Should Japanese Banks Be Recapitalized?

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When a bank is a relationship lender, its financial health affects the access to credit of its borrowers. If bank regulators or uninsured private depositors might force a bank to close, it will take any action necessary to remain open. This can lead to inefficient and excessive foreclosure of the bank's relationship-based loans to viable borrowers, or alternatively to the inability to collect existing loans due to its fear of recognizing an accounting loss if a loan is called. The level of bank capital then has real effects on its borrowers' access to credit. A subsidized recapitalization of banks with relationship-based loans can be a good policy. The size of the recapitalization is critical, because providing too small an amount of subsidized capital can be worse than providing no capital. Providing subsidized capital to banks without relationship-based loans is never a good policy.

Key words: Bank capital; Recapitalization; Relationship lending; Banking; Bank failure

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I. Introduction

When a nation's banks experience major losses, depositors, the markets, and regulators respond. The market responds by making it difficult for the bank to raise funds. Depositors may rush to withdraw funds from the banks. The regulators respond by closing banks, guaranteeing their liabilities, and/or recapitalizing them. One or more of these outcomes is inevitable. This paper studies the effects of the regulatory choice on various parties in the economy.

The most obvious choice to make is whether to let banks fail. Does their inability to raise sufficient private capital indicate that they are not viable, produce no future services, and thus should be closed? Because deposits must be fully paid, and not renegotiated as in a U.S.-style Chapter 11 bankruptcy, it is possible that the banks still add value despite being unable to restructure. This paper analyzes the effects and desirability of recapitalizing banks, with special focus on the current situation in Japan.

In Japan, there is a very deep government safety net and substantial regulation (see Ito and Sasaki [1998] and Hogarth and Thomas [1999] for discussions of bank capital in Japan). So one approach would be to ignore the markets and analyze bank recapitalization as a bargaining situation between banks and regulators. However, there is legislation in Japan that will limit deposit insurance by 2001, and require prompt corrective action from undercapitalized banks (see Nakaso [1999]). These changes imply that the discipline of banks may partly rely on market incentives, if the laws are not delayed and are enforced. As a result, it is important to study the effects of bank capital on how much they will be able to raise in the market. Even with total deposit insurance, the banks will need to consider the effects of their credit rating on what other lines of business they can provide. If the level of capital is not much above the minimum necessary to stay in business (and this minimum will actually be enforced), then banks will need to do whatever it takes to increase their capital. This "whatever it takes" type of bank behavior could have undesired effects on the economy.

I focus on the effect of bank recapitalization on banks and their existing borrowers. The effect on future borrowers (new business development) is ignored, on the basis that new banks, other recapitalized banks, or even foreign banks could provide such new relationship-based funding without a subsidized recapitalization of the majority of existing banks. Recapitalizing a large number of banks is desirable only if it protects the value of existing relationship lending and the human capital in banks and firms. If it is just necessary to have a well-capitalized banking system in place for the establishment of relationships in the future, only a few of the best-managed and healthiest banks should be recapitalized. The analysis here points out that the recapitalization, and its extent, can result in transfers between banks and borrowing firms that can go in either direction. This occurs because bank capital influences the bargaining between a bank and its borrowers. In addition, recapitalization can have efficiency effects by influencing a bank's decision on whether to foreclose on its defaulted loans.

To keep the argument simple and applicable to Japan, I base the effects of capital on the threat of closure by regulators. There are multiple government agencies that regulate and bargain with banks, and each may have different incentives. For

simplicity, I assume that, despite this, the minimum capital requirement is enforced at a fixed time in the near future. The results also hold when the threat of closure due to low capital comes from market participants that may not provide capital or from potentially uninsured depositors that may withdraw deposits, as in Diamond and Rajan (2000a), summarized in Diamond and Rajan (2001c). As a result, the analysis can also be applied to the nearly insolvent insurance companies in Japan that face a potential run by policyholders. In addition, see Diamond and Rajan (2000b) for an extension to understand the role of short-term debt in the East Asian financial crisis of 1997.

The remainder of the paper has the following structure. Section II outlines the basic argument, without technical details. Section III discusses the effects of a bank's capital on its behavior. Section IV discusses the impact of the effect of bank capital on the way that banks treat their borrowers and on the endogenous payments made by borrowers. Section V discusses the policy choice trade-offs in choosing how much capital to provide. Section VI argues that banks without lending relationships and those with nonviable borrowers should not be recapitalized. Section VII concludes the paper.

II. A Sketch of the Reasons for and against Recapitalization

The effect of bank capital on bank behavior and borrower welfare depends on characteristics of the borrower and of the bank. The relevant characteristic of the bank is the presence or absence of relationship lending. I define a relationship lender as one whose knowledge allows it to induce the borrower to make larger future payments. As a result, a relationship lender can lend more today than other lenders, and is less inclined to foreclose on a loan because it can collect more in the future. However, if the relationship lender is in financial trouble, it may be unable to provide these larger loans or loan extensions. If instead there is no relationship lending, then a bank's financial situation has no effect on the borrower. Another lender can replace an undercapitalized bank, and the undercapitalized bank can either sell the loan or accept a payment that the borrower raises from borrowing elsewhere.

The characteristics of a bank's borrowers also partly determine the effect and desirability of providing subsidized capital to a distressed bank. The relevant borrower characteristic is the viability of its business. A business is viable if it can commit to pay the relationship lender more (in present value) than the lender can raise by foreclosing today. A viable borrower should not lose access to credit, and will not lose its access to credit from its bank if the bank is well capitalized. A nonviable borrower should lose access to credit, and in many cases a bank will cut off credit to such a borrower independent of its capital position. I argue that the only case where a subsidized recapitalization may be justified is when the undercapitalized bank is one with lending relationships and viable borrowers. In all other cases, recapitalization is a government subsidy without social value. Table 1 summarizes the results. A more detailed version of this table in presented in Table 2 in the conclusion.

Table 1 Desirable and Undesirable Forms of Recapitalization

	Financially distressed bank with a relationship borrower	Financially distressed bank without a relationship borrower
Borrower is best use of collateral (and is thus viable)	***Main case analyzed.*** Subsidized capital may be socially desirable.	No reason to recapitalize.
	A very small recapitalization may be worse than no recapitalization at all.	No effect on borrowers of too small a recapitalization.
Borrower is not best use of collateral (and is thus not viable)	No reason to recapitalize unless banks are reluctant to foreclose due to effect on accounting bank capital.	No reason to recapitalize.
	A very small recapitalization just sufficient enough to avoid this reluctance is a good policy.	No effect on borrowers of too small a recapitalization.

A. Relationship Lending

A bank with a valuable lending relationship can induce its borrowers to make larger payments than other lenders. The relationship lender has what I call a specific loan collection skill. If a bank has specific loan collection skills, other lenders can collect only a fraction of future loan proceeds collectable by it (see Diamond and Rajan [2001a]). As a result, the bank's relationship-based loans are illiquid. In addition, this source of illiquidity makes it more difficult for the bank to raise capital than deposits. It turns out that only a fraction of the present value of future relationship-based loan collections is capitalized in the market prices of the bank's capital. The results on relationship borrowers may apply to *keiretsu* loans based on long-standing relationships. The results do not apply, for example, to simple real estate mortgage loans, where repayment incentives come only from the threat of sale in the market of the real estate collateral. These are non-relationship loans, discussed in Section VI.

B. Effects of Bank Capital on Bank Behavior

Consider a bank that has developed a lending relationship with a viable borrower. Results in Diamond and Rajan (2000) show that the level of capital influences the horizon over which a relationship lender will operate when a borrower's loans are risky. A well-capitalized bank will operate with a long horizon, while an undercapitalized bank will be forced to try to meet its capital requirement. If a bank can get a larger immediate payment by forcing foreclosure, it may be forced to do so even if it yields a smaller present value than allowing a borrower more time to pay. An undercapitalized bank will be unwilling to wait to collect loans over the long run. It may liquidate the borrower's collateral when a better-capitalized bank would let the borrower continue to operate. In addition, because it is prone to liquidate, an undercapitalized bank may be able to extract very large payments from its relationship borrowers. In effect, such a bank conducts an auction for the right not to be liquidated.

An undercapitalized bank's incentive to liquidate comes from its need to reduce its portfolio of illiquid loans. This will satisfy a capital requirement imposed by the

market: for example, the need to avoid the threat of a run by depositors. If the capital is imposed by regulators and is based on regulatory book capital, then there is an offsetting effect that may dominate. Even if foreclosure leads to a larger current payment, it may lead to a loss relative to the book value of the loan. For very low levels of book capital, relevant to some banks in Japan, the bank would not foreclose or accept a partial payment because it would cause a writedown in book capital. I defer discussion of this "evergreening" effect (where the loan is like a tree that is green even when frozen in the dead of winter) until the analysis with market value accounting is complete.

The effects of bank capital identified here are on banks with relationship loans to viable borrowers. This approach implies that banks without such loans should be allowed to fail. The explicit discussion of this case is deferred to Section VI, after I provide more of the details of the types of recapitalization that may be in the public interest.

III. Foundations for the Link between Relationships, Illiquidity, and Bank Capital

I consider a bank with a collateralized loan to a single representative borrower. There are three dates, 0, 1, and 2. The borrower has substantial bargaining power with the bank, and can make "take it or leave it" offers to reschedule payments to the bank. As a result, the bank cannot force the borrower to pay more than the value for which it can liquidate the collateral. This is assumed only for simplicity. So long as the amount that a lender can collect is an increasing function of the value the lender obtains from liquidation, qualitatively similar results will follow.

If there is no lending relationship, the loan is worth the same amount to any lender, and can be sold for that amount. Equivalently, the borrower can approach a new lender who will lend up to the value of the loan (which may be less than book value), allowing the borrower to change banks. If a lending relationship exists, then lenders other than the relationship bank will be able to redeploy the collateral only for a lower value, and will not lend as much to the borrower (or buy its loans for full value). But relationship lending introduces other considerations, so we defer its discussion.

Most of the issues involving the costs and benefits of recapitalizing banks are related to intertemporal effects, and the effects of capital on the bank's horizon. It is important first to show why the fractions of bank demand deposits and capital matter at all. I begin with a single-period example under certainty to demonstrate why they matter (using the ideas developed in Diamond and Rajan [2001a]).

A. Relationship Lending

When the bank is a relationship lender, it is the only lender that can force the borrower to the maximum value based on its foreclosure threat. Other lenders can collect less. For simplicity only, I assume that other lenders would collect zero if they negotiated the loan.

Even though the relationship lender can collect a loan from the borrower, he cannot raise the full value of the loan by issuing capital (i.e., non-demandable claims) today. This is because the relationship lender's specific skills are needed to extract repayment from the borrower. The only sanction available to outside capital holders is to dismiss the banker with replacement by a less-qualified banker. This threat is very costly to carry out. Without the original banker, outsiders (holders of capital) or replacement bankers cannot get as much from the borrower. So the original relationship lender can, and will, appropriate a rent for his specific skills. For application to banks with many employees, assume that the relationship lender's rent takes the form of excessive employment of bankers. Assuming that he extracts half the additional amount he recovers from the borrower, the relationship lender will keep a rent of one-half in excess employment costs and only pass on the other half to outside holders of capital. The relationship lender can thus sell the loan or issue capital against it for only a fraction of present value of the payments that he can collect. If there were no relationship, and anyone could collect the full amount of the loan, it would be liquid, and the bank could issue capital up to the full value of the loan. With such a liquid loan, outside capital holders would replace the bankers unless they cut employment costs, and the bankers would not be able to threaten to earn a rent.

B. Discipline from the Threat of a Bank Run

Suppose instead that the relationship lender (henceforth the banker) finances illiquid loans by issuing uninsured demandable deposits. These cannot be renegotiated next period without triggering a run, which removes the loan from the banker's control. Because of the "first come, first served" aspect of uninsured demand deposits, no depositor would want to make a concession if the bank still had assets. Each depositor could force the bank to sell assets to pay in full (until the bank runs out of assets). And once the loan is sold, the banker can earn no rents (as shown in Diamond and Rajan [2001a]). The banker will always pay deposits if feasible. If the level of deposits and capital is set when it is known that the banker can collect exactly 1 from a borrower, the problem with a riskless loan's illiquidity can be solved: set deposits equal to 1 and capital equal to zero. The banker will pay out the full 1, and will be forced to cut employment to the efficient level. However, when loans are risky, a significantly positive level of capital is needed unless the probability of bank failure is to be very large. With a positive level of capital, the illiquidity problem will remain. The problem is that demand deposits are a very rigid form of financing. This is good in that it disciplines the banker and enables him to commit to pay out. It is bad if there is any uncertainty in bank asset values because a drop in bank asset values will precipitate a run, disintermediating the banker, and further reducing their value. Capital can act as a buffer in such cases because, unlike deposits, its value adjusts to underlying asset values. Only a fraction of the amount that the banker can collect on the loan can be committed to pay to outside investors. Rather than introduce uncertainty that leads to the need for some capital, I will just look at the effects of using some capital to fund the bank under certainty. This will illustrate the qualitative effects of bank capital on bank behavior. Specifically, when there is

uncertainty, Diamond and Rajan (2000) show that the optimal capital structure for the bank may involve some capital in addition to demand deposits. In the rest of the paper, we will assume there is a capital requirement of γ for banks, specified by regulatory authorities, based on unmodeled uncertainty about asset values.

C. Discipline from the Threat of Closure Due to Capital Requirements

An effect similar to the threat of runs occurs with insured deposits, if the deposit insurer requires prompt corrective action to enforce a minimum level of capital (and sticks by this threat to close the bank unless it raises sufficient capital). When the deposit insurer and the remainder of the government are prohibited from providing subsidized capital to the bank, the bank is under the same incentives as the threat of a run, and rents are an increasing function of the amount of capital required. Consider a bank with a given level of capital. If it incurs losses beyond a given amount, its uninsured depositors will run, closing the bank. If the same loss leads regulators to close the bank, then the incentives are identical.

Suppose that the bank is closed if its capital is below one-ninth of the bank's market value ($\gamma = \frac{1}{9}$). Because the banker takes as a rent one-half of the excess amount over the amount of deposits, the total market value of the bank that can collect P_2 at date 2 and has deposits $D_2 \leq P_2$ is given by $D_2 + \frac{1}{2}(P_2 - D_2) = \frac{1}{2}(P_2 + D_2)$. Thus, with certainty and an all-deposit bank, the value of the bank is equal to the full value of the loans, or P_2. With a capital requirement that capital (worth $\frac{1}{2}(P_2 - D_2)$) equals a fraction γ of total bank value $[\frac{1}{2}(P_2 + D_2)]$, total bank value is equal to $P_2/(1 + \gamma)$. The banker's rent becomes $[\gamma/(1 + \gamma)]P_2$, and the value of capital is also equal to $[\gamma/(1 + \gamma)]P_2$ (because capital and the banker share the surplus equally).

Enforced minimum capital requirements make insured deposits a hard "budget constraint" on bankers by committing the deposit insurer not to allow excess rents to the bankers. An all-capital structure provides no discipline because there is no threat of closure, but once there are some deposits, a required level of capital provides discipline by forcing closure if the bank's total value paid to outsiders falls sufficiently. Although this is consistent with other views of minimum capital requirements as providing discipline to bankers by committing regulators to close insolvent banks, it provides a somewhat different perspective. If the level of capital above the minimum is too much above the minimum level, the banker will be free to appropriate rents and excessive costs from capital, to the extent that the bankers provide a loan collection service not available elsewhere. Excess capital only influences the rents of banks that do relationship lending, when capital owners are free to replace bankers with poor lending performance. A replacement banker, or another bank selected to service the loan, could collect non-relationship loans equally well as the originating banker.

Without a required minimum capital requirement, the regulator can allow the bank to operate with negative capital, and raise additional insured deposits to cover excessive costs. As a result, the deposit insurer could in principle give an unlimited subsidy to banks. Such a deposit insurer would be forced to make as large a concession (0.5) as an all-capital bank (and probably would make an even larger concession).

With a minimum capital requirement, rents are limited. If the deposit insurer must close the bank if capital is too low, and cannot provide capital of its own, then there is no negotiation with the deposit insurer that will yield the bank a larger concession than just negotiating with capital. Negotiations must then be with capital. Capital will make concessions, but not the depositors or their insurer. The value that can go to outsiders as a whole is the value of deposits plus one-half the excess over this amount that the banker can collect. If the deposits exceed what the banker can collect, then the bank fails, and the borrower pays half the amount that the banker could collect, and the deposit insurer covers the rest.

With certainty and a minimum capital ratio of γ, a bank with a relationship loan worth P_2 has a market value of $P_2/(1 + \gamma)$.

D. Capital Value

Consider a loan with payments P_1 at date 1 and P_2 at date 2. Suppose that the banker can actually collect these amounts (the borrower has this much cash at each date and the bank can force the borrower to pay this much). Any other lender cannot force the borrower to pay (can collect only zero).

If the banker threatened to quit (and not use relationship skills to collect the loan) at date 2, capital holders would get zero on their own, and by splitting the surplus with the banker they get $\frac{1}{2}(P_2 - D_2)$. If the bank is to meet its date 2 capital requirement, its maximum date 2 market value is thus $P_2/(1 + \gamma) = \frac{9}{10}P_2$. The total value of the claim to capital is $[\gamma/(1 + \gamma)]P_2 = \frac{1}{10}P_2$.

If date 1 maturing deposits, minus date 1 loan payments, were to exceed $P_2/(1 + \gamma)$, then the bank would have no way to pay them all, and the bank would be closed due to insolvency (negative capital). The bank can issue appropriate quantities of capital and deposits to meet its obligations and continue with a proper capital requirement in this case.

At date 1, the bank could pay up to $P_1 + P_2/(1 + \gamma)$ to outside investors (depositors plus holders of capital). Because the bank can threaten to quit before date 1, the amount that the bank can commit to pay to holders of capital at date 1 is less than this.

Suppose that the bank has date 1 deposits of D_1, and the banker threatens to quit, and not represent the capital holders this period, and not collect P_1. If this breaks the relationship, a capital holder would get zero at date 2 as well. Alternatively, if the bank were closed due to low capital if the date 1 payment were set to zero, then even without breaking the relationship, the capital holder gets zero without the banker, and this analysis applies. For the capital holder to have a positive outside option requires very high initial capital (see the Appendix). Unless deposits are very low, the capital holder could get only zero unilaterally. So if the banker got the entire surplus, the capital holder would get zero. If instead the capital holder got the entire surplus, instructing the banker to collect P_1 now and raise $P_2/(1 + \gamma)$ with new deposits and capital, the capital holder would get $P_1 - D_1 + P_2/(1 + \gamma)$. Capital and the banker divide the surplus equally, and as a result, the value of capital before date 1 is the average of these, or $\frac{1}{2}[P_1 + P_2/(1 + \gamma) - D_1]$.

To meet the capital requirement before date 1, the capital ratio must not exceed γ, or

$$\gamma > \frac{\frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} - D_1\right)}{D_1 + \frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} - D_1\right)}.$$

In terms of D_1, deposits must not exceed

$$\frac{P_1(1-\gamma^2) + P_2(1-\gamma)}{(1+\gamma)^2},$$

or the bank will not be able to meet its capital requirement. This is the limit on the total market value of a bank before date 1, if it must meet its capital requirement on each date. For $\gamma = \frac{1}{9}$, this capital requirement before date 1 is satisfied if and only if $D_1 \leq 0.8P_1 + 0.72P_2$. More distant payments are less reflected in capital value, because they give more bargaining power to the banker. If D_1 exceeds this amount the bank must close, because the bank has no way to recapitalize sufficiently.

To generalize, suppose that the borrower will make a payment of P_0 on the date that the capital requirement must be met. It can be used to pay down loans and reduce deposits, and the bank will be able to meet its current capital requirement if

$$\frac{P_1(1-\gamma^2) + P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 - P_0.$$

IV. Endogenous Payments and Bank Foreclosure

The analysis of minimum capital requirements to this point has taken the payments from the borrower as given, and determined whether the bank will remain open. The borrower's cash holdings on each date, the constraints imposed by minimum capital on the banker's ability to respond to default, and the bank's control rights (i.e., the right to call the loan and foreclose absent a current default) are all important.

If the bank has no liquidation rights over the borrower absent default, then obviously the borrower will pay no larger amounts than the contracted amounts, P_1 and P_2. An undercapitalized bank must close. But the borrower may be unable to make these payments if short of cash, for example, if the cash on date 1 is less than P_1. In addition, the borrower may choose not to pay over all of his cash, because he anticipates that the bank will accept less, and not foreclose.

A. The Bank's Value Obtained from Liquidation (Foreclosure)

At date t, an entrepreneur's project produces a cash flow of C_t, and the relationship lender's liquidation value just before that date is X_t. Suppose for a moment that the capital requirements do not influence the relationship lender's behavior toward the borrower. We determine through backward induction how payments will be

renegotiated over time if the entrepreneur defaults. The borrower's effort and skills are needed to operate the borrower's firm. I assume that the borrower can credibly threaten not to produce that period's cash, at either date 1 or date 2, unless the bank makes a concession. Suppose at date 2 that the borrower defaults and refuses to make the pre-specified payment P_2 and, instead, makes an offer of a lower payment. Once the borrower defaults, the lender has the right to liquidate. If the bank rejected the offer and did not liquidate, no cash would be produced at all. In response, the relationship lender can accept the offer or reject it and liquidate the assets to obtain X_2. Thus if P_2 exceeds X_2, the entrepreneur will renegotiate. At date 2, the entrepreneur will pay $\min[P_2, X_2]$.

Now consider what happens at date 1. The borrower at date 2 will credibly threaten not to produce that period's cash unless the bank makes a concession (offering a lower payment). If the borrower makes this threat and offers a lower payment, the lender can accept the offer. Alternatively, the lender can reject it and liquidate immediately and get X_1, or reject it and hold on to the asset and get X_2 at date 2. In this last case, no date 1 cash is produced, but the lender gets X_2 at date 2. So the lender will accept any offer to renegotiate that makes its payments amounting to $\max[X_1, X_2]$ over dates 1 and 2, where any payment left for date 2 should be enforceable, i.e., should be less than X_2. If the promised payments $P_1 + P_2$ exceed $\max[X_1, X_2]$, they will be renegotiated down to this level. If the borrower is short of cash, and can pay less than $\max[X_1, X_2]$, the lender will liquidate.

When the bank lender must meet its capital requirement, it can constrain the bank's ability to follow this loan negotiation policy. If the borrower defaults (threatens not to produce cash) before date 1, and makes an offer that the bank turns down, the bank can get X_1 by liquidating at date 1 (and nothing at date 2: this is equivalent to a loan that pays $P_0 = 0$, $P_1 = X_1$, and $P_2 = 0$), can get X_2 by liquidating at date 2 (and nothing at date 1: equivalent to a loan with $P_0 = P_1 = 0$ and $P_2 = X_2$). If the bank will be closed before date 1 if $P_0 = P_1 = 0$ and $P_2 = X_2$, the bank does not have the freedom to wait to reject a borrower's offer and wait to collect X_2 by date 2 liquidation. Thus, an undercapitalized bank may have a short horizon. The bank will have a short horizon if it can survive with immediate foreclosure or $P_0 = 0$, $P_1 = X_1$, and $P_2 = 0$, but not with an excused default or $P_0 = P_1 = 0$ and $P_2 = X_2$.

In addition to limiting a bank's ability to wait to foreclose after rejecting a borrower's offer of partial payment, low capital can limit the types of offers that the bank can accept from the borrower. To meet the capital requirement on a date before date 1, the borrower's offer must make immediate payment of P_0, and date 1 and 2 payments of P_1 and P_2, respectively, that satisfy

$$\frac{P_1(1-\gamma^2) + P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 - P_0.$$

In addition, the offer must satisfy $P_0 + P_1 + P_2 \geq X_1$, or the bank will prefer to foreclose at date 1. If the bank is free to reject and wait until date 2 to liquidate, which requires that $X_2(1-\gamma)/(1+\gamma)^2 \geq D_1$, then an acceptable offer must also satisfy $P_0 + P_1 + P_2 \geq X_2$, or the bank will reject it to wait to collect X_2 at date 2. If the

bank is not free to wait to collect at date 2, or $D_1 > [X_2(1 - \gamma)/(1 + \gamma)^2]$, I will call the bank undercapitalized.

The level of initial capital, a decreasing function of D_1, determines how the bank will respond to a default. Suppose that the borrower has defaulted on the original deal, and the bank has the right to foreclose. What offers can the bank accept, and how much can the bank force the borrower to pay? An example will illustrate this point.

B. Example

Assume that the capital requirement is $\gamma = \frac{1}{9}$, that $X_1 = 0.99$, and that $X_2 = 1$.

If the borrower defaults before date 1, and the bank rejects the borrower's offer, then if $D_1 > 0.72$, the bank cannot wait until date 2 to foreclose, but can survive by date 1 foreclosure if $D_1 \leq 0.8$.

The banker would like the largest total payment, but the capital shortage requires that any acceptable offer must satisfy $P_0 + 0.8P_1 + 0.72P_2 \geq D_1$.

Suppose that $D_1 = 0.8$. The borrower cannot commit to pay more than 1 at date 2. To avoid foreclosure by the bank, $P_0 + 0.8P_1 + 0.72(1) \geq 0.8$, or $P_0 + 0.8P_1 \geq 0.08$. If the borrower has less than this, the bank must foreclose.

Suppose that the borrower is subject to liquidation before date 1. The borrower may have some cash. If the borrower offers no immediate payment before date 1, then for the bank to remain open, $0.8P_1 + 0.72(1) \geq D_1$ (in addition to $P_1 + P_2 \geq X_1$), or for $D_1 = 0.8$ and $P_2 \leq 1$, there must be $P_1 \geq 0.1$. The bank will require a high interest rate, and not to cover default risk. If an earlier payment—call it P_0—is possible, then the constraint is $P_0 + 0.8P_1 + 0.72(1) \geq D_1$ (in addition to $P_0 + P_1 + P_2 \geq X_1$). If the borrower cannot meet this, then the bank will foreclose.

For the example with $X_1 = 0.99$, $X_2 = 1$ and an outstanding default, the bank will liquidate before date 1 if $P_0 + 0.8P_1 + 0.72(1) \geq D_1 = 0.8$, or $C_0 + 0.8P_1 \leq 0.8$. In addition, the borrower will pay as rapidly as possible. The total amount paid is then $[0.8 - (C_0 + C_1/0.8)]/0.72$.

This interesting case arises when the bank will fail to meet its capital requirement if it does not liquidate, but will not if it does. This means if the borrower pays zero at date 1, the bank will liquidate, although it can collect more by waiting. The bank will do whatever it takes to stay open. This is "whatever it takes" behavior. It gives the banker a very short horizon, and makes it act as if it discounts future cash flows at a very high rate. The bank must meet all obligations without violating its capital requirement on date 1.

This desperation of the banker either leads to liquidation or changes the amount that it forces a liquidity-constrained borrower to pay. Moreover, the bank's ability to extract payment from the borrower does not change monotonically in its capital and depends on the borrower's project characteristics (such as the interim cash flows it generates). Before further analyzing the effects of capital on the bank's ability to get the borrower to pay at date 1, it is helpful to examine what the bank will do when the borrower has no date 1 cash, and must pay zero at date 1.

C. A Borrower with No Date 0 or Date 1 Cash ($C_0 = C_1 = 0$)

If the representative borrower has no cash at date 1 or date 0, but will have cash at date 2, the banker would like to wait until date 2 to collect $X_2 = 1$. However, the most the bank can raise on date 1 against the date 2 loan collection is 0.72. The bank can raise 0.99 by liquidating before date 1. The bank's decisions are as follows.

(1) If the bank is **well capitalized** (has initial date 1 maturing deposits of 0.72 or less), the bank will not liquidate, but will wait until date 2, collect 1, and will be able to meet its date 1 capital requirement.

(2) If the bank is **undercapitalized** (has deposits in excess of 0.72 to pay on date 1, but less than 0.99), the bank will (inefficiently) liquidate the borrower's collateral. It would not be able to meet its capital standard otherwise. By liquidating, the bank can raise 0.99, pay down deposits, and meet the capital standard. So long as deposits are less than 0.99, the bank can avoid failure at date 1.

(3) If the bank is **severely undercapitalized** (deposits exceed 0.99), the bank fails at date 1. The borrower faces liquidation, because it can offer no cash to avoid it.

D. Bargaining with a Borrower with Lots of Cash

Any borrower who has date 0 cash of 0.99 will pay it, and an undercapitalized bank that cannot wait until date 2 to collect will be forced to accept it as total payment on the loan. In general, the borrower will pay early cash when the bank is desperate and charges a very high interest rate to continue loans. Any borrower who can set

$$\frac{P_1(1-\gamma^2) + P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 - P_0$$

while $P_0 + P_1 + P_2 = X_1$ will be able to get an undercapitalized bank to accept X_1 in total, even when X_2 is greater. The borrower gets a discount, because the bank has a high rate of discount on future payments.

E. Example

The borrower would like to pay down the loan as soon as possible when the bank charges very high rates to abstain from liquidation. A borrower who can pay C_0 immediately plus pay $X_1 - C_0$ at date 1 such that $0.8(X_1 - C_0) + C_0 \geq D_1$ will be able to benefit from the bank's desperation. For example, if $D_1 = 0.8$, then $0.8(0.99 - C_0) + C_0 \geq 0.8$ implies that if $C_0 \geq 0.4$ and $C_1 \geq 0.59$, then the borrower can make a total payment of 0.99 and have it accepted. If $C_0 < 0.4$, then the borrower's total payment must exceed 0.99, because higher date 1 or 2 payments that satisfy $C_0 + 0.8(P_1) + 0.72(P_2) \geq D_1$ must then exceed X_1 in sum. For borrowers with high cash:

(1) If the bank is **well capitalized** (has initial date 1 maturing deposits of 0.72 or less), the bank is free to wait until date 2, collect 1, and the borrower will pay 1 in total.

(2) If the bank is **undercapitalized** (has deposits in excess of 0.72 to pay on date 1, but less than 0.99), the bank cannot reject an offer and wait until date 2 to collect, because it will violate its capital standard. The borrower will pay 0.99 in total.

(3) If the bank is **severely undercapitalized** (deposits exceed 0.99), the bank must fail at date 1. The borrower faces liquidation but may be able to negotiate a settlement after the bank fails if immediate cash C_0 is sufficient (if $C_0 > X_1/2 = 0.4545$).

F. An Intermediate Amount of Cash

Because the bank can raise at most 0.72 without liquidating, the **undercapitalized** bank will have constraints on its behavior at date 1. In particular, there is an effect on the banker's horizon when bargaining with borrowers. If the bank responds to default by waiting until date 2 to liquidate, then it will be closed. Any borrower that wants to avoid immediate liquidation will need to offer a positive date 1 payment. This can force the borrower to pay more than the value of the bank's liquidation threat. A borrower with date 0 cash of exactly $D_1 - 0.72$, and no date 1 cash, would need to pay all the date 0 cash to the bank, plus allow the bank to collect all that it can at date 2 (1). As borrowers have more cash, they can reduce their total payment, taking advantage of the undercapitalized bank's desperation. Borrowers with date 0 cash of less than $D_1 - 0.72$ meet the fate of the borrower with no date 1 cash: immediate liquidation. We here consider borrowers with date 0 cash in excess of $D_1 - 0.72$, but less than enough to get the bank to settle for X_1 in total.

This implies the following characterization when the borrower has this intermediate amount of date 1 cash.

(1) If the bank is **well capitalized** (has initial date 1 maturing deposits of 0.72 or less), the bank will collect a total of $X_2 = 1$ from the borrower, and will not liquidate.

(2) If the bank is **undercapitalized** (has deposits in excess of 0.72 to pay on date 1, but less than 0.99), the borrower will satisfy $C_0 + 0.8(P_1) + 0.72(P_2) = D_1$, where $P_2 = \min\{0, (D_1 - C_0 - 0.8C_1)/0.72\}$ and $P_1 = \min\{C_1, (D_1 - C_0)/0.8\}$.

Given the example where $D_1 = 0.8$, if $C_0 = 0$ and $C_1 \in ((0.08)/0.8, 0.99) = (0.1, 0.99)$, the borrower will pay all of its date 1 cash to the bank, plus offer a positive payment to the bank at date 2 to allow the bank to meet its capital requirement without liquidation. The total payment by the borrower declines monotonically from 1.1 to 0.99 as cash C_1 increases from 0.1 to 0.19. The trick here is that the borrower cannot commit to pay more than 0.99 at date 1 if it has sufficient cash at that time.

If $C_1 = 0$, but $C_0 > 0$, then the total payment goes from 1.08 to 1 as C_0 goes from 0.08 to 0.27. (and down to 0.99 as C_0 increases to 0.31149).

(3) If the bank is **severely undercapitalized**, $D_1 > X_1 = 0.99$, the bank fails. After the bank fails, the borrower is liquidated if $C_0 < \frac{1}{2}X_1 = 0.4545$, and pays 0.4545 otherwise to avoid liquidation.

V. Policy Response to Undercapitalized Banks When Future Undercapitalization Leads to Closure

What is a government to do? The well-capitalized bank makes appropriate decisions, but may collect less from borrowers with a moderate amount of current cash. The undercapitalized bank will squeeze cash-poor borrowers, break mutually beneficial relationships with very low cash borrowers, and collect less than the maximum amount that it can from liquid borrowers. Severely undercapitalized banks face immediate closure.

A government that cares about preserving the banking system itself would be very tempted to add at least enough capital to prevent immediate closure. But what is the effect on the borrower, the corporate sector, employment, and growth? If the bank fails, then there will be bargaining such that the borrower can be forced to pay 0.4545 (half of X_1, because the government will be forced to hire the banker to collect the loan), or face immediate liquidation. If the borrower has sufficient date 1 cash (at least 0.4545), then the borrower would benefit from the bank's failure, because it has little future value in its relationship and can get rid of its debt burden more cheaply if the bank fails. However, this case is quite unlikely. If the borrower has less cash, the borrower will be liquidated if the bank fails, but with only one-half the proceeds to depositors and the government deposit insurer. The corporate sector will be very anxious to have the bank recapitalized in this case if its cash is just below 0.4545. How much recapitalization it will desire depends on how much cash it has. If it has enough date 1 cash to frontload the payment to the bank, so that its total value and its pledgible value are close to 0.99, then a small recapitalization is desired. The borrower could avoid the liquidation threat by making date 1 payments and small date 2 promises to the bank. If the borrower has too little cash to do this, a large recapitalization is desired.

Once the bank has been given enough capital to be well capitalized, any additional capital will transfer rents to the banker and reduce the rate of return received by the government. Too small a recapitalization (from severely undercapitalized to undercapitalized) may be bad, because it does not prevent inefficient foreclosure. This is especially true if the borrowers are short on cash. It is a bit outside the model, but it can be less expensive for a government that wants to avoid inefficient liquidation to give banks a smaller amount of capital, and give the firms cash to pay the banks. This reduces the banker's rents and protects the human capital in firms. However, it requires the government to know which firms are viable but short on cash. This seems unlikely, but is outside the model. Too large a recapitalization will not lead to inefficient loan decisions, but will lead to inefficient operations in the bank and increase the cost to the government.

A. Evergreening and Loss of Bargaining Power When Book Capital Is Inaccurate

Suppose that if a bank exercised its liquidation threat, its book capital would fall sufficiently to force immediate closure. The bank will never foreclose in this situation. This protects the borrower from foreclosure, but implies that the borrower will not have an incentive to pay the bank at all. If the borrower is the efficient user of the firm's

capital, this protects valuable human capital, but causes further reductions in the real economic capital of the bank. For borrowers with nonviable businesses, and which should be liquidated for efficiency, this delays efficient redeployment of capital, and increases the losses to the banking system, due to lost bargaining power.

This case occurs when deposits exceed X_1, the amount that the bank can get from liquidation, but the regulators do not measure capital as this low, so long as the loan is not written down in the accounts. Such banks are in the severely undercapitalized category in the examples.

In the model outlined above where the borrower is viable and thus the best user of the firm's capital, bank recapitalization sufficient to avoid evergreening can be a free lunch for the government. This occurs if the borrower has sufficient cash to reach a negotiated settlement with the bank, worth at least X_2. If the bank evergreens and then fails, the borrower will end up paying a very small amount (one-half of what the bank could liquidate for, or one-half of X_1). By recapitalizing the bank sufficiently to have it negotiate a larger payment (equal to the full liquidation value), the government can save the deposit insurer money. The real decision is the same, but the borrower pays more. This saves money for the deposit insurer.

Once enough capital has been advanced to allow a negotiated settlement, the analysis in the remainder of the paper applies. The results imply that if the borrower is short of date 1 cash, a small recapitalization which is just enough to avoid evergreening (to $D_1 = 0.99$ and leaves the bank undercapitalized) is a bad policy. An undercapitalized bank will liquidate inefficiently, and the borrower and society are worse off than if the bank had received no capital and continued to be afraid to liquidate. If the government provides this small amount of capital and borrowers are cash poor, the borrower will lobby the government for relief. It will ask for cash or for the government to force the banks to convert some debt into equity, reducing the amount that the banks obtain from liquidation. This position has been taken by the Japan Federation of Economic Organizations (Keidanren); see Rowley (1999). Viable borrowers would be less afraid of a bank recapitalization if the bank were well capitalized ($D_1 < 0.72$).

B. The Intertemporal Problem with Repeated Government Recapitalization

Government recapitalization leads to a classic time-consistency problem. If the deposit insurer cannot put capital into banks, but can only allow them to stay in business without recapitalization, then there is a limit on the concessions that can be extracted from deposit insurers over the short term. However, anticipations of the closure behavior of regulators can give bankers perverse current incentives. If a period of persistent undercapitalization exists, then a government would wish to provide a subsidized recapitalization. If the future closure policy were unchanged, this could make all parties in the economy better off (protecting human and physical capital). The government would exert a bad influence if it generated a belief that a recapitalization were always forthcoming. That would eliminate liquidity creation by banks and lead to large future government expenditure on bank bailouts. Use of political constraints to recapitalize banks only when called for by external conditions, and not banker rent taking or incompetence, would be desirable. However,

bankers will realize that this discrimination is imperfect. The possibility of future recapitalization will lead to rents to banker human capital (overemployment, excessive costs, and resistance to change). It is therefore very appropriate that the Japanese recapitalization has been accompanied by both a promise of commitment to future prompt corrective action, employment reduction, and improved portfolio disclosure and valuation.

VI. Banks That Should Not Be Recapitalized

A. A Bank with No Relationship Lending

The financial health of a bank without lending relationships is of no consequence to the borrower. Such a bank can sell loans to meet the requirement, and the sale or retention of loans is of no consequence to the borrower. If the value of capital is negative, then the bank will not be able to recapitalize without subsidized capital, but again this is of no consequence to the borrower. The decision to liquidate or to continue lending is independent of the identity of the lender.

B. A Nonviable Borrower

A nonviable borrower is one whose current management is not the best user of the firm's capital, and as a result the lender can collect more by foreclosure than by continuing to lend. If there is no lending relationship, this just means that anyone can collect more from foreclosure, implying that independent of the capital position of a bank there will be foreclosure after default. In this case, the only value of recapitalization is to avoid evergreening that prevents loans from being foreclosed, but such liquidation could be achieved by a government agency which foreclosed on the loans, perhaps hiring bankers from the failed bank. There is no long-run value to retaining relationships to nonviable borrowers.

VII. Summary and Conclusion

The analysis presented here suggests that for banks with viable lending relationships, it may be a good policy to recapitalize banks until they are well capitalized. Two bad policies are recapitalizing them only to the point where they are willing to write off loans (stop the evergreening policy), or to the undercapitalized point where they avoid failure only by liquidating the collateral of viable borrowers. These policies make sense only if some cash is provided to borrowers by the government, or the banks are forced to extend the viable loans in return for receiving the capital. But these policies of multiple-level bailouts by the government would require more information and long-run commitment than a government possesses.

Providing too much capital to the banks will leave them with rents, which in the Japanese context means too large a wage bill and continued inefficient operations. The government thus faces a difficult problem. Too little capital may be worse than none, and too much will be wasted. It is appropriate in this context that the capital

injections to date have required labor force reductions in return, and explicit management plans. However, nothing focuses the mind on rent reduction as much as the threat of impending closure.

The recent recapitalization has come in two stages, and some suggest that more stages might be forthcoming. Given the time-consistency problem, repeated recapitalization can cause problems. Guaranteed future recapitalization is equivalent to an all-capital bank. This leads to maximum rents and destroys liquidity creation.

Finally, the analysis has focused on banks with valuable relationships, whose borrowers are still viable. Banks not in this category should be closed. Without a relationship, a change in capital will not change a bank's incentive to inefficiently foreclose, so there is no extra efficiency gain from recapitalizing them. If the bank has a relationship, but the borrowers are not viable, then efficient allocation of capital requires that their collateral be liquidated and redeployed. Absent accounting-based reluctance to foreclose, the banks would have every incentive to liquidate such borrowers, even if undercapitalized. If evergreening is the issue, recapitalizing the bank slightly could be sensible, but just for the purpose of closing it very soon thereafter. Alternatively, if the bank's extra efficiency of liquidating those loans is small, then just closing it and transferring collection to the Resolution and Collection Corporation will be the best choice. These results are summarized in Table 2.

This analysis is just a first step in the study of the optimal amount of recapitalization to provide to banks. There is much to add to make the results robust. However, I am not aware of any other theoretically based analysis of this topic, so it is important to begin with this first step. It is clear that recapitalization by the government has time-consistency problems if it is expected to continue in the future. To my mind, however, this is not an argument against the current recapitalization. When (nearly) all the banks are underwater, it is desirable to recapitalize at least some of them. We need a framework to determine which ones are provided with subsidized capital, and how much to provide.

Table 2 Details of Desirable and Undesirable Forms of Recapitalization

	Financially distressed bank with a relationship borrower	Financially distressed bank without a relationship borrower
Borrower is best use of collateral (and is thus viable)	***Main case analyzed.*** Provide subsidized capital to well-capitalized level unless borrowers have substantial cash. Providing just enough capital to end fear of writing off loans due to book capital problems ("evergreening") is worse than providing no capital.	No reason to recapitalize. Will not liquidate inefficiently. Recapitalization just to the level to avoid fear of writing off loans due to book capital problems ("evergreening") has no effect.
Borrower is not best use of collateral (and is thus not viable)	Undercapitalized bank will liquidate (efficiently) unless subject to the "evergreening" effect on book capital. Recapitalization just sufficient enough to avoid "evergreening" is a good policy. More capital has no beneficial effect.	No reason to recapitalize. Recapitalization just enough to avoid "evergreening" leads to efficient foreclosure. Equivalent to transferring loans to an outside collection agency (Resolution and Collection Corporation).

APPENDIX: BANK LOAN COLLECTION AT HIGH LEVELS OF CAPITAL

If the relationship is not broken by not collecting this period and the bank has substantial capital, the borrower can pay zero this period and face liquidation by the banker next period. If the bank is not closed in this scenario, then the capital holders can get $X_2/(1 + \gamma) - D_1$ unilaterally, and respect the capital requirement by reducing deposits if needed by selling added claims to capital. The condition for the banker not being closed in this scenario is that the bank meets the capital requirement with $P_1 = 0$, or $D_1 \leq [\gamma/(1 + \gamma)]X_2$. This is a high level of date 1 capital, and will not be of interest. If the bank has this much capital, then the value of capital is then

$$\frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} - D_1\right) + \frac{X_2}{1+\gamma} - D_1.$$

In this case, if $P_2 = X_2$, the value of capital on date 1 is $\frac{1}{2}P_1 + P_2/(1 + \gamma) - D_1$.

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