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Has the Credit Crunch Occurred in Japan in 1990s?

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Abstract

The purpose of this paper is to elucidate whether the supply side played a crucial role in causing credit crunch in 1990s. To this end, we estimated the supply and demand functions using prefectural panel data from 1990 to 2001, and calculate the shift of those functions. The results reveal that until 1996, the supply function largely shifted toward right, indicating that the supply side was not the main cause. However, after 1996 the loan supply shifted leftwards as much as the loan demand, implying that the contraction of supply contributed to the decrease in the loans.

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1. Introduction

Japanese loan market has been in severe slump since 1990, which is really a historical event. Figure 1 shows the amount of loans advanced by domestically licensed banks since 1944. It is apparent that 1990s is the first time in the post war Japan that the amount of loan stopped increasing and then decreased significantly. Closer inspection reveals that the loan became stagnant around 1993, but it still increased until around 1998, then it began decreasing.

In Figure 2, we present the bank credit of commercial banks in U.S. since 1973, which shows a monotonic upwards trend. Thus, we may say that the turn of the trend in 1990s of the outstanding loans in Japan is a global big event.

Facing this remarkable stagnant amount of loans, they say that firms, especially small and medium sized firms, are in trouble in their business because their applications for loans are refused by banks. Opinion, including that of the Diet, the government, and the media, blamed banks arguing that the problem originates from bank's reluctance to advance loans.

Many economists argue that a fall in stock prices decreased banks' asset, which, in turn, decreased their capital and therefore their own capital ratio, so that they are compelled to compress loans in order to clear the BIS regulation. According to their view, fall in the land price may be another cause because it decreased the value of collateral, so that banks suffered losses from bankruptcy of their borrowed firms. Thus, Japan fell into a vicious circle where the depression of the Japanese economy. In other words, an increase in the bankruptcy of firms, together with a fall of the land price, increased non-performing loans, which in turn caused the banks to reduce their loans to firms, i.e. credit crunch. In reverse, the credit crunch increased the bankruptcy of borrowed firms and worsened the Japanese economy. In order to solve this vicious circle, the government injected a huge public fund into banks in 1998 and 1999.

However, the problem is not so simple. The decrease in and/or stagnation of the amount of loans may be due to a decrease in the demand of loans, not due to a decrease in the supply of loans. Because Japanese economy has been in serious slump and the loan interest rate has been falling throughout 1990s, this view is very convincing.[1] If so, what is necessary to recover from the slump of Japanese economy is to increase the demand for loans by raising firms' effective demand, and the injection of public fund into banks is not an effective measure to raise the loans.[2]

The purpose of this paper is to elucidate which side, supply (bank) side or demand (firm and household) side caused a decrease in and/or stagnation of loans. As will be

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[1] Declining loan interest rate is only derived by the left shift of the demand function or right shift of the supply function, both of which contradict to credit crunch.

[2] Still it helps banks to amortize their bad loans and escape from their failure.

shown in the next section, almost of all the previous studies on the credit crunch have focused on the effect of own capital ratio and non-performing loans on the amount of loans, and disregard the demand side for loans. It should be noted that the effect of these variables is only a necessary condition for the credit crunch; it does not constitute a direct evidence for the credit crunch. On the contrary, the present paper is unique to take a different method: it estimates the magnitude of shifts of the supply and demand functions. A comparison of the magnitude of shifts of the supply and demand functions constitutes a direct evidence for the existence of the credit crunch.

This analysis has an important implication for the economic policy to banks. Policies which support banks, e.g. injection of public fund, will decrease their importance because they do not substantially increase the amount of loans. This paper also aims to investigate how the situation of bank loan market differs among prefectures by analyzing panel data for prefectures.

Rest of the paper is organized as follows. In the next section, we survey the literature. In section 3, we explain the analytical framework, including specification of our model, estimation method, and data. In section 4, we present the results and discuss them. In section 5, we conduct an analysis to see the differences among prefectures. Section 6 concludes.

2. An overview of the literature

There have been many studies on the credit crunch in Japan. Most of them focus on the banks, i.e. supply side of loans. They try to explain the stagnant loans in 1990s by a fall of land prices, an increase in bad loans, regulation on own capital ratio, and so on.

Ogawa and Kitasaka (2000) found that non-performing loans and own capital ratio had negative and positive effect on loan supply in 1990s, respectively. Namely, their study supports the existence of credit crunch. Meanwhile, Yoshikawa et al. (1994) found that there was no significant negative correlation between non-performing loan ratio and loan supply. In sum, they are negative to the occurrence of the credit crunch in early 1990s.

In many other studies, the results are mixed. For example, Woo (1999), using bank's financial data from 1991 to 1997, made a cross-section analysis of the effect of banks' own capital ratio on loans, and reported that it had significant effect in 1997, but not in the other periods. Horie (2001) and Ishikawa (2005) got the similar results. These studies may suggest that the credit crunch was severe in the late of 1990s, but not in the early 1990s. Ito and Sasaki (2002) tested whether banks' augmented capitals, which were financed by subordinate bonds, affected the loan supply. They found that own capital ratio had positive effects on loan supply for large banks, but not for smaller banks. Honda et al. (1995) obtained the similar results. These studies may suggest that the credit crunch was severer for larger banks than smaller banks.

Surprisingly, some studies reported that non-performing loans and own capital ratio exerted positive and negative effect respectively on loan supply for specific sectors, such as construction and real estate industry. They interpreted this result that banks may have advanced additional loans to the industries which accumulated huge non-performing loans. Sasaki (1998) and Tsuru (2001) are in line of this study.

3. Analytical Framework

3.1 Basic idea of the analysis

As we have seen in section 2, most of the previous studies focus on the effect of BIS regulation and nonperforming loans on the supply of loans paying no attention to the demand side. However, credit crunch may become severe when negative loan supply shift outweighs negative demand shift. Thus, even if they found a restricting effect of BIS regulation, they, at best, confirm the necessary condition for the credit crunch. To clarify whether the credit crunch prevails, it is necessary to investigate whether the effect of supply side reduction dominates the demand side. Thus, an analysis of the demand function is necessary as well as the supply function, which is done in this paper.

Then, how to define the credit crunch is still a problem, which has been seldom asked in previous studies. Different interpretations are possible. The first interpretation is that credit crunch is a phenomenon that banks refuse the application of loans by firms. This is the credit rationing, of which there have been large literatures in the banking theory. The disequilibrium econometrics is a statistical tool to examine disequilibrium credit rationing (Fair and Jaffee, 1972).

The second interpretation is that the credit crunch is a phenomenon that the loan supply function shifts to the left more than the loan demand function. In this case, borrowers face strict attitude of banks for advancing loans, leading to a reduction of the amount of loans. Borrowers feel that banks are reluctant to advance loans, i.e. the credit crunch.

In this paper we estimate the supply and demand functions for loans, and evaluate their magnitude of shifts, and elucidate whether the credit crunch occurred or not in the Japanese loan market. We will not apply the disequilibrium econometrics in this paper because it may suffer a problem of non-stationarity

3.2 Hypothesis of segmented loan markets by prefecture

In this paper we utilize panel data of prefectures from 1990 to 2001. We use prefectural data because we suppose that the loan markets in Japan are segmented into each prefecture, so that the amount of loans and the loan interest rates are determined based on prefectural loan demand and supply.[3]

This assumption may be supported because regional banks, shinkin banks, and credit cooperatives operate in restricted areas. Of course, the segmentation is not perfect, if it exists. First, city banks have nationwide branch networks, so that they arbitrage the segmented market. Regional banks have 19% of their branches outside the home prefecture, so that 'prefectural loan markets' actually overlapped. Kano and Tsutsui (2003) concluded that loan markets of shinkin banks were segmented for each prefecture, but those of regional banks were not, using data in 1996. However, as we analyze the period of 1990-2001, we may obtain different results. In this paper, we estimate the loan supply and demand functions, assuming that the markets are segmented for each prefecture, and if this assumption fails, the estimates of these functions will be unreasonable. In contrast, if interest rate and scale variables aggregated for each prefecture will show the expected signs, the assumption of segmented markets is supported.

[3] As explained below, we aggregate bank data to construct data of supply side for each prefecture. Alternatively, we can estimate using the data of each bank. However, in this case, how to construct demand variables (especially scale variables) for each bank will be a problem. Assuming an isolated bank who acts as if a monopoly in its operation area is harder to accept than the assumption of prefectural loan markets of this paper.

3.3 Specification of the loan supply function

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

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

where, $r_{it}(L_{it})$, l_t^k, r_t^c, cl_t^k, r_t^d, d_t^k, fl_t^k are loan interest rate, amount of outstanding loans, call rate, call loan, deposit interest rate, amount of deposit, and net increase in loan ($fl_t^k \equiv l_t^k - l_{t-1}^k$). Considering that a few banks competes within a prefecture, we assume imperfect loan markets, so that the loan interest rate, $r_{it}(L_{it})$, depends on the total amount of loans of prefecture *i*, $L_{it} \equiv \sum_{k \in prefecture\ i} l_t^k$. We assume that loan and deposit interest rates are identical for banks in the same prefecture. Call rate is the same over Japan. $C(l_t^k, fl_t^k)$ represents the operational cost function of the bank. We assume $C_l > 0$, $C_{ll} \geq 0$, $C_{fl} > 0$, $C_{fl,fl} \geq 0$. The reason for $C_{fl} > 0$ is the search cost for new customers and monitoring cost to mitigate the asymmetric information between new customers and a bank.

k-th bank is assumed to maximize their firm value V_t^k under the balance sheet constraint $l_t^k + cl_t^k = d_t^k + cap_t^k$.

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

To simplify the model, we assume that d_t^k and cap_t^k are exogenous variables.[4] E_t is an operator of conditional expectation, γ ($0<\gamma<1$) is the time discount rate. Euler equation of (1) becomes

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

where $\eta_{it} \equiv -\frac{r_{it}}{L_{it}} \frac{dL_{it}}{dr_{it}}$ is the supply elasticity of the total amount of loans in prefecture i to the loan interest rate, and $S_{kt} \equiv \frac{l_t^k}{L_{it}}$ is the bank k's market share in prefecture i.

Taking the linear approximation of the cost function and solving this for l_t^k we obtain,

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

where we added the land price, LP_{it}, non-performing loans, bad_t^k, own capital, cap_t^k, and the stock market price index, SP_t, to the explanatory variables, and $\alpha_1 \equiv \gamma(C_{fl,fl} + C_{fl,l})/\delta > 0$, $\alpha_2 \equiv (C_{fl,fl} + C_{fl,l})/\delta > 0$, $\alpha_3 \equiv 1/\delta > 0$, $\alpha_4>0$, $\alpha_5<0$, $\alpha_6>0$, $\delta \equiv C_{fl,fl}(1+\gamma) + 2C_{fl,l} + C_{ll} > 0$[5].

[4] Deposit interest rate was deregulated in 1993, so that deposit may be treated as a decision variable. Even in this case, the following analysis applies as the Euler equation with respect to loan.

[5] If $C_{fl,l}$ was large negative value, δ becomes negative, so that α_3 is negative. However, negative sign on α_3 is embarrassing 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.

$\alpha_1>0$ means a smoothing effect that when the amount of loan in the next period is expected to increase, a bank will increase the loan in the current period to restrain an increase in new lending costs. $\alpha_2>0$ means inertia effect that an increase in the loan in the former period decreases new lending costs of the current period, so that a bank increases the loan in the current period. We expect $\alpha_4>0$ because a decrease in land prices lowers the value of the land held by the banks, leading to a decrease in capital and therefore in loan supply. A decrease in land prices also lowers the collateral value of the land which may increase the screening costs of loan provisions, leading to an decrease in loans. We expect $\alpha_5<0$, $\alpha_6>0$ because an increase in non-performing loans and a decrease in own capital result in a rise in probability of bank default, leading to reduction of the risky loans.[6] The sign of α_7 is not known a priori because a bank, faced with a blip of the stock market price index, increases investment in stocks, leading to reduction of the loans, while a rise in the index makes the value of owned stocks higher, leading to an increase in capital, so that an increase in loans.

Loan supply function for prefecture i in t-th year is derived by an aggregation of (4). If the number of banks in prefecture i is I, we obtain

[6] Some may argue $\alpha_7>0$, because bank will advance more loans to the firms whose borrowings becomes non-performing to prevent direct depreciation of the loan (Berglof and Roland, 1995, 1997).

$$L_{it} = \alpha_0 + \alpha_1 E_t[L_{it+1}] + \alpha_2 L_{it-1} + \alpha_3 (r_{it} - r_t^c) + \alpha_4 LP_{it} + \alpha_5 BAD_{it} + \alpha_6 CAP_{it} \\ + \alpha_7 SP_t + \alpha_8 HI_{it} + v_i^S + \varepsilon_{it}^S \tag{5}$$

where $L_{it} \equiv \sum_{k \in prefecture\ i} l_t^k$, $BAD_{it} \equiv \sum_{k \in prefecture\ i} bad_t^k$, $CAP_{it} \equiv \sum_k cap_t^k$ and we redefine $\alpha_k I$ as α_k, $k = 3,4,7$. v_i^S is the individual effect of prefecture i, and ε_{it}^S represents 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, $\alpha_8 < 0$.

3.4 Specification of the loan demand function

We assume that the loan demand increases, as loan interest rates decline, sales increase, retained earnings decrease, and the cost of alternative funds, e.g. bonds and equities, increases (Me'litz and Pardue, 1973, Fase, 1995, Ogawa and Suzuki, 2000). We also assume that land prices and stock price market index affect the loan demand. An increase of land prices boosts the value of land held, lowers the probability of default, and increases the investment, which may augment the loan demand. The effect of stock price market index on the loan demand has two ways to look at; a firm, faced with a clime of the index, may increase fund raising from issuing stocks, leading to reduction of the loans, while a rise in the index reflects better business condition in the future, which may increase the loans. In addition, housing starts may be important in Japan considering that many people borrow in their younger period to buy a house and smooth the utility from housing.

When firms and households borrow from a new bank, additional search cost emerges, as is the case of the loan supply. Thus, the loan demand also depends on the past demand and the future expected demand. Since the data of retained earnings per prefecture are not available, we specify the loan demand function as follows.

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

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

3.5 Data

In this paper we use annual data from 1990 to 2001 for each prefecture. However, only data of amount of outstanding loans, shipment of products, and number of housing starts are available for each prefecture. Therefore, as for the data of loan interest rates, amount of non-performing loans, and the amount of bank capital, we construct the data for each prefecture by aggregating corresponding data of individual bank. Specifically, denoting financial data of k -th bank as x_{kt} ,

1) for regional and second regional banks, which we call group A, we just add up x_{kt} of banks whose head offices locate in prefecture i .

2) for city banks, trust banks, and long term credit banks, which we call group B, we multiply x_k with weight to prefecture i , w_{kit} , and then, add up the products. [7]

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

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

w_{kit} is defined as (the number of employees who work at branches of k -th bank in t -th year located in prefecture i)/(the number of employees who work at branches of k -th bank in t -th year)[8]

Data description is given in Table 1. What is interesting in this Table is that gap between minimum and maximum is quite large except for the loan interest rate. Indeed, The ratio of maximum/minimum is 248 for loans, 39 for land price, 126650 for non-performing loans, 663 for own capital, 74 for sales, and 39 for construction of housing. Thus, the economic variables are largely diversified among the prefectures.

The precise definition of the data are given in Appendix.

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7 We delete Bank of Tokyo because it is substantially specialized in international transactions, and Shinsei bank and Aozora bank because of the data restriction.

8 The data of the number of employees for each prefecture have been described in the financial statement reports until 1998. Thereafter, the data of 1998 is replicated.

3.6 Estimation method

Assuming that the loan markets are in equilibrium, we estimate (5) and (6) simultaneously by Generalized Method of Moments (GMM). Endogenous variables are loan interest rate and the amount of outstanding loans. As for the expected value of loan, we assume perfect foresight, $E_t[L_{it+1}] = L_{it+1}$.

We estimate our model by GMM, in which we control fixed effect by subtracting individual mean from the equations,[9] as well as by 'Error-Component 3SLS Model' (hereafter, EC3SLS, see Hsiao, 2003, and Baltagi, 2001). The distribution of the Hausman test of these two estimations, to our knowledge, is not known yet. Thus, we adopt the estimation by 'fixed effect model' which has the consistency, and present results by EC3SLS just for a reference. Instrumental variables are all the variables in (5) and (6) except for loan interest rate and the amount of loans which are endogenous variables, and density of population.

4. Estimation Results

[9] If we employ the fixed effect model to estimate a dynamic equation with panel data, it will suffer from endogeniety problem that lags of dependent variable are not orthogonal to error terms. In order to cope with this problem, one may difference eqs. (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 give up taking this method because the shifts of 'differenced' demand and supply curve are hard to interpret.

4.1 Estimates of the supply and demand functions

We estimated (5) and (6), using the data of BAD and CAP of the current and former periods. Estimation with the data of the current period suffers a problem that $SALE$ 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 of the previous period because they cannot get their current data by the time they make decision on advancing loans.

The results with the data of BAD and CAP of the previous period are presented in the left column of Table 2. The lead and lag of the loan are significantly positive in the supply function as expected. Spread between the loan interest rate and the call rate (SPR) is significantly positive as expected. Land price is positive but insignificant. While own capital is significantly positive as expected, non-performing loan is insignificant.[10] 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 increase investment in stocks, while reducing the loans instead.

Looking at the results of the demand function, the lead and lag of the loan are

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

significantly positive, loan interest rate significantly negative, sales significantly positive, and bond interest rate significantly positive, as are all expected. Land price is positive but insignificant. Housing starts is insignificant, suggesting that borrowing by households is still a small part of the loan advanced by banks. The stock market price index is significantly negative, implying that firms in the soaring equity market may increase fund raising in stocks, while reducing the bank borrowings. J-statistic is not significant at the10% level, supporting this specification.

We estimate the functions deleting the number of housing starts and the other insignificant variables, such as land price, non-performing loans, and the Herfindahl index. The results which are shown in the right column of Table 2 are almost the same as those in which that variable is included (the left column). In sum, these results are satisfactory, suggesting that the assumption of segmented prefectural markets reflects the reality fairly well.

Two stage least squares (hereafter, 2SLS) is less efficient than GMM, but it may be a good method in the sense that estimation of one equation is not disturbed by a possible specification error of the other equation because it disregard the correlation between error terms of eqs. (5) and (6). Thus, we also estimate them with 2SLS. The results which are shown in Table 3 are almost the same as those by GMM, however, the estimated coefficients like *SALE* become less significant as the econometric theory predicts. The exception is that the land price and housing starts in the loan demand function turn to be significantly positive.

The results by EC3SLS are shown in Table 4. Here, the Herfindahl index, *SALE*, and housing starts are insignificant. Loan and bond interest rate in the demand side have wrong signs, both of which are significant. Thus, EC3SLS gives less reasonable results than fixed effect model. This may imply that error term in the random effect model and explanatory variables are not orthogonal, so that EC3SLS loses the consistency.

4.2 Magnitude of the shift of the supply and demand functions

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, we substitute the mean of each explanatory variable in 1991 and calculate the fitted value of supply of and demand for loans. Then, substituting the mean of loan interest rate in 1991 and the mean of the other variables in 1992, we calculate the fitted value in 1992. The discrepancy between the fitted values is the magnitude of the shifts from 1991 to 1992. [11]

[11] We calculate the ratio of the shift by dividing the magnitude of the shifts by the fitted value. The results are almost the same as Figure 3 in which 100 billion yen corresponds 1%.

Figure 3, which presents the results of such calculations, reveals two facts. The one is that the actual value, the supply function, and the demand function shifted toward the right (i.e. an increase) before 1996, while they shifted toward the left (a decrease) thereafter. The other is that before 1996 a right (i.e. an increase) shift of the supply function always exceeded that of the demand function, while after 1996 both shifts were roughly of similar magnitude.

Let us consider the period prior to 1996. The positive shift of the actual value implies that the amount of outstanding loans increased every year. According to the result, one may argue that the credit crunch did not exist. However, as we explained in Introduction, although the amount of loans continued to increase until 1996, its speed slowed down remarkably compared with the speed in 1980s. Thus, it is not convincing to argue that the credit crunch did not exist because of positive growth rate of loans. Figure 3 indicates, however, the increase in loans in this period was induced by an increase in supply rather than an increase in demand. The stagnant loan market was caused by the stagnant loan demand. Therefore, we conclude that credit crunch did not occur in this period.

In the period after 1996, the amount of loan decreased and left shifts of the supply and demand functions are roughly of the same magnitude. This implies that the decrease in loan depended on both of supply and demand. Comparing with the situation before 1996, we may say that the credit crunch became more prevalent.

To quantify how severe the credit crunch was during the periods, we calculate the differences between supply and demand shifts (demand shift－supply shift), which we adopt as an indicator of the credit crunch. The magnitude of this measure indicates the contribution of supply shift relative to demand shift. If this is positive, it means supply shift relatively contributes to decrease the loan. Therefore, the difference between supply and demand shifts (demand shift－supply shift) may be a good measure for the credit crunch.

Figure 4 which shows the difference reveals two facts. The one is that the degree of the credit crunch grows during the period from 1992 to 2000, implying the credit crunch became severer in the late 90's. IOne may alternatively argue that the credit crunch was not the case at all before 1996 except for 1994, but it might have been thereafter. The other fact is that credit crunch was greatly eased in 1995.

Let us compare these results with Diffusion Index (D.I.) of lending attitude of financial institutions announced by the Bank of Japan. The D.I. is defined as the ratio of the firms considering that lending attitude becomes severer – the ratio of the firms considering that lending attitude becomes laxer, which is presented in Figure 5 from

1990 to 2002. The Figure reveals that the lending attitude became laxer until 1996, and turned sharply to 'severer' in 1997. The Figure also digs up the fact that the lending attitude was the easiest in around 1995. The Figure is generally consistent with our conclusion derived from Figure 3 and Figure 4.

4.3 Impact of the public funds injection to bank lending

In 1998 and 1999, the Japanese government injected public funds into troubled banks, aiming to stabilize the flurried financial system and to relax the credit crunch. It is worthwhile to evaluate the effects of infusions on the bank lending by a simulation method.

In our simulation, we assume that the total amount of injected money is distributed for the prefecture *i* with the weighting factor of $CAP_i / \Sigma CAP_i$ (i.e. the ratio of the amount of banks' capitals in prefecture *i* to that in whole Japan). Calculateing the difference between the loan supply shifts with and without the injection, we evaluate the impact of the public funds injection. Consequently, our simulation reveals that the differences are 1.35 and 5.88 billion yen in 1999 and 2000 respectively.[12] Compared with the actual shifts in 1999 and 2000, which are -142.31 and -173.53 billion yen, the

[12] The capital injection affects the loan supply in the next year because we used the one-period-lagged capital in estimating the loan supply equation.

impacts was rather small.

5. Analysis of the Credit Crunch by Prefecture

5.1 Magnitude of the shifts for each prefecture

We substitute the value of the explanatory variables of each prefecture to construct the fitted value for each prefecture. Then, we calculate the shifts for the period of 1991-1996, and divide it by the fitted value to get the rate of the shifts, which is shown in Figure 6.

Looking at the shift of the actual value, it increased over 10% for most of prefectures. Those that increased over 20% are (Aomori), (Iwate), Akita, Yamagata, Niigata, Nagano, Mie, Okayama, Shimane, Tottori, (Tokushima), Kochi, Fukuoka, (Saga), Nagasaki, Kumamoto, Oita, Miyazaki, and Kagoshima, most of which are rural prefectures (those increased over 30% are in parentheses). In contrast, those increased only less than 10% are (Tokyo), Aichi, Kyoto, (Osaka), Hyogo, Wakayama, and Ehime, most of which are urban prefectures (those decreased are in parentheses).

We present the rate of shift for each prefecture in the period 1996 to 2000 in Figure 7. Most of the prefectures decreased their amount of loan in this period. Those increased the loans are <u>Aomori</u>, <u>Iwate</u>, <u>Akita</u>, <u>Yamagata</u>, Saitama, Toyama, Gifu, Shizuoka, Tottori, Okayama, Tokushima, Ehime, Kochi, Oita, Miyazaki, Kagoshima, and Okinawa, most of which overlap with the prefectures increased over 20% during 1991 to 1996 (the overlapped prefectures are underlined). On the other hand, those decreased over 5% are Hokkaido, Miyagi, Gunma, Tokyo, Niigata, Ishikawa, Yamanashi, Kyoto, Osaka, Hyogo, Wakayama, Hiroshima, Yamaguchi, and Kagawa, most of which have large cities like the prefectures whose loans increased less than 10% in the former period (the overlapped prefectures are underlined). Indeed, the correlation coefficient between the actual shifts in both periods is 0.56, which is significantly positive.[13]

Comparing Figure 7 with Figure 6, it is apparent that the mean of actual shift became negative in the latter period, and that magnitude of the supply shift is similar to that of the demand shift in the latter period.

5.2 Prefectures that have large cities decreased more loans

In order to confirm the conclusion of the previous subsection, we compare the characteristics of those prefectures whose shift was large and small. In Table 5, we split the whole prefectures into those 23 prefectures whose rate of shift was over 18% in the

[13] In the test of no correlation when the number of samples is 47, no correlation is not rejected if the correlation coefficient is under 0.28.

former period of 1991 to 1996 and the other 24 prefectures, and present the mean of various economic variables such as GDP and price level for each group. In the extreme right column in the Table, we show the ratio of the means of the both groups , i.e. (mean of high rate shift group)/ (mean of low rate shift group). Looking at the ratio, item that the mean is larger for the high group is only area of prefecture. Those items for which two groups are roughly the same are per capita GDP, price level, the number of branches of regional banks, and the number of branches of all financial intermediaries. As for the population and GDP, the mean of high group is a half of low group, for population density 1/4, and for the number of branches of city banks less than 10%. As for the amount of loans and deposits, high group is far small.

In Table 6, we present these figures for the period of 1996 to 2000. Here we divide the group by the criterion that the loan decreased over or less than 2%. Looking at the ratio shown in the extreme right column, the same tendency of the previous period, even if not so clear, is recognized in the latter period.

These results indicate that prefectures whose loans became stagnant are those which have large population, population density and many branches of city banks. Prefectures whose loans decreased in the latter period have a similar tendency.

One might question this result because they say that the credit crunch has been severer for medium and small sized firms than for large firms, and large firms are more concentrated in large cities. Thus, let us confirm that loans to medium and small sized firms decreased more. In Table 7, we show the rate of change in loans to lager firms and smaller firms. When we define large firms A as those whose capital is over 1 billion yen, the change is 1.19% during 1991-1996 and -16% during 1996-2000, while small firms A defined as those whose capital is less than 1 million yen is -29.4% and -62.1%, respectively. Thus, casual observation is confirmed. This conclusion remains true for the period of 1966-2000 when we define large and small firms B as those whose capital is more and less than 100 million yen.

Thus, one possible interpretation of these contradictory facts is that banks' attitude of advancing loan was different between rural and urban area. If banks, especially large banks in large cities, decreased the loans, especially loans to smaller firms radically, our results and the conventional observations on loans to different sized firms are compatible. We show the rate of change in loans advanced by city banks and regional banks at the right column if Table 7, which reveals that the loans of city banks decreased more than those of regional banks in both periods.

5.3 The credit crunch was severer in urban prefectures

The difference between supply and demand shifts may be a good measure for the credit crunch. Thus, we calculate the rate of demand shift – the rate of supply shift for the period of 1991-96, which we call DIFF91 (see Figure 8). Prefectures whose DIFF91 is less than -15% are Aomori, Iwate, Akita, Yamagata, Fukui, Yamanashi, Tottori, Shimane, Tokushima, Kochi, Saga, Oita, and Miyazaki, most of which overlap with those increased loans over 20% in the early 1990s (overlapped prefectures are underlined). On the other hand, prefectures whose DIFF91 is more than -5% are Hokkaido, Saitama, Chiba, Tokyo, Kanagawa, Shizuoka, Aichi, Osaka, Hyogo, Hiroshima, and Fukuoka, most of which have large cities as the prefectures whose loans increased less than 10% (overlapped prefectures are underlined). Indeed, correlation coefficient between the actual growth rate of loans and DIFF91 is 0.54, which is highly significant. This suggests that the increase in actual loans in the period 1991 to 1996 is caused by rightward shift of supply function, implying that the credit crunch did not prevail at all.

Next, we calculate the rate of demand shift – the rate of supply shift in the later period, DIFF00. Prefectures whose DIFF00 is less than -1.5% are Iwate, Akita, Yamagata, Toyama, Ishikawa, Fukui, Yamanashi, Shiga, Nara, Wakayama, Tottori, Shimane, Yamaguchi, Tokushima, Kagawa, Kochi, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, and Okinawa, while those more than -0.5% are Saitama, Chiba, Tokyo, Kanagawa, Aichi, Osaka, and Fukuoka (prefectures which overlap with those of which loan was over 0% or less than 5%, are underlined, respectively). Thus, prefectures with relatively small supply shift are those which have large cities. However, the prefectures with relatively large supply shift are somewhat different from those whose shift of the actual loans was large. In fact, correlation coefficient between the actual growth rate of loans and DIFF00 is -0.19, which does not reject no correlation, even if it takes negative sign. In sum, we cannot conclude that the decrease in loan in the later period was mainly due to supply side.

7. Conclusions

In this paper, we analyze whether the supply side played a crucial role in causing stagnant and declining outstanding loans in 1990s. In other word, the purpose of this paper is to make clear whether the credit crunch really happened in Japanese loan market.

In this paper we calculate the magnitude of the shift of the supply and demand functions assuming market equilibrium. If the supply function shifted towards left more than the demand function, borrowers would have faced strict attitude of banks, which means existence of credit crunch. 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.

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

Examining the rate of shift of loans by prefecture, amount of loan, as well as supply and demand, decreased more in the prefectures which have large cities. The credit crunch, if it existed, was severer in urban prefectures than rural prefectures.

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Appendix: The 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, 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.

Non-performing loans: "Allowances for Loan Losses", Source: Nikkei Needs Bank data[14].

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.

14 There have been three data on non-performing loans other than reserve for default. We adopt allowances for loan losses because the other data are available only for limited period, and the definition of the data varies over time.

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}
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}

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

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

L(+1)	+	0.487^{***} (16.1)	0.504^{***} (20.7)
L(-1)	+	0.472^{***} (13.3)	0.461^{***} (17.1)
SPR	+	$3.88\times10^{2**}$ (2.28)	$4.77\times10^{2**}$ (2.40)
LP	+	0.446 (0.583)	
BAD(-1)	-	7.87×10^{-3} (0.344)	
CAP(-1)	+	0.0526^{**} (2.32)	0.0453^{***} (2.67)
HI	-	5.15×10^{2} (1.36)	
SP	?	-0.0799^{***} (-3.45)	-0.0797^{***} (-3.21)
L(+1)	+	0.484^{***} (15.6)	0.505^{***} (19.9)
L(-1)	+	0.475^{***} (13.3)	0.459^{***} (16.7)
RL	-	$-1.15\times10^{2**}$ (-2.53)	$-1.28\times10^{2**}$ (-2.49)
LP	+	0.448 (0.591)	
SALE	+	$4.59\times10^{-3**}$ (2.36)	$3.65\times10^{-3*}$ (1.90)
HOUSE	+	-6.30×10^{-3} (-0.547)	
SP	?	-0.0514^{**} (-2.07)	-0.0460^{*} (-1.67)
RB	+	49.7^{**} (2.33)	49.5^{**} (2.10)
J-Statistics		10.7	5.44
		[0.219]	[0.364]

Notes : See notes to Table 1 for definition of the variables. The dependent variable is amount of outstanding loans. *L*(+1) and *L*(-1) denote a one-year lead and lag of amount of outstanding loans. *BAD*(-1) and *CAP*(-1) denote a one-year lag of amount of non-performing loans and own capital. The loan demand and supply equations are estimated simultaneously by the GMM, in which we control fixed effect by subtracting individual mean from the equations. Endogenous variables are amount of outstanding loans and loan interest rate. Instrumental variables are all the variables in the loan demand and supply equations except the endogenous variables, and density of population. Number 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 prefecture is 47. The number of observations is 470.

Table 3. Estimation Results of the loan supply and demand function (2SLS)

L(+1)	+	0.493*** (13.6)	0.538*** (13.4)
L(-1)	+	0.482*** (9.79)	0.445*** (9.65)
SPR	+	8.79×10^{2}** (2.38)	4.40×10^{2} (1.49)
LP	+	1.50 (1.56)	
BAD(-1)	-	-0.0846 (-0.776)	
CAP(-1)	+	0.346*** (3.27)	0.398*** (2.95)
HI	-	-4.02×10^{3} (-1.33)	
SP	?	-0.113** (-2.39)	-0.0881** (-1.98)
L(+1)	+	0.475*** (10.4)	0.535*** (11.0)
L(-1)	+	0.498*** (9.10)	0.441*** (8.78)
RL	-	-2.42×10^{2} (-1.61)	-1.88×10^{2} (-1.23)
LP	+	2.84* (1.70)	
SALE	+	-0.0181 (-0.571)	0.0178 (0.843)
HOUSE	+	0.188* (1.86)	
SP	?	-0.0396 (-1.00)	-0.0467 (-1.12)
RB	+	1.12×10^{2} (0.664)	99.6 (0.546)

Notes : The loan demand and supply functions are estimated simultaneously by the two-stage least squares, in which we control fixed effect by subtracting individual mean from the equations. Endogenous variables are amount of outstanding loans and loan interest rate. Instrumental variables are all the variables in the loan demand and supply equations except the endogenous variables, and density of population. Also refer to Notes to Table2.

Table 4. Estimation Results of the loan supply and demand function (EC3SLS)

L(+1)	+	0.482*** (79.3)	0.506*** (68.1)
L(-1)	+	0.521*** (87.9)	0.498*** (71.1)
SPR	+	6.70×10^{2}*** (9.07)	1.32×10^{2} (0.733)
LP	+	0.198*** (5.55)	
BAD(-1)	-	-0.249*** (-8.50)	
CAP(-1)	+	0.0354*** (2.98)	2.64×10^{-3} (0.150)
HI	-	-91.2 (-1.07)	
SP	?	-0.0563*** (-4.56)	-0.0450 (-1.06)
L(+1)	+	0.503*** (36.3)	0.514*** (26.4)
L(-1)	+	0.500*** (37.1)	0.490*** (25.8)
RL	-	3.13×10^{2}*** (2.89)	1.34×10^{2} (0.700)
LP	+	0.226** (2.13)	
SALE	+	-9.02×10^{-4} (-1.30)	1.61×10^{-3} (1.53)
HOUSE	+	2.01×10^{-5} (1.01×10^{-3})	
SP	?	-0.0717** (-2.21)	-0.0519 (-0.936)
RB	+	-2.55×10^{2}** (-2.19)	-1.41×10^{2} (-0.693)

Notes : The loan demand and supply functions are estimated simultaneously by the error-corrected three-stage least squares. Endogenous variables are amount of outstanding loans and loan interest rate. Instrumental variables are all the variables in the loan demand and supply equations except the endogenous variables, and density of population. Also refer to Notes to Table2.

Table 5. Salient features of prefectures having large and small actual shifts of bank loans: 1991-1996

	the rate of actual shift of bank loan (R91)>18				the rate of actual shift of bank loan (R91)<18				
	average	standard deviation	minimum	maximum	average	standard deviation	minimum	maximum	ratio (high R/low R)
per capita GDP	0.032	0.004	0.027	0.043	0.037	0.008	0.025	0.067	0.874
GDP	61088	44921	20097	198776	143762	172733	30084	797050	0.425
price level	90	2	85	93	92	3	87	99	0.978
population	1830990	1235842	614070	5669137	3451042	3037463	823939	11849000	0.531
area	10560	16172	2439	83408	5075	2694	1861	13781	2.081
population density	253	194	68	1011	1024	1477	154	5755	0.248
loans outstanding	31299	30458	9412	137073	167844	422725	12733	2066388	0.186
deposits outstanding	41103	28214	14642	129267	141764	272664	19126	1345602	0.290
# of city bank branches 93	12	31	1	152	137	303	1	1426	0.089
# of regional bank branches 93	166	76	83	454	163	61	78	321	1.016
# of branches of all banks 93	1278	609	610	3239	1652	1107	595	5378	0.773
# of prefectures	23				24				

Notes: The features of prefectures whose actual rate of shifts of bank loans are over and less than 18% are summarized in the left and right columns respectively. The rightmost column is the ratio of the average of high rate shift group to that of low rate shift group. # of city bank branches 93, # of regional bank branches 93, and # of branches of all banks 93 are the number of those branches at the end of March, 1993. # of branches of all banks includes those of post office, and Agricultural and Fisheries Cooperative Association.

Table 6. Salient features of prefectures having large and small actual shifts of bank loans: 1996-2000

	the rate of actual shift of bank loan (R00)>−2				the rate of actual shift of bank loan (R00)<−2				
	average	standard deviation	minimum	maximum	average	standard deviation	minimum	maximum	ratio (high R/low R)
per capita GDP	0.0348	0.0051	0.0269	0.0486	0.0383	0.0083	0.0265	0.0718	0.909
GDP	76128	70264	21310	339290	142637	182943	25385	848849	0.534
price level	93	2	89	97	95	3	91	101	0.980
population	2091475	1645344	614766	6974481	3317001	3044843	765866	11829900	0.631
area	7173	3336	2264	14816	8371	16516	1861	83408	0.857
population density	369	408	96	1824	953	1522	68	5745	0.387
loans outstanding	41256	39665	12014	190636	160590	397640	10903	1909677	0.257
deposits outstanding	56626	52956	17090	245740	141998	254077	17502	1215734	0.399
# of city bank branches 00	25	67	1	264	120	281	1	1289	0.208
# of regional bank branches 00	161	50	80	315	174	87	81	464	0.925
# of branches of all banks 00	1265	547	600	2990	1662	1122	610	5172	0.761
# of prefectures	24				23				

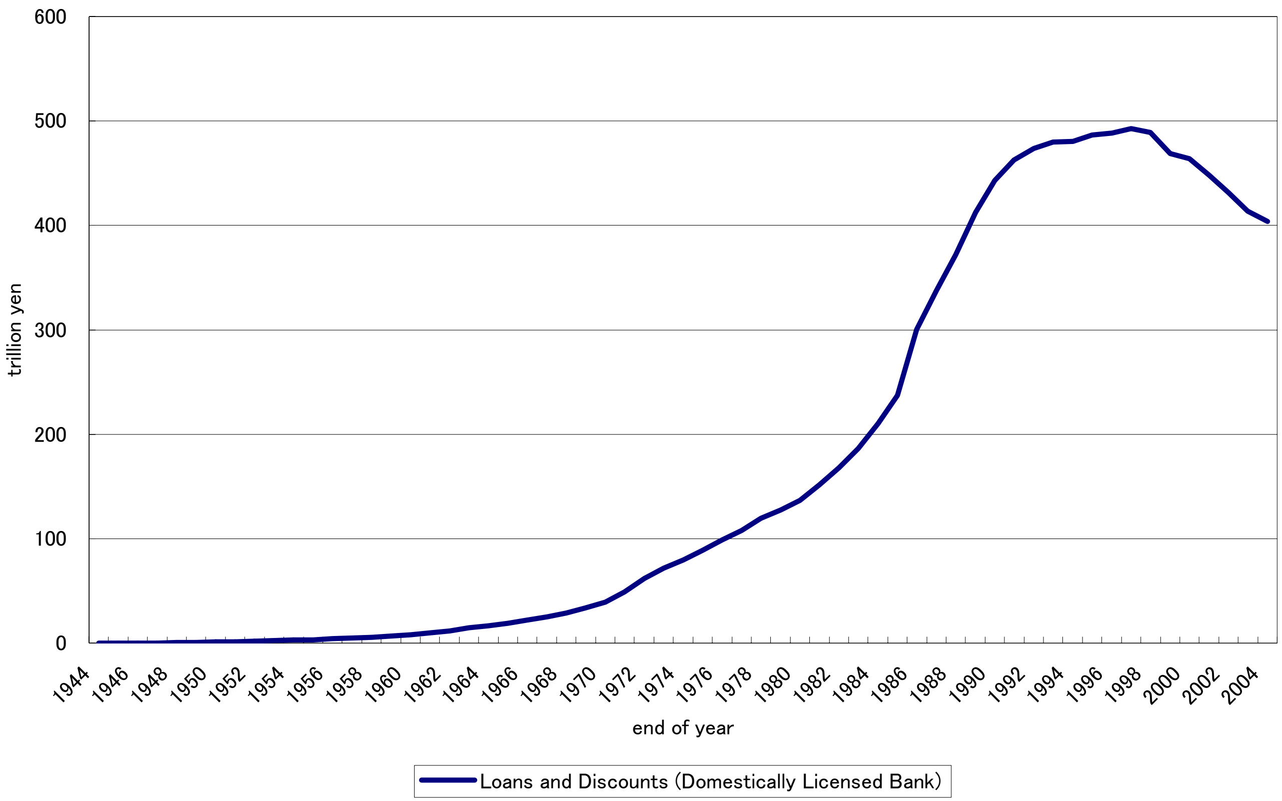
Notes: The features of prefectures whose actual rate of shifts of bank loans are over and less than -2% are summarized in the left and right columns,,respectively. # of city bank branches 00, # of regional bank branches 00, and # of branches of all banks 00 are the number of those branches at the end of March, 2000. Also refer to Notes to Table5.

Table 7. Rate of change in loans

	large firms A	small firms A	Large firms B	small firms B	city banks	regional banks
1991-1996	1.19	−29.4	6.08	6.04	-0.836	13.2
1996-2000	−16.0	−62.1	−18.53	−30.50	-1.33	0.172

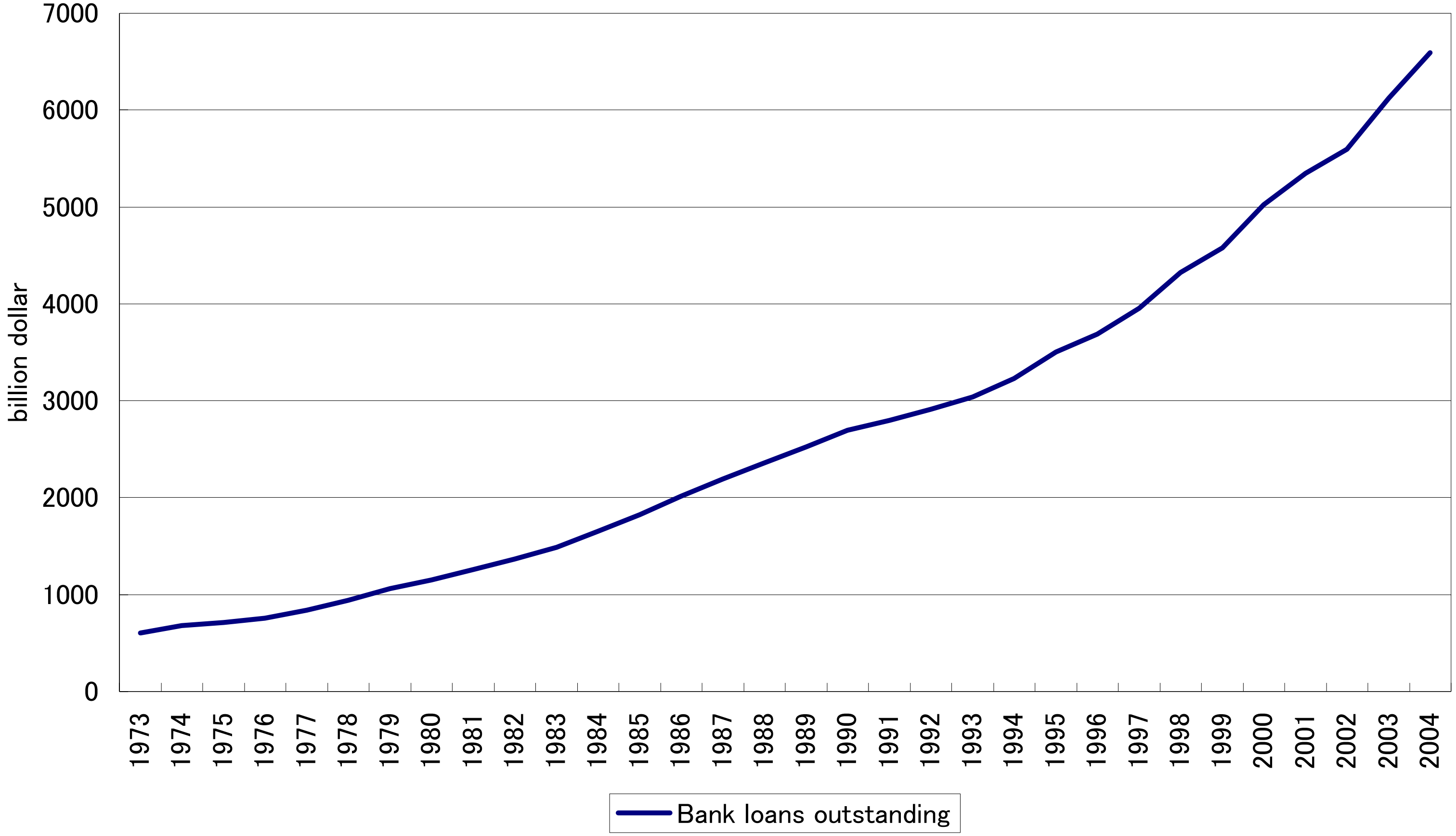
Note: Large firms A are those whose capital is over 1 billion yen, while small firms A are those whose capital is under 1 million yen.
Large firms A and small firms B are those whose capital is more and less than 100 million yen, respectively.

Figure 1. Loans and Discounts (Domestically Licensed Bank)



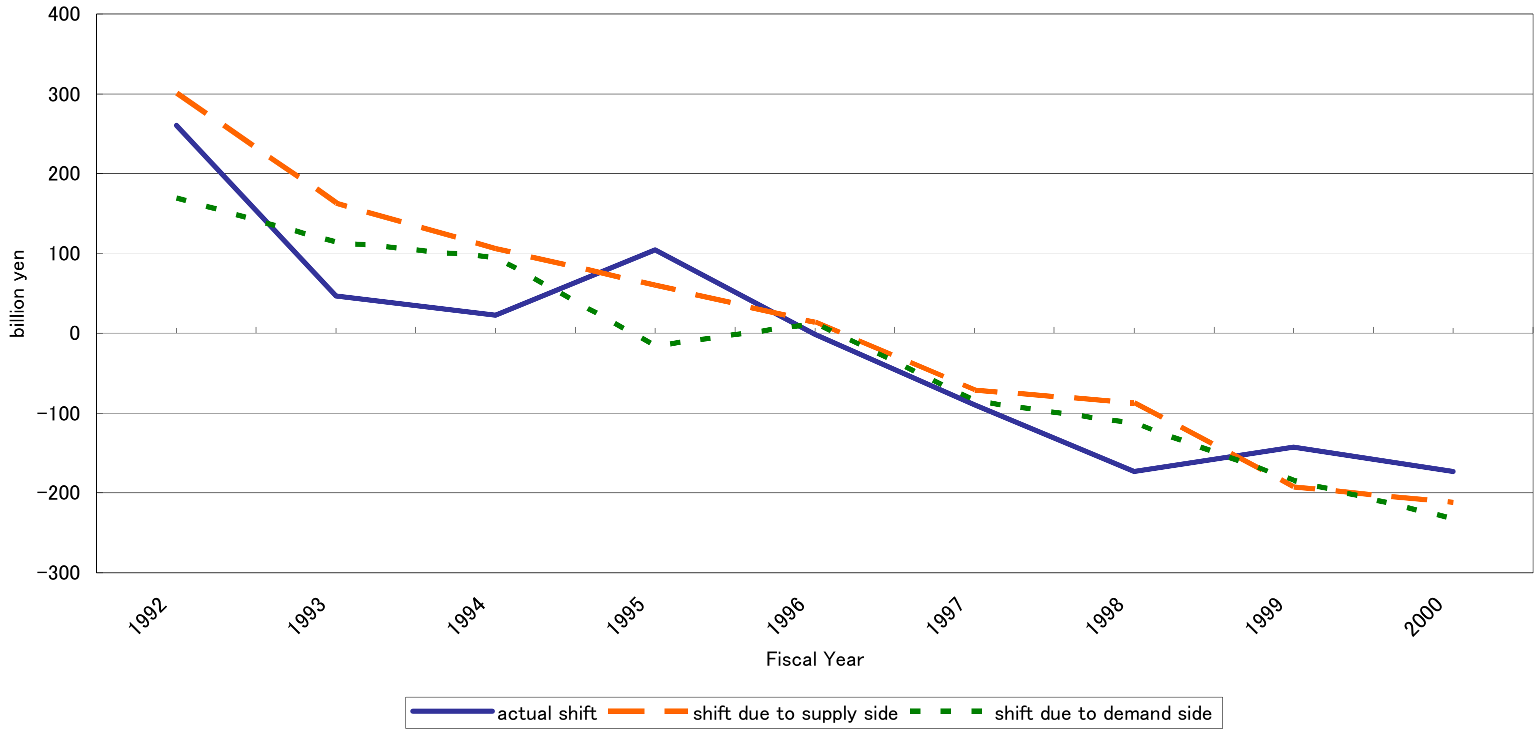
Notes: The data source is the Financial Statistics Annual, the Bank of Japan. The sample period is from 1944 to 2004.

Figure 2 Bank credit in the U.S. : commercial banks



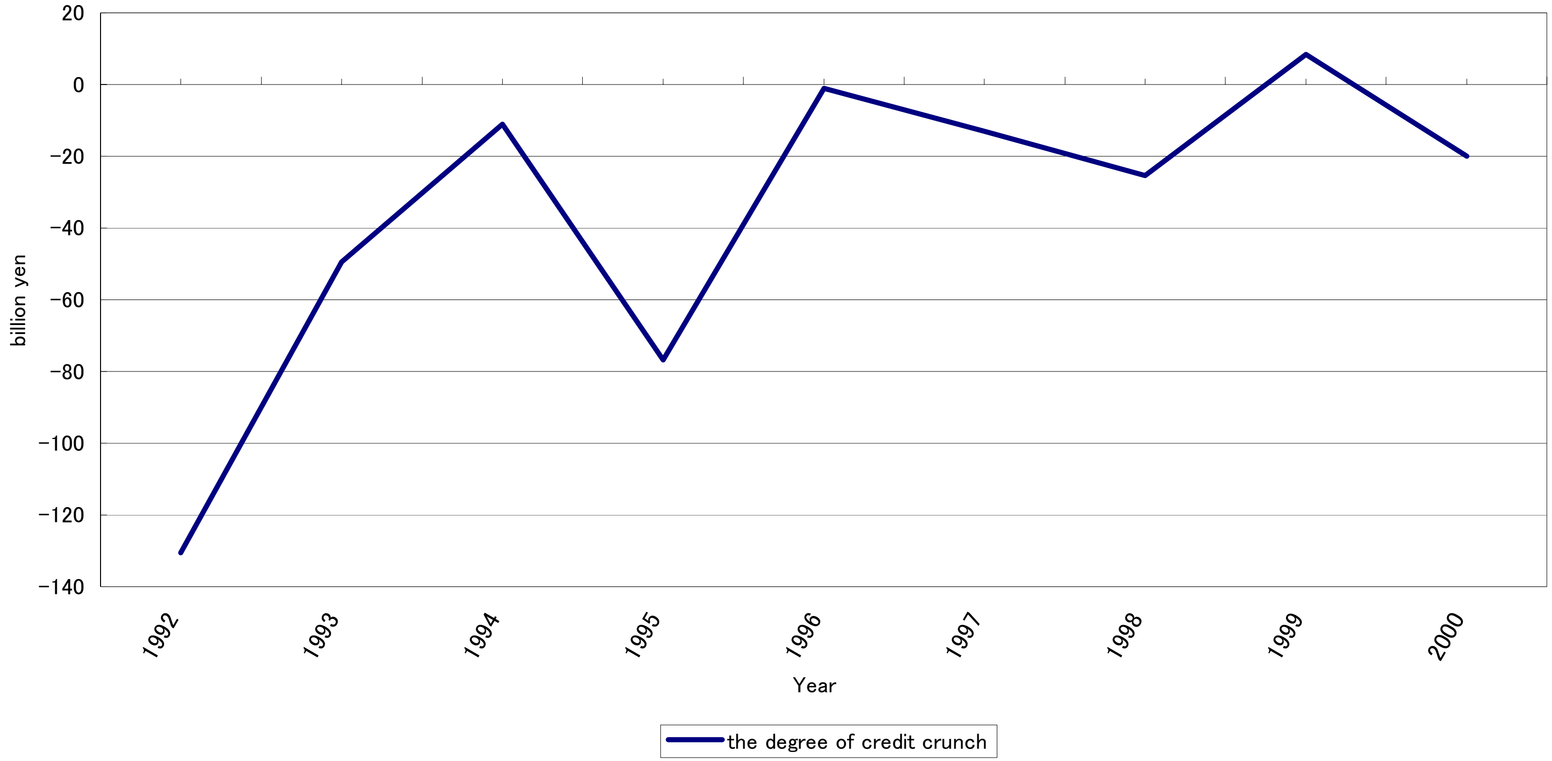
Notes: The data source is the Board of Governors of the Federal Reserve System. The sample period is from 1973 to 2003.

Figure 3. Shifts of the loan supply and demand functions



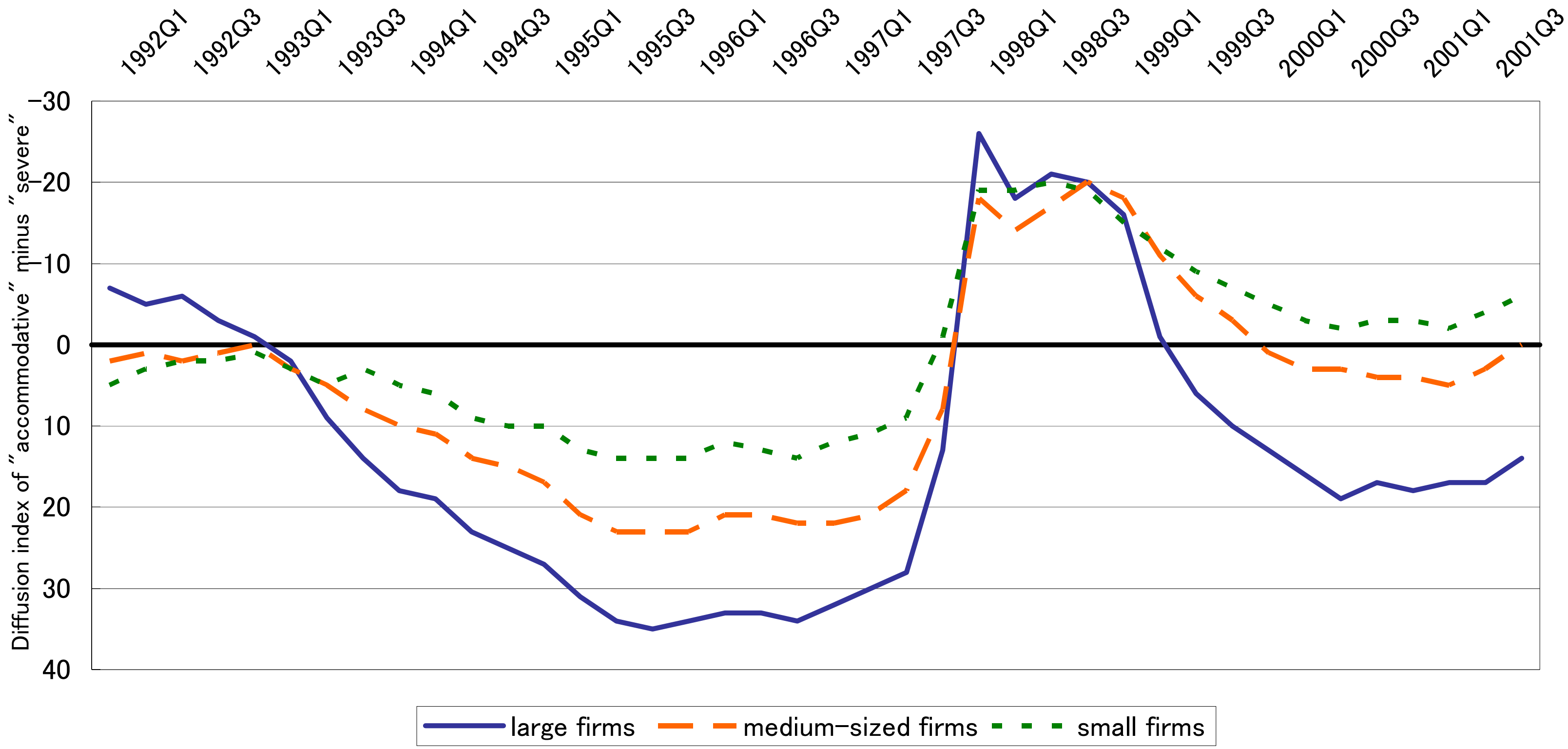
Notes: The actual shift for year *y* is the difference between the prefectural average of outstanding loans in year *y* and that in year *y*-1. The shift due to supply and demand side for year *y* is calculated as follows: first, we substitute the prefectural average of each explanatory variable in year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

Figure 4. The degree of credit crunch



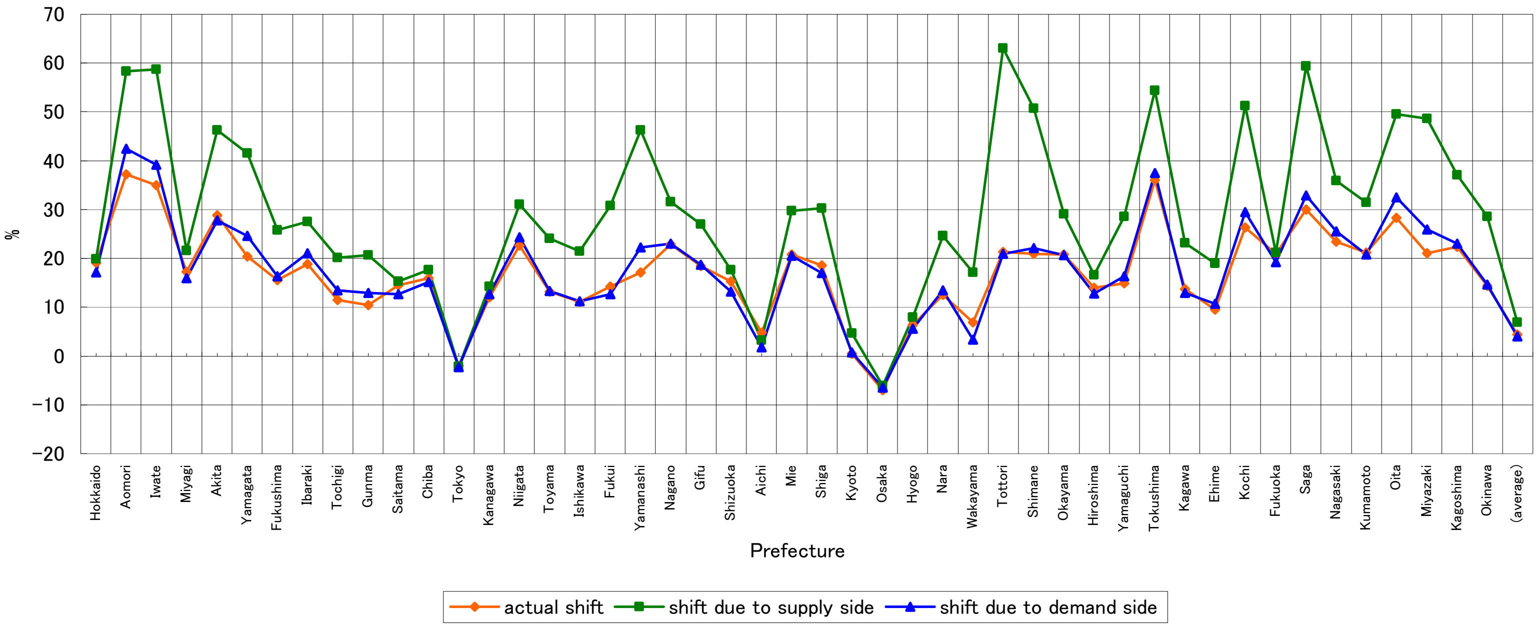
Notes: The degree of credit crunch is calculated as the differences between supply and demand shifts (demand shift－supply shift) and take average over all prefectures. As for the definition of the supply and demand shift, see Figure3.

Figure 5. Lending attitude of financial Institutions in Japan



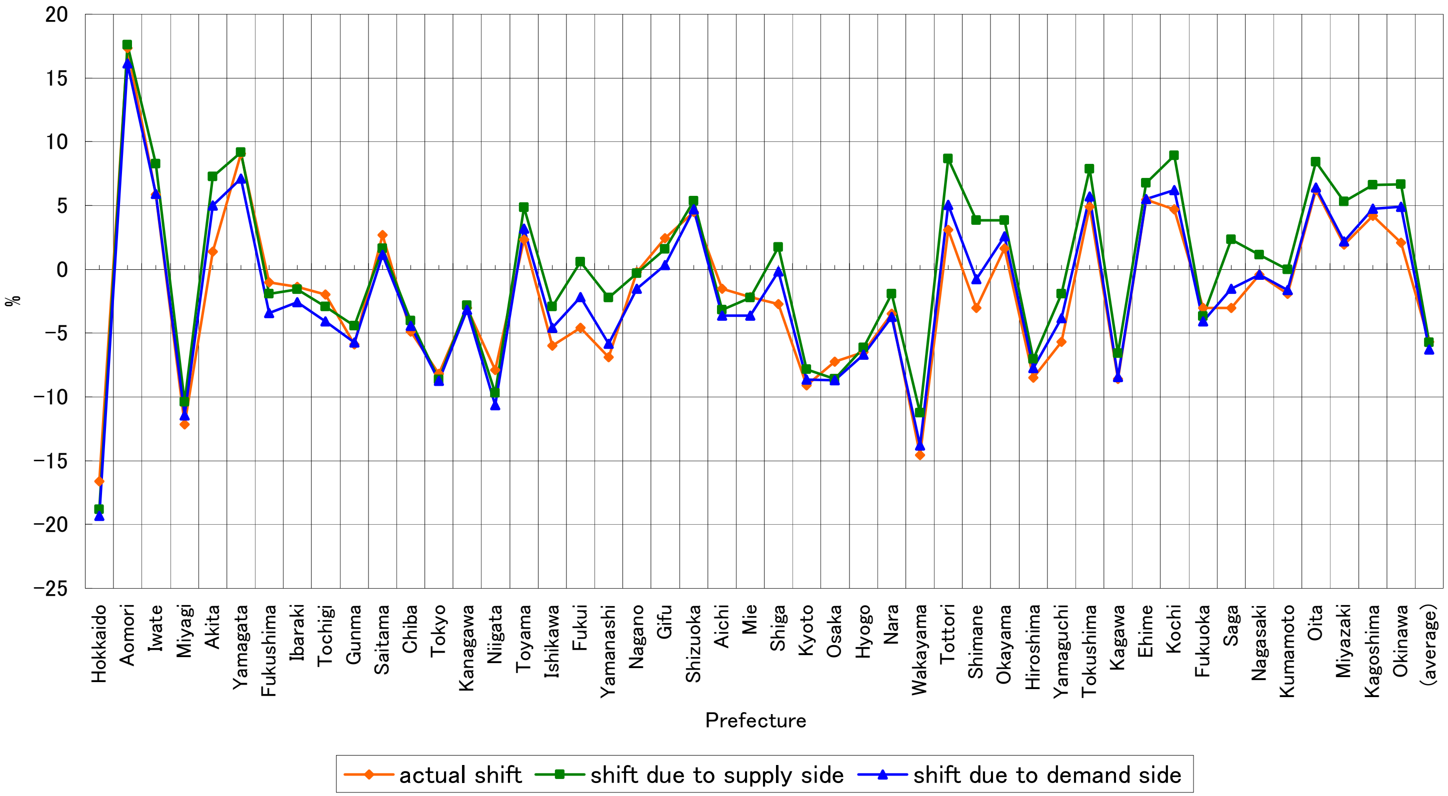
Notes: Data are of all enterprises, all industries, and evaluation of current situation...The data source is the Tankan (Short-term Economic Survey in Japan), the Bank of Japan. The diffusion index is defined as the ratio of the firms considering that lending attitude becomes severer – the ratio of the firms considering that lending attitude becomes laxer. The sample period is from fourth quarter in 1990 to second quarter in 2002.

Figure 6. Shifts of the loan supply and demand functions (1991-1996)



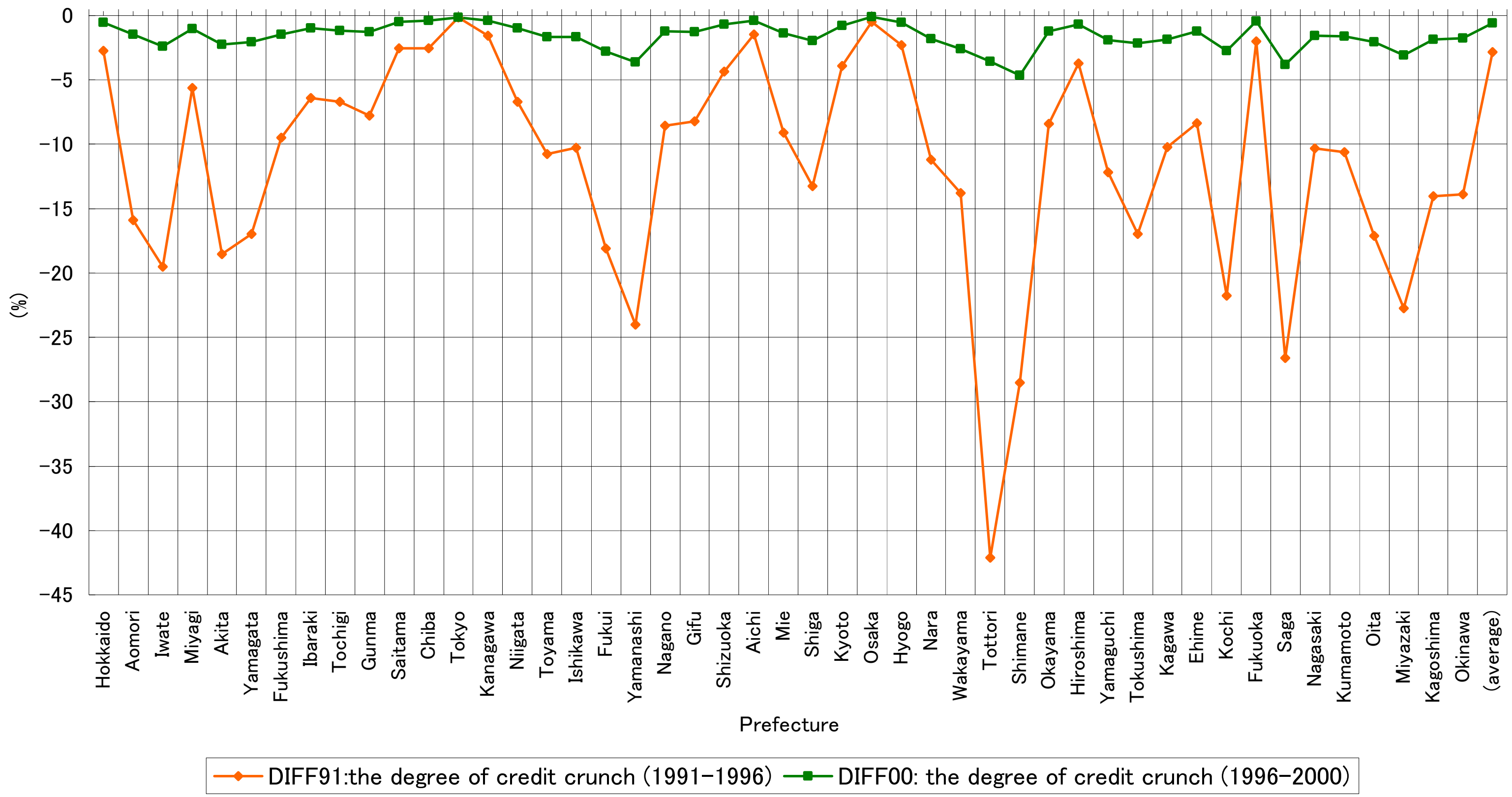
Notes: The actual shift of the prefecture for year *y* is the difference between the rate of change of outstanding loans of the prefecture in year *y* and that in year *y*-1. The shift due to supply and demand side of the prefecture for year *y* is calculated as follows: first, we substitute each explanatory variable of the prefecture in year *y*-1 and calculate the fitted value of supply of and demand for loans in year *y*. Then, substituting the loan interest rate of the prefecture in year *y*-1 and the other variables of the prefecture in year *y*, we calculate the fitted value in year *y*. The rate of change between the fitted values (in percent) is the shifts of the prefecture from year *y*-1 to *y*. The sample period is from 1991 to 1996.

Figure 7. Shifts of the loan supply and demand functions（1996-2000）



Notes: The definitions of the actual shift, shift due to supply side, and shift due to demand side are the same as those of Figure6. The sample period is from 1996 to 2000.

Figure 8. The degree of credit crunch



Notes: The degree of credit crunch of the prefecture is calculated as the differences between supply and demand shifts of the prefecture (demand shift－supply shift). As for the definitions of the supply and demand shift of the prefecture, see Figure6. The sample periods are from 1991 to 1996, and from 1996 to 2000.