ANJAN V. THAKOR
JESS BELTZ

A "Barter" Theory of Bank Regulation and Credit Allocation

> Enough is enough. Let's tell the financial institutions that this gimmee-gimmee game is over. It's time the banks and savings and loans gave some back. It's time they addressed the banking needs of elderly and low-income Americans.
>
> Rep. Henry Gonzales, in Hearings before the House Subcommittee on Consumer Affairs and Coinage, *Consumer Access to Basic Financial Services* (1989)

THERE ARE FEW WHO WOULD DISPUTE the observation that bank regulation is politicized. Yet, other than informal remarks about the economic implications of this highly visible and almost constant interplay between politics and economics, there is surprisingly little analysis of this subject. The purpose of this paper is to formally suggest that certain aspects of bank regulation can be best understood as barter agreements between politicians and bankers. The provision of governmental subsidies to banks and the powerful role played by the government in the *private-sector* allocation of credit provides an interesting example of this.

Like farmers, banks in virtually all countries are the recipients of subsidies of one form or another. These subsidies usually emanate from the provision of a "safety net" to ensure banking stability.[1] The safety net involves a "lender-of-last-resort" (LOLR) facility and deposit insurance that varies in formality and the level of coverage across countries. Subsidies may arise from the underpricing of the LOLR facili-

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1. For example, the provision of deposit insurance to eliminate bank runs arising from coordination failures, as in Diamond and Dybvig (1983).

ANJAN V. THAKOR *is INB National Bank Professor of Finance at Indiana University.* JESS BELTZ *is assistant professor of finance, Hong Kong Institute of Science and Technology.*

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ty and deposit insurance,[2] entry restrictions, deposit interest rate controls, and other similar regulations.

In most countries, the role of the government in credit allocation is large and explicitly acknowledged. In the United States, this role is admittedly smaller but present nonetheless. Yet, the government has studiously avoided the *appearance* of interference in private-sector credit allocation. The idea of the government allocating credit seems repugnant to most Americans and thus has the political "stench of death" about it. On the other hand, helping economically disadvantaged groups get better access to credit is a laudable objective. Consequently, the goals of regulations such as the *Community Reinvestment Act* (CRA)—a piece of legislation explicitly designed to influence credit allocation by encouraging federally insured banks to lend in their communities—are couched in oxymoronic language. For example, the Federal Financial Institutions Examination Council (FFIEC) adopted the following statement in connection with the CRA in September 1980:[3]

> Although directed toward meeting community credit needs, the CRA does not impose credit allocation.

In addition to the CRA, there are various governmental initiatives that influence credit allocation in more indirect ways. Examples are tax credits and tax deductions for designated capital allocations.

Juxtaposing the government's role in providing safety-net subsidies with its role in credit allocation, we are led to two questions. First, why are banks subsidized? Second, why does the government play such a significant role in credit allocation? Or put a little differently, why does the government tell banks to whom they should lend when it does not tell computer manufacturers to whom they should sell computers?

We argue that the answers to these two questions are related. Banks are subsidized because these subsidies empower the government to extract credit allocation concessions from banks. The direct political benefits of such concessions may well exceed the dollar cost of subsidies.[4] Banks may agree to this barter because the cost to them of accommodating the government's credit allocation may be less than the benefits of the subsidies. Such mutually beneficial gains to barter are likely when the governmental safety net eliminates negative externalities such as banking panics.

This perspective sheds light on how regulation evolves and expands in scope. The very nature of banking creates coordination problems and systemic risks that link the fortunes of individual banks, leading to negative externalities being created for the banking industry as a whole even by failures caused by (idiosyncratic) bank-specific adversities (see Gorton 1988). If banking failures are productively disruptive, then these externalities invite governmental intervention in the form of the pro-

2. See, for example, Chan, Greenbaum, and Thakor (1992). By underpriced deposit insurance, we don't necessarily mean that the deposit insurer loses money. Rather, the insurance is priced so as *not* to fully exhaust all of the bank's surplus from insured deposits.

3. See Garwood and Smith (1993). A similar statement was made earlier by the Federal Reserve.

4. But even if they do not, the subsidies are politically almost invisible, whereas the credit allocation concessions can produce highly visible gains for incumbent politicians.

vision of a safety net such as deposit insurance (see, for example, Diamond and Dybvig 1983). But the safety net creates moral hazard as banks adapt their asset choices and liquidity decisions (see Bhattacharya and Gale 1987) in ways that augment the cost of providing the safety net. This then necessitates a regulatory response, spawning a host of safety-and-soundness regulations. This is perhaps the most fundamental insight of bank regulation, and it is well recognized (see, for example, Bhattacharya and Thakor 1993). What is not as well understood is the reason for the escalation in "consumer-protection" legislation or "fair-play regulation" as Kane (1981) calls it. This is aptly captured in the following quote from Kane (1981):

> Over the years, the thrust of U.S. banking regulation has changed from merely discouraging unsafe banking practices and policing abuses to differentially handicapping broad classes of banks to benefit politically powerful competitors or customers. Although targeted beneficiaries are usually economically disadvantaged in some way (as, for example, very small deposit institutions), this is not always the case.

Our theory explains this phenomenon. An increase in the value of the governmental safety net, without an adjustment in the price, empowers the government to extract greater credit allocation concessions from banks. This increases regulations in two ways. First, new regulations are needed to implement the credit allocation concessions. Second, additional regulations are needed to counteract the actions banks take to circumvent the new fair-play regulations.[5] There is thus an ever-expanding web of regulations.

This is fine for all banks as long as the cost of complying with fair-play regulations is no greater than the benefits they derive from the governmental safety net. But suppose now that the government decides to impose compliance costs on a subset of the banks that exceed the safety-net benefits to them. These banks would be better off if there were no barter arrangement. However, as long as some banks remain for whom the safety-net benefits exceed the regulatory compliance costs, achieving coordination across *all* banks to "renegotiate" with the government may be impossible. And as long as some banks continue to be covered by the safety net, those that choose not to be covered may be competitively disadvantaged. Some banks may therefore find themselves between the proverbial "rock and a hard place"—they are worse off if all banks are covered by the safety net than if none are, but they are better off being covered by the safety net than being part of only a subset of banks that are not covered! In other words, a "bad" Nash equilibrium can arise and lead to a "regulatory trap."

A basic premise that serves as the starting point of our analysis is that banks are special in credit allocation. Thus, from the government's standpoint, subsidizing banks by a dollar to induce them to lend to unprofitable borrowers produces greater

5. For instance, Kane (1981) writes,

> Our explanation proceeds within the framework of the *regulatory dialectic* (Kane 1977). This concept embodies an interpretive version of cyclical interaction between political processes of *regulation* and economic processes of *regulatee avoidance* as opposing forces that, like riders on a seesaw, adapt continually to each other.

benefits than directly giving these borrowers a one dollar subsidy. There are many reasons why banks and other financial intermediaries may serve such a role (see, for example, Allen 1990; Berlin and Mester 1992; Ramakrishnan and Thakor 1984; Yavas 1992). This makes the government's role in bank credit allocation quite different from its role in taxing firms. In other words, the CRA, for example, is not just a tax on bank profits. It defines a credit allocation guideline that has far greater political implications than a revenue-equivalent tax on bank profits.

As we mentioned earlier, the formal literature on this is scant. The paper closest in spirit to ours is Buser, Chen, and Kane (1981) which argues that deposit insurance is purposefully underpriced to give the Federal Deposit Insurance Corporation (FDIC) the regulatory "carrot" with which to deter asset-substitution moral hazard. However, their argument is cast in the context of safety and soundness regulation. The point that bank regulation is motivated by considerations other than social welfare—such as personal reputation, effort-aversion and political gain—has been forcefully made both informally (Kane 1990) and formally (Boot and Thakor 1993 and Campbell, Chan, and Marino 1992). These papers, however, bear only tangentially upon the issues that are pivotal to the thesis of this paper.

What follows is organized in five sections. Section 1 presents the basic model. Section 2 examines bank-borrower and bank-depositor relations without deposit insurance and shows that, in an informationally constrained environment, the absence of a banking safety net can hurt real productivity by inducing banks' borrowers to invest in lower-valued projects. Section 3 introduces federal deposit insurance and shows that it realigns borrowers' incentives in favor of higher-valued projects, thereby generating an additional surplus, a real productivity gain. The role of deposit insurance in our model is therefore to improve bank asset quality, rather than serving the usual function of facilitating liquidity transformation (for example, Diamond and Dybvig 1983). Section 4 analyzes the barter arrangement between the government and banks and derives the bad Nash equilibrium. Section 5 concludes with a discussion of the policy implications, both for regulators and for banks. An interesting prediction of the model is that if costly fair-play regulation like the CRA is extended to nonbanks, the government will also extend the scope of subsidies to cover these institutions.

1. THE BASIC MODEL

A. Time Horizon and Sequence of Events

Consider a three-date, two-period setting with universal risk neutrality. At date 0 (the start of the first period), banks receive \$1 loan applications from borrowers. Each application is for a single-period loan, but the terms of loan granted in the second period can be predicated on the borrower's publicly observable repayment behavior with respect to the first-period loan. That is, credit history may play a role. The borrower finances a single-period project with the bank loan. There are no alternatives to bank loans. At date 1 (the end of the first period), the payoff on the borrower's project is realized and the bank loan is repaid if possible. The borrower may now request another bank loan to finance its second-period project. Such a project, if available, pays off at date 2 (the end of the second period).

B. Borrower Types

There are three types of borrowers at date 0: good (G) borrowers, bad (B) borrowers and underprivileged (U) borrowers. The G borrowers have access to a positive net-present-value (NPV) project at date 0 that requires a \$1 investment. If this project fails at date 1, it pays nothing and the borrower has the same second-period project as the B borrower had at date 0. But if the project succeeds at date 1, it pays $R > 0$. The probability of success is $\delta_0 \in (0, 1)$. Moreover, conditional on first-period success, the borrower will face a random second-period investment opportunity set. With probability $\gamma \in (0, 1)$, it will be able to choose between a "safe" and a "risky" second-period project. With probability $1 - \gamma$, it will have only the risky project. Each project requires a \$1 investment at date 1. The safe project pays R_s with probability $\delta_1 \in (0, 1)$ and 0 with probability $1 - \delta_1$ at date 2. The risky project pays R with probability δ_0 and 0 with probability $1 - \delta_0$. We assume $R_s < R$, $1 > \delta_1 > \delta_0 > 0$ and $\delta_1 R_s > \delta_0 R$. This sequence of events is depicted in Figure 1.

The B borrowers each have a single-period project available only at date 0; they have no visible projects available in the second period. Each borrower's project requires a \$1 investment and yields no contractible payoff at date 1. The U borrowers each need \$1 at date 0 to invest in a project that yields a contractible payoff of $Y_b < r_f$ at date 1. These borrowers have no second-period project. In recognition of the special monitoring role of banks, we assume that Y_b is attainable only with *bank* lending. With any other form of lending, the contractible payoff would be zero. From the bank's standpoint, the B and U borrowers are clearly negative NPV borrowers. Letting τ denote the borrower's type, we have $\tau \in \{G,B,U\}$. Define $T_{GB} \equiv \{G, B\}$ and $T \equiv \{G, B, U\}$. No borrower has any assets other than its projects.

Each borrower obtains a nontransferrable, noncontractible control rent of $N > 0$ regardless of borrower type and the outcome of the project. This control rent can be viewed as a personal gain to the manager in the borrowing firm that is beyond the bank's reach.[6] Most of our analysis focuses on borrowers in T_{GB}. It is only in section 3 that the U borrowers enter the analysis.

The term structure of interest rates is flat and nonstochastic and the single-period riskless interest factor (one plus the riskless interest rate) is r_f.

C. The Credit Market Structure and the Bank's Information

The credit market is perfectly competitive. That is, banks compete in Bertrand fashion, subject to their informational and screening-efficiency constraints. Each bank can observe whether a borrower has a project or not, and can also distinguish U borrowers from the others. However, the G and B borrowers appear observa-

6. See O'Hara (1993) for another paper in which noncontractible control rents play a role.

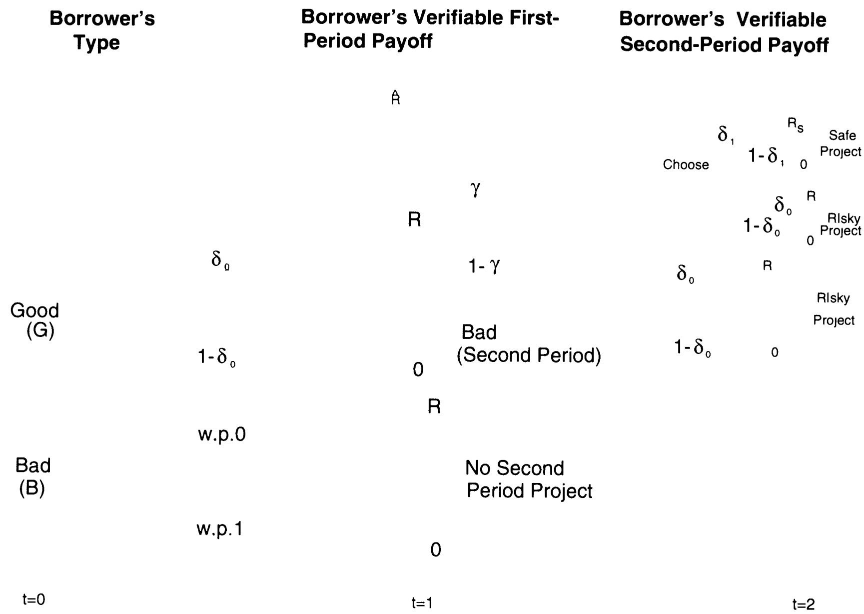

FIG. 1. Evolution of Borrower Types

tionally identical to all banks at date 0. In other words, every bank can tell a U borrower apart from the G and B borrowers, but none can a priori tell a G borrower apart from a B borrower. The bank's commonly known prior probabilities are

$$\Pr(\tau = G \mid \tau \in T_{GB}) = \theta \in (0, 1) \text{ and}$$
$$\Pr(\tau = B \mid \tau \in T_{GB}) = 1 - \theta \,.$$

A bank can expend a screening cost of $\$C > 0$ to obtain a noisy signal ϕ that facilitates sorting the G from the B borrowers. The probability distribution of ϕ is

$$\Pr(\phi = i \mid \tau = i) = \eta \in (0.5, 1), \text{ and}$$
$$\Pr(\phi = i \mid \tau \neq i) = 1 - \eta \;\forall i \in \{G, B\}, \tau \in \{G, B\} \,.$$

We assume that, at date 0, there are observationally distinct T_{GB} subsets of borrowers, with all borrowers within a particular subset being observationally identical. There is exactly one bank that has specialized in screening a particular subset, and this gives it a screening advantage over competitors in dealing with that subset. There are also some banks that are nonspecialists. For simplicity, we assume that the "specialist's" screening cost is 0, whereas all other banks must expend $C > 0$ to obtain the same signal. We impose the following parametric restriction:

$$\theta\delta_0 R < r_f \,. \tag{PR-1}$$

This restriction means that a bank will never wish to lend to a borrower from T_{GB} without screening. To see this, note that if the bank does not screen, it perceives a probability θ of lending to a G borrower, and if it lends to such a borrower, the highest interest factor it can charge is R. Since the G borrower's success probability is δ_0, the bank's expected payoff is $\theta\delta_0 R$. The risk-neutral bank demands an expected return of at least r_f on its loan.

Each specialist bank can earn a lending profit in the first period due to its screening advantage. In addition, we also endow banks with an *incumbency advantage* in the second period. A bank that has loaned to a G borrower at date 0 can observe the borrower's second-period investment opportunity set, conditional on first-period success; competing banks cannot. That is, we assume that *all* banks can observe whether a borrower succeeded or failed at date 1, but only the bank that loaned to the borrower can tell whether the borrower has a choice between the safe and the risky second-period project or whether it is locked into the risky project for the second period.[7]

In addition to lending, banks can also invest in marketable securities. For a \$1 investment at the beginning of the period, the bank can obtain a payoff of r_f/δ_m with probability $\delta_m \in (0, 1)$ and a payoff of zero with probability $1 - \delta_t m$.

At date 0 each bank raises \$1 in deposits and can invest it either in a loan or in marketable securities. Date 0 depositors are repaid at date 1 if the bank is solvent. New deposits in the amount of \$1 are raised at date 1 if the bank survives for the second period. Depositors are risk neutral and demand an expected payoff of r_f.

D. *Interbank Bidding*

Each borrower can approach multiple banks for its \$1 loan, and each bank must announce the loan interest rate it will charge if it decides to lend, prior to the results of its screening becoming known. Of course, the bank can decline to lend if its screening leads it to believe the borrower is likely to be B. Interbank competition at date 0 can potentially dissipate some of the future incumbency rents arising from the accumulation of proprietary information by the initial lender. In each period, the borrower solicits bids from multiple banks, and these bids must be submitted *simultaneously*. The borrower then picks the lowest bid.

If a borrower does not receive a loan at date 0, then we assume that it is shut out of the credit market for both periods. This is an innocuous assumption that merely simplifies the analysis.

E. *The Role of the Government*

The government is uniquely equipped to provide a safety net which in our model takes the form of deposit insurance. There are many reasons why the government

7. For other recent papers in which the incumbent bank gains an informational advantage during a lending relationship, see Besanko and Thakor (1993), Rajan (1992), and Sharpe (1990).

may have a special advantage in insuring bank deposits. Included are these: a potentially greater ability to diversify than private insurers,[8] an ability to tax in order to meet payout commitments during banking panics,[9] and an ability to provide the insurance at below the actuarially fair rate.[10]

The government also has a special interest in the U borrowers. For every dollar loaned by banks to these borrowers, incumbent politicians perceive a political gain of $P_G > 0$. This gain can be thought of as possibly arising from an enhanced probability of reelection for incumbents. There are two reasons why loans to the U borrowers can improve reelection chances. First, there may be a direct political benefit due to the creation of a stronger perception that those in office care about the underprivileged. Second, bank credit to such borrowers can partially ameliorate income disparities across different groups in society and ease social tension. Whatever the source of P_G, we simply assume that politicians have something to gain from asking banks to make loans that they otherwise would not, and that banks are averse to these loans not because they are prejudiced but because these loans are truly money-losing propositions. This is admittedly a rather Machiavellian view of government and a rather generous view of banks.

Another interpretation is that, in avoiding the U borrowers, bankers fail to internalize the costs of denying credit (riots and other forms of social unrest, for example). The politicians can be viewed as internalizing the externality. With this interpretation, one can think of three possibilities. One is that it is privately unprofitable for banks to lend to the U borrowers, but socially optimal for such lending to occur, given the negative externalties associated with credit denial. In this case, bankers are not bigoted, and total welfare is enhanced by the barter arrangement. A second possibility is that it is neither privately profitable for banks nor socially optimal to lend to the U borrowers, so that the barter arrangement is attributable solely to the private gains from political featherbedding, a deadweight social loss. Both these possibilities are consistent with our model. A third possibility is that it is both privately profitable for banks and socially beneficial to lend to the U borrowers, but banks abstain because they are prejudiced. In this case, the barter arrangement actually improves bank profits even apart from deposit insurance. This possibility, which is consistently featured in the arguments of community action groups, leads to a different type of model and is not formally explored here.

2. BANKING WITHOUT GOVERNMENT INTERVENTION

In this section we examine the equilibrium that obtains when banks finance with *uninsured* deposits. This provides a benchmark with which to assess the potential gains from deposit insurance. Our focus will be on borrowers in T_{GB} since banks will never wish to lend to the U borrowers without governmental persuasion.

8. See Chan, Greenbaum, and Thakor (1992).
9. See Diamond and Dybvig (1983).
10. See Chan, Greenbaum, and Thakor (1992).

A. The Second-Period Outcome

We proceed as usual with backward induction, starting with an analysis of the second-period outcome and then working back to the first period. Now, if the borrower received credit in the first period and then failed at date 1, the bank knows that the borrower was either a G borrower who was unlucky or a B borrower. An unlucky G borrower is a B borrower in the second period, whereas a first-period B borrower has no second-period project. In either case, the bank extends no loan in the second period.

What about a borrower who received a first-period loan and succeeded in the first period? The borrower's first-period success makes it common knowledge that the borrower was G in the first period. Competing banks know that the borrower either has a choice between the safe and the risky second-period projects or has just the risky project. The incumbent bank knows precisely, however, whether the borrower has a second-period project choice or not.

If we assume that the borrower will prefer the safe project when it has a choice, then a competing bank knows that the probability is γ that the borrower's second-period success probability is δ_1 and $1 - \gamma$ that it is δ_0. That is, the *expected* second-period success probability, assessed at date 1, is

$$\bar{\delta} \equiv \gamma\delta_1 + [1 - \gamma]\delta_0 \ .$$

Earlier we assumed that $\delta_1 R_s > \delta_0 R$. We restate this parametric restriction now in terms of an *interval* of permissible values for the expected value of the safe project.

$$\delta_1 R_s \in (\delta_0 R + [\delta_1 - \delta_0][\delta_1]^{-1} r_f \, , \qquad \delta_0 R + [\delta_1 - \delta_0][\bar{\delta}]^{-1} r_f) \ . \qquad \text{(PR-2)}$$

The idea behind (PR-2) is that the borrower prefers the safe project to the risky project, but not by "too much." That is, the borrower's preference depends also on the interest rate charged on the second-period loan, and if this rate is high enough, the borrower's preference will switch to the risky project. This potential asset-substitution moral hazard will play a key role in the analysis.

Let i^* be the "cutoff" interest factor at which the borrower is indifferent between the safe and risky projects. That is, i^* solves

$$\delta_1[R_s - i^*] + N = \delta_0[R - i^*] + N \ ,$$

which yields

$$i^* = \frac{\delta_1 R_s - \delta_0 R}{\delta_1 - \delta_0} \ . \qquad (1)$$

Given (PR-2), it is transparent that

$$r_f/\bar{\delta} > i^* > r_f/\delta_1 \ . \qquad (2)$$

We can now characterize the second-period interest factors faced by the borrower. Throughout we shall assume that the borrower prefers the incumbent bank if it offers the same rate as competitors.

PROPOSITION 1: *A borrower that defaulted on its first-period loan is denied second-period credit by all banks. A borrower that has repaid its first-period loan will borrow from the incumbent bank at r_f/δ_0 in the second period. The bank earns zero expected profit on its second-period loan.*

PROOF: We have already established that a borrower that defaults on first-period credit will be shut out of the credit market in the second period. So consider now a borrower that has repaid its first-period loan. Since a bank can invest in marketable securities and must finance itself with uninsured deposits, its reservation price on lending will be its expected payoff on marketable securities, that is, $(r_f/\delta_m) \times \delta_m = r_f$. Thus, faced with a borrower with success probability δ, the bank will have a reservation price of r_f/δ.

Let i_{min} be a competing bank's reservation interest factor when it knows only that the probability is γ that the borrower has a project choice and it is $1 - \gamma$ that the borrower is locked into the risky project. That is, if the competing bank assumes that $i_{min} < i^*$, then i_{min} solves

$$\gamma\delta_1 i_{min} + [1 - \gamma]\delta_0 i_{min} = r_f \, .$$

This yields

$$i_{min} = \frac{r_f}{\gamma\delta_1 + [1 - \gamma]\delta_0} = r_f/\bar{\delta} \, . \tag{3}$$

Given (2), we see that $i_{min} > i^*$. Thus, any competing bank must assume that the borrower will choose the risky project if it borrows at i_{min}. Consequently, the *lowest* interest factor the competing bank can offer is

$$i_{com} = r_f/\delta_0 \, . \tag{4}$$

Consider now the incumbent bank's problem. If the borrower can choose between the safe and risky projects, then the bank would like to lend to the borrower at $i^* - \epsilon$, with ϵ an arbitrarily small positive scalar. If the borrower were to accept a loan at this price, its success probability would be δ_1 since it would choose the safe project. Since $i^* > r_f/\delta_1$, the incumbent would earn a positive expected profit on the loan if it could raise deposits at r_f/δ_1. This would be possible if depositors had the same information as the bank about the borrower. However, depositors are no more informed than competing banks. Thus, they will demand an interest factor of $r_f/\bar{\delta}$. But from (3), we know that $r_f/\bar{\delta} = i_{min} > i^*$. This means that if deposits are forthcoming at i_{min}, then the bank will lose money if it lends at i^* (even though this resolves the asset-substitution moral hazard problem vis à vis the borrower) and will earn positive expected profit if it lends at r_f/δ_0.

To see this, suppose the bank prices at i^* when the borrower has a project choice and at r_f/δ_0 when the borrower is locked into the risky project. Then its expected profit is

$$\delta_1[i^* - r_f/\bar{\delta}] < 0$$

when the borrower has a project choice and

$$\delta_0[r_f/\delta_0 - r_f/\bar{\delta}] > 0$$

when the borrower has no project choice. But if the bank prices at r_f/δ_0 even when the borrower has a project choice, then its expected profit will be

$$\delta_0[r_f/\delta_0 - r_f/\bar{\delta}] > 0 \ .$$

Thus, the subgame perfect strategy is for the incumbent bank to price its loan at r_f/δ_0, ignoring its own private information about the borrower. Recognizing this ex ante, depositors will price deposits at r_f/δ_0 rather than $r_f/\bar{\delta}$, and the bank will earn zero expected profit. Since all banks offer the same price to the borrower, it will stay with the incumbent bank for a second period. ■

The intuition is as follows. Although the uninsured depositors know that their bank is incumbent, they are unable to distinguish between two states—the one in which the borrower has a choice between the safe and the risky project and the one in which the borrower is locked into the risky project. Given the asymmetric information between the depositors and the bank, the depositors recognize that the bank manager will misrepresent his private information about the state in order to raise deposits at r_f/δ_1 regardless of the true state; doing so benefits the bank's shareholders. They are thus compelled to price their deposits at no less than $r_f/\bar{\delta}$, but this leads to an asset-substitution moral hazard problem between the bank and the uninsured depositors (who hold a debt contract), resulting in the bank pricing its loan in such a way that the borrower is induced to invest in the risky project. Consequently, there is a real productivity loss through a lowering of the net project-related surplus of $\delta_1 R_s - \delta_0 R$. Thus, what dooms the incumbent bank's ability to exploit its second-period informational advantage is the informational asymmetry between the bank and uninsured depositors and the consequent agency problem. We turn now to the first-period outcome.

B. First-Period Outcome

We have just established that the borrower's second-period interest factor is r_f/δ_0, conditional on first-period success. And since the bank earns zero expected profit in the second period, interbank competition implies that its first-period interest factor should also be set so as to yield the bank zero expected profit. Moreover, the bank will be closed at date 1 if its first-period loan defaults. The reason is that second-period deposits will be impossible to raise, given that first-period depositors would have priority over second-period depositors for date-2 payments. We can now characterize the date-0 equilibrium. We define i_1 as the interest factor on the first-period loan.

PROPOSITION 2: *In a competitive date-0 Nash equilibrium with uninsured deposits:*

(i) Each borrower that applies for credit is promised the following schedule of interest factors:

$$i_1 = [Cr_f + r_f][\eta\theta + \{1 - \eta\}\{1 - \theta\}][\delta_0\eta\theta]^{-1} , \tag{5}$$

conditional on the bank's agreeing to lend to the borrower, and $i_2 = r_f/\delta_0$ if the borrower repays the first-period loan, with no second-period credit being extended if the borrower defaults on the first-period loan. This rate schedule is offered to the borrower prior to the screening result becoming known.

(ii) Even though the borrower may apply to multiple banks, only the bank that is specialized in screening the T_{GB} subset to which the borrower belongs will actually screen the borrower and possibly offer it credit.

(iii) Each specialist bank earns an expected profit of C over its two-period horizon on the loan it makes, and an expected profit of zero on its investment in marketable securities.

(iv) The expected two-period utility of a G borrower is

$$U_G = \eta\{r_f^{-1}\delta_0[R - i_1] + \delta_0^2 r_f^{-2}[R - i_2] + [r_f^{-1} + r_f^{-2}\delta_0]N\} \tag{6}$$

and that of a B borrower is

$$U_B = [1 - \eta]r_f^{-1}N . \tag{7}$$

PROOF: To prove (i), we only need to verify (5) since Proposition 1 establishes i_2 and the rest follows from the assumed structure of the game. Now, interbank competition in bidding means that each bank must bid a price no higher than the lowest price any competitor can bid. Since the specialist bank is unique, this is the lowest price that a nonspecialist can bid. Given zero expected profit on the second-period loan, the i_1 that yields a non-specialist its reservation profit is the solution to

$$r_f^{-1}\Pr(\tau = G \mid \phi = G)$$
$$\times \Pr(\textit{borrower succeeds in first period} \mid \tau = G)[i_1 - r_d] - C = 0 \tag{8}$$

where r_d is the repayment promised depositors and is such that it yields them an expected return of r_f. That is, we have $r_d = r_f/\{\delta_0 \Pr(\tau = G \mid \phi = G)\}$. Note that equation (8) follows from the fact that the screen is informative, so that the bank will lend if $\phi = G$ and decline to lend if $\phi = B$. Using Bayes rule we get

$$\Pr(\tau = G \mid \phi = G) = \frac{\eta\theta}{\eta\theta + [1 - \eta][1 - \theta]} . \tag{9}$$

Substituting (9) in (8) and rearranging gives us (5).

As for (ii), a bank knows that it can earn a higher expected profit (C) lending to a borrower from a subset for which the bank is a specialist. Thus, it will screen a borrower only from the T_{GB} subset in which it specializes. A bank that is not a specialist for any T_{GB} will bid but will not screen as long as there is a specialist bidding a competitive price. This is because it cannot then win the bid unless the specialist rejects the borrower, and losing the bid means losing its screening cost of C. And if it wins the bid when the specialist rejects the borrower, then its expected profit is negative even if it can charge the borrower a monopoly price. To see this, note that the expected profit of a nonspecialist from screening a rejected borrower and then lending at R (the monopoly price) if its screen reveals $\phi = G$ is given by

$$\begin{aligned} &\Pr(\tau = G \mid \phi = B \textit{ for another bank}) \\ &\quad \times \Pr(\phi = G \textit{ for nonspecialist} \mid \tau = G)\delta_0[R - r_d] - C , \end{aligned} \tag{10}$$

where r_d is the repayment promised depositors. By Bayes rule, we have

$$\begin{aligned} &\Pr(\tau = G \mid \phi = B \textit{ for another bank}) \times \Pr(\phi = G \textit{ for nonspecialist} \mid \tau = G) \\ &\quad = \frac{[1 - \eta]\theta\eta}{[1 - \eta]\theta + \eta[1 - \theta]} \end{aligned} \tag{11}$$

and

$$r_d = \frac{r_f[\eta\{1 - \theta\} + \{1 - \eta\}\theta]}{[1 - \eta]\theta\eta\delta_0} . \tag{12}$$

Substituting (11) and (12) in (10), we see that (10) will be negative if

$$R < \frac{\{[1 - \eta]\theta + \eta[1 - \theta]\}\{C + r_f\}}{\theta\eta[1 - \eta]\delta_0} . \tag{13}$$

It is apparent that (PR-1) implies that (13) holds since $r_f/\theta\delta_0 < \{r_f/\theta\delta_0\}\{\theta[1 - \eta] + \eta[1 - \theta]/\eta[1 - \eta]\}$.

As for (iii), note that (5) implies that the specialist bank earns an expected profit of C on its first-period loan, given that its deposit funding cost has an expected value of r_f. The expected profit on its second-period loan is zero. And the expected profit on investment in marketable securities is also zero since deposits are priced to yield depositors the same expected return (r_f) as that on marketable securities.

Finally, U_G in (iv) follows from the observation that a G borrower can invest in the first-period project only if screening reveals $\phi = G$ (probability η) and that the second-period project is available only if the first-period loan is granted and repaid. U_B follows from the observation that a B borrower will be screened as $\phi = G$ with probability $1 - \eta$, and if the borrower receives credit its only payoff is the control rent N. ■

This proposition asserts that the only excess profit a bank can earn in equilibrium is C. This rent comes from the specialist bank's screening advantage. In the first period, a G borrower pays an interest rate that impounds the screening cost C, the bank's cost of deposit funding, and an add-on that reflects the bank's expected loss due to noise in the screening technology.[11] We will see in the next section how deposit insurance not only alters these features of the equilibrium but also eliminates the second-period investment distortion we discussed earlier.

3. BANKING WITH DEPOSIT INSURANCE

We now introduce a government safety net through federal deposit insurance. This insurance is complete and priced at zero so as to give insured banks a subsidy. Deposits are now riskless, so that the bank's repayment obligation is r_f per dollar of deposits. One implication of this is that the bank will be kept open for two periods regardless of the first-period outcome. We will proceed as in the previous section, with the second-period analyzed first.

A. Second-Period Outcome

Deposit insurance changes the bank's reservation price for lending. Assuming that deposit insurance does not affect the "no-arbitrage" price of a marketable security,[12] such a security will continue to promise r_f/δ_m in the successful state for each dollar invested. The bank, which can now finance with riskless deposits, assesses its net expected profit on marketable securities as

$$\alpha_m = \delta_m \left[\frac{r_f}{\delta_m} - r_f \right] = r_f[1 - \delta_m] > 0 \ . \tag{14}$$

11. This should be contrasted with Thakor (1993) where the borrower pays C *only* in some states of nature. The reason is that all banks are equally proficient in screening any borrower.

12. This means that we are assuming that banks are relatively "small" players in the securities market. This assumption is not crucial. All that is needed is that banks' demand for marketable securities is not so high relative to the total demand that *all* of the deposit insurance subsidy is transferred to the securities market through an increase in the price of marketable securities.

Thus, α_m will be the bank's reservation profit level on loans. Note that this reservation profit level was zero without deposit insurance and is positive with deposit insurance.

Now, a bank that faces a borrower with known success probability δ will have a reservation interest factor of $\hat{\imath}(\delta)$, where $\hat{\imath}(\delta)$ solves (hats are used to delineate the deposit-insurance case)

$$\delta[\hat{\imath}(\delta) - r_f] = \alpha_m \ ,$$

which implies

$$\hat{\imath}(\delta) = \frac{r_f}{\delta} + \frac{[\delta - \delta_m]r_f}{\delta} \ . \tag{15}$$

If we assume that $\delta_m > \delta$ (that is, marketable securities are safer than the loan with success probability δ), then the competitive loan interest factor, $\hat{\imath}(\delta)$, is *lower* than r_f/δ, the corresponding interest factor in the no-deposit-insurance case. Thus, the deposit insurance subsidy is being shared between the bank and the borrower.[13] On the other hand, if $\delta_m < \delta$, then $\hat{\imath}(\delta) > r_f/\delta$. To simplify what follows, we will assume that $\delta_1 = \delta_m$. Thus, $\hat{\imath}(\delta_1) = r_f/\delta_1$ and

$$\hat{\imath}(\delta_0) = \frac{r_f}{\delta_0} - \frac{[\delta_1 - \delta_0]r_f}{\delta_0} < \frac{r_f}{\delta_0} \ . \tag{16}$$

That is, the δ_1-borrower does not receive any of the deposit insurance subsidy, whereas the δ_0-borrower receives a portion of it. We can now characterize the second-period outcome.

PROPOSITION 3: *A borrower that defaults on its first-period loan will be denied credit by all banks. A borrower that repays its first-period loan will borrow from the incumbent bank at a second-period interest factor given by the following:*

$$\hat{\imath}_2 = \begin{cases} i^* & \text{if the borrower has a project choice} \\ \hat{\imath}(\delta_0) & \text{if the borrower is locked into the risky project} \end{cases} \tag{17}$$

where i^* is given in (1) *and $\hat{\imath}(\delta_0)$ in* (16). *The incumbent bank earns an expected profit in excess of its reservation price when the borrower has a project choice, and in that case the borrower invests in the safe project.*

PROOF: The case of the defaulting borrower is the same as the no-insurance case, so we will focus only on the borrower that has repaid its first-period loan. Consider

13. The reason for this is straightforward. When $\delta_m > \delta$, the loan is riskier than the marketable security. Given the put-option nature of deposit insurance (see, for example, Merton 1977), the loan is more valuable to the bank, ceteris paribus. Interbank competition ensures that enough of the additional value will be passed along to the borrower through a lower loan interest rate to ensure the bank's indifference between lending and investing in the marketable security.

first the decision problem of an incumbent bank confronted with a successful borrower at date 1. If the incumbent bank knows that the borrower is locked into the risky project, then it will bid its reservation price, $\hat{\imath}(\delta_0)$; any higher bid would cause the borrower to migrate to a competing bank. To see this, note that (15) implies that competing banks could offer the borrower an interest factor of

$$\hat{\imath}_{com} = [r_f/\bar{\delta}] - [\delta_1 - \bar{\delta}][r_f/\bar{\delta}] \; . \tag{18}$$

This is the "break-even" interest factor, given the competing bank's information set. But in this case the competing bank knows that it can never attract a borrower that has a project choice because $\hat{\imath}_{com} > i^*$.[14] Rather, it can at best hope to attract only a borrower locked into the risky project. Thus, a competing bank will offer an interest factor of $\hat{\imath}(\delta_0)$, which means that this is the interest factor that the incumbent bank will charge.

Consider now a borrower that has a project choice. If the incumbent sets $\hat{\imath}_2 = \hat{\imath}(\delta_0)$, the borrower will choose the risky project and the bank's expected profit is

$$\delta[i^* - r_f] > \delta_1 \left[\frac{r_f}{\delta_1} - r_f\right] = \delta_1[\hat{\imath}(\delta_1) - r_f] = \alpha_m \qquad \text{[by (15)]} \; .$$

This means that the incumbent bank is better off setting the interest factor at i^* because the borrower selects the safe project and the bank's expected profit exceeds α_m.

We turn now to competing banks. As argued earlier in the proof, a competing bank cannot hope to lure the borrower away by setting the interest factor at $\hat{\imath}_{com}$ or $\hat{\imath}(\delta_0)$. Another strategy would be for the competing bank to offer i^*. If the borrower has a project choice, the bank will earn an expected profit exceeding α_m. If the borrower has no project choice, the bank will earn an expected profit below α_m. Could the overall expected profit then be greater than or equal to α_m? The answer is no. To see this, we write the bank's overall expected profit from this strategy as

$$\gamma\delta_1[i^* - r_f] + [1 - \gamma]\delta_0[i^* - r_f] \; . \tag{20}$$

We want to prove that (20) is less than $\alpha_m = r_f[1 - \delta_1]$. That is, we want to show that

$$\gamma\delta_1 i^* + [1 - \gamma]\delta_0 i^* < r_f[1 - \delta_1] + r_f[\gamma\delta_1 + [1 - \gamma]\delta_0] \; . \tag{21}$$

Rearranging (21), we see that we need to show that

14. To see this, note that we need to ask if it is true that

$$\hat{\imath}_{com} + [r_f/\bar{\delta}] - [\delta_1 - \bar{\delta}] > r_f/\delta_1 \text{ or } [r_f/\bar{\delta}] - [r_f/\delta_1] > [\delta_1 - \bar{\delta}][r_f/\bar{\delta}] \text{ or } [\delta_1 - \bar{\delta}][\delta_1\bar{\delta}]^{-1}$$
$$> [\delta_1 - \bar{\delta}][\bar{\delta}]^{-1} \text{ which is true since } \frac{1}{\delta_1} > 1.$$

$$i^* < [1 - \delta_1][r_f/\bar{\delta}] + r_f = \hat{\imath}_{com} \qquad \text{[using (18)]} .$$

Since we have already proved the $\hat{\imath}_{com} > i^*$, we see that (21) holds. Hence, a competing bank will not offer i^*. We have proved, therefore, that a successful borrower will take its second-period loan from the incumbent bank at the terms indicated in (17). ■

Proposition 3 explains how deposit insurance alters the equilibrium. First, the incumbent bank earns an expected profit that exceeds its reservation price. This is due to the incumbent's position as an information monopolist in the second period, and it is a familiar result from the existing literature (for example, Besanko and Thakor 1993; Rajan 1992; and Sharpe 1990).[15] What our analysis emphasizes is that deposit insurance—or some other form of guarantee that makes deposits riskless—plays a critical role in sustaining such ex post rents. Second, the borrower invests in the higher-valued safe project. Thus, deposit insurance helps to eliminate the investment distortion encountered in the previous section, and thereby creates a real productivity gain.

The reason why deposit insurance serves this function is that it desensitizes deposit pricing to the attributes of the bank's asset portfolio. This enables the incumbent bank to "fine-tune" its loan pricing based on its proprietary information even when such information cannot be (costlessly) communicated to depositors.

B. First-Period Outcome

Let $\hat{\imath}_1$ represent the first-period interest factor for a borrower that repaid its first-period loan. To compute this interest factor, we need to first write down the bank's two-period expected profit from investing in a loan. This is given by

$$\begin{aligned}\pi_L = {} & r_f^{-1} \times \Pr(\tau = G \mid \phi = G)\{\delta_0[\hat{\imath}_i - r_f] + \delta_0\gamma\delta_1[i^* - r_f]r_f^{-1} \\ & + \delta_0[1 - \gamma]\delta_0[\hat{\imath}(\delta_0) - r_f]r_f^{-1} + [1 - \delta_0]\alpha_m r_f^{-1}\} + r_f^{-1} \\ & \times \Pr(\tau = B \mid \phi = G)\alpha_m r_f^{-1} - C \, . \end{aligned} \tag{22}$$

To understand (22), note that the first two terms are profit terms and the third (C) is a cost term. Consider the first term. The probability that the borrower granted a loan (that is, one for whom $\phi = G$) is G is multiplied by the discounted (at r_f) present value of the bank's two-period expected profit in lending to a G borrower. This expected profit, contained within the braces in the first term in (22), has four components. First there is $\delta_0[\hat{\imath} - r_f]$, the expected profit on the first-period loan.

15. Two other papers have analyzed relationship banking in somewhat similar settings. In Petersen and Rajan (1993), there is a similar private-information-cum-moral-hazard problem, with the moral hazard occurring in the first period. There is thus an endogenously created upper bound on the first-period interest rate, with the possibility of future monopoly rents. Whereas deposit insurance helps to restore efficient asset choice incentives in our model, banks' monopoly power facilitates that in their model. Wilson (1993) develops a multiperiod model in which the bank offers subsidized services to induce the borrower to develop only one banking relationship and pay monopoly rents later.

Then there is $\delta_0\gamma\delta_1[i^* - r_f]r_f^{-1}$ in which $\delta_1[i^* - r_f]r_f^{-1}$ is the present value of the expected profit on the second-period loan when the borrower chooses the safe project and $\delta_0\gamma$ is the joint probability that the borrower will experience first-period project success *and* also have a second-period project choice. The third component is $\delta_0[1 - \gamma]\delta_0[\hat{\imath}(\delta_0) - r_f]r_f^{-1}$ in which $\delta_0[\hat{\imath}(\delta_0) - r_f]r_f^{-1}$ is the present value of the second-period expected profit if the borrower is locked into the risky project and $\delta_0[1 - \gamma]$ is the joint probability that the borrower will experience first-period project success *and* also have no choice but to invest in the risky project in the second period. Lastly, $[1 - \delta_0]\alpha_m r_f^{-1}$ consists of the probability of first-period default by the borrower $(1 - \delta_0)$ multiplied by the present value of the profit on the second-period investment in marketable securities necessitated by first-period borrower default. This last term follows from the observation that first-period default implies that the bank will be a nonspecialist competitor for second-period loans and, by the nature of the equilibrium, will not win any bids to lend. Hence, it must invest in marketable securities.

The second term in (22) is the expected two-period profit from lending (erroneously) to a B borrower. In the first period the bank gets nothing (the deposit insurance pays off depositors) and in the second period it receives the present value of investing in marketable securities. The last term (22) reflects the nonstochastic incidence of the screening cost at date 0. This cost term is in (22) despite the fact that the specialist bank's screening cost is zero. The reason is that this bank needs to bid its price down only to the lowest price its competitors can offer and thus it solves the *competitor's* problem in determining $\hat{\imath}_1$.

The alternative to lending is to invest in marketable securities in both periods. The bank's expected profit from doing so is

$$\pi_M = r_f^{-1}\alpha_m + r_f^{-2}\alpha_m \; . \tag{23}$$

Thus, the bank's total expected profit is

$$\pi_T = \Pr(\phi = G)\pi_L + \Pr(\phi = B)\pi_M \; . \tag{24}$$

That is, if the screen reveals $\phi = G$, the bank lends in the first period and its expected two-period profit is given by π_L. If the screen reveals $\phi = B$, the bank declines to lend in the first period and its expected two-period profit is given by π_M.

Interbank competition at date 0 ensures that the bank earns an expected two-period profit no greater than that attainable by investing in marketable securities in both periods. That is, the equilibrium condition determining $\hat{\imath}_1$ is

$$\pi_T = \pi_M \; . \tag{25}$$

We can now characterize the date-0 equilibrium.

PROPOSITION 4: *In a competitive date-0 Nash equilibrium with insured deposits:*

(i) Each borrower that applies for credit is promised the following schedule of interest factors:

$$\hat{\imath}_1 = \left\{ \begin{array}{l} [\alpha_m + C][\eta\theta + \{1 - \eta\}\{1 - \theta\}][\delta_0\eta\theta]^{-1} + \alpha_m r_f^{-1} + r_f \\ \qquad - \gamma\delta_1[i^* - r_f]r_f^{-1} - [1 - \gamma]\delta_0[i(\delta_0) - r_f]r_f^{-1} \end{array} \right\} \tag{26}$$

conditional on the bank's agreeing to lend to the borrower and $\hat{\imath}_2$ *given by* (17) *if the borrower repays the first-period loan, with no credit being extended if the borrower defaults on the first-period loan. This rate schedule is offered to the borrower prior to the first-period screening results becoming known.*

(ii) Even though the borrower may apply to multiple banks, only the bank that is specialized in screening the T_{GB} *subset to which the borrower belongs will actually screen the borrower and possibly offer it credit.*

(iii) Each specialist bank earns an expected profit of $C + \alpha_m r_f^{-1} + \alpha_m r_f^{-2}$ *over its two-period horizon on the loan it makes.*

(iv) The expected two-period utility of a G borrower is

$$\begin{aligned} \hat{U}_G = \eta\{ & r_f^{-1}\delta_0[R - \hat{\imath}_1] + r_f^{-2}\delta_0\delta_1\gamma[R_s - i^*] \\ & + r_f^{-2}\delta_0^2[1 - \gamma][R - \hat{\imath}(\delta_0)] + [r_f^{-1} + \bar{\delta}r_f^{-2}]N\} \end{aligned} \tag{27}$$

and that of a B borrower is

$$\hat{U}_B = [1 - \eta]r_f^{-1}N \ . \tag{28}$$

(v) the equilibrium with deposit insurance strictly Pareto dominates that without deposit insurance, with $\hat{U}_G > U_G$, $\hat{U}_B = U_B$ *and strictly higher expected profits for banks.*

PROOF: To prove (i), all that we need to do is to establish (26). We define

$$\begin{aligned} \Psi \equiv\ & \delta_0[\hat{\imath}_1 - r_f] + r_f^{-1}\delta_0\gamma\delta_1[i^* - r_f] + r_f^{-1}\delta_0^2[1 - \gamma][\hat{\imath}(\delta_0) - r_f] \\ & + r_f^{-1}\alpha_m[1 - \delta_0] \ . \end{aligned}$$

Now substituting (23) and (24) in (25) yields

$$\pi_M = \Pr(\phi = G)\pi_L + \Pr(\phi = B)\pi_M \ .$$

This means

$$\pi_M[1 - \Pr(\phi = B)] = \pi_L \Pr(\phi = G) \ ,$$

giving us the equilibrium pricing condition:

$$\pi_m = \pi_L \ . \tag{29}$$

Substituting (22) and (23) in (29) yields

$$\Psi \Pr(\tau = G \mid \phi = G) + r_f^{-1}\alpha_m \Pr(\tau = B \mid \phi = G) - Cr_f = \alpha_m + r_f^{-1}\alpha_m \ .$$

Rearranging gives us

$$\Psi = \frac{\alpha_m + Cr_f}{\Pr(\tau = G \mid \phi = G)} + r_f^{-1}\alpha_m \ .$$

Substituting for Ψ in the above equation and rearranging allows us to write

$$\begin{aligned} \delta_0 \hat{\imath}_1 = {} & \frac{\alpha_m + Cr_f}{\Pr(\tau = G \mid \phi = G)} + r_f^{-1}\alpha_m - [1 - \delta_0] r_f^{-1}\alpha_m \\ & - \mathrm{r}_\mathrm{f}^{-1}\delta_0\gamma\delta_1[i^* - r_f] \\ & - \delta_0^2[1 - \gamma] r_f^{-1}[\hat{\imath}(\delta_0) - r_f] + \delta_0 r_f \ . \end{aligned} \tag{30}$$

Substituting for $\Pr(\tau = G \mid \phi = G)$ from (9) and canceling terms in (30) now gives us (26).

We have already proved (ii), so we shall move on to (iii). In the second period the bank makes an expected profit of α_m, the present value of which is $r_f^{-2}\alpha_m$. In the first period the bank's expected profit is $C + r_f^{-1}\alpha_m$. Thus, the bank's total expected profit over two periods is $C + r_f^{-1}\alpha_m + r_f^{-2}\alpha_m$.

Note that (iv) is obvious and corresponds to a similar result in Proposition 2. We now turn to (v). It is obvious that $\hat{U}_B = U_B$, that is, the B borrower experiences the same expected utility with or without deposit insurance. Moreover, the specialist bank's expected profit with deposit insurance, $C + \alpha_m[r_f^{-1} + r_f^{-2}]$, is strictly greater than its expected profit without deposit insurance, C. Nonspecialist banks each experience an expected profit of $\alpha_m[r_f^{-1} + r_f^{-2}]$ which is positive, whereas each of these banks earns zero expected profit without deposit insurance. All that remains is to show that $\hat{U}_G > U_G$.

To prove this, note that in the second period the borrower faces a lower interest rate with deposit insurance regardless of whether it has a project choice or not, since $i^* < i(\delta_0)$ and $\hat{\imath}(\delta_0) < i(\delta_0)$. We will now show that the borrower faces a lower first-period interest rate as well. To do this, we note that $\delta_0[\hat{\imath}(\delta_0) - r_f] = \alpha_m$, so that we can write (26) as

$$\begin{aligned} \hat{\imath}_1 = {} & \frac{\alpha_m + Cr_f}{\delta_0 \Pr(\tau = G \mid \phi = G)} + \alpha_m r_f^{-1} - \gamma\delta_1[i^* - r_f] r_f^{-1} \\ & - r_f^{-1}[1 - \gamma]\alpha_m + r_f \ . \end{aligned} \tag{31}$$

Noting the $\delta_1[\hat{\imath}(\delta_1) - r_f] = \alpha_m$ and $i^* > i(\delta_1)$, we have

$$\begin{aligned}
\hat{\imath}_1 &< \frac{\alpha_m + Cr_f}{\delta_0 \Pr(\tau = G \mid \phi = G)} + \alpha_m r_f^{-1} - \gamma\delta_1[\hat{\imath}(\delta_1)] - r_f]r_f^{-1} - r_f[1 - \gamma]\alpha_m + r_f \\
&= \frac{\alpha_m + Cr_f}{\delta_0 \Pr(\tau = G \mid \phi = G)} + \alpha_m r_f^{-1} - r_f^{-1}\alpha_m\gamma - r_f^{-1}\alpha_m[1 - \gamma] + r_f \\
&= \frac{\alpha_m + Cr_f}{\delta_0 \Pr(\tau = G \mid \phi = G)} + r_f \\
&= \frac{r_f[1 - \delta_1] + Cr_f}{\delta_0 \Pr(\tau = G \mid \phi = G)} + r_f \\
&= i_1 - \frac{r_f\delta_1}{\delta_0 \Pr(\tau = G \mid \phi = G)} + r_f \text{(using (5) and (9)} \\
&< i_1 \text{ (since } \delta_1 > \delta_0 \Pr(\tau = G \mid \phi = G)) .
\end{aligned}$$

Thus, $\hat{\imath}_1 < i_1$, which implies $\hat{U}_G > U_G$. ∎

Deposit insurance benefits banks and borrowers in two ways. First, as we saw in Proposition 1, the G borrowers invest in higher-valued safe projects when there is deposit insurance. That is, deposit insurance improves asset quality. Second, deposit insurance creates a surplus due to underpricing that is shared by the bank and the borrower; this surplus is available even if the bank invests its deposits in marketable securities. This second benefit is unimportant for the result that deposit insurance is welfare improving. Even if deposit insurance is fairly priced, the premium will simply represent a fixed amount that is equal to the deposit insurer's expected insurance liability and is paid up front by the bank.[16] Deposits will still be riskless and hence the first effect will be present. What the second effect makes possible is a barter arrangement between banks and the government which we analyze in the next section.

4. DEPOSIT INSURANCE AND FAIR-PLAY REGULATION

Thus far we have considered only the G and B borrowers. We now include the U borrowers in our analysis. One can think of these borrowers as belonging to low-income or other socially/economically disadvantaged groups that attract political attention. In the context of U.S. fair-play regulation, these are groups that would be protected in credit allocation by regulations such as the Home Mortgage Disclosure Act (HMDA) and the CRA.

Since the contractible payoff from the U borrower's project is realized *only* with bank lending, credit to these borrowers is allocated most efficiently by banks. More-

16. This is true even if deposit insurance is risk sensitive as in Chan, Greenbaum, and Thakor (1992).

over, we will now assume that the government (which provides deposit insurance) permits each bank an additional $\$d$ of deposits at date 0, with date-1 deposits unchanged. Thus, each bank now raises $\$(1 + d)$ in deposits at date 0, but it is required by the government to invest $\$d$ in a U borrower. The bank is free to do what it wishes with the other dollar of deposits. Further, since the U borrowers exist only in the first period, this restriction applies only at date 0.

For every dollar invested in U at date 0, the bank receives $\$y_b < r_f$ for sure at date 1. Since the bank must still pay depositors r_f, the difference $r_f - Y_b$ must come from the bank's shareholders. The bank's net loss per dollar, including the opportunity cost of foregoing the marketable security investment, is

$$L \equiv \alpha_m + r_f - Y_b = r_f[2 - \delta_1] - Y_b\ . \tag{32}$$

We will assume that

$$P_G > r_f[2 - \delta_1] - Y_b\ . \tag{PR-3}$$

This parametric restriction ensures that there is a net "social benefit" to funding U borrowers. Also assume constant returns to scale so that if $\$d$ is invested in U borrowers, the payoffs are dY_b, dG, and dN.

The increase in a bank's profit due to deposit insurance is $\beta \equiv \alpha_m[r_f^{-1} + r_f^{-2}]$. If the "price" of obtaining deposit insurance is complying with fair-play regulation, then the net surplus for the bank from deposit insurance and fair-play regulation is $\beta - d_iL$, where d_i is the investment in U borrowers required of bank i. We now permit d_i to vary cross-sectionally. For the "barter" arrangement to satisfy a bank's participation constraint, we need $\beta - d_iL \geq 0$. Suppose that initially this participation constraint is satisfied for each bank. However, the next proposition asserts that this could change over time.

PROPOSITION 5: *Suppose $C < \hat{U}_G - U_G$. Then at some point in time after banks agree to a "barter" arrangement with the government, it is possible to have a Nash equilibrium in which $\beta - d_iL > 0$ for a fraction $f \in (0,1)$ of the banks in the industry and $-C < \beta - d_iL < 0$ for the remaining fraction $(1 - f)$ of banks.*

PROOF: Consider the banks for which $\beta - d_iL < 0$. If such a bank quits the deposit insurance system, the *best* it can do for a borrower will be an expected utility of $U_G + C$ for the borrower, that is, the equilibrium utility of U_G in the uninsured case plus a reduction in price equal to the specialist's screening cost C. However, since $C < \hat{U}_G - U_G$, the borrower would be better off obtaining a loan from a bank with access to deposit insurance. Hence, a bank that quits the deposit insurance system cannot hope to attract any borrowers and will therefore earn no more than zero expected profit. If it stays within the system, its net expected profit is $\beta - d_iL + C$, which is positive since $-C < \beta - d_iL$. This means that the bank will stay within the insurance system even though its expected profit $\beta - d_iL + C$ is *lower* than its expected profit, C, if *all* banks were uninsured.

To establish this as a Nash equilibrium, consider the strategy of a bank for which $\beta - d_iL > 0$. It is clearly a dominant strategy for this bank to seek deposit insurance. Now consider a bank for which $\beta - d_iL < 0$. If it believes that all other banks will quit the system, then its optimal strategy is also to quit. On the other hand, if it believes that the banks for which $\beta - d_iL > 0$ will not quit the system, then its optimal strategy is also not to quit. Note, however, that since not quitting is a dominant strategy for the banks for which $\beta - d_iL > 0$, the belief that these banks will quit is *not rationalizable*. ■

This proposition asserts that it is possible for deposit insurance to make some banks worse off and yet they are "trapped" in that it is not in their best interest to quit the insurance system. This happens because of an interbank *coordination problem*. Note that the Nash equilibrium in Proposition 5 can arise even if the *aggregate* net benefit to banks from deposit insurance is negative, that is, even if $\Sigma_{i=1}^{\mathbb{N}}(\beta - d_iL) < 0$ where $\mathbb{N}$ is the total number of banks in the industry and d_i is the dollar investment in U borrowers mandated by fair-play regulation for bank i. This means that the banking industry as a whole would be worse off with deposit insurance, and yet an interbank coordination failure could keep the industry from being united in its rejection of federal deposit insurance. In anticipation of this, the government could impose an ever-expanding web of fair-play regulations that could escalate regulatory compliance costs for banks.[17] In a recent study (see Thakor and Beltz 1993) we found that the average cost of complying with fair-play regulations is 18.3 percent of net bank income. Moreover, this percentage is greater for smaller banks.

This interbank coordination failure arises when C is sufficiently low (that is, lower than $\hat{U}_G - U_G$). This means that the coordination failure is likely when the advantage that a specialist bank has over its competitors is small. Thus, when banks are undifferentiated relative to each other and deposit insurance is valuable (there is a wedge between $\hat{U}_G$ and U_G), the coordination failure leading to a regulatory trap is likely.

Another point worth noting is that there may be banks for which $\beta - d_iL + C < 0$ (we have formally not considered this case). These banks would then prefer to exit the system and forgo deposit insurance. Such banks could transform themselves into nonbank financial intermediaries. This may be one explanation for the growing share of nonbank intermediaries both in the market for consumer savings (deposits) and in the credit market.

How does the government decide which banks should experience $\beta - d_iL < 0$? This issue is outside the scope of our analysis, but we can conjecture that d_i will be greater for banks that, by virtue of their location and potential customer base, are better equipped to serve the U borrowers. This is also roughly consistent with our

17. Suppose P_G is an increasing and concave function of $\Sigma_{i=1}^{\mathbb{N}} d_i$, which means that the marginal political gain from allocating credit to the U borrowers diminishes as more credit is allocated to them. Then, since the losses suffered by the banking industry from governmental credit allocation are linearly increasing in $\Sigma_{i=1}^{\mathbb{N}} d_i$, at some point (PR-3) will be violated. What is interesting is that, as long as $\beta - d_iL > 0$ for a sufficiently large number of banks, there is nothing to preclude such an outcome. That is, the government forces so much credit allocation that the net "social benefit" of doing so is negative.

earlier empirical analysis (Thakor and Beltz 1993) in which we found that the regulatory compliance cost as a percentage of net income is higher for banks in larger-population locations.

There is also agreement that fair-play regulations have been increasing over time. One way to understand this phenomenon is to look at the financial support for federal programs for low and moderate-income housing. This support, measured in constant dollars, was reduced by more than half between 1980 and 1991. Moreover, federal support for rental housing has also shrunk significantly (see Garwood and Smith 1993). This implies a greater marginal political benefit to those in government from asking banks to do more to serve the U borrowers.

5. CONCLUSION

It is customary to consider safety regulation in banking as distinct from fair-play regulation since the two types of regulations serve distinct purposes. We have argued that these two types of regulations are intimately related and the interaction between economics and politics[18] that creates this link also leads to a significant role for the government in dictating the private allocation of credit. As a starting point, we assumed that the government mandated credit allocation to borrowers who are money-losing propositions for banks.[19] This does *not* mean that we believe that banks never reject creditworthy loan applicants. Indeed, there seems to be some evidence of redlining (see, for example, Duca and Rosenthal 1993). The point of this paper is not to debate whether banks discriminate illegally in lending. Rather, the point is that *even if* banks lend to every creditworthy loan applicant, the government may wish to dictate credit allocation in exchange for subsidies related to deposit insurance.

Our analysis has implications for government policymakers as well as bankers. From the government's standpoint, the barter arrangement involving deposit insurance and fair-play regulation is a very indirect credit allocation mechanism. If credit allocation is desirable, is this the best way to achieve it? Improvements are hard to contemplate, however, when the government refuses to admit its role in bank credit allocation.[20] In the meantime, the indirection in governmental policy transmission may continue to weaken some banks relative to less-regulated nonbank competitors that are exempt from fair-play regulations. This is perhaps only one of potentially many unintended distortions created by the implicit barter arrangement between the government and banks. As with other forms of indirect regulation, achieving a so-

18. Kane (1977) refers to this as the "regulatory dialectic."

19. One indication of this is that *minority* banks and thrifts recently scored far lower on their CRA ratings on average than did all other banks (see Cox 1993).

20. For example, Cummins (1993b) recently reported,

> Federal Reserve Governor Lawrence B. Lindsey warned on Wednesday that unless carefully crafted, reform of the Community Reinvestment Act could create more problems for the banking industry than it solves. While changes in the rules are needed, he said, bank regulators must avoid pushing the law so far that it becomes a rule for credit allocation.

cioeconomic objective this way can be costly (see Boot and Greenbaum 1992). Banks often claim that when it comes to complying with fair-play regulation, they are "damned if they do and damned if they don't." Perhaps they would be "damned" less if the government owned up explicitly to its role in credit allocation and critically examined its economic ramifications.

Of course, this is not the first instance in which a regulatory tax has handicapped regulated banks relative to the unregulated. At one time, only banks that were members of the Federal Reserve were subjected to cash-asset reserve requirements. The consequence was an erosion in Fed membership, to which the regulatory response was to make reserve requirements "universal," that is, applicable to nonmember banks as well. Interestingly, the imposition of universal reserve requirements (a regulatory cost) was accompanied by universal access to the discount window and check clearing functions (a subsidy). This is consistent with the barter approach of our paper.[21] Similarly, one hears calls now by politicians that the CRA—which currently applies only to banks and thrifts insured by the FDIC—ought to constrain even those financial institutions not covered by federal deposit insurance. For example, House Banking Committee Chairman Henry B. Gonzales said recently,[22] "Why should other credit-granting institutions be exempt?"

We doubt the feasibility of extending the CRA to uninsured financial intermediaries without subsidies to these intermediaries. Without the deposit-insurance carrot, the CRA would be viewed merely as a tax that would need to apply to *all* lenders. This seems difficult for the government to implement and easy for the lenders to escape, particularly if the tax violates their participation constraints in the absence of deposit insurance.

In order to escape the CRA tax, lenders are likely to innovate and carry out the financial intermediation function of lending in forms as-yet unknown. Enormous resources are likely to be dissipated in spurious innovation by financial intermediaries engaging in lending transactions that are called something else and by regulators constantly playing catch-up to ensure that *all* forms of lending are subject to the CRA (see Kane 1981).[23] Moreover, there is also likely to be relocation of lenders from areas where the CRA constraint is binding to those where it is not.

It is likely that politicians will foresee these possibilities; if they do, they will extend the scope of subsidies to nonbank lenders subject to the CRA. These subsidies may or may not be related to deposit insurance. But our model does predict that *if* the CRA is extended to nonbanks, it will be done in conjunction with a regulatory subsidy for these lenders.[24]

21. We are grateful to Joe Haubrich for this helpful observation.

22. See Cummins (1993a).

23. The ability of financial intermediaries to cross the artificial boundaries delineating them is growing as distinctions between the activities of different types of intermediaries are getting blurred. Moreover, even when the boundaries are not crossed, products offered by banks and their nonbank competitors are often close substitutes. For example, Benveniste, Singh, and Wilhelm (1993) highlight the close substitutability between bank loans and junk bonds by documenting a positive wealth effect for the commercial banking industry associated with the failure of Drexel Burnham and Lambert.

24. For example, the discount window may be used for this subsidy. Although the 1991 FDICIA per-

Bankers too have played a role in sustaining their barter arrangement with the government. On one hand, they have staunchly resisted proposals to reduce deposit insurance coverage. On the other hand, they have complained bitterly about the mounting burden of regulatory compliance, and have supported the recent political argument that this burden should be imposed on nonbanks as well.[25] There seems to be little recognition that the two are so intricately linked that pleas for regulatory reform cannot be directed at just one. The time may be ripe for bankers to ask themselves if deposit insurance is "too much of a good thing." Can banks really afford federal deposit insurance?

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mitted emergency discount window access for nonbanks, the Federal Reserve has discretion over this access. One way to subsidize nonbanks would be to permit discount window access in a greater number of circumstances and with less stringent collateral requirements.

25. Cummins (1993a) quotes Richard M. Rosenberg, Chairman and CEO of BankAmerica:

> The government should recognize the vast resources that nonbank financial institutions, which are not bound by the Community Reinvestment Act, can bring to the CRA arena. As part of any consideration of banking reforms, Congress ought to consider expanding the scope of CRA to bring these institutions under its umbrella. There is no question that most of these institutions benefit indirectly from FDIC deposit insurance, just as banks benefit directly.

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