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

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Abstract

This paper explores how the Bank of Japan (BOJ) dealt with the trade-off between stability of the financial system and the moral hazard of banks in pre-war Japan. The BOJ concentrated Lender of Last Resort (LLR) loans with those banks that had an established transaction relationship with the BOJ. At the same time, the BOJ carefully selected its transaction counterparts, and did not hesitate to end the relationship if the performance of a counterpart declined. Further, the BOJ was selective in providing LLR loans. Through this policy, the BOJ could avoid the moral hazard that the LLR policy might otherwise have incurred.

Key words: lender of last resort, central bank, monetary policy, financial crisis, bank, Japan
JEL Classification numbers: E52, E58, G21, N15, N25

1. 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 a rich store of theoretical and empirical literature on LLR (Goodhart 1985; Miron 1986; Bordo 1990; Goodhart and Huang 2005, among others). According to the "classical view" of the LLR, the Central Bank should prevent illiquid but solvent banks from failing by lending money at a penalty rate (Bordo 1990, p.19). That LLR lending has been effective in preventing bank panics is well established (Bordo 1990; Butliewicz 1995; Miron 1986). However, as Goodhart (1985) argues, it is difficult for central banks to distinguish between solvent and insolvent banks. Therefore, the bank as the LLR is faced with a trade-off between the stability of the financial system and moral hazard (Cordella and Yayati 2003).

Drawing on the experience of the United States and Europe, Bordo (1990, p. 9) states that "[a]ssistance to insolvent banks was the exception rather than the rule until the 1970s … [t]he monetary authority in earlier times erred on the side of deficiency rather than excess." However, not so much is known about how the central banks have dealt with the trade-off. In this paper we address this issue focusing on the Bank of Japan (BOJ) in the period before the Second World War. The Japanese financial system became unstable in the 1920s and the BOJ actively played the role of LLR. We explore how the BOJ selected the banks to be bailed out and what implications 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 during this period. As they point out, the LLR loan by the BOJ was a major policy tool for stabilizing the financial system of the 1920s. In another strand of the literature, Yabushita and Inoue (1993) found that the probability of bank closure during the financial crisis of 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 this result using data regarding a wider range of bank exits. Yabushita and Inoue concluded that bank closures during the financial crisis of 1927 were not contagious.[1] In the context of this paper, this interpretation suggests that the LLR loans by the BOJ successfully prevented financial crises from becoming contagious. Further, 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 seems that the BOJ could deal with the above trade-off reasonably well.

In order to understand how this occurred, it should be noted that the BOJ was selective in its provision of LLR loans, and that LLR loans were crucial for banks (Ishii 1980). Ishii (1980) indicated that those banks which already had transaction relationships with the BOJ were the main recipients of LLR loans, and that those banks, for the most part, were large–sized ones.[2] Referring to this fact, this paper will examine how the BOJ selected its transaction counterparts, using internal documents from 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. I look at how the BOJ evaluated banks that applied to open a transaction relationship, and how it made the decision to approve or reject such applications. *Nihon Ginko Enkakushi* (*The History of the BOJ*) also contains comprehensive records of the individual transaction relationships

[1] Korenaga, Nagase and Teranishi (2001) reexamined their proposition by discriminating between two waves of bank closures in 1927 and found that while the second wave was contagious, the first was not. It is important to explore how the LLR loans from the BOJ affected these attributes of the bank closures.

[2] 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.

between the BOJ and private banks.[3] Based on these materials, a database of the transaction relationships was constructed and matched with another containing financial data of individual banks. Using the matched dataset, I econometrically analyze the determinants of the transaction relationships between the BOJ and private banks. Adding another dataset to the above data, I directly examine how the BOJ selected the recipient banks of LLR loans.

Lastly, I investigate how the transaction relationships with the BOJ affected bank management. Specifically, I examine the effects on the portfolio management and risk-taking of a bank to see whether moral hazard, which the literature indicates is a possible consequence, was incurred or not.

2.Historical background

The period from the 1920s to the early 1930s was a major epoch in the financial history of Japan. Following 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, which was followed by a significant shake-out (Figure 1). This shake-out was accelerated by the impact and sudden end of the boom during the First World War. Due to high economic growth and loose monetary policy during the war, bank deposits increased sharply, which brought about a substantial change in the balance sheet of the banking sector. Before this, the average ratio of equity to total liabilities was as high as 25 percent later dropping to 15-20 percent in the 1920s.

Many banks lent out large sums to new industries that developed during the war

[3] *Nippon Ginko Enkakushi* is an unpublished series of volumes on the BOJ's history, as edited by the BOJ.

boom. However, these industries were faced with difficulties when international competition recommenced after the war. The macro-economic policy of the Japanese government made the depression even worse. While the Japanese government stopped using the gold standard during the war, it intended to return to it at the previous parity level. For that purpose, the government intervened in the foreign exchange market to keep the yen exchange rate close to the previous parity, which in turn made international competition still tougher for Japanese industries. Further, a natural disaster seriously damaged the financial system. In 1923, the Great Kanto Earthquake hit the area that includes Tokyo and Yokohama, and assets worth around 3,290 million yen,[4] approximately equal to 22 percent of Japan's GNP in 1923, were destroyed (Bank of Japan 1983, p.48; Okazaki 1997, p.135). This implies that collateral and firms' assets, which would otherwise generate profits, were damaged. In turn this rendered a large number of bank loans non-performing.

In addition, since the end of the 1910s, many banks expanded their branch networks. The initial cause was agreement among major banks in 1918 on the deposit interest rate. As a result of the agreement, the spread between the deposit and loan interest rates increased, which had the effect of stimulating competition among banks for deposits (Tsurumi 1981, p.77; Okazaki 1993, p.304). In Japan, branch-banking was underdeveloped before the First World War, which limited interregional competition in the banking industry. However, in the 1920s, due to the expansion of branch networks, fierce interregional competition developed.

The change in the banks' balance sheets and the level of interregional competition led to instability in the financial system of the 1920s. I measure the level of instability in the financial system by the interest rate spread between risky debt and safe debt

[4] The damage estimate for Tokyo and Yokohama Cities only.

(Bernanke 1983; Stock and Watson 1989; Mishkin 1991). Specifically, we use the spread between the average bank loan and government bond rates (Shikano 1993; Okazaki 1993). Figure 2 shows the long-term time series of the interest rate spread. Before the First World War, we can identify four spikes in the interest rate spread, in 1900, 1904, 1907 and 1913. They correspond to four episodes of bank panic (Akashi and Suzuki 1957, 1958; Nagaoka 1971; Oshima 1952). During these panics, the spread rose above 4%. Just after the War, the spread increased 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 observed in bank panics before the War, suggesting that the financial system was continuously unstable over this period. Bank panics occurred in 1922, 1923 and 1927, of which the panic in 1927 was the most serious and dubbed the Showa Financial Crisis (Oshima 1955; Takahashi and Morigaki 1993; Takeda 1983). It is noteworthy that we cannot observe the individual impacts of these panics. We will discuss the reason why these individual panics were not reflected in the interest rate spread below.

Under the prolonged financial instability of the 1920s, the shake-out of banks proceeded rapidly. The number of ordinary banks in Japan including Sakhalin and Taiwan, which was 1799 in 1922, had dropped sharply to 683 by the end of 1931. Of the gross decrease of 1227 banks during this period,[5] 847 were due to mergers, and the other 380 to failures and voluntary liquidations (Figure 1). One of the 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 undertaken until the 1920s. In 1920, through a revision to the Bank Act, the procedure for effecting bank mergers was made easier than for mergers between non-bank companies. In 1923, the Ministry of Finance

[5] There were 111 new entries in this period, most of which were due to mergers.

issued a notification placing restrictions on the establishment of new branches, which spurred major banks to acquire smaller banks in order to expand their branch networks. Finally, the Bank Law of 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; Okazaki and Sawada 2006).

Due to the change in the structure of the banking industry through mergers and failures, as well as monitoring by the Ministry of Finance, based on the Bank Law, the instability of the financial system decreased, especially after the Showa Financial Crisis in 1927. Improvement of macro-economic conditions also contributed to the stabilization of the financial system. Japan's return to the gold standard in early 1930 was short-lived, and it abandoned the standard again by the end of 1931, which resulted in a sharp depreciation of the yen. Increased exports due to the yen's depreciation, together with the expanding fiscal policy, finally put the long depression to an end (Cha 2003; Flath 2000, pp.58-59; Okazaki 1997, pp.99-106). Stabilization of the financial system is reflected in the decline of the interest rate spread. It started to decline in 1927 and returned to pre-WWI level in 1931 (Figure 2). In this sense, we can regard the period from 1920 to 1931 as a period of financial crisis.

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 BOJ actively played the role of LLR by giving "Special Loans" to private banks facing financial crises. Special Loans included loans based on the special laws passed to cope with emergencies (i.e. the Loss Compensation due to Earthquake Bill Discount Act passed in 1923, the Bank of Japan Special Loan and Loss

Compensation Law passed in 1927, and the Loan to the Taiwan Bank Law passed in 1927), and other emergency loans provided at the discretion of the BOJ, skipping due process and the conditions that would normally have to be met (Ito 2003, p.171). In the 1920s, Special Loans as a proportion of total domestic loans provided by the BOJ climbed to over 90% (Table 1).

The lending pattern of the BOJ indicates that it actively intervened in the financial market as the LLR in the 1920s. One of the diagrams in Figure 4 refers to the increase in domestic loans from the BOJ compared with the same quarter in the previous year. As shown in this figure, 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, 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. However, I observe sharp spikes in BOJ's lending in 1920, 1922, 1923 and 1927. It has been assumed that active intervention by the BOJ is the main 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 providing Special Loans (Ishii 1980). Table 2 indicates the composition of Special Loans based on the Bank of Japan Special Loan and Loss Compensation Law by borrower's transaction relationship with the BOJ. As shown here, the proportion of banks which already had transaction relationships was as high as 95.0%.

3.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, overdraft accounts, correspondent accounts, discounts,

and loans. Table 3 summarizes the amount of BOJ transactions with private banks. Until the end of the nineteenth century, the main 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 less than for deeds because of revision of the Stamp Act in 1899 (Ishii 1999, p.194; Sugiyama and Kawakami 1965). While correspondent accounts increased to 240 in 1900, they declined after that because their function was replaced by current account transfers. 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 that wished to open a transaction relationship with the BOJ filed an application with the Business Bureau at the headquarters of the BOJ or any its branches. If the Business Bureau or the branch judged that the applicant bank was eligible, it sent the application to the Governor of the BOJ. The Examination Department at headquarters then examined the application, and if it also judged that the applicant bank was eligible, the Governor proposed opening the transaction at the next Director Meeting.[6]

I identify the ordinary banks that had transaction relationships with the BOJ. The basic data can be obtained from the tables: 'Change in the Correspondents,' which Ishii (1980) used.[7] The information in these tables includes the date on which BOJ headquarters or one of its branches opened or closed a transaction relationship with the headquarters or branches of a bank by the kind of transaction: current deposit, discount, etc. Data from

[6] The Bank of Japan, *Nippon Ginko Enkakushi* (*The History of the Bank of Japan*), series 1-volume 2, p.403, series 2-volume 3, p.1, pp.524-525.
[7] *Nippon Ginko Enkakushi* (*The History of the Bank of Japan*), *op cit.*, series2-volume 3 and series 3-volume 3.

September 1923, with respect to the headquarters of the BOJ, and data from January 1909, with respect to the BOJ's branches, are available. For relationships which started before September 1923 or January 1909, the starting dates are recorded as: 'before September 1923' or 'before January 1909.' Data regarding BOJ's headquarters are limited because the documents were lost in the fire that followed the Great Kanto Earthquake of 1923. Using this source, I compiled a comprehensive database of the BOJ's transaction relationships from 1923 to 1942.

I then matched this database with a comprehensive database of ordinary banks in Japan (excluding its colonies) from 1925 to 1931. The database of ordinary banks was compiled from various issues of the Yearbook of the Bank Bureau issued by the Ministry of Finance (*Ginkokyoku Nenpo*). This source began publishing financial data for each bank from 1925. The year 1931 was selected as the end of the period we will focus on because we intend to investigate the role of the BOJ's LLR loans during the financial crisis. Table 4 compares the number of ordinary banks that had transaction relationships with the BOJ, with all the ordinary banks in Japan (excluding its colonies). The number declined sharply from 253 in 1925 to 167 in 1931. While this movement corresponds with the decline in the total number of ordinary banks, as the latter trend was sharper, the proportion of ordinary banks that had transaction relationships with the BOJ increased from 16.5% in 1925 to 24.6% in 1931, but still they were the minority in terms of numbers (Imuta 1980 and Ishii 1980). However, in terms of the amounts of deposits and loans, the BOJ correspondent banks had a larger share. Their share of the total deposits and loans of ordinary banks was higher than 85% in 1931 (Table 5).

Next, the ordinary banks are classified according to two criteria into several groups to compare the ratios of BOJ correspondents between them. Table 6 shows the results of classifying banks by deposit scale. With respect to the years 1925 and 1931, we find a clear

positive correlation between deposit scale and the ratio of BOJ correspondents. For example, in 1925, while all of the ordinary banks whose deposits were greater than 100 million yen had transaction relationships with the BOJ, only 2.3% of banks whose deposits were less than one million yen had transaction relationships with the BOJ, even though they represented more than 50% of the banks. The shares of the BOJ correspondents in each deposit scale group did not change substantially over time. This implies that the rise in the share of the BOJ correspondents in Table 4 basically reflects the change in the distribution of bank scale over the years.

Table 7 shows the results of classifying the banks by the area in which their headquarters were located, namely, urban and non-urban areas. The urban area includes the seven prefectures: Tokyo, Osaka, Kyoto, Kanagawa, Aichi, Hyogo, and Fukuoka. With respect to location, the proportion of BOJ correspondents was not substantially different between the two areas. Finally, I examine the difference in the proportion of BOJ correspondents between the prefectures where the headquarters or branches of the BOJ were located and those 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.[8] After that, BOJ branches were established in Hyogo prefecture in 1927 (Bank of Japan 1986, p.450). The proportion of BOJ correspondents was much higher in prefectures with BOJ headquarters or branches (Table 8).

4. How did the BOJ select transaction counterparts?

Using the database of BOJ correspondents, I can identify the names of the ordinary

[8] In Hokkaido, the BOJ had two branches in the cities of Otaru and Hakodate.

banks which opened and closed transaction relationships with the BOJ and the year when these events took place. The numbers of openings and closings in each year from 1926 to 1931 are shown in Table 9. Ten ordinary banks opened transaction relationships with the BOJ during this period, while 96 closed them. For 77 of these 96 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 19 banks continued business at least until the end of the next year following the close. We regard these 19 cases of closing transactions with the BOJ in a narrow sense, that is, the closing of transactions not due to exits. The fact that so many closings occurred is worth noting in itself. While Special Loans by the BOJ were concentrated with banks which had transaction relationships with the BOJ, as Ishii (1980) stressed, a bank would not necessarily survive, even if it had a transaction relationship with the BOJ.

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

While the BOJ recognized the situation the private banks were in, it paid attention to the following conditions when approving their applications. The first was the soundness of the bank's financial condition in terms of profitability and the riskiness of its portfolio. As

the second condition, which is related to the first point, the BOJ took into account the composition of the directors and large shareholders, and their personal financial status[9]. 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 funds for transactions, other than the BOJ.

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

$$Pr(BOJ_{it}=1)=\Phi(\boldsymbol{\beta}'\mathbf{X}_{it-1}+\alpha_i) \quad (1)$$

BOJ_{it} is a dummy variable which equals 1 if bank i had a transaction relationship with the BOJ in year t, and 0, otherwise. Φ is the standard normal cumulative distribution function, and α_i is the individual effects of bank i, which is a normally distributed random variable. $\mathbf{X}_{it}$ is a vector of the attributes of bank i in year t, including the attributes of the area where bank i was located in year t. In other words, we assume a random-effects probit model.

For the attributes of a bank, I focus on scale, profitability, riskiness of its portfolio, and liquidity, referring to the above case studies. Scale is measured by the log value of the bank's assets (LNASSET). In addition, I 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 assets (ROA). Riskiness of the portfolio is

[9] Concerning the negative effects of close ties between banks and non-banking companies in this period, see Okazaki, Sawada and Yokoyama(2005).

measured by the loan deposit ratio (LDR), while liquidity is measured by the reserve ratio (RESERVE). I compute RESERVE by (cash + deposits to other banks)/deposits. The attribute for the liabilities side of the balance sheet is captured by ratio of equity to assets (EQUITY). For the area where a bank was located, I use URBAN, which is a dummy variable that equals 1 if the prefecture where the headquarters of the bank was located was Tokyo, Kanagawa, Aichi, Kyoto, Osaka, Hyogo or Fukuoka, that is the prefectures of the seven largest cities, and 0, otherwise. Because the BOJ prioritized those banks which had difficulty accessing the central financial market, as noted above, I expect that the coefficient of URBAN will be negative. Also, I use the 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) indicates, I expect that the probability of a bank forming a transaction relationship with the BOJ was higher for banks which had their headquarters in the prefectures where a branch of the BOJ was located.

I estimate equation (1), using the sample of all the ordinary banks that existed in the period from 1926 to 1931. As there were many exits and entries of banks during this period, the dataset is an unbalanced panel made up of 5925 observations. The observations where BOJ=1 number 1184. The results are shown in Table 10. The coefficient of LNASSET has the expected sign and is statistically significant. The coefficient of ROA is positive and statistically significant, as expected -- in other words, a bank with high profitability tended to have a transaction relationship with the BOJ. As the positive and significant coefficient of EQUITY indicates, a bank with higher equity-asset ratio also tended to have a transaction relationship with the BOJ. Concerning the variables related to the area attributes, the coefficient of BOJBRANCH is positive and significant. As expected, the probability of becoming a correspondent of the BOJ was higher for the banks in the prefectures where BOJ's branches were located.

In the above analysis, I focused on the state of transaction relationships between the BOJ and an ordinary bank in each year. Alternatively, I can focus on the number of openings and closings of transaction relationships in each year. First, I analyze the determinants of opening transaction relationships between the BOJ and ordinary banks. For that purpose, I use the 4731 bank-years, whose BOJ variable in the previous year is 0, as the sample. Of these, there were 10 openings of transaction relationships. Then, I create the dummy variable $BOJO_{it}$, which equals one if a bank opened a transaction relationship with the BOJ in year t, and 0, otherwise, and regress it with the same independent variables as in Table 10, using a random-effects probit model. As the result indicates, ρ is not significantly different from 0, which means the panel estimator is not different from the pooled estimator. While the coefficient of LNASSET is not statistically significant, the coefficient of ASSETRANK is negative and significant. Banks whose asset scale was relatively large in the prefecture had a higher probability of opening a transaction relationship with the BOJ. The coefficient of BOJBRANCH is positive and significant as in Table 10. However, the financial variables are not significant. This may be because the number of positive observations of the dependent variable is small.

Next, I analyze the determinants of closing transaction relationships between the BOJ and ordinary banks. Here, I focus on the 1889 bank-years whose BOJ was 1 in the previous year. Of these, 19 banks closed transactions with the BOJ for reasons other than exit. We create the dummy variable $BOJC_{it}$, which equals 1 if bank i closed a transaction relationship with the BOJ in year t, and 0, otherwise, and regress it with the same independent variables as in Tables 10 and 11, using a random-effects probit model. The results are 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 result concerning profitability is noteworthy because it implies that the BOJ closed transaction relationships with those correspondents whose profitability declined, and did not persevere in trying to rescue them by maintaining the transaction relationship.

5. Implications of the LLR loan policy of the BOJ

The BOJ was selective concerning its transaction counterparts, before and after it opened a transaction relationship with a certain bank. I expected that this "dry" stance would be reflected in its LLR policy, and therefore it was effective in dealing with the potential moral hazard which might be incurred with the LLR loans.

Data on individual Special Loans are available only for those issued according to the Bank of Japan Special Loan and Loss Compensation Law passed in 1927, which are cited in Ishii (1980), (pp.163-166). Hence, I first used these data to see how the BOJ selected the recipient banks of the Special Loans. The Special Loans according to that law started to be issued on May 11th in 1927, and were stopped on May 8th in 1928 (Bank of Japan 1933, p.955). From Ishii (1980), I identified the banks that had Special Loans in 1927 or 1928.[10] Excluding banks in the colonies and savings banks, we identified 193 bank-years as Special Loan recipients. They can be regarded as the banks which the BOJ intended to rescue. As a control group, to be compared with the Special Loan recipients, I use banks that exited due to reasons other than mergers without receiving Special Loans in 1927 or 1928. The control group has 95 bank-years. There were 4 banks which failed even after they received Special Loans. This brings the total number of observations to 288. They can be regarded as bank-years which needed rescues, from which the BOJ selected LLR loan recipients.

[10] We identified a bank as a Special Loan recipient in 1928 if the month when it finished repaying the Special Loan was after December 1927.

Using these observations, I estimate the following equation for Special Loan recipient selection.

$$Pr(SL_{it}=1)=\Phi(\beta' X_{it-1}) \qquad (2)$$

SL_{it} is a dummy variable which equals 1, if bank i received a Special Loan in year t, and 0, otherwise. Φ is the standard normal cumulative distribution function. As explanatory variables we use the following bank and area attributes: $LNASSET_{it-1}$, ROA_{it-1}, LDR_{it-1}, $RESERVE_{it-1}$, $EQUITY_{it-1}$, $URBAN_{it-1}$, $LNASSET_{it-1}*URBAN_{it-1}$. To these we add the variable BOJ and the following interaction terms between BOJ and the financial variables: $BOJ_{it-1}* ROA_{it-1}$, $BOJ_{it-1}* LDR_{it-1}$, $BOJ_{it-1}* RESERVE_{it-1}$, $\beta_{12} BOJ_{it-1}* EQUITY_{it-1}$.

The estimation results are reported in Table 13. The coefficients of LNASSET and ROA are positive and significant, which implies that the BOJ took into account the scale and profitability of banks in selecting Special Loan recipients. In this sense, the BOJ was selective in providing Special Loans. At the same time, it is notable that the coefficient of BOJ is positive but not significant, while the coefficient of BOJ * ROA is positive and significant. These results mean that a transaction relationship with the BOJ did not generally increase the probability of receiving a Special Loan, but that a transaction relationship with the BOJ increased the probability for a profitable bank to receive such a loan. This suggests that the BOJ used transaction relationships to select profitable banks which were eligible to receive Special Loans.

The selective LLR policy of the BOJ is expected to be reflected in the effect of a transaction relationship with the BOJ on a bank's survivability. As stated in section 2, many banks exited over the period from the 1920s to the early 1930s as a result of mergers and failures. And, it has been found that bank failures during 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). I 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 probit model for bank exits.

$$\Pr(EXIT_{it}=q)=\Pr(U_{itq}>U_{itj},\ j=0,\ 1,\ 2,\ j\neq q)$$

$$U_{itj}=\boldsymbol{\beta}_j'\mathbf{X}_{it-1}+e_{itj} \qquad (3)$$

where j=0, if bank i survived in year t, j=1, if bank i merged in year t, and j=2, if bank i exited due to reasons other than a merger. $\mathbf{X}_{it-1}$ is a vector of exogenous variables that affected bank exits. e_{itj} is the normally distributed error term. In $\mathbf{X}_{it-1}$ we include the same variables as equation (2), but add: the age of bank i (AGE_{it-1}), a dummy variable which equals 1 if the prefecture where a bank was located is Tokyo, Kanagawa, or Saitama, which were seriously damaged by the Great Kanto Earthquake of 1923 (EQ), a dummy variable which equals 1 if the bank was a joint-stock company, and 0, otherwise (FORM), and a dummy variable which equals 1 if the bank's capital was smaller than the lower limit of capital prescribed under the Bank Law (CRITERION).

The estimation results are shown in Table 14. ROA is negatively associated with failure, which confirms the results of Yabushita and Inoue (1993) and Okazaki (2002). The coefficient of BOJ 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. However, the coefficient of BOJ*ROA is negative and statistically

significant, and the coefficient of BOJ*LDR is positive and statistically significant with respect to the failures. These results imply that while 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 words, if banks had a transaction relationship with the BOJ, the survivability of good banks increased. This result is consistent with that regarding the selection of LLR loan recipients in Table 13. In this sense, transaction relationships with the BOJ and LLR loans enhanced the efficacy of the selection of banks by the market.

Next, I explore the effects of a transaction with the BOJ on bank management, in particular, portfolio management. It is natural to expect that a transaction relationship with the BOJ reduced the liquidity risk for a bank, which would have enabled it to apply funds more aggressively than it otherwise could. To examine this possibility, it is essential to deal with the endogeneity of the transaction relationship with the BOJ. I can use equation (1) in the previous section to do this. That is, we estimate the following treatment effects model (Greene 2000, p.933).

$$\Pi_{it}=\boldsymbol{\beta}'\mathbf{Z}_{it}+\delta BOJ_{it}+e_{it} \quad (4)$$

$BOJ_{it}=1$, if $V_{it}>0$, and 0, otherwise

$$V_{it}=\boldsymbol{\gamma}'\mathbf{X}_{it-1}+u_{it} \quad (5)$$

Π_{it} is a variable indicating management policy or performance of bank i in year t. $\mathbf{Z}_{it}$ is a vector of exogenous variables which affected Π_{it}. $\mathbf{X}_{it-1}$ is a vector of exogenous variables determining the transaction relationship with the BOJ. The error terms of (4) and (5), e_{it} and u_{it}, respectively, are assumed to be normally distributed and correlated with each other. As Π indicates portfolio management, we focus on the ratio of loans to total assets (LOAN),

the ratio of securities to total assets (SECURITIES), LOAN+SECURITIES, and RESERVE. For the exogenous variables in equation (4), we use LNASSET, BRANCH, EQUITY and year dummies. For the exogenous variables in equation (5), we use LNASSET, URBAN and BOJBRANCH, referring to the results in the previous section.

The results are shown in Panels A and B of Table 15. As expected, a transaction relationship with the BOJ had the effect of reducing the reserve ratio, which implies that a BOJ correspondent bank paid less attention to its short-term liquidity position. However, in other respects, a transaction relationship with the BOJ did not give a substantial impact on banks' portfolio. While the variable BOJ had a positive effect on SECURITIES, it had a negative effect on LOAN, and consequently had no significant effect on LOAN+SECURITIES.

The results reported in Table 15 are related to the issue of moral hazard which would be incurred by the transaction relationships with the BOJ. In order to examine this issue, it is necessary to use information on the quality of loans and securities. The problem is that this kind of information is not available in the Yearbook of Bank Bureau. To my knowledge, there are two alternative sources that provide the necessary information -- that is bank-level data for loans by collateral. The first source is business reports from the individual banks. The merit of using this source is that data on banks in various prefectures are available. However, business reports are available for only some of the ordinary banks, and only some of these business reports contain information on loans by collateral. It is also very time consuming to collect data from business reports. The other source is the Statistical Yearbook for each prefecture (*Fuken Tokeisho*). The merit of using this source is that we can systematically gather the data for loans by collateral with respect to all banks in the prefecture. However, only the Yearbooks of three prefectures, namely Fukushima (until 1929), Shiga (until 1930), and Kumamoto have bank-level data on loans

by collateral.

Therefore, I used both these sources, taking into account their characteristics. First, from business reports included in the micro-film collection of business reports edited by Yushodo Press, I collected data for loans by collateral in 1926 for 153 of the 1416 ordinary banks in Japan (excluding its colonies). I created two variables indicating a bank's risk-taking, namely, the ratio of loans without collateral and loans with real estate collateral to total loans (RISK), and the ratio of loans with public bond collateral to total loans (SAFE). Using cross-sectional data for RISK and SAFE in 1926 as the independent variables, we estimate treatment effects models similar to equations (6) and (7), to see the effect of the variable BOJ on RISK and SAFE. The results are reported in Table 16. For both cases, RISK and SAFE, the coefficients of BOJ are not significant. This implies that a transaction relationship with the BOJ did not have a significant impact on a bank's risk-taking.

Second, I used data from the Statistical Yearbooks of Fukushima (1926-29), Shiga (1926-30), and Kumamoto (1926-31) prefectures. From these sources, I have 239 observations for RISK and SAFE, as defined above. Using these observations, I estimate the following fixed-effects model.

$$\Pi_{it}=\boldsymbol{\beta}'\mathbf{X}_{it}+\alpha_i+e_{it} \qquad (6)$$

Π_{it} is RISK or SAFE for bank i in year t. $\mathbf{X}_{it}$ is a vector of exogenous variables including BOJ. α_i is the fixed-effects of bank i, and e_{it} is the normally distributed error term. I control for the unobserved factors that may be correlated with the variable BOJ by using fixed-effects α_i. The results are reported in Table 17. As with the results for the treatment effects models, the coefficient of BOJ is not significant for either RISK or SAFE. Again,

there is no evidence that a transaction relationship with the BOJ significantly impacted on a bank's risk-taking.

6. Concluding remarks

Under the unstable financial system of the 1920s, the BOJ actively intervened in the market as the LLR, which is reflected in the spikes in BOJ lending during periods of bank panic. The BOJ concentrated LLR loans with those banks which already had a transaction relationship with the BOJ, and it selected transaction counterparts based on the applications made by private banks. From case studies regarding the opening of transaction relationships, we found that the BOJ used the following criteria in selecting counterparts: (a) the financial condition of the bank (i.e. profitability and soundness of the portfolio), (b) the composition of the directors and large shareholders, and their private assets, (c) the scale of the bank and its position in the local financial market, and (d) the availability of funds other than BOJ loans. This finding is confirmed by 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 ROA was high and whose scale was large. And, for banks whose ROA was low and whose reserve ratio was low, 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.

This policy of the BOJ in selecting transaction counterparts was consistent with the policy for selecting Special Loan recipients. In selecting recipients from the banks which needed rescue, the BOJ focused on their profitability. The probability of receiving an LLR loan was higher for a bank with a higher ROA. Further, a transaction relationship with the BOJ did not have the overall effect of increasing the probability for transaction

counterparts to receive LLR loans, but it did increase the probability for profitable counterparts to receive LLR loans. As a result, a transaction relationship with the BOJ had no significant overall effect on a bank's survivability, but it did enhance the effect of a high ROA on the survivability of a bank. These policies of the BOJ were effective in preventing moral hazard in banks, which could be incurred by LLR loans. There is no evidence that a transaction relationship with the BOJ had a significant impact on a bank's risk-taking.

The 1920s was an epoch of structural changes in Japanese financial history. Due to the harsh competition and poor macro-economic environment, a number of banks exited through mergers and failures. At the same time, during this wave of mergers and failures, an important feature of the Japanese financial system, namely, close ties between banks and industrial firms, which was one of the basic sources of bad loans in this period, declined (Teranishi 2003; Okazaki, Sawada and Wang 2006). The LLR loans by the BOJ were a measure to cope with financial instability accompanying the structural changes. However, it is possible that the LLR loans themselves could have incurred a moral hazard and impeded structural changes. The BOJ's LLR policy successfully avoided this problem, while mitigating instability in the financial system.

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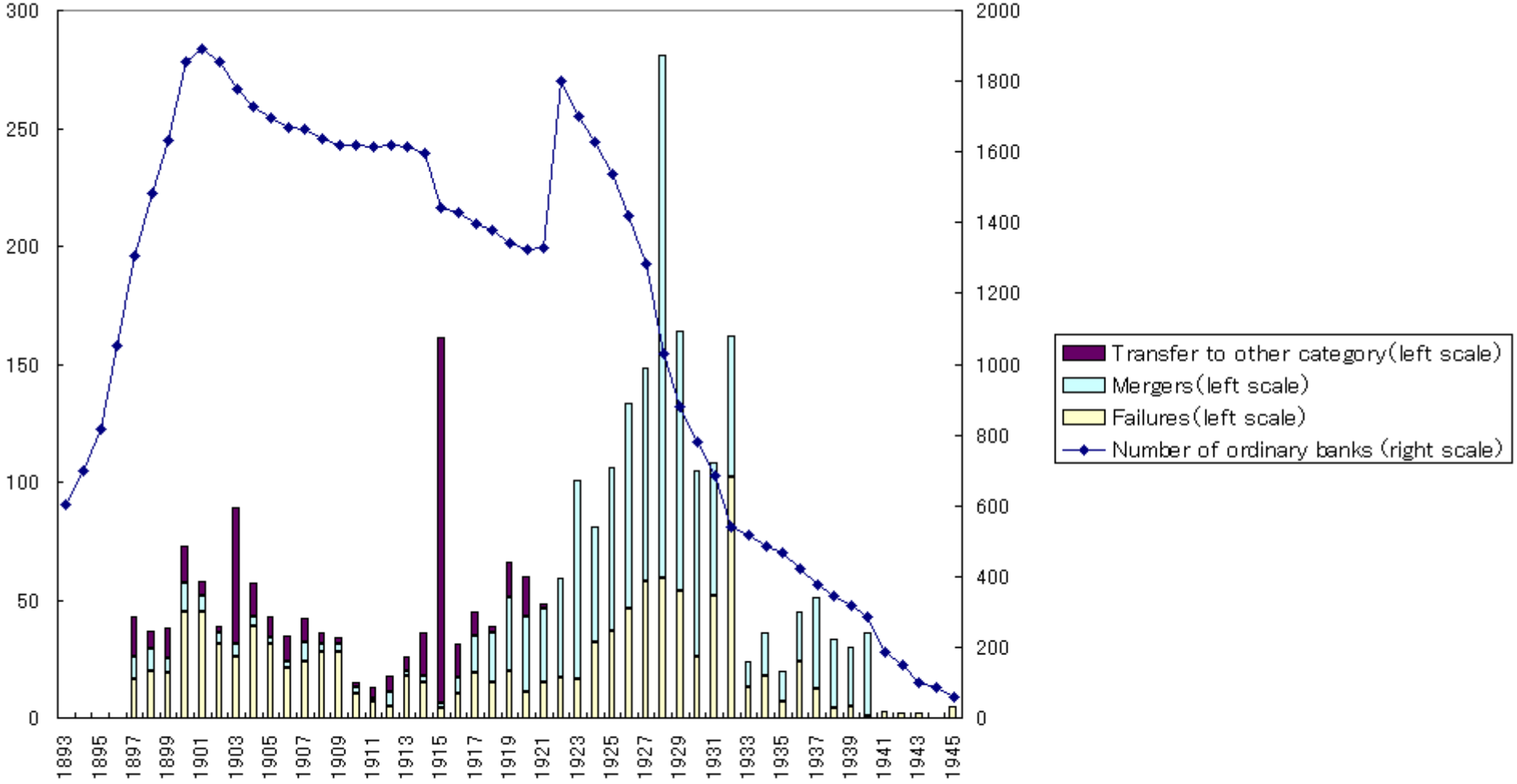
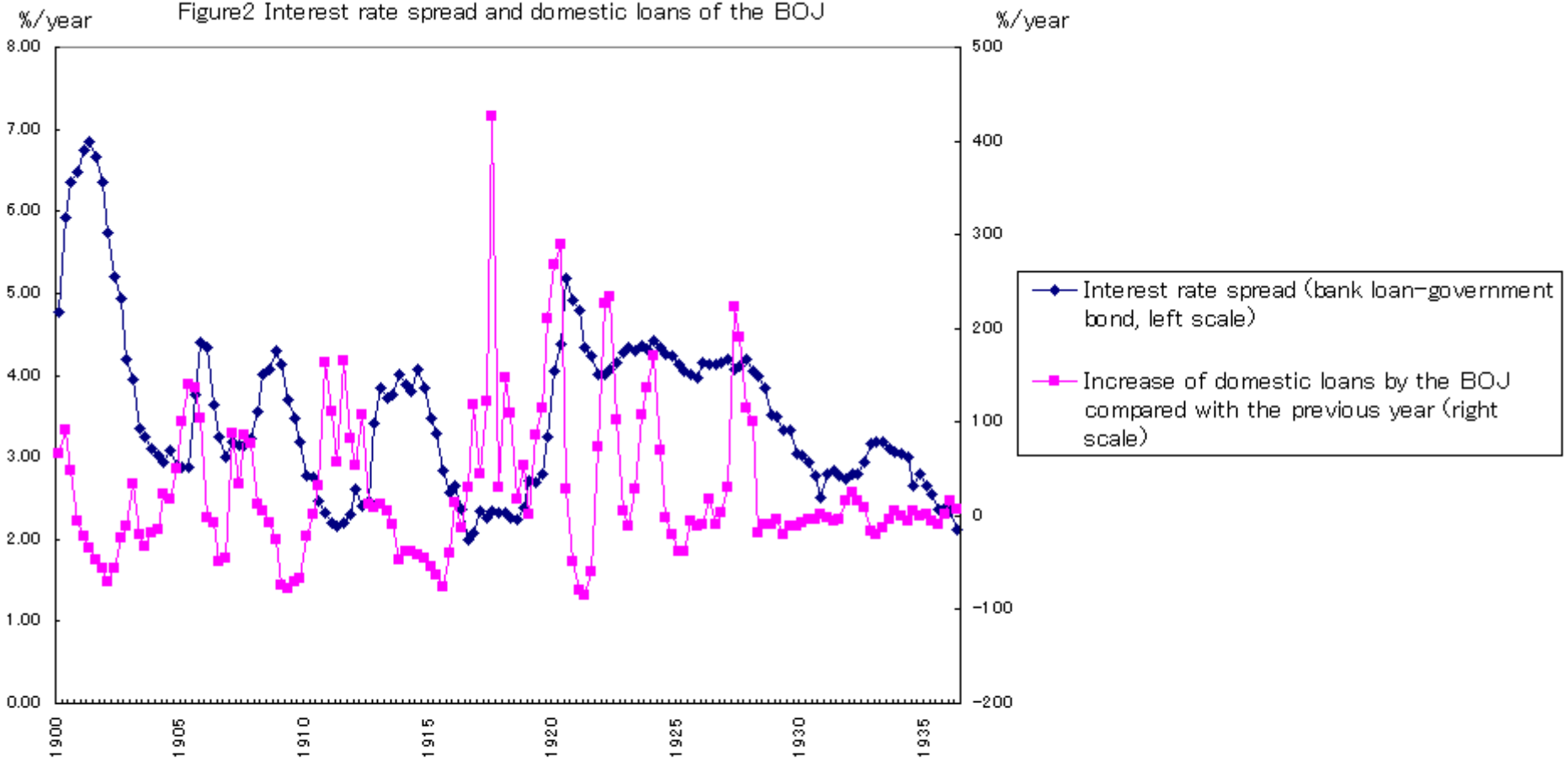
Figure1 Increase and shake out of ordinary



Source: Goto (1970).

Figure2 Interest rate spread and domestic loans of the BOJ



Source: Toyo Keizai Shinposha (1927); The Ministry of Finance, *Kin'yu Jiko Sankosho* (*Handbook of Financial Issues*), various issues

Table1 Composition of the domestic loans by the BOJ

	Total (1000 yen)	Special lonas (1000 yen)	Percentage
1923	641,336	133,530	20.8
1924	523,792	144,840	27.7
1925	463,964	148,091	31.9
1926	517,907	159,035	30.7
1927	815,297	402,983	49.4
1928	769,658	649,496	84.4
1929	649,655	598,180	92.1
1930	688,473	585,434	85.0
1931	882,718	575,742	65.2
1932	632,040	565,648	89.5
1933	707,013	552,430	78.1
1934	712,841	529,820	74.3
1935	661,658	498,176	75.3
1936	585,628	472,480	80.7

Source: Ministry of Finance, *Handbook of Financial Issues*, 1930 and 1938 issues.

Table 2 Composition of the BOJ Special Loans by borrower's transaction relationship with the BOJ

	Amount (1000 yen)	Precentage
Total	761,971	100.0
BOJ correnpondent banks	723,859	95.0
Other banks	38,112	5.0

Source: Ishii[1980], pp.163-166.

Note: Only the Special Loans according to the Bank of Japan Special Loan and Loss Compensation Law.

Table 3 Amount of the BOJ's transaction with private banks

	Loan	Overdrawn of current account	Discount	Current deposit	Number of correspondent accounts
	1000 yen	1000 yen	1000 yen	1000 yen	
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	･･･

Source: Bank of Japan (1986), pp. 272–289; *Semiannual Report of the Bank of Japan*, various issues; *Yearbook of the Bank Bureau*, various issues.

Table 4 Number of ordinary banks with transaction relationship with the BOJ

	Total	BOJ correspondent banks	Share(%)
1925	1,532	253	16.5
1926	1,416	246	17.4
1927	1,279	225	17.6
1928	1,026	197	19.2
1929	877	180	20.5
1930	777	173	22.3
1931	678	167	24.6

Source: See the text.
Note: Banks in the colonies are not included.

Table 5 Share of the BOJ correspondent banks in terms of deposit and loan amount

		Deposit	Loan
BOJ correspondent banks	1925	6,992	7,315
(million yen)	1931	7,333	5,741
Total	1925	8,666	9,198
(million yen)	1931	8,203	6,691
Percentage	1925	80.7	79.5
	1931	89.4	85.8

Source: See the text.
Note: Banks in the colonies are not included.

Table 6 Share of the BOJ correspondent banks in terms of number by deposit scale in terms of bank number

		Total	BOJ correspondent banks	Share(%)
1925	100 million yen≦deposit	16	16	100.0
	10 million yen≦deposit＜100 million yen	106	93	87.7
	5 million yen≦deposit＜10 million yen	88	46	52.3
	1 million yen≦deposit＜5 million yen	464	78	16.8
	deposit＜1 million yen	858	20	2.3
1931	100 million yen≦deposit	13	13	100.0
	10 million yen≦deposit＜100 million yen	85	73	85.9
	5 million yen≦deposit＜10 million yen	55	29	52.7
	1 million yen≦deposit＜5 million yen	234	40	17.1
	deposit＜1 million yen	291	12	4.1

Source: See the text.
Note: Banks in the colonies are not included.

Table 7 Share of the BOJ corespondent banks by area in terms of bank number

		Total	BOJ correspondent banks	Share (%)
1925	Urban	478	83	17.4
	Non-urban	1,054	170	16.1
1931	Urban	208	56	26.9
	Non-urban	470	111	23.6

Source: See the text.
Note: Banks in the colonies are not included.
Urban area refers to the seven prefectures, Tokyo, Kanagawa, Aichi, Kyoto, Osaka, Hyogo and Fukuoka.

Table 8 Share of the BOJ correspondent banks by proximity to the BOJ headquarters or a branch in terms of bank number

		Total	BOJ correrspondent banks	Share (%)
1925	With the BOJ headquarters or a branch	597	139	23.3
	Without the BOJ headquarters or a brancl	935	114	12.2
1931	With the BOJ headquarters or a branch	313	95	30.4
	Without the BOJ headquarters or a brancl	365	72	19.7

Source: See the text.
Note: Banks in the colonies are not included.

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

	Openings	Closures		
			Survive	Exit
Total	10	96	19	77
1926	2	9	4	5
1927	1	22	2	20
1928	2	30	8	22
1929	1	18	2	16
1930	2	9	1	8
1931	2	8	2	6

Source: See the text.

Table 10 Determinants of transaction relationships with the BOJ

Dependent variable: BOJT	Coeffieient		∂ Pr/ ∂ x
Const.	−45.139	***	
	(2.564)		
$LNASSET_{t-1}$	2.761	***	$0.972*10^{-3}$
	(0.164)		
$ASSETRANK_{t-1}$	0.007		$0.260*10^{-5}$
	(0.010)		
$BRANCH_{t-1}$	−0.055		$-0.195*10^{-4}$
	(0.015)		
ROA_{t-1}	5.980	***	0.002
	(1.958)		
LDR_{t-1}	0.001		$0.466*10^{-6}$
	(0.003)		
$RESERVE_{t-1}$	−0.419		$-0..148*10^{-3}$
	(0.542)		
$EQUITY_{t-1}$	4.045	***	0.001
	(0.663)		
$URBAN_{t-1}$	−5.396		−0.018
	(3.288)		
$BOJBRANCH_{t-1}$	1.789	***	0.003
	(0.223)		
$LNASSET_{t-1}*URBAN_{t-1}$	0.237		$0.834*10^{-4}$
	(0.211)		
Log likelihood	−631.03		
Pseudo-R^2	0.452		
ρ	0.821		
	(0.009)		
Number of obs.	5925		
Number of positive obs.	1184		
Number of groups	1467		

Note: Estimates by random-effects probit model.
Standard errors are in parentheses.
∂ Pr/ ∂ x are the partial derivatives evaluated at the sample means.
*** 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	Coefficient	∂ Pr/ ∂ x
Const.	−9.621 *	
	(5.376)	
$LNASSET_{t-1}$	0.535	$0.293*10^{-10}$
	(0.328)	
$ASSETRANK_{t-1}$	−0.130 *	$-0.711*10^{-11}$
	(0.071)	
$BRANCH_{t-1}$	−0.056 *	$-0.309*10^{-11}$
	(0.032)	
ROA_{t-1}	5.070	$0.278*10^{-9}$
	(6.307)	
LDR_{t-1}	−0.320	$-0.175*10^{-10}$
	(0.465)	
$RESERVE_{t-1}$	0.303	$0.166*10^{-10}$
	(0.438)	
$EQUITY_{t-1}$	−1.970	$-0.108*10^{-9}$
	(2.072)	
$URBAN_{t-1}$	−5.898	$-0.334*10^{-6}$
	(7.124)	
$LNASSET_{t-1}*URBAN_{t-1}$	0.367	$0.201*10^{-10}$
	(0.448)	
$BOJBRANCH_{t-1}$	0.886 **	$0.259*10^{-9}$
	(0.389)	
Log likelihood	−34.945	
Pseudo-R^2	0.408	
ρ	$0.306*10^{-6}$	
	(0.002)	
Number of observations	4731	
Number of positive observati	10	
Number of groups	1227	

Note: Estimates by random-effects probit model.
Standard errors are in parentheses.
∂ Pr/ ∂ x are the partial derivatives evaluated at the sample means.
*** 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 : BOJT	Coefficient	∂ Pr/ ∂ x
Const.	4.363 *	
	(2.591)	
$LNASSET_{t-1}$	−0.349 **	−0.009
	(0.162)	
$ASSETRANK_{t-1}$	−0.019	$-0.511*10^{-3}$
	(0.018)	
$BRANCH_{t-1}$	−0.022	$-0.578*10^{-3}$
	(0.016)	
ROA_{t-1}	−9.818 *	−0.263
	(5.643)	
LDR_{t-1}	0.015	$0.391*10^{-3}$
	(0.037)	
$RESERVE_{t-1}$	−3.543 **	−0.095
	(1.504)	
$EQUITY_{t-1}$	0.203	0.005
	(0.865)	
$URBAN_{t-1}$ #	−4.822 *	−0.229
	(2.700)	
$LNASSET_{t-1}*URBAN_{t-1}$	0.325 *	0.009
	(0.168)	
$BOJBRANCH_{t-1}$ #	−0.124	−0.003
	(0.205)	
Log likelihood	−107.47	
Pseudo-R^2	0.112	
ρ	$0.306*10^{-6}$	
	$(0.0570*10^{-3})$	
Number of obs.	1189	
Number of positive obs.	19	
Number of groups	266	

Note: Estimates by random-effects probit model.
Standard errors are in parentheses.
∂ Pr/ ∂ x are the partial derivatives evaluated at the sample means.
∂ Pr/ ∂ x are for discrete change of dummy variables.
*** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level

Table 13 Determinants of Special Loans by the BOJ

Dependent variable : BOJ	Coefficient		∂ Pr/ ∂ x
Const.	−7.040	***	
	(1.471)		
$LNASSET_{t-1}$	0.522	***	0.190
	(0.096)		
ROA_{t-1}	6.476	**	2.360
	(3.028)		
LDR_{t-1}	−0.011		−0.004
	(0.048)		
$RESERVE_{t-1}$	−0.095		−0.035
	(0.489)		
$EQUITY_{t-1}$	−0.684		−0.249
	(0.626)		
$URBAN_{t-1}^{\#}$	−0.346	*	−0.129
	(0.210)		
$BOJ_{t-1}^{\#}$	0.483		0.166
	(0.662)		
$BOJ*ROA_{t-1}$	40.327	*	14.700
	(22.272)		
$BOJ*LDR_{t-1}$	0.176		0.064
	(0.187)		
$BOJ*RESERVE_{t-1}$	0.255		0.093
	(2.153)		
$BOJ*EQUITY_{t-1}$	−5.818	*	−2.121
	(3.187)		
Log likelihood	−126.565		
Pseudo-R^2	0.330		
Number of obs.	288		
Number of positive obs.	193		

Note: Estimates by random-effects probit model.
Standard errors are in parentheses.
∂ Pr/ ∂ x are the partial derivatives evaluated at the sample means.
∂ Pr/ ∂ x are for discrete change of dummy variables.
*** Statistically significant at 1% level
** Statistically significant at 5% level

Table 14 Effect of a transaction relationship with the BOJ on bank exit

	Failure			Merger		
	Coefficient		∂ Pr/ ∂ x	Coefficient		∂ Pr/ ∂ x
Const.	2.583	***		−0.171		
	(0.816)			(0.658)		
LNASSET	−0.388	***	−0.017	−0.120	***	−0.010
	(0.052)			(0.042)		
BRANCH	0.016	**	$0.787*10^{-3}$	−0.006		$-0.853*10^{-3}$
	(0.007)			(0.007)		
ROA	−6.384	***	−0.293	−0.828		−0.039
	(1.110)			(0.930)		
LDR	$-0.117*10^{-3}$		$-0.117*10^{-4}$	$0.691*10^{-3}$		$0.807*10^{-4}$
	(0.002)			(0.003)		
RESERVE	−0.003		$-0.399*10^{-4}$	−0.012		−0.001
	(0.005)			(0.028)		
EQUITY	1.296	***	0.064	−0.374	*	−0.055
	(0.230)			(0.215)		
AGE	0.007	*	$0.268*10^{-3}$	0.007	**	$0.729*10^{-3}$
	(0.004)			(0.003)		
FORM#	0.138	*	0.007	−0.064		−0.009
	(0.080)			(0.070)		
CRITERION#	−0.196		−0.011	0.177	*	0.022
	(0.129)			(0.094)		
URBAN#	0.130		0.008	−0.143	**	−0.017
	(0.091)			(0.071)		
EQ#	0.486	***	0.029	0.052		$0.532*10^{-3}$
	(0.109)			(0.096)		
BOJ#	0.289		0.016	−0.064		−0.010
	(0.329)			(0.253)		
BOJ*ROA	−22.116	***	−0.959	−8.933		−0.832
	(8.429)			(5.943)		
BOJ*LDR	0.039	***	0.003	−0.123		−0.015
	(0.014)			(0.152)		
BOJ*RESERVE	1.269	*	0.055	0.498		0.046
	(0.768)			(0.794)		
BOJ*EQUITY	−0.124		−0.014	0.910		0.106
	(0.843)			(0.945)		
Loglikelihood	−3054.054					
Wald $\chi^2(32)$	389.31					
Number of obs.	6846					
Number of positive obs.	286			633		

Note: Estimates by multinominal probit model.
∂ Pr/ ∂ x are the partial derivatives evaluated at the sample means.
∂ Pr/ ∂ x are for discrete change of dummy variables.

Table 15 Effect of a transaction relationship with the BOJ on bank management

A.Portfolio effect

	(a) Dependent variable: LOAN	(b) Dependent variable: SECURITIES	(c) Dependent variable: LOAN+SECURITIES	(d) Dependent variable: RESERVE
Const.	−0.344	−0.246 ***	−0.589 **	−17.57 ***
	(0.261)	(0.092)	(0.291)	(3.478)
LNASSET	0.069 ***	0.024 ***	0.093 ***	1.076 ***
	(0.018)	(0.006)	(0.020)	(0.244)
BRANCH	−0.002	−0.002 **	−0.003	−0.034
	(0.002)	(0.001)	(0.002)	(0.026)
EQUITY	0.849 ***	0.006	0.856 ***	8.566 ***
	(0.080)	(0.028)	(0.090)	(1.085)
LOAN				−0.151
				(0.177)
SECURITIES				4.308 ***
				(0.500)
BOJ	−0.217 **	0.096 ***	−0.122	−3.253 ***
	(0.093	(0.033)	(0.104)	(1.240)
Wald χ^2	132.60	150.69	96.13	145.75
Number of obs.	5920	5920	5920	5920

Note: Estimates by treatment effect model. First we estimate equation(2) in the text to probit model to obtain the estimate of BOJ. Then, we estimate equation(1) by OLS, using the estimate of BOJ. The estimation result of equation (2) is reported in this Table.
Year dummies are included, although not reported.
Standard errors are in parentheses.
Degree of freedom of Wald χ^2 is 9 for (a) ,(b) and (c), and 11 for (d).
*** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level

B.Estimation of BOJ

Dependent variable: BOJ	
Const.	−15.313 ***
	(0.396)
$LNASSET_{t-1}$	0.949 ***
	(0.026)
URBAN	−0.701 ***
	(0.068)
$BOJBRANCH_{t-1}$	0.888 ***
	(0.062)
Log likelihood	−1498.59
Pseudo-R^2	0.491
Number of obs.	5920

Note: See the note of Panel A.

Table 16 Effect of a transaction relationship with the BOJ on bank's risk taking (1): Treatment effect model

A. Risk taking effect

	(a) Dependent variable: RISK	(b) Dependent variable: SAFE
Const.	1.123 **	−0.384
	(0.537)	(0.449)
LNASSET	−0.031	0.038
	(0.037)	(0.031)
BRANCH	0.002	−0.002
	(0.003)	(0.003)
LOAN	0.005	0.002
	(0.011)	(0.009)
SECURITIES	−0.511 ***	0.519
	(0.129)	(0.108)
RESERVE	0.053	0.034
	(0.085)	(0.071)
EQUITY	−0.109	−0.113
	(0.139)	(0.117)
URBAN	0.082 **	0.037
	(0.038)	(0.032)
BOJ	−0.086	−0.214
	(0.103)	(0.086)
Wald $\chi^2(9)$	46.63	64.59
Number of obs.	153	153

Note: Estimates by treatment effect model. First we estimate equation of BOJ, then we estimate equation of loan by collateral by OLS, using the estimate of BOJ. The estimation result of BOJ equation is reported in panel B in this table.
Year dummies are included, although not reported.
Standard errors are in parentheses.
*** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level

B.Estimation of BOJ

Dependent variable: BOJ	
Const.	−17.904 ***
	(2.378)
$LNASSET_{t-1}$	1.147 ***
	(0.154)
URBAN	−0.511
	(0.336)
$BOJBRANCH_{t-1}$	0.981 ***
	(0..08)
Log likelihood	−50.95
Pseudo-R^2	0.515
Number of obs.	153

Note: See the note of Panel A.

Table 17 Effect of a transaction relationship with the BOJ on bank's risk taking (2): Fixed-effects estimation

	(a) Dependent variable: RISK	(b) Dependent variable: SAFE
Const.	1.886 ***	0.077
	(0.701)	(0.126)
LNASSET	−0.101 **	−0.003
	(0.047)	(0.007)
LOAN	0.127 *	−0.020 **
	−0.065	(0.010)
SECURITIES	−0.009	0.029
	(0.170)	(0.026)
RESERVE	0.268 **	0.004
	(0.109)	(0.016)
EQUITY	0.101	0.001
	(0.161)	(0.024)
BOJ_{t-1}	−0.017	−0.007
	(0.035)	(0.005)
Ad-R^2	0.834	0.196
Number of obs.	239	239

Note: Estimates by fixed-effect model, using the data on Fukushima, Shiga and Kumamoto prefectures.
Standard errors are in parentheses.
Fixed-effects of individual banks and year dummies are included, although not reported.
*** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level