Should Banks Be Recapitalized?

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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, or recapitalizing them. One or more of these outcomes is inevitable. This article studies the effects of the regulatory choice on various parties in the economy.

The most obvious choice that regulators make is whether to let banks fail. Does their inability to raise sufficient private capital indicate that they are not viable or produce future services that are worth less than their cost, and thus should be closed? Only if the government, depositors, and borrowers were first allowed to jointly renegotiate would the inability to restructure indicate that the banks are not viable. This article analyzes the effects and desirability of recapitalizing banks with public funds, with a brief discussion of the implications of recapitalization for the current situation in Japan.

In many countries, including 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 structure 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

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legislation in Japan that will limit deposit insurance (see Nakaso [1999]) and require prompt corrective action from undercapitalized banks, as is now required in the United States. Around the world, the discipline of banks relies to some extent on market incentives. As a result, it is important to study the effects of bank capital on how much banks 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 the other lines of business they can provide. If the level of capital is below 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 to the minimum. 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 human capital in banks and firms. If the reason to have a well-capitalized banking system is to ensure that new relationships can be established, this can be achieved by recapitalizing a few of the best banks. 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 result 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 whether to foreclose on its defaulted loans.

The amount of current bank capital affects the behavior of a bank when it is required to have a minimum amount of capital in order to remain in business. The same effect occurs when the threat of closure due to low capital comes from market participants who may not provide capital or from potentially uninsured depositors who may withdraw deposits, as in Diamond and Rajan (2000a), summarized in Diamond and Rajan (2001c).[1]

The remainder of the article has the following structure. Section 1 outlines the basic argument, without technical details. Section 2 discusses the effects of a bank's capital on its behavior. Section 3 discusses the effect of bank capital on the way that banks treat their borrowers and on the endogenous payments made by borrowers. Section 4 discusses the policy choice tradeoffs in choosing how much capital to provide. Section 5 argues that banks without lending relationships and those with nonviable borrowers should not be recapitalized. Section 6 concludes the article.

[1] 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.

1. A SKETCH OF THE REASONS FOR AND AGAINST RECAPITALIZATION

The effect of bank capital on bank behavior and borrower welfare depends on certain characteristics of the borrower and of the bank. The relevant characteristic of the bank is the presence or absence of relationship lending. Relationship lending implies that the lender has a special skill in evaluating a borrower or in committing to providing a long-term financing policy that a new lender cannot provide. Many discussions of the *keiretsu* system in Japan stress the importance of relationship lending (see Hoshi, Kashyap, and Scharfstein [1991], Aoki, Patrick, and Sheard [1994], and Hoshi and Patrick [2000]). One expects that relationship lending is most important for loans to firms rather than to consumers and when the anticipated response to a potential default is renegotiation rather than immediate foreclosure of collateral.

Applying the model introduced in Diamond and Rajan (2000, 2001a), 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. The relationship lender's special loan collection skill makes loans illiquid and hard to sell or borrow against. If there is not 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. Only when relationship lending is important is the financial health of particular bank lenders of critical importance to their borrowers and to the economy as a whole.

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 paying 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 it 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 is 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 has the best use of the 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 does not have the best use of the 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 to avoid this reluctance is a good policy.	No effect on borrowers of too small a recapitalization.

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 collectable future loan proceeds (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 non-deposit capital. The higher the capital ratio, the greater the rents absorbed by the bank. 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.[2]

[2] These are nonrelationship loans, discussed in Section 5.

Effects of Bank Capital on Bank Behavior

A bank's capital structure directly influences its ability to raise funding for its relationship loans. Because higher capital implies higher rents to bankers, a high level of required capital reduces the sum of the values of deposits plus capital that a bank can raise from outside investors. Such a limitation on a bank's ability to fund its loans can indirectly influence its behavior toward borrowers—a bank that cannot raise sufficient capital may limit its ability to make or renew loans to its relationship borrowers.

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 capital bank will be forced to try to immediately meet its capital requirement. If a bank can get a larger immediate payment by forcing foreclosure, it may have to do so even if it yields a smaller present value than would 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 requirement is imposed by regulators and is based on regulatory book capital, then an offsetting effect may dominate. Even if foreclosure produces a larger present value than extending the loan, 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 write down in book capital that would lead the bank to be closed. In this case, the bank would not foreclose on any loans. 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 5, after I have provided further details regarding the types of recapitalization that may be in the public interest.

2. 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, and riskless interest rates are zero. There are three types of agent: a borrower who needs funds for a project, a banker who is a relationship lender and has special skills in collecting loans from the borrower, and an outside investor who has no loan collection skills. Outside investors can hold deposits or non-deposit capital issued by the bank. They can hold loans, but they have no skill in collecting the loans.

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. The next section describes the bank's negotiations with the borrower.

Negotiations between the Bank and the Borrower

In Section 3, I examine the effects of the bank's financial position on its dealings with the borrower. It is useful here to describe the dealings between bank and borrower when there is no such constraint and the banker is negotiating unconstrained (as if negotiating for his or her own personal account). As in Hart and Moore (1994), I consider financial contracts that specify that the borrower owns the machinery and has to make a payment to the banker, failing which the banker will get possession of the collateral and the right to use it as he or she pleases. So a contract specifies repayments P_t (for dates $t = 1$ and $t = 2$) that the borrower is required to make at date t, as well as the assets the bank may liquidate if the borrower defaults. Using some notation that I will not use again until Section 3, the bank can liquidate the collateral for $X_1 \geq 0$ at date 1 or $X_2 \geq X_1 \geq 0$ at date 2. The borrower's project produces cash of $C_1 \geq 0$ at date 1 and $C_2 \geq X_2 \geq 0$ at date 2 if not liquidated on or before these dates. The borrower has cash before date 1 production of $C_0 \geq 0$.

The source of friction in the model is that any agent can commit explicitly to contributing specific skills to a specific venture only in the spot market—not in advance, but just before production is to occur. As a result, just before production the borrower may attempt to renegotiate the terms of the loan that was agreed to in the past, using the threat of withholding his or her human capital from production this period (and the promise of committing to produce now if a new agreement is reached). Without the borrower's human capital, no current cash flow is produced (apart from the value of liquidation).

Bargaining between bank and borrower just before the borrower is due to produce takes the following form; the borrower offers an alternative payment

to the one contracted in the past and commits to contribute his or her human capital if the offer is accepted (and not to contribute it if rejected). The banker can (1) accept the offer, (2) reject the offer and choose to liquidate the project immediately, or (3) if the bargaining occurs on or before date 1, reject the offer (implying that the borrower does not produce this period), retaining the option to liquidate at date 2. The game gives all the bargaining power to the borrower, apart from the banker's ability to exercise control rights to liquidate. If the borrower's offer is accepted, the borrower contributes his or her human capital, and the offered payment is made.

Example 1 *Suppose that it is just before date 2, and the borrower promised to pay* $P_2 = C_2$. *The borrower knows the banker can obtain* $X_2 < C_2$ *by liquidating the collateral. As a result, the borrower offers to pay only* X_2 *and the banker,who cannot do any better by refusing, accepts. Note that lenders other than the bank would have no ability to liquidate the project for a positive amount. As a result, they would not be able to enforce any repayment. The banker's specific skills enable him or her to collect more, so I will refer to these skills as collection skills. In this example, in order to be collectable using the bank's threat to liquidate for* X_2, *a contract must specify a promised payment* $P_2 \leq X_2$.

Until Section 3, I will assume that all payments specified in the loan contracts can be collected by the bank using its threat to liquidate the collateral, and I will not further analyze the negotiation between bank and borrower. This allows study of the bank's ability to fund itself and to satisfy capital requirements before examining the effect on the bank's actions toward borrowers.

Relationship Lending

When the bank is a relationship lender, it is the only lender that can force the borrower to repay the maximum value. Other lenders can collect less. For simplicity only, I assume that other lenders would collect zero if they attempted to collect the loan (all results follow when other lenders could collect a positive but smaller amount than that collected by the bank). As a result, a loan would be worthless without some access to the bank's loan collection skills.

A relationship lender cannot raise the full present value that it can collect from the borrower 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 bank and replace it with one that cannot collect anything from the borrower. So, the original relationship lender can, and will, appropriate a rent for its specific skills. For application to banks with many employees, one can interpret the relationship lender's rent as excessive employment of bankers. Assuming that, in bargaining, the relationship lender

extracts half the additional amount recovered from the borrower, it will keep a rent of one-half and only pass on the other half to outside holders of capital.[3]

The implications of the banker's ability to negotiate for rent from outside investors are best illustrated by an example. Suppose that the relationship lender can collect P_2 from the borrower and has raised exclusively non-deposit capital from outside investors. If the banker threatens to quit and not to collect the loan, both the banker and outside capital holders get zero. If the banker collects the loan, however, their total surplus is P_2. I assume that in bargaining, they divide surplus equally. As a result, outside investors who hold capital know that the banker will renegotiate if he or she promises to pay them more than $\frac{1}{2}P_2$. Thus the most that the banker can raise in non-deposit capital is $\frac{1}{2}P_2$.

The relationship lender can sell the loan or issue capital against it for only a fraction of present value of the payments that it can collect. If there were no relationship, and anyone could collect the full amount of the loan, it would be liquid: the bank could issue capital up to the full value of the loan or sell it for the full amount. With such a liquid loan, outside capital holders would replace the banker or sell the loan unless the banker's rent was zero, and the banker would not be able to threaten to earn a rent.

Discipline from the Threat of a Bank Run

Suppose instead that the banker finances illiquid loans by issuing uninsured demand deposits. These cannot be renegotiated next period without triggering a run, which removes the loan from the banker's control (see Diamond and Rajan [2001a]). 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. 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 P_2 from a borrower, the problem with a riskless loan's illiquidity can be solved: set deposits equal to P_2 and capital equal to zero. The banker will pay out the full P_2.

When the bank's capital structure combines deposits and capital, the bank's ability to commit to pay outside investors is in between an all-capital

[3] Note that unlike in the bargaining between the borrower and the banker, where the latter has no bargaining power, here outside investors have some bargaining power. In practice, we would typically have interior amounts of bargaining power in both situations. I assume the borrower has all the bargaining power in negotiations with the banker only to simplify notation.

bank and an all-deposit bank. Returning to Example 1 illustrates the commitment ability of a bank with deposits less than the value of the amount it can collect with its relationship skills.

Example 1 (continued) *Suppose that the banker can collect P_2 from the borrower and has $D_2 < P_2$ deposits outstanding, with outside investors holding 100 percent of the residual equity capital claim on the bank. Without the banker, capital holders are able to collect nothing from the borrower. So capital holders will not be able to avoid a run if the banker quits, and will get zero. The net amount of surplus available to capital and the banker if the bank does use its skills to collect the loan is $P_2 - D$. Since neither can get any of the surplus without the other's cooperation, and because they divide the surplus equally, each gets $\frac{1}{2}(P_2 - D_2)$. As a result, $\frac{1}{2}(P_2 - D_2)$ will be absorbed by the banker as rent. The remainder, $\frac{1}{2}(P_2 - D_2)$ is the maximum value of outside equity capital on the bank. When added to the D_2 that the bank can commit to pay to depositors, the total that the bank can commit to pay to outside investors is $\frac{1}{2}(P_2 - D_2) + D_2 = \frac{1}{2}(P_2 + D_2)$.*

The problem with capital is that it does not provide the banker as hard a budget constraint as demand deposits. The higher the capital-to-deposit ratio, the higher the rent collected by the banker. However, when loans are risky, a positive level of capital is needed to avoid the costs of a high probability of bank failure. With a positive level of capital needed, 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 sufficient 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. If there is a reduction in the amount that the bank's borrowers can pay, the bank can raise additional capital so long as it can commit to giving a normal rate of return to investors. However, only a fraction of the amount that the banker can collect on the loan can be committed to pay to outside holders of capital.

Rather than introduce uncertainty that leads to the need for some capital, I will instead 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 article, I will assume there is a capital requirement for banks, specified by regulatory authorities.

The capital requirement is as follows. A bank can raise new capital at any time, but will be closed if the market value of its capital falls below a fraction γ of the market value of its capital plus the par value of its deposits. This

capital requirement limits the amount that the bank can raise, as illustrated in the following example.

Example 1 (continued) *If a bank has a relationship loan that pays P_2, and if its capital requirement is just met, it must be that $\gamma = \frac{\frac{1}{2}(P_2 - D_2)}{\frac{1}{2}(P_2 + D_2)}$ where the numerator on the right hand side is the date 2 value of capital, and the denominator is the value of capital plus deposits (the market value of external claims on the bank). This implies that date 1 deposits satisfy $D_2 = \frac{(1-\gamma)}{1+\gamma} P_2$. Therefore, the total amount that can be pledged to investors at date 1 out of the amount the bank collects from borrowers at date 2 is $\frac{1}{2}(P_2 + D_2)$, which, on substituting for D_2, works out to $\frac{P_2}{1+\gamma}$. Since the total amount paid by the borrower is P_2, the bank absorbs $\frac{\gamma}{1+\gamma} P_2$ in rent, an amount increasing in γ. More generally, we will see that only a fraction $\frac{1}{(1+\gamma)}$ of the total date-t value of the bank can be pledged to outsiders at date $t-1$. The banker absorbs the remaining amount as rent because the capital requirements impose the constraint that $D_2 \leq \frac{(1-\gamma)}{1+\gamma} P_2$.*

Discipline from the Threat of Closure due to Capital Requirements

An effect similar to the threat of runs occurs with insured deposits if deposits are insured and 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 in the market). 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 the market value of the capital that it has or it raises is below a fraction γ of the market value of its total external liabilities (market value of capital plus deposits valued at par). The market value (the maximum value that can be pledged to outside investors other than the banker) of its total external liabilities will be less than the total present value of what the bank can collect on its loans (plus any other assets) because the relationship loan collection skill makes its loans illiquid. All of the valuation is as if the commitment came from the threat of a run on uninsured deposits: the maximum total that a bank could commit to pay to outsiders (deposits plus capital) is again $\frac{P_2}{1+\gamma}$ if the bank must meet its capital requirement.

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 outside claimants 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.

Without a minimum capital requirement, the regulator can allow the bank to operate with negative capital and to 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 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 holders. Negotiations must then be with capital holders. Capital holders 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 the deposit insurer one-half the amount that the banker could collect (if less was paid, the deposit insurer would hire the banker to collect for a fee of one-half the amount collected), and the deposit insurer covers the rest. Notice that at date 2 (representing the long run) I assume that the borrower has this much cash. I make no such assumption about date 1 in Section 3.

Capital Value over Two Periods

Consider a relationship 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). No other lender can force the borrower to pay (it can collect only zero).

We showed above that if the bank is to meet its date 2 capital requirement, the maximum date 2 market value of claims (deposits plus capital) on the date 2 part of the claim, P_2, is $\frac{P_2}{1+\gamma}$. This limit is imposed by the banker's ability to threaten to quit just before date 2. If date 1 maturing deposits minus date 1 loan

payments received were to exceed $\frac{P_2}{1+\gamma}$, the bank would have no way to pay them all, and the bank would be closed due to insolvency (negative capital). If instead maturing date 1 deposits minus date 1 loan payments received were less than or equal to $\frac{P_2}{1+\gamma}$, then the bank would be able to issue new deposits and sufficient additional capital to survive.

At date 1, the bank could potentially pay up to $P_1 + \frac{P_2}{1+\gamma}$ to outside investors (depositors plus holders of capital) by collecting P_1 and issuing claims worth $\frac{P_2}{1+\gamma}$. Because the bank can threaten to quit just before date 1, the amount that the bank will be able to commit to pay to outsiders at date 1 is less than this. Suppose that before date 1, the bank has date 1 demand deposits of D_1, and the banker threatens to quit and not represent the capital holders this period to collect P_1 from the borrower. If not collecting the loan at date 1 breaks the relationship (eliminates the specific loan collection skill), a capital holder who does not reach an agreement to keep the banker would get zero at date 2 as well because the capital holder would be unable to hire the banker to collect the loan at date 2. Alternatively, if the relationship is maintained at date 2 even if the banker does not collect the loan at date 1, but the lost value from the bank not collecting the loan at date 1 implies that the bank is closed immediately due to low capital, then both the capital holder and the banker get zero unless they reach an agreement at date 1 (both capital and banker have an "outside option" to go it alone that is worth zero).[4] The total surplus available to the banker and the capital holders from reaching an agreement is $P_1 - D_1 + \frac{P_2}{1+\gamma}$: this is the value of collecting P_1, raising $\frac{P_2}{1+\gamma}$ with new deposits and capital and repaying the maturing deposits of D_1. Because capital and the banker divide the surplus equally, the value of capital before date 1 is $\frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} - D_1\right)$ and the value of capital plus deposits is $\frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} + D_1\right)$.

The bank must also meet its minimum capital requirement before date 1 (or it will be closed). To meet the capital requirement before date 1, the ratio of the value of capital to capital plus deposits must not exceed γ, that is, $\gamma \geq \frac{\frac{1}{2}\left(P_1+\frac{P_2}{1+\gamma}-D_1\right)}{\frac{1}{2}\left(P_1+\frac{P_2}{1+\gamma}+D_1\right)}$. In terms of D_1, this result implies that date 1 deposits must satisfy $D_1 \leq \frac{P_1(1-\gamma^2)+P_2(1-\gamma)}{(1+\gamma)^2}$ or the bank will not be able to meet its capital requirement before date 1. If date 1 deposits exceed this amount, the bank will be closed because it cannot recapitalize itself. Substituting for D_1, this result implies that the maximum market value of date 1 capital plus deposits ($\frac{1}{2}\left(P_1 + \frac{P_2}{1+\gamma} + D_1\right)$) is at most equal to $\frac{P_1}{1+\gamma} + \frac{P_2}{(1+\gamma)^2}$. More distant payments are less reflected in capital value because they give more bargaining power to

[4] For a very high level of initial capital ($D_1 \leq \frac{X_2(1-\gamma)}{(1+\gamma)^2}$), a bank meets the minimum before date 1, even if it collects nothing at date 1. This turns out to imply that the bank's capital level does not constrain its loan collection ability (see Appendix).

the banker. For $\gamma = \frac{1}{9}$, the capital requirement before date 1 is satisfied if and only if $D_1 \leq 0.8P_1 + 0.72P_2$ and the maximum market value of external liabilities (deposits plus capital) before date 1 is $0.9P_1 + 0.81P_2$.

3. 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 bank's control rights (i.e., the right to call the loan and foreclose absent a current default) are all important.

We examine the ex-post capital position of banks and the ex-post financial position of borrowers in order to examine the effects of capital on banks, borrowers, and depositors and holders of bank capital. The ex-post positions are presumably realizations of uncertain ex-ante prospects, but we look only ex-post. All analysis occurs on a date before date 1 because date 1 and 2 cash flows and liquidation values become known on a date before date 1, and the capital requirement must be met on that date. The market prices of the bank's capital will reflect the position of the borrower, any new capital or deposits issued, anticipations of future such issues, and the outcome of any negotiations between the borrower and banker.

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 or her cash, anticipating that the bank will accept less and not foreclose.

An Unconstrained Bank's Loan Collection Ability

A borrower's project produces a cash flow of $C_t > 0$ if it is not liquidated before date t (where $t = 1$ or $t = 2$) and if the borrower has initial cash $C_0 \geq 0$ that the lender cannot seize, but which the borrower may use to pay his or her loan. The relationship lender can obtain a liquidation value of X_t just before date t. Suppose 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 borrower 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

but instead makes an offer of a lower payment. Once the borrower defaults, the lender has the right to liquidate. If the bank rejects the offer and does not liquidate, no cash will 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 borrower will renegotiate. At date 2, the borrower will pay min $[P_2, X_2]$.

Now consider what happens at date 1. Suppose that the borrower at date 1 threatens 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 either 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. Thus, the lender will accept any offer to renegotiate that makes its payments amount 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 sum of promised payments $P_1 + P_2$ exceeds max$[X_1, X_2]$, they will be renegotiated down to this level. If the borrower is short of cash, and can commit to pay less than max$[X_1, X_2]$, the lender will liquidate. Because $X_1 < X_2$, an unconstrained bank can collect a loan worth up to X_2.

A Capital-Constrained Bank's Loan Collection Ability

When the bank lender must meet its capital requirement, it can constrain the bank's ability to follow the unconstrained loan negotiation policy. This is important for two reasons. A constrained negotiation policy will affect the outcomes of forced defaults by borrowers who have less cash than they owe. If the bank's capital constraint weakens its bargaining position, then the borrower will enter negotiations to get a reduction in the amount to be paid even if immediate default is avoidable.

I now consider negotiations that occur before date 1. I begin by assuming that the loan is in default, either because the borrower has missed a promised payment or because the bank has the right to call the loan and liquidate the collateral at any time. If the borrower threatens not to produce the cash C_1 before date 1, and makes an offer that the bank turns down, the bank can either

1. get X_1 by liquidating on or before date 1 and get nothing at date 2; this choice implies a value of the bank and bank capital that is equivalent to a collectable loan that pays nothing after date 1, pays $P_1 = X_1$ and $P_2 = 0$, or

2. get X_2 by liquidating at date 2 and get nothing at date 1 (because the borrower does not supply human capital); this choice implies a value of the bank and bank capital that is equivalent to a collectable loan that pays nothing before date 1, $P_1 = 0$ and $P_2 = X_2$.

If the bank would be closed before date 1 under the second option, it does not have the freedom to wait to reject a borrower's offer and to collect X_2 by date 2 liquidation. Thus, an undercapitalized bank may have a short horizon and be forced to ignore its ability to wait to collect a defaulted loan, potentially weakening its bargaining power over the borrower whenever immediate liquidation is less profitable than delayed liquidation ($X_1 < X_2$). The bank will have a short horizon if it can survive with immediate foreclosure or $P_1 + X_1$ and $P_2 = 0$, but not with an excused default with deferred liquidation or $P_1 = 0$ and $P_2 = X_2$.

A bank with enough capital so that it is free to reject an offer and wait to collect at date 2, or $D_1 \leq \frac{X_2(1-\gamma)}{(1+\gamma)^2} = 0.72$ will be called *well-capitalized*. A bank that is not free to reject an offer and wait to collect at date 2, or $D_1 > \frac{X_2(1-\gamma)}{(1+\gamma)^2} = 0.72$, will be called *undercapitalized.*

If deposits before date 1 are so high that the bank's loan collection skills at date 1 and date 2 are insufficient to collect enough to allow the bank to survive, or $D_1 > \max[X_1, \frac{X_2(1-\gamma)}{(1+\gamma)^2}] = 0.99$, then the bank is termed *severely undercapitalized.*

In addition to limiting a bank's ability to wait to foreclose after it rejects a borrower's offer of partial payment, low capital can limit the types of offers that the bank can choose to accept as an inducement to abstain from liquidation of the borrower. To meet the capital requirement on a date before date 1, I showed above that the borrower must offer collectable date 1 and 2 payments of P_1 and P_2 respectively, plus possibly an immediate payment of P_0 financed out of the borrower's initial cash (C_0), such that $\frac{P_1(1-\gamma^2)+P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 - P_0$. Otherwise the bank would have to close if it accepted the borrower's offer. If the bank can survive by one of its liquidation options, then an unacceptable offer will be followed by liquidation. If neither liquidation option allows the bank to survive, then the borrower will watch the bank fail if it makes a low offer.

An acceptable offer before date 1 to a well-capitalized bank must satisfy

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

$$P_0 + P_1 + P_2 \geq X_1,\ P_0 \leq C_0,\ P_1 \leq C_1,\ P_2 \leq X_2 \leq C_2,$$

and

$$P_0 + P_1 + P_2 \geq X_2.$$

Only the last constraint is binding because $X_2 > X_1$ and $X_2 \leq C_2$, and the well-capitalized bank will collect a total of X_2.

An acceptable offer to an undercapitalized bank must satisfy

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

$$P_0 \leq C_0,\ P_1 \leq C_1,\ P_2 \leq X_2 \leq C_2,$$

and

$$P_0 + P_1 + P_2 \geq X_1.$$

The offer has two possible effects. When the first constraint is binding (which requires one of the cash constraints to bind), then the borrower needs to pay a total sum of payments exceeding X_1 and can be forced to offer very large payments. Offers of lower payments would lead the bank to foreclose to maintain its capital requirement. When the last constraint is binding, then the borrower can get away with paying only X_1, despite the bank's ability to liquidate for more at date 2. When there is no solution, then the borrower must face liquidation or the bank must fail.

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? The example below will illustrate this point.

Example

Assume that the capital requirement is $\gamma = \frac{1}{9}$, that $X_1 = 0.99$, and that $X_2 = 1$. A well-capitalized bank (with $D_1 \leq \frac{X_2(1-\gamma)}{(1+\gamma)^2} = 0.72$) would receive and accept an offer of $P_0+P_1+P_2 = 1$ (for example, $P_2 = 1$ and $P_0 = P_1 = 0$) and would be able to collect the date 2 payment.

Consider an undercapitalized bank with $D_1 = 0.8 > \frac{X_2(1-\gamma)}{(1+\gamma)^2} = 0.72$. The borrower has defaulted and will make an offered set of payments before date 1. If the bank rejects the borrower's offer, it cannot wait until date 2 to foreclose, but it can survive by date 1 foreclosure because $D_1 \leq \frac{X_1}{1+\gamma} = 0.8$ (the bank is not severely undercapitalized).

The bank would like the largest total payment ($P_0 + P_1 + P_2$), but its undercapitalized position requires that any acceptable and collectable offer must satisfy $\frac{P_1(1-\gamma^2)+P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 - P_0$, which works out to $P_0 + 0.8P_1 + 0.72P_2 \geq D_1 = 0.8$. Because the liquidation value at date 2 is one, $X_2 = 1$, the borrower cannot commit to pay more than one at date 2 and $P_2 \leq 1$. To avoid foreclosure by the bank, the borrower must offer collectable payments such that $P_0 + 0.8P_1 + 0.72(1) \geq D_1 = 0.8$, or $P_0 + 8P_1 \geq 0.8$. If the borrower has less cash than this at dates 0 and 1, the bank must foreclose.

If the borrower has no date 0 cash, there can be no immediate payment ($P_0 \leq C_0 = 0$). The maximum collectable date 2 payment is $X_2 = 1$. To induce the bank not to liquidate, the borrower must make a collectable offer that satisfies $0.8P_1 + 0.72(1) \geq D_1 = 0.8$ (in addition to a nonbinding $P_1 + P_2 \geq X_1$), or $P_1 \geq 0.1$. If date 1 cash is too low ($C_1 < 0.1$), the bank will foreclose.

The undercapitalized bank discounts future payments to meet its capital requirement. Its limit on pledging its cash flows to outside investors makes it discount future payments heavily. In addition, because the bank discounts future payments but the borrower does not, the borrower will pay as rapidly as possible. The total amount paid, then, is $P_0+P_1+P_2 = C_0+C_1+\frac{D_1-C_0-0.8C_1}{0.72}$, assuming that a positive payment at date 2, P_2, is required (i.e., $C_0+0.8C_1 < 0.8$).

The bank's desperation 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 flow it generates).

These possibilities are most easily seen by considering three subexamples, with differing amounts of date 1 cash possessed by the borrower. In one, the borrower is short on cash (has none until date 2); in the second, the borrower has a large amount of immediate cash; and in the third, the borrower has an intermediate amount of cash. I retain the parameter assumptions $\gamma = \frac{1}{9}$, that $X_1 = 0.99$, and that $X_2 = 1$.

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

If the 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, 0.72 is the most cash the bank can raise before date 1 against the date 2 loan collection. 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 borrower will offer $P_2 = 1$. The bank will not liquidate, but will wait until date 2, collect one, 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 after the bank fails because it can offer no cash to avoid it.

Bargaining with a Borrower with Lots of Cash

Suppose that the borrower has date 0 cash of $C_0 \geq X_1 = 0.99$. The borrower would like to pay down the loan as soon as possible when the bank charges very high rates to abstain from liquidation. 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 and collect one, and the borrower will pay $X_2 = 1$ 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 immediately.

3. If the bank is *severely undercapitalized* (deposits exceed 0.99), the bank must fail at date 1. The borrower will be able to negotiate a settlement with the government receiver after the bank fails to pay $\frac{1}{2}X_1 = 0.4545$ because the receiver would otherwise need to hire the banker to collect the loan, and the banker would charge a rent of $\frac{1}{2}X_1 = 0.4545$.

The borrower with substantial cash benefits from the bank's desperation if the bank accepts a low payment in order to survive or if the bank fails and the borrower can make a partial payment to the receiver of the failed bank (whose collection skills are weaker).

This result does not just apply to borrowers with initial cash of $C_0 \geq 0.99$. A borrower who can pay C_0 immediately, as well as 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 $C_0 \geq 0.4$ and $C_1 \geq 0.59$, then $0.8(0.99 - C_0) + C_0 \geq D_1 = 0.8$ implies that the borrower can make an acceptable total payment of 0.99. If $C_0 < 0.4$, then the borrower's total payment must exceed 0.99 because higher date 1 or 2 payments that satisfy $C_0 + 0.8(P_1) + 0.72(P_2)$ will exceed $D_1 = 0.8$. If $C_0 < 0.4$, then the borrower has an intermediate amount of cash. This is the third (and most complicated) example.

An Intermediate Amount of Cash

If the borrower has enough date 0 cash to avoid liquidation, but not enough to induce the bank to accept a total payment of $X_1 = 0.99$, then the total amount that the borrower must pay, $P_0 + P_1 + P_2$, is decreasing in the borrower's cash holding.

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, the banker's horizon is affected by its bargaining with borrowers. If the bank responds to default by waiting until date 2 to liquidate, then it will close. Any borrower who wants to avoid immediate liquidation needs to offer a positive date 1 payment. This necessity 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 and also allow the bank to collect $X_2 = 1$ (the maximum that it can collect) at date 2. 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.

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

The bank needs to satisfy the constraints

$$P_0 + \frac{P_1(1-\gamma^2)+P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1 \text{ and } P_0 + P_1 + P_2 = X_1.$$

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 binding constraint is $P_0 + \frac{P_1(1-\gamma^2)+P_2(1-\gamma)}{(1+\gamma)^2} \geq D_1$ and the borrower will want to pay as quickly as possible. The borrower will set $C_0 + 0.8(P_1) + 0.72(P_2) = D_1$, where $P_2 = \min\{0, (D_1 - C_0 - 0.8C_1)/0.72\}$ and $P_1 = \min\{C_1, (D_1 - C_0)/0.8\}$.
   With $D_1 = 0.8$, if $C_0 = 0$ and $P_1 = C_1 \in ((0.08)/0.8, 0.99) = (0.1, 0.99)$, then $P_2 = (0.8 - 0.8C_1)/0.72$ and 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 deter the bank from liquidation. The total payment $P_0 + P_1 + P_2$ declines monotonically from 1.1 to 0.99 as cash C_1 increases from 0.1 to 0.19.
   If $C_1 = 0$, but $C_0 > 0$, then the total payment declines from 1.08 to 0.99 as C_0 increases from 0.08 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 otherwise pays 0.4545 to avoid liquidation.

It is worth noting that an undercapitalized bank facing a borrower with an intermediate amount of cash can force the borrower to make a very large payment—a payment as large as 1.1, which is in excess of the $X_2 = 1$ that a well-capitalized bank can collect.

4. 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 it 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 might be very tempted to add at least enough capital to prevent immediate closure. But what is the effect of this action 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 $\frac{1}{2}X_1$ because the government would be forced to hire the banker to collect the loan at date 1 if the borrower paid less than this amount. Returning to "Example" on page 86, the borrower must pay $\frac{1}{2}X_1 = 0.4545$ (it is $\frac{1}{2}X_1$ because the government will be forced to hire the banker to collect the loan at date 1) or face immediate liquidation. If the borrower has a very large amount of date 1 cash (at least $\frac{1}{2}X_1 = 0.4545$), then the borrower would benefit from the bank's failure because it has little future value in its relationship with the bank and can get rid of its debt burden more cheaply if the bank fails. However, this case requires the borrower to have current cash flows that are a very large fraction of its total long-run value. If the borrower has less cash, the borrower will be liquidated if the bank fails, but only one-half of the proceeds would go to depositors and the government deposit insurer. The corporate sector will be very anxious to have the bank recapitalized in this case if their cash is just below $\frac{1}{2}X_1 = 0.4545$. How much recapitalization they desire will depend on how much cash they have. If they have enough date 1 cash to frontload the payment to the bank, so that its total value and its pledged value are close to $X_1 = 0.99$, then a small recapitalization is desired. In this case, 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 will not prevent inefficient foreclosure. This is especially true if the borrowers are short on cash. This 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 approach reduces the banker's rents and protects the human capital in firms; however, it also requires the government to know which firms are viable but short on cash. The latter seems unlikely, but is outside the model so cannot be confirmed here. Too large a recapitalization will lead not to inefficient loan decisions, but to inefficient operations in the bank, and it will increase the cost to the government.

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, which 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, valuable human capital is protected, but further reductions in the real economic capital of the bank result. For borrowers with nonviable businesses that should be liquidated for efficiency, this effect 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 when regulatory capital is inflated by the overvaluation of the loan. Such banks would fit into the severely undercapitalized category in the examples.

In the model outlined above, where the borrower is viable and thus is the best user of the firm's capital, bank recapitalization sufficient to avoid evergreening can be a free lunch for the government. This result 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 the deposit insurer money.

Once enough capital has been advanced to allow a negotiated settlement, the analysis in the remainder of the article applies. The results imply that if the

borrower is short of date 1 cash, a small recapitalization that is just sufficient to avoid evergreening (to $D_1 = 0.99$ and leaving 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 ask the government to force the banks to convert some debt into equity, reducing the amount that the banks obtain from liquidation. After the Japanese government provided the initial recapitalization of banks in Japan, this position was 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 ($D_1 < 0.72$).

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 regulators' closure behavior can give bankers perverse current incentives. If a period of persistent undercapitalization exists, then a government will wish to provide a subsidized recapitalization. If the future closure policy did not change, all parties in the economy could be better off (protecting human and physical capital). The government would have a bad influence if it generated a belief that recapitalizations were always forthcoming. That influence would totally eliminate liquidity creation by banks and lead to large future government expenditure on bank bailouts. It would be desirable to use political constraints to recapitalize banks only when called for by external conditions, and not because of banker rent-taking or incompetence. However, bankers will realize that this discrimination will be 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 Japanese recapitalization has been accompanied both by a promise of commitment to future prompt corrective action and employment reduction and by improved portfolio disclosure and valuation. But the very logic that suggests that recapitalization can be ex-post desirable also suggests that the government may have a difficult time forcing banks to carry through with their commitments if they remain unprofitable.

5. BANKS THAT SHOULD NOT BE RECAPITALIZED

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 capital requirements, 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; 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.

A Nonviable Borrower

A borrower is nonviable if the 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, then 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 that foreclosed on the loans, perhaps by hiring bankers from the failed bank. There is no long-run value to retaining relationships to nonviable borrowers.

6. 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. Recapitalizing them only to the point where they are willing to write off loans (stop the evergreen policy) or to the undercapitalized point where they avoid failure only by liquidating the collateral of viable borrowers are both bad policies. These policies make sense only if some cash is provided to borrowers by the government or if the banks are forced to extend the viable loans in return for receiving the capital. But such 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 take the forms of a too-large wage bill and continued inefficient operations. The government 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 in return required labor force reductions and explicit management plans. However, nothing focuses a bank on rent reduction as much as the threat of impending closure.

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 has the best use of the 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 ("evergreen") 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 ("evergreen") has no effect.
Borrower does not have the best use of the collateral (and is thus not viable)	Undercapitalized bank will liquidate (efficiently) unless subject to the evergreen effect on book capital. Recapitalization just sufficient to avoid evergreen is a good policy. More capital has no beneficial effect.	No reason to recapitalize. Recapitalization just enough to avoid evergreen leads to efficient foreclosure. Equivalent to transferring loans to an outside collection agency.

The recent recapitalization in Japan has come in two stages, and it has been suggested 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 guarantee 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. A change in capital will not change a bank's incentive to inefficiently foreclose unless it has a relationship, 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 the borrowers' 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 in liquidating those loans is small, the best option will be to close it and transfer collection to a receiver (such

as the Japanese Resolution and Collection Corporation (RCC)). 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 this first step is an important beginning. It is clear that recapitalization by the government has time-consistency problems if it is expected to continue in the future. To my mind, 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 to be provided with subsidized capital, and how much to provide.

APPENDIX: BANK LOAN COLLECTION AT HIGH LEVELS OF CAPITAL

If the relationship-lending skill to collect the loan at date 2 is not lost, if the banker does not collect the loan in period 1 this period, and if the bank has enough capital that it would not be closed if it collected nothing at date $1 (D_1 \leq \frac{X_2}{1+\gamma})$, the payoff to capital would be greater than zero if the holders of capital rejected an offer from the banker to collect the loan at date 1. If the borrower defaults and the holders of capital do not reach an agreement with the banker to collect the loan at date 1, capital holders will be able to hire the banker at date 2 to collect X_2 at that time. This high level of date 1 capital holders will turn out to imply that the bank is well capitalized, by the definition in the article. The only difference in the analysis is that because capital holders have a positive outside option to reject the banker's offer to collect the loan at date 1, capital holders get a payment from bankers that will exceed $\frac{1}{2}(P_1 + \frac{P_2}{1+\gamma} - D_1)$. This difference has no effect on the banker's negotiation with the borrower: the bank can still collect the unconstrained amount, $\max[X_1, X_2]$.

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