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# Information Asymmetry in SME Credit Guarantee Schemes: Evidence from Japan[*]

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## Abstract

In this paper, we investigate whether adverse selection and/or moral hazard can be detected in credit guarantee schemes for small and medium enterprises (SMEs). Using bank-level data, we analyzed whether the subrogation rate is positively associated with the ratio of guaranteed loans to total loans, and found that the data are consistent with an adverse selection and/or moral hazard hypothesis. Further analyses show that the relationship is stronger for 100% coverage than for 80% coverage, indicating that "20% self-payment" mitigates the problem, but is not enough to eliminate it.

*Keywords*: Public credit guarantee, Small business loans, Asymmetric information
*JEL classification*: G21, G28, G38, G14

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## 1. Introduction

Credit rationing caused by capital market imperfection is widely seen as an important phenomenon in the loan market, especially for small and medium enterprises (SMEs). Along with various ways of alleviating the problem, such as long-term relationships and collateral lending, credit guarantees schemes have been one of the most important policy tools in many countries. According to Green (2003), "(t)oday over 2,250 schemes exist in almost 100 countries" (p.22), although the volume of credit guarantee as a percentage of GDP varies significantly across countries (Centre for Entrepreneurship, SMEs, and Local Development, 2012). An economic rationale for such public intervention is that it can enhance efficiency by providing additional funds for SMEs that are in fact healthy but unable to borrow enough loans because of the informational gap between lenders and borrowers.

Indeed, existing empirical studies provide evidence that justifies such intervention. For example, Riding and Haines Jr. (2001) and Riding et al. (2007) analyzed certain data from Canada data and observed that a credit guarantee program did enhance the loan availability for SMEs. In the UK, Cowling (2010) shows that the loan guarantee program alleviated credit constraints of small firms by promoting access to debt finance. Using a firm-level panel data from Italy for the period 1999–2004, Zecchini and Ventura (2009) demonstrate that credit guarantee reduced the cost of finance by 16–20% and the median value of total debt increased 9.64%. Using a dataset from Japan during the financial crisis in the late 1990s, Uesugi et al. (2010) too find that the special credit guarantee program improved credit availability for small businesses. More extensive evaluations of credit guarantee schemes are provided by a few other studies (Kang and Heshmati, 2008; Oh et al. ,2009; Hancock et al., 2007; Craig et al., 2007; Ono et al., 2013).[1]

Despite many empirical studies that evaluate the effectiveness of credit guarantee schemes, empirical analyses on the cost side of the policy are scarce.[2] One important source of the cost of providing credit guarantee is adverse selection and moral hazard. Since credit guarantee insures banks from incurring losses from default, they are enticed for asking seemingly risky borrowers to apply for credit guarantee. Since credit guarantee

[1] Using a micro dataset, Kang and Heshmati (2008) and Oh et al. (2009) find that the Korean credit guarantee program initiated after the Asian currency crisis had a significantly positive impact on employment, sales, and wages, although it had no considerable impact on productivity and investment. In the US, Hancock et al. (2007) used state-level data for 1990–2000 and observed that disbursements of bank loans guaranteed by the Small Business Administration (SBA) are associated not only with more output, employment, and dollar payrolls, but also with less business failures and bankruptcies. Craig et al. (2007) also find a positive correlation between the relative levels of SBA-guaranteed bank loans in a local market and the future per capita income growth. Using data of the emergency credit guarantee program during the Lehman shock episode in Japan, Ono et al. (2013) demonstrate that the program eased credit availability, but the ex-post performance of small businesses after receiving credit guarantee deteriorated compared with those not receiving.

[2] There are some studies on the cost and benefit of credit guarantee schemes, such as those by Riding and Haines (2001) and Boocock and Shariff (2005).

corporations cannot distinguish low-risk borrowers from risky ones, credit guarantee schemes attract a sizable portion of risky borrowers, which results in inefficient resource allocation. This potential problem could be especially grim in Japan where the proportion of 100% credit guarantee is more than half. While the threat of adverse selection and moral hazard in credit guarantee schemes has been often pointed out, to the best of our knowledge, no empirical study of such a potential threat has been conducted.

The purpose of this paper is to empirically examine whether adverse selection and/or moral hazard is detected in Japanese credit guarantee schemes. We believe that Japanese credit guarantee schemes have some ideal characteristics. First, the proportion of credit guarantees to GDP is very high in Japan compared to other countries,[3] which means that we can focus on one of the largest credit guarantee schemes in the world. Second, as we will see more closely in the next section, there are several features that can lead to adverse selection and moral hazard, such as 100% coverage and a significant amount of government subsidies.

Using data on city, regional, and shinkin banks[4], we apply the basic positive correlation test proposed by Chiappori and Salanie (2000) to investigate whether (i) banks that

[3] According to Centre for Entrepreneurship, SMEs, and Local Development (2012), the volume of credit guarantee as a percentage of GDP is 7.3%, which is the highest in the listed countries.
[4] Shinkin banks are cooperative regional financial institutions for SMEs. See the website of Shinkin Central Bank for details about shinkin banks: http://www.shinkin-central-bank.jp/index_fin_e.html

transact with risky small businesses are more likely to offer loans with guarantees (adverse selection); and (ii) small businesses with guaranteed loans are more likely to default (moral hazard).

Our findings are consistent with the adverse selection and/or moral hazard predicament. We find statistically significant positive correlations between credit risk (subrogation rate) and the amount of guaranteed loans, indicating that a public credit guarantee program is influenced by asymmetric information. Further investigation suggests that the association between the subrogation rate and the ratio of guaranteed loans to total loan is stronger for 100% credit guarantee than for 80% credit guarantees, implying that the "20% self-payment" criteria is working as an effective mechanism for alleviating the problem, but is not enough for eliminating it.

The remainder of the paper is organized as follows. In section 2, we introduce the Japanese credit guarantee system. In section 3, empirical strategies are proposed. In section 4, we explain the data set, while estimation results are shown in section 5. In section 6, we discuss interpretations of our estimation results. Section 7 provides some concluding remarks.

## 2. Credit Guarantee System in Japan

Credit guarantee schemes are quite popular in Japan. The country has 51 government-affiliated credit guarantee corporations (CGCs) that offer credit guarantees on bank loans to credit-constrained small businesses. Small businesses and banks apply for credit guarantees, following which the CGCs decide whether to approve them.[5] If approved, banks offer guaranteed loans to small businesses, and small businesses pay a guarantee fee to the CGC. If small businesses' guaranteed loans go into default, the CGCs repay the banks (this is called subrogation).

Ceilings on credit guarantees for small businesses are JPY80 million for guarantee programs without collateral and JPY200 million for the general guarantee program. According to *Chusho Kigyou Jittai Chosa* (Basic Survey of Small and Medium Enterprises) by the Small and Medium Enterprise Agency, the total average borrowings of a small business stood at JPY85.6 million in fiscal year 2009; thus, it can be said that the ceiling is fair enough for a small business. After credit guarantees are accepted, the small businesses pay guarantee fees of 0.45% to 1.90% according to each firm's credit risk. The total value of guarantees accepted stood at JPY19,581 billion, JPY16,625 billion, and JPY14,172 billion in fiscal years 2008, 2009, and 2010, respectively. In fiscal year 2010, the value of

[5] As we will see later, in general, it is banks rather than small businesses that apply for credit guarantees.

outstanding guarantee liabilities stood at JPY35,068 billion, and 37.5% of small businesses used credit guarantees.

The credit guarantee system in Japan has some seemingly problematic features in the light of asymmetric information. First, CGCs mainly provide full credit guarantees.[6] Until October 2007, the coverage rate in Japan was 100% and 80% thereafter. However, for emergency guarantee programs for the period October 2008 to March 2011, it returned to 100%. To use emergency guarantee programs, small businesses had to operate in one of 793 designated industries, which covers 82% of small businesses.[7] As a result, a large portion of guaranteed loans covers 100% of defaulted loans. The proportion of 100% guaranteed loans was approximately 59% and 57% in fiscal years 2009 and 2010, respectively.

Second, the Japan Finance Corporation (JFC), which is a public corporation wholly owned by the Japanese government, offers credit insurance that covers losses from subrogation. Coverage rates of credit insurance range from 70% to 80%, and hence the CGCs themselves suffer little loss from subrogation. The JFC accepts all credit insurance for CGCs, implying that CGCs have only a weak incentive to monitor banks and small businesses. Notably, the JFC has suffered substantial losses in credit insurance accounts:

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[6] References show that full coverage under a credit guarantee system is adopted in several countries, such as France, Japan, Korea, and Luxembourg (Levitsky and Prasad, 1989 and Uesugi et al., 2010).

[7] See the website of the Small and Medium Enterprise Agency: http://www.chusho.meti.go.jp/kinyu/2009/download/091127Diagram.pdf.

JPY568 billion in fiscal year 2009 and JPY436 billion in fiscal year 2010.[8] The subrogation rate has been high as well; it was 3.19% in fiscal year 2009 and 2.67% in fiscal year 2010[9], which is higher than the default rate for bank loans.

Third, in the credit guarantee system practiced in Japan, small businesses apply for credit guarantees from CGCs; however, in general, this is not their decision. Instead, banks that transact with the small businesses (not the businesses themselves) apply for credit guarantees from CGCs on their behalf. Therefore, banks elect to offer credit-guaranteed loans to risky small businesses. Fourth, the rejection rate of credit guarantees is low, at approximately 10%, implying that most credit guarantee applicants are accepted. This, as we have mentioned, might be due to the fact that CGCs have weak incentive to screen small business applicants because of the high coverage of credit insurance.

Finally, CGCs cannot collect sufficient soft information from applicants. Many studies (for example, Berger et al., 2005; Berger and Udell, 2006) claim that soft information plays an important role in assessing the credit risk of small businesses. Unlike banks, which can acquire soft information through relationship lending from continuous transactions, CGCs cannot gather enough soft information, and therefore have to rely only on hard information

[8] See the website of JFC for more detail:
http://www.jfc.go.jp/n/company/sme/state insurance.html

[9] See *Credit Guarantee System in Japan 2011* by the National Federation of Credit Guarantee Corporations.

of small businesses. Moreover, banks that are unable to assess the risks of small businesses have strong incentives to offer them guaranteed loans. Considering these factors, we believe Japanese credit guarantee schemes provide an ideal situation for testing adverse selection and moral hazard.

## 3. Empirical Specification

The extensively used "positive correlation test" proposed by Chiappori and Salanie (2000) is the essential theory for our empirical strategy. The underlying analysis shows that riskier small businesses are more likely to have loans with guarantees (adverse selection) and small businesses with guaranteed loans are more likely to default (moral hazard). In both cases, a positive correlation is observed between the amount of loans with guarantees ($y_i$) and ex-post default risk ($z_i$). As this correlation should be assessed within the group of observationally equivalent firms, the association between $y_i$ and $z_i$ should be assessed conditionally on all observable variables ($\boldsymbol{X}_i$). Chiappori and Salanie (2000) argue that this property holds in fairly general contexts. Based on their argument, we deduce the following model:

$$y_i = \boldsymbol{X_i \beta} + \epsilon_i \tag{1}$$

$$z_i = \boldsymbol{X_i \gamma} + \eta_i \tag{2}$$

$$cov(\epsilon_i, \eta_i) = \sigma_{\epsilon\eta} \tag{3}$$

where $y_i$ is the amount of loans guaranteed, $z_i$ is ex-post default risk, $\boldsymbol{X_i}$ is a set of control variables, and $\epsilon_i$ and $\eta_i$ are error terms. If residual adverse selection and/or moral hazard exist, the null hypothesis of $\mathrm{H_0}: cov(\epsilon_i, \eta_i) = \sigma_{\epsilon\eta} = 0$ should be rejected.

In the context of SME loan guarantee, the variables $y_i$, $z_i$, and $\boldsymbol{X_i}$ are defined as follows:

$$y_i \equiv \frac{\text{amount of loans with guarantees}}{\text{total amount of loans for small businesses}}$$

$$z_i \equiv \frac{\text{amount of subrogation}}{\text{amount of loans with guarantee}}$$

$\boldsymbol{X_i}$: a set of control variables

However, there are two caveats here that need to be mentioned. First, the positive correlation approach requires researchers to include *all* variables that are observed by the insurer (CGCs in this case) in $\boldsymbol{X_i}$. In the case of credit guarantees for bank loans, or loan markets in general, it is quite difficult to include all the observed variables, because contracting in the loan market is not as standardized as in insurance markets. As asserted, in deciding whether or not to grant a loan, loan lenders will not only use the potential borrower's financial statements, but also use various types of soft information, including their forecasting of the potential borrower's performance, which is obviously not observed by the researcher. Given this nature of the loan market, it is stated that a strict assessment of asymmetric information cannot be conducted in loan markets because it is not practical to include all the observed variables about borrowers. Keeping this limitation under consideration, we tried our best to control the default risk of small businesses.

We consider that banks' financial conditions are related to observable default risk of small businesses. This is because, under the Basel Regulation, banks with a low capital ratio will try to reduce their level of risk-weighted assets by increasing the ratio of loans with guarantee so that they can satisfy the capital adequacy requirements. Based on this concept, we include the financial institutions' capital asset ratio ($car$) and return on assets ($roa$) as proxies for the default risk of small businesses. We also include two additional variables, $extension$ and $risk\_npl$. The former is the repayment extension ratio for each bank, which is defined as the ratio of total amount of loans requested for repayment extension to total amount of loans for small businesses for a proxy of borrowers' risk. A high extension ratio suggests that financial institutions lend more to risky small businesses, which results in the high observable default ratio. The latter variable, $risk\_npl$, is the ratio of nonperforming loans. The high nonperforming loans indicate that the default risk of borrowers is high.

In addition to these variables, we also use prefecture dummies that indicate the location of bank headquarters to control the regional risk,[10] and the natural logarithm of a bank's total assets (ln_asset) and two financial institution type dummies (regional bank and shinkin bank dummies) to control other characteristics of financial institutions.

Second caveat is that $y_i$ and $z_i$ are continuous variables in our study, rather than index variables as in Chiappori and Salanie (2000). Thus, we refer to the model as the seemingly unrelated regressions (SUR) model and estimate it by following the standard estimation technique.

We also consider an additional model, which is a partial linear model. A partial linear model is estimated to analyze how $(y_i, z_i)$ are distributed. Specifically, we consider the following model:

$$z_i = \boldsymbol{X_i \beta} + f(y_i) + \epsilon_i \qquad (4)$$

where all the variable definitions are the same as those in the SUR model. A notable feature of this model is that no assumption is imposed on the functional form of $y_i$, which allows us to observe the distribution of $(y_i, z_i)$ visually. To identify the shape of $f(\cdot)$, we follow the differencing method explained in Yatchew (2003).

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[10] We include 46 prefecture dummies to control regional risk. If we limit the sample to city and regional banks (109 observations), the number of observations might be too small compared to the number of explanatory variables. However, we obtain similar results if we estimate the SUR model without the 46 prefecture dummies.

## 4. Data

We investigate the equations described in Section 3 by emphasizing on two types of financial institutions: city and regional banks, and shinkin banks. Statistics on loans with guarantees and defaults for each bank have been obtained from the Small Business Agency's website.[11] The sample period of dependent variables is the end of fiscal year 2011. The data on amount of loans with guarantees and defaults for each bank are disclosed since June 2012. Data on the total amount of loans for small businesses was obtained from the Financial Service Agency's website.[12] Moreover, we used data on the financial state of financial institutions ($\boldsymbol{X_i}$) obtained from *Financial Statements of All Banks*[13], *Zenkoku Shinyoukinko Zaimushohyou* (Financial Statements of Shinkin Banks), and Nikkei Financial Quest at the end of fiscal year 2010. Furthermore, we obtained data of loans requested for repayment extension at the end of fiscal year 2010 from the website of each bank.[14] The full sample size is 371, including 109 city and regional banks, and 262 shinkin

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[11] See the Small Business Agency's website for more details:
http://www.chusho.meti.go.jp/kinyu/shikinguri/hosho/daii.htm

[12] See http://www.fsa.go.jp/policy/chusho/shihyou.html for more details

[13] See the website of the Japanese Bankers Association:
http://www.zenginkyo.or.jp/en/stats/year2_01/index.html

[14] From December 2009 to March 2013, banks have obligations to disclose the amount of loans requested for repayment extension under the SME Finance Facilitation Act.

banks.[15] Table 1 provides the summary statistics for $y_i$, $z_i$, and $\boldsymbol{X}_i$.

# 5. Main Results

## 5.1. Estimation Results of SUR Model

Table 2 shows the estimation results of the SUR model. Our primary interest is in the correlation between two error terms, which can be checked by Breusch–Pagan chi-squared test statistics. They suggest that the null hypothesis of no correlation between the rate of loans with guarantee ($y_i$) and ex-post default risk ($z_i$) is rejected at the 1 or 5% level for all banks (columns 1 and 2), city and regional banks (columns 3 and 4), and shinkin banks (columns 5 and 6). These suggest that there is data consistency in the adverse selection and/or moral hazard hypotheses.[16]

To obtain more detailed knowledge about the reasons behind inefficiency caused by informational asymmetry in the loan guarantee scheme, we have divided our data into guaranteed loans that are 100% guaranteed in case of default ("100% guarantee") and those guaranteed at a rate of 80%, with 20% paid by banks ("80% guarantee").

[15] We do not use the observations if the rate of loans requested for repayment extension is unavailable. Also, we exclude one sample that seems to be an outlier whose value of $z_i$ exceeds 0.1.

[16] As a reference, the correlation coefficients between $y_i$ and $z_i$ are $0.055$, $0.113$, and $-0.076$ for all data, 100% guarantee, and 80% guarantee, respectively. These figures imply the positive correlation between $y_i$ and $z_i$ for all data and 100% guarantee, but not for 80% guarantee, which is consistent with more thorough analyses in the text.

Tables 3 and 4 show the estimation results for the SUR model using the 100% and 80% guarantees, respectively. For the 100% guarantee, we observe a positive and statistically significant correlation between $y_i$ and $z_i$ regardless of the bank type. However, for the 80% guarantee, the results are slightly different. When we look at all types of financial institutions (columns 1 and 2), the null of no correlation between $y_i$ and $z_i$ is not rejected. However, when we focus on each type of financial institution, the null is rejected, although it is rejected at the 10% significance level for shinkin banks. We will discuss the reasons later.

One concern about the results so far is related to the Great East Japan Earthquake of 2011. To check whether the above findings are robust to the event, we estimate the SUR model excluding three prefectures that were severely damaged by the disaster: Iwate, Miyagi, and Fukushima. Table 5 demonstrates the estimation results. In all types of guarantees, the results show that the null hypothesis of no correlation between $y_i$ and $z_i$ is rejected at 1 or 10% level. Contrary to the previous results, the estimation results using 80% guarantee show that the null is rejected at a 10% significance level when we exclude prefectures severely damaged by the disaster.

To summarize, we reject the null of no correlation between $y_i$ and $z_i$ regardless of the financial institution type or 100% and 80% guarantee, which suggests that the guarantee system is plagued by asymmetric information. We also find that the correlation is weaker for 80% guarantee than for 100% guarantee. A possible interpretation of this finding is that 20% of self-payment alleviates the problem, but is not enough for eliminating it.[17]

### 5.2. Estimation Results of Partial Linear Model

Figures 1 to 6 show the results from the partial linear model. Figures 1 and 2 show the results using all samples, and Figures 3 and 4 and Figures 5 and 6 show the results using 100% and 80% guarantees, respectively.

In all figures, the plotted data is dispersed widely, but the shapes of $f(\cdot)$ indicate a positive correlation between $y_i$ and $z_i$ for all samples and 100% guarantees (Figures 1 and 3). We find a similar tendency even if we divide the sample into city and regional banks and shinkin banks, although the shapes of $f(\cdot)$ are highly vulnerable to the samples located at both ends (Figures 2 and 4). The slope of $f(\cdot)$ for 80% guarantee is flatter than in the case of 100% guarantee, indicating that the information problem is less severe because of the 20% self-payment. This feature persists even if we focus on the different types of financial institutions (Figure 6). At any rate, these observations are consistent

[17] This finding is consistent with the findings by Riding and Haines (2001) that "(s)mall reductions in the level of the guarantee (for example, guaranteeing 80% of principal and accrued interest instead of 85%) could lead to substantial reductions in default rates." (p.596)

with the results from the SUR models.

# 6. Discussion

## 6.1. Large or small?

So far, we have assessed whether our data is consistent with the asymmetric information or not. However, neither the SUR nor the partial linear model clearly indicates the severity of the informational problem. In this section, we try to measure the magnitude of the inefficiency arising from the informational asymmetry.

To measure the magnitude of the problem, we consider an instrumental variable (IV) regression model. Specifically, we estimate the model as follows:

$$z_i = \boldsymbol{X_i\beta} + \alpha y_i + \epsilon_i. \quad (5)$$

where all the variables are defined in the same way as those in the SUR model. Our primary interest is in the size of $\alpha$, which indicates how much the default rate increases if the loan with guarantee increases by 1%. Here we consider $y_i$ as an endogenous variable, because $z_i$ affects $y_i$ under the adverse selection hypothesis.

Table 6 demonstrates the estimation results of the instrumental variable model. Let us first verify the validity and exogeneity of the instrumental variable. In columns (1) to (3), first stage F-statistics exceed 10, assuring that instruments are not weak. Hansen's J-test statistics for exogeneity, which reports whether the null of exogeneity of instruments is rejected or not, indicate that the null is not rejected at a reasonable statistical significance level in columns (1) and (3), but it is rejected at 5% for column (2).[18] Thus, we basically rely on the results from models (1) and (3).

The coefficients of $y_i$ are positive and statistically significant for all models.[19] Positive coefficients of $y_i$ indicate that the ratio of the amount of subrogation to loans with guarantee ($z_i$) increases as the ratio of loans with guarantees to total amount of loans for small businesses ($y_i$) goes higher. The size of the coefficient is 0.1525 in model (1), which means that the 1% increase in $y_i$ leads to a 0.1525% increase in $z_i$.

It would be important to analyze if this size is large or small. For this, we look at the following situation. In October 2008, during the global financial crisis, the Small and Medium Enterprise Agency started the emergency loan guarantee program. On account of this program, the ratio of the amount of loans with guarantees to total amount of loans for small businesses ($y_i$) increased by 2.8 percentage points, from 11.4% in March 2008 to 14.2% in March 2010. During the same period, the ratio of the amount of subrogation to the amount of loans with guarantee ($z_i$) rose by 0.49 percentage points, from 2.7% in March

[18] We tried a variety of variables for instruments, but could not find better instruments than the used ones.

[19] The basic results are not affected by focusing on the sample that excludes three prefectures severely damaged by the Tohoku earthquake in 2011 (Iwate, Miyagi, and Fukushima), although it slightly changes the size of the coefficients on $y_i$ (0.1435 instead of 0.1525).

2008 to 3.19% in March 2010. Our estimation result of 0.1525 suggests that the 2.8% increase in $y_i$ leads to a 0.427% ($\cong 0.1525 \times 2.8\%$) increase in $z_i$, which seems to be a substantial contribution to the increase in $z_i$.

### 6.2. Further Results for Shinkin Banks

Our primary finding so far is that the adverse selection and/or moral hazard hypotheses are supported regardless of the type of financial institution and self-payment, although the significance level slightly changes depending on the sample we focus on.

In this subsection, we reconsider the estimation results using 80% guarantee (Table 4). We found that the null of no correlation between $y_i$ and $z_i$ is rejected when we focus on city and regional banks (columns 3 and 4) and shinkin banks (columns 5 and 6), but it is not rejected when we focus on the total sample (columns 1 and 2). Figure 6 suggests that the weak correlation in the 80% guarantee is caused by the behavior of shinkin banks.

The weak correlation raises two possible interpretations. First, shinkin banks do not have an incentive to offer guaranteed loans for risky small businesses despite having sufficient information about borrowers. If this story holds, we can interpret that the self-payment works as an effective mechanism for mitigating the problem. Second, some shinkin banks do not have an information advantage over CGCs, so they do not offer guaranteed loans for risky borrowers. To investigate each of these interpretations, we test the correlation between $y_i$ and $z_i$ by dividing the shinkin banks into three groups by the degree of their information advantages. If the 80% guarantee prevent the information problem, the correlations between $y_i$ and $z_i$ are insignificant in all groups. On the other hand, if only shinkin banks without information do not offer guaranteed loans for risky firms, the correlations between $y_i$ and $z_i$ are insignificant only in the group of uninformed shinkin banks.

We use the SME loans ratio (defined as total amount of loans for SMEs/total amount of loans) as a proxy of degree of information advantage over CGCs. We classify shinkin banks with a SME loans ratio in the top tertile as "high" group, which are shinkin banks that specialize in small businesses loans. These banks are considered to have an information advantage over CGCs. Similarly, we classify shinkin banks with a SME loans ratio in the middle tertile as "middle" group, and those in the bottom tertile as "low" group. Shinkin banks in the low group are regarded as those without an information advantage over CGCs.

Each cell in Table 7 shows the Breusch-Pagan chi-squared test statistics. The correlations between $y_i$ and $z_i$ are all positive and statistically significant if we limit the sample to observations in the high group. This implies that shinkin banks specialized in small businesses loans offer guaranteed loans for high-risk borrowers in both 80% and

100% guarantee systems. On the other hand, the correlations are positive only in 100% guarantee if we limit the sample to observations in the middle group. In addition, in the low SME loans ratio group, the positive correlations between $y_i$ and $z_i$ are statistically insignificant, suggesting that the information problem is not supported.

These results suggest that the correlations in shinkin banks are weak because some shinkin banks without an information advantage do not offer guaranteed loans for risky small businesses. Conversely, if they specialize in small business lending, they offer guaranteed loans for risky small businesses under both full and partial guarantee schemes. This implies that the cause for weak correlations between $y_i$ and $z_i$ is not the self-payments, but the lack of information advantage for some shinkin banks.

## 7. Conclusion

In many countries, SME credit guarantee schemes are one of the most popular policy tools to alleviate the inefficiency resulting from the informational asymmetry between lenders and borrowers. Our results, however, indicate that the Japanese SME loan guarantee scheme is also suffered from the same problems.[20] Although the findings of this

[20] Some economists argue that, without a rigorous empirical study, it is obvious that the Japanese credit guarantee scheme is severely affected by adverse selection and moral hazard. At the same time, however, bank officers claim that banks do not offer loans without sufficient screening and monitoring even if the loans are credit-guaranteed. Given these differing opinions, we believe that empirical analyses are

study might be specific to the Japanese credit guarantee scheme that has some characteristic features such as 100% guarantee and a substantial amount of government subsidization, we believe that our analysis on the Japanese experience provides an important lesson for all policy makers who seek a better design of credit guarantee schemes.

One important limitation of this study is that our results rely on the bank-level data set, rather than the firm- or contract-level data set. More sophisticated dataset is indispensable for obtaining better estimates. Also, this study has focused on one specific type of inefficiency and does not provide overall evaluation of the policy. The credit guarantee scheme as a public policy should be evaluated from a broader perspective, considering various types of costs and benefits. Nonetheless, this study provides some empirical evidence that leads to an important policy implication that the threat of adverse selection and moral hazard should be taken into account in the design and implementation of the credit guarantee programs.

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essential to assess whether adverse selection and/or moral hazard are detected in the Japanese credit guarantee scheme. We also believe that our study contributes to the recent policy debate on whether CGCs should lower the rate of self-payment under 80% (Nihon Keizai Shimbun (Nikkei), p.5 in the morning issue of June 2, 2014).

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**Table 1: Summary Statistics**

| Variable | Definition | N | Mean | S.D. | Min | Max |
|---|---|---|---|---|---|---|
| $y_i$ | amount of loans with guarantees/amount of loan for small businesses | 371 | 0.158 | 0.066 | 0.000 | 0.406 |
| $z_i$ | amount of subrogation/amount of guarantees | 371 | 0.024 | 0.012 | 0.000 | 0.078 |
| $z_i^{100}$ | amount of subrogation (100% guarantee only)/amount of guarantees | 371 | 0.017 | 0.009 | 0.000 | 0.053 |
| $z_i^{80}$ | amount of subrogation (80% guarantee only)/amount of guarantees | 371 | 0.007 | 0.005 | 0.000 | 0.041 |
| ln_asset | Ln(total assets) | 371 | 13.219 | 1.404 | 10.619 | 18.849 |
| car | capital asset ratio | 371 | 12.936 | 5.614 | 5.690 | 67.760 |
| risk_npl | amount of nonperforming loans/total amount of loans | 371 | 0.024 | 0.019 | 0.001 | 0.162 |
| roa | return on assets | 371 | 0.004 | 0.002 | 0.000 | 0.011 |
| extension | total amount of loans requested for repayment extension/total amount of loans for small businesses | 371 | 0.170 | 0.070 | 0.006 | 0.411 |

Note: This table provides summary statistics of the variables used in the econometric models.

**Table 2: Estimation results of the SUR model using all samples**

| VARIABLES | (1) $z_i$ | (2) $y_i$ | (3) $z_i$ | (4) $y_i$ | (5) $z_i$ | (6) $y_i$ |
|---|---|---|---|---|---|---|
| | All | | City and Regional Banks | | Shinkin bank | |
| ln_asset | 0.0009 | 0.0002 | -0.0020* | -0.0290*** | 0.0025** | 0.0046 |
| | (0.001) | (0.004) | (0.001) | (0.006) | (0.001) | (0.005) |
| car | -0.0003*** | 0.0005 | -0.0005 | 0.0049** | -0.0002 | 0.0006 |
| | (0.000) | (0.001) | (0.000) | (0.002) | (0.000) | (0.001) |
| risk_npl | 0.0502 | -0.4502*** | 0.0377 | 0.0261 | 0.0603 | -0.5307*** |
| | (0.034) | (0.165) | (0.065) | (0.339) | (0.041) | (0.183) |
| roa | 0.7684** | -4.0434** | 0.6743 | -3.3685 | 0.8003 | -3.2850 |
| | (0.374) | (1.815) | (0.547) | (2.837) | (0.495) | (2.202) |
| extension | 0.0120 | 0.2564*** | 0.0294** | 0.3682*** | 0.0150 | 0.2162*** |
| | (0.008) | (0.041) | (0.015) | (0.077) | (0.011) | (0.047) |
| FI Type Dummy | Yes | Yes | Yes | Yes | No | No |
| Prefecture Dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 371 | | 109 | | 262 | |
| R-squared | 0.411 | 0.502 | 0.711 | 0.743 | 0.407 | 0.518 |
| Breusch-Pagan chi-squared | 11.62*** | | 15.72*** | | 6.570** | |
| P-value | 0.001 | | 0.000 | | 0.010 | |

Note: This table provides the estimates of a SUR model with $y_i$ (amount of loans with guarantees/amount of loan for small businesses) and $z_i$ (amount of subrogation/amount of guarantees as the dependent variables. Definitions of all independent variables are in notes accompanying Table 1. Standard errors in parentheses; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level, respectively.

**Table 3: Estimation results of the SUR model using 100% guarantees**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | $z_i^{100}$ | $y_i$ | $z_i^{100}$ | $y_i$ | $z_i^{100}$ | $y_i$ |
| | All | | City and Regional Banks | | Shinkin bank | |
| ln_asset | 0.0008 | 0.0002 | -0.0016 | -0.0290*** | 0.0020*** | 0.0046 |
| | (0.001) | (0.004) | (0.001) | (0.006) | (0.001) | (0.005) |
| car | -0.0002*** | 0.0005 | -0.0005 | 0.0049** | -0.0002* | 0.0006 |
| | (0.000) | (0.001) | (0.000) | (0.002) | (0.000) | (0.001) |
| risk_npl | 0.0409* | -0.4502*** | 0.0463 | 0.0261 | 0.0558* | -0.5307*** |
| | (0.025) | (0.165) | (0.054) | (0.339) | (0.029) | (0.183) |
| roa | 0.5762** | -4.0434** | 0.6812 | -3.3685 | 0.5327 | -3.2850 |
| | (0.272) | (1.815) | (0.453) | (2.837) | (0.353) | (2.202) |
| extension | 0.0065 | 0.2564*** | 0.0153 | 0.3682*** | 0.0088 | 0.2162*** |
| | (0.006) | (0.041) | (0.012) | (0.077) | (0.008) | (0.047) |
| FI Type Dummy | Yes | Yes | Yes | Yes | No | No |
| Prefecture Dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 371 | | 109 | | 262 | |
| R-squared | 0.436 | 0.502 | 0.640 | 0.743 | 0.452 | 0.518 |
| Breusch-Pagan chi-squared | 13.89*** | | 11.57*** | | 6.394** | |
| P-value | 0.000 | | 0.000 | | 0.012 | |

Note: This table provides the estimates of a SUR model with $y_i$ (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{100}$ (amount of subrogation (100% guarantee only)/amount of guarantees) as the dependent variables. Definitions of all independent variables are in notes accompanying Table 1. Standard errors in parentheses; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level, respectively.

**Table 4: Estimation results of the SUR model using 80% guarantees**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | $z_i^{80}$ | $y_i$ | $z_i^{80}$ | $y_i$ | $z_i^{80}$ | $y_i$ |
| | All | | City and Regional Banks | | Shinkin bank | |
| ln_asset | 0.0001 | 0.0002 | -0.0004 | -0.0290*** | 0.0005 | 0.0046 |
| | (0.000) | (0.004) | (0.000) | (0.006) | (0.000) | (0.005) |
| car | -0.0001 | 0.0005 | 0.0000 | 0.0049** | -0.0000 | 0.0006 |
| | (0.000) | (0.001) | (0.000) | (0.002) | (0.000) | (0.001) |
| risk_npl | 0.0093 | -0.4502*** | -0.0085 | 0.0261 | 0.0044 | -0.5307*** |
| | (0.016) | (0.165) | (0.026) | (0.339) | (0.019) | (0.183) |
| roa | 0.1922 | -4.0434** | -0.0069 | -3.3685 | 0.2676 | -3.2850 |
| | (0.171) | (1.815) | (0.219) | (2.837) | (0.225) | (2.202) |
| extension | 0.0055 | 0.2564*** | 0.0140** | 0.3682*** | 0.0062 | 0.2162*** |
| | (0.004) | (0.041) | (0.006) | (0.077) | (0.005) | (0.047) |
| FI Type Dummy | Yes | Yes | Yes | Yes | No | No |
| Prefecture Dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 371 | | 109 | | 262 | |
| R-squared | 0.350 | 0.502 | 0.727 | 0.761 | 0.378 | 0.518 |
| Breusch-Pagan chi-squared | 2.361 | | 8.162*** | | 2.798* | |
| P-value | 0.124 | | 0.004 | | 0.094 | |

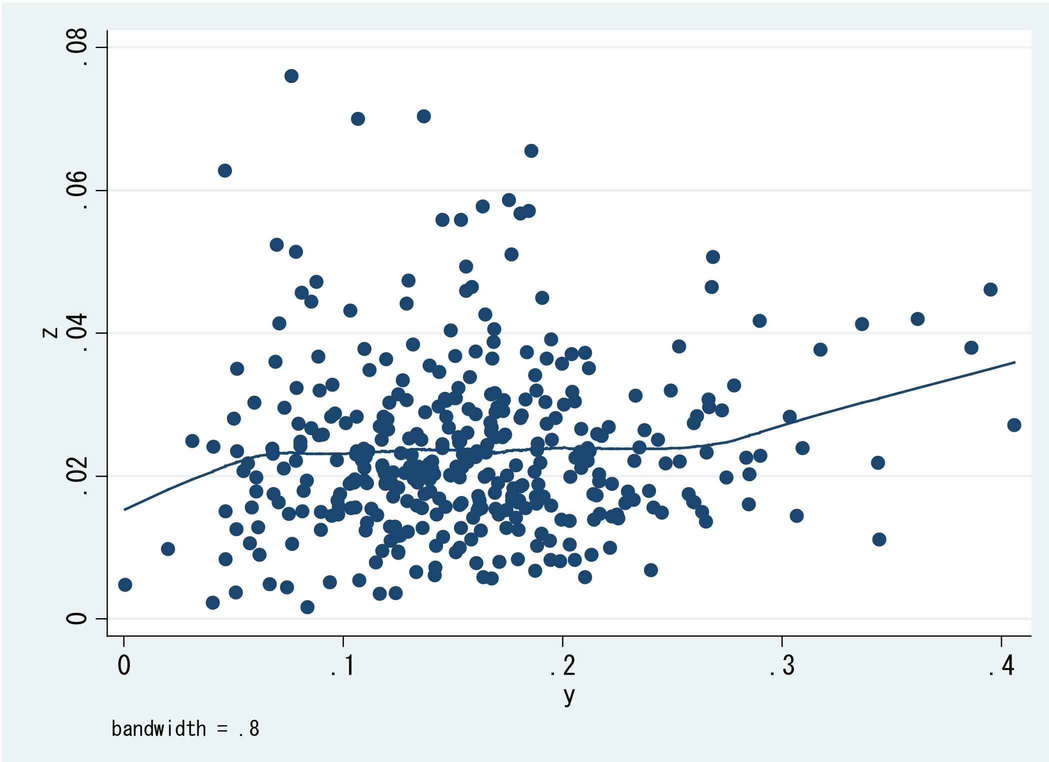
Note: This table provides the estimates of a SUR model with $y_i$ (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{80}$ (amount of subrogation (80% guarantee only)/amount of guarantees) as the dependent variables. Definitions of all independent variables are in notes accompanying Table 1. Standard errors in parentheses; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level, respectively.

**Table 5: Estimation results of the SUR model excluding observations in prefectures suffered by the Great East Japan Earthquake (Iwate, Miyagi, Fukushima)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | $z_i$ | $y_i$ | $z_i^{100}$ | $y_i$ | $z_i^{80}$ | $y_i$ |
| FI Type | All | | All | | All | |
| ln_asset | 0.0007 | 0.0024 | 0.0008 | 0.0024 | -0.0000 | 0.0024 |
| | (0.001) | (0.004) | (0.001) | (0.004) | (0.000) | (0.004) |
| car | -0.0003*** | 0.0006 | -0.0002*** | 0.0006 | -0.0001 | 0.0006 |
| | (0.000) | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) |
| risk_npl | 0.0406 | -0.4262** | 0.0443 | -0.4262** | -0.0037 | -0.4262** |
| | (0.038) | (0.181) | (0.028) | (0.181) | (0.017) | (0.181) |
| roa | 0.7797* | -5.0674*** | 0.5788** | -5.0674*** | 0.2009 | -5.0674*** |
| | (0.402) | (1.918) | (0.293) | (1.918) | (0.182) | (1.918) |
| extension | 0.0125 | 0.2716*** | 0.0075 | 0.2716*** | 0.0050 | 0.2716*** |
| | (0.009) | (0.042) | (0.006) | (0.042) | (0.004) | (0.042) |
| FI Type Dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Prefecture Dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 344 | | 344 | | 344 | |
| R-squared | 0.387 | 0.519 | 0.409 | 0.519 | 0.347 | 0.519 |
| Breusch-Pagan chi-squared | 12.65*** | | 14.36*** | | 3.049* | |
| P-value | 0.000 | | 0.000 | | 0.081 | |

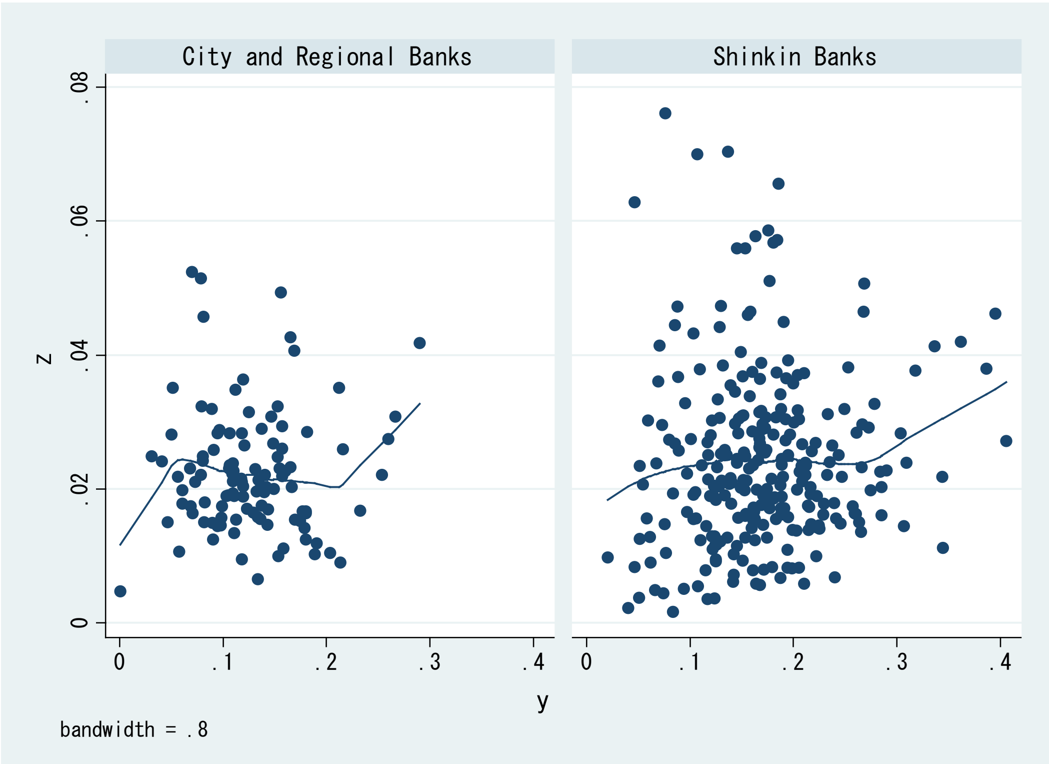
Note: This table provides the estimates of a SUR model with $y_i$, $z_i$, $z_i^{80}$, and $z_i^{100}$ as the dependent variables using observations excluding banks at Iwate, Miyagi, and Fukushima prefectures. Definitions of all variables are in notes accompanying Tables 3. Standard errors in parentheses; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level, respectively.

**Figure 1: Partial linear model using all samples**



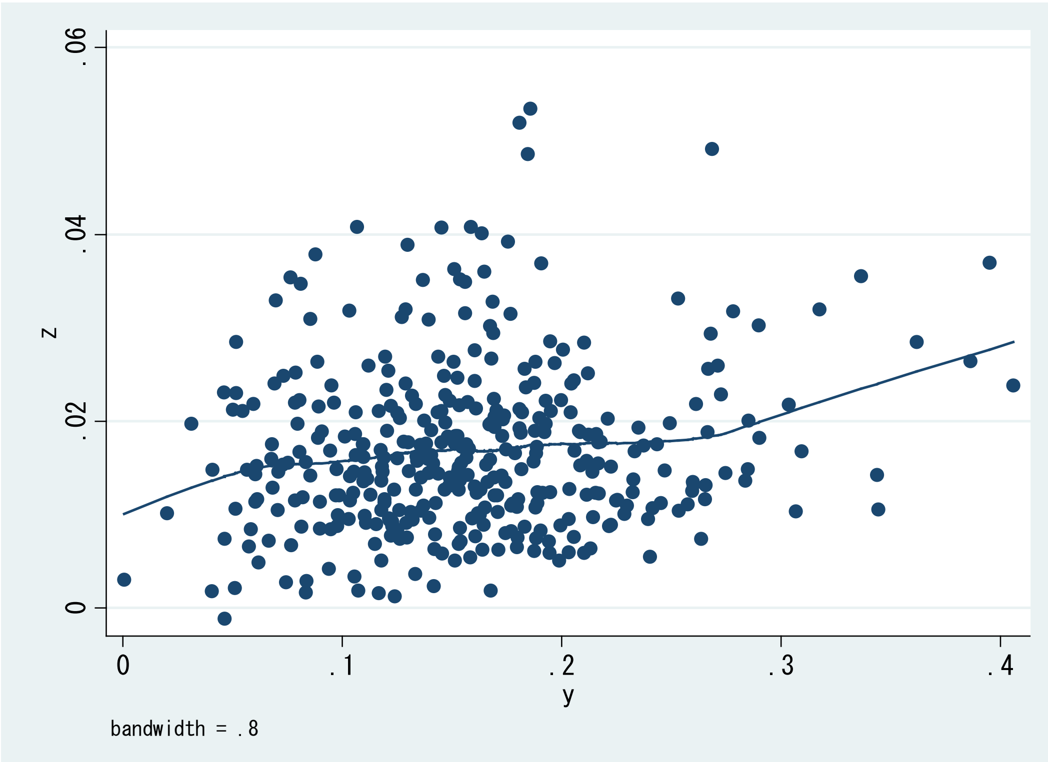

Note: This figure provides the estimates of a partial liner regression model with yi (amount of loans with guarantees/amount of loan for small businesses) and zi (amount of subrogation/amount of guarantees).

**Figure 2: Partial linear model using all samples for city and regional banks (left) and shinkin banks (right)**



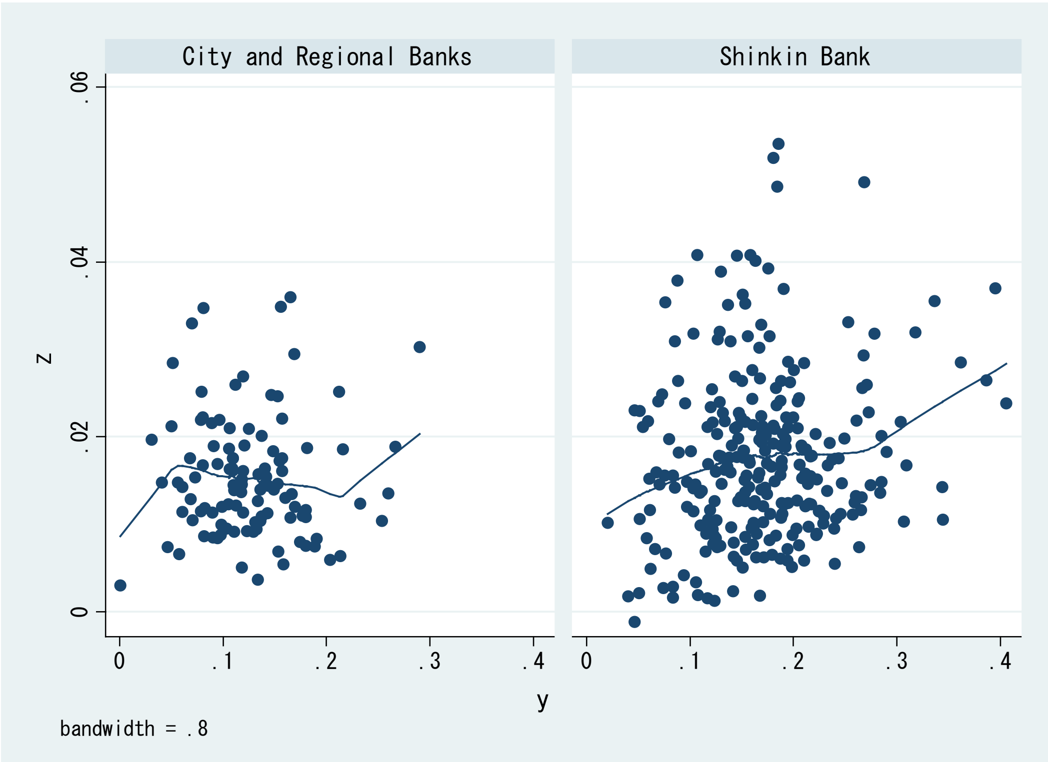

Note: This figure provides the estimates of a partial liner regression model for city and regional banks (left) and shinkin banks (right) with yi (amount of loans with guarantees/amount of loan for small businesses) and zi (amount of subrogation/amount of guarantees).

**Figure 3: Partial linear model using 100% guarantees**



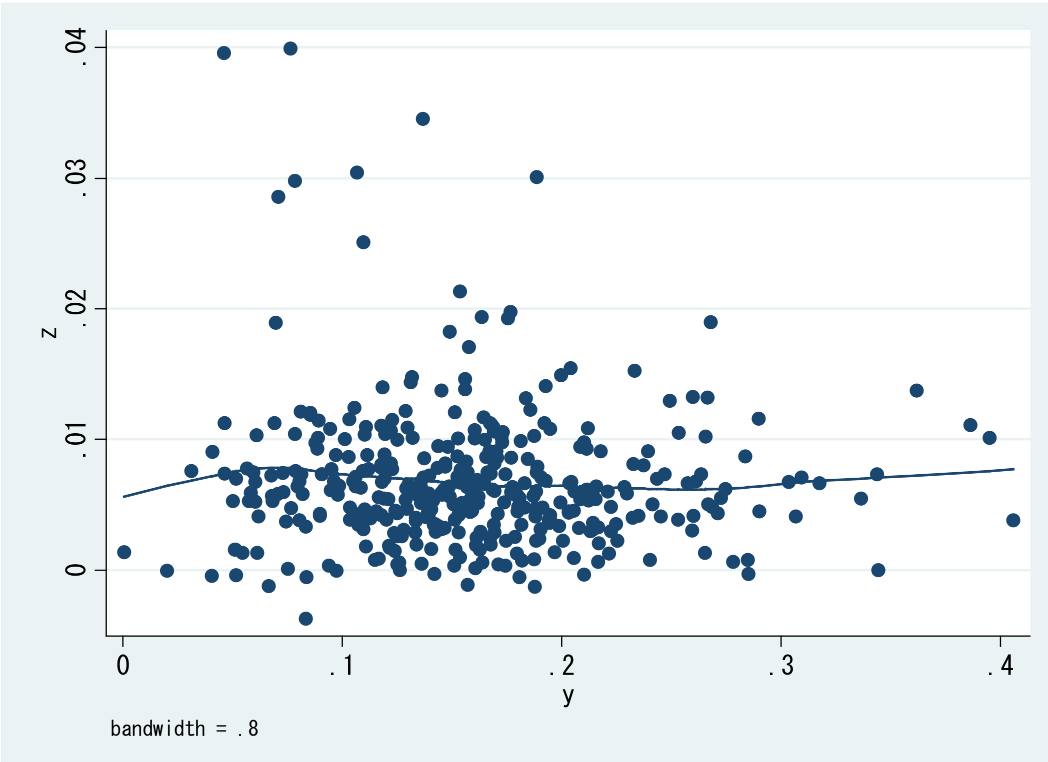

Note: This figure provides the estimates of a partial liner regression model with yi (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{100}$ (amount of subrogation/amount of guarantees).

**Figure 4: Partial linear model using 100% guarantees for city and regional banks (left) and shinkin banks (right)**



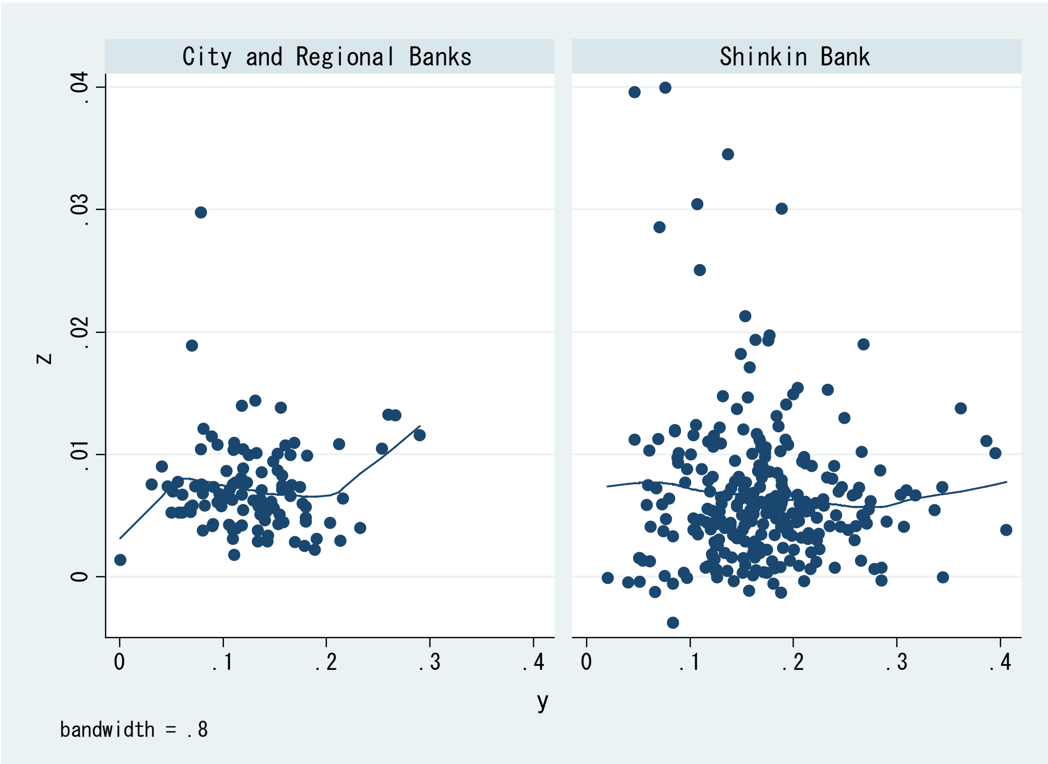

Note: These figures provide the estimates of a partial liner regression model for city and regional banks (left) and shinkin bank (right) with yi (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{100}$ (amount of subrogation/amount of guarantees).

**Figure 5: Partial linear model using 80% guarantees**




Note: This figure provides the estimates of a partial liner regression model with yi (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{80}$ (amount of subrogation/amount of guarantees as the dependent variables).

**Figure 6: Partial linear model using 80% guarantees for city and regional banks (left) and shinkin bank (right)**




Note: This figure provides the estimates of a partial liner regression model for city and regional banks (left) and shinkin bank (right) with yi (amount of loans with guarantees/amount of loan for small businesses) and $z_i^{80}$ (amount of subrogation/amount of guarantees as the dependent variables).

**Table 6: Estimation results of the instrumental variable model**

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | 100%&80% guarantees | 100% guarantees | 80% guarantees |
| y | 0.1525*** | 0.0695* | 0.0653** |
| | (0.059) | (0.039) | (0.028) |
| ln_asset | -0.0002 | -0.0004 | 0.0001 |
| | (0.001) | (0.000) | (0.000) |
| car | -0.0003* | -0.0002* | -0.0001 |
| | (0.000) | (0.000) | (0.000) |
| risk_npl | 0.0926** | 0.0453 | 0.0380* |
| | (0.040) | (0.028) | (0.020) |
| roa | 1.2496*** | 0.8139*** | 0.5112** |
| | (0.413) | (0.269) | (0.206) |
| extension | -0.0215 | -0.0058 | -0.0106 |
| | (0.016) | (0.012) | (0.008) |
| Constant | 0.0076 | 0.0114 | -0.0030 |
| | (0.017) | (0.011) | (0.008) |
| Prefecture dummy | yes | yes | yes |
| FI type dummy | yes | yes | yes |
| Instruments for *y* | type of financial institution, rate of loan for small businesses, and all the exogenous variables | type of financial institution and all the exogenous variables | type of financial institution, rate of loan for small businesses, and all the exogenous variables |
| Hansen's J-test | 5.21 | 9.12 | 1.74 |
| for Exogeneity | [0.16] | [0.01] | [0.63] |
| Observations | 371 | 371 | 371 |
| R-squared | 0.233 | 0.4 | 0.102 |

Note: This table provides the estimates of an instrumental variable regression model with $z_i$ (column 1), $z_i^{100}$ (column 2), and $z_i^{80}$ (column 3) as the dependent variables. Definitions of all independent variables are in notes accompanying Table 1. Robust standard errors in parentheses; * significant at the 10 level; ** significant at the 5% level; *** significant at the 1% level, respectively. P-values are expressed in square brackets

**Table 7: Estimation Results of SUR Model using Observations of Shinkin banks**

| Level of SME loans ratio | (1) 100% & 80% Guarantee | (2) 100% Guarantee | (3) 80% Guarantee | Observations |
|---|---|---|---|---|
| Low | 1.013 | 1.325 | 0.098 | 88 |
| | (0.314) | (0.250) | (0.755) | |
| Middle | 2.303 | 3.467* | 0.213 | 88 |
| | (0.129) | (0.063) | (0.645) | |
| High | 4.67** | 4.097** | 2.947* | 86 |
| | (0.031) | (0.043) | (0.086) | |

Note: This table provides the estimates of a SUR model with $y_i$, $z_i$ (column 1), $z_i^{100}$ (column 2), and $z_i^{80}$ (column 3) as the dependent variables using observations of shinkin banks. We show only the Breusch-Pagan chi-squared test statistics. Definitions of all variables are in notes accompanying Tables 4. Level of SME loans ratio is defines as total amount of loans for SMEs/total amount of loans. We classify shinkin banks with a SME loans ratio in the top tertile as “high” group, those in the middle tertile as “middle” group, and those in the bottom tertile as “low” group. P-values of the Breusch-Pagan chi-squared test statistics are shown in parentheses. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level, respectively.