to test the hypothesis that the effect of BOJT on ROA is the result of an aggressive portfolio management policy, we estimate the equation which does not include LOAN, SECURITIES and RESERVE (column (c)) as well as that which includes these variables (column (d)). In column (c) the coefficient of BOJT is positive and statistically significant, which implies that a positive effect of a transaction relationship with the BOJ on the profitability is confirmed, even after controlling for the endogeneity of BOJT. On the other hand the coefficient of BOJT is not significant in column (d), which implies that the positive effect of a transaction with the BOJ was basically through its effect on the bank's portfolio.

Finally we explore the effect of a transaction relationship with the BOJ on a bank's exit. As described in section 2, many banks exited over the period from the 1920s to the 1930s as a result of mergers and failures. And it has been found that bank failures in this period tended to eliminate banks with poor performance, thereby enhancing the efficiency of the banking industry (Yabushita and Inoue 1993; Okazaki 2002; Okazaki, Sawada and Yokoyama 2005). We hypothesize that this property of the failures was related to the role of the BOJ. More specifically, through supplying funds selectively to those banks which were facing a liquidity shortage but not insolvent, the BOJ supported the efficiency enhancing effect of the selection of banks by the market. In order to examine this hypothesis, we estimate the following multinomial logit model for bank exit.

$$\text{Prob}(\text{EXIT}_{it}=j)=G[\gamma'(V_{it-1})], j=0, 1, 2 \quad (4)$$

$j=0$ , if a bank survived in year  $t$ .  $j=1$ , if a bank was merged in year  $t$ , and  $j=2$ , if a bank failed in year  $t$ .  $V_{it}$  is a vector of exogenous variables on bank  $i$  in year  $t$ . The

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<sup>8</sup> "3" in the numerator refers to the number of the headquarters of the three largest banks. The concentration ratio in terms of deposit or asset is not available.

equation to be estimated is

$$\begin{aligned}
\text{Prob}(\text{EXIT}_{it=j}) = & \gamma_0 + \gamma_1 \text{LNASSET}_{it-1} + \gamma_2 \text{BRANCH}_{it-1} + \gamma_3 \text{ROA}_{it-1} + \gamma_4 \text{LDR}_{it-1} \\
& + \gamma_5 \text{EQUITY}_{it-1} + \gamma_6 \text{RESERVE}_{it-1} + \gamma_7 \text{AGE}_{it-1} + \gamma_8 \text{URBAN}_{it-1} + \gamma_9 \text{QUAKE}_{it-1} \\
& + \gamma_{10} \text{FORM} + \gamma_{11} \text{CRITERION} + \gamma_{12} \text{BOJT}_{it-1} + \gamma_{13} \text{BOJT}_{it-1} * \text{ROA}_{it-1} \\
& + \gamma_{14} \text{BOJT}_{it-1} * \text{LDR}_{it-1} + \gamma_{15} \text{BOJT}_{it-1} * \text{EQUITY}_{it-1} \\
& + \gamma_{16} \text{BOJT}_{it-1} * \text{RESERVE}_{it-1}
\end{aligned} \tag{5}$$

EQUITY is the ratio of equity to total assets, and QUAKE is a dummy variable which equals 1 if the prefecture where a bank was located is Tokyo or Kanagawa, and which were seriously damaged by the Great Kanto Earthquake of 1923. FORM is a dummy variable which equals 1 if the bank was a joint-stock company, and 0, otherwise. CRITERION is a dummy variable, which equals 1 if the bank's capital was smaller than the lower limit of the capital prescribed under Bank Law. BOJT\*ROA, BOJT\*LDR, BOJT\*EQUITY and BOJT\*RESERVE are the interaction terms between BOJT and the variables of the bank's financial condition, ROA, LDR, EQUITY and RESERVE.

The estimation results are shown in Table 14. In column (a), we estimated equation (5), excluding the interaction terms. ROA is negatively associated with failure, which confirms the results of Yabushita and Inoue [1993] and Okazaki[2002]. The coefficient of BOJT is negative, but not statistically significant, which implies that a transaction with the BOJ did not have the effect of increasing the overall survivability of its transaction counterparts. Column (b) is the same equation but where we limit the samples to those from 1926 to 1931, when the financial system was unstable, but the result is basically the same. In column (c) and (d), we show the estimation results of equation (5) including the interaction terms. If we use all of the sample period, the coefficients of the interaction terms are not statistically significant. On the other hand, where we limit the samples to those from 1926 to 1931, the coefficient of BOJT\*ROA is negative and statistically significant, and the coefficient of BOJT\*LDR is positive and statistically significant with respect to the failure. BOJT is not significant here, either. These results imply that whereas a transaction with the BOJ did not have the effect of increasing the overall survivability of transaction counterparts, it amplified the effect of ROA and LDR. In other word, if banks had a transaction relationship with the BOJ, the survivability of good banks increased. In this sense, transaction relationships with the BOJ enhanced the efficacy of the selection of banks by the market.



## 6. Concluding remarks

Under the unstable financial system that existed in the 1920s, the BOJ actively intervened in the market as the LLR, which is reflected in the spikes in BOJ lending during the periods of bank panics. In providing an LLR loan, the BOJ adopted the policy of favoring banks which already had a transaction relationship with the BOJ. On the other hand, the BOJ selected transaction counterparts based on the applications made by private banks. From the case studies on the opening of transaction relationships, we found that the BOJ used the following criteria in selecting counterparts, namely, (a) financial condition of the bank (profitability and soundness of the portfolio), (b) composition of the directors and large shareholders, and their private assets, (c) scale of the bank and its position in the local financial market, (d) availability of funds other than BOJ loans. This finding is basically confirmed by the econometric analysis of the determinants of the transaction relationship. That is, the probability of having a transaction relationship with the BOJ was high for those banks whose scale was large, whose scale ranking in the prefecture was high, and which was located in a non-urban area. Also, the probability of opening a transaction relationship with the BOJ was high for those banks whose scale was large and whose scale ranking in the prefecture was high, and it was low for banks whose portfolios were risky. At the same time, for banks whose ROA was low and which were located in urban areas, the probability of a transaction relationship with the BOJ being closed was high. It is noteworthy that banks whose profitability was low could not maintain a transaction relationship with the BOJ, which implies that the relationship did not always guarantee the bank's survival.

Based on the findings about the determinants of the transaction relationship with the BOJ, we explored the effects of the relationship on the bank performance, using the treatment effect model. It was found that the transaction relationship with the BOJ enabled a bank to adopt an aggressive portfolio management policy, and thereby had a positive impact on profitability. Finally, we analyzed how the transaction relationship affected bank failure. It was found that the relationship had no significant overall effect on a bank's survivability, but that in the period when the financial system was especially unstable, it enhances the effect of high ROA and low LDR on survivability of banks. It implies that the BOJ was not only selective in forming transaction relationships with private banks, but it was also selective in bailing out its transaction counterparts. In other words, the BOJ rescued only those counterparts which were profitable and prudent, and also it was only in the period when the financial system was especially unstable. This suggests that through

concentrating its LLR lending on its transaction counterparts, the BOJ could successfully bail out illiquid but solvent banks, and thereby avoided the moral hazard that the LLR policy might otherwise have incurred.

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Figure1 Increase and shake out of ordinary banks

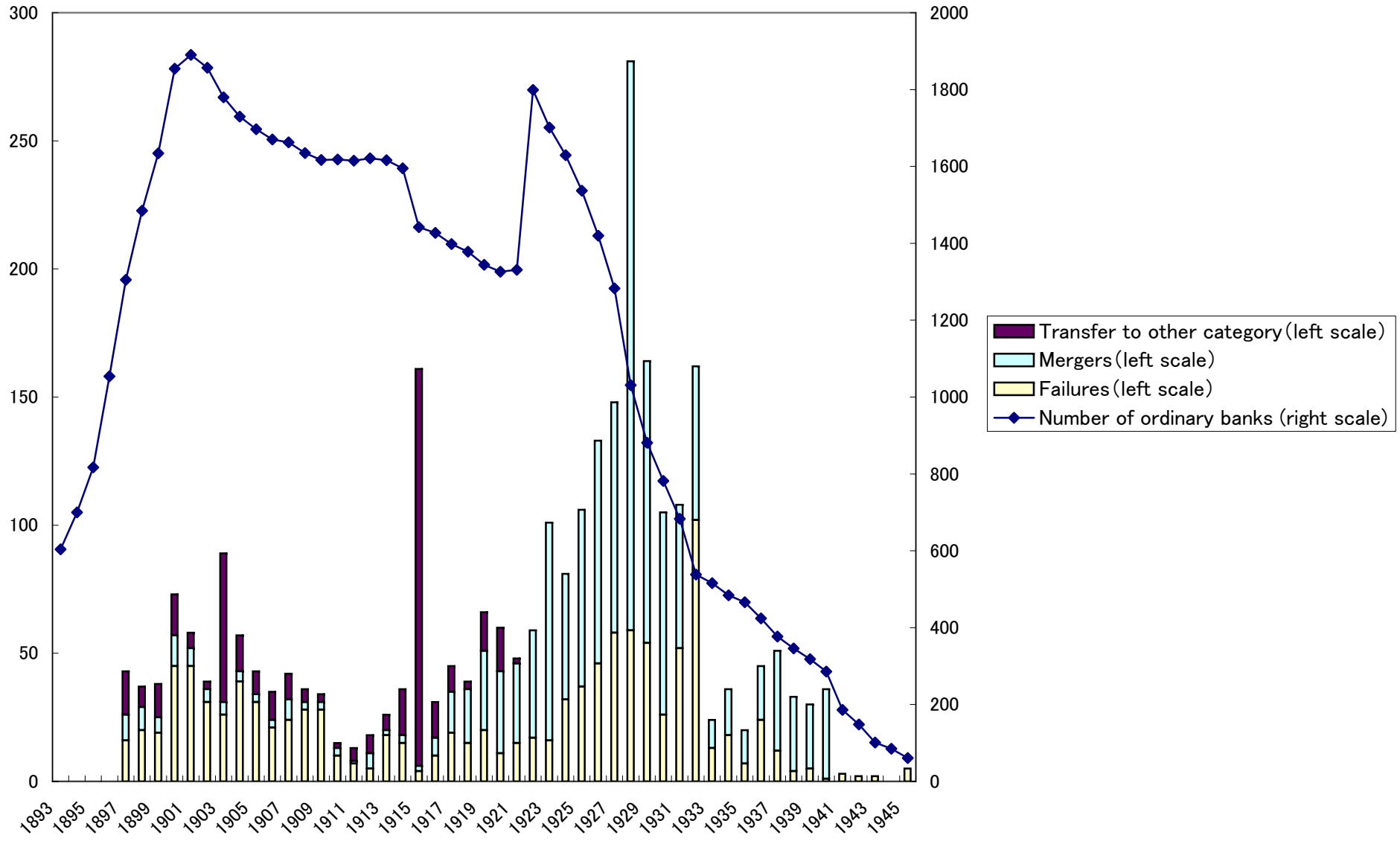


Figure2 Expansion of deposit and branch networks

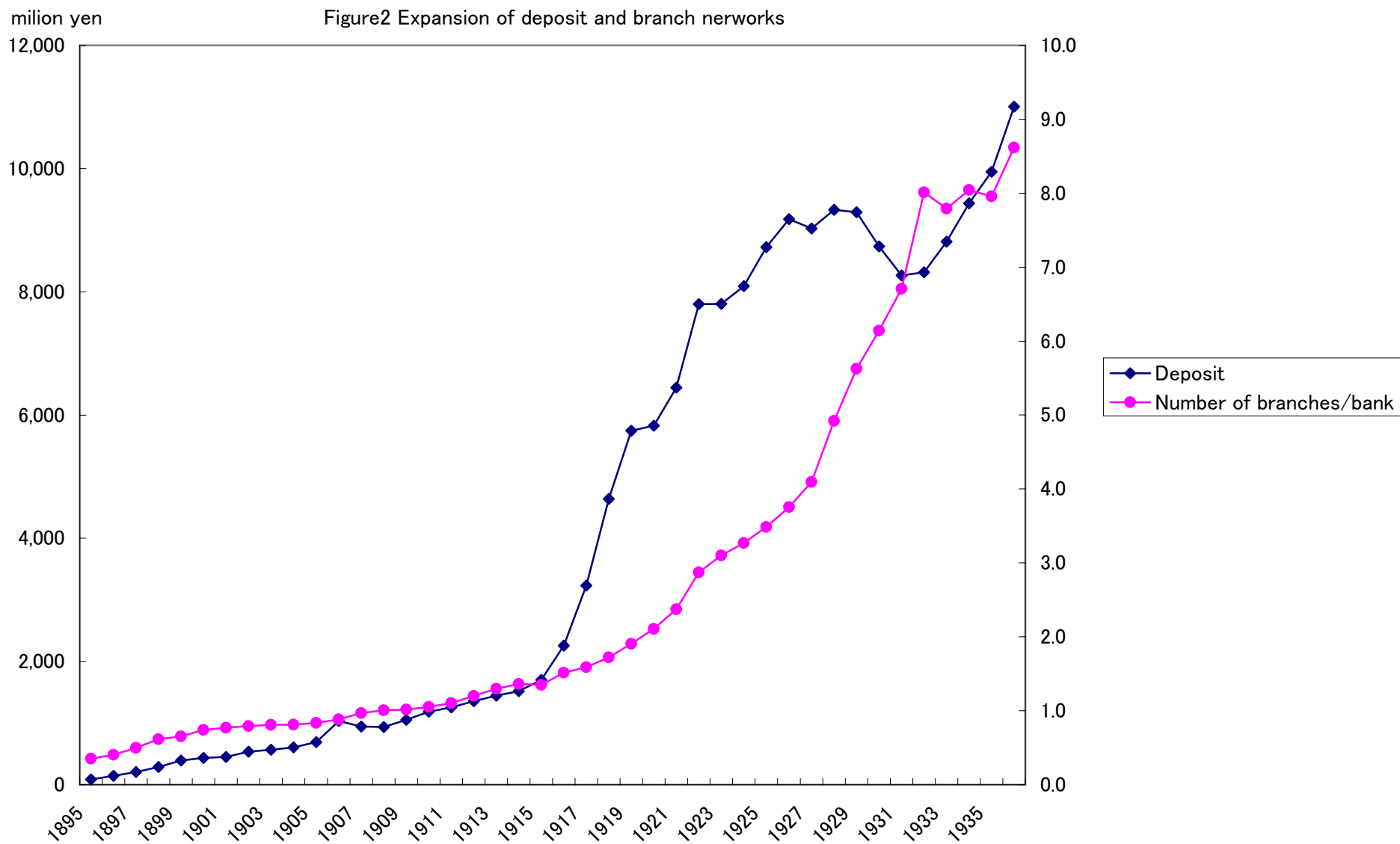
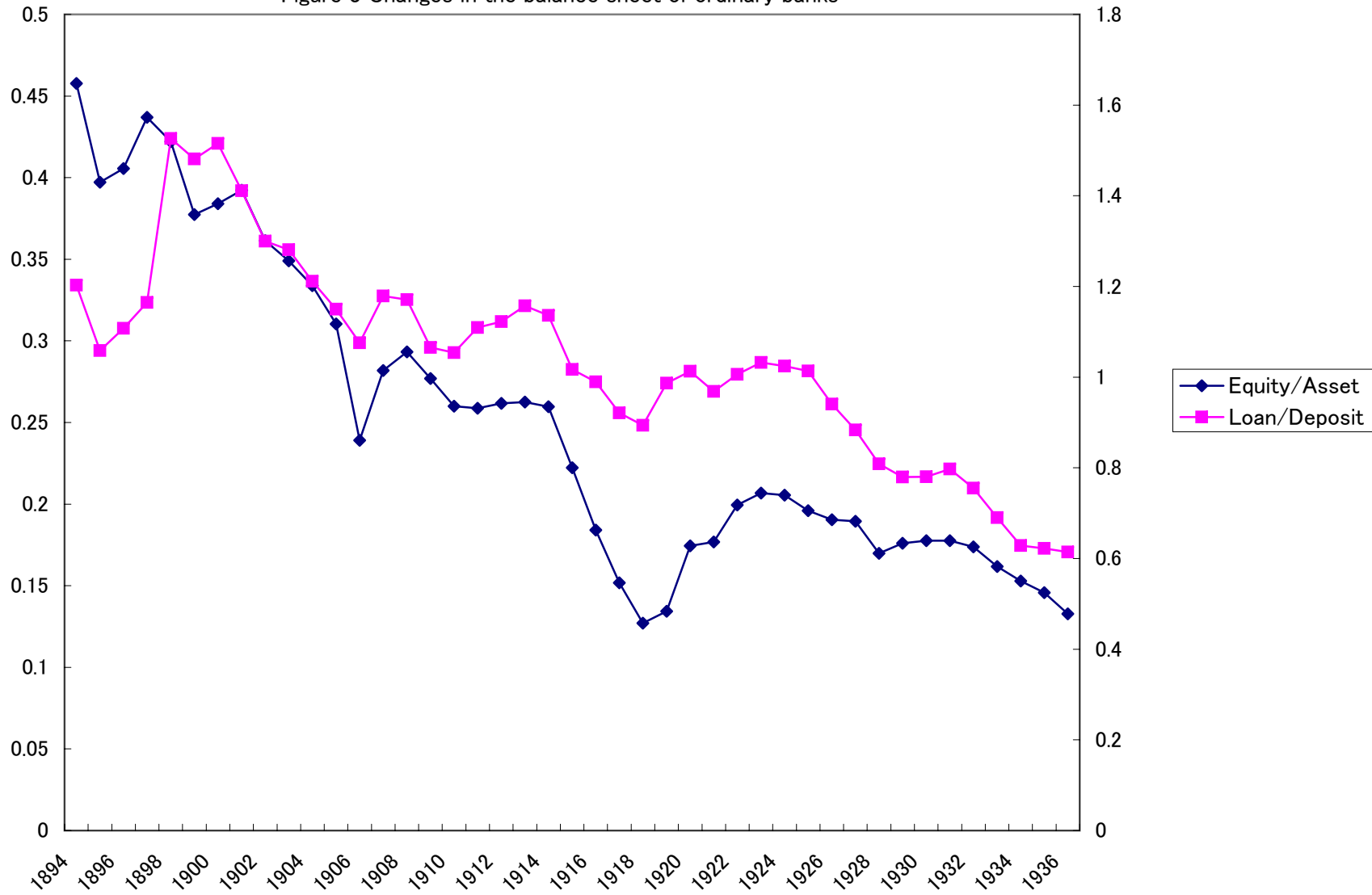


Figure 3 Changes in the balance sheet of ordinary banks



%/year

Interest rate spread (bank loan – government bond)

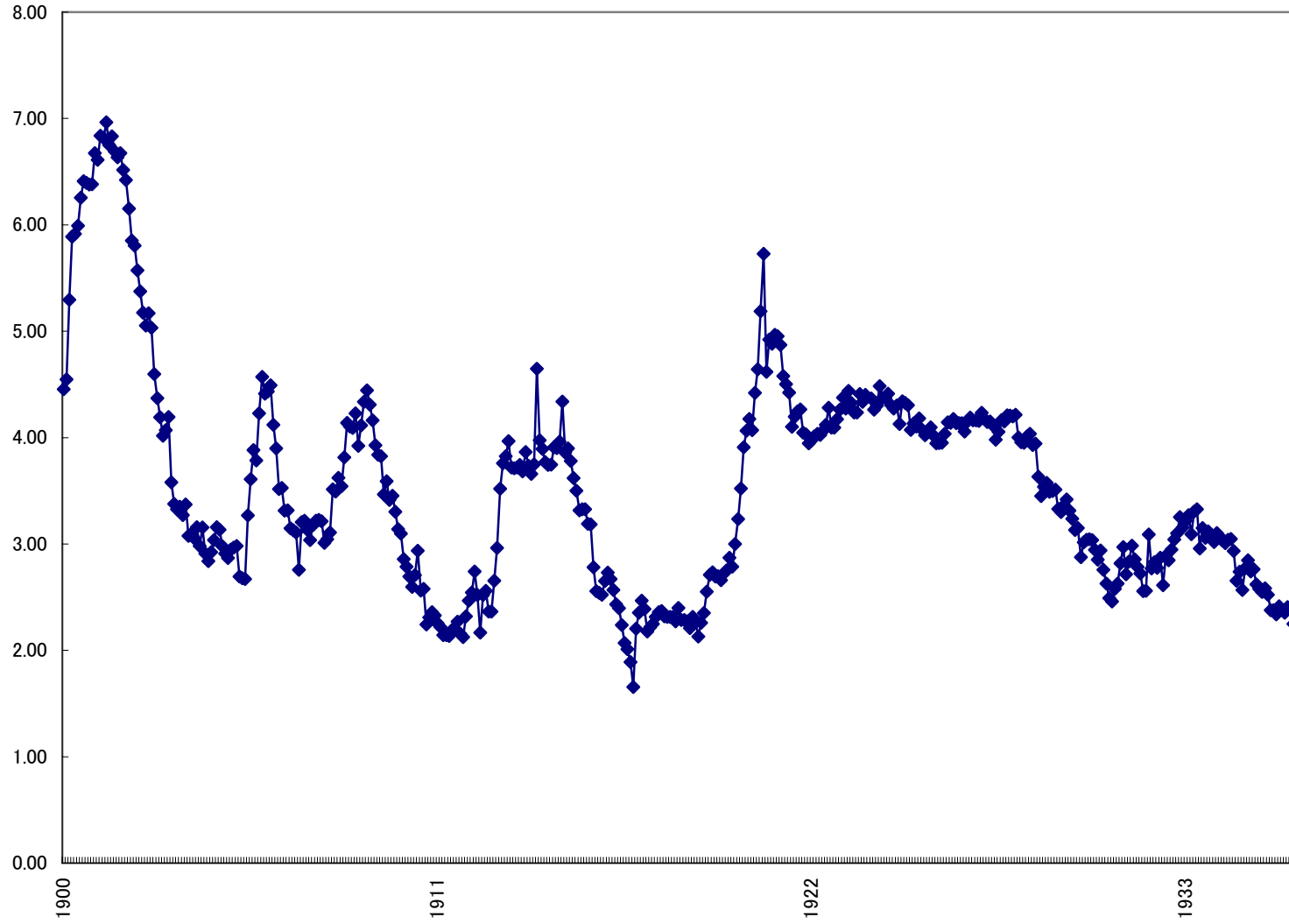




Table1 Scale of the BOJ's transaction with private banks

thousand yen, number of accounts

	Loan	Overdrawn of current account	Discount	Current deposit	Number of correspondent accounts
1882	477	0	0	253	...
1885	2,586	32	1,315	324	...
1890	13,540	2,284	12,578	2,403	...
1895	24,933	4,395	26,183	1,601	126
1900	7,683	3,764	80,195	2,007	240
1905	9,646	403	28,152	10,824	176
1910	6,900	2,589	29,323	7,363	155
1915	1,950	837	26,786	8,979	153
1920	1,700	1,611	155,296	49,942	116
1925	0	9,267	306,606	54,513	72
1930	0	0	103,039	112,625	42
1935	0	570	162,913	112,568	...
1940	0	173	386,479	228,725	...

Source: Bank of Japan [1986]; Semiannual Report of the Bank of Japan; Year Book of the Bank Bureau.

Table2 Numer of ordinary banks with transaction relationship with the BOJ

	Total	BOJ correspondent bank	Share(%)
1925	1,536	253	16.5
1926	1,420	246	17.3
1927	1,283	227	17.7
1928	1,031	198	19.2
1929	881	180	20.4
1930	782	173	22.1
1931	683	167	24.5
1932	538	148	27.5
1933	516	143	27.7
1934	484	141	29.1
1935	466	138	29.6
1936	424	133	31.4

Source: With respect to the number of correspondent banks, see the text.  
 The total number is from the Year Book of Bank Bureau.

Table3 Share of the BOJ correspondent banks in terms of deposit and loan

		Deposit	Loan
BOJ correspondent banks (million yen)	1925	6,992	7,315
	1930	7,576	5,799
	1935	9,105	5,902
Total (million yen)	1925	8,727	8,843
	1930	8,737	6,815
	1935	9,950	6,192
Share (%)	1925	80.1	82.7
	1930	86.7	85.1
	1935	91.5	95.3

Source: See Table 3.

Table 4 Share of the BOJ correspondent banks in terms of number by deposit scale

	Total	BOJ correspondent banks	Share(%)
1925 Not less than 100 million yen	16	16	100.0
Not less than 10 million yen	107	93	86.9
Not less than 5 million yen	90	46	51.1
Not less than 1million yen	465	78	16.8
Less than 1million yen	858	20	2.3
1930 Not less than 100 million yen	14	14	100.0
Not less than 10 million yen	94	78	83.0
Not less than 5 million yen	57	26	45.6
Not less than 1million yen	270	45	16.7
Less than 1million yen	347	10	2.9
1935 Not less than 100 million yen	15	15	100.0
Not less than 10 million yen	83	67	80.7
Not less than 5 million yen	41	24	58.5
Not less than 1million yen	188	28	14.9
Less than 1million yen	139	4	2.9

Source: See Table 2.

Table5 Share of the BOJ correspondent banks by area

	Total	BOJ correspondent banks	Share (%)
1925 Urban	478	83	17.4
Non-urban	1,058	170	16.1
1930 Urban	240	58	24.2
Non-urban	542	115	21.2
1935 Urban	149	47	31.5
Non-urban	317	91	28.7

Source: See Table2.

Note: Urban area refers to the seven prefectures, Tokyo, Kanagawa, Aichi, Kyoto, Osaka, Hyogo and Fukuoka.

Table 6 Share of the BOJ correspondent banks by are and deposit scale

		Total	BOJ correspondent banks	Share (%)
1925 Urban	Not less than 100 million yen	16	16	100.0
	Not less than 10 million yen	36	31	86.1
	Not less than 5 million yen	30	15	50.0
	Not less than 1million yen	148	19	12.8
	Less than 1million yen	248	2	0.8
Non-urban	Not less than 100 million yen	0	0	...
	Not less than 10 million yen	72	62	86.1
	Not less than 5 million yen	59	31	52.5
	Not less than 1million yen	317	59	18.6
	Less than 1million yen	450	18	4.0
1930 Urban	Not less than 100 million yen	14	14	100.0
	Not less than 10 million yen	16	15	93.8
	Not less than 5 million yen	27	16	59.3
	Not less than 1million yen	86	11	12.8
	Less than 1million yen	97	2	2.1
Non-urban	Not less than 100 million yen	0	0	...
	Not less than 10 million yen	78	63	80.8
	Not less than 5 million yen	30	10	33.3
	Not less than 1million yen	184	34	18.5
	Less than 1million yen	250	8	3.2
1935 Urban	Not less than 100 million yen	13	13	100.0
	Not less than 10 million yen	15	14	93.3
	Not less than 5 million yen	22	13	59.1
	Not less than 1million yen	66	6	9.1
	Less than 1million yen	33	1	3.0
Non-urban	Not less than 100 million yen	2	2	100.0
	Not less than 10 million yen	68	53	77.9
	Not less than 5 million yen	19	11	57.9
	Not less than 1million yen	122	22	18.0
	Less than 1million yen	105	3	2.9

Source: See Table 2.

Table 7 Share of the BOJ correspondent banks by proximity to the BOJ headquarters or a branch

	Total	BOJ correspondent banks	Share (%)
1925 With the BOJ headquarters or a branch	599	139	23.2
Without the BOJ headquarters or a branch	937	114	12.2
1930 With the BOJ headquarters or a branch	369	101	27.4
Without the BOJ headquarters or a branch	413	72	17.4
1935 With the BOJ headquarters or a branch	230	83	36.1
Without the BOJ headquarters or a branch	236	55	23.3

Source: See Table 2.

Table 8 Share of the BOJ correspondent banks by deposit scale and proximity to the BOJ headquarters or a branch

		Total	BOJ correspondent bank	Share (%)
1925	With the BOJ headquarters or a branch	Not less than 100 million yen	16	100.0
		Not less than 10 million yen	44	95.5
		Not less than 5 million yen	37	64.9
		Not less than 1million yen	170	26.5
		Less than 1million yen	332	3.6
	Without the BOJ headquarters or a branch	Not less than 100 million yen	0	...
	Not less than 10 million yen	64	79.7	
	Not less than 5 million yen	42	52.4	
	Not less than 1million yen	295	11.2	
	Less than 1million yen	526	1.5	
1930	With the BOJ headquarters or a branch	Not less than 100 million yen	14	100.0
		Not less than 10 million yen	34	97.1
		Not less than 5 million yen	26	69.2
		Not less than 1million yen	121	23.1
		Less than 1million yen	174	4.6
	Without the BOJ headquarters or a branch	Not less than 100 million yen	0	...
	Not less than 10 million yen	60	75.0	
	Not less than 5 million yen	31	25.8	
	Not less than 1million yen	149	11.4	
	Less than 1million yen	173	1.2	
1935	With the BOJ headquarters or a branch	Not less than 100 million yen	15	100.0
		Not less than 10 million yen	32	90.6
		Not less than 5 million yen	25	72.0
		Not less than 1million yen	88	20.5
		Less than 1million yen	70	4.3
	Without the BOJ headquarters or a branch	Not less than 100 million yen	0	...
	Not less than 10 million yen	51	74.5	
	Not less than 5 million yen	16	37.5	
	Not less than 1million yen	100	10.0	
	Less than 1million yen	69	1.4	

Source: See Table 2.



Table 9 Number of openings and closures of transaction relationships with the BOJ

	Openings Closures		Survive Exit	
Total	18	162	38	124
1926	2	11	4	7
1927	3	25	5	20
1928	0	36	10	26
1929	1	17	3	14
1930	2	11	1	10
1931	2	9	2	7
1932	1	24	12	12
1933	1	8	1	7
1934	4	7	0	7
1935	0	5	0	5
1936	2	9	0	9

Source: See the text.

Table10 Determinants of transaction relationships with the BOJ

Dependent variable: BOJT	(a)		(b)	
Const.	-33.758	(-30.379) ***	-32.298	(-27.270) ***
LNASSET <sub>t-1</sub>	2.135	(30.409) ***	2.042	(27.049) ***
ASSETRANK <sub>t-1</sub>	-0.740	(-3.468) ***	-0.740	(-3.480) ***
BRANCH <sub>t-1</sub>	-0.057	(-10.789) ***	-0.058	(-9.403) ***
ROA <sub>t-1</sub>	10.082	(6.168) ***	9.792	(5.989) ***
LDR <sub>t-1</sub>	0.004	(2.390) **	0.004	(2.488) **
RESERVE <sub>t-1</sub>	-0.426	(-1.421)	-0.338	(-1.135)
URBAN <sub>t-1</sub>	-1.386	(-12.723) ***	-8.373	(-4.692) ***
BOJBRANCH <sub>t-1</sub>	1.753	(17.567) ***	1.704	(17.189) ***
LNASSET <sub>t-1</sub> *URBAN <sub>t-1</sub>			0.451	(3.925) ***
R <sup>2</sup>	0.556		0.557	
Log likelihood	-2123.82		-2114.89	
Obs.	8296		8296	
Positive obs.	1863		1863	

Note: t-values in parentheses

\*\*\* Statistically significant at 1% level

\*\* Statistically significant at 5% level

\* Statistically significant at 10% level

Table 11 Determinants of openings of transaction relationships with the BOJ

Dependent variable: BOJTO		
Const.	-17.334	(-2.487) **
LNASSET <sub>t-1</sub>	0.965	(2.393) **
ASSETRANK <sub>t-1</sub>	-2.241	(-1.461)
BRANCH <sub>t-1</sub>	0.964	(1.497)
ROA <sub>t-1</sub>	-2.243	(-0.155)
LDR <sub>t-1</sub>	-2.068	(-2.184) **
RESERVE <sub>t-1</sub>	-0.063	(-0.039)
URBAN <sub>t-1</sub>	-0.720	(-1.057)
BOJBRANCH <sub>t-1</sub>	0.964	(1.497)
R <sup>2</sup>	0.005	
Log likelihood	-95.72	
Obs.	6413	
Positive obs.	18	

Note: t-values in parentheses

- \*\*\* Statistically significant at 1% level
- \*\* Statistically significant at 5% level
- \* Statistically significant at 10% level

Table 12 Determinants of closures of transaction relationships with the BOJ

Dependent variable: BOJTC		
Const.	10.456	(2.569) **
LNASSET <sub>t-1</sub>	-0.812	(-3.271) ***
ASSETRANK <sub>t-1</sub>	0.151	(0.149)
BRANCH <sub>t-1</sub>	0.025	(1.796) *
ROA <sub>t-1</sub>	-19.794	(-1.921) *
LDR <sub>t-1</sub>	0.006	(0.111)
RESERVE <sub>t-1</sub>	-10.906	(-3.595) ***
URBAN <sub>t-1</sub>	0.832	(1.915) *
BOJBRANCH <sub>t-1</sub>	-0.342	(-0.884)
R <sup>2</sup>	0.029	
Log likelihood	-167.42	
Obs.	1883	
Positive obs.	38	

Note: t-values in parentheses

- \*\*\* Statistically significant at 1% level
- \*\* Statistically significant at 5% level
- \* Statistically significant at 10% level

Table 13 Effect of a transaction relationship with the BOJ on a bank's portfolio (treatment effect model)

	Dependent variable: LOAN		Dependent variable: SECURITIES	
Const.	1.688	7.92 ***	-0.107	-1.57
LNASSET	-0.062	-4.68 ***	0.011	2.47 **
BRANCH	-0.003	-2.17 **	-0.002	-4.63 ***
BOJT	0.272	3.90 ***	0.168	7.51 ***
	Dependent variable: BOJT		Dependent variable: BOJT	
Const.	-11.378	-39.05 ***	-11.378	-39.05 ***
BOJBRANCH	0.679	16.31 ***	0.679	16.31 ***
LNASSET	0.714	37.96 ***	0.714	37.96 ***
ASSETRANK	-0.001	-0.30	-0.001	-0.30
URBAN	-0.513	-10.16 ***	-0.513	-10.16 ***
Obs.	9913		9913	
Wald chi2(60)	408.31		614.54	

Note: LOAN regression and SECURITIES regression include prefecture dummies and year dummies, but not reported.

Table 14 Effect of a transaction relationship with the BOJ on a bank's profitability (treatment effect model)

	Dependent variable: ROA		Dependent variable: ROA	
Const.	0.083	12.39 ***	0.089	13.11 ***
LNASSET	-0.004	-9.95 ***	-0.004	-10.36 ***
BRANCH	-0.001	-1.41	-0.001	-1.95 *
LOAN	0.004	13.73 ***		
SECURITIES	0.005	5.49 ***		
RESERVE	0.000	-1.14		
CON3	-0.008	-1.21	-0.006	-0.97
BOJT	0.002	0.83	0.004	1.78 *
	Dependent variable: BOJT		Dependent variable: BOJT	
Const.	-11.378	-39.05 ***	-11.378	-39.05 ***
BOJBRANCH	0.679	16.31 ***	0.679	16.31 ***
LNASSET	0.714	37.96 ***	0.714	37.96 ***
ASSETRANK	-0.001	-0.30	-0.001	-0.30
URBAN	-0.513	-10.16 ***	-0.513	-10.16 ***
Obs.	9913		9913	
Wald chi2(60)	2111.81		1819.45	

Note: LOAN regression and SECURITIES regression include prefecture dummies and year dummies, but not reported.

Table 15 Effect of transaction relationships with the BOJ on bank exits

## A.1926-1936

	Failure		Merger		Failure		Merger	
Const.	4.693	(4.543) ***	0.860	(1.036)	4.756	(4.606) ***	0.814	(0.978)
LNASSET	-0.583	(-8.553) ***	-0.247	(-4.557) ***	-0.584	(-8.570) ***	-0.244	(-4.482) ***
BRANCH	0.201	(1.877) *	0.003	(0.436)	0.023	(2.090) **	0.003	(0.398)
ROA	-15.841	(-7.890) ***	-0.063	(-0.055)	-16.693	(-7.992) ***	0.245	(0.212)
LDR	0.000	(-0.241)	0.001	(0.212)	-0.001	(-0.382)	0.001	(0.411)
RESERVE	-0.010	(-1.032)	-0.013	(-0.339)	-0.009	(-0.954)	-0.014	(-0.354)
EQUITY	2.189	(8.063) ***	-0.828	(-3.126) ***	2.125	(7.689) ***	-0.863	(-3.153) ***
AGE	0.011	(2.618) ***	0.007	(2.028) **	0.011	(2.667) ***	0.006	(1.948) *
FORM	-0.481	(-2.221) **	0.093	(0.492)	-0.494	(-2.280) **	0.090	(0.473)
CRITERION	0.103	(0.660)	0.446	(3.830) ***	0.110	(0.700)	0.455	(3.896) ***
URBAN	-0.041	(-0.303)	-0.145	(-1.505)	-0.056	(-0.415)	-0.141	(-1.468)
QUAKE	0.970	(5.417) ***	-0.121	(-0.667)	0.959	(5.345) ***	-0.104	(-0.576)
BOJT	-0.167	(-0.717)	-0.019	(-0.133)	-0.607	(-1.220)	-0.033	(-0.108)
BOJT*ROA					3.407	(0.459)	-10.340	(-1.348)
BOJT*LDR					0.015	(1.435)	-0.133	(-0.833)
BOJT*RESERVE					0.903	(0.800)	0.182	(0.181)
BOJT*EQUITY					0.273	(0.261)	1.555	(1.464)
Obs.	9915		9915		9915		9915	
Positive obs.	451		749		451		749	
Log likelihood	-4077.72				-4072.61			

## B.1926-1931

	Failure		Merger		Failure		Merger	
Const.	4.723	(4.293) ***	0.020	(0.023)	4.693	(4.268) ***	-0.038	(-0.043)
LNASSET	-0.584	(-8.110) ***	-0.181	(-3.179) ***	-0.579	(-8.041) ***	-0.177	(-3.106) ***
BRANCH	0.023	(2.086) **	-0.009	(-0.932)	0.023	(1.919) *	-0.011	(-1.059)
ROA	-14.714	(-7.137) ***	-1.325	(-1.035)	-15.195	(-7.107) ***	-1.025	(-0.800)
LDR	-0.001	(-0.638)	0.000	(0.104)	-0.002	(-0.850)	0.001	(0.208)
RESERVE	-0.008	(-0.789)	-0.009	(-0.303)	-0.007	(-0.661)	-0.108	(-0.327)
EQUITY	1.968	(6.674) ***	-0.624	(-2.220) **	1.939	(6.457) ***	-0.607	(-2.107) **
AGE	0.015	(3.072) ***	0.009	(2.596) ***	0.015	(3.205) ***	0.009	(2.577) ***
FORM	-0.406	(-1.881) *	0.160	(0.840)	-0.422	(-1.952) *	0.152	(0.797)
CRITERION	0.040	(0.213)	0.368	(2.847) ***	0.043	(0.228)	0.369	(2.855) ***
URBAN	-0.018	(-0.121)	-0.142	(-1.389)	-0.042	(-0.289)	-0.142	(-1.388)
QUAKE	0.920	(4.870) ***	-0.151	(-0.809)	0.896	(4.720) ***	-0.138	(-0.737)
BOJT	-0.028	(-1.115)	-0.173	(-1.103)	0.112	(0.208)	-0.035	(-0.097)
BOJT*ROA					-20.381	(-1.843) *	-9.524	(-1.118)
BOJT*LDR					0.052	(2.724) ***	-0.124	(-0.646)
BOJT*RESERVE					1.369	(1.274)	0.634	(0.578)
BOJT*EQUITY					-0.030	(-0.027)	0.792	(0.624)
Obs.	7519		7519		7519		7519	
Positive obs.	388		686		388		686	
Log likelihood	-3492.98				-3485.51			