Effectiveness of Credit Guarantees in the Japanese Loan Market*

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Abstract

From 1998-2001, the Japanese government implemented a massive credit guarantee program that was unprecedented in both scale and scope. Utilizing a new panel data set of Japanese firms we empirically test whether government credit programs do more to stimulate small business investment, or serve to worsen adverse selection problems in credit markets. We find evidence consistent with the former. Specifically, program participants (1) significantly increase their leverage, particularly their use of long-term loans, and (2) with the exception of high-risk firms, become more efficient. Overall, our findings suggest that government interventions in credit markets can be beneficial.

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1 Introduction

The question of whether government intervention can improve the economic efficiency of credit markets has been the subject of a number of theoretical studies.[1] The economic impact of direct loans, credit guarantees, and debt subsidies have been examined in a variety of different theoretical frameworks. In contrast, empirical evidence on the effectiveness of federal credit programs has been rather hard to come by. Firm-level panel data which includes the period of government intervention has generally not been available, or when available has generally not been utilized to correctly identify the policy effects of government credit programs. This has been especially true of small business studies.[2]

For a limited period of time (1998-2001) the Japanese government guaranteed 30 trillion yen worth of loans (or about 10% of total lending) to small- and medium-sized enterprises (SMEs) in a program officially known as the "Special Credit Guarantee Program for Financial Stability" (SCG program). Its intent was to alleviate the effects of a severe credit crunch among SMEs brought about by a contraction in the financial sector. What sets the SCG program apart from other credit guarantee schemes[3] was that it was accessible by nearly all SMEs as long as they were not in default, were not tax delinquent, did not have significantly negative net worth, or were not "window-dressing" their balance sheets. In addition, the SCG program, like Japan's other existing loan guarantee programs, covered 100% of the default cost incurred by borrowers. Because of this set-up, the SCG program provides a unique opportunity to determine if federal credit programs improve the efficiency of credit markets. The main contribution of this paper is an analysis of this extremely generous natural experiment in the Japanese credit market, an analysis made possible by the availability of a dataset which includes ex-ante and ex-post information on program users and non-users.

The justification for federal intervention in credit markets is that information problems result in inefficiencies in SME financing. On the flip side, federal intervention often exacerbates these information problems. Thus, to ascertain whether implementing a program like the SCG on a loan market with asymmetric information is beneficial we must determine if the positive impact of intervention, which we call the "investment effect," outweighs the negative impact of intervention, which we call the "adverse selection effect." In the investment effect, efficiency-improving projects that are not undertaken in an unfettered equilibrium are implemented under the SCG program since a 100% credit guarantee lowers the interest rate to the risk-free level and expands the investment frontier of borrowers. In contrast, in the adverse selection effect, the 100% guarantee reduces the incentives of financial institutions to thoroughly examine the creditworthiness of borrowers worsening the asymmetry. In this case,

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[1] For example, see Mankiw (1986), Gale (1990a, 1990b, 1991), Smith and Stutzer (1989), Innes (1991), and Williamson (1994).

[2] Among the many possible instruments used in credit market interventions, credit guarantee programs are the most frequently investigated. For example, Craig et al. (2005) examine the effectiveness of these programs in the U.S., Cowling and Mitchell (2003) do so for the U.K., Riding and Haines (2001) for Canada, and Matsuura and Hori (2003) for Japan. Most of these studies, however, do not have control samples even when they have access to firm-level data. The focus has been rather different in Japan, where many empirical studies including Hanazaki and Hachisuka (1997), point to how direct loans extended by government financial institutions have lowered the external finance premium and stimulated corporate investment. Presumably due to data availability, these studies have mainly been limited to the Development Bank of Japan and large, listed firms.

[3] For example, to qualify for the guaranteed loans program offered by the Small Business Administration in the U.S., firms must prove that they have no access to external sources of financing.

the allocation of credit in the unfettered market equilibrium is further deteriorated, which significantly reduces the efficiency of the loan market.

In this paper, by utilizing a new firm-level data set of small- and medium-sized Japanese firms, we are able to determine which of these hypotheses dominated in the Japanese credit market upon the implementation of the SCG program. We compare the procurement behavior and performance of SCG users to non-users, control for the endogeneity bias of sample selection, and find that the program led to gains in efficiency in terms of SME profitability and loan procurement. Our study, therefore, provides evidence that government intervention in credit markets can be beneficial. Further, the results suggest ways in which the program can be modified to improve sustainability and efficiency.

The paper proceeds as follows. Section 2 describes the credit guarantee system in Japan, including the SCG program. In section 3, we present a theoretical model of government intervention in credit markets under asymmetric information. Section 4 contains a discussion of the firm-level SME data. We test the predictions of the model using both summary statistics and a two-step estimation procedure in section 5. Section 6 concludes with policy implications.

2 The Special Credit Guarantee Program

In section 2.1 we discuss credit guarantees, one of the most important federal credit programs in Japan. Section 2.2 contains a detailed discussion of the Special Credit Guarantee Program.

2.1 The Credit Guarantee System in Japan

To facilitate the flow of funds to SMEs, the Japanese government has implemented a variety of programs, including the use of direct loans by government-backed financial institutions and loan guarantees. Even though loan guarantees are not significantly different from direct loans in terms of amount outstanding, the use rate of guarantees, which is almost 40% of the total number of SMEs in Japan, is far higher than the use rate of direct loans.

The credit guarantee system in Japan began in 1937 when the first credit guarantee corporation was established in Tokyo. After the Second World War, the system continued to develop. In 1948 the Japanese government established the Small and Medium Enterprise Agency (SMEA), which founded a number of prefectural guarantee corporations. The agency considered the guarantee system to be one of the major pillars of its SME financing policy. In 1951, the government began to partially insure the loan guarantees, and the scheme has remained unchanged since. The system's current insurer is the credit insurance division of the Japan Finance Corporation for Small and Medium Enterprise (JASME). The division finances 70% to 80% of the repayments by corporations. The amount of credit guarantees outstanding has grown in tandem with the Japanese economy. During the recessions of the 1970s and 1980s, the government frequently used the guarantee system as a convenient tool to stimulate activity in the SME sector.[4]

Three parties are involved in credit guarantee transactions in Japan: a small business borrower, a financial institution, and the credit guarantee corporation, which is financially backed by the government. The first step in the process is the filing of an application with a credit guarantee corporation. Financial institutions, acting on behalf of the small business

[4] Two examples are the guarantee program for firms harmed by exchange rate appreciations and the guarantee program for recession-hit areas.

borrower, file most applications, although some firms file on their own behalf. In the first case, the financial institution may implement a preliminary screening process before it actually delivers the guarantee application. The second step involves the examination of, and the decision on the application by the guarantee corporation. Finally, based on a letter of approval from the credit guarantee corporation, the financial institution extends a loan to the small business. The borrowing firm is then required to pay a guarantee premium, which is 1% of the total amount extended.[5] In cases where the firm is unable to repay its debt to the bank, the corporation covers the debt, whereupon it receives the loan claim. The corporation then collects the claim over the long-term by assisting with the firm's business restructuring.

There are two additional points worth noting with regard to the guarantee system. The share of debt relief assumed by the guarantee corporation, as a percentage of the total loan claim outstanding is, in principle, 100%, which is unique to the Japanese guarantee system. The primary implication of this is that the financial institution bears no default risk, which significantly reduces the institution's incentive to examine and monitor the borrower. Also, collateral or guarantees are sometimes required for sizable loan contracts. For example, collateral can be required for loans of more than 80 million yen, and a third-party guarantor can be required for loans of more than 50 million yen.

2.2 Introduction of the Special Credit Guarantee Program

In the 1990s, as the Japanese economy entered a period of prolonged stagnation, public guarantees were frequently included in government economic stimulus packages. This culminated with the introduction of the Special Credit Guarantee Program for Financial Stability, which ran from October 1998 to March 2001. The purpose of the measure was to alleviate the severe credit crunch faced by the small business sector. Beneficiaries of the program were subject to little in the way of collateral or third-party guarantor requirements. The scale of the SCG program, in terms of funding, was unprecedented. It is presumably the largest single credit guarantee program ever implemented in any country. Funding was initially capped at 20 trillion yen, but, in 1999, the cap was increased to 30 trillion yen.

Another unique feature of the SCG program was the loose examination policy. An applicant could be rejected for a guaranteed loan only under certain conditions: significantly negative net worth, tax delinquency, default, or window dressing of balance sheets.[6] Needless to say it was very difficult to be rejected. In most cases, the credit risk of an applicant was no longer a concern for approval, which meant that there was virtually no incentive for a risky firm to masquerade as an eligible firm to obtain funding. Hence, an astonishing number of small businesses (1.7 million approvals totaling about 28.9 trillion yen in guaranteed loans) benefited from the SCG program. Figure 1 displays the amount of SME loans backed by guarantees. It is clear from the figure that the introduction of the SCG program led to a significant increase in the amount of guaranteed loans.

The program, however, has come under increasing criticism. A series of media reports have exposed the blatant misuse of funds by some borrowers. Some borrowers made stock investments with loans guaranteed for daily company operations (Nikkei Financial Newspaper, February 16, 2000), others filed for bankruptcy less than one month after receiving loans (Nikkei Newspaper, January 11, 1999), and finally some, who were in no need of financing, simply obtained the loans because they could (Nikkei Newspaper, January 11, 1999).

[5] The premium was raised to 1.35% (without collateral) or 1.25% (with collateral) in fiscal year 2003.
[6] This list of "negative" conditions was also unprecedented.

Most of these abuses can be attributed to information problems, which were worsened by the SCG program. Inherently, informational asymmetries exist between lenders and SMEs. Two features of the program magnified these effects. First, due to the complete coverage of default costs by the credit guarantee corporation, private financial institutions had no incentive to properly screen or monitor their borrowers. Secondly, since the examination criteria of the SCG program set by the guarantee corporations were exceptionally lenient, most of the applications filed by financial institutions were approved for guarantees even though they may have been highly risky. One of the serious consequences of this, of course, is firms defaulting on their loans. And this has been the major problem for Japan's credit guarantee system. As of the end of October 2004, credit guarantee corporations have paid out a total of 2.1 trillion yen. Of this amount, whatever cannot be collected from the delinquent firms, and is not covered by the guarantee and insurance premium,[7] is financed by the federal budget.[8]

3 Theoretical Framework of the SCG Program

For a number of reasons, not the least of which is its enormity, the program is of great interest to the Japanese government. From a research standpoint, the program is intriguing because the temporal nature of the program, it lasted for less than three years, allows us to determine its overall impact on the Japanese economy. The 100% guarantee coverage did lower the interest rate to the risk-free level and stimulated firms to undertake a larger number of projects. Further, unlike other credit schemes, most SMEs were eligible for the program whether or not they were credit-rationed.[9] Leniency was regarded as a necessary feature of the program in order to ease the severe financing constraints faced by a large number of SMEs, and moreover, to enable these firms to go ahead with profitable projects. In addition, it significantly reduced the incentives for firms to masquerade as an eligible firm.

On the other hand, the 100% guarantee coverage and the loose examination criteria for guarantees exacerbated adverse selection problems in the Japanese credit market. The 100% percent guarantee scheme provided no incentives for financial institutions to engage in sufficient credit examinations. Furthermore, most of the applications filed by those financial institutions were approved for guarantees due to the generous criteria set by the guarantee corporations. The end result was that high risk firms, who are already more likely to default and less likely to repay their debt than their low risk counterparts, implemented unprofitable projects due to the small expected repayment value of the loan. Low risk firms, in contrast, did not implement potentially profitable projects. We examine these two effects of the SCG program, the "investment effect" and the "adverse selection effect," within the framework of the adverse selection model developed by Mankiw (1986).[10]

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[7] The insurance division of JASME has an accumulated deficit of 1.2 trillion yen for the SCG program as of the end of fiscal year 2003, which roughly corresponds to the amount not covered by the insurance premium.

[8] This has raised serious concern about the sustainability of the overall system of government credit guarantees. At the end of 2004, the SMEA established a committee to assess the future of the credit guarantee system. The committee has discussed topics such as risk-sharing between guarantee corporations and financial institutions and the introduction of flexible guarantee premiums.

[9] The Small Business Administration in the U.S. requires applicants for its loan guarantee program to prove they are not eligible for outside funding.

[10] In addition to adverse selection, lack of appropriate monitoring by financial institutions may point to moral hazard. Note, however, that both moral hazard and adverse selection are identical in that they reduce efficiency. Chaney and Thakor (1985) theoretically study how credit guarantee programs incur the moral hazard problem.

3.1 Basic Setup of the Model

We model a simple loan market where lenders extend loans to firms, who then undertake investment projects. Loans are the only procurement instrument for borrowers. Both borrowers and lenders are assumed to be risk-neutral. The repayment probability of the firm, P, measures the credit risk of the firm. Firms with high repayment probability (P) are called H-firms and those with low P are called L-firms. Each firm has its portfolio of projects yielding R.

We now posit two equilibria with differing degrees of asymmetric information between lenders and borrowers. We first consider the case where lenders are not able to distinguish between the expected rate of return, R, of a firm's project and the repayment probability (P) of the firm, although the distributions of P and R are public information. We denote the joint-density of P and R as $f(P,R)$. Lenders, therefore, offer loans at one interest rate, r. The average repayment probability of firms that actually borrow is denoted by π. The expected repayment revenue of lenders is then πr. Instead of lending, however, lenders can invest in a safe project, such as government bonds, that yield ρ. We can, therefore, define the equilibrium condition for lenders to extend loans as

$$\pi r = \rho \tag{1}$$

Thus, for a loan to be extended it must be the case that the expected repayment revenue is at least equal to the risk-free rate. Each firm decides whether to borrow, at r, to implement an investment project. Since the expected rate of return of the project is R, and the expected borrowing cost is Pr, a firm borrows and invests in a project only if

$$R > Pr \tag{2}$$

In other words, firms invest only when the expected return of the project exceeds the expected cost of borrowing.

Next, we consider the case where lenders know the repayment probability, P, of a firm. If the true value of P is known to both borrowers and lenders, then $P = \pi$ and (1) and (2) reduces to $R > \rho$, which implies that all projects that exceed the risk-free rate will be undertaken. In this case the market reaches the fully efficient allocation of funds since all implemented projects earn no less than the risk-free rate of ρ, while all projects not implemented earn less than ρ.

In figure 2, we plot the projects undertaken in each of these two equilibria: with information asymmetries and without. In the presence of information problems, projects located in A, B1, and B2 are undertaken, while in the fully efficient allocation projects in B1, B2, and D are undertaken. It is clear that information problems result in an inefficient allocation of funds, as positive net present value projects (D) are not undertaken by H-firms, and negative net present value projects (A) are undertaken by L-firms. In contrast, in the absence of any frictions, only positive net present value projects are funded.

Note, however, that since we can use only one of these two equilibria as a benchmark when deriving the theoretical predictions, the predictions based on the "unused" equilibrium will be trivial. For example, when we examine the effects of an interest rate decrease on investment, we only need consider the equilibrium with asymmetries. In the unfettered equilibrium with perfect information all efficient projects are already undertaken, thus, a change in the interest rate has no effect. Similarly, when we examine the effects of worsening

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They posit that firms expecting guarantees undertake riskier projects and put forth less managerial effort. Their theoretical prediction on the efficiency of guarantee users is the same as the one we posit in this section.

adverse selection, we only need consider the frictionless equilibrium. In the unfettered equilibrium where lenders already have no information on borrowers' characteristics, it is impossible to worsen adverse selection by providing less information. Therefore, in the following discussion on the possible effects of credit guarantees, we only employ the relevant equilibrium as a benchmark.[11]

3.2 The Investment Effect

Let's begin by supposing that government intervention in credit markets improves the flow of funds to firms. In this case, we analyze how a change in borrowing costs (r) affects equilibrium in the loan market. The introduction of the credit guarantee program ensures repayment by the government in response to borrowers' default. This will lower the market interest rate. If the ratio of repayment to the default amount is 100%, which is actually the case with the SCG program, the cost of borrowing will fall to the risk-free rate (ρ). Note the fact that the vast majority of SMEs are eligible for the SCG program further simplifies the analytical framework. If, instead, the program were available only to firms without sources of external financing, the possibility of non-eligible firms masquerading as eligible firms would emerge. In that case, it would be necessary to incorporate a mechanism to prevent the mimicking behavior, which would complicate the theoretical framework.[12]

As the market interest rate (r_U) falls to $r_I\left(=\rho\right)$, loans are more available. As shown in figure 3, the result is that firms are now able to undertake projects in C1, C2, and D. We call the expansion of the investment frontier the "investment effect." Whether these changes in firm behavior improve efficiency, however, depends upon the creditworthiness of the firm. Because of government intervention firms with a low probability of repayment (L-firms) undertake projects in C1. The expected return of projects in this area is lower than the risk-free rate, and are, therefore, efficiency-reducing. High repayment probability firms (H-firms), on the other hand, undertake a mix of efficiency-reducing (C2) and efficiency-improving (D) projects. Finally, risk free firms ($P=1$) implement only efficiency-improving projects. Overall, the aggregate investment effect improves efficiency if the reduction of the interest rate ($r_U - r_I$) is larger than the level of the interest rate r_I, and projects are uniformly distributed in the $\left(P,R\right)$ locus.

3.3 The Adverse Selection Effect

Now suppose that government intervention only worsens information problems in the market. Assuming we start from the unfettered equilibrium of perfect information, the introduction of the credit guarantee program eliminates any incentives banks have to examine and monitor borrowers. In this case, because lenders cannot distinguish H-firms from L-firms, they charge a single interest rate of r_A, which is assumed to be higher than the risk-free rate (ρ), to all the firms. At r_A firms undertake projects in A, B1, and B2. This is illustrated in figure 4. In contrast to the unfettered perfect information equilibrium, where projects in B1, B2, and D are funded, firms with high repayment probability (H-firms) are discouraged from implementing

[11] By assuming that lenders know the characteristics of borrowers with probability between 0 and 1 it is possible to work with one, rather than two equilibria. For graphical clarity, however, it is much simpler to consider the two extreme cases.

[12] See Gale (1990a), Smith and Stutzer (1989), and Innes (1991) for models that incorporate such a mechanism.

potentially efficiency-improving projects in D, while low repayment probability firms (L-firms) are encouraged to invest in efficiency-reducing projects in A. Hence, the changes wrought upon the market by the adverse selection effect are unequivocally efficiency-reducing.

In table 1 we summarize the predicted effects on the loan market of implementing a credit guarantee program. We consider the impact the program has on credit allocation, newly undertaken projects, and efficiency. In the case of riskier firms access to credit and investment, it does not matter whether the investment effect or the adverse selection effect dominates. For these firms, the introduction of a government credit program will always result in an increase in the availability of loans, and an increase in new investment. In contrast, if the adverse selection effect dominates, less risky firms have reduced access to loans, and, therefore, reduce their investment. The impact of government intervention on the efficiency of the market, which we interpret as firms undertaking projects whose expected return exceeds the risk free rate, depends on the creditworthiness of a firm. If the investment effect dominates the adverse selection effect low risk firms should see an increase in efficiency, while the efficiency of risky firms will always decrease when the government intervenes in the market.

4 Data

We construct a firm-level, balanced panel data set based on the Survey of Financial Environments. In conducting this survey, the SMEA sends questionnaires to 15,000 corporations annually and typically receives 7,000 to 8,000 replies. The questionnaire covers a variety of issues, including the maximum short-term interest rate paid over the past year and their main bank's responses to requests for credit. The 2001 survey includes a question on whether the firm made use of the SCG program between October 1998 and March 2001. Based on the answer to this question, we divide the entire sample of SMEs into two groups: (1) SCG users and (2) Non SCG users. The sample is made up of 1,344 SCG user firms and 2,144 non-SCG user firms. For each responding firm in the 2001 survey, we add annual balance sheet data, provided by the Tokyo Shoko Research Incorporated, from 1997 to 2003. We then further divide the sample into three periods: (t-1) the pre-crisis period (January 1997 and December 1998), (t) the crisis period (January 1999 and December 2001), and (t+1) the post-crisis period (January 2002 and December 2003). The crisis period roughly coincides with the period of the SCG program.

In table 2 we present, for each user category, sample statistics for the variables of interest. For each variable we eliminate any firms in the highest and the lowest 0.1%. Note that although all the sample firms are legally classified as SMEs, which have either no more than 300 employees or no more than 300 million yen in capital, the mean size of the firms in the sample is rather large considering the fact that the average employee size of small and medium sized corporations is 16.6 (Basic Survey of SMEs in 2004 by SMEA). The table also indicates that non-users are larger and better performers than the SCG users.

5 Hypothesis Tests

In this section we empirically test the predictions of our theoretical model. We begin with summary statistics in section 5.1. In section 5.2 we use the two-step estimation procedure,

documented in Wooldridge (2001), to clearly identify the policy effect, and estimate the effectiveness of the program.

5.1 Summary Statistics

To test the effect of the SCG program on both the allocation of credit and efficiency we consider the following variables:

- Leverage (Total liabilities/ Total assets; %)
- Short-term borrowing ratio (Short-term loans / Total assets; %)
- Long-term borrowing ratio (Long-term loans / Total assets; %)
- Interest payment rate (Interest payments in year t / Total Borrowings; %)
- Fixed tangible asset ratio (Fixed tangible assets / Total assets; %)
- ROA (Business profit / Total assets; %)

The first three of these variables are measures of credit allocation. We measure borrowing costs and firm investment with the interest payment rate and the fixed tangible asset ratio, respectively. Finally, we use the rate of return to measure economic efficiency. The idea is that if the SCG users efficiently allocate guaranteed loans, they will be more profitable. To test the theoretical predictions of the model we first calculate the time series development of each variable by comparing their pre-crisis values to their post-crisis values. We then calculate the differences across users and non-users. We must be careful, however, to account for cross-sectional differences in firm characteristics, between users and non-users, and macroeconomic shocks in each year. We, therefore, regress each variable on industry, region, and year dummies and base our calculations on the estimated residuals.

In table 3 we summarize the development of these variables over the sample period after controlling for industry, region and year. Looking at the credit allocation variables, we see that users of the program, relative to non-users, became increasingly more dependent on loans. Users increased their leverage by 2.71%, while non-users decreased their leverage by 1.35%. SCG users, therefore, increased their holdings of debt by 4.06% more than non-users. Furthermore, users increased their dependence on long-term loans by more than non-users, as shown by the 2.49% increase in the long-term borrowing ratio for users, and the 1.31% decrease for non-users. The opposite is true for the short-term borrowing ratio, where users decreased their holdings of short-term loans by 0.69%, while non-users increased their short-term borrowing by 0.27%. These findings are consistent with the set-up of the program. The SCG program allowed financial institutions to extend five- to seven-year guaranteed loans. Note that the differences in leverage and long-term loans between users and non-users are significant at the 1% level, while for short-term loans the differences are significant at the 10% level.

Not surprisingly interest payments increase more for users. This partly reflects an increased reliance on long-term loans, which charge higher interest rates. We also find that SCG users increase their fixed tangible asset ratio by 0.70% more than non-users. Notably, the numbers also reveal that ROA increases by 0.69% for users, while it decreases by 0.33% for non-users, or a difference of almost 1%. The developments in ROA significantly differ between users and non-users at the 1% level. Figure 5 graphs ROA in the pre-crisis and the post-crisis periods for both guarantee users and non-users. We observe a clear difference in performance. The ROA distribution of user firms skews to the right in the post-crisis period, while the distribution for non-user firms becomes tighter.

Since the theoretical predictions of the model, as summarized in table 1, depend on the

repayment probability of the firm, to more clearly determine the effectiveness of the program we must further divide the sample according to the riskiness of the firm. We use the capital ratio as a proxy for creditworthiness, with high capital ratios corresponding to low-risk firms and low capital ratios corresponding to high-risk firms. The model predicts that under the investment effect, high capital ratio firms possibly become more efficient, while low capital ratio firms become less efficient. In addition, the capital ratio is crucial for controlling selection bias. The difference-in-means estimator, presented in table 3, is only consistent when the SCG user samples are chosen randomly. In most cases, however, randomization of the policy treatment is not feasible even when a policy program is accessible by every firm. A firm's decision on whether or not to apply for a program is based on the expected benefit, to the firm, of that program, and the expected benefit depends on each firm's characteristics. In our case, the benefit of the SCG program is dependent upon the creditworthiness of a firm, which is relevant for loan availability. Less creditworthy firms are often credit rationed by private financial institutions, and, thus, greatly benefit from the program. Hence, by sub-dividing our sample by the capital ratio we are able to control for a significant portion of the self-selection bias.

In table 4, we present summary statistics for loan allocation, investment, and profitability for each quartile of net worth. We still find that, regardless of the pre-crisis capital ratio, SCG users are more likely to increase their leverage and their use of long-term loans. For all levels of the capital ratio, these variables significantly differ across users and non-users at the 1% level. We also still find that, except for the second highest capital levels, investment, as measured by the change in the fixed tangible asset ratio, increases more among users than non-users. Finally, we find that profitability depends crucially on the ex-ante capital ratio. SCG users are more likely to improve their ROA when their net worth is high, while the ROA for users is more likely to fall when net worth is low.

Overall, these findings are more consistent with the investment effect rather than the adverse selection effect. When we consider the availability of loans there is, uniformly, a more sizable dependence on loans, particularly long-term loans, among the program users. In addition, the results provide evidence that lower risk firms become more efficient, while higher risk firms become less efficient following the introduction of the program.

5.2 Two-Step Estimation and the Effect of the SCG Program

While the results of section 5.1 suggest that the SCG program improved the efficiency of Japanese credit markets, the use of summary statistics is admittedly not thoroughly convincing. If, however, we could formally estimate that government intervention led to more investment and improved firm performance we would clearly have much stronger evidence. What is necessary is to use an estimation method that can consistently measure the treatment effect of a policy program.[13]

For the purposes of this study we use a simple two-step estimation procedure.[14] Our primary objective is to adjust for the self-selection bias of the treatment effect. In the first step, to account for the selection process of the SCG program, we estimate the propensity score $p(w_t = 1)$, which is the response probability for a policy program. w_t is a binary variable indicating whether a firm participates in the program in period t: 0 = non-user and 1 = user. We

[13] The treatment effect measures the difference in outcomes between when a policy program is applied to when it is not applied.

[14] Detailed descriptions of the procedure can be found in Wooldridge (2001) pp. 603 - 621.

then include the predicted values, $\hat{p}(w_t = 1)$, in the second stage regression, in which we regress the policy outcomes on the use of a policy program.

We begin by specifying a vector of observed variables X_{t-1}. Included in X_{t-1} are the variables that a firm considers (in t-1) when deciding whether to apply for the policy program (in t). For example, we expect firms with lower levels of capital to need guaranteed loans much more than firms with higher capital ratios since they are more likely to be denied non-guaranteed loans (by private financial institutions). It is also likely that smaller or younger firms with little collateralizable assets, or cash, would make more frequent use of the program. We, therefore, include in X_{t-1} the capital ratio, firm size as measured by the number of employees, firm age, the collateralizable asset to total asset ratio, the cash and marketable securities to total asset ratio, the long-term borrowing to total borrowing ratio, industry dummies, and region dummies.

Next, we use the predicted value of the propensity score $\hat{p}(w_t = 1)$ in the second stage of the estimation. The dependent variable $y^k_{t+1,t-1}$ represents policy outcomes. In our case, $y^0_{t+1,t-1}$ is the change, from period t-1 to t+1, in economic efficiency among firms who do not use the program (no policy treatment), and $y^1_{t+1,t-1}$ is the change in efficiency of the program users (policy treatment). Included along with $\hat{p}(w_t = 1)$ as explanatory variables are program choice w_t and the cross-term of w_t and $\hat{p}(w_t = 1) - \hat{\mu}_p$, where $\hat{\mu}_p$ is the sample average of $\hat{p}(w_t = 1)$. Hence, we estimate the following two equations:

$$p(w_t = 1) = \alpha + \beta X_{t-1} + e_t \tag{3}$$

$$\Delta ROA_{t+1,t-1} = \gamma + \phi w_t + \delta \hat{p}(w_t = 1) + \eta w_t(\hat{p}(w_t = 1) - \hat{\mu}_p) + \psi industry_t + \xi region_t + u_t \tag{4}$$

The coefficient ϕ on w_t, in equation (4), is the consistent estimator of the treatment effect of the SCG program.

We first implement the two-step procedure for each quartile. The purpose of this exercise is to determine if, as the theory predicts, creditworthiness matters for efficiency. The results for each quartile are presented in the first four columns of table 5. The first thing to notice is that the coefficients for firm size are negative and significant across all quartiles, implying that smaller firms participate in the program more frequently than their larger counterparts. Firm age and the collaterlizable asset ratio are not significant. For firms with lower levels of net worth the cash ratio has a positive (and significant) effect on program participation. It may be that these firms build up their cash reserves in anticipation of being credit rationed, and use the SCG as an opportunity to fund additional projects. Finally, the long-term borrowing coefficient is positive perhaps implying that long-term loans are difficult to obtain. Firms that already have long-term loans use the program to as a means to secure even more of them.

In the second step OLS estimation the coefficient of interest is on the SCG dummy. Consistent with the model's predictions we estimate this to be negative for firms with low net worth (L-firms), and positive for firms with higher levels of net worth (H-firms). We find that the SCG program results in a 1.4% increase in the profitability of borrowers with the second highest net worth. The program also has a positive, though insignificant, impact on firms with the most net worth. In contrast, for firms with the lowest levels of net worth, the program has an insignificant, but negative impact on profitability. Thus, the story suggested by the summary

statistics is told much more strongly here. The investment effect dominates the adverse selection effect. In other words, the implementation of the SCG program by the Japanese government resulted in increased credit market efficiency.

Finally, we examine whether the program resulted in an overall improvement in the performance of participating firms. We test for this by implementing the two-step estimation on the entire sample. The results are displayed in the last column of table 5. Because the sample now includes firms with different levels of net worth, we add dummies for each net worth category in the first step. Also, since we expect net worth to matter for some of our explanatory variables we include some cross-term variables. Once again we find the SCG dummy to be significantly positive. On average, the ROA of program users increase by 0.5% more than non-users, providing more evidence that the SCG program resulted in significant improvements in efficiency.

6 Conclusion

In this paper, we empirically examine how government credit guarantee programs affect the allocation of credit in an economy, and also how this intervention impacts economic efficiency. The Japanese SCG program provides an excellent test case in that it was massive, temporary, and uniformly available to almost all SMEs. Utilizing a new and unique panel data set we test the theoretical predictions of Mankiw's (1986) adverse selection model. We come to three major conclusions. First, credit allocation, particularly in terms of long-term loans, increases more among SCG users than non-users. Second, economic efficiency, measured by profitability, improves among the less risky SCG users, while we find no significant change in profitability among risky users. Third, for SCG users the program has a positive overall impact on efficiency. These findings suggest that the SCG program positively affected the Japanese economy by stimulating investment among small businesses. This contrasts strongly with the publicly held view that the program worsened adverse selection problems in Japanese credit markets and led to a misallocation of funds in the economy. It should be noted that the period of analysis was characterized by a large amount of non-performing loans in the financial sector. In this environment, financial institutions may have been perversely motivated to keep lending to the riskiest (doomed-to-fail) program participants in an effort to avoid having to increase their loan loss reserves. This bank policy of "evergreening" loans results in the riskiest firms making heavy use of the program, which possibly reduces the overall efficiency of SCG users. In spite of this possible bias, however, we still find that the positive effects of the program dominate the negative ones.

Admittedly, our analysis only focuses on the allocation of credit among surviving firms, not defaulters. We justify this approach by appealing to the fact that less than 7% of SCG loans have been defaulted on and repaid by credit guarantee corporations. Nevertheless, it is possible to augment our study by additionally examining the characteristics of defaulting firms. For example, we could investigate whether the program lowers the default ratio, or if the poor-performing SCG users are separated from the good-performing survivors and eventually forced out of the market.[15]

We can draw several implications from our findings. First, given evidence of the

[15] Additional estimation with the data set including defaulting firms (results not shown in the paper) suggests that the use of SCG significantly lowers the default ratio.

program's effectiveness, a quantitative evaluation of the SCG program is possible. One method is to contrast the benefits of the program with the fiscal costs incurred by defaulters. Defaults have amounted to 2.1 trillion yen in repayments by the guarantee corporations or 1.2 trillion yen of accumulated deficits in the credit insurance division. We can, therefore, compare this cost with the benefit of an approximate 0.5% increase in ROA among the program users. We believe that if the SCG users are able to maintain their current profit margins for seven to twelve years, the program will break even.[16] Next, the fact that we find no significant efficiency effect among high-risk firms poses a serious question about the sustainability of the government credit guarantee scheme since these are the firms that generally favor guarantees. For the scheme to be financially sustainable it needs to attract low-risk firms, or high-risk firms with profitable investment opportunities. A possible solution is to change the (nearly) fixed pricing policy to a more flexible one that charges a higher guarantee premium for riskier firms. Note, however, that a higher guarantee premium will induce risky firms to strategically default on their debt. To avoid this, risky applicants could be required to provide collateral, which may be useful in alleviating any adverse selection problems.

[16] Our shorthand calculation is as follows: the program has guaranteed 28.9 trillion yen of loans. Since, on average, firm leverage is 83%, total assets are no less than 34.8 trillion yen. In the estimation we find an additional increase in ROA by 0.5%, which is equivalent to 0.17 trillion yen in business profits, among program users. Given these findings if the SCG users maintain the margin for 7 to 12 years, it will cover the 1.2 trillion yen of accumulated losses by the insurance division of JASME, or 2.1 trillion yen of repayment incurred by guaranteed loans that are in default.

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Table 1: Predicted Effects of a Credit Guarantee Program

	Firm Type	Investment Effect	Adverse Selection Effect
Loan Allocation & Newly Undertaken Projects	H	+	-
	L	+	+
Efficiency	H	+ (possibly)	-
	L	-	-

Note: H firms are high credit-worthy firms and L firms are low credit-worthy firms.

Table 2: Summary Statistics

	User	Non-user	All
Asset (thousand yen)	1,951,822	4,092,362	3,266,990
	(3,175,077)	(6,959,977)	(5,893,597)
Sales (thousand yen)	2,226,895	4,131,651	3,397,094
	(3,033,945)	(5,822,400)	(5,023,496)
Number of Employees	51.85	86.24	72.97
	(55.88)	(104.75)	(90.68)
Age (years)	34.50	37.19	36.15
	(14.04)	(14.58)	(14.43)
ROA (business profit / total asset; %)	1.86	2.61	2.32
	(4.91)	(5.63)	(5.38)
Capital ratio (capital / total asset; %)	17.04	34.06	27.50
	(18.01)	(24.23)	(23.54)
Leverage (liabilities / total asset; %)	82.96	65.94	72.50
	(18.01)	(24.23)	(23.54)
Short-term borrowing to total asset ratio (%)	26.26	17.05	20.60
	(19.75)	(17.83)	(19.13)
Long-term borrowing to total asset ratio (%)	30.36	17.14	22.23
	(19.77)	(18.56)	(20.09)
Long-term to total borrowing ratio (%)	54.36	49.61	51.58
	(27.05)	(32.99)	(30.76)
Cash and marketable securities to total asset ratio (%)	17.20	19.32	18.50
	(11.35)	(14.44)	(13.37)
Interest payment rate (interest payment / total borrowings; %)	2.83	2.58	2.69
	(2.30)	(3.58)	(3.12)
Fixed tangible asset to total asset ratio (%)	30.30	30.57	30.47
	(19.64)	(21.08)	(20.54)
Number of Observations	9,408	15,008	24,416

Note: We display the mean values for each variable. Standard errors are in parentheses.

Table 3: Development of Variables between Pre and Post Crisis Periods

		Pre-crisis	Post-crisis	Difference (Post-Pre)	t-test (User vs. Non-User)
Leverage (%)	User	8.93	11.64	2.71	4.06**
		(15.81)	(19.70)	(11.76)	(0.45)
	Non-user	-5.07	-6.42	-1.35	
		(21.75)	(25.12)	(14.05)	
Short-term borrowing ratio (%)	User	6.15	5.47	-0.69	-0.95
		(19.48)	(18.16)	(14.73)	(0.49)
	Non-user	-3.29	-3.03	0.27	
		(17.31)	(16.85)	(12.25)	
Long-term borrowing ratio (%)	User	6.82	9.31	2.49	3.79**
		(18.20)	(19.05)	(13.67)	(0.47)
	Non-user	-4.08	-5.39	-1.31	
		(17.58)	(17.88)	(12.70)	
Interest payment rate (%)	User	0.10	0.26	0.16	0.07
		(2.71)	(1.97)	(2.75)	(0.09)
	Non-user	-0.22	-0.13	0.09	
		(2.28)	(2.54)	(2.24)	
Fixed tangible asset ratio (%)	User	-0.10	0.29	0.39	0.70*
		(17.84)	(18.78)	(9.76)	(0.34)
	Non-user	-0.10	-0.41	-0.31	
		(18.10)	(18.90)	(9.22)	
ROA (%)	User	-0.75	-0.06	0.69	1.02**
		(4.30)	(4.42)	(5.25)	(0.19)
	Non-user	0.42	0.08	-0.33	
		(4.95)	(5.04)	(5.47)	

Notes:
a) We display the mean values for each variable.
b) Standard errors are in parentheses.
c) Each variable is a residual from a regression on year, industry and region dummies.
d) * and ** represent significance at the 5% and 1% levels, respectively.

Table 4: Development of Variables between Pre and Post Crisis Periods, by Capital Ratio

		Quartile	Pre-crisis	Post-crisis	Difference (Post-Pre)	t-test (Users vs. Non-users)
Leverage (%)	User	Smallest	22.32	25.64	3.32	3.50**
			(10.03)	(15.46)	(12.66)	(1.16)
		Second	9.24	11.88	2.63	2.84**
			(2.76)	(10.74)	(10.17)	(0.73)
		Third	-2.56	-0.49	2.06	4.74**
			(4.25)	(11.81)	(11.24)	(0.91)
		Largest	-22.62	-20.76	1.86	3.42**
			(10.86)	(15.35)	(13.56)	(1.30)
	Non-user	Smallest	23.06	22.87	-0.18	
			(14.90)	(18.61)	(18.15)	
		Second	8.79	8.59	-0.20	
			(2.84)	(11.81)	(11.28)	
		Third	-3.43	-6.11	-2.68	
			(4.38)	(15.59)	(14.61)	
		Largest	-29.50	-31.06	-1.57	
			(13.92)	(16.36)	(12.90)	
Short-term borrowing ratio (%)	User	Smallest	11.76	9.63	-2.13	-1.38
			(20.77)	(19.59)	(16.53)	(1.23)
		Second	7.27	7.15	-0.12	-0.16
			(19.12)	(17.46)	(14.96)	(0.94)
		Third	0.04	0.39	0.35	-0.38
			(14.74)	(14.71)	(11.96)	(0.89)
		Largest	-7.41	-6.17	1.25	0.74
			(12.87)	(12.86)	(10.46)	(0.98)
	Non-user	Smallest	9.47	8.73	-0.75	
			(21.33)	(21.30)	(17.92)	
		Second	2.78	2.82	0.04	
			(17.49)	(16.72)	(12.32)	
		Third	-3.68	-2.96	0.73	
			(14.16)	(14.07)	(12.38)	
		Largest	-13.22	-12.71	0.51	
			(10.20)	(9.84)	(8.02)	
Long-term borrowing ratio (%)	User	Smallest	12.62	15.90	3.28	3.61**
			(19.13)	(20.31)	(15.64)	(1.25)
		Second	7.10	8.97	1.87	2.64**
			(17.77)	(17.44)	(13.63)	(0.90)
		Third	1.90	3.71	1.81	3.98**
			(14.20)	(15.34)	(11.03)	(0.84)
		Largest	-7.40	-4.77	2.63	4.03**
			(11.46)	(13.47)	(9.50)	(0.91)
	Non-user	Smallest	7.15	6.82	-0.33	
			(24.28)	(24.03)	(18.62)	
		Second	1.44	0.67	-0.77	
			(17.18)	(17.66)	(12.63)	
		Third	-3.89	-6.06	-2.16	
			(14.22)	(14.24)	(12.34)	
		Largest	-13.38	-14.79	-1.41	
			(10.47)	(10.89)	(9.04)	

Fixed tangible asset ratio (%)	User	Smallest	1.14	2.09	0.96	0.65
			(18.54)	(19.49)	(10.49)	(0.73)
		Second	-0.73	-0.26	0.46	0.93
			(18.46)	(19.39)	(9.34)	(0.62)
		Third	-0.78	-1.75	-0.97	-0.53
			(15.53)	(16.33)	(8.75)	(0.67)
		Largest	-1.76	-1.04	0.72	1.14
			(17.41)	(18.27)	(9.76)	(0.93)
	Non-user	Smallest	0.21	0.52	0.31	
			(20.58)	(22.09)	(10.23)	
		Second	0.31	-0.15	-0.47	
			(18.30)	(18.56)	(8.79)	
		Third	0.29	-0.15	-0.44	
			(16.99)	(17.38)	(9.66)	
		Largest	-0.88	-1.29	-0.41	
			(17.64)	(18.74)	(8.58)	
ROA (%)	User	Smallest	-1.29	0.24	1.53	-0.11
			(4.35)	(4.45)	(5.30)	(0.43)
		Second	-0.64	-0.15	0.49	-0.28
			(3.39)	(4.02)	(4.31)	(0.30)
		Third	-0.38	-0.13	0.26	0.94*
			(4.73)	(4.60)	(5.41)	(0.39)
		Largest	0.37	-0.89	-1.25	0.49
			(5.29)	(4.99)	(6.59)	(0.62)
	Non-user	Smallest	-2.11	-0.47	1.64	
			(5.12)	(5.94)	(6.53)	
		Second	-0.49	0.28	0.77	
			(3.30)	(4.65)	(4.54)	
		Third	0.93	0.25	-0.68	
			(4.41)	(4.68)	(4.96)	
		Largest	1.82	0.07	-1.74	
			(5.64)	(5.11)	(5.48)	

Notes:
a) We display the mean values for each variable. Standard errors are in parentheses.
b) Each variable is a residual from a regression on year, industry and region dummies.
c) * and ** represent significance at the 5% and 1% levels, respectively.

Table 5: Two-Step ROA Estimation

(1) First step: Probit Estimation

	Smallest quartile	Second quartile	Third quartile	Largest quartile	All firms
ln (Number of employees)	-0.212**	-0.386**	-0.331**	-0.372**	-0.212**
	(0.054)	(0.056)	(0.059)	(0.074)	(0.054)
ln (Age)	0.127	0.031	-0.090	0.050	0.127
	(0.080)	(0.096)	(0.107)	(0.140)	(0.080)
Collateralizable asset ratio	0.002	0.000	-0.005	-0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Cash and deposit ratio	0.010	0.011*	0.001	-0.006	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Long-term to total borrowing ratio	0.005*	0.002	0.003	0.000	0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Second quartile dummy					-0.320
					(0.553)
Third quartile dummy					-0.161
					(0.564)
Largest quartile dummy					-0.232
					(0.684)
Constant	0.157	0.951	1.101	-1.030	0.277
	(0.390)	(0.919)	(0.709)	(0.755)	(0.359)
Dependent Variable: SCG program use (0 = non-user, 1 = user)					
Indusrty dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Number of Observation	834	846	817	672	3171
Pseudo R-sq	0.067	0.088	0.089	0.088	0.160
Log likelihood	-513.6	-534.3	-475.0	-287.6	-1810.5

(2) Second step: OLS Estimation

	Smallest quartile	Second quartile	Third quartile	Largest quartile	All firms
Special guarantee user dummy	-0.127	-0.033	1.365**	0.676	0.477*
	(0.456)	(0.307)	(0.400)	(0.601)	(0.214)
Propensity score	-2.769	-2.517	-3.021	3.154	4.548**
	(2.809)	(1.381)	(1.764)	(2.742)	(0.622)
Interaction term	-2.525	-2.021	-6.682**	-7.230	-3.211**
	(3.095)	(1.862)	(2.578)	(4.595)	(0.979)
Constant	3.837*	2.375	2.629	-0.068	-2.814**
	(1.937)	(2.576)	(2.487)	(1.437)	(0.673)
Dependent Variable: Development of ROA between pre- and post-crisis period					
Indusrty dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Number of Observation	832	845	817	672	3168
Adj R-sq	0.018	0.035	0.046	0.032	0.041

Notes:

a) Standard errors in parentheses.

b) The collateralizable asset ratio is identical to the fixed tangible asset ratio.

c) For the "all firms" estimation, the first step includes interaction terms between quartile dummies and all other

explanatory variables.

d) Coefficients for these terms are not reported here.
e) We also include an "interaction term" variable in the second step estimation, which we define as (SCG user dummy) * [(Propensity score) - (sample average of Propensity score)].
f) * and ** represent significance at the 5% and 1% levels, respectively.

Figure 1: Guaranteed Loans Amount Outstanding in Japan

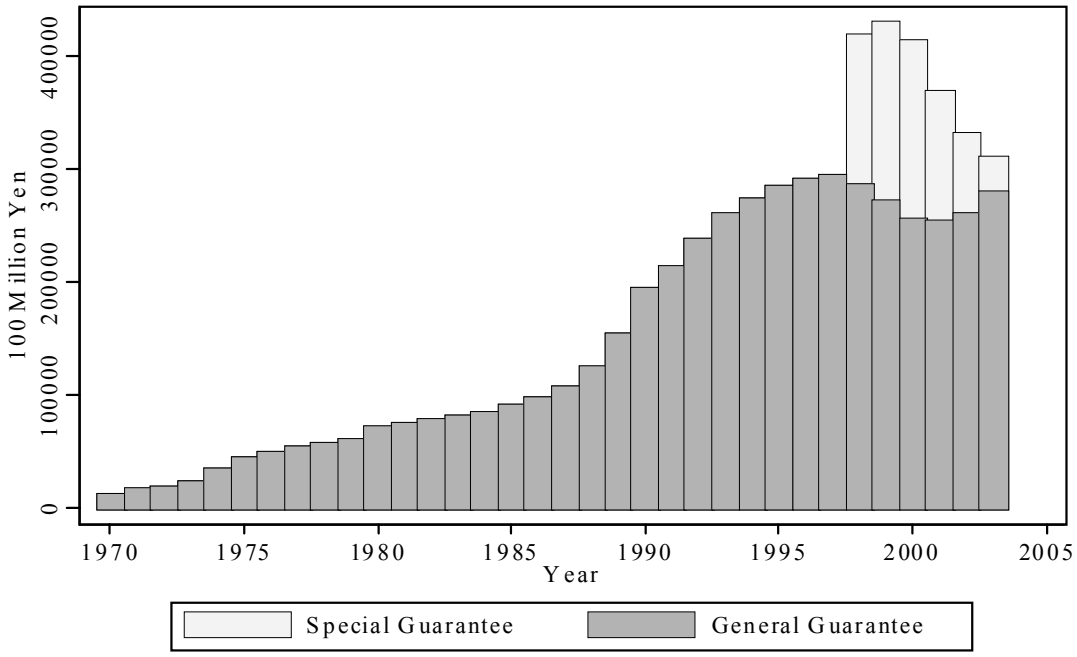
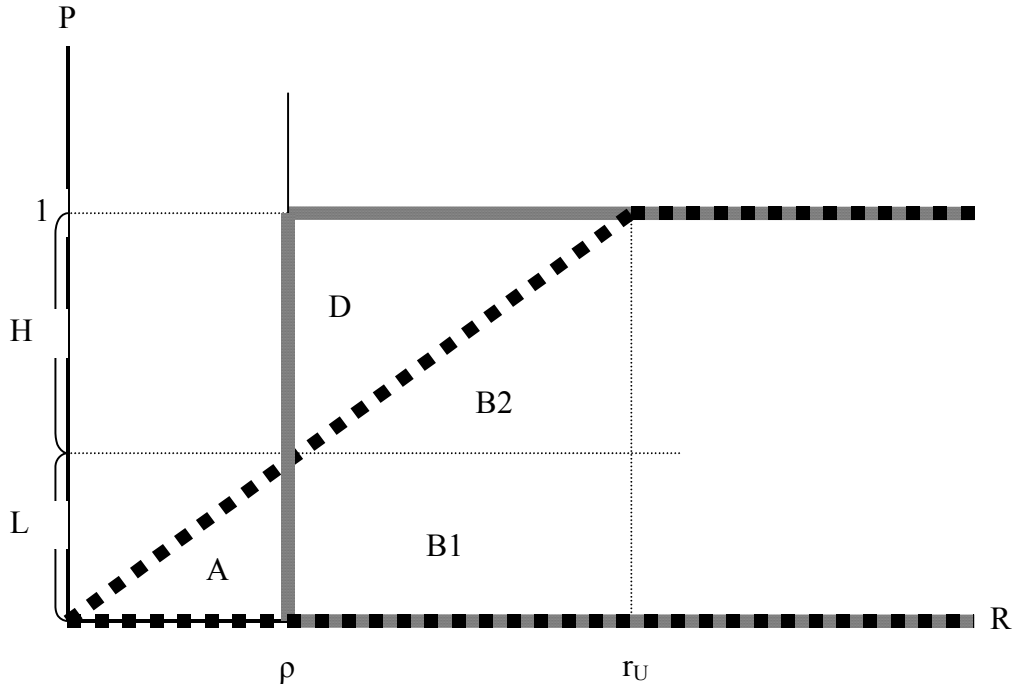
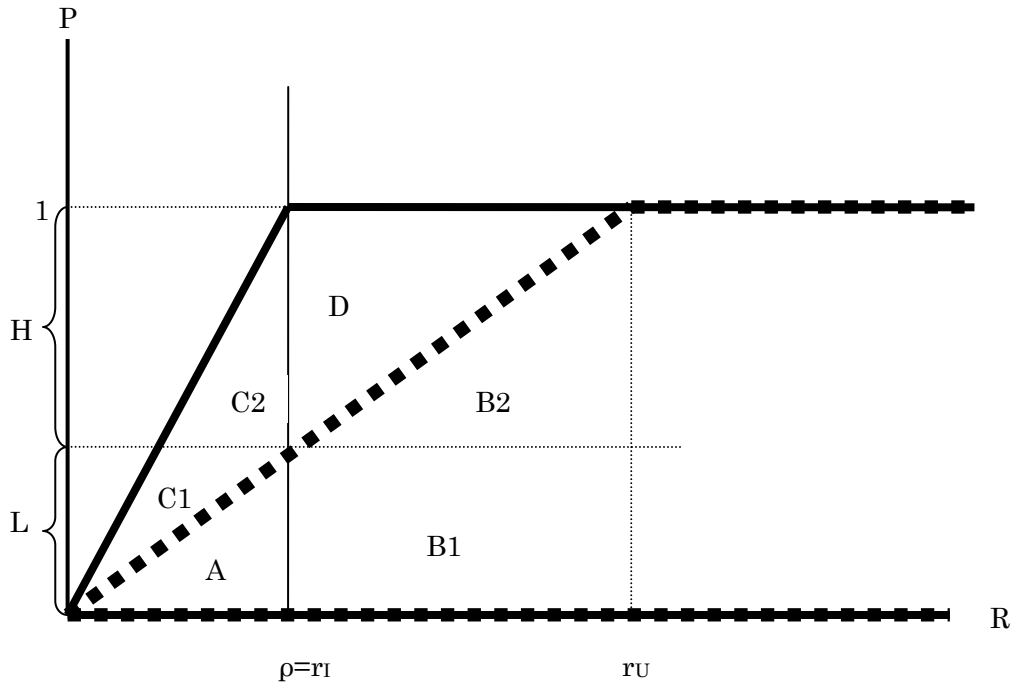


Figure 2: Unfettered Equilibria in the Loan Market



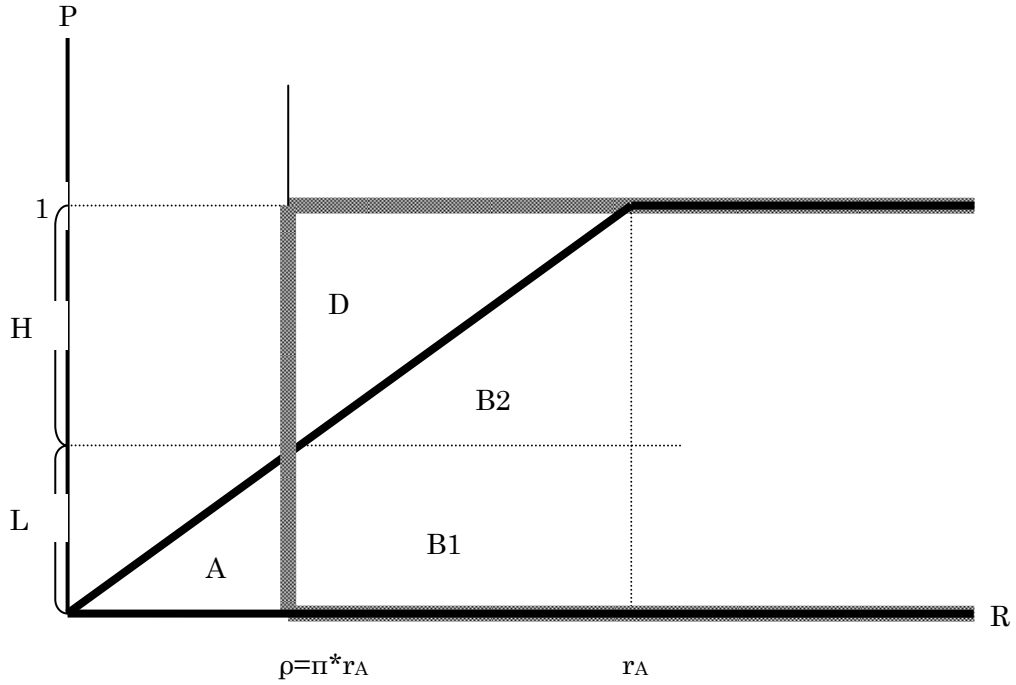
Note: H-firms are located along the vertical axis in the interval labeled "H,' while L-firms are located in the interval labeled "L." Dashed lines surround the projects undertaken in the presence of information asymmetries. The shaded line surrounds the projects undertaken in the frictionless equilibrium.

Figure 3: Graphical Representation of the Investment Effect



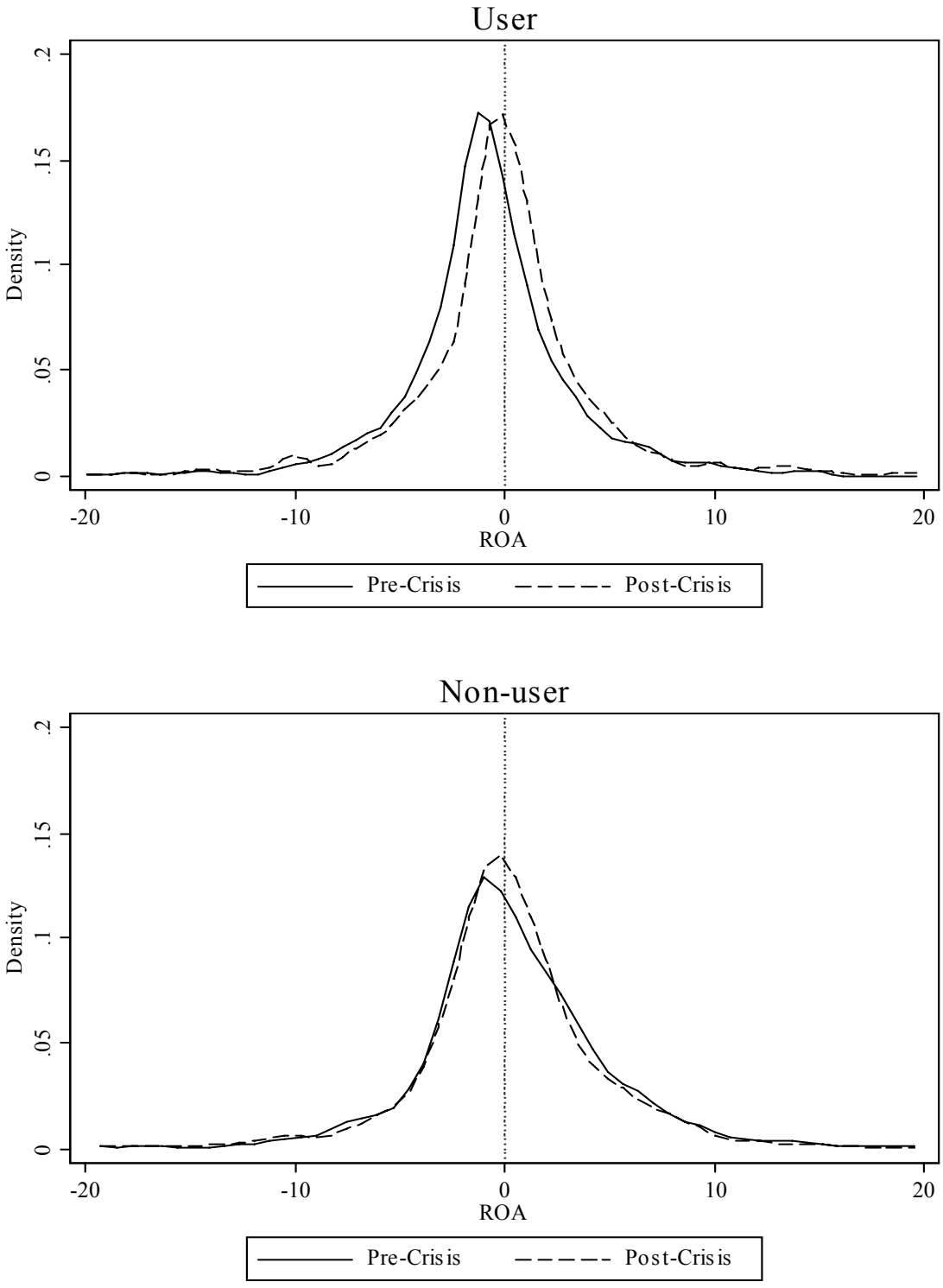
Note: Original areas of undertaken projects are those surrounded by dashed lines. Because the program results in a lower cost of borrowing, the area encompassing undertaken projects expands to include C1, C2, and D.

Figure 4: Graphical Representation of the Adverse Selection Effect



Note: Original areas of undertaken projects are those surrounded by the shaded lines. Information asymmetries result in adverse selection, which results in the inclusion of projects in A and the exclusion of projects in D.

Figure 5: Distribution of ROA for SCG Users and Non-Users



Note: ROA is measured as a percent.