Efficient lending and a new aspect of government deposit insurance agency

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July, 1999

abstract

This paper considers a model where an insolvent bank raises the funds and lends regardless of project return. It is said that one of the purposes of promptly corrective action in Japan which was put in action in April, 1998 is to prevent such a lending. In this paper, we examine what kind of agents must loan funds to the insolvent bank with projects to lend in order to prevent it from inefficiently lending. We show that government deposit insurance agency (GDIA)'s loan can make the bank lending efficient although a large number of studies has emphasized the point that existence of GDIA gives a bank an incentive to take too much risk. We also show that efficient lending can be achieved irrespective of the total deposits to be insured.

JEL classification : G21, G33, E53.
Keywords : Insolvent bank, Efficient lending, Limited liability, Nationalization, Caps on insured deposit.

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The author is grateful for helpful comments and discussions by Yoshiro Tsutsui, Yuzo Honda, Takeo Hoshi, Hirofumi Uchida, and seminar participants at Osaka University. This article also greatly benefited from the suggestions and helpful comments of Hajime Miyazaki. I also thank Kojun Hamada, Atsushi Shiiba and Yoichi Hizen for valuable comments. Of course, remaining errors are my own.

1. Introduction

The purpose of this paper is to show how efficient lending by an insolvent bank can be achieved and to apply this theory to bank closure policy. The number of insolvent banks has dramatically increased in recent years in Japan. So how we should dispose of an insolvent bank becomes a hot topic in Japan. The most popular wisdom is that insolvent banks should be liquidated immediately, possibly with the selective assistance by government's deposit insurance agency (GDIA). This paper questions such a wisdom because this policy makes the lending project passed up not only with negative net present value (NPV) but also with positive NPV.

The major result of this paper is that GDIA can enforce the insolvent bank's efficient lending[1] if GDIA stands ready to loan funds to the bank in return for the bank's stockholders giving up their equity claims. So, this paper analyzes the new aspect of GDIA that GDIA's loan can make the bank lending efficient although it has long been recognized that existence of GDIA gives a bank an incentive to take too much risk.[2] We also discuss an implication and interpretation of GDIA confiscating the bank's equity claims. And this policy differs from Acharya and Dreyfus (1989)'s claim which a bank should be closed whenever its asset-to-deposits ratio falls below a threshold which is set to be greater than 1 using the option framework.

Gertner and Scharfstein (1991) consider a situation in which a bank lends fund to an insolvent firm that has an investment project. They show that depending on parameters there are two cases considered: one is the case wherein the project is adopted even though the net present value of the project is negative and the other is the case wherein the project is rejected even though the net present value is positive[3]. Our model is related to those of Myers (1977)'s and Gertner and Scharfstein (1991)'s; They have analyzed problems of investment inefficiency that occurs when the investing firm is insolvent. Unlike Myers (1977), we assume that investment returns are unknown at the time of investment. We modify the Gertner and Scharfstein (1991)'s model so that we can interpret it as a lending firm rather than a borrowing firm. Gertner and Scharfstein (1991) show that efficiency of

[1] To avoid confusion of expression, we use the terminology "lend" whenever the insolvent bank provides funds to the firm and the terminology "loan" whenever some agent provides funds to the insolvent bank.
[2] Berlin, Saunders and Udell (1991) survey the literature on this moral hazard problem.
[3] Myers (1977) first analyzed this case.

investment depends on parameters and that it is by sheer coincidence that efficient investment is achieved. But they do not show how efficient investment is achieved. In this paper, we examine what kind of agents must loan funds to the insolvent bank with project to lend in order to prevent the insolvent bank from inefficiently lending. The notion of efficiency of bank lending using in this paper requires that all and only positive NPV lending project is carried out regardless of eventual solvency of bank.

Unlike early papers on deposit insurance, we abstract away from the pricing of fair risk-adjusted insurance premium.[4] Instead, as in Dreyfus, Saunders and Allen (1994), we investigate the caps on insured deposit coverage.

The remainder of the paper is organized as follows. In the next section we set out the structure of our model. Section 3 analyzes the situation where the only role of GDIA is to compensate for depositors. We show that under this situation it is purely by chance that efficient bank lending is achieved. Section 4 analyzes how the efficient bank lending can be achieved. Section 5 concludes the paper.

2. Basic framework of the analysis

Throughout a paper, we consider a two-period model in which a bank has become insolvent. At the beginning of Date 1, this bank has liquid assets of Y and an opportunity of lending I dollars in the project to its client firm. In Date 2, the bank obtains the return x from this lending. This x is random variables distributed over the support $[0, \infty)$ with the density function $f(x)$, the cumulative function $F(x)$, and the mean $\bar{x}$.[5] We assume that the bank begins Date 1 with the total deposits in the amount of D. Fraction q of the deposits, however, will be withdrawn by depositors during Date1; the remaining $(1-q)$ of D will become due in Date 2. Fraction q is taken as exogenous in this paper. The interest rate on the existent deposit D is normalized to be zero and all parties are risk neutral. We shall ignore "bank run" in the analysis by assuming that GDIA can credibly insure all deposits.

4 See, for instance, Merton (1977) and Ronn and Verma (1986).

5 Here the functional form may be arbitrary. We can show that the main results in this paper hold when x is specified as the return to the insolvent bank from the standard debt contract.

That the bank is already insolvent at the beginning of Date 1 can be expressed as follows:

A1. $Y < D$.

Figure 1 described the balance sheet of the bank at the beginning of the Date 1. Thus if the bank is resolved, stockholders receive nothing because of absolute priority rule. So, stockholders have the incentive to finance an investment dollar I whenever the bank can borrow the invest amount.

Since the bank's stockholders receive nothing in case of the declaration of bankruptcy to investing project, they are willing to borrow and finance regardless of its returns. In other words, we assume situations wherein the bank must raise ($I + qD - Y > 0$) in Date 1 to implement the investment, that is, lending to the firm. This is described as

A2. $Y < I + qD$.

Under A1 and A2, whether the lending to the firm is adopted or not depends on the decision by the agent who loans funds to the insolvent bank. We call this agent as a financing agent. The sequence of events and decisions, described in figure 2, is as follows. In Date 1, the insolvent bank lends funds of I to the firm and pays off the deposit maturing at Date 1 of qD. Under A1 and A2, it must raise funds $(I + qD - Y)$. The financing agent decides whether to loan or not. If the bank cannot raise the needed funds in Date 1, it simply defaults either at the end of Date 1 (the case of $Y \leq qD$) or during Date 2 (the case of $Y \geq qD$).

In Date 2, if the insolvent bank can raise funds and lend to the firm, it gets returns on lending x and pays off the deposits maturing in Date 2, $(1-q)D$ and funds with interest of r to the financing agent, $(1+r)$ $(I + qD - Y)$. So, debt obligations of the insolvent bank at Date 2 amount to $z \equiv (1-q)D + (1+r)(I + qD - Y)$. Note that the insolvent bank pays the new depositors at r percent interest rate. This is because the insolvent bank needs to raise deposits at higher interest rate.

Of course, the ability of the bank to finance the firm's investment project depends on availability of the financing agent willing to loan to the defact insolvent bank. In this paper, potential financing agents who loan funds to the insolvent bank are GDIA, new depositors, a financing bank, old stockholders, and new stockholders.[6] We assume that the insolvent bank

[6] We call a bank that loans funds to the insolvent bank as a financing bank to distinguish between these two banks. And we call existent depositors (stockholders)

raises all its needed funds, $I + qD - Y$, from one agent only.

We define efficient lending that the lending is achieved, if and only if the net present value (NPV) of the lending is non-negative, where NPV is defined as $NPV \equiv \int_0^\infty xf(x)dx - I \equiv \bar{x} - I$. The problem is that the financing agents do not use this criterion as a bench mark of loaning to the insolvent bank. They offer funds as far as the expected return to them is nonnegative. And these two criteria usually differ. In what follows, we examine what kind of agents should loan to the insolvent bank in order to achieve the efficient lending.

3. Bank lending without GDIA's loan

In this section, the only role of GDIA is to compensate for loss of deposits.[7] We analyze the case where the insolvent bank raises funds with interest from new depositors, a financing bank, old stockholders, or new stockholders and show that the bank lending to a firm becomes inefficient in any case.

3.1. Financing with new deposits

In this subsection, we analyze the model in which the insolvent bank raises all its lending funds from new depositors only, namely amount of new deposit is equal to $I + qD - Y$. We assume that unlike old depositors, new depositors stay bank till the end of Date 2. As deposits are completely insured by GDIA, the expected net returns of the new depositors are given by

$$(1) \qquad \int_0^Z (I + qD - Y) f(x)dx + \int_Z^\infty \left[Z - (1-q)D \right] f(x)dx - (I + qD - Y) \quad .$$

The first term is the gross present value of new deposits in the case of bank's liquidation. This means that even if the insolvent bank cannot meet debt obligations Z in Date 2, new depositors recover principal $I + qD - Y$ from GDIA. The second term is the gross present value of new deposits when

owning deposits (equities) at the beginning of Date 1 as old depositors (stockholders).

[7] The case of GDIA directly loaning to the insolvent bank is analyzed in the next section.

the bank realizes returns exceeding Z. This means that when returns on lending of the insolvent bank are more than Z, new depositors get principal and interest.

Equation (1) can be transformed into

$$(2) \quad \int_{Z}^{\infty} r(I + qD - Y) f(x) dx ,$$

which is positive under A2.

The insolvent bank can raise funds from new deposits and therefore lend regardless of returns on lending because people can profit from the deposits. It is convenient for the insolvent bank's stockholders to raise funds from deposits because stockholders have the incentive to lend regardless of net present value of lending. This means that GDIA makes completely insured depositors willing to supply an unlimited amount of deposits regardless of the bank's returns on lending. We call this effect moral hazard problem of depositors caused by GDIA.[8] Let us call that under-lending problem is occurred if a lending project with positive *NPV* is passed up and over-lending problem if a lending project with negative *NPV* is carried out. Then, we get the following lemma.

Lemma1: *When the insolvent bank raises funds from deposit, it never causes under-lending problem, but can cause over-lending problem.*

3.2. Raising funds from the financing bank[9]

The financing bank loans to the insolvent bank if net returns of

[8] Our result holds in case where the insolvent bank pays a premium to GDIA in raising fund from new deposits. We define p as flat insurance premium per deposit. So the bank must raise funds $[1/(1-p)](I + qD - Y)$ in Date 1. But as long as deposits are completely insured by GDIA, new depositor's action does not change. That is, irrespective of NPV of lending project, new depositor deposits money in this bank.

[9] We assume that the financing bank's debt is junior to deposits. And we are assuming implicitly that no other bank can have access to this project investment on the ground that there is the ongoing monitoring and screening investment requisite to the idiosyncratic investment for other lenders, which cannot be easily transferable to other lenders without having invested in the long term relationship. So, if the insolvent bank cannot raise funds, even the project with positive NPV may be passed up. These forgone benefits are called the charter value.

financing bank with financing are more than those without financing. This condition is described as

$$(3)\quad \int_{(1-q)D}^{Z}[\ x-(1-q)D\ ]f(x)dx+\int_{Z}^{\infty}[\ Z-(1-q)D\ ]f(x)dx-(I+qD-Y)\geq 0.$$

The left-hand side of inequality (3) is net returns of the financing bank when it loans to the insolvent bank. The right-hand side of inequality (3) is returns that the financing bank receives when it does not loan to the insolvent bank. This is because that the financing bank has only projects to lend with zero interest rate, so that the financing bank's opportunity cost is zero.[10]

The first term in equation (3) has the integral sign from $(1-q)D$ to Z, reflecting the fact that the bank's depositors have higher debt seniority on the insolvent bank than the financing bank. The second term in equation (3) is gross present value of the financing bank when returns on lending of the insolvent bank are more than Z. Since $Z-(1-q)D=(1+r)(I+qD-Y)$, the second integration is simply the financing bank's principal and interest. This means that the financing bank gets principal and interest when returns on the insolvent bank's lending are more than the insolvent bank's amount of debt obligations in Date 2. The third term is amount of loan by the financing bank to the insolvent bank. We transform equation (3) into the following equation, which enables us to judge about efficiency of bank lending.

$$(4)\quad NPV \geq \left[qD+\int_{0}^{(1-q)D}xf(x)dx+\int_{(1-q)D}^{\infty}(1-q)Df(x)dx-Y\right]+\int_{z}^{\infty}(x-Z)f(x)dx$$
$$\equiv V-Y+S,$$

where $V\equiv qD+\int_{0}^{(1-q)D}xf(x)dx+\int_{(1-q)D}^{\infty}(1-q)Df(x)dx$ and $S\equiv\int_{Z}^{\infty}(x-Z)f(x)dx$.

The first term on the right-hand side is what the depositors withdraw in Date 1. The second term is the expected amount that the insolvent bank pays out to the depositors in Date 2 in case it actually fails and cannot meet the full deposit obligations in Date 2. The third term describes the case in which the insolvent bank can meet the full deposit obligations in Date 2, $(1-q)D$.

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[10] All our results hold even in general case where opportunity cost is non zero.

Note in this case that the insolvent bank may or may not be bankrupt.[11] So, the first three terms on the right-hand side, which we sum up as V, describe what the insolvent bank pays out to depositors if it obtains loans from the financing bank.[12] The fourth term of Y describes what the bankrupt insolvent bank pays out to depositors in Date 1 if the invest project cannot be financed. The fifth term of $\int_Z^\infty (x-Z) f(x)dx$, which we shall call S, is the expected returns that stockholders get when the insolvent bank raises funds and therefore lends to the firm.

$V-Y$ is the transfer from the financing bank to depositors conditional on bank lending because depositors get Y if the insolvent bank cannot lend to the firm. S is the transfer from the financing bank to stockholders conditional on bank lending because equity value is zero if the insolvent bank cannot lend to the firm. The interpretation of inequality (4) is that if the NPV exceeds the sum of these transfers, the financing bank loans to the insolvent bank and the bank lending can be carried out.

The notion of efficiency of bank lending using in this paper requires that all and only positive NPV lending project is carried out regardless of eventual solvency of bank. Efficient lending means that only if $NPV \geqq 0$, the bank lending is carried out and if not, it is not carried out. The problem is that the financing agents do not necessarily use its criterion as a bench mark of loaning to the insolvent bank. The financing bank loans whenever NPV exceeds $V-Y+S$ which may be positive or negative. In other words, this loan by a financing bank results in either over- or under-lending depending on the parameters Y, q, D and $f(x)$.

For example, when almost all of depositors draw out their deposits in Date 1 $(q \quad 1)$, the right-hand side of inequality (4) must be positive (under-lending).[13] When an excess of liabilities over asset is small $(D-Y \quad 0)$ and the financing bank gets all of the return by setting r sufficiently high, the right-hand side of inequality (4) can be negative (over-lending). These show that over-lending and under-lending can occur depending on

[11] The insolvent bank defaults if x is less than Z and does not default if x is more than Z.

[12] As deposits are completely insured by GDIA, $D-V$ is net expected payments of GDIA to depositors.

[13] In this case, $V = D$, so that we can write (4) as $NPV \geqq D - Y + S$. As both $D-Y$ and S are positive, respectively, efficient lending is not achieved, even if $r \to \infty$.

parameters.

To summarize this finding,

Lemma 2: *When the insolvent bank raises funds from the financing bank, it can cause both under-lending problem and over-lending problem.*

3.3. Raising funds from old stockholders[14]

In this subsection, we investigate the situation wherein the insolvent bank issues stocks and all these stocks are purchased by incumbent stockholders. To simplify analysis, we assume that there is no agency problem among old stockholders.[15] And we assume that each old stockholder purchases newly issued stocks proportionally to his holding equities. Let the ratio of number of equities owned by the j-th old stockholder before the new issue be q_j. Then, because the j-th old stockholder purchases the ratio q_j of newly issued equities, his holding ratio remains the same level of q_j. So, the j-th old stockholder purchases the equities if $q_j\{ \int_{(1-q)D}^{\infty}[\ x-(1-q)D\ ]f(x)dx - (I+qD-Y)\ \} \geq 0$. Summing up this inequality over the stockholders, we get

$$(5) \quad \int_{(1-q)D}^{\infty}[\ x-(1-q)D\ ]f(x)dx-(I+qD-Y) \geq 0.$$

The left-hand side of inequality (5) is what old stockholders receive when they purchase newly issued equities and the lending of the insolvent bank can be carried out. The first term shows that the stockholders get returns only when returns on lending are more than obligations of deposits maturing in Date 2. The second term is the total amount of newly issued stocks that the stockholders purchase. The right-hand side is what the stockholders receive when they do not purchase newly issued stocks and the lending of the insolvent bank cannot be carried out because the bank is insolvent. Inequality (5) can be transformed into

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[14] We call stockholders owning equities at the beginning of Date 1 as old stockholders.
[15] This means that the old stockholders behave as if they were one agent. This assumption is not crucial to our analysis.

(6) $NPV \geq V - Y$.

$V - Y$ can be positive or negative, so this loan results in either under-lending or over-lending. Inequality (6) is equal to inequality (4) when $S = 0$. Thus, the loan condition under which the insolvent bank raises funds from the old stockholders is equal to that under which the insolvent bank raises funds from the financing bank when $S = 0$.

To summarize this finding,

Lemma 3: *When the insolvent bank raises funds from old stockholders, it can cause both under-lending problem and over-lending problem. But raising funds from old stockholders results in under-lending problem less frequently than raising funds from the financing bank.*

3.4. Raising funds from new stockholders

In this subsection, we assume that the newly issued stocks are purchased by the people except old stockholders.[16] Let the number of equities owned by the old stockholders be M at the beginning of Date 1 and the number of newly issued equities be N, so that the total number of equities becomes $M + N$. To simplify analysis, we assume that there is no agency problem among the new stockholders.

The condition under which the new stockholders purchase the stocks is given by

(7) $$\frac{N}{M+N}\int_{(1-q)D}^{\infty}[\ x-(1-q)D\ ]f(x)dx-(I+qD-Y)\geq 0,$$

which can be transformed into

(8) $$NPV \geq V - Y + \frac{M}{M+N}S.$$

The right-hand side of (8) is bigger than that of (6) by $\frac{M}{M+N}S$ which is

[16] This means that old stockholders do not purchase the new issue. Myers and Majluf (1984) call such stockholders the "passive" old stockholders.

the equity value of old stockholders.[17] This means that the new stockholders have less incentive to purchase the new issues than the old stockholders because the new stockholders get only part of equity value.

Thus, we obtain the following lemma.

Lemma 4: *When the insolvent bank raises funds from the new stockholders, it can cause both under-lending problem and over-lending problem. It is likely to cause under-lending problem compared with the case of raising funds from the old stockholders.*

The following result formalizes the above discussion:

Proposition 1: *If deposits are all insured by GDIA, then efficient bank lending is achieved only by coincidence of parameters when financing agents are depositors, a financing bank, old stockholders, and new stockholders.*

In the literature dealing with regulatory bank closure policy, the policy that government keeps an insolvent bank in operation until asset maturity is called as forbearance policy. Some papers point out that there are benefits for forbearance policy. For example, Nagarajan and Sealey (1995) show that forbearance can make bank select better assets ex ante in the presence of moral hazard. Dreyfus, Saunders and Allen (1994) show that forbearance policy may be an optimal policy ex post. On the other hand, we examined an effect of forbearance policy on efficiency of bank lending in this section. Proposition 1 shows that without GDIA's direct loan, once the bank is insolvent, forbearance policy makes bank lending inefficient.

4. Bank lending with GDIA's loan

The analysis so far has taken it as given that the only role of GDIA is to compensate for loss of deposits. In this section, we assume that GDIA can also loan to the insolvent bank directly.

[17] We can also interpret that $\frac{M}{M+N}S$ is the transfer from the new stockholders to the old stockholders conditional on bank lending because the equity value of the old stockholders is zero if the insolvent bank cannot lend to the firm.

4.1. Raising funds from GDIA

As GDIA compensates depositors for all their losses, GDIA has to be burdened with $Y-D$ if it does not loan to the insolvent bank. And even if it loans to the insolvent bank, it has to be burdened with depositors' losses when returns on lending to the firm by the insolvent bank do not suffice for liabilities of deposits. Thus, GDIA loans funds of $I+qD-Y$ to the insolvent bank if

$$(9)\qquad \int_0^{(1-q)D}[\,x-(1-q)D\,]f(x)dx+\int_{(1-q)D}^{Z}[\,x-(1-q)D\,]f(x)dx+\int_{Z}^{\infty}[\,Z-(1-q)D\,]f(x)dx \\ -(I+qD-Y)\geq(Y-D).$$

The left-hand side of inequality (9) is the net present value of GDIA when it loans to the insolvent bank. The first term is what GDIA bears for the depositors who withdraw their deposits in Date 2 when returns on lending of the bank are less than obligations of deposits maturing in Date 2. The second term is returns that GDIA gets when returns on lending are more than obligations of deposit maturing in Date 2 but less than total debt obligations of Z. The third term shows that GDIA gets a principal and interest when returns on lending are more than total obligations in Date 2. The fourth term is funds that GDIA loans to the bank. The right-hand side is the net present value of GDIA when it does not loan to the insolvent bank.

Inequality (9) can be transformed into

$$(10)\qquad NPV \geq S.$$

S is by no means negative, so this shows that under-lending problem can occur, although over-lending problem never occurs. However, S converges 0 as $r\to\infty$. That $r\to\infty$ means that GDIA gets not only the principal of the loan but also all the equity value, while the existent stockholders get nothing. Infinite interest rate is unrealistic. However, the same result can be obtained if GDIA obtains the whole equities at Date 1 and becomes the only stockholder of the insolvent bank. Note that the equity value is zero at Date 1, so that GDIA need not pay to stockholders for the acquisition. This is exactly the nationalization of Long-Term Credit Bank of

Japan and Nippon Credit Bank in 1998 in Japan.

The following result formalizes the above discussion:

Proposition 2: *When GDIA loans to the insolvent bank and gets all equity value of the insolvent bank, efficient lending is achieved without depending on parameters.*

That GDIA becomes the only stockholder of the insolvent bank implies that it assumes unlimited liability because of its obligation of compensation for deposit loss. And it is why GDIA loan achieves the efficiency of lending.

We will show that once bank stockholders accept an unlimited liability for their deposits,[18] they advance the funds only when the bank lending is efficient. At Date 1, they loan (or they purchase the issues) $I+qD-Y$ to the insolvent bank and at Date 2 they get $\bar{x}-(1-q)D$ because when x is less than $(1-q)D$ they must compensate the deposits matured at Date 2. So their net returns are $\bar{x}-I+Y-D$, if they loan to the insolvent bank. If they do not loan to the insolvent bank, they get $Y-D$, which is negative. So, only if $NPV \equiv \bar{x}-I \geq 0$, they prefer to loan to the insolvent bank rather than not to loan although their net returns are negative unless $\bar{x}-I \geq D-Y$. Although stockholders' liability is limited in the real world, only GDIA that obtained the whole equities functions as the stockholders in the unlimited liability.

4.2. *Caps on insured deposits*[19]

Thus far, we showed that efficient lending was achieved on the assumption that deposits were all insured. In Japan, GDIA has insured all the deposits including interest, so that this assumption applies in Japan until 2001. However, it is scheduled to change the system that only deposits less

[18] John, John, and Senbet (1991) show that the moral hazard problem of banks taking on excessive risk arises from existence of the limited liability and the associated convex payoff to stockholders.
[19] Dreyfus, Saunders and Allen (1994) first analyze the optimality of caps on insured deposits. They show that raising a cap on insurance coverage and allowing the bank to keep running for an additional period may actually serve to lower GDIA's failure resolution cost.

than ten million yen are insured by GDIA. In this subsection, we will examine whether our results hold in the system where only a part of deposits is insured. Because actual provisions are too complex to formalize, we analyze the following two cases: one is the case wherein GDIA insures a certain ratio of the total deposits of the insolvent bank and the other is the case wherein GDIA insures a certain amount of deposits that is independent of the total outstanding deposits.

When GDIA insures a certain ratio of the deposits, gD, $0 < g < 1$, GDIA loans funds to the insolvent bank, if

$$(11) \quad \int_0^{g(1-q)D} [\, x - g(1-q)D \,] f(x)dx + \int_{g(1-q)D}^{\infty} [\, x - g(1-q)D \,] f(x)dx \\ - (I + qgD - Y) \geq Y - gD,$$

which we can transform into $NPV \geq 0$.

The left-hand side of inequality (11) is the net present value of GDIA when it loans to the insolvent bank. The first term is what GDIA bears for the depositors who withdraw their deposits in Date 2, in the case that returns on lending of the insolvent bank are less than obligations of deposits maturing in Date 2. The second term is returns that GDIA gets when returns on lending of the insolvent bank are more than obligations of deposit maturing in Date 2. The third term is funds that GDIA loans to the bank. The right-hand side is the net present value of GDIA when it does not loan to the insolvent bank.

When GDIA insures a certain amount of deposits, $\overline{D}$ ($\overline{D} < D$), GDIA has to be burdened with $Y - \overline{D}$, if it does not loan to the insolvent bank. And if it loans to the insolvent bank, it has to be burdened with $\overline{D} - x$ when returns on lending do not suffice for liabilities of deposits and gets $x - \overline{D}$ when returns on lending suffice for liabilities of deposits. Thus, GDIA loans funds of $I + q\overline{D} - Y$ to the insolvent bank, if

$$(12) \quad \int_0^{(1-q)\overline{D}} [\, x - (1-q)\overline{D} \,] f(x)dx + \int_{(1-q)\overline{D}}^{\infty} [\, x - (1-q)\overline{D} \,] f(x)dx - (I + q\overline{D} - Y) \geq Y - \overline{D},$$

which we can transform into $NPV \geq 0$.

The following result formalizes the above discussion:

Proposition 3 ：*Even if only a part of the deposits is insured, efficient bank lending can be achieved, if GDIA loans to the insolvent bank, and gets all equity value of stockholders.*

5. Conclusion

Myth that Japanese banks do not bankrupt is collapsing. So, now in Japan we need to consider how to resolve problems stemming from the bank bankruptcy. So far, only the safety of the deposits has been focused on and the influence on the firms and bank lending has not been considered. However, moral hazard problem that stockholders (or managers) of the bank in financial difficulties tend to execute inefficient lending is also serious and should be resolved. This paper analyzes the closure policy of the insolvent bank from a viewpoint of efficiency of lending and shows that in order to achieve efficient bank lending, the financing agent should be GDIA who is given the right to acquire all the surplus, if it emerges. This finding highlights a new role of GDIA.

The policy implication of our findings is that once the bank is insolvent government should take not the forbearance policy but the prompt nationalization of the bank by GDIA in order to achieve efficient bank lending. Actually, in Japan, in accordance with Article 36 of “the Law Concerning Emergency Measures for the Revitalization of the Functions of the Financial System”, which was legislated in 1998, GDIA acquired all shares of the Long-Term Credit Bank of Japan and the Nippon Credit Bank and provided necessary support for loans. This newly adopted financial regulation just corresponds to the procedure proposed in this paper to achieve efficient lending by the insolvent banks.

Figure 1 : Balance sheet of the insolvent bank at the beginning of Date 1

asset Y	D *value of deposit*
	S *value of equity*

Figure 2: Time occurrence of the events

(Date1)	(Date 2)
• Depositors withdraw qD. • Insolvent bank raises funds of $(I+qD-Y)$ and lends I.	• Project pays out x. • Depositors withdraw $(1-q)D$. • Insolvent bank pays his debt.

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