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Liquidity Risk and Bank Portfolio Management in a Financial System without Deposit Insurance: Empirical Evidence from Prewar Japan

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Liquidity Risk and Bank Portfolio Management in a Financial System without Deposit Insurance: Empirical Evidence from Prewar Japan*

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Abstract

Using data from prewar Japan, this paper investigates the impact of liquidity shock on bank portfolio management during financial crises in a system lacking deposit insurance. It is found that banks faced with a rise in their liquidity risk increased their cash holdings not by liquidating bank loans but by selling securities in the financial market. Moreover, banks exposed to local financial contagion adjusted the liquidity of their portfolio mainly by actively selling and buying their securities in the financial market. Finally, there is no evidence to conclude that the existence of the lender of last resort mitigated the liquidity constraints in bank portfolio adjustments.

JEL Classification; G21, O16, N25

Keywords; Bank portfolio; Financial contagion; Lender of last resort; Liquidity risk

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1. Introduction

One of the most important roles of banks is to perform the maturity transformation of assets by issuing short-term liabilities and holding long-term assets. Therefore, given a system where depositors are insufficiently protected, banking systems are potentially exposed to the probability of bank runs. In fact, during prewar periods, bank runs occurred frequently in the U.S., Europe, Japan, and contemporary emerging countries where deposit insurance was nonexistent.

Since Diamond and Dybvig (1983), a considerable number of studies have been conducted on bank runs and panics. The majority of these studies have focused on the origin and causes of bank runs, which can be classified into two alternative views. The first is the random withdrawal theory, which considers bank runs as self-fulfilling phenomena (e.g., Waldo (1985); Postle and Vives (1987); Chang and Velasco (2000, 2001)). The other is the information based theory, which considers bank runs as phenomena induced by the market discipline of depositors under the asymmetric information (e.g., Gorton (1985); Chari and Jagannathan (1988); Calomiris and Gorton (1991)). Recently, there has been renewed interest in portfolio management with respect to economies where runs are possible (Cooper and Ross (1998); Peck and Shell (2003); Ennis and Keister (2006); Franck and Krausz (2007)). These studies, developing Diamond and Dybvig (1983), analyze how banks manage the liquidity of their portfolios taking into account the strategic behavior of depositors. Cooper and Ross (1998) and Ennis and Keister (2006) examine the relation between the probability of a bank run and the level of liquid assets held by banks. Peck and Shell (2003) investigate how restrictions on the holding of illiquid assets affect the level of liquid assets chosen by banks. Franck and Krausz (2007) analyze the impact of the stock market and the presence of a lender of last resort (LLR) on the portfolio allocations of banks when they are faced with random withdrawals by depositors. Despite such theoretical developments, empirical evidence is lacking on the liquidity management of banks in a system devoid of deposit insurance—at least, since Friedman and Schwartz (1963). These authors demonstrated that the deposit-reserve ratio is inclined to decrease during periods of banking crisis (as in 1907 and the early 1930s). However, they analyzed the time-series behavior of banks on the basis of aggregate data. Moreover, they did not conduct a detailed statistical analysis. Therefore, few details are available on the behavior of individual banks that are exposed to liquidity risk in a system without deposit insurance.

To investigate portfolio management with respect to banks exposed to liquidity risk, this study uses micro-level data pertaining to the prewar Japanese banking industry. In pre-war Japan, since numerous small banks operated without deposit insurance, the banking sector was subject to liquidity risk due to the frequent occurrence of bank runs. In fact, nationwide bank runs occurred in the late 1920s and early 1930s, which resulted in numerous bank closures. This paper focuses on bank behavior during the banking crisis from 1927 to 1932. —to this author's knowledge, the first time bank-level analysis is used to examine the liquidity management of banks operating without deposit insurance during past periods of financial crises.

This paper examines how banks adjusted the liquidity of their asset portfolios in response to liquidity shocks during periods of banking crises. Concretely, I focus on a deposit shock of a bank to capture its liquidity risk, and analyze its effect on the proportions of three assets in its asset portfolio—loans, cash, and securities. If a bank fears a future liquidity shortage due to a significant outflow of deposits, then the bank is expected to increase its proportion of liquid assets such as cash and securities and decrease its proportion of illiquid assets such as loans. In the very short run, however, it is difficult to liquidate non-marketable assets such as loans. Thus, this paper also investigates the impact of contagion on bank portfolios in order to capture the effect of a temporary deposit shock. Furthermore, I examine the influence of the central bank as the lender of last resort on the portfolio management of private banks. The existence of the LLR from the central bank is likely to affect the portfolio management of private banks when the former guarantees the supply of loans to the latter in times of emergency. In prewar Japan, the Bank of Japan (BOJ), which was the central bank of Japan, exercised the role of the LLR by providing loans to private banks during periods of financial crises. Moreover, the BOJ had a well-known tendency to provide LLR loans to banks with which it had an established transactional relationship (Ishi (1980); Shiratori (2003); Okazaki (2007)). The role of the LLR is herein further examined through an analytical comparison of the portfolio management of the BOJ's correspondent banks and non-correspondent banks.

This paper is in line with the recent policy discussions on the need to create financial safety nets. It is generally recognized that deposit insurance suffocates market discipline, although it is effective in preventing self-fulfilling depositor runs that induce bank panic. Many financial economists point out the importance of market discipline and propose various safety net designs to guarantee, among other things, its proper functioning (Kane (2000); Demirguc-Kunt and Huizinga (2004); Demirguc-Kunt, Kane, and Laeven (2006)). However, the cost impact on banks that operate without deposit insurance is not thoroughly understood, particularly in terms of bank behavior[1]. In light of these arguments, this paper will attempt to provide useful evidence.

The remainder of this paper is organized as follows. Section 2 discusses the historical background of the Japanese banking system. Section 3 describes the study's data and

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[1] For instance, as stated in Ennis and Keister (2006), a bank that is exposed to the possibility of a bank run might hold more reserves, which leads to a decrease in long-term lending and consequently has an effect on economic activities to some degree.

methodology. Section 4 presents the study's main results. Section 5 considers the impact of financial contagion on bank portfolios. Section 6 addresses the role of the LLR and the BOJ. Section 7 concludes the study.

2. A Historical Background

The industrial organization of the prewar Japanese banking sector differed substantially from its postwar counterpart. An interesting feature is that this industry was composed of numerous small banks, which was due to the lax regulations that facilitated entry into the banking industry. Indeed, in the early twentieth century, the number of banks exceeded two thousand[2]. However, a safety net for depositors was not properly established. That is, since deposit insurance was inexistent in prewar Japan, it was not rare for depositors to incur losses when banks fell into bankruptcy (Takahashi and Morigaki (1968); Imuta (2001)). Therefore, the banking industry was frequently susceptible to a series of runs, which resulted in the closure of many banks, particularly in the 1920s after the collapse of the speculative bubble that followed the economic boom of the World War I. Table 1 provides historical data related to liquidity shocks in Japanese banking industry from 1922 to 1935. The number of bank closures is particularly high during the late 1920s and early 1930s. This period includes major historic Japanese financial crises namely, the Showa Financial Crisis of 1927 and the Showa Depression from 1930 to 1931, when nationwide bank runs occurred[3]. In addition it is noteworthy that while the growth rate of total deposits of all banks was

[2] In 1901, the number of banks reached a peaked at 2334 (1890 ordinary banks and 444 saving banks). Thereafter, the numbers decreased due to the change in government policy. Specifically, in addition to the imposition of strict restrictions on new entrants, the Ministry of Finance promoted bank consolidation efforts. For example, The Bank Law of 1927 obliged an ordinary bank to maintain an amount of capital of not less than one million yen by 1932, and forbade them to increase capital by their own means. Therefore, many banks were forced to choose a merger or a dissolution (Okazaki and Sawada (2007)).

[3] For further details on the Showa Financial Crisis and the Showa Depression, see Hoshi and Kashyap (2001, p29-31).

negative from 1927 to 1931excepting 1928, the postal savings continued to grow at more than 10%. These figures are considered to reflect the risk-averse behavior of depositors during banking crises. As such, Japanese banks suffered from a liquidity crisis, particularly in the late 1920s and early 1930s.

The BOJ, which was the central bank of Japan, attempted to stabilize the financial system through its role as the lender of last resort (Ishii (1980); Okazaki (2007)). The BOJ performed its role as LLR by providing special loans to private banks during a liquidity crisis. Principally, the special loans helped banks cope with emergencies in the banking system[4]. According to Table 1, the share of special loans in the total domestic loans provided by the BOJ reached 90% in the end of 1920s. Moreover, the amount of outstanding special loans rose sharply after 1927 when the financial crisis was very severe.

Another feature of the prewar Japanese banking industry was that many banks were controlled by industrial companies through capital and personal relationships. These so-called organ banks generally gave loans to their affiliated industrial group (Okazaki, Sawada, and Yokoyama (2005)). Therefore, lending was the most important component among bank assets[5]. Figure 1 displays the total amount of loans, security holdings, and cash assets—where cash assets indicate the sum of cash holdings and deposits with the BOJ and other banks—held by all ordinary banks from 1912 to 1936.

Reflecting the economic boom generated by World War I, the amount of loans was

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[4] Special loans included loans based on special laws and other loans supplied at the discretion of the BOJ. The special laws refer to the loss in compensation due to the Earthquake Bill Law, the 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 (Okazaki (2007)).

[5] The modern history of the Japanese banking industry started with the establishment of national banks in 1872, which were authorized to issue bank notes. The issue of bank notes was accompanied by the requirement to hold the same amount of government bonds according to the National Bank Act. Therefore, the share of government bonds in bank assets was over 60% in 1887. However, this share in 1890 decreased by 20% due to a wave of newly established private banks and the transformation of national banks into private banks.

increased substantially in the second half of the 1910s. However, this upward trend was reversed at the financial turning point of the mid-1920s. Bank loans continued to decrease from the late 1920s to the early 1930s, when the Japanese economy fell into a chronic recession after the collapse of the speculative bubble and the impact of the 1923 Great Kanto Earthquake in Tokyo[6]. By contrast, security holdings principally grew during these periods—as a result likely due to the imposition on banks to hold liquid assets, since bank runs frequently occurred during the 1920s and early 1930s (Imuta (1980); Nanjo and Kasuya (2005)). The structural change in the financial market after the 1920s additionally affected bank security holdings. While the corporate bond market was expanding against a background in which bond issuance was aggressively stimulated by the low interest monetary policies of the second half of the 1920s, the amount of government bonds underwritten by the Bank of Japan grew rapidly after the early 1930s due to an increase in fiscal and military expenditures[7]. According to Shimura (1969) and Nanjo and Kasuya (2005), a significant amount of funds were shifted into a number of large banks during various financial crises, and the surplus funds were thereafter actively invested in securities by the banks. In contrast to loans and securities, cash assets did not change dramatically after the 1920s. Figure 2 illustrates the proportions of these three assets during this period[8]. It is noteworthy that after the mid-1920s, the proportion of securities increased while that of loans decreased; therefore, security holdings exercised a significant role in the asset portfolios of banks after the mid-1920s.

Table 2 illustrates the composition of securities holdings in ordinary banks from 1927 to 1935. The share of the sum of all types of bonds reached approximately 90% of total

[6] The loss as a result of this earthquake amounted to approximately 5 billion yen, which was equivalent to about 30 % of GNP at that time (Hoshi and Kashyap, (2001)).
[7] According to Shimura (1969), 60-80% of government bonds underwritten by the Bank of Japan from 1932 and1936 were sold to private banks.
[8] The denominator is the sum of these three assets.

security holdings. It is notable that 40–50% of security holdings were government bonds, which may reflect the need of most banks to reserve liquid assets as insurance against large withdrawals of deposits (Nanjo and Kasuya (2005)). By contrast, stock shares were generally low. Shimura (1969) indicates that bank managers hesitated to invest in stocks because they were considered to be too risky to invest in. .

3. Methodology

In the following analysis, I use panel data from 1926 to 1932 to determine how banks dealt with liquidity risk through portfolio management. Concretely, I capture a bank's liquidity risk by a deposit shock and examine its effect on the liquidity of the asset portfolio. As mentioned previously, the period of analysis corresponds to a time when the banking industry was frequently susceptible to a liquidity crisis such as a series of bank runs. The main data is sourced from the Yearbook of the Bank Bureau issued by the Ministry of Finance (*Ginkokyoku Nenpo*), which covers the financial data of all the banks controlled by the Ministry of Finance[9].

Since it was only possible to obtain the sums of all the types of securities held by banks from the individual financial data available in the *Ginkokyoku Nenpo,* we consider both cash assets and security holdings to be liquid assets in the following analysis. Concerning the degree of liquidity of securities held by banks, it is important to note how readily or inexpensively the banks could realize these in the financial market. Government bonds were actively traded after the 1920s because of the reform of a secondary market that progressed drastically[10]. On the basis of the historical records of several banks, Nanjo and Kasuya (2005) stated that banks held government

[9]This source does not carry all account items. Especially, it is mostly limited to balance-sheet data.

[10] Nanjo and Kausya (2005) demonstrated that the ratio of a trading volume at the Tokyo Stock Exchange with respect to the total value of the outstanding amount of issues exceeded 30% in 1928. In addition, government bonds were traded at over-the-counter markets in more than several times the amount of the trading volume at the Tokyo Stock Exchange (Shimura (1969); Bond Underwriters Association of Japan(1980)).

bonds as reserve assets because they could be immediately sold in the financial market, and that such bonds were accepted as collateral when borrowing from the Bank of Japan. Therefore, government bonds were considered to be highly liquid. The information on the secondary market of corporate bonds is very limited, since they were primarily traded in over-the–counter markets (Shimura (1969); Bond Underwriters Association of Japan(1980)). However, Kasuya (2003) showed the historical records that large regional banks sold corporate bonds before maturity and bought those outstanding bonds, and inferred that the secondary market for corporate bonds was present to some degree.

It was difficult, however, to liquidate bank loans easily because the liquidation markets were limited[11]. Moreover, since the loans given by organ banks to related groups were generally fixed, banks could not always collect the loans at the time of maturity (Kato (1957)). Therefore, bank loans were considered to be relatively illiquid as compared to securities and cash assets.

I investigate how banks dealt with liquidity risk through portfolio management. The basic equations used for this study's estimations are as follows:

$$\Delta\left(\frac{C}{A}\right)_{it} = \alpha_0 + \alpha_1 \Delta LiqRisk_{it-1} + \gamma X_{it-1} + u_{it} \tag{1}$$

$$\Delta\left(\frac{S}{A}\right)_{it} = \beta_0 + \beta_1 \Delta LiqRisk_{it-1} + \gamma X_{it-1} + v_{it} \tag{2}$$

$$\Delta\left(\frac{S+C}{A}\right)_{it} = \lambda_0 + \lambda_1 \Delta LiqRisk_{it-1} + \gamma X_{it-1} + w_{it} \tag{3}$$

[11] Tsurumi (2001) stated that the interbank markets in prewar Japan included bill discount markets in addition to call loan markets. Therefore, bank loans could be partly liquidated in the financial market. According to Goto (1970, p87) The proportion of discounted bills to total bank loans was approximately 20% in the early 1920s and continued to decline gradually afterward.

$(A_{it} = S_{it} + C_{it} + L_{it})$

where S, C, L, and A, are security holdings, cash assets, loans, and total assets, respectively. Total assets indicate the sum of security holdings, bank loans, and cash assets[12]. I use three indices, each as an independent variable, for the liquidity of assets in a bank portfolio. Moreover, $\Delta(C/A)_{it}$ denotes the change in the ratio of cash assets to total assets (cash-asset ratio) of bank i from year t – 1 to year t. In addition, $\Delta(S/A)_{it}$ and $\Delta(\frac{C+S}{A})_{it}$ are the changes in the ratio of securities to total assets (security-asset ratio) and the ratio of securities plus cash assets to total assets (liquid asset ratio) from year t – 1 to year t, respectively (hereinafter, we use the term liquid assets to indicate the sum of securities and cash assets). A positive value in these variables indicates that a bank's portfolio has become more liquid. Here, the annual change in the liquid asset ratio ($\Delta(\frac{C+S}{A})_{it}$) is equal to the negative value of the annual change in the illiquid asset ratio ($\Delta(L/A)_{it}$), by definition.

In explanatory variables, $\Delta LiqRisk_{it-1}$ indicates a variable for a deposit shock, which determines the liquidity risk of a bank. We use the deposit growth rate and the annual change in the deposit-to-loan ratio as $\Delta LiqRisk_{it-1}$, respectively. The deposit-to-loan ratio is considered to be not only an indicator of the ability to collect deposits but also an indicator of the liquidity position of a bank, particularly in the field of bank risk analysis (Van Greuning and Brajovic Bratanovic(2000), among others)[14]. A negative value in these variables indicates that the liquidity risk of the bank has become higher.

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[12] *Ginkokyoku Nenpo* did not provide the precise figures for total assets in the individual financial data but rather in the aggregate balance-sheet data of all banks. However, the information on the rest of the accounting items of bank assets is not significantly important from the viewpoint of analyzing the portfolio management of banks assets. Moreover, the share of the sum of these three assets (security holdings, cash assets, and loans) to precise total assets exceeded 90%, based on the figures in the aggregate balance-sheet data for 1928.

[14] See Van Greuning and Brajovic Bratanovic (2000), Chapter 8.

Taking simultaneity into account, deposit shock variables are lagged by one period based on independent variables. These variables determine the change from year t – 2 to year t – 1. X_{it-1} is a vector of other control variables. It includes the natural log of one-year-lagged total assets and year dummies. In the following analyses, we estimate these equations from 1928 to 1932 by OLS.

Before the analysis, I will consider the expected effects liquidity shocks on asset portfolios. If banks fear a future liquidity shortage due to negative deposit shocks, they are expected to liquidate their bank loans as quickly as possible. Moreover, Cooper and Ross (1998) (hereinafter, referred to as CR) and Ennis and Keister (2006) (hereinafter, referred to as EK) treat similar situations in their models. CR (1998)—expanding upon the work of Diamond and Dybvig (1983)—assume that a bank determines the allocation of liquid investments in the short term and illiquid investments in the long term, provided that a run will occur with some fixed probability. Although an illiquid investment is more productive than a liquid investment, it involves some costs when liquidated before its maturity. It is demonstrated that banks hold more liquid assets when bank runs are increasingly probable and the liquation costs of bank investments are higher. EK (2006) correct and expand upon some results proposed by CR[15] EK also demonstrate that the level of liquid assets held by banks increases with the probability of a run given a sufficiently high level of liquidation costs[16]. Generally, banks with high

[15] Cooper and Ross (1998) demonstrate that when the probability of a run is small, the bank will offer a contract that allows bank run equilibrium. In this case, the bank will hold precautionary liquidity (excess liquidity) under certain conditions. However, Ennis and Keister (2006) demonstrate that in such a contract, the bank will chose to hold only the exact amount of liquidity reserves needed to meet withdrawal demands in the event that a run does not occur. Therefore, the bank will hold excess liquidity only for the purpose of preventing a run.

[16] Ennis and Keister (2006) also demonstrate that the level of illiquid investment increased with the probability of a run when liquidation costs are small. However, in prewar Japan, markets for liquidating bank loans were inadequately established. Moreover, the average time for the maturity of a bank loan had a tendency to lengthen after the 1920s because many banks gave long-term loans to their related groups in order to rescue them from their financial crisis (Kato (1957)). Therefore, it is considered

liquidity risk are more susceptible to runs in the future than those with low liquidity risk because the depositors of the former banks greatly fear that those banks will run short of cash[17]. Therefore, according to CR and EK, banks whose liquidity risk increases due to outflows of deposits will increase the ratio of liquid assets to prepare for runs in the future. In their studies, liquid assets are considered to be directly applicable to cash assets, whereas in our model the coefficient of deposit shock is expected to be negative in equation (1) where the dependent variable is the change in the cash-asset ratio ($\Delta(C/A)_{it}$). As for securities, CR and EK do not assume such marketable assets. However, if securities are included in liquid assets as defined in their models because the prewar Japanese banks could liquidate them easily as stated above, the coefficient of deposit shock is expected to be negative in equations (2) and (3) where the dependent variable is the change in the security-asset ratio ($\Delta(S/A)$) and the liquid asset ratio ($\Delta(\frac{C+S}{A})_{it}$), respectively. However, in interpreting the estimated results, we have to further consider two points: (A) the term for the adjustment of a bank portfolio and (B) the kinds of deposit shocks.

First, the term for the adjustment of a bank portfolio (A) refers to the actual time a bank takes to adjust its financial portfolio. CR (1998) and EK (2006) are static models in that they examine the optimal ex ante portfolio allocation of a bank, given the probability of bank runs[18]. Namely, they do not analyze the details of the ex-post portfolio adjustment process in response to liquidity shocks. However, for example, when a bank is faced with a rise in its liquidity risk due to a negative deposit shock,

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that the liquidation costs of bank loans were extremely high in prewar Japan.

[17] According to the Bank of Japan (1969), most of the bank closures which were due to runs in the Showa Financial Crisis of 1927 had suffered from remarkable outflows of deposits before the occurrences of the runs.

[18] In their models with three periods (0,1, and 2), a bank is completely free to determine the allocation between a liquid and an illiquid asset at the start point of period 0, provided that a run will occur at period 1 with some fixed probability. Since their models focus on the optimal portfolio allocation at the start point of period 0, it is not necessary to consider the dynamic process of adjusting a given portfolio to optimal level.

thereby increasing its concerns regarding the potential of a bank run or an unexpected future liquidity shortage, it is impelled to adjust its bank portfolio in the short-term by immediately procuring funds. If the bank immediately liquidates its loans, this process will be accompanied by large liquidation costs. Therefore, the bank is likely to sell its securities in the short-term and gradually liquidate its loans in the long-term. In this study, a one year time frame is used for the adjustment of a bank portfolio in response to a liquidity shock. However, if one year is not long enough to produce the effects noted by CR and EK, this study's estimation will grasp the short-term adjustment of a bank portfolio—more specifically, the coefficient of deposit shock will be positive in equation (2) and not be indeterminate, in advance, in equation (3).

Second, when considering the kinds of deposit shocks that can affect the financial market, it is important to consider whether the shock is temporary or permanent. If a bank manager recognizes that a deposit withdrawal is temporary, he or she will not have an incentive to lower the ratio of illiquid assets at a high cost. Rather, he or she will adjust the liquidity of the bank's portfolio in the short term by selling securities. By contrast, if that deposit shock is permanent, a bank is expected to liquidate loans—at least gradually. It is difficult, however, to identify whether a shock is temporary or permanent. In following this line of thought, I focus on the contagious withdrawals of deposits. There is historical evidence from prewar Japan that outlines the susceptibility of banks to temporary withdrawals of deposits in the aftermath of the closures of neighboring banks (Akiyoshi(2006)). If the negative deposit shock is temporary, the sign of the coefficient of deposit shock will be positive in equation (2) and indeterminate in advance in equation (3). The kinds of deposit shocks will be further analyzed in section 5.

In selecting samples, we principally use all the banks listed in *Ginkokyoku Nenpo*, which covers all banks controlled by the Ministry of Finance. However, some banks are removed from our sample list due to the technical difficulties they imposed in the estimation. First, with respect to the continuity of data, the banks involved in a merger and acquisition (M&A) during the estimation periods are excluded from our sample. Second, data pertaining to closed banks after their closure years are removed because these banks were principally unable to adjust their portfolios during debt collection proceedings. The information on closed banks is obtained from the records provided by the BOJ (1928) and Shindo (1987)[19]. Finally, to avoid the outlier problem, the top and bottom one percent of all the observation are removed with respect to dependent variables and deposit-shock variables. Table 3 presents a summary of the statistical information corresponding to the sample banks selected in this manner.

4. Empirical Results (Baseline Estimation)

Table 4 presents the estimation results. Columns 1 and 2 report the results when the annual change in the cash-assets ratio ($\Delta(C/A)$) is employed as the dependent variable. It can be confirmed that the coefficients of deposit shock are negative in both regressions and statistically significant at the 1% level when the explanatory variable is the change in the deposit-loan ratio (column(2)). This indicates that when banks are faced with a negative shock, they tend to increase their cash-assets ratio. These results are consistent with Cooper and Ross (1998) and Ennis and Keister (2006). Therefore, it can be assumed that banks with an increased liquidity risk will secure cash in hand to prepare for a bank run or unexpected liquidity shortage. By contrast, we can confirm from columns 3 and 4, where the annual change of security-assets ratio is used as the dependent variable, that the coefficients of deposit shock are positive and statistically significant at the 1% level in both estimations. This result indicates that banks exposed to negative liquidity shocks generally decreased their security-asset ratio. Considering

[19] I obtained the data of banks that closed in 1927 from the BOJ (1928) and those that closed after 1928 from Shindo (1987).

the results from columns 1 and 2, it can be assumed that the banks faced with a rise in liquidity risk due to an outflow of their deposits attempted to deal with the situation by procuring an immediate cash through the sale of government bonds or other securities, which could be more easily sold in the financial market than bank loans. Moreover, columns 5 and 6 report the results when the annual change in the liquid asset ratio ($\Delta(\frac{C+S}{A})_{it}$) is employed as the dependent variable. It is confirmed that while the coefficient of change in the deposit growth rate is positive, that of the annual change of deposit-loan ratio is negative. Moreover, neither of the coefficients is statistically significant. Therefore, we have no strong evidence that a deposit shock had an effect on the liquid asset ratio. In other words, it can be interpreted that the banks faced with a negative liquidity shock were unable to decrease the proportion of their illiquid assets, considering the relation $\Delta(L/A)_{it} = \Delta(\frac{C+S}{A})_{it}$, by definition.

One explanation for the results in Table 4 is that our estimations captured the short-term adjustment of liquidity in a bank's portfolio. Specifically, banks exposed to negative deposit shocks attempted to increase cash holdings in the short-term to prepare for a bank run or further withdrawals of deposits by selling securities in the financial market as opposed to bank loans, which were difficult to liquidate immediately. Another explanation is that the deposit shock was temporary. If so, banks would not have an incentive to lower the ratio of illiquid assets at high costs. I explore this point further in the following section. In sum, the security market very likely performed a significant role in the liquidity adjustments of banks given a financial system operating without deposit insurance.

We can confirm that the coefficient of bank size is positive and statistically significant when the security-asset ratio or the liquid asset ratio is a dependent variable and insignificant when the cash-assets ratio is a dependent variable. Considering the significance of the coefficients of bank size when the dependent variable includes securities, it is likely that large banks tended to increase their security holdings during periods of deposit shocks. One possible interpretation of this result is that small amounts of investment might disadvantage small banks in terms of market accessibility[20].

5. Contagion Effect

In this section I explore the relationship between the kinds of deposit and banks' portfolio management. In this study, it was difficult to precisely identify a permanent deposit shock, since our data was limited to a number of time-series observations. Therefore, the focus in the following analysis will be on local financial contagion as a temporary deposit shock. When a bank failed, it occasionally induced contagiously triggered runs on the neighboring banks, although they were solvent. In such cases, the neighboring banks were likely to recognize the deposit shock was temporary because it was contagiously triggered by the failure of that particular bank. As previously described, the prewar banking industry in Japan was frequently susceptible to intensive bank runs, and a portion of these were caused by contagion (Korenaga et al. (2001); Akiyoshi (2006)). Using data from 1930 to1932, Akiyoshi (2006) investigates the effect of bank failures on the deposit growth of the neighboring banks in order to determine the contagion effect. The data confirms that the failure of a bank induced a negative effect on the deposit growth rate of the neighboring banks. This paper examines the effect of a failed bank on the portfolio choices of neighboring banks. In prewar Japan, bank failures and the runs triggered by them differed among regions

[20] According to the Bond Underwriters Association (1980), it was difficult for small investors to liquidate public bonds due to the imperfections of the secondary markets prior to World War I. However, the development of the secondary market for public bonds was gradually promoted thereafter.

(Shindo (1987))[21]. The information utilized in this study on the regional and time distribution of bank failures follows that provided by Akiyoshi (2006). Hence, we introduce dummy variables such as $CONTAGION_{jt-1}$, which equals one when other banks failed in the previous year (t – 1) within the same prefecture (j) where the headquarters of the bank was located, and zero otherwise. Since it is ambiguous in advance how quickly a bank adjusted its portfolio in response to a shock, $CONTAGION_{jt}$ is also used, which indicates that nearby banks failed in the same year (t). The information on bank failures was obtained from Shindo (1987), which provides information on the time and regional distribution of bank closures from 1927 to 1935. In the following analysis, we identify a bank closure as a failure—the closure of a bank during the prewar period was considered a failure because most of them did not reopen, according to Shindo (1987).

In the estimations, $CONTAGION_{jt}$ and $CONTAGION_{jt-1}$ are added in equations (1)–(3). Therefore, the existent variables for deposit shocks (the deposit growth rate and the change of deposit-to-loan ratio) might capture a permanent shock because a temporary shock is controlled by contagion variables.

Table 5 presents the estimation results. Panels A, B, and C report the results in the cases where $\Delta(C/A)_{it}$, $\Delta(S/A)_{it}$, and $\Delta(\frac{C+S}{A})_{it}$ are used as the dependent variables, respectively. Panel B confirms that the coefficients of $CONTAGION_{jt}$ are negative and statistically significant in all the cases, which indicates that the banks located in the prefecture where other local banks failed in the same year had sold their securities in the market. From Panel A, we can confirm the negative signs for the coefficients of $CONTAGION_{jt}$, which indicates that banks located near failed banks suffered from a decrease in cash assets. However, these coefficients are statistically insignificant.

[21]According to the data of Shindo (1987), while numerous bank closures occurred in the Chubu and Tohoku areas, they rarely closed in Chugoku during the sample periods.

Therefore, we can assume that the decrease in the cash ratio due to the local contagion effect was partially offset by the increase in cash derived by selling securities in the financial market. This short-term adjustment in a bank's portfolio is consistent with our conjecture. Moreover, in Panel C, the negative sign for the coefficient of $CONTAGION_{jt}$ indicates that the banks located in a neighborhood containing other failed banks generally decreased their liquid asset ratio; therefore, the portfolio of these banks became more illiquid—at least temporarily.

We now focus on the effect of the one-year-lagged contagion, $CONTAGION_{jt-1}$. This coefficient is positive in all the specifications listed in Table 5. These results likely correspond to a reaction against the decrease in liquidity of a bank's portfolio due to the contagious effects produced by the failures of other local banks in the previous year. For instance, Panel B illustrates that the security-asset ratio, which dropped remarkably in the year when other local banks failed, reacted significantly in the following year. However, it is noteworthy that the magnitude of the coefficient for $CONTAGION_{jt}$ is larger than that of $CONTAGION_{jt-1}$ in all the regressions. Therefore, a bank situated within a neighborhood of failed banks could not completely return liquid assets to their previous levels within one year's time. Nonetheless, banks susceptible to temporary deposit shocks adjusted the liquidity of their portfolio not by liquidating bank loans at a high cost, but by selling securities in the market at a low cost.

Furthermore, after containing the temporary deposit shock, the coefficients on the existent variables of deposit shock ($dlnD_{it-1}$ and $d(D/L)_{it-1}$) are not greatly changed compared to those in Table 4 (Baseline Estimation). Specifically, banks exposed to negative deposit shocks did not generally decrease the ratio of illiquid assets in their portfolio. An explanation for this result could be that one year is an insufficient amount of time to grasp a permanent deposit shock. Anyway, the estimated results in Table 5 suggest that the security market in prewar Japan exercised a significant role in the adjustment of liquidity in bank portfolios during periods of financial crisis.

6. LLR and Portfolio Management

It is important to examine the role of the central bank as the lender of last resort. The LLR exercises the role of provider to banks during times of temporary liquidity shortages (Bagehot (1873); Bordo (1990); and others))[22]. Therefore, this can affect the portfolio management of banks because as these relief loans are expected during a financial crisis, they relieve a bank's need to increase the liquidity of their portfolios in excess. Franck and Krausz (2007) theoretically demonstrate that given the assured support of the LLR, a bank will hold a lower amount of cash than when the LLR's support is lacking, unless the LLR's lending rate is not so high. Moreover, the bank can survive against stochastic early withdrawals with a higher probability, in the former case. Although the model of these authors cannot be directly applied to this analysis, it is considered to imply that the LLR can play a role of the guarantee to mitigate the restrictions on the liquidity management of private banks[23]. As described in section 2, in prewar Japan, the Bank of Japan actively exercised the role of the LLR by providing special loans during periods of financial crisis. Moreover, they generally provided their LLR loans to banks with which they had an established transactional relationship (Ishi (1980); Shiratori (2003); Okazaki (2007)). According to Okazaki (2007), 95% of the special loans, based on the Bank of Japan Special Loan and Loss Compensation Law

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[22] The LLR has been discussed and analyzed in much literature since Bagehot (1873). Many researchers considered that the central bank should provide loans to illiquid but solvent banks in order to prevent bank panics. On the other hand, the associated moral hazard problem occurred because it was difficult for the central bank to identify between solvent and insolvent banks (Goodhart, 1985).

[23] Franck and Krausz (2007) focus on the ex ante optimal portfolio allocation of a bank, given the proportion of early withdrawals. Specifically, they do not analyze the details of the process of a bank's adjusting its portfolio to the optimal level, in response to a liquidity shock.

passed in 1927, were provided to banks already had transactional relationships with the BOJ. By contrast, only approximately 20% of banks had transactional relationships with the BOJ in the late 1920s (Ito (2003); Okazaki (2007)). Therefore, we can assume that the other banks which had no transactional relationships with the BOJ could not have an ex ante expectation to receive the LLR loans in the case of a liquidity crisis. This study will analyze the difference between the correspondent banks and the non-correspondent banks of the BOJ to examine the effects of the presence of the LLR on bank portfolio management.

Okazaki (2007) empirically investigates the role of the LLR using data on the transactional relationships between the BOJ and private banks. Performance is compared between the BOJ's correspondent banks and their non-correspondent banks. Following Okazaki (2007), I identified banks which had transactional relationships with the BOJ. Okazaki (2007) used the *Nihon Ginko Enkakushi* (The History of the BOJ) which includes comprehensive records of the individual transactional relationships between the BOJ and private banks, and constructed a database listing this information annually for the years 1925 to 1931[24]. I constructed a similar database to identify the banks which had transactional relationships with the BOJ by the end of each year for the years 1927–1931, which are one-year lagged to our estimation periods[25]. In the following analysis, I categorize these sample banks as BOJ correspondent banks and the non-correspondent, and conduct the same regressions as the baseline estimations in Table 4 for each group.

It is natural to expect that the banks having transactional relationships with the BOJ are less sensitive to liquidity shocks in adjusting the liquidity of their portfolios than the non correspondent banks of the BOJ because the former need not hold excess

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[24] This source is discussed in detail in Okazaki(2007).

[25] In the estimation, the portfolio adjustment from year t – 1 to year t has been focused. Hence, it is important whether a bank had a transactional relationship with the BOJ in year t – 1 (previous year).

cash under the guarantee of LLR loans from the BOJ, which represents the *guarantee effect*. As confirmed in the baseline estimation (Table 4), the coefficient of the deposit shock is negative when the cash-asset ratio is used as the dependent variable and the coefficient is positive when the security-asset ratio is used as the dependent variable. Therefore, it is expected that the magnitudes of these coefficients are larger for the non-correspondent banks and smaller for the correspondent banks of the BOJ, due to the guarantee effect associated with the LLR loans. Additionally, the *direct effect*—caused by an increase in a bank's cash holdings through the LLR loans provided by the BOJ during a liquidity shortage—must be considered. This direct effect is considered to strengthen the negative correlation between the deposit shock variable and the change of the cash-asset ratio in the correspondent banks of the BOJ. That is, this effect is expected to be opposite to that of the guarantee effect when the dependent variable is the change of cash-asset ratio. While controlling the direct effect requires the data on individual LLR loans from the BOJ to private banks, the availability of this data is extremely limited[26]. Therefore, we should be cautious when interpreting the coefficient of deposit shock by keeping both the guarantee and the direct effect in mind especially when the change of the cash-assets ratio ($\Delta(C/A)$) is the dependent variable.

The estimation results are reported in Table 6. Panels A and B indicate those for the BOJ correspondent banks and the non-correspondent banks of the BOJ, respectively. It is confirmed by columns 3 and 4—where the dependent variable is the annual change in the security-asset ratio—that all of the coefficients of deposit shocks are positive in both Panel A and Panel B. The coefficients for the non-correspondent banks are statistically significant in both specifications. However, the magnitude of the

[26] The data on individual special loans can be obtained from *Nihon Ginko Enkakushi* Vol3.-6(The History of the BOJ). However, this source only includes data on loans based on the Bank of Japan Special Loan and Compensation Law of 1927. Furthermore, the BOJ started giving these loans in May 1927 and stopped it in May 1928 (Okazaki (2007)).

coefficients for the correspondent banks of the BOJ (Panel A) is equal to, or larger than that for the non-correspondent banks (Panel B). We are unable to acquire evidence indicating that the correspondent banks of the BOJ would less actively conduct the short-term adjustment of their portfolio liquidity in the security market, compared to the non-correspondent banks. Therefore, the guarantee effect by the LLR is rejected.

The estimated results of the effects on the change of the cash-asset ratio are presented in columns 1 and 2. All of the coefficients of deposit shock variables are negative in both Panel A and Panel B, and the magnitude of the coefficients for the correspondent banks of the BOJ is larger than that for the non-correspondent banks, which indicates that the BOJ correspondent banks increased more cash holdings against a deposit shock than the non-correspondent banks. While these results are inconsistent with the guarantee effect of the LLR loans, they are consistent with the direct effect of the LLR loans. However, caution is advised when interpreting these results—at least in column 2 which uses $\Delta(D/L)_{it-1}$ as a deposit shock variable—because as illustrated in column 4, the effect of $\Delta(D/L)_{it-1}$ on the security-asset ratio is stronger in the correspondent banks of the BOJ than that in the non-correspondent banks. Namely, since the BOJ's correspondent banks more actively sold securities in the financial market than the non-correspondent banks, the former consequently increased their cash-assets ratio more than the latter in response to a negative deposit shock. Interestingly, the difference between the values of the coefficients for the correspondent banks (Panel A) and the non-correspondent banks (Panel B) in column 2 (0.0411 – 0.028 = 0.0131) is quite similar to the difference in the values in column 4 (0.0352 – 0.0228 = 0.0124). On the other hand, in column 1, the difference in the values of the coefficients for the ΔlnD_{it-1} between the BOJ's correspondent banks (Panel A) and their non-correspondent banks (Panel B) may reflect the direct effect of the LLR loans. However, both of the coefficients are statistically insignificant. Anyway, the guarantee effect of the LLR loans from the BOJ is here also strongly rejected.

The results of columns 5 and 6 correspond to those where the dependent variable is the change of the liquid asset ratio ($\Delta(\frac{C+S}{A})_{it}$). In column 5, it is found that the coefficient of the deposit growth rate (ΔlnD_{it-1}) in the non-correspondent banks (Panel B) is positive and statistically significant, while that in the correspondent banks is not different from zero. These results suggest that the BOJ correspondent banks could neutralize the deposit shock while the non-correspondent banks could not and consequently decreased their proportion of liquid assets in response to the negative deposit shock. Therefore, they were considered to reflect the direct effect in that the LLR loans from the BOJ increased the liquidity of private banks, given that the guarantee effect had been strongly rejected.

In sum, there is no evidence that the BOJ correspondent banks were less sensitive to the liquidity shocks due to the guarantee of the LLR loans. On the other hand, we can confirm the partial evidence that the LLR loans from the BOJ enabled the correspondent banks to neutralize the deposit shock.

One explanation for the lack of evidence in support of the guarantee effect is that the LLR loans from the BOJ were very expensive. Shiratori (2003), who conducted historical analyses on the behavior of the BOJ as the LLR, pointed out that the BOJ gave special loans to its correspondent banks at high interest rates as an incentive to immediately repay these outstanding debts. Therefore, it can be inferred that the expected cost of borrowing the LLR loans from the BOJ exceeded that of liquidating securities in the financial market. Anyway, private banks in prewar Japan adjusted the liquidity of their portfolios during financial crises mainly through the security markets, even in the presence of the LLR loans from the BOJ.

Conclusion

This study empirically examined the portfolio management of the banking industry in response to a liquidity risk during the interwar years in Japan where deposit insurance schemes were inexistent. Concretely, we analyzed the effect of a deposit shock on the liquidity of bank portfolios. Regression analyses confirmed the negative effect of a deposit shock on the cash-asset ratio and the positive effect on the security-asset ratio, which suggested that banks faced with a rise in their liquidity risk increased their cash holdings by selling securities in the financial market. By contrast, it could not be confirmed that such banks decreased their ratio of illiquid assets (bank loans) in response to imminent bank runs or drastic withdrawals of deposits. Furthermore, this paper examined the effect of local financial contagion on bank portfolios to capture the effect of a temporary deposit shock. Consequently, the banks susceptible to the local contagion adjusted the liquidity of their portfolios by actively selling and buying their securities in the financial market. The effect of the central bank as the LLR on the liquidity adjustments in a bank's portfolio was also examined. However, there was no evidence indicating that the existence of the LLR mitigated the liquidity constraints in bank portfolio adjustments (guarantee effect). From these results, it is safe to say that the security market exercised a significant role in the short-term adjustment of liquidity in bank portfolios in a system without deposit insurance schemes. In other words, the security market acted as a buffer against a banking crisis when deposit insurance schemes were lacking. These results are consistent with Franck and Krausz (2007) who state that security markets are more significant for the liquidity of banks than the LLR. Moreover, these results are considered to have important implications in the design of financial safety nets. For instance, while policy makers have recently demonstrated an interest in creating a financial safety net in which the discipline of depositors functions efficiently, this paper suggests that the development or the reform of the security market should be simultaneously dealt with, in particular with respect to those countries with underdeveloped financial infrastructures. Finally, this paper does not determine the long term effect of a deposit shock on a bank portfolio. It would be interesting to know whether banks exposed to negative deposit shocks decrease their ratio of illiquid assets such as loans, in the long run. This remains an aim of future research.

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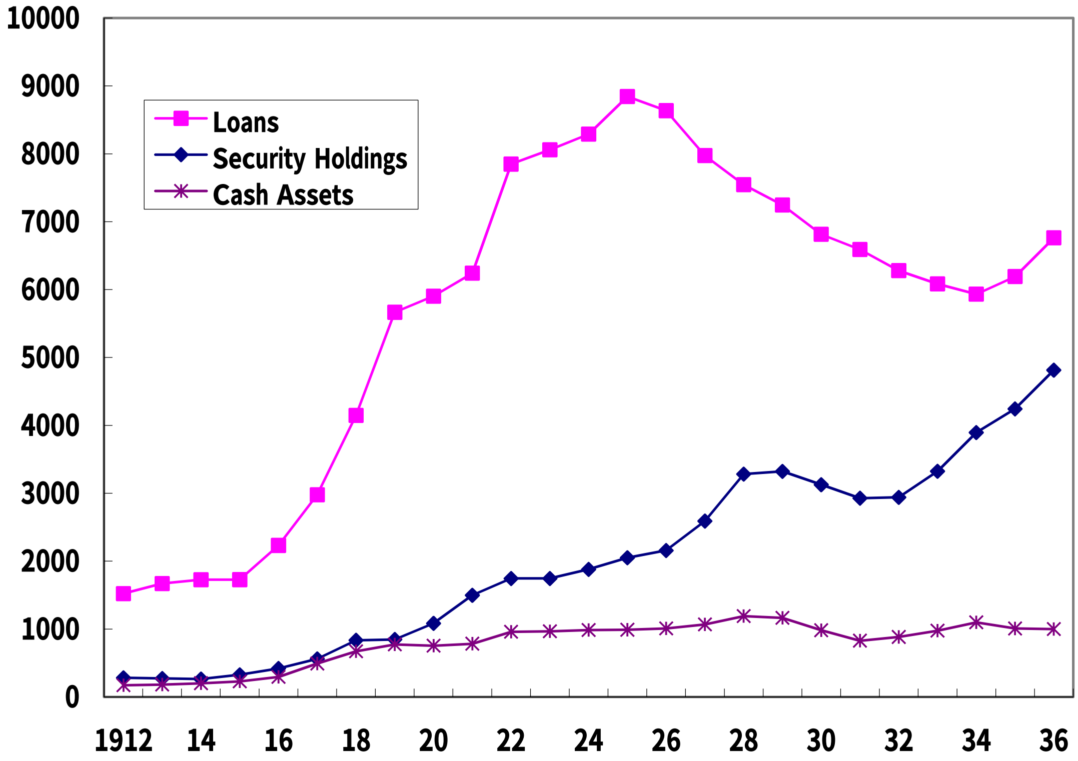
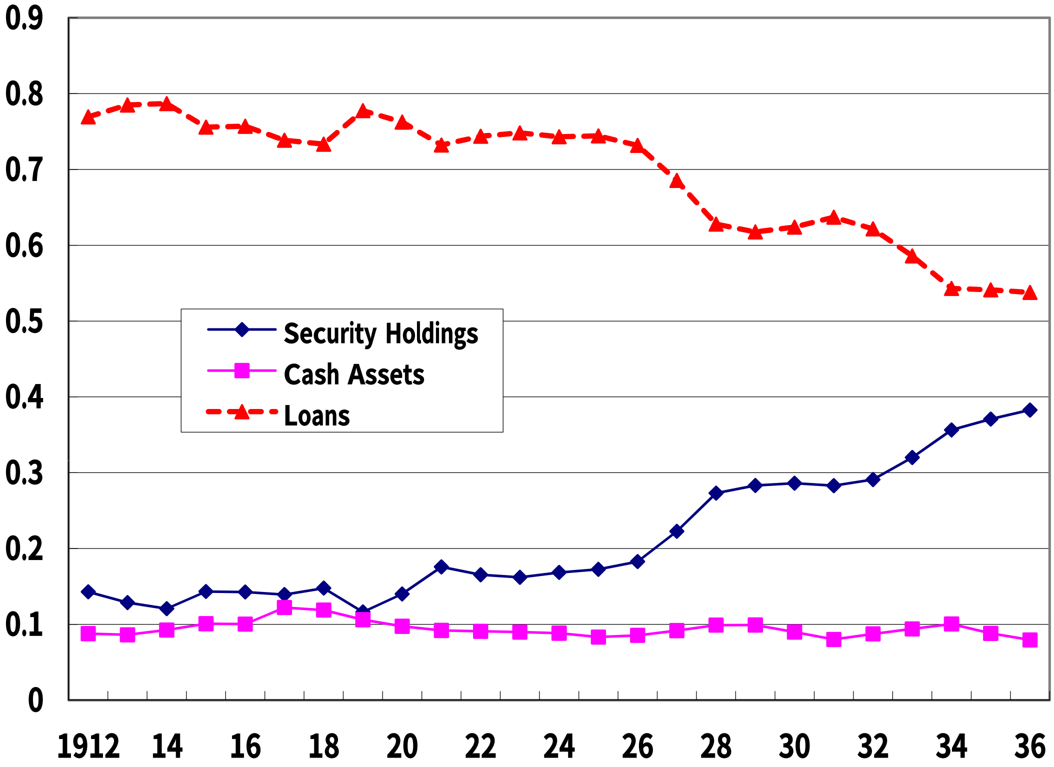
Fig.1. Bank portfolio during the 1910s-1930s (outstanding)



Sorce：Goto(1970) and Bank of Japan(1967)

Fig.2. Propotion of bank portfolio during the 1910s-1930s



Sorce：Goto(1970) and Bank of Japan(1967)

Table1 Liquidity Shocks in Japanese Banking Industry During Prewar Periods

year	All banks	Ordinary banks	Closed banks	Closure rate	Deposit growth rate	Postal saving growth rate	Total loans by the BOJ (outstanding)	Special loans (outstanding
1920	1987	1326	n.a.	-	1.4%	19.5%	158.6	-
1921	1967	1331	n.a.	-	10.6%	1.8%	298.0	-
1922	1945	1799	16	0.81%	21.0%	10.4%	344.1	-
1923	1840	1701	18	0.93%	0.1%	13.8%	641.3	133.5
1924	1765	1629	13	0.71%	3.7%	-0.1%	523.7	144.8
1925	1670	1537	9	0.51%	7.8%	3.2%	463.9	148.0
1926	1544	1420	8	0.48%	5.2%	7.4%	517.9	159.0
1927	1396	1283	44	2.85%	-1.6%	30.5%	815.2	402.9
1928	1131	1031	20	1.43%	3.4%	13.9%	761.1	649.4
1929	976	881	8	0.71%	-0.4%	18.1%	649.6	598.1
1930	872	782	27	2.77%	-6.0%	13.4%	688.4	585.4
1931	771	683	71	8.14%	-5.4%	12.8%	882.7	575.7
1932	625	538	20	2.59%	0.6%	-1.6%	632.0	565.6
1933	601	516	3	0.48%	6.0%	5.3%	707.0	552.4
1934	563	484	0	0.00%	7.1%	5.0%	712.8	529.8
1935	545	466	2	0.36%	5.4%	5.5%	661.6	498.1

Source: Goto(1970),and the Bank of Japan(1969)

Table2 Composition of Security Holdings in the Prewar Japanese Banking Industry

Year	Government Bonds	Local Government	Corporate Bonds	Stocks	Foreign Securities
1927	42.5%	12.8%	28.1%	15.4%	1.2%
1928	45.3%	9.7%	31.3%	12.8%	0.9%
1929	43.3%	9.4%	34.6%	11.8%	0.9%
1930	42.0%	9.9%	36.4%	10.6%	1.1%
1931	42.2%	11.1%	34.1%	11.2%	1.4%
1932	41.1%	9.6%	38.2%	10.3%	0.8%
1933	47.1%	8.5%	33.0%	10.3%	1.1%
1934	51.8%	7.9%	29.5%	9.8%	1.0%
1935	52.0%	8.2%	28.3%	9.7%	1.8%

Source: Ginkokyoku Nenpo various issues

Table3 Basic Statistics

	NOB	Median	Mean	Std.dev.	Min	Max
d(S/L)	2710	0.002	0.006	0.035	-0.157	0.178
d(C/A)	2710	0.000	0.003	0.048	-0.165	0.200
d((S+C)/A)	2710	0.006	0.009	0.054	-0.160	0.208
dlnD	2710	-0.023	-0.043	0.161	-0.905	0.519
d(D/L)	2710	0.008	0.018	0.134	-0.549	0.774
SIZE	2710	14.302	14.426	1.463	9.927	20.511

Table4 Baseline Regression

	Dependent Variables					
	d(C/A)	d(C/A)	d(S/A)	d(S/A)	d((C+S)/A)	d((C+S)/A)
	[1]	[2]	[3]	[4]	[5]	[6]
$dlnD_{t-1}$	-0.0051		0.0165 a		0.0114	
	(0.0061)		(0.0042)		(0.007)	
$d(D/L)_{t-1}$		-0.0306 a		0.0273 a		-0.0033
		(0.0081)		(0.0063)		(0.0089)
SIZE	-0.0006	-0.0003	0.0019 a	0.0018 a	0.0013 c	0.0015 b
	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0007)	(0.0007)
year1929	-0.0168 a	-0.0157 a	-0.0004	-0.0006	-0.0172 a	-0.0163 a
	(0.0027)	(0.0027)	(0.0019)	(0.0019)	(0.003)	(0.003)
year1930	-0.0374 a	-0.037 a	-0.0075 a	-0.0076 a	-0.045 a	-0.0446 a
	(0.0027)	(0.0027)	(0.0021)	(0.0021)	(0.0031)	(0.0031)
year1931	-0.0314 a	-0.033 a	-0.0065 a	-0.0059 a	-0.0379 a	-0.0389 a
	(0.0027)	(0.0027)	(0.0021)	(0.002)	(0.003)	(0.003)
year1932	-0.0116 a	-0.0134 a	-0.0121 a	-0.0111 a	-0.0237 a	-0.0245 a
	(0.0028)	(0.0029)	(0.0023)	(0.0023)	(0.0032)	(0.0032)
constant	0.0301 a	0.0267 a	-0.0158 b	-0.0164 b	0.0143	0.0103
	(0.0085)	(0.0083)	(0.0072)	(0.0071)	(0.0098)	(0.0097)
R^2	0.0907	0.0972	0.0275	0.0322	0.0997	0.0987
NOB	2710	2710	2710	2710	2710	2710

Notes:
Significance at 1%,5% and 10% level are denoted by "a" "b" and "c".
The figures in parentheses are standard errors.

Table5 Financial Contagion and Portfolio management

Panel A: d(C/A)

	[1]	[2]	[3]	[4]	[5]
Contagion(t)	-0.0029		-0.0031	-0.0031	-0.0029
	(0.0019)		(0.002)	(0.002)	(0.002)
Contagion(t-1)		0.0006	0.0011	0.0009	0.0007
		(0.0019)	(0.002)	(0.002)	(0.002)
$dlnD_{t-1}$				-0.005	
				(0.0061)	
$d(D/L)_{t-1}$					-0.0304 a
					(0.0081)
SIZE	-0.0007	-0.0007	-0.0008	-0.0007	-0.0004
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
constant	0.0327 a	0.0314 a	0.0324 a	-0.0114 a	-0.0132 a
	(0.0084)	(0.0083)	(0.0084)	(0.0028)	(0.0029)
R2	0.0911	0.0905	0.0913	0.0915	0.0979
NOB	2710	2710	2710	2710	2710

Panel B: d(S/A)

	[1]	[2]	[3]	[4]	[5]
Contagion(t)	-0.0042 a		-0.0046 a	-0.0046 a	-0.0047 a
	(0.0015)		(0.0015)	(0.0015)	(0.0015)
Contagion(t-1)		0.0016	0.0024 c	0.003 b	0.0027 c
		(0.0014)	(0.0014)	(0.00149	(0.0014)
$dlnD_{t-1}$				0.0173 a	
				(0.0042)	
$d(D/L)_{t-1}$					0.0278 a
					(0.0063)
SIZE	0.0021 a	0.0022 a	0.0021 a	0.0018 a	0.0018 a
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
constant	-0.0192 a	-0.0213 a	-0.0199 a	-0.0117 a	-0.0106 a
	(0.0071)	(0.0071)	(0.0072)	(0.0023)	(0.0023)
R2	0.0251	0.0227	0.026	0.0316	0.0363
NOB	2710	2710	2710	2710	2710

Panel C: d((S+C)/A)

	[1]	[2]	[3]	[4]	[5]
Contagion(t)	-0.007 a		-0.0077 a	-0.0077 a	-0.0076 a
	(0.0022)		(0.0022)	(0.0022)	(0.0022)
Contagion(t-1)		0.0022	0.0035	0.0039 c	0.0034
		(0.0021)	(0.0022)	(0.0022)	(0.0022)
$dlnD_{t-1}$				0.0123 c	
				(0.007)	
$d(D/L)_{t-1}$					-0.0026
					(0.0088)
SIZE	0.0014 b	0.0014 b	0.0014 b	0.0011 c	0.0014 b
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
constant	0.0135	0.0101	0.0125	-0.0231 a	-0.0239 a
	(0.00989	(0.0097)	(0.0098)	(0.0032)	(0.0032)
R2	0.102	0.099	0.1029	0.1041	0.1029
NOB	2710	2710	2710	2710	2710

Notes:

Significance at 1%,5% and 10% level are denoted by "a" "b" and "c".

The figures in parentheses are standard errors.

Table6 LLR and Portfolio management

Panel A: The BOJ correspondent banks

	Dependent Variables					
	d(C/A)	d(C/A)	d(S/A)	d(S/A)	d((C+S)/A)	d((C+S)/A)
	[1]	[2]	[3]	[4]	[5]	[6]
$dlnD_{t-1}$	-0.0174		0.0181		0.0007	
	(0.0164)		(0.0153)		(0.0183)	
$d(D/L)_{t-1}$		-0.0411 b		0.0352 b		-0.0059
		(0.0164)		(0.0161)		(0.0172)
SIZE	-0.0002	0	-0.0005	-0.0006	-0.0007	-0.0006
	(0.0014)	(0.0014)	(0.0013)	(0.0013)	(0.0016)	(0.0016)
constant	0.0124	0.0126	0.0365 c	0.0357 c	0.0489 c	0.0483 c
	(0.0231)	(0.0223)	(0.0209)	(0.0206)	(0.0258)	(0.0256)
R2	0.0544	0.0679	0.0812	0.0893	0.1179	0.1181
NOB	529	529	529	529	529	529

Panel B: The non-correspondent banks of the BOJ

	Dependent Variables					
	d(C/A)	d(C/A)	d(S/A)	d(S/A)	d((C+S)/A)	d((C+S)/A)
	[1]	[2]	[3]	[4]	[5]	[6]
$dlnD_{t-1}$	-0.0031		0.0158 a		0.0127 c	
	(0.0066)		(0.0041)		(0.0076)	
$d(D/L)_{t-1}$		-0.028 a		0.0228 a		-0.0053
		(0.0093)		(0.0068)		(0.0102)
SIZE	-0.0007	-0.0003	0.0023 a	0.0024 a	0.0017	0.0021 b
	(0.0009)	(0.0009)	(0.0006)	(0.0006)	(0.001)	(0.001)
constant	0.0322 b	0.0281 b	-0.0244 a	-0.0268 a	0.0079	0.0013
	(0.0132)	(0.013)	(0.0087)	(0.0086)	(0.0147)	(0.0145)
R2	0.099	0.1041	0.0234	0.0254	0.1021	0.1009
NOB	2181	2181	2181	2181	2181	2181

Notes:

Significance at 1%,5% and 10% level are denoted by "a" "b" and "c".

The figures in parentheses are standard errors.