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Reluctance to Lend and Its Spatial Differences in Japan’s Lost Decade: What Can We Learn from It?

Daisuke Ishikawa and Yoshiro Tsutsui

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GCOE Secretariat
Graduate School of Economics
OSAKA UNIVERSITY
1-7 Machikaneyama, Toyonaka, Osaka, 560-0043, Japan

Reluctance to Lend and Its Spatial Differences in Japan's Lost Decade: What Can We Learn from It?*

Daisuke Ishikawa (Ministry of Finance, Japan)

Yoshiro Tsutsui (Osaka University)

Abstract

This paper aims to elucidate whether supply side factors played a crucial role in causing the "reluctance to lend" in Japan in the 1990s. We estimate loan supply and demand functions using prefectural panel data and calculate their shifts. Our analysis reveals that the demand side played an equal or greater role, even in the context of the historical financial crisis in Japan during the period 1997–2000, and that the reluctance to lend was severer in the urban prefectures. These findings suggest that countermeasures in the banking sector that uniformly influence all regions may not achieve the expected recovery.

JEL classification numbers: G21, E51, R51

Keywords: credit crunch, prefectural panel data, shift of functions, Japanese loan market

Please address all correspondence to:

Yoshiro Tsutsui

Graduate School of Economics, Osaka University

1-7 Machikaneyama, Toyonaka, Osaka 560-0043, Japan

Phone: 06-6850-5223, Fax: 06-6850-5274

E-mail: tsutsui@econ.osaka-u.ac.jp

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1. Introduction

Since 2007, subprime loan problems have hit financial institutions worldwide. Many of these institutions have reported huge losses and financial troubles. Among them, in the United States, Lehman Brothers filed for bankruptcy in September 2008, Bear Sterns was sold to JP Morgan Chase in March 2008 owing to pressure from the Federal Reserve Bank, and there was a run on Indy Mac in July 2008. The possibility of a credit crunch has been discussed since the summer of 2007 (e.g., *The Japan Times*, Oct. 13, 2007). Indeed, bank credit and loans and leases in bank credit in the US, which had been increasing almost monotonically for years, started decreasing in April 2008 (see Figure 1). The purpose of this paper is to identify what can be learned from the Japanese banking crisis of the 1990s.

The Japanese loan market was in a severe slump from 1990 to 2003, which is considered a significant historical event. This period of financial crisis might gain new significance, however, if lessons can be gleaned from it. Figure 2 shows the level of bank credit in Japan and the US. The solid line in the figure represents the amount of loans advanced by domestically licensed banks in Japan since 1944. The path of this line indicates that the 1990s was the first decade in postwar Japan to experience a significant decline in the amount of loans being advanced. A closer inspection of Figure 2 reveals that lending growth actually became sluggish around 1993 but still continued to increase until around 1998. Then the amount of loans began to decrease until 2004; however, the graph shows a recovery after 2005. The dotted line in Figure 2 represents the bank credit of commercial banks in the US since 1973, which shows a monotonic upward trend. However, as shown in Figure 1, this trend became stagnant after April 2008, suggesting that the United States has been facing a sharp decline in outstanding loans since July 2008. Thus, it is important for us to ask what we can learn from the nightmarish events of financial distress in Japan in the 1990s, and how can this knowledge benefit the current lending issues in the US.

When Japan faced this remarkable stagnancy of loans in the 1990s, it was said that firms, especially small and medium sized enterprises (SMEs) were in trouble because their applications for loans had been refused by banks. The general opinion, including that of the Diet, the government, and the media, was that the banks were to blame and that the problem stemmed from the banks' reluctance to advance loans.

Some economists attribute the Japanese depression of the 1990s to the fall in stock prices, which decreased bank assets and, in turn, impaired their capital. Therefore, banks were compelled to compress loans in order to clear regulations by the Bank for International Settlements (BIS). A fall in land prices may have been another cause: it decreased the values of collateral and banks suffered losses due to the bankruptcy of their borrowers. Thus, Japan fell into a vicious circle: an increase in the bankruptcy of borrowers together with a fall in land prices led to a rise in nonperforming loans, which caused the banks to reduce lending to firms (i.e., it led to a credit crunch). Conversely, the credit crunch reduced borrower options and thus contributed toward an increase in the number of bankruptcies, thereby worsening the Japanese economy. In order to end this vicious circle, the Japanese government injected a huge amount of public funds into banks in 1998 and in 1999.

However, it is important to recognize that the problem is not that simple. Because the Japanese economy was in a serious slump and the loan interest rate was falling throughout the 1990s, the decrease in the amount of loans may have come from the demand side, and not from the supply side.[1] If this was the case, it would have been necessary to increase the demand for loans by raising firms' effective demand to revitalize the slumped Japanese economy. A measure to support banks, such as injection of public funds, could only have a limited effect on raising the loan amount.[2]

This paper aims to elucidate which side, supply or demand, caused a decrease in loans in Japan in the 1990s, with a special focus on its spatial differences. As explained in the next

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1 Declining loan interest rate is derived only from a left shift in the demand function or a right shift in the supply function.

2 Still, it helps banks to amortize their bad loans and to escape from their failures.

section, many of the previous studies on the credit crunch in Japan have focused on the effects of banks' own capital ratios and nonperforming loans on the supply of loans. The analysis in these studies identifies how the supply side is affected by these factors, but they exclusively consider the supply side; it may still be true that raising the demand for loans is the key to recovery. This paper is unique in that it estimates both the loan supply and demand functions and calculates their shifts to reveal which side and which factors primarily caused the decrease in loans. In addition, using a prefectural panel data set, this paper tries to clarify whether the credit crunch—or "reluctance to lend"—hit the Japanese economy uniformly or whether it affected only specific regions.

The rest of the paper is organized as follows. In the next section, we survey the literature. In section 3, we explain the analytical framework, specification of our model, estimation method, and data. In section 4, we present and discuss the results. Section 5 concludes the article.

2. An overview of the literature

There have been many studies on the credit crunch or reluctance to lend in Japan. Most of them focus on bank behavior (i.e., the supply side of loans). These studies have tried to explain the stagnant loan market of the 1990s by focusing mostly on the fall in land prices, the rise in bad loans, and the regulation of banks' own capital ratios.

Ogawa and Kitasaka (2000) found that nonperforming loans had a negative effect on loan supply in the 1990s and banks' own capital ratios had a positive effect. In other words, their study supports the existence of the credit crunch. Conversely, Yoshikawa et al. (1994) found that there was no significant negative correlation between nonperforming loan ratios and loan supply in the early 1990s; therefore, they denied the occurrence of the credit crunch during that period.

In many other studies, the results are mixed. For example, Woo (1999) conducted a cross-sectional analysis using bank financial data from 1991 to 1997 in order to clarify the effect of bank's own capital ratios on loans, and reported that they had significant effects in 1997, but not in the other periods. Motonishi and Yoshikawa (1999) analyzed the fall in corporate investment in the 1990s and found that it was largely explained by real factors in 1992–1994, but it was triggered by financial factors in 1997. Horie (2001), Ishikawa (2005), and Watanabe (2007) obtained similar results. These studies suggest that the credit crunch was severe in the late 1990s, but not in the early 1990s. Ito and Sasaki (2002) tested whether increase in bank capital, which was financed by subordinate debentures, affected the loan supply. They found that banks' own capital ratios had positive effects on loan supply in larger banks but not in smaller banks. Honda et al. (1995) obtained similar results. These studies also suggest that the credit crunch was severer in larger banks than in smaller banks.

Some studies focused on banks' excessive forbearance: banks advanced additional loans to sluggish industries, such as construction and real estate, in order to postpone their failures. Peek and Rosengren (2005) confirmed empirically that the banks practiced forbearance lending, particularly if a bank had a reported capital ratio close to its required capital ratio and particularly to affiliated borrowers. Caballero *et al.* (2008) identified zombie firms—insolvent borrowers surviving on forbearance lending by banks—and found that zombie-dominated industries exhibited more depressed job creation and lower productivity. The works of Sasaki (1998) and Tsuru (2001) are in line with this study.

3. Analytical Framework

3.1 Basic idea of the analysis

As evident in section 2, most of the previous studies on the Japanese loan market focused on the effects of BIS regulations and nonperforming loans on the supply of loans. However, this single estimation of the supply function may suffer from simultaneous biases. In order to identify the supply side function, it is necessary to take into account the demand side, which is carefully considered in this paper.

Of course, some studies have tried to control the demand side of loans in a variety of ways. For example, Berger and Udell (1994) adopted a reduced-form approach by adding demand-side variables, such as proxies for economic activities, into the reduced form equation. Peek and Rosengren (1995) controlled for the demand side in a study on credit supply in New England. However, it is still the case that such controls are not perfect and usually do not adequately isolate the supply shocks from the demand shocks. Therefore, our approach of estimating both the loan supply and the demand functions is unique and may be superior to other widespread approaches.

Another problem that has seldom been addressed in previous studies is how to define credit crunch. Bernanke and Lown (1991) defined credit crunch as a shift in the supply function due to some exogenous shock, and most of the previous studies adhere to this definition.[3] However, this definition does not seem perfect—as argued below, it sometimes misclassifies counterintuitive cases as cases of credit crunch. One of the aims of this paper is to propose a new measure for credit crunch, or "reluctance to lend" ("Kashishibui" in Japanese), to address this issue.

In most cases, the cause of a reduction in the size of credit may be shrinkage in the demand for credit as well as shrinkage in the supply. In that regard, it is important to understand the extent to which the supply side is responsible. Even if previous studies found a negative effect of BIS regulations on loans, they at best confirmed a necessary condition for the situation where the supply side is the main cause. It appeals to our intuition to call "credit crunch" the case where supply side factors are the main cause for shrinkage in loans. Thus, we intend to investigate whether the supply side is the dominant cause for a decrease in loans or whether it is

3 An alternative definition of credit crunch is a phenomenon that results from banks refusing loan applications by firms, that is, credit rationing. As for the equilibrium credit rationing, although much has been written in the field of banking theory—for example, Jaffee and Russell (1976) and Stiglitz and Weiss (1981)—a method to estimate its magnitude has not been adequately developed. In addition, a change in magnitude of the equilibrium credit rationing should be associated with a shift in supply and demand loan functions. Moreover, according to Fair and Jaffee (1972), the magnitude of the disequilibrium credit rationing is relatively small after the 1990s, as noted in footnote 5.

the demand side. This can be quantified by the difference between shifts in the supply and demand functions.

It is possible to interpret our measure based on the attitude of banks towards advancing loans. When the loan supply function shifts to the left more than the loan demand function, borrowers face banks that have a stricter attitude towards advancing loans, and vice versa. To understand this, suppose that a bank's supply schedule shrinks slightly and the demand for loans declines simultaneously, largely owing to an exogenous shock. In this case, a large excess supply emerges until the interest rate is adjusted, which implies that the lender cannot find a borrower unless they soften their lending attitude. At the equilibrium, the interest rate falls (i.e., banks offer more generous conditions to find a borrower). In this case, according to the conventional definition, a credit crunch is said to have occurred. In contrast, by our measure, there has been no occurrence of credit crunch.

Despite the merit of our measure, we do not use the term "credit crunch" from this point onward to avoid unnecessary confusion with the conventional definition of credit crunch. Instead, we use the term "reluctance to lend" for our concept, to indicate that we measure a different concept.[4]

In this paper, we estimate the loan supply and demand functions assuming that the loan market is in equilibrium. The assumption of equilibrium seems reasonable owing to the fact that several studies suggest that the Japanese loan market became increasingly competitive after 1973.[5]

3.2 Hypothesis of the segmented loan markets by prefecture

In this paper, we utilize prefectural panel data from 1990 to 2001. We use a prefectural

[4] The English term "credit crunch" is indicated by the word *Kashisiburi* in Japanese, which literally means "reluctance to lend."

[5] Tsutsui (1982) reports that the excess demand for loans became smaller after 1973. Takenaka (1983) reports that the speed of adjustment became increasingly faster. Tsutsui (2005) reports that the largest excess demand (supply) was about 5% (2%) of outstanding loans in the 1990s, while it was about 15% (5%) before 1977.

data set because we understand the loan markets in Japan to be segmented by prefecture: the amount of loans and the loan interest rate within a prefecture are determined by the demand and the supply of loans in the prefecture.

This assumption may be supported because regional banks, shinkin banks (cooperative banks), and credit cooperatives operate in restricted areas. Of course, this segmentation, if it exists, is not perfect. First, city banks have nationwide branch networks, so they engage in arbitrage between the prefectural loan markets. Second, regional banks have 19% of their branches outside the home prefecture, so “prefectural loan markets” actually overlap. Using cross-sectional data from 1996, Kano and Tsutsui (2003) demonstrate that the loan markets of shinkin banks were segmented by prefectures, while those of regional banks were not. However, this time, we may obtain different results because we use the panel data set from 1990 to 2001. In this paper, we estimate the loan supply and demand functions assuming that the loan markets are segmented by prefecture. If this assumption is not valid, the estimates of these functions would be unreasonable. However, if the estimated coefficients of loan interest rate and other prefecture-specific variables show the expected signs, the assumption of market segmentation is validated.

3.3 Specification of the loan supply function

We derive a loan supply function from an inter-temporal profit maximization problem of a bank (see Ishikawa (2005), Ogawa and Kitasaka (2000), and Elyasiani et al. (1995)). First, we define profit π_t^k of the k -th bank operating in prefecture i in year t as

$$\pi_t^k = r_{it}(L_{it})l_t^k + r_t^c cl_t^k - r_t^d d_t^k - C(l_t^k, fl_t^k), \qquad (1)$$

where, $r_{it}(L_{it})$, l_t^k , r_t^c , cl_t^k , r_t^d , d_t^k , fl_t^k are the loan interest rate, amount of loan outstanding, call rate, amount of the call loan, deposit interest rate, amount of the deposit, and net increase in the loan ($fl_t^k \equiv l_t^k - l_{t-1}^k$), respectively. Because a few banks compete within a prefecture, we assume an imperfect loan market so that the loan interest rate $r_{it}(L_{it})$ depends on the aggregate of loans in prefecture *i*, $L_{it} \equiv \sum_{k \in prefecture\ i} l_t^k$. We also assume that the loan and deposit interest rates are common for banks in the same prefecture.[6] The call rate is the same across all prefectures. The operational cost function of a bank is $C(l_t^k, fl_t^k)$, where we assume $C_l > 0$, $C_{ll} \geq 0$, $C_{fl} > 0$, and $C_{fl,fl} \geq 0$. Note that $C_{fl} > 0$ reflects a positive search cost to obtain new customers and a positive monitoring cost to mitigate asymmetric information between new customers and the bank.

The k-th bank aims to maximize its firm value V_t^k under the balance sheet constraint $l_t^k + cl_t^k = d_t^k + cap_t^k$.

$$\underset{\{l_t^k, cl_t^k\}}{Max} \; V_t^k = E_t\left[\sum_{p=0}^{\infty} \gamma^p \pi_{t+p}^k\right]. \quad \text{s.t.} \quad l_t^k + cl_t^k = d_t^k + cap_t^k \tag{2}$$

To simplify the model, we assume that d_t^k and cap_t^k are exogenous.[7] Further, E_t is the operator of conditional expectation based on the information available in year t, $\gamma (0<\gamma<1)$ is the time discount rate. The first order condition becomes

$$\gamma E_t[\frac{\partial C_{t+1}}{\partial fl_{t+1}^k}] + r_{it}(1 - \frac{1}{\eta_{it}} S_{kt} \frac{\partial L_{it}}{\partial l_t^k}) - r_t^c = \frac{\partial C_t}{\partial fl_t^k} + \frac{\partial C_t}{\partial l_t^k}, \tag{3}$$

6 Although inspection of the data of each bank reveals this assumption does not rigorously hold, the framework of prefectural segmented markets implies the existence of a market interest rate for each prefecture.

7 In Japan, since the regulation on deposit interest rates was liberalized in 1993, the amount of deposits may be treated as a decision variable. Even in this case, however, the results of the following analysis are in essence not altered.

where $\eta_{it} \equiv -\frac{r_{it}}{L_{it}}\frac{dL_{it}}{dr_{it}}$ is the loan supply elasticity to the loan interest rate in prefecture *i*, and

$S_{kt} \equiv \frac{l_t^k}{L_{it}}$ is bank *k*'s market share in prefecture *i*.

Taking a linear approximation of the cost function and solving equation (3) for l_t^k yields

$$\begin{aligned} l_t^k = {} & \alpha_0 + \alpha_1 E_t[l_{t+1}^k] + \alpha_2 l_{t-1}^k + \alpha_3 (r_{ir} - r_t^r) - \alpha_3 \frac{r_{it}}{\eta_{it}} S_{kt} \frac{\partial L_{it}}{\partial l_t^k} + \alpha_4 LP_{it} \\ & + \alpha_5 bad_t^k + \alpha_6 cap_t^k + \alpha_7 SP_t + \alpha_8 CITYBANKS_{it} + \alpha_9 DENSITY_{it} \end{aligned} \quad , \tag{4}$$

where we add land price (LP_{it}), nonperforming loans (bad_t^k), bank's own capital (cap_t^k), stock market price index (SP_t), the dominance ratio of the number of branches of city banks to that of all types of banks (city, regional, and second regional banks) in prefecture *i* ($CITYBANKS_{it}$), and the population density ($DENSITY_{it}$) to the explanatory variables. We assume that $\alpha_1 \equiv \gamma(C_{fl,fl} + C_{fl,l})/\delta > 0$, $\alpha_2 \equiv (C_{fl,fl} + C_{fl,l})/\delta > 0$, $\alpha_3 \equiv 1/\delta > 0$, $\alpha_4 > 0, \alpha_5 < 0, \alpha_6 > 0, \alpha_9 > 0,$ and $\delta \equiv C_{fl,fl}(1+\gamma) + 2C_{fl,l} + C_{ll} > 0$.[8,9]

Here, $\alpha_1 > 0$ captures a smoothing effect: When loans are expected to increase tomorrow, a bank will increase loans today to save operational costs. This type of formulation of forward-looking behavior is typical of Japanese banks, which has been empirically supported by Ogawa and Kitasaka (2000). In addition, $\alpha_2 > 0$ captures an inertia effect: if loans increased yesterday, which can lower the monitoring costs today, a bank will increase loans today because

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8 The population density is included in the operational cost function and, in turn, in the loan supply function, because it is less costly for bank staffs in higher density areas to visit their customers.

9 If $C_{fl,l}$ was a large negative value, δ became negative, thus yielding a negative α_3. However, a negative sign on α_3 is not likely because it implies that a bank will increase its lending as the loan interest rate rises. Therefore, we postulate $C_{fl,l}$ does not take a large negative value.

it can take advantage of the lowered costs.[10] We expect $\alpha_4 > 0$ because a decrease in land price lowers the value of land held by a bank, leading to the impairment of capital and therefore a decrease in loans. A decrease in land price also lowers the collateral value of land, which may increase the screening costs of loan provisions, leading to a decrease in loans. We expect $\alpha_5 < 0$ and $\alpha_6 > 0$ because an increase in nonperforming loans and a decrease in own capital will result in a rise in the probability of a bank's default, leading to a reduction in the advancement of risky loans. However, $\alpha_5 > 0$ is possible, which represents the case of forbearance lending (i.e., the advance of more loans by banks to troubled firms in order to postpone their bankruptcy) (Berglof and Roland (1995, 1997)).

The sign of α_7 is not known a priori because a bank, faced with a blip in the stock market price index, may increase investment in stocks, consequently leading to a reduction of loans. Conversely, a rise in the index makes the value of owned stocks higher, consequently leading to an increase in capital, and therefore an increase in loans. The sign of α_8 is also not known: if bank *k* is as competitive as the city banks, it can increase its loans, but if it is not as competitive, it will be overwhelmed by the competition and decrease its loans. We expect $\alpha_9 > 0$ because a bank faced with high population density can expand business easily and will increase its loans.

Loan supply function for prefecture i in year t is derived by aggregating equation (4). By denoting the number of banks in prefecture i as I, we obtain

$$\begin{aligned} L_{it}^S &= \alpha_0 + \alpha_1 E_t[L_{it+1}] + \alpha_2 L_{it-1} + \alpha_3 (r_{it} - r_t^c) + \alpha_4 LP_{it} + \alpha_5 BAD_{it} + \alpha_6 CAP_{it} \\ &\quad + \alpha_7 SP_t + \alpha_8 CITYBANKS_{it} + \alpha_9 DENSITY_{it} + \alpha_{10} HI_{it} + v_i^S + \varepsilon_{it}^S \end{aligned}, \qquad (5)$$

[10] Behavioral equations of forward-looking economic agents, which include both the lead and lag of the dependent variable, are often seen in recent macroeconomic literature, such as the hybrid New Keynesian Phillips curve (Gali, Gertler, and Lopez (2005)).

where $L_{it} \equiv \sum_{k \in prefecture\ i} l_t^k$, $BAD_{it} \equiv \sum_{k \in prefecture\ i} bad_t^k$, $CAP_{it} \equiv \sum_k cap_t^k$. We redefine $\alpha_k I$ as $\alpha_k,\ k = 3,\ 4,\ 7,\ 8,\ 9$. Moreover, ν_i^S is an individual effect of prefecture i and ε_{it}^S represents an i.i.d. disturbance term with $E[\varepsilon_{it}^S] = 0$. Following Kano and Tsutsui (2003), we assume that $\frac{r_{it}}{\eta_{it}} \sum_{k \in prefecture\ i} (S_{kt} \frac{\partial L_{it}}{\partial l_t^k})$ is associated with the Herfindahl index, $HI_{it} \equiv \sum_{k \in prefecture\ i} S_{kt}^{\ 2}$. If the market structure-performance hypothesis is valid, then $\alpha_{10} < 0$.

3.4 Specification of the loan demand function

We assume that loan demand increases as loan interest rates decline, sales increase, retained earnings decrease, population density increases, and the costs of alternative funds (e.g., bonds and equities) increase (Me'litz and Pardue (1973), Fase (1995), Ogawa and Suzuki (2000)). We also assume that land prices and the stock market price index can affect loan demand. An increase in land prices boosts the value of real estate owned by firms, lowers the probability that firms will default, and helps to increase investments, which may augment loan demand. There are two ways to look at the effects of the stock market price index on loan demand. Firms faced with a climb of the index may increase funds by issuing stocks, which would lead to a reduction of loan demand. On the other hand, a rise of the index can be viewed as better profitability in the future, which may increase loan demand. The dominance ratio of SMEs in prefecture *i*, (defined as the number of employees of firms that have 4 to 99 staff members in prefecture *i* / the number of employees of firms that have more than 4 staff members in prefecture *i*), can be an explanatory variable in the loan demand equation. Since the SMEs have difficulty in raising funds directly in the financial markets, they are more bank-dependent: the higher the dominance ratio of the SMEs, the stronger the bank loan demand. In addition, the number of housing starts may be an important explanatory variable in the loan demand equation, because people may borrow funds in order to buy houses.

When a firm or a household borrows funds from a new bank, they may incur additional search costs, as is the case with the loan supply. Thus, the loan demand also depends on its past and expected values. As the data of retained earnings by prefectures are not available, we specify the loan demand function as follows.

$$
\begin{aligned}
L_{it}^{D} = {} & \beta_0 + \beta_1 E_t[L_{it+1}] + \beta_2 L_{it-1} + \beta_3 r_{it} + \beta_4 SALE_{it} + \beta_5 HOUSE_{it} \\
& + \beta_6 LP_{it} + \beta_7 SP_t + \beta_8 r_t^b + \beta_9 SME_{it} + \beta_{10} DENSITY_{it} + \nu_i^D + \varepsilon_{it}^D ,
\end{aligned}
\tag{6}
$$

where $SALE_{it}$ is shipment of products, $HOUSE_{it}$ is the number of housing starts, r_t^b is the interest rate of government bonds, SME_{it} is the dominance ratio of SMEs, ν_i^D is an individual effect of prefecture i, and ε_{it}^D represents an i.i.d. disturbance term with $E[\varepsilon_{it}^D] = 0$. We expect that $\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 > 0, \beta_5 > 0, \beta_6 > 0, \beta_8 > 0, \beta_9 > 0,$ and $\beta_{10} > 0$. The sign of β_7 is not known a priori.

3.5 Data

We use annual data from 1990 to 2001 for each prefecture.[11] However, only the data for the following items are available for each prefecture: the amount of loans outstanding, dominance ratio of city banks, population density, shipment of products, number of housing starts, and dominance ratio of SMEs. Therefore, as for the data of loan interest rates, the amount of nonperforming loans, and the amount of bank capitals, we construct these data for each prefecture by aggregating the corresponding data of individual banks. Specifically, denoting the financial data of the k-th bank as x_{kt} —(1) for regional and second regional banks whose head offices are located in prefecture i (referred to as group A), we just add up x_{kt} and (2) for city

[11] Because the Japanese economy began to recover in January 2002, we chose the period up to 2001 to analyze times when the reluctance to lend was supposed to be most severe, if it existed.

banks, trust banks, and long-term credit banks (referred to as group B), we multiply x_{kt} with w_{kit}, a weight for prefecture i, and then add up the products.[12]

Therefore, the data for prefecture i in year t, $X_{i,t}$, is

$$X_{it} = \sum_{\substack{k \in A\ group\ and \\ head\ office\ locates \\ in\ prefecture\ i}} x_{kt} + \sum_{k \in \mathrm{B}\ group} w_{kit} x_{kt} \quad , \tag{7}$$

where w_{kit} is defined as the number of employees of the k-th bank in year t who work at branches located in prefecture i / the total number of employees of k-th bank in year t.[13]

Data description is given in Table 1. It is interesting to note that in Table 1 the gaps between the minimums and the maximums are quite large except for the loan interest rate and the dominance ratio of SMEs. Indeed, the ratio maximum/minimum is 248 for loans, 39 for land price, 126,650 for nonperforming loans, 663 for own capital, 87 for population density, 74 for sales, and 39 for the number of housing starts. The necessity of utilizing the prefectural data stems from the fact that the economic variables are largely diversified among prefectures. The precise definitions of the data are given in Appendix.

3.6 Estimation method

Assuming that the loan markets are in equilibrium, we estimate equations (5) and (6) simultaneously by the Generalized Method of Moments (GMM).[14] The endogenous variables are the loan interest rate and the amount of outstanding loans, and the instrumental variables are

[12] We omitted the Bank of Tokyo because it specialized primarily in international transactions. We also omitted the Shinsei and Aozora Banks because of data restrictions.

[13] Since the information on the number of employees for each branch was made public only up until 1998, the data for 1999–2001 were replaced by the values for 1998.

[14] We also estimated equations (5) and (6) by the two-stage least squares (2SLS). The results are almost the same as those by GMM; therefore, we skip reporting them.

all the variables in equations (5) and (6) except for the endogenous variables.[15] As for the expected value of the loans, we assume perfect foresight, $E_t[L_{it+1}] = L_{it+1}$.[16]

We control the fixed effects by subtracting the individual mean from the equations. We do not employ the random effects model because the distribution of the associated Hausman test statistics in this estimation is not yet well known to us.

4. Results

4.1 Estimates of the supply and demand functions

We estimated equations (5) and (6) using the data of BAD and CAP in the current and former periods. Estimation with the data in the current period is problematic because $SALE$ is not significant and *J*-statistic is significant at the 10% level, which suggests misspecification of the model. Banks probably refer to BAD and CAP in relation to the previous period because they cannot obtain their current data by the time they make decisions on advancing loans.

The results using the data of BAD and CAP in the previous period are presented in the left column of Table 2. The results of the supply function are as expected: the lead and lag of the loan are significantly positive. Spread between the loan interest rate and the call rate, (SPR) and land price (*LP*) are significantly positive, which was also to be expected. Likewise, bank's own capital is significantly positive. However, the coefficient of nonperforming loans is

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[15] If we estimate a dynamic equation with panel data, it will also suffer from the endogeneity problem that lags of the dependent variable are not orthogonal to the error terms. In order to cope with this problem, one may take a difference of equations (5) and (6), and estimate them with instrumental variables chosen to be orthogonal to the error term (Arrelano and Bond (1991), Anderson and Hsiao (1981)). However, we have no other choice than to sacrifice econometric legitimacy because what we need to know is the magnitudes of the shifts of demand and supply curves and not the shifts of "differenced" demand and supply curves, which are hard to interpret.

[16] Some may argue that concomitant forecast errors will contaminate the consistency of the estimates. However, as is shown in the next subsection, the *J*-statistic is not significant at the 10% level, implying that the estimation may not be blurred by the endogeneity problem.

insignificant,[17] which suggests that some banks must have advanced forbearance lending to some firms. The Herfindahl index is insignificant, indicating the market structure-performance hypothesis is not valid. The stock market price index is significantly negative, implying that banks in the bull equity market may reduce the amount of loans and may increase investments in stocks instead. The dominance ratio of city banks is insignificant, but the population density is significantly positive as was expected.

Looking at the results of the demand function, the lead and lag of the loan are significantly positive, loan interest rate is significantly negative, land price is significantly positive, sales are significantly positive, bond interest rate is significantly positive, the dominance ratio of SMEs is significantly positive, and population density is significantly positive; all of these take the expected signs. The number of housing starts is insignificant, suggesting that households borrowing to buy houses may not be a substantial part of the loans advanced by private banks. The stock market price index is significantly negative, implying that firms in the bearish equity market may decrease funds raised from stocks and may increase borrowing from banks instead. The *J*-statistic is not significant at the 10% level, supporting this specification.

We estimate the functions deleting the insignificant variables, such as nonperforming loans, the Herfindahl index, the ratio of city banks, and the number of housing starts. The results are shown in the right column of Table 2. They are almost the same as those in the left column. In sum, these results are satisfactory, and the assumption of segmented prefectural loan markets fits the reality fairly well.

In the late 1990s, large banks went into bankruptcy. It is an interesting question whether the bank supply shrank owing to the bank failures. Thus, we ran regressions to measure the possible effects of the bank failures. Specifically, we constructed the bank failure dummies and estimated the same equation system shown in Table 2, incorporating the dummies to the

[17] When we drop own capital, nonperforming loans becomes negative but remains insignificant at the 10% level.

supply function. Bank failure dummies are Hyogo in 1995, Hokkaido in 1997, Osaka in 1999, and Tokyo in 1999. We also checked the effect of the dummy variable defined as the sum of these dummies, which represents the average bank failures. However, in any case, these dummies do not show significant negative impact on the supply of loans (the results are not shown to save space). One possible reason for these results is that the other banks took over the loans of the failed banks.

4.2 Has a reluctance to lend occurred?

Based on the estimates shown in the right column of Table 2, we calculate the shift of the supply and demand functions for each year from 1991 to 2001. First, the average of each explanatory variable across all prefectures in 1991 is substituted into the supply and demand functions, and these fitted values (*fitA_supply*, *fitA_demand*) are calculated. Then, the average of loan interest rates across all prefectures in 1991 and the averages of the other variables across all prefectures in 1992 are substituted into the supply and demand functions, and these fitted values (*fitB_supply*, *fitB_demand*) are calculated. The differences between these fitted values (*fitB_supply*−*fitA_supply*, *fitB_demand*−*fitA_demand*) are the magnitude of the supply and demand shifts from 1991 to 1992.

Figure 3, which presents the results of such calculations, reveals two facts. First, the actual value, the equilibrium value that equates loan demand and supply, the supply function, and the demand function all shifted toward the right (i.e., increasing direction) before 1996, while they shifted toward the left (decreasing direction) thereafter. Second, before 1996 the right (i.e., increasing) shifts of the supply function always exceeded those of the demand function, while after 1996 both shifts were roughly of the similar magnitude.

Let us first consider the period prior to 1996. The positive shifts of the actual and equilibrium values imply that the amount of outstanding loans increased every year. Figure 3 indicates, however, that the increase in loans during this period was induced by an increase in supply rather than an increase in demand, implying that the stagnant loan market was caused by the stagnant loan demand. Therefore, we conclude that the reluctance to lend did not occur in the earlier period.

In the period after 1996, the actual amount of loans decreased and the left shifts of the supply and demand functions are roughly of the same magnitude—implying that the decrease in loans depended on both supply and demand. When the results from the period after 1996 are compared with the results before 1996, it is clear that the reluctance to lend became more prevalent during the latter period.

In order to measure the magnitude of the reluctance to lend directly, let us calculate demand shift $-$ supply shift, which we denote as $RL_{i,t}$. The demand and supply functions are denoted as $L_{i,t}^{D} = \beta_3 r_{it} + \beta X_{i,t}^{D}$ and $L_{i,t}^{S} = \alpha_3 r_{it} + \alpha X_{i,t}^{S}$, the corresponding demand and supply "shifts" can be written as $\Delta L_{i,t}^{D} \equiv \beta\left(X_{i,t}^{D} - X_{i,t-1}^{D}\right)$ and $\Delta L_{i,t}^{S} \equiv \alpha\left(X_{i,t}^{S} - X_{i,t-1}^{S}\right)$ respectively, where $X_{i,t}^{D}$ and $X_{i,t}^{S}$ stand for the exogenous explanatory variables in the demand and supply functions. Then, the reluctance to lend measure $RL_{i,t}$ is defined as $\Delta L_{i,t}^{D} - \Delta L_{i,t}^{S} = \beta(X_{i,t}^{D} - X_{i,t-1}^{D}) - \alpha(X_{i,t}^{S} - X_{i,t-1}^{S})$.

A large and positive $RL_{i,t}$ means that the reluctance to lend is severer in prefecture *i* in year *t*. In addition, we calculate the factor decomposition $FD_{i,t}$ as $FD_{i,t} \equiv \beta(X_{i,t}^{D} - X_{i,t-1}^{D})$ for each explanatory variable in the demand function and $FD_{i,t} \equiv -\alpha(X_{i,t}^{S} - X_{i,t-1}^{S})$ for that in the supply function in order to evaluate the cause of the reluctance to lend.[18]

Figure 4, which shows the degree of reluctance to lend (demand shift $-$ supply shift)

[18] If an exogenous variable *Z* is included both in the demand and supply functions, then the factor decomposition of this variable becomes $FD_{i,t} \equiv (\beta - \alpha)(Z_{i,t} - Z_{i,t-1})$.

and its factor decomposition, reveals three facts. First, the degree of reluctance to lend consistently increased from 1992 to 2000, implying that the reluctance to lend became severer in the late 1990s.[19] Second, the reluctance to lend was greatly eased in 1995. Third, the call rate factor alone is almost enough to understand the severity of the reluctance to lend before 1996. However, other factors such as stock prices, bond rates, and bank capital became relatively important in the latter period.

Let us take a closer look at the factor decomposition. In Table 3, we present the average factor decomposition across all prefectures during the periods 1992–1996 and 1996–2000, in which the large and positive $RL_{i,t}$ means that the reluctance to lend is severer in prefecture i in year t. Among them, the call rate was the largest factor that alleviated the reluctance to lend. This result reflects the fact that the Bank of Japan lowered the call rate consecutively to ease money throughout the period. The effect, however, became weaker in the latter period because the call rate was lowered to near zero, so that there remained almost no room to fall further.[20] The bond rate was the second largest factor that alleviated the reluctance to lend by suppressing the loan demand, in which the easing of the monetary policy also played a leading role. Another variable that had a large effect on easing the reluctance to lend was stock prices, which were declining throughout the period. This affected the reluctance to lend because the decrease in stock prices boosted both the supply of and the demand for loans; since the boost to the supply was stronger, it helped to alleviate the reluctance to lend.

The other variables had a relatively small effect on the reluctance to lend. It is interesting to note, however, the results for the capital factor: the negative value of the factor decomposition for both periods indicates that bank capital was augmenting throughout the periods and helped to ease the reluctance to lend, although the contrary is often suggested by

[19] One may alternatively argue that the reluctance to lend was not the case at all before 1996, except for 1994, but it might have been thereafter.

[20] The Bank of Japan began to adopt a zero-interest-rate policy in February, 1999 and effectively lifted it in July, 2006.

previous studies. The results indicate that the difference between the two periods is significantly positive, which implies that the augmentation of bank capital contributed to easing the reluctance to lend more in the latter period than in the former.

4.3 The reluctance to lend was severer in populous and urban prefectures

In order to allow the comparisons of the degree of reluctance to lend among prefectures, we calculate the rate of shift $RRL_{i,t}$, dividing $RL_{i,t}$ by the equilibrium value of the loan (the demand-and-supply balancing loan amount) from the previous year. RRL_{it} is then averaged over 1992 to 1996, and 1996 to 2000.

We present the rate of reluctance to lend, *RRL*, for each prefecture in Figure 5 (1992–1996) and in Figure 6 (1996–2000), which reveal the following four facts. First, the *RRL* is negative in every prefecture, suggesting that an expansion in supply (a reduction in demand) outweighed an expansion in demand (a reduction in supply) in 1992–1996 (in 1996–2000) in every prefecture. Second, when we compare the two periods, the *RRL* is larger (smaller in negative value) in 1996–2000 than in 1992–1996 for most of the prefectures, which is consistent with our intuition that the reluctance to lend was severer in the latter period. Third, the prefectures in the top five *RRL*s are Tokyo, Kanagawa, Aichi, Osaka, and Fukuoka in either period, all of which have megacities. Meanwhile, the prefectures in the bottom five *RRL*s are Iwate, Tottori, Shimane, Kochi, and Miyazaki in the former period (Akita, Yamanashi, Tottori, Shimane, and Kochi in the latter period), all of which do not have large cities and are characterized as rural regions. In a word, the reluctance to lend was severer in populated areas.[21] Fourth, most of the prefectures with larger (smaller in negative value) *RRL*s in the earlier period also have larger (smaller in negative value) *RRL*s in the latter period. Indeed, the correlation between the *RRL*s in both periods is quite high with a correlation coefficient of 0.989.

In order to confirm the third fact, we selected the five largest and five smallest *RRL*

[21] Actual outstanding loans also decreased in the populated prefectures like Tokyo, Aichi and Osaka.

prefectures and examined their characteristics. In Table 4, we present the mean of the population, population density, GDP, per capita GDP, sales, per capita sales, the dominance ratio of the number of branches of city banks to that of all types of banks, and the SME ratio for the top five and bottom five prefectures in 1992–1996 and in 1996–2000.

In 1992–1996 (the upper panel of Table 4), the mean of the population for the top five prefectures is 8.09×10^6 and for the bottom five prefectures it is 9.59×10^5. This is shown by the mean difference test in the rightmost column; the former is significantly larger than the latter. Similarly, the means of population density, GDP, per capita GDP, sales, per capita sales, and the dominance ratio of city banks for the top five prefectures are significantly larger than those for the bottom five prefectures. The mean of the dominance ratio of SMEs, *SME*, is significantly smaller for the top five prefectures than that for the bottom five prefectures. In sum, the top five prefectures are characterized by larger population, GDP, sales, and city bank branches; therefore, we will refer to them as “populous prefectures” from this point on.[22]

4.4 Why were populous prefectures hit by a reluctance to lend?

In the previous subsection, we found that the reluctance to lend was severer in the prefectures that have megacities than in others. In order to elucidate the possible causes, we calculate the factor decompositions for the top five prefectures and for the bottom five, which are presented in Table 5.[23] To highlight the characteristics of the two groups, we test the difference of the mean of the factor decomposition, which are shown in the right hand columns of the table.

Let us take a look at the results of the mean difference in the table. Changes in bank capital and the dominance ratio of SMEs were the principal causes of the intensified reluctance

[22] We also examined whether populous and urban prefectures tend to decrease the actual amount of loans. The results are just the same as those of *RRL*s.
[23] Here, we present only the results of the factor decompositions for the prefecture-specific variables, because those for the other variables, such as the call rate, are identical to every prefecture, so that their factor decompositions will also be identical.

to lend in populous prefectures throughout both periods. Population density similarly affected the intensified reluctance to lend, but its effect became much smaller. The value of capital factors is significantly positive in the earlier period, which indicates that bank capital was an important element that intensified the reluctance to lend in populous prefectures in comparison with the bottom five prefectures. In the later period, the mean difference is still positive and large, though not significant.[24]

In the earlier period, SME factors, although not significant, were also important. However, in the later period, SME factors did become significant and were, in fact, the largest contributing element that intensified the reluctance to lend in populous prefectures in comparison with the bottom five prefectures, while capital factors were the second largest.[25]

In sum, variations in the intensity of the reluctance to lend among prefectures came from discrepancies in the health of the local economies, which is represented by the capital of banks as well as by the SME ratio, which are indicators of profitability among firms in the prefecture.

5. Conclusions

In this paper, we analyzed whether the supply side played a crucial role in causing stagnant and declining outstanding loans in Japan in the 1990s, with a special focus on its spatial differences. In other words, this paper attempted to clarify whether a reluctance to lend

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[24] The bank capital factor for the top five prefectures had a positive sign in the earlier period, implying that loans had decreased in populous prefectures (the first column in the upper panel). In the latter period, however, the bank capital factor of populous prefectures became negative, which means that loans had increased. This may be because bank capital in the populous prefectures was augmented possibly due to the injection of public funds. The same is true for the bottom five prefectures, and the mean difference was positive, which implies that bank capital in the bottom five prefectures experienced greater augmentation than the populous prefectures during the latter period.

[25] A larger SME ratio expanded loan demand (see Table 2), leading to a deterioration of the reluctance to lend. The bottom panel of Table 5 reveals that in the latter period, SME factors took on a large negative value for the bottom five prefectures. Comparison with the corresponding value in the earlier period (upper panel) indicates that loans for SMEs had sharply increased for the bottom five prefectures during the latter period. This is the reason why the SME ratio became an important element in the latter period.

actually occurred in the Japanese loan market. To this end, we calculate the magnitude of the shift of the supply and demand functions, provided that the loan market was in equilibrium. If the supply function shifted towards the left more than the demand function did, borrowers would have faced a strict attitude from the banks regarding the advancement of loans, which is in effect a reluctance to lend. Under the assumption that the Japanese loan markets are segmented by prefecture, we estimated the supply and demand functions using prefectural panel data from 1990 to 2001. This paper is unique in that it estimates both equations simultaneously and evaluates the severity of the reluctance to lend by comparing the magnitudes of the supply and demand shifts.

The estimation results reveal that until 1996, the supply function shifted toward the right more than the demand function did, indicating that stagnant loans in this period cannot be explained by the supply side. However, after 1996, when the loan amount decreased, the loan supply shifted leftward as much as the loan demand, implying that the contraction of supply contributed partly to the decrease in loans.

Closer examination revealed the salient characteristics of those prefectures that suffered from a severer reluctance to lend. First, the degree of the reluctance to lend was severer in the urban and populous prefectures. Second, the call rate and bond rate, which were declining because of a monetary easing policy, played a leading role in alleviating the reluctance to lend throughout the period.

These results suggest the following lessons. First, it is important to evaluate how much banks contribute to the reduction of loans—the role of the supply side is often overemphasized, as was the case in Japan. Our analysis reveals that the demand side played an equal or greater role, even in the context of the historical financial crisis in Japan during the period 1997–2000. If the reduction is mainly due to the lack of demand, countermeasures in the banking sector may not achieve the expected recovery. For example, according to an exercise conducted in 1998 and 1999 to evaluate the effect of the injection of public funds on bank lending, the injection increased outstanding loans by only a couple of percentage points among the actual decrease of −142.31 and −173.53 billion yen respectively.[26] Second, we demonstrate that the degree of the reluctance to lend was not uniform in Japan, but differed markedly among regions. This suggests that measures such as traditional monetary policy that influenced all regions uniformly were inadequate. Region-specific policies are therefore called for.

As shown in Figure 1, bank loans in the US are in sharp decline and have been since April 2008. Whether this decline is brought about from the supply or demand side, however, is not known a priori. Although the supply side did not play an important role in the Heisei Depression in Japan, as discussed in this paper, mechanisms of the crises differ between Japan and the US. In the case of Japan, the stock bubble burst first in 1990, the real estate bubble burst in 1991, then the GDP growth rate started to decline in 1992, and finally, financial crisis (bankruptcy of financial institutions) started in 1997-98. On the other hand, the order of occurrence differed for the US: the real estate bubble burst, the default of financial derivatives occurred, financial crisis (bankruptcy of financial institutions) started, and then the GDP growth rate declined. This fact suggests that the collapse of the financial system in the US preceded the depression, which is contrary to what happened in Japan. Therefore, the supply side of loans should play a more important role in the US than in Japan; however, since the corporate profits started to decline already in 2006, it might be that the opposite is true. In order to obtain a definitive answer, we will need to estimate the magnitudes of the shifts of demand and supply functions in the case of the US.

[26] The effect of the injection should be smaller than these estimates, if we consider the effect of financing the injection fund from a tax increase. Ishikawa (2004) simulated his general equilibrium model and found that the injection resulted in a decrease rather than an increase in the short run.

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Appendix: Precise definitions of the data

Bank Loans Outstanding: "Deposits, Loans and Discounts Outstanding of Domestically Licensed Banks by Prefecture (at the end of the fiscal year)," Source: Economic Statistics by Prefecture, Bank of Japan.

Land Prices: "Land Price of Residential District (average, unit is 100 yen/m^2)," Source: Land Price Survey by Prefecture, Ministry of Land, Infrastructure and Transport.

Call Rates: "Unsecured Overnight Call Rate (monthly average balance)," Source: Financial and Economic Statistics Monthly, Bank of Japan.

Shipment of Products: "Statistics by Prefecture, Shipment of Products (employees over 4 people, all manufacturing industries, and calendar year)," Source: Industrial Statistics (Manufacturing Industry), Ministry of Economic, Trade and Industry.

Housing Starts: "The Number of Housing Starts, Classified by Funds and Purposes (houses funded by private sector, owned house)," Source: Statistical Report on Execution of Construction Work, Ministry of Land, Infrastructure and Transport.

Bond Rates: "Subscriber's Yield of 10-year Government Bond (annual average)," Source: Home Page of Bank of Japan.

Stock market price index: "Nikkei Average of 225 Selected Issues in the Tokyo Stock Exchange (at the end of the fiscal year, monthly average), Source: Home Page of Tokyo Stock Exchange.

The number of branches of city banks, regional banks, second regional banks: "The number of branches of city banks, regional banks, second regional banks," Source: Financial Journal Monthly, Extra Edition (in Japanese, *Gekkan Kin-yu Journal*, *Zoukan Gou*), The Japan Financial News Co., Ltd.

Dominance ratio of city banks of prefecture i at t-th year is calculated as "(the number of branches of city banks of prefecture i at t-th year) / (the number of branches of city banks, regional banks, and second regional banks of prefecture i at t-th year).”

Population: “Population by Prefectures, with intercensal adjustment (as of October 1 of each year),” Source: Population Census, Ministry of Internal Affairs and Communications.

Area of prefecture: “Area by Prefectures (as of October 1 of each year, in square kilometers),” Source: Area Survey, Geographical Survey Institute, Ministry of Land, Infrastructure and Transport.

Population Density of prefecture i at t-th year is calculated as “(population of prefecture i at t-th year) / (area of prefecture i at t-th year in square kilometers).”

The number of employees of small and medium sized firms: “Number of employees, Statistics Tables by Prefecture (establishments with 4 or more employees),” Source: Industrial Statistics (Manufacturing Industry), Ministry of Economic, Trade and Industry.

Dominance ratio of small and medium sized firms of prefecture i at t-th year is calculated as “(the total number of employees of the firms of 4 to 99 staffs in the prefecture i at t-th year) / (the total number of employees of the firms of more than 4 staffs in the prefecture i at t-th year).”

Nonperforming loans: “Allowances for Loan Losses,” Source: Nikkei Needs Bank data.

Own capital: “the sum of capital stock, payment for new shares, capital reserve, earned surplus reserve, voluntary reserve, and unappropriated profit,” Source: Nikkei Needs Bank data.

Loan interest rate of prefecture i at t-th year is calculated as “(loan interest revenue of prefecture i at t-th year)/ (amount of outstanding loan of prefecture i at the end of t-1-th year),” Source: Nikkei Needs Bank data.

Table 1. Descriptive Statistics

(variables)	average	standard deviation	minimum	maximum
L	9.91×10^{3}	2.90×10^{4}	8.38×10^{2}	2.09×10^{5}
SPR	2.09	0.920	−1.68	3.80
RL	4.02	1.89	1.65	8.56
RC	1.93	2.53	2.00×10^{-3}	8.28
RB	3.24	1.80	0.972	6.80
LP	8.68	9.42	2.23	8.59
SP	1.80×10^{4}	3.79×10^{3}	1.15×10^{4}	2.65×10^{4}
CITYBANKS	0.0958	0.159	0.00435	0.736
DENSITY	6.52×10^{2}	1.12×10^{3}	67.7	5.90×10^{3}
HI	0.405	0.172	0.0747	0.802
BAD	78.6	3.04×10^{2}	0.323	4.09×10^{3}
CAP	6.45×10^{2}	1.70×10^{3}	19.8	1.31×10^{4}
SALE	6.61×10^{3}	7.11×10^{3}	5.27×10^{2}	3.88×10^{4}
HOUSE	4.66×10^{3}	4.56×10^{3}	7.15×10^{2}	2.80×10^{4}
SME	0.559	0.0789	0.356	0.778

Notes : *L* is amount of outstanding loans (in billion yen). *SPR* is spread between the loan interest rate and the call rate (in percent). *RL* is the loan interest rate (in percent). *RC* is the call rate (in percent). *RB* is the bond interest rate (subscriber's yield of 10-year government bond, in percent). *LP* is the land price (per unit square meter, in ten thousand yen). *SP* is the stock market price index (in yen). *CITYBANKS* is the dominance ratio of city banks. *DENSITY* is the population density (persons in square kilometers). *HI* is the Herfindahl index. *BAD* is the amount of nonperforming loans (in billion yen). *CAP* is the amount of own capital (in billion yen). *SALE* is the amount of sales (in billion yen). *HOUSE* is the number of housing starts. *SME* is the dominance ratio of SMEs. The sample period is from 1990 to 2001, and the number of prefectures is 47. The number of observations is 564.

Table 2. Estimation Results of the loan supply and demand functions (GMM)

L(+1)	+	0.488^{***} (15.1)	0.489^{***} (13.6)
L(−1)	+	0.476^{***} (11.6)	0.481^{***} (11.1)
SPR	+	$4.96\times10^{2**}$ (2.52)	$4.27\times10^{2**}$ (2.36)
LP	+	2.07^{**} (2.33)	1.84^{**} (2.00)
BAD(−1)	−	0.0109 (0.871)	
CAP(−1)	+	0.0520^{***} (4.27)	0.0400^{***} (3.46)
HI	−	3.76×10^{2} (0.771)	
SP	?	-0.102^{***} (−3.75)	-0.0895^{***} (−3.10)
CITY BANKS	?	9.72×10^{2} (1.28)	
DENSITY	+	22.1^{**} (2.01)	20.5^{*} (1.73)
L(+1)	+	0.486^{***} (14.6)	0.488^{***} (13.4)
L(−1)	+	0.475^{***} (11.3)	0.480^{***} (10.9)
RL	−	$-1.50\times10^{2***}$ (−2.72)	$-1.36\times10^{2**}$ (−2.50)
LP	+	2.08^{**} (2.30)	1.88^{**} (2.02)
SALE	+	$5.60\times10^{-3**}$ (2.24)	$5.53\times10^{-3**}$ (2.34)
HOUSE	+	-2.86×10^{-3} (−0.331)	
SP	?	-0.0683^{***} (−2.594)	-0.0613^{**} (−2.19)
RB	+	57.0^{**} (2.31)	56.0^{**} (2.30)
SME	+	$2.95\times10^{3*}$ (1.72)	2.42×10^{3} (1.56)
DENSITY	+	22.2^{**} (1.97)	21.1^{*} (1.72)
J-Statistics		8.04 [0.430]	6.43 [0.377]

Notes: See notes to Table 1 for definition of the variables. The dependent variable is the amount of outstanding loans. *L*(+1) and *L*(−1) denote a one-year lead and lag of the amount of outstanding loans. *BAD*(−1) and *CAP*(−1) denote a one-year lag of the amount of nonperforming loans and own capital. The loan demand and supply equations are estimated simultaneously by the GMM, in which we control fixed effects by subtracting individual mean from the equations. Endogenous variables are the amount of outstanding loans and loan interest rate. Instrumental variables are all of the variables in the loan demand and supply equations except for the endogenous variables. The numbers in parentheses ( ) are *t*-ratios. The superscripts ***, **, and * mean that the variables are significant at the 1% (***), 5% (**), and 10% (*) level. *J*-Statistics tests the null hypothesis that over-identified restriction is satisfied in the GMM estimation. *p*-values are shown in brackets [ ]. The sample period is from 1991 to 2000, and the number of prefectures is 47. The number of observations is 470.

Table 3. Factor decompositions of the reluctance to lend measure (average of all prefectures)

variables	average of all prefectures						
	1992–1996		1996–2000		mean difference (Welch) test		
	(a) mean	s.d.	(b) mean	s.d.	(a) - (b)	*T*	*d.f.*
reluctance to lend measure RL_{it}	-1.537^{***}	1.910	-0.255^{***}	0.480	-1.282^{***}	−10.00	264
call rate factors	-1.372^{***}	1.790	-0.081^{***}	0.241	-1.292^{***}	−10.96	242
land price factors	$-1.64\times10^{-3\,***}$	6.12×10^{-3}	$-1.14\times10^{-3\,***}$	2.32×10^{-3}	-5.00×10^{-4}	−1.18	300
sales factors	$-5.05\times10^{-3\,***}$	0.026	2.16×10^{-3}	0.028	$-7.21\times10^{-3***}$	−2.89	465
capital factors	$-2.33\times10^{-3\,***}$	0.015	$-7.49\times10^{-3\,***}$	0.036	$5.17\times10^{-3**}$	2.01	317
stock price factors	-0.039^{***}	0.294	-0.122^{***}	0.344	0.083^{***}	2.81	457
bond rate factors	-0.106^{***}	0.211	-0.039^{***}	0.120	-0.067^{***}	−4.26	370
SME factors	-0.012^{***}	0.066	-0.020^{***}	0.077	8.37×10^{-3}	1.27	457
population density factors	$1.17\times10^{-3\,***}$	1.93×10^{-3}	$3.80\times10^{-4***}$	1.80×10^{-3}	$7.86\times10^{-4***}$	4.57	466

Notes: The reluctance to lend measure RL_{it} is defined as "demand shift−supply shift," or $RL_{it} = \beta(X^D_{it} - X^D_{it-1}) - \alpha(X^S_{it} - X^S_{it-1})$, where X^D_{it} and X^S_{it} are the exogenous explanatory variables in the demand and supply functions, α and β are the corresponding coefficients. Large and positive RL_{it} means that the reluctance to lend is severer in prefecture *i* in year *t*. The factor decompositions of the reluctance to lend measure, for example, correspond to $\beta(X^D_{it} - X^D_{it-1})$ or $\alpha(X^S_{it} - X^S_{it-1})$. The null hypothesis of the mean difference (Welch) test is that the mean difference (a)-(b) is zero. The statistics *T* is defined as $(\mu_A - \mu_B)\big/\sqrt{s_A{}^2/n_A + s_B{}^2/n_B}$, where μ_A and μ_B are the sample means of group A and B, s_A and s_B are the sample standard deviations, n_A and n_B are the number of observations, respectively. Under the null, the statistics *T* follows *t*-distribution with degrees of freedom *d.f.* Also refer to the notes for Table 2.

Table 4. Characteristics of prefectures whose reluctance to lend measures are top five and bottom five

[1992–1996]

variables	top 5 prefectures (a) mean	s.d.	bottom 5 prefectures (b) mean	s.d.	mean difference (Welch) test (a) − (b)	T	$d.f.$
Reluctance to lend measures RRL_{it}	−0.164***	0.224	−3.41	3.13	3.25 ***	5.18	24
population	8.09×10^{6}***	2.35×10^{6}	9.59×10^{5}***	2.98×10^{5}	7.13×10^{6} ***	15.06	25
population density	3.24×10^{3}***	1.87×10^{3}	1.36×10^{2}***	33.99	3.10×10^{3} ***	8.27	24
GDP	3.99×10^{5}***	2.20×10^{5}	2.88×10^{4}***	8.84×10^{3}	3.70×10^{5} ***	8.42	24
per capita GDP	0.046***	0.012	0.030***	2.07×10^{-3}	0.016 ***	6.67	25
Sales	2.27×10^{5}***	9.34×10^{4}	1.27×10^{4}***	5.27×10^{3}	2.14×10^{5} ***	11.43	24
per capita sales	0.029***	0.014	0.013***	3.36×10^{-3}	0.016 ***	5.52	27
city banks	0.100***	0.064	1.49×10^{-3}***	4.59×10^{-4}	0.098 ***	7.65	24
SME	0.519***	0.102	0.621***	0.075	−0.102 ***	−4.03	44

[1996–2000]

variables	top 5 prefectures (a) mean	s.d.	bottom 5 prefectures (b) mean	s.d.	mean difference (Welch) test (a) – (b)	T	$d.f.$
Reluctance to lend measures RRL_{it}	−0.020	0.059	−0.578	0.858	0.558 ***	3.24	24
population	8.17×10^{6}***	2.30×10^{6}	8.58×10^{5}***	1.99×10^{5}	3.71×10^{6} ***	15.83	24
population density	3.26×10^{3}***	1.86×10^{3}	1.46×10^{2}***	41.34	3.12×10^{3} ***	8.35	24
GDP	4.14×10^{5}***	2.30×10^{5}	2.84×10^{4}***	6.51×10^{3}	3.85×10^{5} ***	8.38	24
per capita GDP	0.048***	0.013	0.033***	2.06×10^{-3}	0.014 ***	5.49	25
sales	2.11×10^{5}***	8.82×10^{4}	1.41×10^{4}***	6.35×10^{3}	1.97×10^{5} ***	11.15	24
per capita sales	0.027***	0.013	0.017***	6.80×10^{-3}	0.010 ***	3.46	36
city banks	0.096***	0.061	2.27×10^{-3}***	1.87×10^{-3}	0.094 ***	7.71	24
SMEs	0.523***	0.100	0.622***	0.073	−0.093 ***	−4.00	44

Notes: The reluctance to lend measure RRL_{it} is defined as RL_{it} divided the equilibrium value of the loan (demand-and-supply balancing loan amount) in the previous year. Also refer to the notes for Tables 2 and 3.

Table 5. Factor decompositions of the reluctance to lend measures (top five and bottom five prefectures)

[1992–1996]

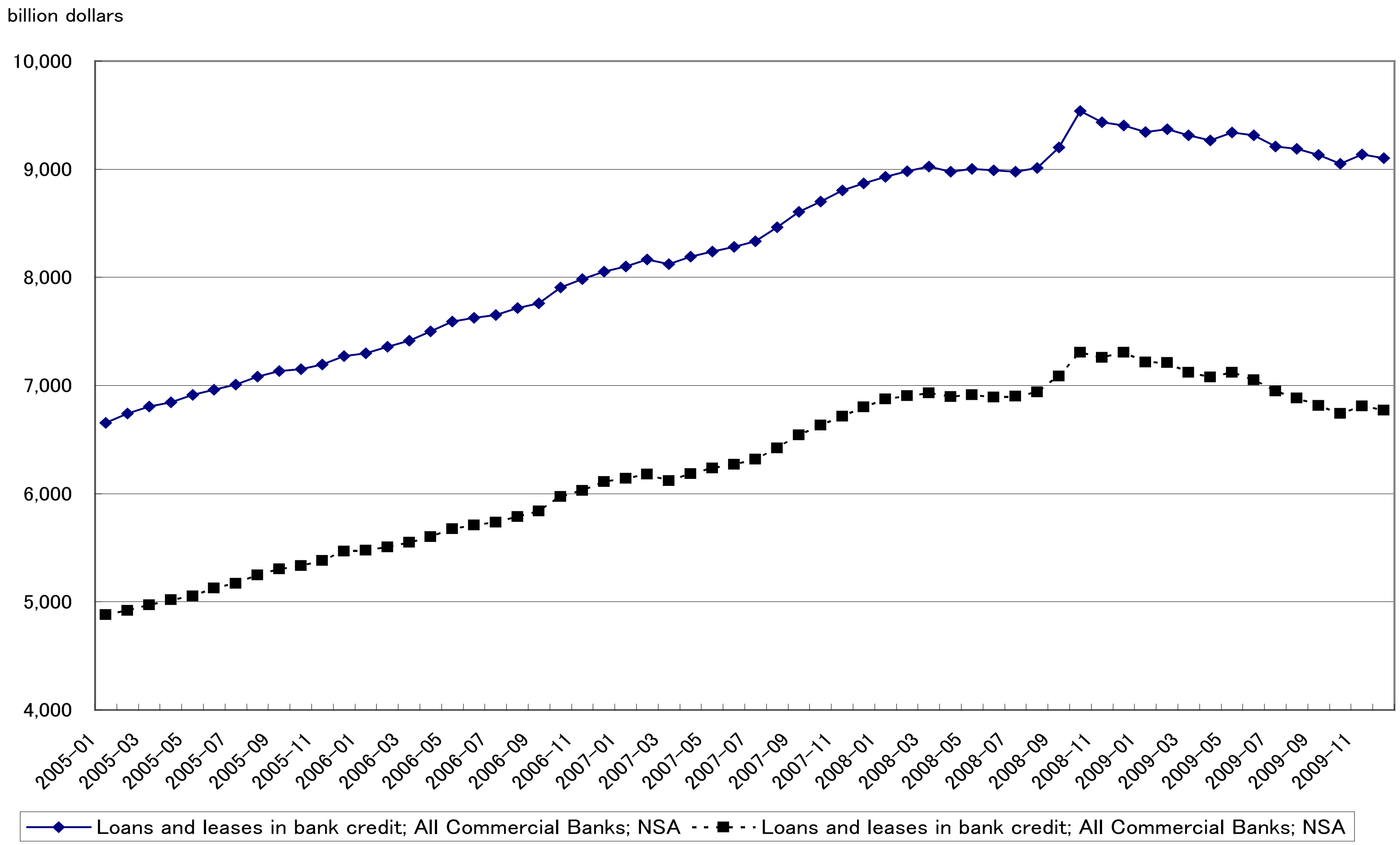
variables	top 5 prefectures		bottom 5 prefectures		mean difference (Welch) test		
	(a) mean	s.d.	(b) mean	s.d.	(a) – (b)	T	$d.f.$
reluctance to lend measures RRL_{it}	-0.164^{***}	0.224	-3.41^{***}	3.13	3.25^{***}	5.18	24
land price factors	$-1.97\times10^{-3***}$	1.99×10^{-3}	$1.40\times10^{-3***}$	2.55×10^{-3}	$-3.37\times10^{-3***}$	−5.20	45
sales factors	$-9.71\times10^{-3***}$	0.021	3.05×10^{-3}	0.014	-0.013^{***}	−2.52	41
Capital factors	6.05×10^{-3}	0.017	$-8.52\times10^{-3***}$	0.016	0.015^{***}	3.07	48
SME factors	-9.08×10^{-4}	4.71×10^{-3}	−0.020	0.124	0.019	0.78	24
population density factors	$1.47\times10^{-3***}$	1.58×10^{-3}	-1.83×10^{-4}	9.41×10^{-4}	$1.65\times10^{-3***}$	4.49	39

[1996–2000]

variables	top 5 prefectures		bottom 5 prefectures		mean difference (Welch) test		
	(a) mean	s.d.	(b) mean	s.d.	(a) – (b)	T	$d.f.$
reluctance to lend measures RRL_{it}	−0.020	0.059	-0.578^{***}	0.858	0.558^{***}	3.24	24
land price factors	$-7.37\times10^{-4***}$	5.84×10^{-4}	-6.35×10^{-4}	3.02×10^{-3}	-1.02×10^{-4}	−0.17	26
sales factors	-3.00×10^{-3}	0.022	5.81×10^{-3}	0.027	-8.81×10^{-3}	−1.27	46
Capital factors	-4.04×10^{-3}	0.044	$-1.47\times10^{-2***}$	0.024	0.011	1.07	37
SME factors	1.63×10^{-3}	6.97×10^{-3}	-0.062^{*}	0.149	0.064^{**}	2.15	24
population density factors	$1.50\times10^{-3***}$	1.51×10^{-3}	-4.09×10^{-4}	1.33×10^{-3}	$1.91\times10^{-3***}$	4.73	47

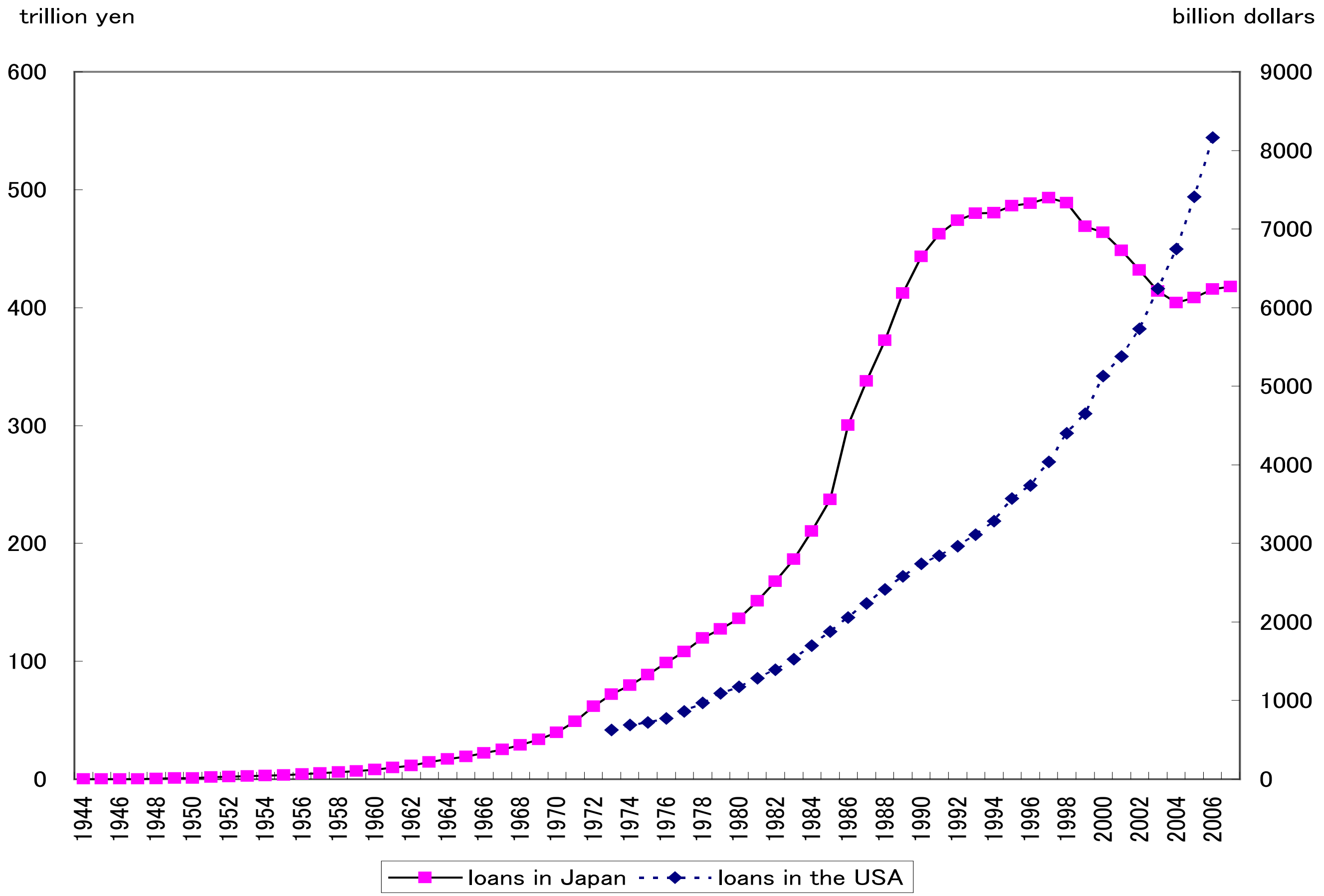
Notes: Refer to the notes for Tables 2, 3, and 4.

Figure 1. Recent decline in the amount of loans in the United States due to the subprime loan problem



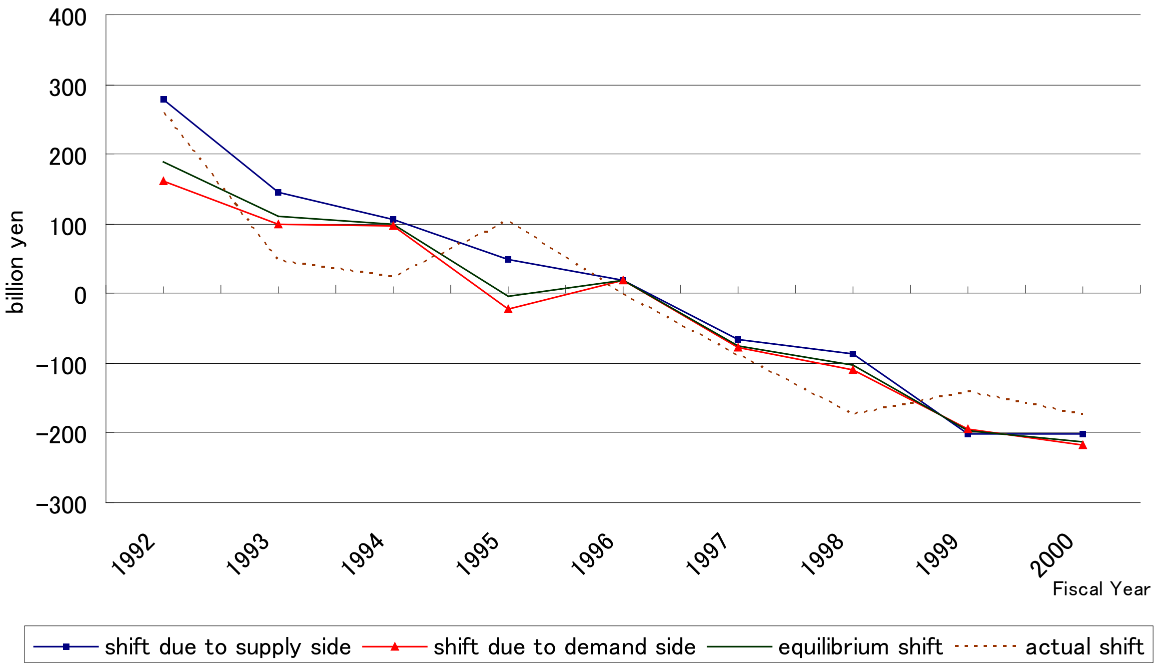
Notes: The data source is the website of The Federal Reserve Board.

Figure 2. Bank credit in Japan and the United States



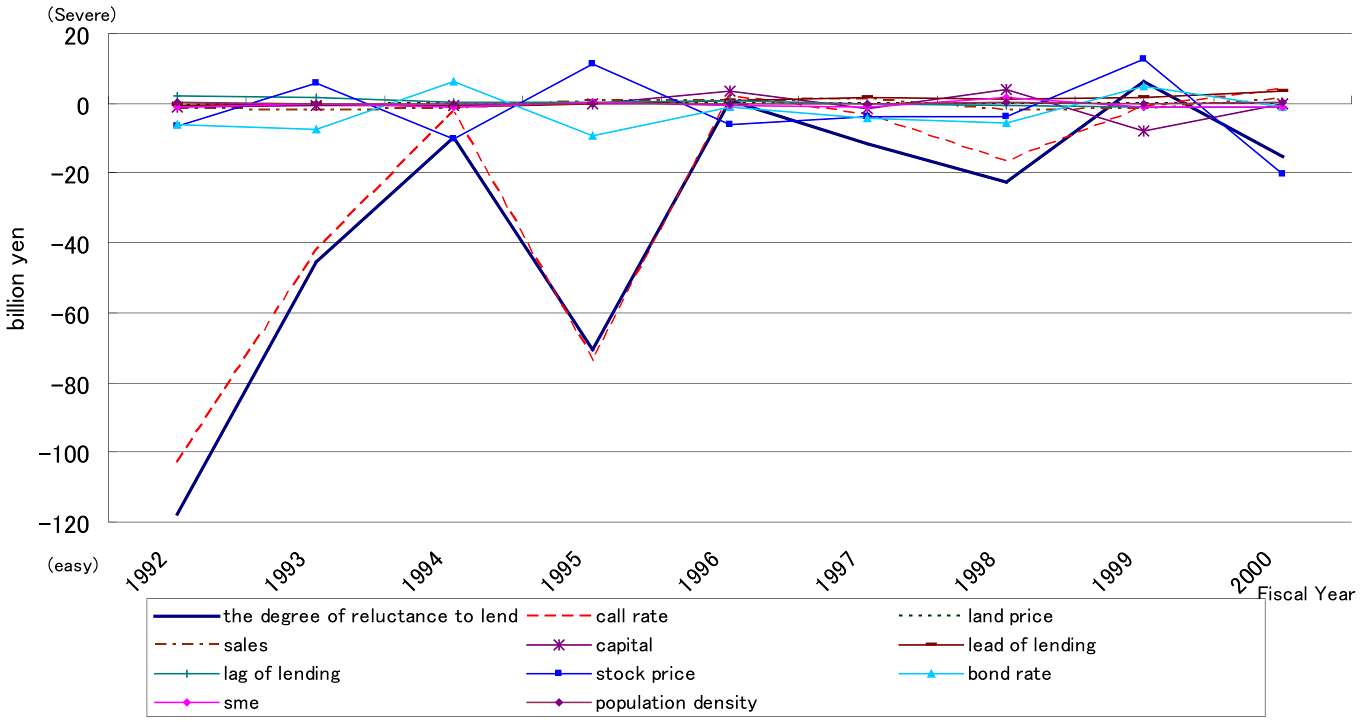
Notes: The data source of bank credit in Japan is from the Financial Statistics Annual, the Bank of Japan. The sample period is from 1944 to 2004. The data source of bank credit in the US is from the Board of Governors of the Federal Reserve System. The sample period is from 1973 to 2003.

Figure 3. Shifts in the loan supply and demand functions



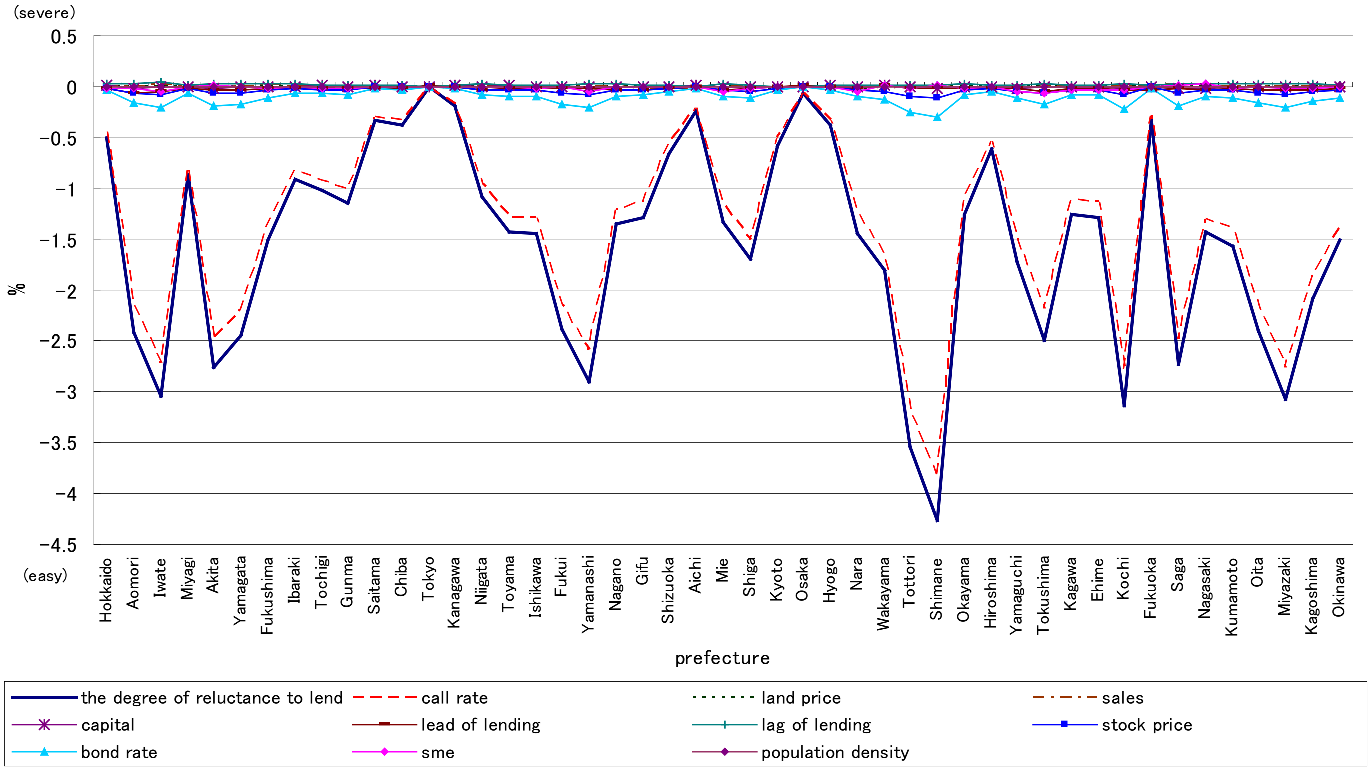
Notes: The shift due to supply and demand side for year *t* is calculated as follows: first, we substitute the prefectural average of each explanatory variable in year *t*-1 and calculate the fitted value of supply of and demand for loans in year *t-1*. Then, substituting the mean of loan interest rate in year *t*-1 and the mean of the other variables in year *t*, we calculate the fitted value in year *t*. The difference between these fitted values is the magnitude of the shifts from year *t*-1 to *t*. The equilibrium shift for year *t* is the difference between the prefectural average of equilibrium loans (supply-demand balancing loans) in year *t* and that in year *t*-1. The actual shift for year *t* is the difference between the prefectural average of outstanding loans in year *t* and that in year *t*-1.

Figure 4. The degree of reluctance to lend and its factor decompostion



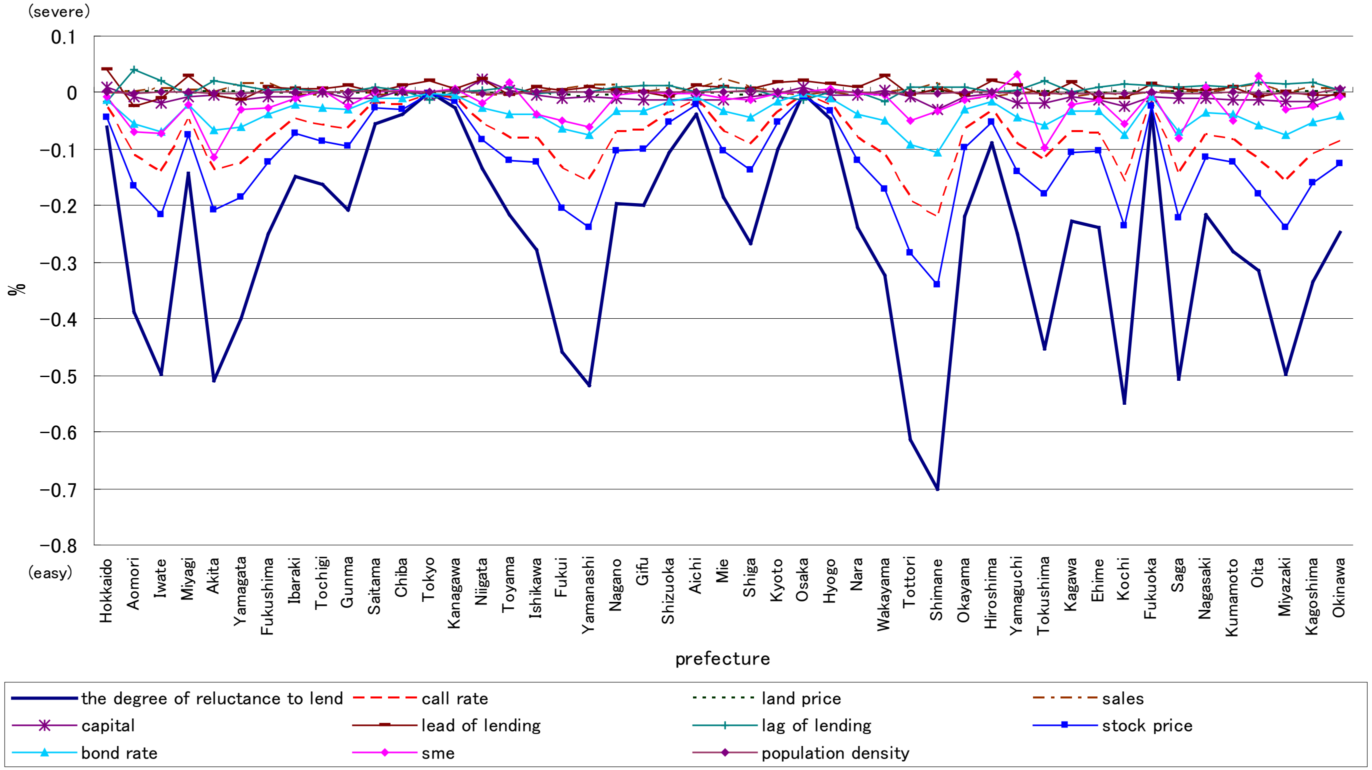
Notes: Refer to the notes for Table 3.

Figure 5. The degree of reluctance to lend and its factor decompostion (by prefecture; 92–96)



Notes: Refer to the notes for Tables 3 and 4.

Figure 6. The degree of credit cruch and its factor decompostion (by prefecture; 96–00)



Notes: Refer to the notes for Tables 3 and 4.