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Strategic Creditor Passivity, Regulation, and Bank Bailouts

by Janet Mitchell

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Strategic Creditor Passivity, Regulation, and Bank Bailouts

Janet Mitchell
Facultés Universitaires Saint-Louis
and
ECARE, Free University of Brussels

ECARE
39 avenue Franklin Roosevelt
1050 Brussels, Belgium
Tel.: (32 2) 650-3075
or (32 2) 211-7939

E-mail: jmitchell@fusl.ac.be

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Abstract

This paper analyzes two interrelated aspects of banking crises: the choices that banks make between actively pursuing satisfaction of their claims in default versus passively rolling over loans; and choices by regulators to "punish" passive and insolvent banks versus rescuing them. Because a bank's actions may signal its poor financial condition or because a bank may wish to gamble for resurrection, a bank with financial problems may choose to passively roll over its bad loans rather than to initiate bankruptcy against a defaultor.

Regulators can play a crucial role in preventing creditor passivity, through their *ex ante* choice of monitoring capability and through their *ex post* choice of policy for insolvent or passive banks. Increasing the degree of monitoring, together with the threat of *ex post* punishment for passive behavior, can lower the level of passivity. Yet, if too many banks are discovered to be passive or insolvent, a situation labeled "too-many-to-fail" (TMTF) may arise, whereby it is less costly to rescue banks than to close large numbers of banks or to fire the bank managers. Banks may implicitly collude through their choice of actions in order to trigger TMTF.

One result of the analysis is that attempts by the regulator to offer rescue in order to induce insolvent banks to use bankruptcy against their defaultors and to reveal their insolvency may fail if *ex ante* monitoring capability is too weak or if the recapitalization accompanying rescue is not sufficiently generous. Rescue and recapitalization may thus need to be repeated in the future. Another principal result is that the regulator may react to the possibility of banks' triggering TMTF by "softening," either *ex ante* by lowering monitoring capacity or *ex post* by rescuing insolvent and passive banks. The threat of TMTF may thus make it impossible for the regulator to implement tough banking regulation.

1 Introduction

Many countries throughout the developing and industrialized world have suffered banking crises in recent years. Banks' attempts to hide loan losses by rolling over loans in default have often precipitated or contributed to these crises. In dealing with the crises, regulators have employed a variety of policies, ranging from bank closures to widespread bank rescues. This paper focuses on two interrelated aspects of banking crises: the choices banks make between actively pursuing satisfaction of their claims in default, versus remaining passive and rolling over the loans;[1] and choices by regulators to "punish" passive and insolvent banks, versus rescuing them.

Whereas the concept of "too-big-to-fail" can explain why regulators tend to rescue individual, large banks in financial distress, it cannot explain why governments in some countries have chosen to rescue all or most of the banks in the financial system. Widespread bank rescues have occurred in countries such as Norway, Sweden, Japan, Chile, and the economies in transition, including Hungary, the Czech Republic, Poland, and Bulgaria. In this paper I model a phenomenon that I label "too-many-to-fail" (TMTF) to explain the occurrence of widespread bank rescues. TMTF occurs when regulators react to the financial distress of several creditors by initiating rescues or otherwise allowing banks to remain in operation.

The starting point of the analysis of interactions between bank behavior and regulators' handling of banking crises is the modelling of both the *ex ante* design of regulatory institutions and the *ex post* choice of policy, once financially distressed banks have been discovered. Both *ex ante* institutions and regulators' *ex post* reactions to financial distress will influence bank behavior. Furthermore, institutions that are in place *ex ante* will determine the *ex post* feasibility of differing policies. To the best of my knowledge, this is the first analysis of bank regulation to take simultaneous account of the effects of *ex ante* and *ex post* policies on bank and regulator behavior. The importance of *ex ante* institutions

[1] In a summary of the experiences with financial crises in five countries, Sundarajan and Balino (1991, p. 13) note: "It took some time for the [banking] problems to be discovered by supervisory authorities because of the normal tendency of banks in distress to reduce the transparency of their accounts." Concern with the problems created by this type of creditor passivity is especially notable in discussions of financially distressed banks in the economies in transition. (See, for example, Begg and Portes, 1993a, 1993b, Coricelli and Thorme, 1993, and Mitchell, 1993.)

is illustrated by the following quote from World Bank (1989, p. 76), summarizing experience during the decade from 1978 to 1988, in which governments in twenty-five countries were forced to intervene in distressed banks: "[I]n most [of these] countries ... inadequate regulation has permitted risky lending, and ineffective supervision has permitted banks to ignore their losses."

Two motivations for creditors in the model of this paper to passively roll over loans in default are their unwillingness to signal their own poor financial conditions and a desire to "gamble for resurrection," or to take advantage of what is often called a deposit insurance put option. Weak *ex ante* monitoring capability by the regulator will reinforce passivity resulting from either of these motivations. Yet another factor that may motivate solvent banks to engage in passive behavior is the prospect of TMTF, which creates a strategic complementarity in bank actions. Knowing that regulators are susceptible to TMTF may encourage banks to engage in a form of implicit collusion, by which they choose not to use bankruptcy against their defaulting debtors. Bad debts will accumulate on everyone's balance sheets, and the government will be pressured to bail out creditors in one form or another.

The regulator's policy choices in the model are endogenous. The *ex ante* design of institutions is a choice of monitoring capability, before any default has occurred on banks' balance sheets, and determines the regulator's ability to detect if banks are rolling over loans. Upon monitoring and discovering banks that have rolled over loans or are insolvent, the regulator chooses between two policy options: *intervention* and *rescue*. The table below describes the types of activities that are associated with each policy.

Intervention	auditing bank to determine solvency replacing bank management if bank solvent closing bank or merging it with another if insolvent forcing debtors with rolled over loans into bankruptcy possibility of operating bank for some period of time
Rescue	no audit of bank to determine solvency maintaining bank in operation recapitalizing bank

With intervention the regulator attempts to determine the bank's net worth and the appropriate remedy, whereas with rescue banks are simply recapitalized. Each of these policies entails costs. These costs depend, among other things, upon the number of banks discovered to be in distress. Moreover, even though initial monitoring may reveal that a bank has hidden some loan losses, the regulator is not fully informed of the individual bank's financial situation. The fact that additional examination is necessary to determine the appropriate course of action for the bank (e.g., merger, liquidation, or change of management) when intervention is applied implies that this policy is costly. If the regulator chooses not to undertake the examination, or if the regulator decides that it is too costly to close down a large number of banks in the economy, then the regulator will be obliged to recapitalize insolvent banks in order to keep them open. Since recapitalization is costly, rescue is also costly.

One result of the anlaysis is that when financially distressed banks are insolvent, the regulator may want to use of a policy of rescue (and recapitalization) to encourage these banks to use bankruptcy against defaultors (and thus reveal their insolvency). This policy, however, may fail if not accompanied by strong *ex ante* monitoring capability or by generous recapitalization, due to banks' desires to gamble for resurrection. Thus, multiple episodes of recapitalization may occur as a result of the failure of previous recapitalizations to save the banks that the regulator intended to save, rather than as a result of a credibility problem for the regulator created by his willingness to undertake recapitalization in the first place.

Another principal result is that the regulator may react to the potential of banks' triggering TMTF by "softening," either *ex ante* by choosing a weaker monitoring capability than would otherwise have been chosen, or *ex post* by rescuing insolvent banks instead of applying intervention. When the *ex ante* monitoring capability is weakened, there will be more undetected passivity among banks in equilibrium. Whereas the regulator lowers monitoring capability in order to avoid being trapped in a situation where rescues are necessary, this response creates a snowball effect: the prospect of high passivity among creditors leads the regulator to choose a low degree of monitoring, which results in high passivity in equilibrium.[2] An implication of this result is that it may be impossible for regulators in certain

[2]That this type of reaction can occur even in well developed economies is illustrated by the description in Dewatripont and Maskin (1994, Ch. 4) of U.S. regulators' reactions to financial distress of S&Ls in the early 1980s when S&Ls were hurt by interest rate shocks. Regulators lowered solvency standards by first lowering the floor on the minimum capital-asset ratio from 5% to 3%, then by adopting laxer accounting

economic conditions (such as early in transition) to apply tough banking regulations.

An indirect implication of the model is that creditors' potential reluctance to seek satisfaction of claims in default and regulators' reactions to this passivity may significantly influence the implementation of bankruptcy laws in an economy. This effect can have drastic implications for countries with developing financial sectors. Effective default laws in any economy are needed to define property rights of a firm's claimants in the event of default, to improve the efficiency of resource allocation, and to discipline firm managers. When bankruptcy or other related procedures are not implemented, none of these beneficial functions may be served, and financial development will be hindered.

This paper relates to two bodies of literature: analyses of bank behavior and analyses of regulators' bank closure decisions. Since much of the literature on bank behavior concentrates on banks' *ex ante* decisions to invest in risky assets as a result of deposit insurance, relatively few papers in this literature treat creditors' decisions to roll over loans in default. O'Hara (1993) identifies an equilibrium where banks roll over loans of insolvent debtors in response to the imposition of market-value accounting standards. Rajan (1994) analyzes a model where bank managers are passive (lenient, in his terminology) in order not to tarnish reputations in managerial or stock markets. Mitchell (1993) identifies and analyzes the phenomenon of creditor passivity in economies in transition. Other papers concerned with creditor passivity in economies in transition include Aghion, Bolton, and Fries (1996), Mitchell (1995), and Perotti (1995).

Most papers in the literature on bank closure also focus on the *ex ante* riskiness of banks' investments and on regulators' decisions to close banks on the basis of these investments.[3] These papers generally assume that the regulator knows or can observe the bank's riskiness of investment; therefore, the closure decision is made with full information. In addition, if a regulator does not close a bank, the bank is assumed to be able to stay in operation.

This paper differs from the existing literature on bank closure in a number of respects. It considers policies that require more than a simple decision to close a bank or not. Each policy option entails costs, and these costs explicitly include effects related to the financial distress of multiple banks. The regulator does not have full information regarding banks'

procedures. More S&Ls could thus be deemed solvent according to the new rules.

[3]See, for example, Acharya and Dreyfus (1989), Boot and Thakor (1993), Davies and McManus (1991), Kane (1990), and Mailath and Mester (1994).)

financial states at the point where he chooses a policy.

The bank closure models of Kane (1990) and Boot and Thakor (1993) yield regulatory forbearance as the result of an agency probolem: regulators delay bank closure because they are acting in their own personal interest. The forbearance arising in this paper does not result from an agency problem between society and regulators: the regulator's objective is to minimize the total costs due to bank financial distress.

Section 2 of the paper describes a general version of the model. Because of the complexity of the regulator's cost functions and of the interactions between *ex ante* institutions, bank behavior, and *ex post* policy choice, Sections 3-5 analyze two simple versions of the model. In Sections 3 and 4 all banks with defaultors are insolvent. In Section 5 all banks with defaultors are solvent but financially distressed. The analysis in these sections provides the intuition for results in a more general model, in which some banks with bad loans are solvent and others insolvent. The results obtained in a more general setting are discussed in Section 6.

2 General Model

2.1 Description

There are N banks in the economy, each with liabilities of L. Each bank has outstanding risky debt in the amount of B. It also has other, nonrisky sources of income, I_0, such as income from provision of services or from the holding of government debt. A number m of the banks in the economy experiences default. The fraction of a bank's portfolio in default is given by α. Although m is known to the regulator, which banks experience default is not known in the absence of monitoring.

A bank's income in period 1, which is composed of nonrisky income and repayment of risky debt, will be denoted by I. A bank which is repaid by a proportion $(1-\alpha)$ of the total debt B owed by its debtors has a period-one income of $I = I_0 + (1-\alpha) \cdot B$.

A bank with default on its loans chooses between two actions: being "passive" or being "active." A choice of passivity represents a decision to passively roll over, or reschedule, loans, with no negociations regarding reorganization or liquidation of the firm. Thus, the passive bank rolls over debt and allows the defaulting firm to continue operating according to the status quo.

In contrast to the choice of passivity, a choice to be active represents a decision by the bank to actively recover at least a portion of the outstanding debt, either through an out-of-court workout or through a formal bankruptcy proceeding. Hence, if a firm's continuation value exceeds its liquidation value but if, at the same time, the firm should be reorganized, reorganization will occur. I use the terms "active banks" and "banks using bankruptcy" synonymously throughout the paper. I also assume that the use of bankruptcy (or out-of-court workout) is costlessly observable by the regulator. Thus, the regulator costlessly observes the level of default of an active bank's portfolio.

When banks are passive, default on debt remains hidden (unless the bank is detected by the regulator). Because firms' loans are passively rescheduled, firms whose liquidation values are greater than their continuation values will be able continue in operation. These firms thus have soft budget constraints. Note that the motivation for soft budget constraints and the context in which they occur differ from those described in the model of soft budget constraints analyzed by Dewatripont and Maskin (1995). The latter consider a situation in which it is always *ex post* efficient to continue the firm in operation, although *ex ante* the investment has negative net present value. Banks cannot commit not to refinance a defaultor *ex post*, since a new loan will be recovered and the old loan is sunk. In the current paper, firms may be continued in operation even though it is not *ex post* efficient to do so.[4]

The time line below describes the sequence of events.

Timing:

Period 0

G establishes monitoring capability;

G may precommit to recapitalization and rescue of banks

Period 1

Banks observe income and default;

Banks choose action with respect to defaultors;

G monitors and discovers passive or insolvent banks;

[4] Whereas there is an explicit assumption of the need for refinancing in Dewatripont-Maskin, there is no such assumption in this paper. The model here could easily by modified to incorporate the need for refinancing defaultors without changing any of the major results.

G chooses policy for all detected banks (rescue if precommitment to rescue, or intervention or rescue if no precommitment)

Period 2

Returns received from defaultors in period 1

Banks receive payoff, depending on whether detected passive or insolvent, and depending upon G's choice of policy

In period 0 the regulator chooses a monitoring capability that will determine a probability D with which the regulator will be able to detect passivity on the part of banks. At the beginning of period 1 banks earn income and observe default. Banks then choose an action to take with respect to defaulting debtors. The regulator then monitors banks and either detects insolvency and/or rolling over of loans or not in each bank. The regulator chooses the policy to apply to banks that have been discovered passive or insolvent. Banks' payoffs (or punishments) are realized in period 2.

I assume that deposit insurance exists. Because depositors will not monitor the bank in the presence of deposit insurance, the regulator's monitoring role is crucial. The assumptions regarding the monitoring function and the informational abilities of the regulator follow from two stylized facts. (1) Observation of a bank's financial standing is costly; hence, there is a costly verification problem. (2) It is in general much more difficult to identify a bank in financial difficulty than it is a bank that is healthy.[5] Monitoring requires each bank to submit to a periodic bank examination, during which the regulator reviews bank income statements and documents and attempts to determine if the bank has bad loans in its portfolio and if it has taken appropriate actions with respect to those loans. Given the choice of institutions, the probability is D that passive banks will be detected.

A key aspect of the model is that G's choice of policy *ex post* must be subgame perfect. That is, G is unable to commit himself *ex ante* to being tough *ex post* if being tough is not credible. Hence, *ex post*, G may be forced into a situation of rescuing banks because it is less costly to rescue than to apply intervention to discovered passive or insolvent banks. This situation will be labeled as one where too-many-to-fail (TMTF) takes effect. On the

[5] An example consistent with this fact appears in U.S. banking history. New York was the first state in the United States to set up a bank supervisory authority. After its establishment in 1829, however, this authority was abolished in 1843 beacuse the legislature believed that the commissioners "[w]ere superfluous when bankers were honest, and of no avail when bankers were dishonest." (Klebaner, p. 44)

other hand, G can commit himself to being more lenient *ex ante* than he might have wished *ex post;* hence G can precommit to rescue of banks in period 0. A commitment in period 0 of rescue with a given amount of recapitalization may encourage insolvent banks to become active and thus to reveal themselves.

When rescue is implemented, the regulator provides recapitalization to banks and allows banks to continue in operation. The amount of recapitalization accompanying rescue is one of the regulator's choice variables; nevertheless, the regulator will be forced to offer insolvent banks at least the minimum level of recapitalization that will render them solvent. A precommitment to rescue in period 0 may well involve an amount of recapitalization that is greater than the minimum amount necessary to render insolvent banks just solvent. The analysis will show, however, that when rescue is chosen *ex post*, after monitoring in period 1, it will be associated with only the minimum level of recapitalization.

2.2 Bank Strategies

As mentioned above, banks choose between being passive or active. When a bank rolls over a loan in the amount of B, the return is B with probability q and 0 with probability $(1-q)$. The return from use of bankruptcy for a defaulting loan of B is given by $\tilde{B}$, where $B > \tilde{B} > qB$. Bankruptcy thus yields a higher expected return than does rollover, since bankruptcy allows the bank to take the action (reorganization or liquidation) with respect to the firm that yields the highest value of the firm's assets. In addition, rollover is implicitly assumed to be a riskier action than bankruptcy. The explanation for this assumption is that because no attempt is made by a passive bank to obtain information regarding the most valuable use of the firm's assets and to reallocate the assets to their most valuable uses, the uncertainty of repayment is greater with rollover than with bankruptcy.[6]

Assumption 1: The banker's objective function is $\max[\Pi, 0] + \rho$, where Π represents bank profit and ρ represents a private benefit from operating the bank.[7]

[6] What is important in the model is the existence of a risky action that can be associated with "gambling for resurrection." An alternative assumption that would yield similar results would be that first-period income I may be invested in a safe asset or in a risky asset with a lower expected return. However, since the focus of the paper is on banks' decisions to be active or passive, it seems reasonable to focus on rollover as a riskier action than bankruptcy.

[7] As long as banks are not required to set aside provisions against expected loan losses, Π is equal to

Bank managers maximize expected bank profit (as long as it is positive) plus a private benefit of maintaining the bank in operation.

Assumption 2: $I < L < B$.

Liabilities L to depositors are assumed to be high enough that period-1 income I alone cannot satisfy the liabilities; however, full recovery of debts B is sufficient.

Define the two-period profit of a bank that is active (and that will be said to use bankruptcy) by[8]

$$\Pi^{bankr} = I + \alpha \bar{B} - L. \tag{1}$$

Assumption 3: $I + \alpha q B < L$.

Assumption 3 implies that the expected earnings with rollover cannot cover the bank's liabilities.

Suppose that the regulator selects a detection probability D and that if a passive bank is detected, it is "punished" and earns a payoff of zero.[9] The expected monetary payoff to the banker that rolls over a loan is

$$\Pi^{roll}(D) = (1 - D) \cdot q[I + \alpha B - L]. \tag{2}$$

2.3 The regulator's objective

The regulator's objective is to choose the *ex ante* monitoring capability and the *ex post* policy to minimize total costs associated with default on bank debt. These costs can be classified in two categories: *ex ante* or *ex post* costs. The *ex ante* component of costs is the cost of monitoring banks. *Ex post* costs include two components: losses in net worth of passive banks which are not detected; and costs of administering a policy—intervention or rescue—to banks discovered passive or insolvent. The costs of administering the policy of intervention include any costs to disruptions of the financial system when banks are closed.

bank net worth. When loan loss provisions are required, bank profit Π differs from bank net worth by the deduction of the loss provisions.

[8] I assume that the bank's liabilities come due in period 2; therefore, the bank's solvency is determined by its two-period earnings minus liabilities.

[9] It is shown below that when G applies a policy of intervention, detected passive bankers will earn a payoff of zero.

Given the costs associated with auditing, operating, or closing down a large number of banks in an economy when intervention is applied, the policy of rescue will be chosen when it enables the regulator to avoid a large portion of these costs.

Ex ante costs of monitoring are assumed to be an increasing, convex function $g(D)$. The costs included in $g(\cdot)$ represent resources that are necessary to ensure that each bank faces a probability D of discovery if it chooses passivity. These resources include personnel, training, regulations, etc.

The component of *ex post* costs defined as the expected losses in bank net worth due to passivity arise from the fact that passive banks choose the "wrong" action with respect to defaultors. Their expected net worths are thus lower than they would be if the banks chose to be active. Define the loss in net worth per passive bank by

$$LNW = \alpha(\widetilde{\beta} - q\beta).$$

Define the total loss in net worth due to banks' undetected passivity by the function

$$h[D; P] = LNW \cdot (1 - D) \cdot P,$$

where P represents the number of passive banks.

The total costs associated with each policy are specified more precisely in the subsections below.

Costs of intervention. Define $c_i(s)$ to be the administrative costs of a policy of intervention applied to s banks. The function $c_i(\cdot)$ is assumed increasing and convex. This function is assumed to include both direct and indirect costs associated with intervention. Direct costs include expenses for staff and resources required to undertake the activities associated with intervention. Indirect costs include social costs generated by disruptions in the financial system from the closing or the taking over of banks. Both direct and indirect costs could reasonably be expected to be convex in the number of banks subject to intervention. As the number of detected banks grows, however, the magnitude of the indirect, social costs of disruptions in the financial system would be expected to dominate the direct costs.[10]

[10]The specification and form of the function $c(\cdot)$ are exogenous to the model and may appear to be *ad hoc*. Formally deriving the social costs associated with bank closures would require specification of an aggregate

It will be convenient for the analysis to define a function representing the total *ex post* costs associated with the policy choice of intervention. Define the *ex post* costs by

$$i(D; P, s) = h[D; P] + c_i(s), \tag{3}$$

where s is the number of banks to which intervention is applied. The precise value of s in the function c_i depends upon the number of passive banks, the number of insolvent, active banks, and whether G has precommited to rescue insolvent, active banks. The value taken by s will be thus be made explicit in Sections 3 and 5, which analyze differing versions of the model. For the purposes of illustration, assume that no insolvent banks are active and that intervention is applied only to detected passive banks. Then $s = D \cdot P$, where P is the number of passive banks.

Note that the function $h(\cdot)$ is linear and negatively sloped in D. The function $c_i(\cdot)$ is positively sloped in s; hence, if $s = D \cdot P$, this function is positively sloped in D. Because $i(D; P, D \cdot P)$ is the sum of these two functions, it may be increasing or decreasing in D. The functions $c_i(\cdot)$ and $h(\cdot)$ are depicted in Figure 1 for a given number P of passive creditors and for the case where $s = D \cdot P$.

Figure 1 *here.*

The total costs associated with an *ex ante* choice of D and an *ex post* policy of intervention for some given number P of passive creditors and s of creditors to whom the policy will be applied are defined to be

$$C_i(D; P, s) = g(D) + i(D; P, s). \tag{4}$$

Whereas $g(\cdot)$ is increasing in D, $i(\cdot)$ may be increasing or decreasing in D. The convexity of the *ex post* administrative-cost function $c_i(\cdot)$ implies that if the derivative of $i(\cdot)$ is positive at $D = 0$, it will be positive for all D. In this case the regulator intending to apply intervention will choose not to monitor banks, since total costs will be minimized at $D = 0$.

model with financial and nonfinancial sectors. Such an exercise would constitute a separate project and is thus beyond the scope of this paper. For the purpose of this paper I assume that the regulator is able to calculate the social costs associated with bank closures and includes these calculations in the costs of intervention.

Thus, in order to guarantee that the regulator has an incentive to choose a positive level of monitoring with intervention, I make the following assumption.

Assumption 4: $\partial i(0; P, 0)/\partial D < 0$ for all P.

Assumption 4 states that the function $i(\cdot)$ is negatively sloped at $D = 0$; i.e., that $c_i(\cdot)$ is flat enough at $D = 0$ so that the benefits of choosing a small positive detection probability outweigh the costs of administering a policy of intervention to a small number of banks. The function $i(\cdot)$ may well become positively sloped at some value of $D > 0$.

Costs of rescue. When the regulator uses a policy of rescue, banks are recapitalized and bank managers remain in control. The regulator undertakes none of the activities associated with the policy of intervention; hence, none of the administrative costs or the social costs of closing banks are incurred. On the other hand, since the policy of rescue involves only recapitalization of the bank, it does not involve forcing the bank to take the "correct" action with respect to defaultors. Thus, if a bank has chosen passivity, its expected net worth, even if detected, is lower than if the bank had used bankruptcy for its defaultors.

The *ex post* costs of rescue include the loss in net worth associated with passivity (detected or undetected) and the costs of recapitalizing banks. There are no costs of administering rescue other than the costs of recapitalization. Suppose that the policy of rescue is applied to s banks and the amount of recapitalization is R. Then administrative costs are

$$c_r(s) = R \cdot s. \tag{5}$$

Define the total *ex post* costs associated with a policy of rescue by

$$r(D; P, s) = LNW \cdot P + c_r(s). \tag{6}$$

Note that the costs due to loss in bank net worth from passivity are a function of the total number of passive banks and are thus constant with respect to D. As noted in the discussion of costs associated with intervention, the precise value of s will depend upon a number of factors and will be made explicit in the analysis of Sections 3 and 5. For illustration, if no insolvent banks are active, $s = D \cdot P$, and $c_r(s)$, as well as $r(D; P, s)$, will be linear and increasing in D.

The total costs of an *ex ante* choice of D and an *ex post* choice of rescue applied to s banks are defined by

$$C_r(D; P, s) = g(D) + r(D; s). \tag{7}$$

Figure 2 compares the functions $i(D; \cdot)$ and $r(D; \cdot)$ for a given number P of passive banks and for the case where $s = D \cdot P$. The values of these functions at $D = 0$ are equal. The function $r(D; \cdot)$ is linear and increasing in D. The function $i(D; \cdot)$ is initially decreasing and may eventually become increasing in D.

Figure 2 here.

3 Model with insolvent banks

I assume that nonrisky income I_0 and the proportion α of the portfolio in default are identical for all m banks with defaultors. Thus, there are only two "types" of banks in the model: those with no default and those with αB in default. This implies that once a passive bank is detected, its type is known. Given the assumption that bankruptcy is costlessly observable, the bank's type is also known if it chooses to be active.

In this version of the model I assume that the level of default is sufficiently high that all banks with default are insolvent. Hence, even if these banks use bankruptcy for their defaultors, their earnings cannot cover their liabilities. These banks are nevertheless assumed not to be illiquid: they are able to stay in operation during period 1 even if they roll over their loans.[11] Call the level of default α_B, where the subscript B represents bad banks. The following assumption states that banks with default are insolvent.

Assumption 5: $\Pi^{bankr} = I_B + \alpha_B \tilde{B} - L < 0$,

where I_B is first-period income.

What happens when a bad bank is passive? If it is not detected and if rollover succeeds, the banker earns a positive monetary return plus the private benefit ρ. If the bank is not

[11] It is in fact quite common for insolvent banks to remain liquid for a period following the insolvency. For example, most of the insolvent S&Ls during the U.S. S&L crisis were liquid up to the point of closure.

detected and rollover fails, the banker earns no monetary return; however, she still earns ρ since by not being detected the bank still manages to stay in operation during period 1. So, with probability $(1-D)$ the banker earns at least ρ. If the passive bank is detected, then the banker's payoff depends upon the *ex post* policy chosen by G and upon the amount of recapitalization accompanying rescue when rescue is chosen.

Definition: Define $\widetilde{R}_{\min}$ to be the minimum amount of recapitalization necessary to render an *active* insolvent bank just solvent; i.e., such that $\Pi^{bankr} + \widetilde{R}_{\min} = 0$.

$\widetilde{R}_{\min} = L - I_B - \alpha_B \cdot \widetilde{B}$.

Definition: Define $R_{\min}$ to be the minimum amount of recapitalization necessary to render a *passive* insolvent bank just solvent. $R_{\min} = L - I_B - q\alpha_B B$.

Obviously, $\widetilde{R}_{\min} < R_{\min}$.

Definition: Define *"extra" recapitalization* to be any amount of recapitalization greater than the minimum necessary to bring an active insolvent bank's solvency to zero.

3.1 Bank best responses to monitoring and choice of policy

3.1.1 Precommitment to rescue.

Because banks with default are insolvent, it might seem that a precommitment to a policy of rescue would avoid the problem of creditor passivity by inducing the banks to become active and thus to reveal themselves. This intuition is not entirely accurate, due to the possibility of gambling for resurrection. The proposition below demonstrates that a simple precommitment to rescue is not sufficient to prevent the occurrence of passivity.

Proposition 1 *A precommitment to rescue accompanied by recapitalization $\widetilde{R}_{\min}$ will not induce insolvent banks to become active unless the level of monitoring is sufficiently high.*

Proof: Suppose that the precommitment to rescue is applied only to active banks and that detected passive banks have intervention applied and earn a payoff of zero. If an active bank is rescued with an amount of recapitalization equal to $\widetilde{R}_{\min}$, then the banker's payoff will be ρ. On the other hand, if the bank is passive and is not detected, its expected payoff is $q[I_B + \alpha_B B - L] + \rho$. Consequently, if the level of monitoring is low enough, the expected payoff for passivity will be higher. More precisely, define $\widetilde{D}$ such that $(1-\widetilde{D})\{q[I_B + \alpha B - L] + \rho\} = \rho$. ($\widetilde{D}$ is the value of D at which banks become indifferent between being passive and being active, given rescue and $\tilde{R}_{\min}$.) For all $D < \tilde{D}$, banks will choose passivity. Only if $D > \tilde{D}$ will banks choose to be active.‖

Definition: Gambling for resurrection is *valuable*, if $q[I_B + \alpha_B B - L] > 0$; i.e., if, given no monitoring ($D = 0$), the bank would prefer to be passive than to be active and rescued with $\tilde{R}_{\min}$.

The insolvency of banks, together with Proposition 1, suggest two potential motives for creditor passivity. The first is the desire by the banker to avoid signalling that the bank is insolvent. The second is the attempt to return to solvency, or to gamble for resurrection. The passivity described in Proposition 1 is due to the motive of gambling for resurrection. The limited liability of the bank gives it the incentive to undertake risky actions in order to recover from its financial distress.[12]

The fact that gambling for resurrection is valuable to insolvent banks implies that they will not choose to become active solely as a result of the desire to obtain the private benefit ρ, unless D is high enough. Thus, if G is interested in inducing insolvent banks to become active, he will have to do so by either choosing a sufficiently high level of monitoring (which reduces the expected payoff to passivity) or by offering sufficient extra recapitalization (which raises the payoff to becoming active). Both of these alternatives are costly. In fact, there exists a continuum of pairs $(D, R(D))$, such that $R(D)$ represents the minimum level of recapitalization, given D, that will induce banks to become active given a precommitment to rescue. $R(D)$ is defined by

$$R(D) \equiv (1 - D)R_{\max} - D\rho, \tag{8}$$

where $R_{\max} \equiv q[I_B + \alpha_B B - L]$. $R_{\max}$ is the expected monetary return from gambling for resurrection. $R_{\max}$ represents the maximum amount of recapitalization that G ever need provide in order to induce insolvent banks to become active. A precommitment to rescue with an amount of recapitalization equal to $R_{\max}$ will induce insolvent banks to become active even when $D = 0$.

Proposition 1 has powerful implications, despite its simplicity. It suggests that an announcement that banks will be rescued and recapitalized will not necessarily eliminate

[12] That deposit insurance can lead banks to undertake excessively risky investment *ex ante* is well known. Nevertheless, the point that deposit insurance can influence a bank's *ex post* reactions to default has not been explored in models of deposit insurance.

creditor passivity in the economy. Namely, if regulatory institutions are weak (and recapitalization not sufficiently generous), insolvent banks may choose not to reveal themselves, which may lead to the need for a second offer of recapitalization in the future. Hence, multiple episodes of recapitalization may result from the failure of prior recapitalizations to induce insolvent banks to reveal their insolvency. It is well understood that a recapitalization of banks can lead to a moral hazard problem, by which banks' expectations of future recapitalization cause them to act so as to render these expectations self-fulfilling. It is not, however, well understood that when regulatory institutions are weak, rescue policies may fail to save the very banks intended to be saved and may, therefore, need to be repeated.

In the subsections below I describe bank best responses to the policy of intervention and to rescue, when the latter is chosen *ex post* rather than as an *ex ante* precommitment.

3.1.2 Intervention.

When the policy of intervention is applied (and when there has been no precommitment to rescue), intervention is applied to active banks that are insolvent as well as to passive banks that are detected. When a policy of intervention is applied to a bank, the banker's payoff is zero. (It is straightforward to show that allowing a positive payoff to the banker in the case of intervention increases the costs of this policy.) Since all of the banks with default are insolvent, they will choose passivity for all levels of D, given a policy of intervention. The motivation for the choice of passivity in this case is to avoid signalling that the bank is insolvent.

3.1.3 *Ex post* choice of rescue.

Since an *ex post* choice of rescue implies the absence of a precommitment to rescue, the amount of recapitalization accompanying rescue must be subgame perfect. The only amount of recapitalization that is credible *ex post* is the amount that minimizes G's *ex post* costs, with the constraint that banks must be made solvent. This amount is $\widetilde{R}_{\min}$ for active insolvent banks and $R_{\min}$ for detected passive banks. The claim below states that banks never have an incentive to become active given an *ex post* choice of rescue.

Claim 1: *Given an ex post choice of rescue, insolvent banks will choose passivity for all values of D.*

Proof: The payoff to a passive bank, given an *ex post* choice of rescue is given by

$$(1-D)\cdot\{q[I_B+\alpha B-L]+\rho\}+D\cdot\rho, \tag{9}$$

or

$$(1-D)\cdot\{q[I_B+\alpha B-L]\}+\rho.$$

This payoff is greater than the payoff ρ that the active bank receives, given rescue.||

4 Equilibrium policy in the model with insolvent banks

In the absence of a precommitment to rescue, G selects a policy of intervention or rescue on the basis of the number of discovered insolvent or passive banks. The fact that the *ex post* choice of policy must be subgame perfect implies that the *ex ante* choice of D will be made in anticipation of the *ex post* policy choice. The analysis of G's choice of D thus employs backward induction.

The following assumption ensures that banks are not always rescued.

Assumption 6: Given one discovered insolvent bank, it is less costly to apply intervention to that bank than to provide minimum necessary recapitalization: $c_i(\cdot;\cdot,1)<\widetilde{R}_{\min}$.

Assumption 6 implies that there exists some number n^* of banks for which it is cheaper, *ex post*, to apply intervention than rescue. I will assume that $n^*<m$, which allows for the possibility of TMTF.[13]

The following claim describes the characteristics of a precommitment to rescue.

Claim 2: *A policy of rescue that is designed to induce insolvent banks to be active will require a lower level of recapitalization for any value of D if it is applied only to active, insolvent banks than if it is also applied to detected passive banks.*

Proof: See appendix.

Claim 2 implies that if R precommits to rescue, the policy will be applied only to active banks, with intervention being applied *ex post* to detected passive banks. Note that although the threat of intervention for passive banks exists, if in equilibrium G precommits to

[13]In this situation, if all banks were active, n^* of them might have intervention applied, and $m-n^*$ would be rescued. Nevertheless, for expositional simplicity I will assume that the policy that is applied to any detected passive banks is applied to all detected passive banks. This assumption simplifies the algebra without changing any of the qualitative results of the model.

rescue, the amount of recapitalization offered will be sufficient to induce all insolvent banks to become active. Thus, no banks will choose passivity in equilibrium, and intervention will not be applied.

The discussion above demonstrates that when G wishes to precommit to rescue in order to induce insolvent banks to become active, there is a tradeoff between the level of *ex ante* monitoring and the amount of recapitalization necessary. For example, if G offers $R_{\max}$, then he will be able to induce banks to become active even in the absence of monitoring. In this case one would observe the policy of rescue associated with weak regulatory institutions and a high level of recapitalization. On the other hand, if the level of monitoring is sufficiently high ($\widetilde{D}$), G need not offer extra recapitalization. In this case one would observe the combination of strong regulatory institutions and relatively low levels of recapitalization. Which combination of D and recapitalization will be chosen by G, given a precommitment to rescue, will depend upon the costs of establishing strong regulatory institutions (i.e., of *ex ante* monitoring) relative to the costs associated with employing funds for recapitalization. When the political costs of recapitalizing banks are high, the only means of inducing insolvent banks to become active will be to establish strong regulatory institutions.

The claim below describes the choice of D, given an *ex post* choice of intervention.

Claim 3: *Let D^i represent the optimal choice of D given a policy of intervention. Then,*

$$-\frac{\partial i(D^i; m, D^i \cdot m)}{\partial D} = g'(D^i), \tag{10}$$

or

$$LNW \cdot m - \frac{\partial c_i(D^i; m, D^i \cdot m)}{\partial D} = g'(D^i).$$

Proof: The choice of D satisfies

$$Arg \min\{C_i(D; P, DP) = g(D) + i(D; P, DP)\},$$

where P represents the number of passive banks and $D \cdot P$ represents the number of banks to which intervention will be applied.||

Claim 3 implies that the optimal value of D, given a policy of intervention, will occur on a decreasing portion of the function $i(\cdot)$. Because monitoring is costly, the *ex post* benefits from intervention will not be exhausted at the optimal level of monitoring. The policy of intervention will be applied to $D^i m$ banks, while $(1 - D^i)m$ banks will remain undetected. Thus, there will exist undetected passivity in the economy when intervention is the equilibrium policy.

A question of interest is whether it is possible that an *ex post* choice of rescue can be an equilibrium policy. Claim 3 and Figure 2 imply that when all banks are passive, G always prefers to implement a policy of intervention than to implement an *ex post* choice of rescue. In other words, given a policy of intervention and given passivity on the part of banks, D^i will never be high enough to trigger TMTF.

That G would prefer to implement intervention than rescue, however, does not guarantee that rescue will not be the equilibrium policy. Banks may be able, through their (implicitly) coordinated actions, to trigger TMTF. For example, suppose that banks switch from being passive to active. Now, if G tries to implement intervention, the policy must be implemented for all m banks. If $\widetilde{R}_{\min} \cdot m < c_i(\cdot\, ; \,\cdot, m)$, then G will be forced to rescue banks, and TMTF will have been triggered through implicit collusion.

It may appear strange that the act of banks' becoming active and revealing their insolvency in order to trigger TMTF is termed implicit collusion. After all, by becoming active, banks are taking the correct actions with respect to firms. Their net worths are thus not reduced further (although they are still insolvent), and their defaultors have hard budget constraints. Yet, whereas the higher net worth of banks constitutes a benefit of this outcome, the cost to G is the obligation of recapitalizing all of the banks.[14]

Define a *collusive continuation equilibrium*[15] as an equilibrium where banks become active in order to trigger TMTF. The proposition below provides necessary and sufficient conditions for existence of a collusive continuation equilibrium.[16]

[14] As an aside, one might ask why G cannot just fire the bank managers. The answer is that firing bank managers and hiring new ones requires G to engage in many of the actions associated with the policy of intervention, such as operating the banks for a period of time until a new management is found. If enough banks are insolvent, this policy may simply be too costly.

[15] A continuation equilibrium is an equilibrium, given a choice of D.

[16] In Rajan (1994) bank managers switch from being passive to active (and thus reveal their bad loans) in states of the world in which their reputations are the least adversely affected; i.e., in states of the world

Claim 4: *Let D^i be the optimal value of D given a policy of intervention. Define D^r to be the optimal value of D given a precommitment to rescue.*[17] *Let $\widetilde{D}$ be the level of monitoring such that banks are indifferent between being passive with intervention and being active with rescue and minimum recapitalization. ($\widetilde{D}$ is defined in the proof of Proposition 1.) Then, if*

(i) $D^i > \widetilde{D}$;

(ii) $\widetilde{R}_{\min} \cdot m < c_i(m)$;

(iii) $C_i(D^i; m, D^i m) < g(D^r) + R(D^r)$,

then a collusive equilibrium exists.

Proof: See appendix.

Since TMTF creates a coordination problem, the possibility of implicit collusion among banks leads to two possible equilibria for all $D > \widetilde{D}$: D with intervention if no implicit collusion occurs, and D with rescue if implicit collusion occurs. If G believes that by setting $D^i > \widetilde{D}$, implicit collusion will occur, he will react *ex ante* to that possibility. The results below demonstrate that G's reaction will involve either committing *ex ante* to rescuing banks or lowering the value of D and applying a policy of intervention. Propositions 2 and 3 characterize the equilibrium choice of D and policy.

Claim 5: *It is less (possibly strictly less) costly for G to precommit to a policy of rescue than to be forced to implement a policy of rescue ex post.*

Proof: See appendix.

Proposition 2 *Let D^i be the optimal value of D given a policy of intervention. Let D^r represent the optimal value of D given a precommitment to rescue. Then, if*

(i) $D^i < \widetilde{D}$,

(ii) $C_i(D^i; m, D^i m) < g(D^r) + R(D^r) \cdot m$,

then $D = D^i$, and a policy of intervention will be chosen in equilibrium. If the inequality (ii) is reversed, a precommitment to rescue with D^r and recapitalization $R(D)$ will be the equilibrium policy.

in which many banks have been affected by negative shocks. Implicit collusion in the current paper creates a situation in which banks jointly benefit from more lenient treatment.

[17] D^r satisfies $Arg\min\{g(D) + R(D) \cdot m\}$, which equals $Arg\min\{g(D) + m \cdot [(1-D)R_{\max} - D\rho]\}$. Thus, $g'(D^r) = m \cdot R_{\max} + \rho$.

The assumption that $D^i < \widetilde{D}$ guarantees that TMTF will not be triggered by implicit collusion; therefore, the policy of intervention is credible. G will choose intervention if the total costs associated with D^i and intervention are less than total costs associated with a precommitment to rescue. Whether intervention is less costly than a precommitment to rescue will depend upon a number of factors: the administrative costs of intervention; the amount of extra recapitalization; and the *ex ante* cost of monitoring.

Proposition 3 *Let D^r represent the optimal value of D given a precommitment to rescue. Suppose that the conditions of Claim 4 hold. (i) If G does not believe that implicit collusion will occur, then $D = D^i$ and intervention is the equilibrium policy; (ii) If G believes that implicit collusion will occur and if*

$$g(\widetilde{D}) + LNW \cdot (1 - \widetilde{D})m + c_i(\widetilde{D}m) < g(D^r) + R(D^r) \cdot m,$$

then $D = \widetilde{D}$ and intervention is applied; (iii) If G believes that implicit collusion will occur and if the above inequality is reversed, then G sets $D = D^r$ and precommits to rescue with $R(D^r)$.

Proof: See appendix.

Proposition 3 states that G reacts to the possibility of implicit collusion and the triggering of TMTF by becoming "softer," either *ex ante* through lowering the level of monitoring or *ex post* by applying a policy of rescue rather than intervention. The conditions of the proposition (namely, of Claim 4) imply that intervention is the preferred policy in the absence of implicit collusion; however, implicit collusion will prevent G from implementing intervention with a level of monitoring D^i. The only way to credibly remain tough *ex post* is to weaken regulatory institutions *ex ante* (lower D to $\widetilde{D}$). If D is lowered and intervention applied, more undetected passivity will exist in equilibrium than would have if TMTF could not be triggered. Moreover, if the costs of the extra recapitalization necessary to induce insolvent banks to reveal themselves are very high, G will have no choice but to lower D and apply intervention to a smaller number of banks in equilibrium. Thus, when banks with bad loans are severely financially distressed and when TMTF is a potential outcome, it may be impossible to implement strong regulatory institutions early in the transition without running the risk of a bailout of the entire banking system.

The result of Proposition 3 demonstrates that the inability of the regulator to commit not to rescue banks *ex post* may result in the *ex ante* establishment of regulatory institutions that are weaker than would be the case if the spector of bank rescues were nonexistent. In practice, definitions of bad debt, requirements for loan loss provisions, and the capacity of the regulatory body to undertake bank examinations may all be weaker than in the absence of TMTF. This result contrasts with the more typical result in a principal-agent setting, where the principal monitors more rather than less when incentive problems worsen. The result here arises from the fact that there are multiple agents who can coordinate their strategies.

This result implies that if regulators believe that imposing financial regulations may lead them to undertake massive rescues, they may postpone implementation of these regulations and, in effect, reduce the probability of detection of passivity. Banks may realize that they may be able to influence the regulator's decision to postpone by not following the regulations even if they would have been able to do so.[18] There have been a number of attempts on the part of regulators in the economies in transition to postpone application, or lengthen the phase-in period, of financial regulations that would more easily expose the financial health of creditors. For example, bank regulators in Hungary postponed the phasing in of capital requirements for banks dictated by the Law on Financial Institutions passed in December, 1991. Authorities in the Czech Republic postponed until April, 1993 implementation of a bankruptcy law passed in October, 1991.

5 Model with banks that can remain solvent if active

In this version of the model I assume that banks with bad debt are slightly less financially distressed than in the previous section. Namely, the level of default is assumed to be low enough that banks are able to remain solvent provided they are active. If, on the other hand, banks choose passivity, their expected net worth will be negative. Let α_G represent the proportion of banks' portfolios in default, where the subscript G represents "good" banks. Because an active bank's expected net worth is positive, passivity cannot result

[18]There were reports of an announcement made at a 1992 stockholders' meeting of a mjor Hungarian commercial bank that the bank had not met the capital requirements dictated by the law, but that this would not be important since the regulations were going to be waived.

from the desire to avoid signalling negative net worth. The only motive for passivity can be gambling for resurrection.

If gambling for resurrection is valuable, then banks will choose passivity for low levels of monitoring. If, however, the level of monitoring is high enough, gambling for resurrection will not be profitable for banks, and they will become active. Yet, for high enough levels of monitoring, banks may have the incentive to engage in implicit collusion (by becoming passive) and triggering TMTF. In a collusive continuation equilibrium bankers' expected payoffs will include the expected benefits from gambling for resurrection plus the certain private benefit from remaining in operation (since detected passive banks will be rescued). This expected payoff will exceed that from using bankruptcy. Note that, in contrast to the model with insolvent banks, implicit collusion here involves passivity on the part of banks that would otherwise be active. The prospect of TMTF thus increases the level of passivity of banks in the economy, unless the banks are insolvent.

The analysis of this section employs assumptions 1-4 of the previous section. Assumption 5 is modified below.

Assumption 5′: $\Pi^{bankr} \equiv I_G + \alpha_G \cdot \widetilde{B} - L > 0$.

Definition: Gambling for resurrection is *valuable* if $q \cdot [I_G + \alpha_G B - L] > \Pi^{bankr}$, or if, given no monitoring, the bank would prefer to be passive than to be active.

Note that the benefit to gambling for resurrection derives from the fact that liabilities L are only paid by the bank with probability q; therefore, expected liabilities equal qL. The fact that the bank's expected payment of liabilities is less than the face value of these liabilities when the bank gambles for resurrection creates a bias in favor of passivity. The cost to passivity (in the absence of monitoring) is that expected loan recovery is lower than if the bank were active.

Assumption 7: Gambling for resurrection is valuable.

Assumption 7 implies that for some range of D banks with default will choose passivity. If gambling for resurrection were not valuable, then creditors would never choose to be passive.

The timing of events in this version of the model is identical to the timing in the previous version. It should be remarked, however, that the only motivation for a precommitment to rescue in Period 0 in the previous version of the model was to induce insolvent banks to reveal themselves. In this version of the model, active banks are not insolvent; hence, any recapitalization provided to active banks will simply increase their positive net worth. It is possible, as in Section 3, to define a function $R(D)$ that represents the minimum level of recapitalization, given D, that would induce passive banks to become active. Nevertheless, the political feasibility of a regulator's transferring funds to banks with positive net worth is questionable, in large part because of the potential for abuse of such transfers through collusion between regulators and banks.[19] I assume that such a transfer is infeasible; therefore, a precommitment to rescue will never occur in the model with good banks.

5.1 Bank best responses to monitoring and choice of policy

5.1.1 Intervention.

The assumption that gambling for resurrection is valuable implies that banks will choose passivity for a range of D, given a policy of intervention. Define D_G as the value of D such that

$$\Pi^{roll}(D_G) + (1 - D_G) \cdot \rho = \Pi^{bankr} + \rho, \tag{11}$$

where $\Pi^{roll}(D) \equiv (1 - D) \cdot q[I_G + \alpha_G B - L]$. Banks will choose passivity for all $D < D_G$ and will become active for all $D \geq D_G$.

5.1.2 *Ex post* choice of rescue.

As in the previous version of the model, a policy of rescue will encourage passivity on the part of banks. In this version, however, rescue will encourage passivity only for a certain range of D. The payoff to a passive bank, given rescue, is $\Pi^{roll}(D) + \rho$. Define $\widehat{D}$ such that $\Pi^{roll}(\widehat{D}) = \Pi^{bankr}$. $\widehat{D}$ represents the level of monitoring such that the bank is indifferent between being passive with rescue upon detection and being active. Note that $\widehat{D} > D_G$. Given an *ex post* choice of rescue, good banks will choose passivity for all $D < \widehat{D}$ and will be active for all $D \geq \widehat{D}$.

[19] In reality regulators in economies in transition have recapitalized banks with positive net worths but with capital/asset ratios below the Basle requirements. This type of recapitalization would correspond in this model to recapitalization of a bank with negative net worth. That is, in a model where capital/asset ratios are important, the banker's monetary payoff would become positive only at the point where the capital/asset ratio reaches the minimum required level.

5.2 Equilibrium policy

That all "good" banks with default choose passivity for $D < D_G$, given a policy of intervention, and become active for $D \geq D_G$ implies that G's costs of intervention are discontinuous at D_G. Namely, at D_G the function $i(\cdot)$ shifts from $i(D_G; m, D_G \cdot m) = LNW \cdot (1 - D_G)m + c_i(D_G \cdot m)$ to $i(D_G; 0, 0) = 0$. Since all banks are active at D_G, there is no loss in net worth from undetected passivity, and intervention is applied to no banks; hence, there are no *ex post* costs associated with intervention. Given the total (*ex ante* and *ex post*) costs of D and intervention, it is clear that G will never choose a level of D greater than D_G.

Claim 6: *Given a policy of intervention, the choice of D will either be an interior solution D^i, in which*

$$LNW \cdot m - \frac{\partial c_i(D^i m)}{\partial D} = g'(D^i)$$

as in Claim 3, or it will be a corner solution at D_G, in which

$$g'(D_G) > LNW \cdot m - \frac{\partial c_i(D_G m)}{\partial D}$$

but where

$$g(D_G) < C_i(D^i; m, D^i m). \qquad (12)$$

The left-hand side of inequality (12) represents the total cost of intervention, given D_G. When D_G is the corner solution, the downward shift in the function $i(\cdot)$ more than compensates for expanding D beyond the point where the first-order condition for the cost minimization problem, given $i(D; m, Dm)$, is satisfied.

Since, with intervention, banks are passive for all $D < D_G$, the only value of D at which TMTF can be triggered by implicit collusion is D_G. The claim below provides necessary and sufficient conditions for the existence of a collusive continuation equilibrium.

Define the minimum amount of recapitalization that is credible *ex post* to be $R_{\min} = L - \alpha_G q B - I_G$. This is the amount of recapitalization that will be offered given an *ex post* choice of rescue.

Claim 7: *Suppose that, given a policy of intervention, the optimal choice of D is a corner solution at D_G. Then, if $c_i(D_G \cdot m) > R_{\min} \cdot D_G m + LNW \cdot D_G m$, a collusive continuation equilibrium exists.*

Proof: See appendix.

Claim 7, along with the forms of the functions $i(\cdot)$ and $r(\cdot)$, demonstrates that the only situation in which a collusive continuation equilibrium can exist is one in which G has chosen a high monitoring level D_G in order to benefit from the downward shift in the *ex post* cost $i(\cdot)$ of intervention. If, in addition, $i(D_G; m, D_G m)$ is increasing at D_G and the inequality of Claim 7 holds, G will not be able to avoid rescuing banks when they engage in implicit collusion.

The following proposition characterizes the equilibrium choices of D and policy.

Proposition 4 *(i) If the optimal value of D, given a policy of intervention, is an interior solution $D^i < D_G$, then the equilibrium choice of monitoring and policy will be D^i and intervention; (ii) If the optimal value of D, given a policy of intervention is a corner solution D_G and G does not believe that implicit collusion will occur, then the equilibrium choices are D_G and intervention; (iii) If the optimal value of D, given a policy of intervention, is a corner solution D_G and if G believes that implicit collusion will occur, then the equilibrium choices will be the value D^i at which the first-order condition is satisfied and intervention.*

Statement (iii) of Proposition 4 presents a result that is similar to that of Proposition 3 in the previous section: G's reaction to the triggering of TMTF is to lower the level of *ex ante* monitoring and to apply intervention. There will be more undetected passivity in equilibrium than in the absence of TMTF.

6 Conclusion

Sections 3-5 treat separately the cases where banks with bad debt on their books are insolvent and where they are solvent. A question of interest is to what extent the results would change in a model with both types of banks with bad debt. For example, suppose that a proportion γ of banks with default are "good" (in the sense of Section 5) and that $(1-\gamma)$ of banks in default are "bad" (in the sense of Section 3). G knows the value of γ but does not know without monitoring which banks with bad debt are good and which are bad.

In this model bank best responses to choices of D and policy are the same as the best responses analyzed in the separate models; however, G's costs change slightly. For example, given a policy of intervention, bad banks will choose passivity for all D, while good banks will be passive for all $D < D_G$ and active for $D \geq D_G$, as before. Whereas the *ex post* costs of intervention will still shift downward at D_G, they will not shift to zero because bad banks remain passive for $D \geq D_G$. Consequently, the optimal value of D given a policy of intervention may be greater than D_G, since the benefit of raising D above D_G is the detection of passive bad banks. That the optimal value of D, given a policy of intervention, may exceed D_G implies that good banks will have an incentive to engage in implicit collusion for a wider range of D than in the model of Section 5.

Moreover, there is an additional factor in this model that will increase good banks' incentives to engage in implicit collusion. When passive banks are detected, G does not know without applying intervention which of the detected banks are "good" and which are "bad." Yet, if the number of detected passive banks is high enough to trigger TMTF–i.e., if the *ex post* costs of intervention are higher than the *ex post* costs of rescue for this number of banks–G will have to rescue all banks without discovering their types. The amount of recapitalization accompanying rescue must be sufficient to render all banks solvent. Since G cannot distinguish the bad banks from the good banks, he must provide to all banks the level of recapitalization necessary for bad banks. Consequently, good banks will receive an amount of recapitalization that raises their net worth to a positive value. Bank managers of good banks will receive a positive monetary return (since Π is positive), in addition to their private benefit ρ of remaining in operation. This positive monetary return from rescue will increase the range of D over which good banks have an incentive to engage in implicit collusion.

In the model with good and bad banks a collusive continuation equilibrium may be triggered by good banks, by bad banks, or by both. Good banks will be passive when they trigger a collusive equilibrium, and bad banks will be active when they trigger such an equilibrium. G's reactions to the threat of a collusive continuation equilibrium are similar to those described earlier: he may lower D and apply intervention to all detected passive banks in equilibrium or he may precommit to rescue active bad banks.

A final observation concerning the model is that it does not incorporate a requirement that banks set aside provisions for expected loan losses. A requirement to set aside loan loss provisions (and thereby lower bank profit by the amount of these provisions) will increase the incentive for good banks to be passive, since passivity will not only allow gambling for resurrection but will also raise reported bank profit and the banker's monetary payoff. As a consequence, good banks will choose passivity for a greater range of D when loan loss provisions are required than when they are not, and their incentives to engage in implicit collusion will also be strengthened.

In summary, banks' financial situations, combined with *ex ante* and *ex post* regulatory institutions, influence banks' decisions to actively recover their claims in default or to passively roll them over. If creditor passivity becomes widespread, the functioning of the entire financial system can be adversely affected.

Regulators can play a crucial role through their monitoring activities in preventing creditor passivity. Increasing the degree of monitoring can lower the level of passivity, provided that all banks with bad debt are not insolvent. Yet, stringent monitoring of banks may provide the incentive for banks to implicitly collude in order to trigger too-many-to-fail. Regulators' responses to the prospect of TMTF, if they respond, will be to become "softer," either on *ex ante* monitoring or on the *ex post* policy applied to financially distressed banks. When the regulator lowers monitoring capacity, it is in order to avoid being forced to undertake rescue *ex post*. Lower monitoring increases passivity; therefore, widespread creditor passivity may be unavoidable.

A precommitment to rescue involves a tradeoff between the level of D and the amount of recapitalization R necessary for the policy to succeed in inducing insolvent banks to become active. This implies that in practice if too little recapitalization is offered, given a level of D, the policy will fail and may lead to the need to offer recapitalization again in the future. Thus, a generous recapitalization offer to banks is not necessarily a sign of weakness or low credibility on the part of the government. It may be less costly to make a one-time offer of generous recapitalization, which succeeds in inducing all insolvent banks to reveal themselves, than to offer less recapitalization initially but to be forced in the future to repeat the recapitalization in order to save the insolvent banks that did not reveal themselves the first time around.

Although the potential for triggering a policy of too-many-to-fail appears to be greater in economies with developing financial markets than in economies with developed markets, even developed market economies do not appear to be immune to the risk. One concern expressed in a review by the Federal Reserve Bank of Atlanta of the Federal Deposit Insurance Corporation Improvement Act of 1991 is that the act does not provide adequate protection against "sudden massive losses at one or more banks." In the event of sudden losses "[r]egulators, [who] have limited operational resources (such as people) and [who] may also face financial constraints that restrict the number of bank closings they can handle at one time...may want to provide 100 percent coverage as a means to avoid closing too many banks in a short period." Moreover, these massive losses do not actually have to occur suddenly in order to appear sudden. "Rather than truly being sudden, large losses may only appear to be so because banks and bank regulators have failed to provide for the timely recognition of reduction in asset values."

When collusive equilibria are highly likely, the regulator may opt for a slow buildup of bank supervisory power over time. The cost of such a policy is that the level of creditor passivity in the economy may remain at a high level over a long period of time, thereby weakening the disciplinary functions of financial markets. Some of the difficulties with financial reform in the economies in transition are likely related to this phenomenon.

7 Appendix

Proof of Claim 2: Suppose that the rescue policy is applied to detected passive banks. Then, the minimum level of recapitalization necessary to induce banks to become active is $R_{\max}$. To see this, take any level R of recapitalization. In order for banks to become active, $R+\rho \geqslant (1-D)\cdot q[I_B+\alpha_B B-L]+D\cdot R+\rho$, or $R \geq (1-D)R_{\max}+DR$. The minimum value of R that satisfies this inequality is $R_{\max}$. If rescue is not applied to detected passive banks, then the minimum value of R necessary to induce banks to become active will be $R(D)+\rho=(1-D)\cdot q[I_B+\alpha_B B-L]+(1-D)\rho$, or $R(D)\equiv(1-D)R_{\max}-D\rho$. It is clear that $R(D)\leq R_{\max}$, with equality only at $D=0$. ||

Proof of Claim 4: (i) Because $D^i>\widetilde{D}$, banks' total expected payoffs are higher with D^i and rescue than with D^i and intervention. Condition (ii) implies that, given the discovery of m insolvent banks, it is less costly to implement rescue than intervention. Condition (iii) implies that, *ex ante*, given no implicit collusion, G would prefer to implement intervention than to precommit to rescue. If condition (iii) does not hold, then G would never try to implement intervention; thus, no collusive equilibrium could occur.||

Proof of Claim 5: TMTF will be triggered only when $D>\widetilde{D}$. *Ex ante*, the total costs to G of a situation in which TMTF is triggered are $g(D)+\widetilde{R}_{\min}\cdot m$. This cost is minimized for $\widetilde{D}$. G can thus ensure himself of paying no more than this minimum cost by choosing $\widetilde{D}$ and precommiting to a policy of rescue with $\widetilde{R}_{\min}$. Moreover, if there exists a $D<\widetilde{D}$ such that precommiting to rescue with this D and $R(D)$ yields even lower cost, then a precommitment to rescue will be stricly less costly than allowing rescue to occur *ex post*.||

Proof of Proposition 3: (i): If G does not believe that implicit collusion will occur, then the situation is similar described in Proposition 2. (ii) and (iii): Claim 5 implies G can always do at least as well by precommiting to rescue than by allowing TMTF to be triggered *ex post*. Hence, either G precommits to rescue in response to implicit collusion, or he lowers D to a level such that implicit collusion will not occur and intervention will be a credible policy. The convexity of the total costs $C_i(D;m,Dm)$ of intervention, together with the assumption that $D^i>\widetilde{D}$, implies that costs of intervention are lower for $\widetilde{D}$ than for any $D<\widetilde{D}$. Hence, the appropriate comparison is between $\widetilde{D}$ and intervention and D^r and precommitment to rescue.||

Proof of Claim 7: If banks are passive at D_G, the *ex post* costs of intervention will be $i(D_G; m, D_G m) = LNW \cdot (1 - D_G)m + c_i(D_G m)$, and the *ex post* costs of rescue will be $r(D_G; m, D_G m) = LNW \cdot m + R_{\min} \cdot D_G m$. TMTF will be triggered if $i(D_G; m, D_G m) > r(D_G; m, D_G m)$, or if the inequality in the statement of the claim holds.‖

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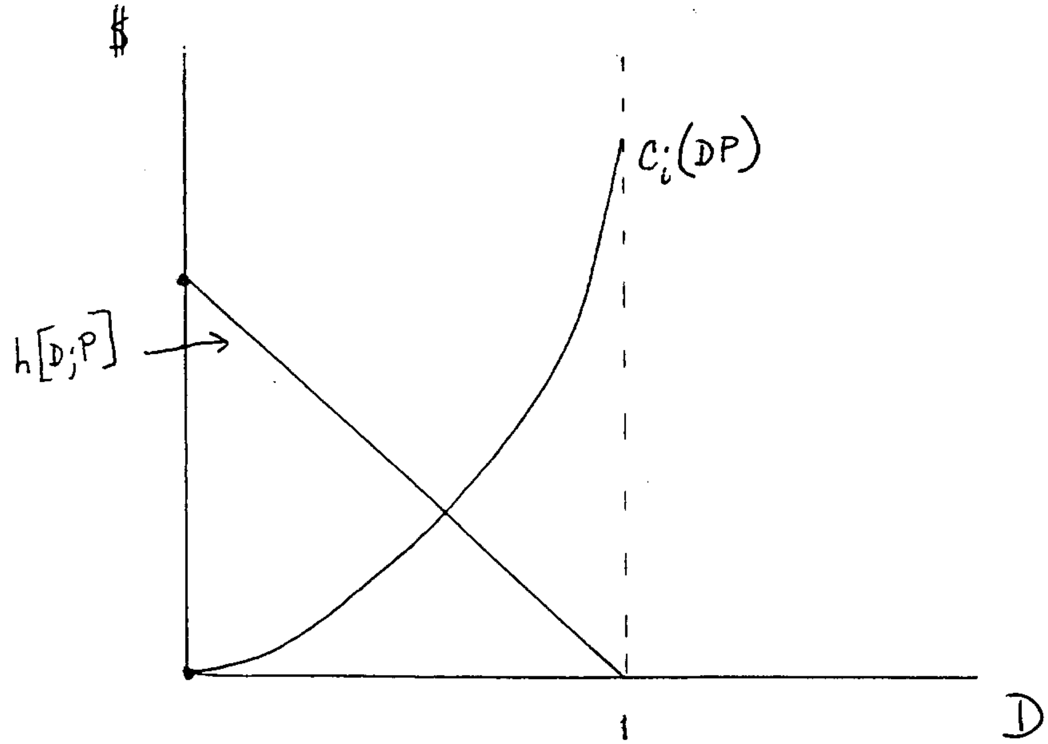

Figure 1

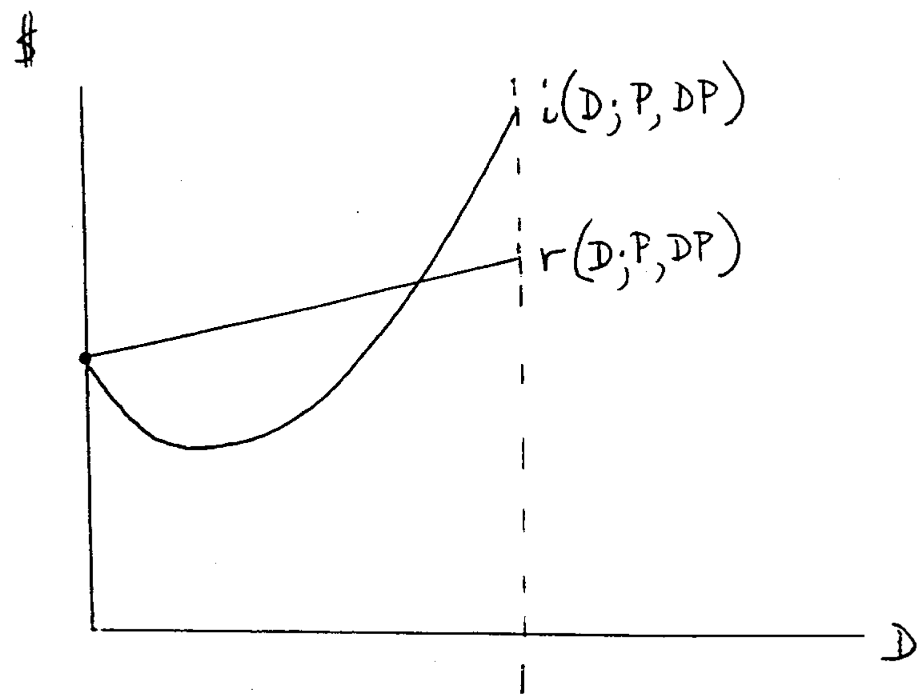

Figure 2