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Abstract

The interwar Japanese economy was unsettled by chronic banking instability, and yet the Bank of Japan (BOJ) restricted access to its liquidity provision to a select group of banks, i.e. BOJ correspondent banks, rather than making its loans widely available "to merchants, to minor bankers, to this man and to that man" as prescribed by Bagehot (1873). This historical episode provides us with a quasi-experimental setting to study the impact of Lender of Last Resort (LOLR) policies on financial intermediation. We find that the growth rate of deposits and loans was notably faster for BOJ correspondent banks than the other banks during the bank panic phase of the Great Depression from 1931-1932, whereas it was not faster before the bank panic phase. Furthermore, BOJ correspondent banks were less likely to be closed during the bank panics. To address possible selection bias, we also instrument a bank's corresponding relationship with the BOJ with its geographical proximity to the nearest branch or the headquarters of the BOJ, which was a major determinant of a bank's transaction relationship with the BOJ at the time. This instrumental variable specification yields qualitatively same results. Taken together, Japan's historical experience suggests that central banks' liquidity provisions play an important backstop role in supporting the essential financial intermediation services in time of financial stringency.

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The Effects of Lender of Last Resort on Financial Intermediation during the Great Depression in Japan[#]

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Abstract

The interwar Japanese economy was unsettled by chronic banking instability, and yet the Bank of Japan (BOJ) restricted access to its liquidity provision to a select group of banks, i.e. BOJ correspondent banks, rather than making its loans widely available "to merchants, to minor bankers, to this man and to that man" as prescribed by Bagehot (1873). This historical episode provides us with a quasi-experimental setting to study the impact of Lender of Last Resort (LOLR) policies on financial intermediation. We find that the growth rate of deposits and loans was notably faster for BOJ correspondent banks than the other banks during the bank panic phase of the Great Depression from 1931-1932, whereas it was not faster before the bank panic phase. Furthermore, BOJ correspondent banks were less likely to be closed during the bank panics. To address possible selection bias, we also instrument a bank's corresponding relationship with the BOJ with its geographical proximity to the nearest branch or the headquarters of the BOJ, which was a major determinant of a bank's transaction relationship with the BOJ at the time. This instrumental variable specification yields qualitatively same results. Taken together, Japan's historical experience suggests that central banks' liquidity provisions play an important backstop role in supporting the essential financial intermediation services in time of financial stringency.

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1. Introduction

Banks issue liquid liabilities (demand deposits) while holding illiquid assets (loans). This maturity mismatch is of little concern to banks (or bank regulators) as long as deposit withdrawals are not strongly correlated with one another and thus are predictable in aggregate. However, it is widely recognized from the theoretical perspective of Diamond and Dybvig (1983) that a self-fulfilling bank run can develop as a sunspot equilibrium if depositors fear that the other depositors would run on their bank. In this scenario, even when their financial fundamentals are sound to begin with, banks will be forced to liquidate illiquid assets at deep discount to meet rapid deposit withdrawals. This socially inefficient outcome can be avoided if a central bank is committed to supply liquidity to illiquid banks. This notion that a central bank should act as the Lender of Last Resort (LOLR) to accommodate a sharp increase in liquidity demand dates back to the 19th century with the seminal work of Thornton (1802) and Bagohet (1873). Both works recognize that the central bank's liquidity provision, if credible, can ease depositors' concern about a potential run on their banks and eliminate their incentive to withdraw en masse.[1]

A number of well-known historical episodes highlight the economic importance of the LOLR. For example, the Bank of England (BOE) played a pivotal role as the LOLR when it led a consortium of major banks in an effort to form a guarantee fund and rescue the Barings Bank in November of 1890, decisively and successfully. Many contemporary observers, as well as today's financial historians, acknowledge that the BOE's policy initiative was instrumental in averting what could have been a full-blown liquidity crisis, given the centrality of the Barings Bank in the financial system (Bordo, 1990). In contrast, according to Friedman and Schwartz (1963) and Bernanke (1983), the Federal Reserve failed to act as the effective LOLR during the Great

[1] See Goodhart (1999), Grossman and Rockoff (2015), Humphrey (1989) for more comprehensive review of the intellectual history of the LOLR.

Depression, leading to a large number of bank failures and a rapid fall in money supply, financial intermediation services, and economic activities. Historical lessons from these episodes continue to be important for monetary authorities today.

While the aforementioned financial history episodes might be highly informative, systematic econometric studies of the LOLR's effectiveness as a backstop for supporting the essential financial intermediation service are still limited to date. It is an elusive topic to tackle because central banks do not give out loans banks in a random fashion. More likely than not, a central bank's liquidity provision is utilized by weak banks (or weak banking systems) whose asset quality is questioned by investors. Even if we observe a rapid decline in bank loans or deposits in spite of aggressive central bank lending, we cannot conclude credibly about the effectiveness of central bank lending, as we do not have a relevant counter-factual of what bank balance sheet would look like in the absence of aggressive central bank lending. That is, the efficacy of the LOLR cannot be evaluated based only on the presence of (or the lack thereof) statistical correlation between financial intermediation activities and the central bank's liquidity support.

In the present paper, we attempt to examine whether LOLR policies mitigate financial contraction using our institutional knowledge of how the Bank of Japan (BOJ) executed its LOLR policy during the Great Depression. The BOJ extensively provided liquidity as the LOLR to stabilize the financial system in the interwar period.[2] LOLR loans from the BOJ were called "Special Loans," which are classified into two categories. The first category was the loans according to the three special laws, i.e. the Loss Compensation due to Earthquake Bill Discount

[2] Even prior to the interwar period, the BOJ shows its willingness to smooth out financial market fluctuations. For example, Tamaki (1995) documents that, when Japan's stock market collapsed in 1890 due to bad rice harvest, the BOJ promptly injected liquidity into the banking system in order to prevent a large scale financial panic. Interestingly, Fukuda and Shao (1992) show that the BOJ supplied reserves in a manner to smooth seasonal fluctuation in interest rate as far back as in 1885, as done by the Federal Reserve after 1913 (Miron, 1983).

Act (1923), the Bank of Japan Special Loan and Loss Compensation Law (1927), and Loan to the Taiwan Bank Law (1927). These laws prescribed that the government should cover the losses of the BOJ due to the special loans up to certain amounts[3]. The second catogery was emergency loans provided at the discretion of the BOJ. Special loans contrast with normal BOJ loans as the former was based on the special laws which granted the BOJ the permission to circumvent the due process and conditions that it would normally have to meet with normal loans (which were made typically through discount of bills). For Special Loans, various channels were used, including loans on deeds, fixed term loans and suspense payments. Also, for Special Loans, the constraint for the acceptable collaterals was relaxed (Ito 2003, pp.171-172; Okazaki 2007, p.662).

In principle, Special Loans could be provided to those banks that did not have transaction relationships with the BOJ, but in practice, most of the loans were given to the BOJ correspondent banks (Ishii, 1980, Okazaki, 2007, Shiratori, 2003). According to the Bank of Japan Special Loan and Loss Compensation Law (1927), 95% of them were provided to the BOJ correspondent banks (Ishii 1980, pp.163-166; Okazaki 2007, p.663). It indicates that transaction relationships with the BOJ gave these banks substantially better access to the BOJ's liquidity. Even during the period of general financial tightness in the interwar period, the BOJ gave preferential access to its liquidity facility to only 20% of banks[4].

[3] The Loss Compensation due to Earthquake Bill Discount Act (1923), the Bank of Japan Special Loan and Loss Compensation Law (1927), and Loan to the Taiwan Bank Law (1927) prescribed that the government should compensate the loss of the BOJ due to the special loans up to one hundred million yen, five hundred million yen and two hundred million yen, respectively (Bank of Japan 1983, p.87, 249, and 253).

[4] The BOJ's selective approach is due to its concerns about external drains and, perhaps more importantly, the risk of moral hazard problem that more liberal LOLR policy could have created (Okazaki, 2007, Ishii, 1980). Okazaki (2007) compared the attributes of the BOJ correspondent banks and the non-correspondent banks. While the percentage of the former was 24.6% in terms of number, their shares of deposit and loans were 89.4% and 85.8%, respectively in 1931,which means the former was more than three times larger on average. The BOJ correspondent banks were equally distributed in urban and non-urban prefectures, but there were more BOJ correspondent banks in the prefectures where the headquarters or branches of the BOJ were located. In addition to these attributes, Okazaki (2007) found that the BOJ correspondent banks had higher return on asset and higher equity ratio, by regression analysis.

The BOJ's lending policy gives a quasi-experimental setting which we exploit to assess the impacts of differential access to the BOJ's liquidity provision on loan and deposit growth at the bank-level. To be more specific, we compare the loan and deposit growth of these "BOJ correspondent banks" with that of the other banks, while controlling for a host of relevant financial and economic factors. For this purpose, we put together the bank-level data on the pre-existing transactions relationships with the BOJ, the bank balance sheet data, and the prefecture-level and city/town-level data on local economic conditions from 1928-1932. The privileged group of banks, BOJ correspondent banks, had much better access to the BOJ's loans; therefore, we expect that these banks must have been better able to withstand bank runs and to continue to provide the essential financial intermediation services during the Great Depression.

We also aim to better understand Japan's experience with the Great Depression and the resultant financial contraction. For the Japanese economy, the Great Depression started with the official announcement by the Minister of Finance, on November 21, 1929, that Japan would return to the gold standard. Nonetheless, Japan's macroeconomic condition was rather weak even before the crisis period. When the administration shifted from the Rikken Seiyukai (Friends of Constitutional Government Party) to the Minseito (Constitutional Party) in July 1929, the government began to cut the budget and the BOJ kept the interest rate high in order to prepare for the return to the gold standard (Patrick, 1972; Bank of Japan 1983, pp.382-383; Metzler, 2006; Grossman and Imai, 2009).[5] As the world economy collapsed in the ensuing years, the demand for Japan's exports declined, rapidly. In particular, Japan's silk reeling industry, which was the major export industry of Japan and depended heavily on exports to the United States market, suffered greatly from the global economic downturn. Consistent with the gold standard view of the Great

[5] Minseito had long supported the restoration of the gold standard at the prewar parity while Seiyukai opposed it.

Depression (Temin,1989, Eichengreen, 1992), Japan's output declined rapidly along with those of the other countries whose currencies were tied to gold, and yet it began to turn the corner soon after the announcement that Japan would go off gold in December 1931, just after the return of the administration from Minseito to Seiyukai (Cha, 2003, Shibamoto and Shizume, 2014, Nanto and Takagi, 1985). The Great Depression ended up being relatively brief in Japan compared to the other countries which continued to adhere to the gold standard well past 1931.

Nonetheless, negative economic shocks continued to threaten the stability of Japan's banking system and led to a series of bank panics from 1931-1932. Banks in rural areas had been suffering from prolonged outflow of deposits and deteriorated profitability of loans. To make matters worse, a severe famine occurred in the fall of 1931, aggravating the economy in Tohoku area, which is located in the northern part of Japan. Not only did it trigger contagious runs on banks in Tohoku, but also it gradually spread to the southern part of Japan. A major bank panic struck the city of Nagoya in Aichi prefecture in December 1931, leading to a wave of bank failures in the region until March 1932 (Bank of Japan, 1969)[6]. Furthermore, when the world price of raw silk plummeted, many banks whose borrowers operated in the silk reeling industry failed (Adachi, 2004; Ito, 1975). In the end, 112 ordinary banks (over 12% of ordinary banks) failed from 1931-1932 (Akiyoshi, 2009). Hence, the banking instability that started in the fall of 1931 persisted into 1932 even after Japan's departure from the gold standard. Although there are several papers that examine the microeconomic aspect of banking instability during the inter-war Japan (e.g., Okazaki

[6]The Aichi Nosho and its affiliates, Nosho Saving banks, closed down in December 1931, which deteriorated depositor confidence and triggered runs on many other banks in Aichi. Furthermore, more severe bank panic occurred in early 1932 in Aichi prefecture due to the closures of two large banks, Murase Bank and Meiji Bank, which had weakened especially since the closure of Aichi Nosho bank. The closures of the two banks fomented anxiety of depositors and triggered contagious runs on banks all around Aichi prefecture. Furthermore, it spilled over to neighboring prefectures such as Mie and Sizuoka. The Nagoya branch of the BOJ extended special loans to correspondent banks and in some cases even to non-correspondent banks as an extraordinary measure. The bank panic lasted until the end of March 1932.

et al., 2005; Sawada, 2010; Yabushita and Inoue, 1993), Adachi(2004) and Akiyoshi (2006, 2009) are the only papers that specifically study the nature of Japan's banking crisis during the Great Depression. We seek to add to this literature as well[7].

To briefly preview our main results, we find that during the period of banking crisis (1931-1932), banks with privileged access to the BOJ loans (i.e., BOJ correspondent banks) tended to grow much faster than the other banks in terms of both loans and deposits, while we observe no such difference between the two groups of banks before the crisis (1928-1930). The results suggest that the BOJ's commitment to supply liquidity to BOJ correspondent banks is likely to have stabilized deposit flows into these banks and supported their lending during the crisis period. We also compare BOJ correspondent banks with the other banks using the difference-in-differences framework with a variety of control for bank health and local economic conditions. The results show that the observed differences in the growth rate of loans/deposits between these two group of banks cannot be explained by differences in banks' financial conditions or the condition of local economies where they operated.

Furthermore, we correlate banks' correspondent relationship with the BOJ to banks' distance to the nearest branch or headquarters of the BOJ in the first stage regression to identify exogenous variation in access to the BOJ's liquidity provision.[8] Our central results are largely robust to this instrumental variable specification. Additionally, we find that BOJ correspondent banks were less likely to be closed, compared to other banks, suggesting that the access to the BOJ's liquidity provisions mitigated the risk of runs and bank failures during the bank panics.

[7] Akiyoshi (2006) examines the effect of bank runs on output growth during the Great Depression based on prefectural level data. It confirmed that bank runs had a negative effect on loan growth although loan growth had only limited effects on output growth.

[8] Hereafter we use the term BOJ's branches in the sense of the BOJ's branches and/or headquarters, for simplicity.

Taken as a whole, our results are consistent with the view that LOLR policies are a potent tool to support financial intermediation during the time of financial stringency.

The rest of the paper is organized as follows. Section 2 reviews the relevant empirical literature on the efficacy of the LOLR. Section 3 describes our data and methodologies. Section 4 displays and interprets the results, followed by conclusions in section 5.

2. Empirical Literature on the LOLR

The progression of actual LOLR policies throughout history around the world is neither smooth nor uniform.[9] For instance, the Bank of England (BOE), which is regarded as the pioneering central bank that made a strong commitment to act as the LOLR, was initially founded to "aid the fiscally embarrassed crown" and "to furnish fiscal assistance to the British Treasury" (Lovell, 1957). According to Hawtrey (1932), it took the BOE almost 100 years to firmly establish itself as the LOLR and actively control liquidity in the British banking system. In the case of the United States, the political consensus on the establishment of a central bank was not consolidated until 1913, which was 77 years after Andrew Jackson decided not to renew the charter of the Second Bank of the United States in 1836. The Federal Reserve, which was established in the Federal Reserve Act of 1913 in response to the 1907 Bank Panic to "furnish elastic supply of currency", did not live up to its expectation as a stabilizing force for the US financial system during the Great Depression (Friedman and Anna Schwartz, 1963, Bordo and Wheelock, 2013).

Varied historical experiences with LOLR policies over time and across geographical boundaries have been used to evaluate a proper role that central banks can play as the LOLR in preventing severe financial contraction. In his seminal work, Miron (1983) compiles the data on

[9] Calomiris, Flandreau, and Laeven (2016) underscore the role that politics played in the historical evolution of institutional structures that governs the LOLR in the pre-WWII period.

seasonal demand for reserves and the timing and frequency of financial panics in the United States. He finds that the establishment of the Federal Reserve made the US financial system more resilient to seasonal fluctuations in liquidity demand.[10] Bernstein, Hughson, and Weidenmier (2010) corroborate Miron's findings and show that the Federal Reserve reduced the volatility in both interest rates and stock returns. Grossman (1994) notes considerable cross-country heterogeneity in LOLR policies during the Great Depression and examines the economic and institutional determinants of banking instability across countries. He finds that, although LOLR policies (measured in terms of central bank discounts) seem to have increased banking stability, macroeconomic policies (e.g., exchange rate policy) and banking structure (e.g., the degree of banking concentration) turn out to be more robust predictors of banking crises during the Great Depression.

More recently, it has been documented that the Federal Reserve Bank of Atlanta (Atlanta Fed), unlike the other Federal Reserve banks, was more decisive in providing much needed liquidity in order to support the local banking system in the interwar period (Carlson, Mitchener, and Richardson, 2011, White, 2015). For example, when the Atlanta Fed saw the price of cotton, the major crop in the Atlanta Fed district, rapidly fall after World War I, it borrowed a large quantity of reserves from the other Federal Reserve banks and aggressively discounted bills to assist its member banks. Unlike the other Federal Reserve banks, the Atlanta Fed continued to exhibit its strong commitment to act as the LOLR during the Great Depression. Several papers indeed show that the bank failure rate and unemployment rate in the Atlanta Fed District were significantly lower than those in the nearby districts because of the Atlanta Fed's aggressive lending policy (Richardson and Troost, 2009, Ziebarth, 2013, and Jalil, 2014). These results

[10] Interestingly, Jalil (2015) shows that some of Miron's results turn out to be sensitive to the alternative definition of financial panic.

suggest that if the LOLR had been employed more extensively and forcefully during the Great Depression, it would have lessened the severity of financial and economic contractions.

Two additional papers that are closely related to ours are: Anderson, Calomiris, Jaremski, and Richardson (2018) and Carlin and Mann (2017). Although these papers do not directly examine the impact of LOLR policy, we draw our empirical strategy from them. Anderson, Calomiris, Jaremski, and Richardson (2018) compile the detailed bank-level data on Federal Reserve membership and access to the Federal Reserve's discount windows. They use these data to show that the Federal Reserve helped ease its member banks' financing constraints even though only a small proportion of state-banks elected to become member banks due to the high regulatory compliance cost (e.g., reserve requirement). Carlin and Mann (2017), too, exploit the fact that most state banks chose not to join the Federal Reserve in order to measure the variation in local economy's exposure to fluctuations in the Federal Reserve's discount rate change. They find that dramatic changes in the discount rate in the post-World War I period had large effects on local credit supply and agricultural outputs, especially in the areas where the Fed member banks dominated the local banking system.

3. Data and Methodology

Our paper utilizes the data from Sawada (2010) on the identity of the BOJ correspondent banks and matches them with the balance sheet data on the universe of ordinary banks in Japan from 1928-1932. The data on the BOJ correspondent banks are originally taken from *Nihon Ginko Enkakushi* (*the History of the Bank of Japan*).[11] The financial data are from *Ginkokyoku Nenpo*

[11] Okazaki (2007) puts together the data on the BOJ's transactions relationship with commercial banks and show that the BOJ correspondent banks indeed had better access to the BOJ loans and enjoyed lower failure rates during the 1927 Banking Crisis. Sawada (2010) extends Okazaki's data the BOJ's transactions relationship through 1932.

(*Yearbook of the Bank Bureau*), which was published by the Ministry of Finance, annually. While *Ginkokyoku Nenpo* covers all ordinary banks. It includes the data on nominal capital, paid-in capital, reserved funds, total deposits, total loans, security holdings, cash, and due from banks are available annually in a consistent fashion at the bank-level. The data on total loans and deposits cover loans and deposits at the headquarters and branches in the mainland of Japan, Taiwan and Karafuto. The detailed information about the composition of these various types of deposits (e.g., current deposits, special current deposits, time deposits and other deposits) and those of loans (e.g., loans on deed, loans by bills, discount bills and other loans) are available at the bank-level.[12] However, some information on the more detailed composition of those loans are only available in aggregate data.[13] We use the data on total loans and total deposits at the bank-level to calculate the growth rate of each as our main outcome variables for econometric analyses.

Ginkokyoku Nenpo publishes the information on profits such as net-earnings, reserves of retained earnings and the ratio of dividend to earnings by biannual basis.[14] We supplement the

Sawada (2010) shows that there was no difference of bank portfolio management between the BOJ correspondent banks and non-correspondent ones during the period of 1928-32.

[12] In *Ginkokyoku Nenpo* of 1927 and 1928 issues, the detail of total deposits included the item on public deposits in bank-level data. But the values of public deposits were zero in all banks in 1928. This item disappeared after 1929 issue. Furthermore, while the footnotes on bank-level data of 1927 indicated that the values of other deposits included the values of bills sold (*urikawase*), that of 1928 did not indicated it. We could not find how much it was even in aggregate level data of 1927. But the value of foreign exchange on liability side of aggregate balance sheet, which seems to include bills sold, was available after 1928 issue. The ratio of foreign exchange to total deposits was only 0.94% according to aggregate data of 1928.

[13] For example, the definition of "other loans" in *Ginkokyoku Nenpo* had been gradually changed during our sample period. Considering the footnote of bank-level data and aggregate level data in the 1927 issue, the value of other loans in bank-level data was considered to be the sum of the values of (a) documentary draft bought, (b) bills bought and interest bills, (c) call loans and (d) others. On the other hand, the value of (b) seemed to be excluded from the value of other loans in 1928 issue. But, the share of (b) to total loans (in the mainland of Japan, Taiwan and Karafuto) in 1927 was only 1.66% according to aggregate level data in which we could identify the value of (b). After 1929 issue, the value of (a) became to be included in the value of discount bills. Furthermore, the value of other loans did not include the value of (d) after 1930 issue. The share of (d) to total loans in 1929 was only 0.70% according to aggregate level data. We consider that the effects of those changes of definitions are controlled by time-fixed effect and less likely to bring about significant bias to our estimation results.

[14] Besides the information on B/L and P/L, the information on the number of branches and stockholders is available by bank level.

aforementioned data with the data on the locations of the BOJ branches and the headquarter of each individual bank to measure the geographical distances between them to capture exogenous variation in access to the BOJ's liquidity provisions. The geographical data are retrieved from *Ginkokyoku Nenpo* an *Ginko Soran* (*Handbook of Banks*) by the Ministry of Finance, respectively. We update the addresses of the BOJ branches in 1932 and each individual bank in 1931 to what they would be in 2006 by city-town-village level, using *Gyoseikai-hensen* database (Administrative boundary data 1889-2006) from University of Tsukuba, Graduate School of Life and Environmental Sciences, Division of Spatial Information Science. Based on the information on the longitude and latitude of the current cities (towns/villages) where they located, we measure the geographical distance between them in kilometer.[15]

We also use the information on a bank closure, which is defined as the event which completely stopped a bank's function of financial intermediation. It is taken from Shindo (1987), which conducts detailed historical analyses on bank closures during the Great depression and provides the list of closed banks. Furthermore, we use the economic data by prefecture-level to control local economic conditions. They are taken from various sources. The data on rice output are from *Teikoku Toukei Nenkan* (*Statistical Yearbook of the Empire of Japan*). Manufacturing production data are from *Kogyo Tokei 50 Nen Shi (50 Year History of Manufacturing Census*). The data on raw silk production are drawn from *Kojo Tokei Hyo* (*Manufacturing Census*), The city/town-level data on population density are computed based on *Kokusei Chosa Hokoku* (*Report on the Population Census*) and *Zenkoku Shichoson betsu Menseki Shirabe* (*Census of Land Area*

[15]To measure distance between cites (towns/villages) where each individual bank and BOJ branches were located, we use the information of the longitude and latitude of the city halls, which was obtained by using the Geocoding Official Site (http://www.geocoding.jp/).

by City-Town- Village). Using these data, we investigate the impact of the LOLR policy on (1) the growth rate of loans and deposits and (2) the probability of bank closure.

Regarding the impact of the LOLR policy on (1) the growth rates of loans and deposits, based on the matched data on individual banks from 1928-1932, we use difference-in-differences framework. We conjecture that to the extent that BOJ correspondent banks had better access to the BOJ loans than the other banks, depositors might have been less concerned about the liquidity condition of the BOJ correspondent banks during the banking crisis (1931-1932). Hence, we predict that the BOJ correspondent banks are less likely to have suffered from large-scale deposit withdrawals; moreover, even if some of them did experience deposit withdrawals, we expect that they should be better able to meet these withdrawals without liquidating illiquid assets by seeking financial assistance from the BOJ. In sum, we expect the deposit growth and loan growth of the BOJ correspondent banks to be faster during the period of banking crisis, as compared to the other banks.

Our basic econometric specification is:

$$\Delta Y_{it} = \beta_i + \beta_t + \gamma(BOJ_i)(Crisis_t) + \beta X_{it} + \varepsilon_{it} \qquad (1)$$

where subscript i and t denote bank and year, respectively, ΔY_{it} is loan growth or deposit growth, which is our measure of financial intermediation, β_i and β_t denote bank-fixed effects and year-fixed effects, respectively, BOJ_i is a dummy variable for BOJ correspondence bank (as of 1928), $Crisis_t$ is a dummy variable for the period of banking crisis (1931-1932), and X_{it} is a set of control variables. Standard errors are clustered by bank to adjust for serially correlated disturbances (Bertrand, Duflo, and Mullainathan, 2004).

The key independent variable is the interaction of BOJ_i with $Crisis_t$, which captures the impact of the LOLR on loan and deposit growth. If the privileged access to the BOJ's liquidity facility helped maintain depositors' confidence in their banks during the crisis period, and thereby sustain their function of credit creation, then the coefficient on this interaction term should be positive and statistically significant. The year-fixed effects, β_t, capture economy-wide shocks. The bank-fixed effects, β_i, are included to control for unobservable bank specific factors that are relevant to loan growth or deposit growth. The bank-fixed effects also capture the pre-existing bank-specific trend; i.e., we expect that as the economic condition worsened from 1928-1930, weaker banks must have seen their loans and deposits declining more rapidly even before the banking crisis period, when compared to relatively healthy banks. A set of control variables, X_{it}, includes measures of bank health/profitability (capital-to-asset ratio, cash-to-asset ratio, and return on assets) as well as bank size (a natural log of assets).[16] These control variables are econometrically important to the extent that transactions relationship with the BOJ might be positively related to the financial health and/or profitability of banks (Okazaki, 2007). It should be noted that the profit data on individual banks used to measure ROA are censored at zero by our source (*Ginkokyoku Nenpo*). That is, financial losses (negative profits) are not reported by this source. Then, in the following analyses, the values of ROA in those banks are treated as zero.

In addition to these bank-level controls, we also include prefecture-level variables, namely, rice output growth and manufacturing production growth, which account for regional heterogeneity in local economic conditions during the Great Depression. Banks located in a prefecture with weakening economic conditions are more likely to have experienced more severe

[16] The assets is defined as the sum of Loans, Security holding, Cash and Due from banks. Also, the capital is defined as the sum of Paid-in capital, Reserved fund, Second-half profits.

financial contraction. Given that the silk reeling industry was the most severely affected by the global economic shocks[17], we also include the ratio of raw silk production to total manufacturing production as of 1928 and interact it with a dummy variable for the crisis period. Finally, to differentiate two different types of banks, banks that operate in large cities and the ones that operate in rural towns, we include the population density in the headquarter of each bank at the city/town-level and interact it with the crisis dummy.

In selecting our samples, we principally use the banks listed in the 1927-1932 issues of *Ginkokyoku Nenpo*. First, to use difference-in-differences framework, we select the banks which were at least in existence at the end of 1931. Second, for the data continuity, the observations of banks which consolidated with other banks during the relevant year are removed from the samples of the year. We identify banks which were involved in consolidations based on *Ginko Jiko Geppo* (Monthly Bank Affairs) by the Bank of Japan. Third, the banks whose values of the dependent variables (loan growth and deposit growth) are either less than -1 or more than one are excluded from the samples in order to avoid problems with outliers. Furthermore, in the following analyses, we also use the instrumental variable method by correlating the BOJ correspondent relationship with the distance to the nearest BOJ branch, which has time-invariant characteristics. Therefore, the banks which closed the correspondent relationship with the BOJ or newly opened it after 1928 are removed from our samples to make the variable of the BOJ correspondent relationship time-invariant. Through these selections, 2737 bank-year observations are used as our base samples[18].

[17] From 1928 to 1931, the raw silk price declined 55%, while the wholesale price index declined 32% (Bank of Japan (1964), p.64, p.88).

[18] The data on the value of reserved funds is also censored at zero in *Ginkokyoku Nenpo*. Therefore, we remove banks whose values of reserved funds are censored (4.8 %) from our samples when we capital -to-asset ratio is included as an explanatory variable.

To investigate the role of LOLR in averting bank closure when bank crisis was more severe, we estimate the model of the probability of bank closure during the period of 1931-1932, based on the banks which existed at the end of 1930. The specification is as follows:

$$Closure_i = \alpha + \lambda BOJ_i + \beta X_i + u_i \qquad (2)$$

where $Closure_i$ is the dummy variable for closed banks during 1931-1932. X_i is a set of control variables which are the same ones with Eq (1). The values at end of 1930 are used with respect to bank characteristics variables (capital-to-asset ratio, cash-to-asset ratio, and return on assets and bank size). Concerning the variables for local economic condition (rice output growth and manufacturing production growth), we use their average values during 1931-1932. The key independent variable is BOJ_i which captures the impact of the LOLR on the probability of bank closure. If the privileged access to the BOJ's liquidity facility helped bank in liquidity shortage in the bank panics, this coefficient should be negative and statistically significant. We estimate Eq.(2) with OLS and 2SLS.

4. Empirical Results

First, Figure 1 displays the distribution of growth rates of deposits and loans for two groups of banks, banks with a long history of transacting with the BOJ and the other banks, before (1928-1930) and during the period of banking crisis (1931-1932). Note that both loan growth and deposit growth are negative before and during the banking crisis for most banks. This observation is not surprising becasue the Japanese government's deflationary policies and large negative trade shocks that were originated from other countries whose currencies were tied to gold after 1929. Nevertheless, we underscore that, during the crisis period, the banks with better access to the BOJ loans tended to grow faster than the other banks. It is possible that the BOJ correspondent banks

(and perhaps their core borrowers) faced better economic prospects than the other banks during the Great Depression, but we do not observe such differences between the two groups before the bank panic phase of the Depression. These results indicate that negative macroeconomic shocks seem to have affected both groups of banks, and yet those with better access to the BOJ's financial backstop performed better during the period of bank panic.

The results from difference-in-differences are displayed in Table 1. As expected, the coefficient on the interaction of *BOJ* with *Crisis* is positive and statistically significant for both loan growth and deposit growth. The magnitude of the estimated impact is economically important as well. Based on the specification that controls only for the bank-specific effects and the year-specific effects (columns 1 and 2), the results suggest that if non-BOJ correspondent banks had had better access to the BOJ loans (as BOJ correspondent banks did), then their loans and deposits would likely have grown by an additional 6%. Moreover, our central results are robust even when we include various measures of bank health in columns 3 and 4. The results show a positive and significant coefficient on cash-to-asset ratio for loan growth (column 3), which suggests that banks whose assets were more liquid expanded their loans faster. In columns 5 and 6, we add a host of control variables that capture local economic shocks. The coefficient on industrial output growth is positive and statistically significant for loan growth (column 5). The central results remain qualitatively robust to controlling for these prefecture-level variables.

The most crucial identifying assumption in difference-in-differences is so-called "parallel trend assumption" in which the difference between both the treated and control groups would have remained the same in the absence of treatment. In our case, one might be concerned that (1) banking crisis is likely to have had differential impacts on banks with weak financial profile and/or banks located in local economies that faced harsher conditions during the crisis period and (2) BOJ

correspondent banks fared better not necessarily because they had access to the BOJ loans but because they were, on average, stronger financially and/or faced more favorable economic conditions than the other banks.

To address this concern, we add the interaction of a dummy variable for bank panic to our proxies for bank health (bank size, return on assets, capital-to-asset ratio, and cash-to-asset ratio), the ratio of raw silk production to total manufacturing production, and population density (columns 7-10). The results show that the coefficient on the interaction of BOJ correspondent banks to a dummy variable for bank panic remains robust to these potential correlates. That is to say, the difference in loan growth and deposit growth between these two group of banks is not driven by variations in financial conditions of banks or conditions in local economies where they operated in. The coefficient on the ratio of raw silk production to total manufacturing production (interacted with bank panic dummy) turns out to be negative and statistically significant. This is consistent with the historical narrative that a rapid decline in global demand for silk had negative effects on local economic and banking performance.

Another econometric issue might be that the long-term correspondent relationship between the BOJ and each individual bank is linked to other extraneous, unobservable, factors that affected loan and deposit growth. One might be concerned that the BOJ might have selected a group of financially stronger banks that would have continued to maintain depositors' confidence and kept lending in the midst of bank panic even without the access to the BOJ's LOLR facility. Of course, selection bias can affect the results in the opposite way if the BOJ loans (or the anticipation of thereof) led to moral hazard problem and weaker fundamentals for BOJ correspondent banks, which their depositors might have been concerned about. Earlier, we address this issue by including the interaction of the banking crisis dummy with observable indicators of bank health

(return on assets, capital-to-asset ratio, and cash-to-asset ratio). As noted above, our central results remain qualitatively robust to the inclusion of these interaction variables, suggesting that the growth of deposits and loans is weakly correlated with bank health during the key bank panic period in the Great Depression. However, our proxies of bank health might be capturing bank fundamentals, rather imperfectly.

To address this econometric concern, we use the instrumental variable method by correlating the BOJ correspondent relationship with the distance to the nearest BOJ branch or the headquarters in the first stage to identify exogenous variation. Ishii (1980) find, through extensive archival works, that the BOJ was motivated to minimize the transaction cost associated with cash delivery and information collection when deciding whether or not to form transactions relationship. As a result, the BOJ exhibited strong tendencies to start transactions relationship with banks that were geographically closer to its branches. We confirm this by producing a geographic view of the locations of the BOJ branches and the headquarters of the BOJ correspondent banks and non-correspondent banks in Figure 2. The headquarters of the BOJ correspondent banks were more likely to be located in the same city or near the BOJ branches than non-correspondent banks. The geographical proximity of banks to the BOJ branches seems to be highly relevant for the transaction relationship between banks and the BOJ.

Our IV specification compares banks that are close to the BOJ branches with those that are distant. Nonetheless, it is important to note that the BOJ did not establish branches in every city or every prefecture merely because one of the neighboring prefectures had received a BOJ branch earlier. As a consequence, there were a large number of banks that operated in large cities which did not receive BOJ branches. To the extent that we control for differences between cities and rural areas with disaggregated city/town-level data on population density, our identification is

essentially based on differences between banks that were located near a BOJ branch and those that were located in a similar city (or town) without a BOJ branch. The results of this IV specification are displayed in Table 2. It shows that the coefficient on the interaction of the BOJ correspondent banks with crisis dummy is positive and statistically significant. The first-stage F-statistics is large and exceeds 10 in all specifications, except for those which control only for the bank specific effects and time-specific effects. These results are broadly consistent with the idea that LOLR is a powerful tool to support financial intermediation during the time of financial stringency.

Table 3 displayed the results about the probability of a bank closure. Columns 1-4 present the estimated results with OLS and columns 5-8 present those with IV estimations. Columns 1-4 presents confirm that the coefficients of the BOJ correspondence are negative and statistically significant. The estimated average marginal effects suggest that the probability of closure was lower in the BOJ correspondent banks by 6-9% than those in non-BOJ correspondent banks. These results suggest that the BOJ correspondence has the effect of lowering the probability of bank closure, which is consistent with the previous results that it had a positive impact on loan and deposit growth during the time of financial crisis. As for control variables, the coefficients of the silk ratio are positive and statistically significant. This indicates that banks operated in the prefecture with highly dependence on the silk industry were more likely to be closed during the period of financial crisis. Hence, a rapid decline in global demand and price for silk had negative effects on local economic and banking performance. The variables for local economic condition (rice output growth and manufacturing production growth) are negative and statistically significant. Hence, banks were more likely to be closed in the area with severe economic conditions. Columns 5-8 present the estimated results with IV specifications. The estimated results show that the coefficients of the BOJ correspondence are negative and their magnitudes

are quite larger than those of OLS (Columns 1-4). On the other hand, their standard errors are also larger and consequently the coefficient becomes statistically insignificant. Chiburis (2012) point out that linear IV estimators could have larger confidence intervals in some conditions such as small observations than Bivariate Probit when the model has an endogenous binary treatment and binary outcome. Then, we complementarily conducted Probit and Bivariate probit estimations in Appendix table 1, which confirms that the coefficients of the BOJ correspondence are negative and statistically significant in all specifications. In sum, the BOJ correspondent banks avoided closures during the bank panics because they had preferential access to LOLR from the BOJ.

5. Concluding Remarks

This paper uses a historical episode from Japan that during the Great Depression, the BOJ gave a select group of banks preferential access to its liquidity provision in order to examine the impact of LOLR policy on financial intermediation. We find that the access to the BOJ's provision of liquidity made a large difference in terms of mitigating financial contractions. Banks which had long established correspondent relationships with the BOJ exhibited much faster growth in loans and deposits than the other banks which did not have such pre-existing relationships with the BOJ, whereas this difference in loan and deposit growth is not observed before the Great Depression. We find this empirical pattern to be robust even after controlling for the financial health of banks and proxies for local economic conditions. Our instrumental variable specifications with the geographical proximity to the nearest BOJ branch yield similar results. We also find that the BOJ correspondent banks were less likely to be closed in comparison to the other banks because of the

BOJ supported the former during the bank panics. In sum, our results are consistent with the view that the LOLR policies acted as an effective backstop for liquidity shortage and that the financial contraction could have been more severe for the Japanese economy, had it not been for BOJ's liquidity facility accessible to its correspondent banks.

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Figure 1: BOJ Correspondent Banks vs. Non-BOJ Correspondent Banks

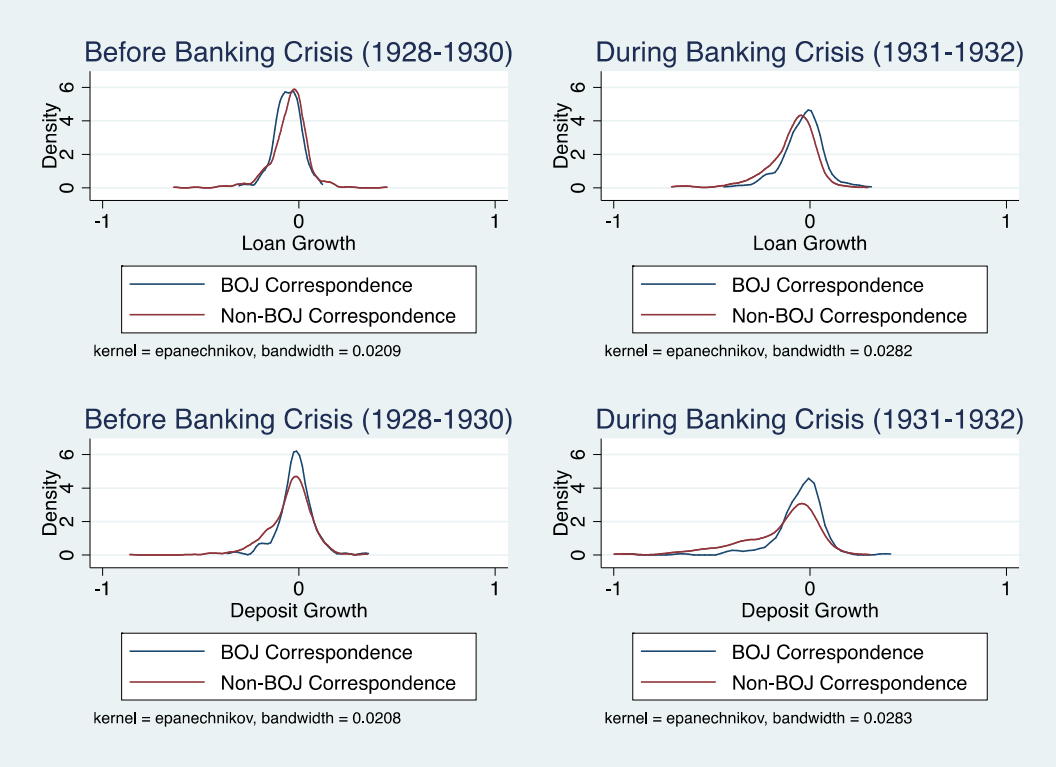

Figure 2: Locations of BOJ branches and the headquarters of BOJ correspondent banks and non-correspondent banks

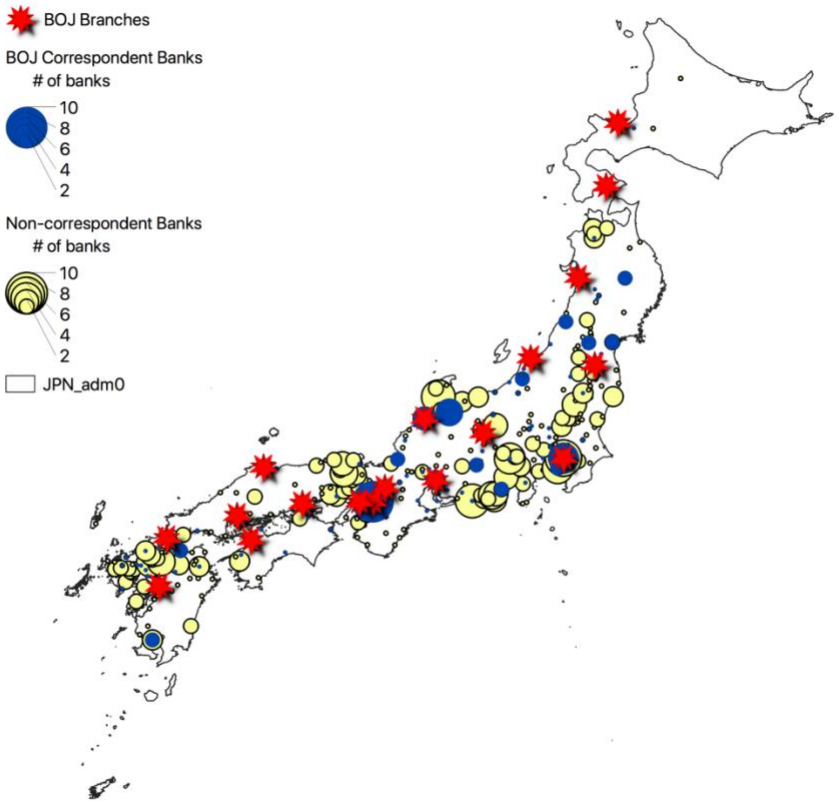

Table 1: Impacts of Lender of Last Resort on Loan and Deposit Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Loan Growth	Deposit Growth	Loan Growth	Deposit Growth	Loan Growth	Deposit Growth	Loan Growth	Deposit Growth	Loan Growth	Deposit Growth
(Banking Crisis)*(BOJ Correspondence)	0.0638***	0.0632***	0.0726***	0.0617***	0.0722***	0.0616***	0.0734***	0.0450**	0.0757***	0.0516**
	(0.0120)	(0.0152)	(0.0124)	(0.0148)	(0.0125)	(0.0149)	(0.0191)	(0.0216)	(0.0189)	(0.0211)
ln(Assets)			-0.155***	-0.126***	-0.157***	-0.127***	-0.161***	-0.131***	-0.160***	-0.127***
			(0.0357)	(0.0346)	(0.0359)	(0.0346)	(0.0375)	(0.0355)	(0.0387)	(0.0370)
Return on Assets			0.119	0.336	0.120	0.337	0.0771	0.306	0.0461	0.235
			(0.155)	(0.320)	(0.151)	(0.318)	(0.149)	(0.314)	(0.149)	(0.302)
Capital-to-Asset Ratio			0.0640	-0.0163	0.0651	-0.0161	0.0670	-0.0161	0.0680	-0.0142
			(0.0483)	(0.0690)	(0.0482)	(0.0690)	(0.0492)	(0.0682)	(0.0497)	(0.0673)
Cash-to-Asset Ratio			0.872***	0.0565	0.877***	0.0643	0.891***	-0.0590	0.904***	-0.0296
			(0.229)	(0.256)	(0.230)	(0.254)	(0.242)	(0.278)	(0.242)	(0.274)
Industrial Output Growth					0.0463*	0.0194	0.0473*	0.0241	0.0483*	0.0272
					(0.0268)	(0.0321)	(0.0269)	(0.0320)	(0.0271)	(0.0322)
Rice Output Growth					-0.0529	-0.0490	-0.0531	-0.0448	-0.0491	-0.0350
					(0.0352)	(0.0465)	(0.0351)	(0.0467)	(0.0352)	(0.0475)
(Banking Crisis)*(ln(Assets))							0.000776	0.00834	-0.00390	-0.00187
							(0.00641)	(0.00753)	(0.00706)	(0.00810)
(Banking Crisis)*(Return on Assets)							0.342	0.278	0.298	0.165
							(0.277)	(0.337)	(0.279)	(0.335)
(Banking Crisis)*(Capital-to-Asset Ratio)							-0.00402	0.0290	-0.00210	0.0357
							(0.0427)	(0.0592)	(0.0437)	(0.0598)
(Banking Crisis)*(Cash-to-Asset Ratio)							-0.0586	0.315	-0.114	0.193
							(0.372)	(0.233)	(0.374)	(0.237)
(Banking Crisis)(silk / total manufacturing in 1928)									-0.0598**	-0.146***
									(0.0287)	(0.0391)
(Banking Crisis)*(Population density)									0.00207	0.00393
									(0.00219)	(0.00244)
Constant	-0.0439***	0.0351***	2.187***	1.886***	2.199***	1.899***	2.269***	1.963***	2.244***	1.909***
	(0.00583)	(0.00613)	(0.529)	(0.515)	(0.533)	(0.514)	(0.558)	(0.529)	(0.575)	(0.551)
Observations	2,737	2,737	2,610	2,610	2,610	2,610	2,610	2,610	2,610	2,610
R-squared	0.025	0.187	0.079	0.209	0.081	0.210	0.082	0.212	0.085	0.223
Number of bank	654	654	646	646	646	646	646	646	646	646

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2: Impacts of Lender of Last Resort on Loan and Deposit Growth (IV Specification)

VARIABLES	(1) Loan Growth	(2) Deposit Growth	(3) Loan Growth	(4) Deposit Growth	(5) Loan Growth	(6) Deposit Growth	(7) Loan Growth	(8) Deposit Growth	(9) Loan Growth	(10) Deposit Growth
(Banking Crisis)*(BOJ Correspondence)	0.238***	0.221**	0.200***	0.298***	0.199***	0.301***	0.456***	0.729***	0.413**	0.620***
	(0.0566)	(0.110)	(0.0508)	(0.0643)	(0.0510)	(0.0659)	(0.175)	(0.252)	(0.171)	(0.237)
ln(Assets)			-0.156***	-0.126***	-0.157***	-0.128***	-0.140***	-0.0927**	-0.142***	-0.0977**
			(0.0373)	(0.0366)	(0.0375)	(0.0365)	(0.0390)	(0.0417)	(0.0406)	(0.0421)
Return on Assets			-0.0238	0.0716	-0.0225	0.0692	-0.0220	0.129	-0.0476	0.0771
			(0.154)	(0.318)	(0.151)	(0.317)	(0.165)	(0.371)	(0.160)	(0.341)
Capital-to-Asset Ratio			0.0907*	0.0330	0.0914*	0.0333	0.111**	0.0616	0.105*	0.0477
			(0.0517)	(0.0678)	(0.0517)	(0.0678)	(0.0534)	(0.0742)	(0.0534)	(0.0710)
Cash-to-Asset Ratio			0.939***	0.180	0.946***	0.193	1.083***	0.284	1.063***	0.237
			(0.232)	(0.260)	(0.234)	(0.259)	(0.262)	(0.319)	(0.260)	(0.307)
Industrial Output Growth					0.0399	0.00726	0.0293	-0.00794	0.0368	0.00782
					(0.0261)	(0.0305)	(0.0285)	(0.0372)	(0.0282)	(0.0354)
Rice Output Growth					-0.0577*	-0.0580	-0.103**	-0.134**	-0.0896**	-0.103
					(0.0351)	(0.0502)	(0.0420)	(0.0678)	(0.0401)	(0.0637)
(Banking Crisis)*(ln(Assets))							-0.0796**	-0.135**	-0.0717**	-0.116**
							(0.0379)	(0.0541)	(0.0358)	(0.0488)
(Banking Crisis)*(Return on Assets)							0.183	-0.00494	0.0989	-0.169
							(0.360)	(0.438)	(0.357)	(0.423)
(Banking Crisis)*(Capital-to-Asset Ratio)							-0.114	-0.168	-0.0857	-0.105
							(0.0735)	(0.103)	(0.0675)	(0.0905)
(Banking Crisis)*(Cash-to-Asset Ratio)							-0.253	-0.0317	-0.269	-0.0675
							(0.304)	(0.385)	(0.302)	(0.342)
(Banking Crisis)(silk / total manufacturing in 1928)									-0.111**	-0.233***
									(0.0445)	(0.0643)
(Banking Crisis)*(Population density)									-0.00143	-0.00196
									(0.00308)	(0.00427)
Observations	2,728	2,728	2,589	2,589	2,589	2,589	2,589	2,589	2,589	2,589
R-squared	-0.052	0.146	0.035	0.114	0.038	0.112	-0.133	-0.229	-0.079	-0.075
Number of bank	645	645	625	625	625	625	625	625	625	625
First Stage F Statistic	6.228	6.228	54.88	54.88	54.25	54.25	11.92	11.92	11.42	11.42

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Impacts of Lender of Last Resort on bank closure

VARIABLES	(1) OLS Closure	(2) OLS Closure	(3) OLS Closure	(4) OLS Closure	(5) IV Closure	(6) IV Closure	(7) IV Closure	(8) IV Closure
BOJ Correspondence	-0.0630*	-0.0875**	-0.0844**	-0.0708*	-0.358	-0.207	-0.331	-0.208
	(0.0362)	(0.0350)	(0.0367)	(0.0368)	(0.219)	(0.181)	(0.222)	(0.268)
ln(Assets)	0.0160**	0.0278***	0.0217**	0.0271***	0.0639*	0.0476	0.0695	0.0517
	(0.00802)	(0.00775)	(0.00937)	(0.00968)	(0.0366)	(0.0309)	(0.0443)	(0.0489)
Return on Assets			-0.494*	-0.473*			-0.408	-0.421
			(0.266)	(0.271)			(0.279)	(0.292)
Capital-to-Asset Ratio			-0.0323	-0.0219			0.0101	-0.000969
			(0.0248)	(0.0252)			(0.0464)	(0.0493)
Cash-to-Asset Ratio			0.220	0.210			0.269	0.233
			(0.307)	(0.306)			(0.330)	(0.315)
Population density per 1000				-0.00724***				-0.00547
				(0.00279)				(0.00459)
(Silk/total manufacturing)		0.335***	0.327***	0.322***		0.353***	0.371***	0.348***
		(0.0653)	(0.0669)	(0.0687)		(0.0650)	(0.0694)	(0.0746)
Industrial Output Grwoth				0.00804				0.000297
				(0.194)				(0.198)
Rice Output Grwoth				-0.608**				-0.548**
				(0.271)				(0.256)
Constant	-0.110	-0.338***	-0.230*	-0.285**	-0.744	-0.604	-0.901	-0.634
	(0.110)	(0.106)	(0.136)	(0.139)	(0.485)	(0.412)	(0.619)	(0.691)
Observations	777	777	726	726	777	777	726	726
R-squared	0.005	0.062	0.061	0.072	-0.085	0.048	0.001	0.054
First Stage F Statistic					16.68	15.51	24.50	15.86

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix table 1 Impacts of Lender of Last Resort on bank closures: Probit and Bivariate probit estimations

	(1)	(2)	(3)	(4)	(5)		(6)		(7)		(8)	
	Probit	Probit	Probit	Probit	Bivariate probit		Bivariate probit		Bivariate probit		Bivariate probit	
VARIABLES	Closure	Closure	Closure	Closure	Closure	BOJ	Closure	BOJ	Closure	BOJ	Closure	BOJ
BOJ Correspondence	-0.343*	-0.531**	-0.464**	-0.409*	-1.157***		-1.264***		-1.376***		-1.447***	
	(0.206)	(0.213)	(0.213)	(0.215)	(0.297)		(0.317)		(0.372)		(0.438)	
ln_asset	0.0886**	0.174***	0.101*	0.157**	0.241***	0.911***	0.316***	0.954***	0.298***	1.084***	0.370***	1.065***
	(0.0450)	(0.0471)	(0.0560)	(0.0620)	(0.0643)	(0.0651)	(0.0656)	(0.0681)	(0.0859)	(0.0817)	(0.0975)	(0.0827)
ROA			-3.880	-3.864					-3.698	6.003***	-3.730	6.279***
			(2.961)	(3.114)					(3.118)	(2.185)	(3.220)	(2.175)
CA			-0.602	-0.532					-0.452	0.959***	-0.342	0.895***
			(0.422)	(0.441)					(0.412)	(0.167)	(0.424)	(0.166)
CASH_A			1.085	1.231					1.470	0.598	1.685	0.405
			(1.847)	(2.001)					(1.880)	(2.223)	(1.987)	(2.202)
Population density per 1000				-0.0635**							-0.0483*	0.0435**
				(0.0265)							(0.0264)	(0.0198)
Silk ratio		1.535***	1.519***	1.563***			1.634***	1.097***	1.648***	1.120***	1.685***	0.991***
		(0.245)	(0.261)	(0.296)			(0.238)	(0.325)	(0.251)	(0.327)	(0.283)	(0.379)
Industrial Output Grwoth				0.255							0.136	-0.786
				(1.226)							(1.184)	(1.310)
Rice Output Grwoth				-3.149***							-2.288*	2.999*
				(1.195)							(1.255)	(1.714)
Distance to Nearest BOJ						-0.00973***		-0.0108***		-0.0126***		-0.0110***
						(0.00191)		(0.00197)		(0.00205)		(0.00217)
Constant	-2.456***	-4.014***	-2.692***	-3.366***	-4.457***	-14.06***	-5.917***	-14.87***	-5.397***	-17.17***	-6.340***	-17.15***
	(0.635)	(0.682)	(0.876)	(0.949)	(0.871)	(1.011)	(0.895)	(1.065)	(1.220)	(1.283)	(1.382)	(1.296)
Observations	777	777	726	726	777	777	777	777	726	726	726	726
pseudo-R-squared	0.00747	0.0797	0.0826	0.104								
rho					0.586		0.542		0.681		0.763	
					(0.1549)		(0.1736)		(0.2131)		(0.2441)	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1