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TSURUTA, Daisuke
Nihon University

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Credit Allocation and Public Credit Guarantee Schemes for Small Businesses: Evidence from Japan*

Daisuke Tsuruta
College of Economics, Nihon University

Abstract

In this paper, we investigate the relationship between the use of a public credit guarantee scheme for small businesses and the efficiency of credit allocation using region- and industry-level data from Japan for the period from 1968 to 2005. Studies argue that credit constraints are more severe for small businesses than for large firms. Therefore, a public credit guarantee scheme that mitigates this constraint could enhance social welfare. If credit guaranteed loans were allocated to firms with high value added, the public credit guarantee scheme would enhance the efficiency of credit allocation. Conversely, however, public credit guarantee schemes can squeeze credit allocations for small businesses. When financial institutions offer loans through credit guarantee schemes, they can offer loans to small businesses at low risk to themselves, even though small businesses are high-risk borrowers, which may reduce the incentives of the financial institutions to monitor the activity of small business borrowers. In addition, because the public credit guarantee scheme in Japan is a component of a broader set of social policies aiming to eliminate inequality, credit guaranteed loans can be offered to economically distressed firms. We identify a negative relationship between the amount of credit guaranteed and the value added. Moreover, we find that the greater the amount of credit guaranteed loans offered to firms, the larger the default rate among small businesses. We show that the public credit guarantee scheme reduced the efficiency of credit allocations, which has implications for industry and regional growth.

Keywords: public credit guarantee, credit allocation, small business, bank loan
JEL classification: G21; G28; G38; G14

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1 Introduction

In this study, we investigate the empirical relationships between a public credit guarantee scheme and credit allocations for small and medium-sized enterprises (SMEs). The information gap between financial institutions and small business borrowers is severe, resulting in stronger financing constraints for SMEs than for large firms (Berger and Udell, 1998; Beck et al., 2005, 2006). To mitigate the issues caused by this information gap, some studies (e.g., Smith, 1983; Mankiw, 1986; Gale, 1991) have argued that public guarantee schemes for small businesses can enhance social welfare. Under a public credit guarantee scheme, credit guarantee corporations (CGCs) owned by the government offer credit guarantees for loans by private financial institutions to SMEs. Financial institutions can offer loans to small businesses at low risk to themselves when they use credit guarantee schemes because CGCs repay the loans if the borrowers default. Storey (2008) argues that SME policies (including financial support by credit guarantee schemes) are justified by the existence of market failures. As Mankiw (1986) argues, public credit guarantee schemes could enhance social welfare by mitigating the credit constraints caused by market failures. The reason for this is that credit guarantee schemes enable small businesses with positive net present values to acquire loans. If credit guaranteed loans are offered to small businesses with high value added, the credit guarantee scheme enhances credit allocation.

Conversely, however, public credit guarantee schemes can squeeze credit allocations for small businesses. If financial institutions offer loans to small businesses without using a credit guarantee scheme, they monitor the activities of small business borrowers to prevent the moral hazard problem. However, when financial institutions offer loans using credit guarantee schemes, they can offer loans suited to low-risk borrowers, even though the small businesses are high-risk borrowers. Therefore, the incentives for financial institutions to monitor the activity of small business borrowers is reduced because they do not bear the risks and are unlikely to suffer losses arising from the moral hazard problem. As a result,

they may choose to offer credit guaranteed loans to risky borrowers to avoid the losses associated with defaults among these borrowers that they would otherwise bear for loans that are not credit guaranteed.

In addition, as noted, the public credit guarantee scheme in Japan is a component of a broader set of social policies aiming to eliminate inequality; therefore, credit guaranteed loans can be offered to economically distressed firms. In this case, credit guaranteed loans can be offered even if market failures are not severe. As Storey (2008) argues, many government departments regard SMEs as "their responsibility" and consider that they should be supported by economic policies. In this case, credit guaranteed loans are made available for small businesses that face credit constraints caused by economic distress. Nitani and Riding (2005) argue that Japan's credit guarantee scheme emphasizes salvaging distressed firms rather than offering financial support to new businesses. In this case, the public credit guarantee scheme would act as a form of relief for distressed small businesses; therefore, the relationships between the amount of loans with credit guarantees and value added would become negative. Moreover, the amount of credit guaranteed loans would increase small business defaults.

To reveal whether credit guarantee schemes enhance credit allocation for small businesses, we investigate the empirical relationships between value added and the amount of credit guarantees using region-, industry-, and year-level data for Japan for the period from 1968 to 2005. This period includes a large boom and recessions, namely the oil shocks of the 1970s, the asset price bubble of the late 1980s, and the financial crisis and "lost decade" after the bursting of the bubble economy in the 1990s. The Japanese economy experienced large fluctuations in economic activity during this period, and the evidence from the Japanese data provides valuable implications for our empirical questions. By using region-, industry-, and year-level data for credit guarantees and value added, we can control for several unobserved fixed effects. OECD (2013) reports that the value of credit guarantees as a percentage of gross domestic product (GDP) in Japan is

the highest of the major developed countries. Therefore, the experiences of Japan over these 30 years provide valuable implications for the SME policies of other countries.

Our estimation results are summarized as follows. First, in Japan, during our period of analysis, credit guaranteed loans were offered to small businesses with low value added. The effects of this policy were significant during the shock periods. In addition, the negative relationships between value added and credit guarantee loans were large in Japan's rural regions, where agriculture and fisheries was the main industry. Second, credit guaranteed loans increased defaults with lags of 1–4 years. These effects were large after the 1990s, in which the bursting of the asset price bubble and the financial crisis occurred. From these estimation results, we conclude that the public credit guarantee schemes squeezed credit allocations in Japan. The credit guarantee schemes acted as relief for distressed small businesses instead of enhancing the growth of viable small businesses.

The remainder of this paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data set and outlines the public credit guarantee schemes in Japan. Section 4 presents the estimation results for the relationships between value added and credit guaranteed loans. Section 5 introduces our empirical strategy for estimating the effects of credit guarantees on defaults and discusses the results. Section 6 concludes.

2 Literature Review

Many studies investigate the effects of credit guarantee schemes on credit availability and borrowing costs. Kang and Heshmati (2008) show that credit guarantees in Korea alleviated the credit constraints of small businesses and stabilized employment. Zecchini and Ventura (2009) find positive relationships between public credit guarantees and the leverage of guaranteed firms using Italian data. In addition, they find that public credit guarantees lowered the cost of debt. Cowling (2010) shows that a loan guarantee scheme in the UK alleviated the credit constraints of small businesses. Calcagnini et al. (2014)

show that credit guarantees had a negative impact on bank loan interest rates for riskier borrowers. Boschi et al. (2014) investigate the effects of partial credit guarantee schemes for Italian SMEs on firm financing. They show that low coverage ratios were ineffective in lessening the obstacles faced by credit constrained firms. Bachas et al. (2021) investigate whether credit guarantee schemes increase lending supply or act as a subsidy to lenders. They show that credit guarantee schemes significantly increased lending supply. Focusing on Japanese data, Uesugi et al. (2010) and Ono et al. (2013) show that credit guarantee schemes enhanced credit availability during periods of financial crisis. Ono et al. (2013), Saito and Tsuruta (2018), and Tsuruta (2023) argue that risky firms used public credit guarantee schemes during the global financial crisis in Japan.

Other studies focus on the economic performance of credit guarantee schemes. Beck et al. (2010) use data on 76 partial credit guarantee schemes across 46 developed and developing countries, and show that there are differences in the organizational structure, the role of the government and private sector, and the risk management and pricing mechanisms of credit guarantee schemes. Nitani and Riding (2005) discuss the aim of credit guarantee schemes in Japan and show that differences existed between the actual and stated goals, with the schemes acting to salvage distressed firms. Some studies (e.g., Riding and Haines Jr., 2001; Riding et al., 2007; Boocock and Shariff, 2005; Honohan, 2010; Cowan et al., 2015) investigate the costs and benefits of credit guarantee schemes. For example, Riding and Haines Jr. (2001) show that credit guarantee schemes enhanced job creation by small businesses, but increased the default rates of newer firms. Chandler (2012) shows that participation in the Canada Small Business Financing Program had positive impacts on the salary, employment, and revenues of small businesses between 2004 and 2006. Craig et al. (2007) show that the Small Business Administration loan guarantee program in the US enhanced local economic growth.

Hancock et al. (2007) observe that the disbursement of bank loans guaranteed by the US Small Business Administration was associated with greater output, employment, and

dollar payrolls using US state-level data over the period of 1990–2000. The credit guarantee decreased business failures and bankruptcies. Oh et al. (2009) estimate propensity score matching models, which show that Korean credit guarantees had positive impacts on firms' ability to maintain their size and increased their survival rates. However, firms with lower productivity were likely to receive credit guarantees because of the adverse selection problem. de Blasio et al. (2018) estimate the empirical effects of credit guarantee schemes for Italian SMEs using regression discontinuity techniques. Lagazio et al. (2021) estimate the effects of the Italian credit guarantee program for SMEs on firm profitability, financial health, investments, borrowing costs, and creditworthiness. Caselli et al. (2019) also investigate the effects of the effectiveness of the Italian State Credit Guarantee Scheme on SMEs. Bonfim et al. (2023) investigate the financial and real effects of a government credit certification program during the global financial crisis, showing that the effects on bank borrowing, investment, and employment were positive for eligible firms during the crisis. Bertoni et al. (2023) investigate the treatment effect of guaranteed loans on firm growth using a large sample of French SMEs. They show that credit guaranteed loans had positive effects on growth in sales, employment, and total assets.

Some studies focus on the default risk of credit guaranteed loans. Cowan et al. (2015) show that credit guarantee schemes increased default rates and did not have significant effects on the long-term performance of borrowers. Caselli et al. (2021) empirically investigate the default risk of loans guaranteed by public credit guarantee schemes using Italian firm data for the period from 2007 to 2009. They show that firms are more likely to default if a bank is involved in the guarantee process. Patel (2021) focus on US interstate branching deregulation and show that increased interbank competition induces higher loan defaults within credit guarantee schemes. Other topics related to credit guarantee schemes are investigated in the literature. Wilcox and Yasuda (2019) show that credit guaranteed loans are complements to nonguaranteed loans using data on Japanese banks. Yoshino and Taghizadeh-Hesary (2019) investigate the optimal credit guarantee ratio for

financing SMEs.

In addition, some studies have investigated the effects of public credit guarantee schemes during the economic crisis caused by the coronavirus disease 2019 (COVID-19) pandemic (hereinafter referred to as the COVID-19 crisis). Gonzalez-Uribe and Wang (2020) find that the loan guarantee programs in the UK had positive impacts on firm profitability and survival, labor productivity, and employment growth. Minoiu et al. (2021) show that the Main Street Lending Program in the US enhanced the availability of credit to small businesses during the COVID-19 crisis. Igan et al. (2023) show that public financial support during the COVID-19 crisis enhanced firm profitability, sales, and interest coverage ratios, and reduced firm defaults. Core and De Marco (2021) demonstrate that public credit guarantees were allocated to financially fragile firms located in the areas most affected by the COVID-19 crisis at the beginning of the pandemic. Hoshi et al. (2023) find that SMEs with low credit scores before the COVID-19 crisis were more likely to receive subsidies and concessional loans (including public credit guaranteed loans) from the Japanese government during the COVID-19 crisis. They conclude that this kind of support increased the number of zombie firms. Honda et al. (2023) investigate the types of SMEs that used the business support programs (including credit guarantee programs) provided by the Japanese government during the COVID-19 crisis. They show that low-performing SMEs (e.g., firms with declining sales, firms with low credit scores, and zombie firms) were more likely to use such support than other firms. In addition, they show that SMEs that used the support programs were less likely to exit the market, but more likely to be zombie and low-return firms. Fernández-Cerezo et al. (2023) show that more vulnerable firms (e.g., younger, smaller, and less productive firms) were more likely to use public credit guaranteed loans during the COVID-19 crisis.

Our paper is related to these previous studies that focus on the effect of credit guarantee schemes on credit availability and economic performance. However, many of these studies use data covering relatively short periods. Our data cover a period of over 30 years

and include several economic crises and boom periods. To the best of our knowledge, few studies use long-term data to investigate credit guarantee schemes, which is one of the main contributions of this paper.

3 Public Credit Guarantee Schemes in Japan

3.1 Public Credit Guarantee Schemes in Japan

Before 2005 in Japan, there were 52 CGCs, one for each of the 47 Japanese prefectures, and one each in the cities of Osaka, Nagoya, Yokohama, Kawasaki, and Gifu. CGCs guaranteed loans offered by banks in exchange for a guarantee fee. According to Christensen et al. (1999) and Nitani and Riding (2005), the aims of credit guarantee schemes in Japan are "to contribute to the smooth flow of funds for SMEs by guaranteeing loans that are advanced to SMEs by banks or other financial institutions" (the Credit Guarantee Corporation Act, 1953, No. 196) and "to discover SMEs that are seeds of growing businesses and build bridges between those SMEs and private financial institutions."

Before 2005, in principle, a guarantee fee in a general credit guarantee scheme was about 1% of the guaranteed loan.[1] Only SMEs under the Small and Medium Enterprise Basic Law are permitted to use the public credit guarantee scheme in Japan. According to the *White Paper on Small and Medium Enterprises in Japan*, "[U]nder the Small and Medium Enterprise Basic Law, the term 'small and medium enterprises' (SMEs) generally refers to enterprises with capital stock under 300 million yen and/or 300 or fewer regular employees, and sole proprietorships with 300 or fewer employees." Either the bank or the small business borrower requests the CGC to provide the credit guarantee, after which the CGC screens the small business borrowers. Following acceptance of the credit guarantee, the small business borrowers pay the guarantee fee every year until the final repayments of the guaranteed loan are completed. In the case of default, the CGC (not

[1] After 2006, the guarantee fee was changed to a variable fee based on the borrower's credit risk, which was between 0.45% and 1.90% of the guaranteed loan.

the small business borrower) repays the debt to the lending financial institution (i.e., subrogation), and the CGC then collects the outstanding debt from the small business borrower. This means that financial institutions potentially collect most of their loans, even when informationally opaque borrowers default. Therefore, financial institutions can and do lend to small, informationally opaque businesses. In Japan, the coverage rate of general credit guarantee programs was 100% before 2009,[2] which allowed financial institutions to offer loans to small businesses without significant credit risk.

3.2 Data Description

To investigate the empirical relationships between credit allocation and public credit guarantee schemes for small businesses, we used data from *gyoumu yoran* (the business directory) published by the Japan Federation of Credit Guarantee Corporations. These books were published every year between 1968 and 2005 and contain data about credit guarantee schemes for 52 CGCs. Most of the available data are annual regional (CGC)-level data, with some annual regional (CGC)-industry-level data. We also use the Census of Manufacture by the Ministry of Economy, Trade and Industry to determine the value added of manufacturing industries for each year after 1970. We match data from *gyoumu yoran* to the Census of Manufacture by industries. As the data on value added are available for the manufacturing industry, we limit our analysis to the manufacturing industry when using regional industry-level data.

3.3 Overview of Japanese Data, 1968–2005

In this subsection, we report the basic statistics of the public credit guarantee scheme between 1968 to 2005 in Japan. Figure 1 shows the trend of the real growth rate in GDP and the use rate of the credit guarantee program. The Japanese economy experienced some important events in this period, as noted, including two oil shocks in the 1970s,

[2]After 2007, the guarantee ratio changed to 80%, in principle.

the asset price bubble in the late 1980s, the recession caused by the bursting of the asset price bubble in the early 1990s, and the financial crisis after 1997. Excluding the oil shock periods, the real GDP growth rate was around 5% from the early 1980s until the bursting of the asset price bubble in 1991. Subsequently, the real GDP growth rate declined, particularly during and after the financial crisis. Therefore, overall, the Japanese economy experienced economic fluctuations between expansionary and contractionary periods during the period of analysis.

Figure 1 also shows the aggregate use rates of the credit guarantee program. The use rate of credit guarantees (firms) is defined as the ratio of the number of companies using guarantees to the number of SMEs. The use rate of credit guarantees (cases) is defined as the ratio of cases of outstanding guaranteed liabilities to the number of SMEs. Due to limited data availability, we show the trend of the use rate of credit guarantees (firms) after 1987. The high use rates for credit guarantees suggest that the number of SMEs using credit guaranteed loans is high. Thus, SMEs and banks relied on the public credit guarantee schemes when they borrowed or offered credit, respectively. Focusing on the guarantee use rate calculated by cases, the rate was low in the early 1970s, ranging between 19% and 23%. During the late 1970s, with the advent of the oil shocks and the subsequent recession, the use rates rose, reaching 34.2% in 1978. This indicates that the number of firms using public credit guarantees increased in response to the severe recession caused by the oil shocks. During the 1980s and the asset price bubble, the guarantee use rates did not change significantly, remaining at around 30%–35%. In the 1990s, after the asset price bubble had burst, the use rates continued to increase annually. For example, in 1989, the credit guarantee use rates by cases and firms were 33.7% and 21.5%, respectively. By 1996, before the financial crisis, the corresponding use rates reached 55.7% (cases) and 30.7% (firms). After the financial crisis, they rose significantly more, reaching 72.9% (cases) and 34.4% (firms) in 2000.

The figure has two implications. First, before the asset price bubble burst, the number

of SMEs using credit guaranteed loans was low. The trend of the real GDP growth rate shows that the growth rate was higher before the asset price bubble. Thus, SMEs and banks did not depend on credit guarantee schemes during this high growth period. Second, the use rate of the credit guarantee scheme increased during and after the oil shocks, the bursting of the asset price bubble, and the 1997 financial crisis. These were all periods of severe shocks; therefore, the number of SMEs that used the credit guarantee scheme tended to increase during and after these severe economic crises.

Figure 2 shows the acceptance rate of credit guarantees, which is defined as the ratio of the accepted amount of the credit guarantee compared with the application amount. We show the quantiles of the acceptance rate of each of the CGCs between 1968 and 2005. In the 1970s, the median acceptance rate was around 90%. For the 75th percentile, the acceptance rate was about 95%, and for the 25th percentile, it was between 85% and 90%. The figure indicates that the acceptance rate of the credit guarantee schemes was high. Until 1998, the median acceptance rate remained around 90%. It fell in 1999 in the midst of the financial crisis, and then returned to around 90% in 2004. Thus, the figure suggests that almost all of the SMEs that applied to use the credit guarantee schemes were able to access credit guaranteed loans. In addition, the CGCs did not strictly screen the SMEs that applied for credit guarantee loans.

Figure 3 shows the quantiles of the annual growth rate of credit guaranteed loans for each year. The growth rates were high in the mid-1970s and around 1980 as a result of the recession caused by the oil shocks. The growth rate of guaranteed loans was high around 1991, during the period when the asset price bubble burst. It was also high in 1999, when a special credit guarantee program, which relaxed the cap on credit guaranteed loans, was implemented in response to the financial crisis.[3] In summary, Figure 3 suggests that the credit guaranteed loans experienced significant growth during the crisis periods.

Figure 4 shows the quantiles of the size of credit guaranteed loans for each year. Loan

[3]The special credit guarantee program was established after 1998 to mitigate the liquidity shortage during the financial crisis. See Uesugi et al. (2010) for more detailed information.

size is the ratio of the amount of loans with credit guarantees (in yen) to the number of loans with credit guarantees. Loan size continued to increase for most of the period between 1968 and 1993. However, from 1994 to 1998, no increase was observed. Then, in 1999 (the financial crisis period), the size of credit guaranteed loans greatly increased with the start of the special credit guarantee program.

Figure 5 shows the quantiles of the default rate for each year. The default rates fell before 1975, but then rose after 1976, mainly in response to the large increase in credit guaranteed loans at that time. The default rates continued to rise until 1978, and then flattened out until 1987. During the asset price bubble in the late 1980s, the default rates fell because of the boom period. After the bursting of the asset price bubble in the early 1990s, the default rates rose again by around 1% at the median. Then, the default rates rose significantly after 2000, after the financial crisis and the start of the special credit guarantee program. This figure suggests that the default rates tended to rise after the expansion of credit guaranteed loans in response to economic shocks. Although the default rate rose after the economic shocks, the median default rate was 3.13% (in 2003). Therefore, we can infer that the default rate was not very high under the full guarantee schemes.

4 Public Credit Guarantee and Credit Allocation

4.1 Empirical Strategy

In this subsection, we test whether credit guarantee loans are allocated to firms with high value added. We apply Wurgler (2000)'s η to estimate the elasticity of industry investment to value added. Wurgler (2000) investigate whether allocations for investment are efficient using country- and industry-level data. [4] By applying the estimation methods

[4]To investigate this issue,Wurgler (2000) estimate the following regression:

$$ln\frac{I_{i,c,t}}{I_{i,c,t-1}} = \alpha_c + \eta_c ln\frac{V_{i,c,t}}{V_{i,c,t-1}} + \epsilon_{i,c,t}, \tag{1}$$

of Wurgler (2000) and Imai (2020), we estimate the elasticity of credit guarantee loans to value added. We estimate the following equation using region- and industry-level panel data:

$$\Delta ln(GL_{i,r,t}) = \alpha + \eta \Delta ln(V_{i,r,t}) + \epsilon_{i,r,t}, \tag{2}$$

where $GL_{i,r,t}$ represents credit guaranteed loans for small businesses and $V_{i,r,t}$ is value added for industry i, region r, and year t. We add region, industry, industry×region, and year fixed effects. Value added is the gross value added for establishments with 4–29 employees. The regions are Japan's 47 prefectures and five cities, and industries are categorized according to the two-digit codes of the Japan Standard Industrial Classification. $\Delta ln(GL_{i,r,t})$ and $\Delta ln(V_{i,r,t})$ are calculated as the real value. We use the yen amount of accepted credit guarantees for $GL_{i,r,t}$, obtained from *gyoumu yoran* by the Japan Federation of Credit Guarantee Corporations. Value added for each industry, region, and year ($V_{i,r,t}$) is obtained from the Census of Manufacture by the Ministry of Economy, Trade and Industry, and is available from 1973. Because of data limitations, the sample period is 1973–2005. The number of full observations is 22,366.

4.2 Estimation Results

Table 1 shows the summary statistics for the variables used in Equation (2). Table 2 shows the estimation results of Equation (2). Columns (1)–(5) show the estimation results including only year fixed effects. In column (1), we show the estimation results using the full sample of observations. The estimated coefficient of value added is negative and statistically significant at the 1% level, suggesting that more credit guaranteed loans are allocated when the value added is lower. Focusing on the difference between periods,

where $I_{i,c,t}$ is investment, $V_{i,c,t}$ is value added for industry i, country c, and year t, and η_c is the elasticity of industry investment to value added. A positive η_c suggests that investment is allocated to high value-added firms, which supports an efficient allocation. Imai (2020) also estimate Wurgler's η using industry- and regional-level data from Japan.

the estimated coefficients of value added are negative and statistically significant at the 1% level during the period of 1973–1980 (column 2). However, the estimated coefficient is negative but not statistically significant during 1981–1990 and 1991–2005. Columns (6)–(10) show the estimation results when we include several fixed effects. The estimation results in columns (6)–(8) are similar to those in columns (1)–(3), suggesting that more credit guaranteed loans are allocated when the value added is lower. This result is statistically significant for 1973–1980. Focusing on column (9), the estimated coefficient of value added is negative and statistically significant. These results suggest that the negative relationship between credit guaranteed loans and value added is supported for 1991–2005 if several unobserved effects are included.

The results above have the following implications. First, they suggest that the inefficient allocation of credit guarantees did not occur during boom periods, such as the 1980s, which included the asset price bubble. This period contrasted with the situation during the 1970s, when the recession induced by the oil shocks occurred, and the 1990s and 2000s, when the asset price bubble burst and the financial crisis occurred. These results suggest that inefficient allocations are observed especially frequently during periods of economic crisis.

In December 1999, the SME Basic Act was revised, changing the aim of SME policy in Japan. Before the revision, the main aim of this policy was to correct the inequality between SMEs and large firms. The act recognized SMEs as vulnerable firms before the revision. After the revision, the aim changed to developing the Japanese economy by encouraging the growth of SMEs using various SME policies. The act described that the development of SMEs must be encouraged by promoting business innovation and start-ups, not by correcting inequality between SMEs and large firms. Therefore, the estimation results may alter after the revision of SME Act. In columns (5) and (10), we estimate equation (2) using observations after 2000. The estimated coefficient of value added is not statistically significant in column (5). However, the coefficient of value added is negative

and statistically significant after controlling for several fixed effects. These results imply that inefficient allocations continue to be observed even though the aim of SME policy had changed.

Table 3 shows the estimation results by boom and recession periods. Columns (1) and (2) show the estimation results including only year fixed effects. In column (1), we estimate the coefficient of value added depending on whether the GDP growth rate is less than or at or above the median. The estimated coefficient of value added is –0.07176 if the GDP growth rate is less than the median and –0.03804 if the GDP growth rate equals or exceeds the median. This suggests that the negative effects of value added are lower if the GDP growth is low, which supports the inefficient allocation during the recession. Column (2) estimates the coefficients for the periods of negative and positive GDP growth. The estimation results show that the negative coefficient of value added is larger if GDP growth is negative, which is similar to the previous results. However, the estimated coefficients of value added are not statistically significant during the period of negative GDP growth.

Columns (3) and (4) show the estimation results when we include several fixed effects. Column (3) shows that the estimated coefficient of value added is –0.9470 if the GDP growth rate is less than the median and –0.05700 if the growth rate is at or above the median. The estimated coefficient of value added becomes statistically significant if the growth rate is at or above the median. Column (4) shows similar results to those in column (2). However, the estimated coefficients of value added become statistically significant if the GDP growth is negative.

Table 4 shows the estimated coefficients of value added by prefecture. The estimated coefficients are high and statistically significant in Tokyo, Nara, and Hyogo prefectures. By contrast, they are low and statistically significant in Akita, Fukushima, Tochigi, Chiba, Niigata, Yamanashi, Nagano, Gifu, Aichi, and Kyoto prefectures. To reveal the geographic trends regarding the effects of value added, Figure 6 plots the estimated coefficients of

value added on a map of Japan. From this figure, we can observe heterogeneity between prefectures. First, the estimated coefficient of value added is positive and larger in Tokyo, Japan's capital, than in other prefectures. In addition, the estimated coefficients of value added are larger in Kanagawa, Saitama, and Gunma, which are the prefectures around Tokyo, than in other prefectures. Second, there are few inefficient allocations to western Japan. By contrast, the negative coefficients of value added are likely to be observed in the Chubu, Tohoku, and Hokkaido regions (east and north Japan). In these prefectures, the primary sector is the main industry. This suggest that the inefficient allocations are observed in prefectures where industry is dominated by the primary sector.

5 Public Credit Guarantees and Default

5.1 Empirical Strategy

In the previous section, we showed that credit guaranteed loans are allocated to firms with low value added. To evaluate whether credit guaranteed loans are allocated efficiently, we estimate the effects of guaranteed loans on default. We estimate the following equation:

$$\begin{aligned} \Delta ln(Default_{r,t}) &= \sum \beta_1^{t-s} \Delta ln(GL_{r,t-s}) + \sum \beta_2^{t-s} \Delta Acceptance_{r,t-s} + \beta_3 Use_{r,t-1} \\ &+ \lambda_r + \delta_t + \epsilon_{r,t} \end{aligned} \tag{3}$$

where $GL_{r,t}$ represents guaranteed loans for small businesses for region r in year t and $Default_{r,t-s}$ is the amount of default for region r in year t-s. Similar to the previous section, our regions are Japan's 47 prefectures and five cities. We use the yen amount of accepted credit guarantees for $GL_{r,t}$, the acceptance rate of credit guarantees for $Acceptance_{r,t}$, and the yen amount of defaulting loans with credit guarantees for $Default_{r,t-s}$, obtained from *gyoumu yoran* by the Japan Federation of Credit Guarantee

Corporations. $\Delta ln(GL_{r,t})$ and $\Delta ln(Default_{r,t})$ are calculated as the real value. The acceptance rate of credit guarantees is defined as the ratio of the yen amount of accepted credit guarantees to applications for credit guarantees. To check robustness, we employ a default rate (equal to the yen amount of defaulting loans with credit guarantees/yen amount of loans with credit guarantees) as a dependent variable. In this case, we regress the Δdefault rate instead of $|DeltalnDefault_{r,t}$. As default occurs with some lags, we employ 1- to 6-year lags (i.e., s equals 1–6). $Use_{r,t-1}$ is the use rate of credit guarantees, defined as the ratio of the yen amount of credit guarantee loans to total loans for SMEs. In addition, the equation includes region (λ_r) and year (δ_t) fixed effects to control for unobserved effects. The full number of observations is 1,867. As we use lagged variables, the sample period t is 1970–2005.

If credit guaranteed loans are allocated efficiently, default is unlikely to occur after the acceptance of credit guarantees. In this case, the coefficients of β_1^{t-s} are negative. If high acceptance rates are caused by CGCs avoiding screening, the higher acceptance rates will be associated with higher defaults. In this case, the coefficients of β_2^{t-s} will be positive. In addition, if CGCs offer credit guarantees to risky firms when the guarantee use rates are high, the coefficients of β_3^{t-s} will be positive.

5.2 Estimation Results

Table 5 shows the summary statistics for the variables used in Equation (3). Table 6 shows the estimation results of Equation (3) using the yen amount of defaulting loans with credit guarantee as a dependent variable. Columns (1)–(6) show the estimation results for s = 1–6, respectively. In all columns, the estimated coefficients of the acceptance of guarantees (t) are negative but not statistically significant. By contrast, columns (1)–(6) show that when lags are incorporated, the estimated coefficients are positive and significant at the 1% level when s = 1–4. This suggests that credit guaranteed loans increase defaults with a 1- to 4-year lag. In column (1), the estimated coefficients of acceptance rates (t) and

(t-1) are negative and statistically significant at the 5% or 10% level. Similarly, in column (2), they are negative and statistically significant at the 5% level for t-1 and t-2. However, when lags are incorporated, they are statistically significant if we employ three or more lagged variables (columns (3)–(6)). These results suggest that acceptance rates have negative effects on default, but the results are not robust. The estimated coefficients of the guarantee use rate are positive and statistically significant at the 1% level, suggesting that the default amount increases if CGCs guarantee a large amount of loans.

Table 7 shows the estimation results using the default rate as the dependent variable. In all columns, the estimated coefficients of the acceptance of guarantees (t) and (t-1) are negative and statistically significant. This suggests that credit guarantee loans reduce the amount of defaults in the same and subsequent years. However, the estimated coefficients for t-2 to t-4 are positive and statistically significant at the 1% level, suggesting that credit guaranteed loans reduce defaults in the same year, but increase defaults with 2- to 4-year lags. The estimation results for the acceptance rate in Table 7 are similar to those in Table 6.

Table 8 shows the estimation results of Equation (3) for two periods: 1973–1990 and 1991–2005. Because the estimated coefficients for the acceptance of guarantees (t-s) for s = 5 and s = 6 are not statistically significant, we employ s = 1–4 in Table 8. In addition, as the results for the acceptance rate were not robust, we exclude the acceptance rate. Column (1) shows the estimation results for the period from 1991 onwards. The estimated coefficients of the acceptance of guarantees for (t-1) to (t-4) are statistically significant, suggesting that credit guaranteed loans increase defaults after 1991. As we described, the size of the credit guarantee scheme expanded during the 1990s after the bursting of the asset price bubble. The increase in credit guaranteed loans in this period increased defaults. By contrast, up to 1990, the estimated coefficient for the acceptance of guarantees (t-s) is statistically significant if s = 2–4. The magnitudes of the estimated coefficients are smaller than those in column (1). Therefore, the effects of credit guaranteed loans on

default are weak before 1990. In columns (3) and (4), we employ the default rate as a dependent variable. Again, the estimation results in columns (3) and (4) suggest that the effects of credit guaranteed loans are larger in the period from 1991 onwards compared with before.

6 Conclusion

In this study, we investigated whether public credit guarantee schemes improve credit allocations for small businesses. To analyze this issue, we used industry-region-level data from Japan from a period covering more than 30 years. We obtained the following results. First, credit guaranteed loans were offered to firms in industries with low value added. The effect was significant during periods of recession over the 30 years. Second, the default rate increased 1–4 years after credit guaranteed loans were offered, and this effect was larger in the periods after the asset price bubble burst in the early 1990s compared with before. Studies have argued that public credit guarantee schemes can mitigate market failures, limiting SMEs' access to finance by increasing credit supply. However, our empirical results indicate that the credit guarantee schemes increase loans for firms with low value added and high credit risks.

Our paper has some limitations, which point to directions for future research. First, although we use industry-regional-level data for over 30 years of credit guarantee schemes—which is a main contribution of our study—we do not use firm-level data on SMEs because such data are not available for a period of over 30 years. In future research, it is important that the effects of credit guarantee schemes are investigated using firm-level data. Second, in a related issue, because we do not use firm-level data, we do not investigate accurately the causal relationships between credit constraints and firm growth. The task of estimating the effects of the credit guarantee schemes in mitigating the credit constraints on firm growth remains one for future research. Third, we show that the credit guarantee schemes for SMEs act as a relief policy. To evaluate this policy, we should compare the

fiscal burden of the policy with its social benefit, that is, the creation of employment through preventing SMEs exiting the market. However, we do not investigate the fiscal burden and social benefit of credit guarantee schemes in this paper.

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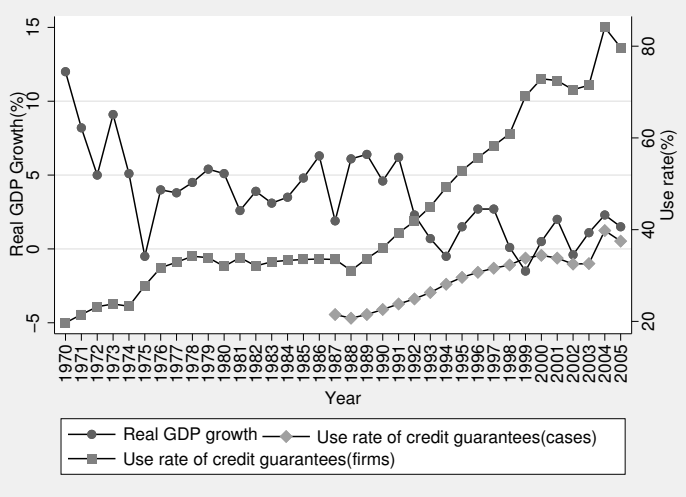
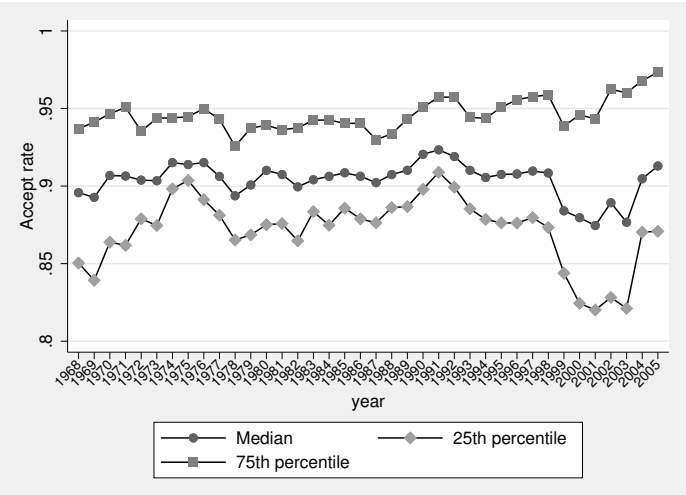
Figure 1: Real GDP Growth and Use Rate of Credit Guarantees, 1970–2005



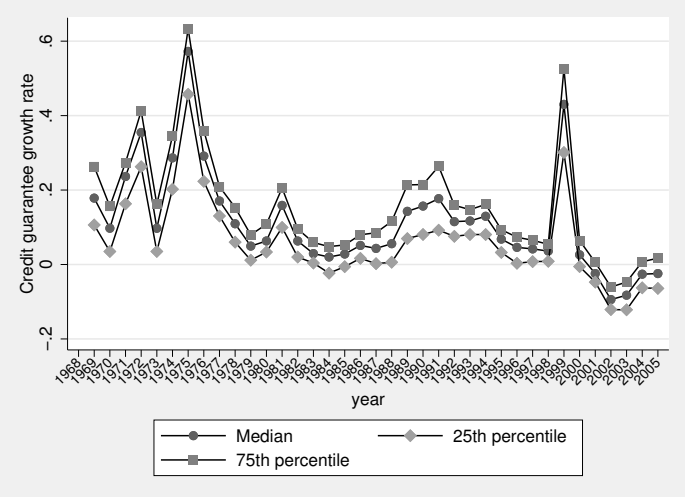
This figure depicts the trend of real GDP growth and the use rate of credit guarantees. Use rate of credit guarantees (firms) = Number of companies using guarantees/Number of SMEs. Use rate of credit guarantees (cases) = Cases of outstanding guaranteed liabilities/Number of SMEs.

Figure 2: Acceptance Rate of Credit Guarantees, 1968–2005



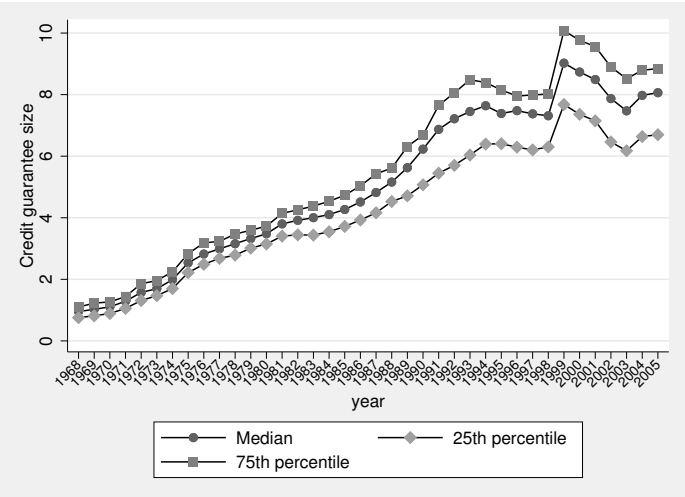
The figure depicts the acceptance rate of credit guarantees in quartiles. The acceptance rate of credit guarantees is the ratio of the yen amount of accepted credit guarantees to the yen amount of credit guarantee applications.

Figure 3: Growth Rate of Credit Guarantees, 1968–2005



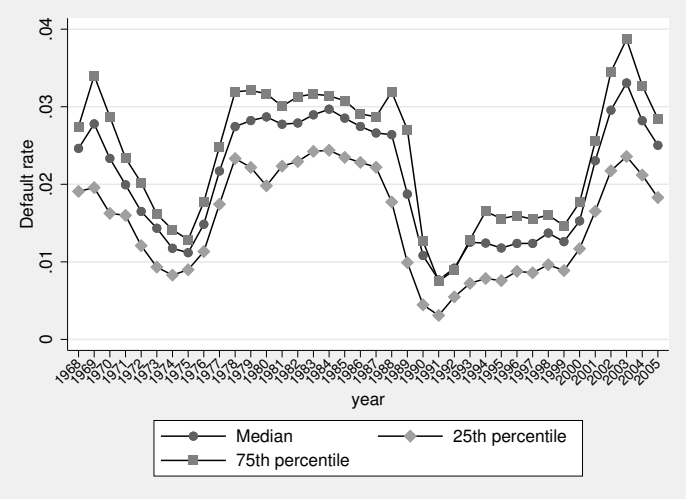
The figure depicts the quartiles of the annual growth rate of loans with credit guarantees.

Figure 4: Loan Size of Credit Guarantees, 1968–2005



The figure depicts the quartiles of loan size with credit guarantees. Loan size is the ratio of the yen amount of loans with credit guarantees to the number of loans with credit guarantees. The y-axis is expressed in million yen.

Figure 5: Default Rate of Credit Guarantees, 1968–2005



The figure depicts the quartiles of the default rate of credit guarantees. The default rate of credit guarantees is defined as the ratio of the yen amount of defaulting loans with credit guarantees to loans with credit guarantees.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Acceptance of credit guarantees	22,366	0.037	0.396	-1.428	1.616
Value added	22,366	0.021	0.155	-0.713	0.726

The table presents summary statistics for variables used in the econometric analysis.

Table 2: Estimation Results for Value Added and Credit Guarantees

	(1)	(2)	(3)	(4)	(5)
	Acceptance of credit guarantees				
	All	1973-1980	1981-1990	1991-2005	2000-2005
Value added	-0.05436**	-0.14043**	0.00626	-0.02791	-0.03963
	(0.020)	(0.051)	(0.028)	(0.022)	(0.037)
Region fixed effects	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No	No
Industry-region fixed effects	No	No	No	No	No
Observations	22,370	5,304	6,740	10,326	4,084
R-squared	0.265	0.292	0.038	0.363	0.334

	(6)	(7)	(8)	(9)	(10)
	Acceptance of credit guarantees				
	All	1973-1980	1981-1990	1991-2005	2000-2005
Value added	-0.07512***	-0.17002***	-0.01911	-0.05692***	-0.10375**
	(0.019)	(0.055)	(0.035)	(0.019)	(0.040)
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-region fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	22,366	5,290	6,731	10,320	4,073
R-squared	0.282	0.352	0.114	0.391	0.4

The table presents estimates for the amount of accepted credit guarantees for small businesses (a proxy for $GL_{i,c,t}$) as the dependent variable. Value added (a proxy for $V_{i,r,t}$) is defined as the gross value added for establishments with 4–29 employees. Estimated robust standard errors (based on clustering across industries, prefectures, and industries×prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Estimation Results for the Amounts of Value Added and Credit Guarantees

	(1)	(2)	(3)	(4)
	Acceptance of credit guarantees			
	All	All	All	All
Value added	-0.07176**		-0.09470***	
if GDP growth<median	(0.031)		(0.027)	
Value added	-0.03804		-0.05700*	
if GDP growth≥median	(0.031)		(0.032)	
Value added		-0.04641**		-0.06686***
if GDP growth is negative		(0.019)		(0.020)
Value added		-0.09478		-0.11777*
if GDP growth is positive		(0.069)		(0.067)
Region fixed effects	No	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	Yes	Yes
Industry-region fixed effects	No	No	Yes	Yes
Observations	22,370	22,370	22,366	22,366
R-squared	0.266	0.266	0.282	0.282

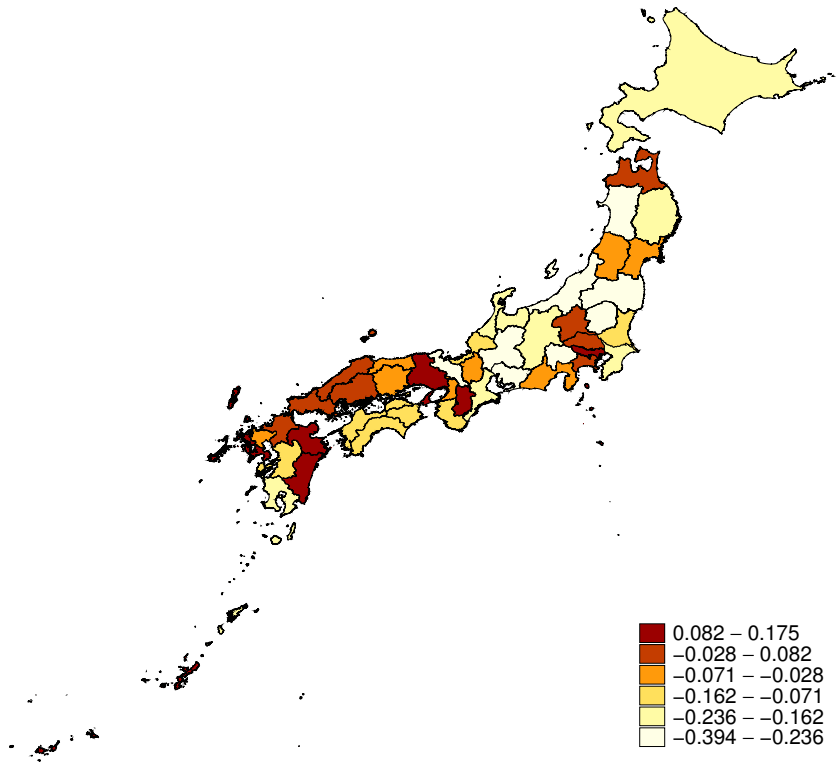
The table presents estimates with the amount of accepted credit guarantees for small businesses (a proxy for $GL_{i,c,t}$) as the dependent variable. Value added (a proxy for $V_{i,r,t}$) is defined as the gross value added for establishments with 4–29 employees. Estimated robust standard errors (based on clustering across industries, prefectures, and industries×prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Estimation Results for Value Added and Credit Guarantees by Region

	(1)		
Coefficients of value added	Acceptance of credit guarantees		
Hokkaido	-0.16164	Kyoto	-0.28520***
	(0.105)		(0.061)
Aomori	0.07874	Osaka	-0.03191
	(0.126)		(0.062)
Iwate	-0.16388	Hyogo	0.12050*
	(0.115)		(0.069)
Miyagi	-0.03659	Nara	0.16726*
	(0.112)		(0.092)
Akita	-0.23610**	Wakayama	-0.14254
	(0.097)		(0.100)
Yamagata	-0.02882	Tottori	-0.04873
	(0.197)		(0.138)
Fukushima	-0.34655*	Shimane	0.00658
	(0.163)		(0.073)
Ibaraki	-0.09488	Okayama	-0.06728
	(0.089)		(0.092)
Tochigi	-0.24396**	Hiroshima	0.05186
	(0.095)		(0.146)
Gunma	0.05168	Yamaguchi	0.02966
	(0.135)		(0.087)
Saitama	0.08158	Tokushima	-0.12632
	(0.162)		(0.081)
Chiba	-0.16554**	Kagawa	-0.09081
	(0.058)		(0.073)
Tokyo	0.12905*	Ehime	-0.07143
	(0.070)		(0.090)
Kanagawa	0.05744	Kochi	-0.11343
	(0.045)		(0.099)
Niigata	-0.28675*	Fukuoka	-0.01861
	(0.160)		(0.118)
Toyama	-0.19096	Saga	-0.04065
	(0.110)		(0.084)
Ishikawa	-0.19680	Nagasaki	0.14647
	(0.139)		(0.104)
Fukui	-0.09680	Kumamoto	-0.09742
	(0.140)		(0.142)
Yamanashi	-0.33187***	Oita	0.08860
	(0.102)		(0.113)
Nagano	-0.21238*	Miyazaki	0.15811
	(0.119)		(0.151)
Gifu	-0.39381**	Kagoshima	-0.16594
	(0.155)		(0.128)
Shizuoka	-0.02787	Okinawa	0.17524
	(0.133)		(0.145)
Aichi	-0.27226*	Region fixed effects	Yes
	(0.132)	Year fixed effects	Yes
Mie	-0.19984	Industry fixed effects	Yes
	(0.134)	Industry-region fixed effects	Yes
Shiga	-0.04919	Observations	22,366
	(0.062)	R-squared	0.284

The table presents the estimated coefficients of value added (a proxy for $V_{i,r,t}$), by region. Estimated robust standard errors (based on clustering across industries, prefectures, and industries×prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 6: Estimated Coefficients of Value Added on Credit Guarantees by Prefecture



The figure plots estimated coefficients of value added on credit guarantees by prefecture.

Table 5: Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Amount of default	1,867	0.077	0.360	-1.569	2.051
Default rate	1,867	0.000	0.007	-0.064	0.076
Acceptance of guarantees	1,867	0.056	0.225	-0.886	0.977
Acceptance rate	1,867	0.000	0.017	-0.102	0.133
Guarantee use rate	1,867	7.810	3.734	1.500	23.860

The table presents summary statistics for the variables used in the econometric analysis.

Table 6: Estimation Results for Credit Guarantees and Default Amounts

	(1)	(2)	(3)	(4)	(5)	(6)
	Amount of default					
Acceptance of guarantees (t)	-0.01685	-0.03294	-0.05608	-0.07572	-0.06715	-0.08543
	(0.054)	(0.054)	(0.061)	(0.060)	(0.067)	(0.068)
Acceptance of guarantees (t-1)	0.22322***	0.23127***	0.22333***	0.20213***	0.23702***	0.25803***
	(0.066)	(0.063)	(0.062)	(0.067)	(0.069)	(0.067)
Acceptance of guarantees (t-2)		0.37413***	0.40347***	0.40122***	0.40609***	0.39623***
		(0.057)	(0.052)	(0.054)	(0.058)	(0.057)
Acceptance of guarantees (t-3)			0.24049***	0.27070***	0.28207***	0.26915***
			(0.051)	(0.052)	(0.051)	(0.053)
Acceptance of guarantees (t-4)				0.23309***	0.24343***	0.23707***
				(0.064)	(0.063)	(0.065)
Acceptance of guarantees (t-5)					0.06375	0.07244
					(0.042)	(0.045)
Acceptance of guarantees (t-6)						0.05362
						(0.047)
Acceptance rate (t)	-0.90689*	-0.50482	-0.23852	-0.12600	-0.21252	-0.22131
	(0.533)	(0.501)	(0.501)	(0.492)	(0.519)	(0.537)
Acceptance rate (t-1)	-1.12110**	-1.18329**	-0.83984	-0.64455	-0.84881	-0.74845
	(0.538)	(0.521)	(0.545)	(0.568)	(0.619)	(0.645)
Acceptance rate (t-2)		-0.83552**	-0.58546	-0.47029	-0.46528	-0.33573
		(0.360)	(0.461)	(0.532)	(0.562)	(0.590)
Acceptance rate (t-3)			0.43074	0.45058	0.47901	0.41222
			(0.491)	(0.552)	(0.586)	(0.559)
Acceptance rate (t-4)				-0.30266	-0.21232	-0.26958
				(0.433)	(0.462)	(0.455)
Acceptance rate (t-5)					-0.03695	0.03034
					(0.386)	(0.365)
Acceptance rate (t-6)						-0.36306
						(0.425)
Guarantee use rate	0.01670***	0.01427***	0.01211***	0.01071***	0.00988***	0.01015***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1867	1815	1763	1711	1659	1607
R-squared	0.442	0.461	0.475	0.486	0.494	0.511

The table presents estimates of the yen amount of defaulting loans with credit guarantees (a proxy for $Default_{r,t-s}$) as the dependent variable. We use the yen amount of accepted credit guarantees for $GL_{r,t-s}$. Estimated robust standard errors (based on clustering across prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Estimation Results for Credit Guarantees and Default Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	Default rate					
Acceptance of guarantees (t)	-0.00954***	-0.00972***	-0.01004***	-0.01029***	-0.01005***	-0.01038***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Acceptance of guarantees (t-1)	-0.00329*	-0.00347*	-0.00382**	-0.00444**	-0.00366*	-0.00388*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Acceptance of guarantees (t-2)		0.00380***	0.00431***	0.00422***	0.00461***	0.00404***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Acceptance of guarantees (t-3)			0.00662***	0.00740***	0.00762***	0.00744***
			(0.001)	(0.002)	(0.002)	(0.002)
Acceptance of guarantees (t-4)				0.00544***	0.00531***	0.00518***
				(0.002)	(0.001)	(0.002)
Acceptance of guarantees (t-5)					-0.00127	-0.00124
					(0.001)	(0.001)
Acceptance of guarantees (t-6)						0.00120
						(0.001)
Acceptance rate (t)	-0.02249*	-0.01692	-0.01171	-0.01043	-0.01108	-0.01053
	(0.013)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)
Acceptance rate (t-1)	-0.01338	-0.01618	-0.00664	-0.00150	-0.00267	0.00069
	(0.013)	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)
Acceptance rate (t-2)		-0.01094	-0.00658	-0.00324	-0.00308	0.00192
		(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Acceptance rate (t-3)			0.00771	0.01125	0.01085	0.01192
			(0.008)	(0.009)	(0.009)	(0.009)
Acceptance rate (t-4)				-0.00342	-0.00040	0.00188
				(0.009)	(0.012)	(0.011)
Acceptance rate (t-5)					0.01066	0.01347
					(0.011)	(0.011)
Acceptance rate (t-6)						0.00151
						(0.011)
Guarantee use rate	0.00029***	0.00027***	0.00021***	0.00017***	0.00018***	0.00018**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1867	1815	1763	1711	1659	1607
R-squared	0.304	0.31	0.327	0.333	0.338	0.34

The table presents estimates of the default rate (defined as the yen amount of defaulting loans with credit guarantees/yen amount of total loans with credit guarantees for $Default_{r,t-s}$) as the dependent variable. We use the yen amount of accepted credit guarantees for $GL_{r,t-s}$. Estimated robust standard errors (based on clustering across prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 8: Estimation Results for Accepted Credit Guarantees and Defaults by Year

	(1)	(2)	(3)	(4)
	Amount of default		Default rate	
Year	1991-2005	1973-1990	1991-2005	1973-1990
Acceptance of guarantees (t)	0.03101	-0.10072	-0.00701***	-0.01302***
	(0.091)	(0.061)	(0.003)	(0.002)
Acceptance of guarantees (t-1)	0.39228***	0.05284	-0.00068	-0.00755***
	(0.083)	(0.095)	(0.003)	(0.003)
Acceptance of guarantees (t-2)	0.56934***	0.26931***	0.00545***	0.00357*
	(0.071)	(0.084)	(0.002)	(0.002)
Acceptance of guarantees (t-3)	0.44347***	0.17529*	0.00742***	0.00853***
	(0.066)	(0.089)	(0.001)	(0.003)
Acceptance of guarantees (t-4)	0.30178***	0.17640*	0.00385***	0.00656**
	(0.076)	(0.094)	(0.001)	(0.003)
Guarantee use rate	0.01152*	0.01145	0.00022*	0.00062***
	(0.006)	(0.009)	(0.000)	(0.000)
Region fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	780	931	780	931
R-squared	0.436	0.542	0.352	0.325

The table presents estimates of the amount of defaults and the default rate as the dependent variable. Estimated robust standard errors (based on clustering across prefectures) are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.