

Bad Debts and the Cleaning of Banks' Balance Sheets: An Application to Transition Economies¹

Janet Mitchell

Facultes Universitaires Saint-Louis (Brussels), ECARES, CEPR, and William Davidson Institute
E-mail: jmitchell@fusl.ac.be

Received March 4, 1999

This paper develops a framework for analyzing tradeoffs between policies for cleaning banks' balance sheets of bad debt when asymmetric information exists between banks and regulators regarding the amount of bad debt. The framework consists of a two-tier hierarchy composed of a regulator, banks, and firms. Hidden information and moral hazard are present at each tier of the hierarchy. The analysis identifies two types of effects of the regulator's policy choice: a direct effect on a bank's willingness to reveal its bad loans versus hiding them via loan rollovers, and an indirect effect on firm behavior as a function of the bank's response. The framework is applied to analyze tradeoffs between three policies: a laissez-faire policy, transfer of debt to an asset management company, and cancellation of debt inherited from a previous regime. *Journal of Economic Literature* Classification Numbers: G21; G28; G30; P34. © 2001 Academic Press

1. INTRODUCTION

Many countries throughout the developing and industrialized world have suffered banking crises in recent years. Lindgren *et al.* (1996) estimated that in the decade and a half prior to the early 1990s over 130 countries experienced some degree of financial difficulty. Of these, 36 countries were judged to have experienced a banking crisis. The Asian crises have undoubtedly added several more countries to the list.

Importantly, the countries experiencing banking crises are not all developing and emerging market economies; many industrialized countries have also suffered

¹ This is a revised version of CEPR Discussion Paper 1977 (1998). I thank Jenny Corbett, Patrick Legros, Maureen O'Hara, Anthony Saunders, Bruce Smith, and three anonymous referees for helpful conversations and advice. I owe special thanks to John Bonin, who worked with me on a very early version of this paper. Research for the paper was financed by the U.S. National Science Foundation and the International Research and Exchanges Board.

crises. Yet, emerging market economies appear to be somewhat more vulnerable to banking crises than industrialized economies.² In addition, a unique set of historical conditions faced by the transition economies (TEs) has created an even greater vulnerability to banking crises than in other emerging market economies. In each of the TEs commercial banks, which were created by dividing up the assets and liabilities of the previous monobank, received a sizeable (though unknown) quantity of bad loans on their books at the point of their inception. These inherited loans are considered to have played a role in banking sector difficulties, at least those occurring early in the transition.

Once a banking crisis has occurred, regulators in any country must address a series of questions, including whether to close troubled banks; how to handle the assets of banks that are closed; and what policy to apply to banks that are allowed to continue in operation but which may have significant quantities of bad loans on their balance sheets. In practice regulators often become reluctant to close troubled banks once a banking crisis is perceived to be systemic. By allowing banks to continue in operation, regulators attempt to avoid negative externalities—such as credit crunches, premature liquidation of profitable projects, and financial contagion to healthy banks—created by large numbers of bank closures.³ Examples in which regulators have opted for bank rescues during banking crises are numerous. In an account of the Swedish banking crisis in the early 1990s, Ingves and Lind (1997) note that “[t]he closer the situation gets to a systemic [banking] crisis, the larger is the likelihood of state intervention, including state financial support.” One description of Norway’s banking crisis states that in 1991 there was a perception that the country was suffering a generalized banking crisis, and “there appeared to be no other acceptable solution than a large-scale government rescue operation.” (Steigum, 1992) These sentiments accurately describe experience in banking crises around the world.

This paper deals with the situation in which regulators have decided not to close troubled banks in a banking crisis. It addresses the following questions. Given that regulators have decided not to immediately close troubled banks, how might policies designed to clean banks’ balance sheets of bad debt affect bank behavior? Does the policy applied to banks influence their borrowers’ behavior? Are loan transfers to a specialized asset management company the optimal policy? When some of the bad debt on banks’ balance sheets has been inherited from a previous regime, as in the case of the TEs or other countries where banks have been recently privatized, is cancellation of this debt optimal?

To address these questions the paper analyzes tradeoffs between three policies: a *laissez-faire* policy, referred to as self-reliance, a transfer of debt from commercial banks to a specialized asset management company (AMC), and cancellation of debt

² Caprio and Honohan (1999) cite greater volatility and political interference in banking as two reasons for the greater susceptibility to crises of emerging market economies.

³ For models of externalities associated with bank closures see Dreyfus *et al.* (1994), Mitchell (1998), and Rochet and Tirole (1996).

that has been inherited from a previous regime. The desirability of transferring debt to an AMC has been the subject of considerable policy discussion and has been cited by some authors (see, for example, Dziobek and Pazarasioglu (1997)) as an element of best practice in the response to banking crises. Many countries, including the United States, Japan, Sweden, Thailand, and the Czech Republic, have used AMCs in some form.

As suggested above, the policy of debt cancellation is especially relevant to TEs. Much discussion regarding the appropriate policies for cleaning banks' balance sheets took place early on in these economies.⁴ The policy of canceling inherited debt in the TEs was advocated by a number of prominent economists (Begg and Portes, 1993; Blanchard *et al.*, 1991, p. 49; Calvo and Frenkel, 1991; Dornbusch, 1991), who argued that cancellation of the inherited debt would remove a burden of the past from firms' balance sheets without changing the value of state-owned assets, since all firms and banks were state-owned at the beginning of transition. Interestingly, with the exception of Bulgaria none of the TEs have canceled any of the inherited debt.⁵

Although the question of debt cancellation is of particular interest for TEs, it is also relevant for countries where banking crises follow a regime change in which banks in the earlier regime either were state-owned or were required to lend to certain firms or sectors. In fact, directed lending and state ownership of banks are common features of developing economies. In addition, there is evidence that banking crises frequently follow liberalization of banking sectors (Demirguc-Kunt and Degtragiache, 1998). Mexico offers a specific example where a banking crisis followed bank privatization. According to some observers, poor handling of the privatization process played a role in the banking crisis that developed two years afterward. For example, McQuerry (1999) notes that "[m]uch evidence suggests that the manner in which Mexico's banks were sold set the stage for future problems in the banking sector." Gil-Diaz (1998) concludes that "[t]he original sin that led to the Mexican crisis is to be found in the expropriation of commercial banks that weakened them and rendered them a fragile conduit for privatization and credit expansion."

A number of factors are shown in this paper to influence policy tradeoffs. These factors include asymmetric information between regulators and banks regarding

⁴ See Begg and Portes (1993), Bonin (1993), Bonin and Schaffer (1995), Brainard (1991), Calvo and Frenkel (1991), Caprio and Levine (1992), Coricelli and Thorne (1993), Dornbusch (1991), Estrin *et al.* (1992), Levine and Scott (1992), Marrese (1994), Saunders and Sommariva (1993), and Thorne (1993).

⁵ The most frequently cited explanation for the absence of this policy has been that it creates a credibility problem: if the government is willing to cancel debt once, then agents may believe that the government will be willing to cancel debt in the future. However, the feature of debt cancellation that gives rise to the credibility problem is bank recapitalization rather than cancellation of the debt *per se*. If banks were not recapitalized in conjunction with debt cancellation, they would oppose this policy since it would require them to write down their assets. Recapitalization has accompanied both the debt transfer and self-reliance policies that governments in TEs have actually implemented; therefore, these policies also give rise to an analogous credibility problem. The credibility argument then cannot completely explain why policies other than debt cancellation have been chosen.

the amount of bad debt on banks' balance sheets, the degree of inside information acquired by banks in their lending relationships with firms, and the effectiveness of corporate governance of firms. Most of the literature focusing on the regulator's decision on when and whether to close a troubled bank assumes symmetric information between the bank and the regulator (and all other outsiders) regarding the financial health of the bank at the point where the regulator must make the closure decision. (See, for example, Boot and Thakor, 1993; Mailath and Mester, 1993; Dreyfus *et al.*, 1994; Rochet and Tirole, 1996.) Yet, asymmetric information between banks and regulators is a common feature of banking sector problems in practice.

The presence of asymmetric information between banks and the regulator implies that a bank may be able to hide its bad loans by rolling them over. It appears that banks regularly engage in this practice, and policy discussions of banking sector problems are filled with references to such behavior. Corbett (1999) provides a revealing quote from Lindgren *et al.* (1996): "[O]wners and managers of unsound banks have incentives to show loans as performing in order not to lose their bank." Caprio and Honohan (1999) note that "bank supervisors do not have the inside information or the resources to challenge the bank's assessment of its loans on a case-by-case basis," and "even with the best accounting systems, it is difficult to prevent a bank from concealing a nonperforming loan simply by making a new loan to cover the repayment, a practice known as 'evergreening.'" Calomiris (1997) makes reference to an agency problem created by the fact that banks "can hide increases in deposit default risk—either by hiding loan losses or disguising the riskiness of their portfolio."

In terms of the model of this paper the presence of asymmetric information implies not only that banks have the capacity to hide bad loans but also that the regulator must take into account the effect of the policy choice on the bank's willingness to reveal and deal with its bad loans. I label the effect of the policy on the bank's decision to roll over defaulting loans versus revealing and addressing them as the *direct* effect of the policy. A manager of an insolvent bank who derives a private benefit from operating the bank will attempt to hide bad loans by rolling them over if revelation of the bank's insolvency would result in the manager losing her job or in bank closure. The policy of self-reliance implies just such an outcome for insolvent banks; therefore, this policy will not induce insolvent banks to reveal and deal with their bad debt. Loan rollovers create inefficiencies (and lower bank values) since defaulting firms whose liquidation values are greater than their continuation values (or whose continuation values would be greater with restructuring) will continue in operation according to the status quo.

A second factor that influences policy tradeoffs is the loss in private information when a loan is transferred from the original lender bank to another institution. That banks acquire inside information about their borrowers is a common assumption in the banking literature (see Petersen and Rajan, 1997; Diamond and Rajan, 1998). Empirical evidence supporting the claim that information is lost when loans are

transferred from the original commercial bank to other institutions is provided by Slovin *et al.* (1993) and James (1991). The assumption of information loss has implications for the policy tradeoffs analyzed here. On the one hand, as a response to the poor incentives of troubled banks to reveal their bad debt with the policy of self-reliance, the regulator might be tempted to transfer loans from commercial banks to an AMC (and recapitalize the original banks). On the other hand, the loss of valuable information when the loans are transferred from the original bank may imply that the AMC would ultimately collect less on the loans.

A final feature of the analysis is that it allows for *indirect* effects of policies on firm behavior, in addition to the direct effects on bank behavior. The strength of the indirect effect of policies will be determined by institutions of corporate governance. The indirect effect of a policy arises from asymmetric information between the lender bank and the firm regarding the value of the firm and the firm manager's use of the firm's assets. When a bank rolls over a defaulting loan, it does not use bankruptcy procedures against the debtor. In this case the bank has less ability to constrain the debtor firm's manager from improper use of the firm's assets than when the bank uses a bankruptcy procedure (or even an out-of-court workout). This is true for two reasons. First, bankruptcy proceedings (or out-of-court workouts) serve the purpose of bringing together the firm's creditors to gather information and value the firm (see Harris and Raviv, 1990). No such valuation takes place when the bank rolls over its defaulting loans. The bank thus obtains less information about the value of the firm and the firm manager's activities. Consequently, there is greater scope for the firm manager to undertake unprofitable activities without being caught. Second, even if the bank detects that the firm manager is not employing the firm's assets in their most productive use, the bank may not be able to provide sufficient incentives to the manager to change her behavior, since the threat of bankruptcy is not credible due to the fact that the bank has rolled over and hidden the defaulting loan. Firms' continuation values (and total repayments to the bank) are lower as a result.⁶

The magnitude of the indirect effect of policies will be determined by the effectiveness of corporate governance of firms, i.e., by the existence of mechanisms other than debt which serve to discipline firm managers. In economies where corporate governance is weak, the indirect effect of the regulator's policy choice may be quite important. The strength of the indirect effect will also be influenced by managers' time horizons with the firm. In TEs, where managers risk losing their jobs upon firm privatization, their time horizons may indeed be short, and indirect effects strong.

The presence of asymmetric information between regulators and banks and between banks and firms—leading respectively to the direct and indirect effects

⁶ The analysis is conducted under the assumption that banks are commercial banks and do not hold equity in their borrowers. A recent paper by Boyd *et al.* (1998) suggests that if a universal bank could share in the benefits of asset dissipation by firm managers, problems arising from indirect effects of policies might actually be worse.

of policies—requires a model with a two-tier hierarchy. This hierarchy consists of a regulator, banks, and firms. Asymmetric information and moral hazard exist at both tiers of the hierarchy. The policy chosen by the regulator is the policy that maximizes the expected value of bank and firm values, where the expectation is taken over the regulator's prior regarding the level of default on banks' balance sheets.

Results of the analysis, and the answers to the questions raised above, may be summarized as follows. First, the government's choice of policy affects bank behavior (and banks' asset values): banks may react to policies by passively rolling over their defaulting loans. Second, the government's policy choice also has an indirect incentive effect on banks' borrowers' behavior, which then impacts the real asset values on banks' balance sheets. This second-order effect of government policy has been largely ignored in literature on the incentive effects of bank regulation.⁷ Third, none of the policies under consideration is unconditionally optimal; none of the policies can qualify unambiguously as an element of best practice in regulatory response to banking crises. The transfer of debt to an AMC can only be optimal if there is little loss of inside information when debt is transferred from commercial banks and if the banks would have strong incentives to roll over bad loans with the policy of self-reliance. Self-reliance can only be optimal if banks do not have strong incentives to roll over loans and if the indirect effects of policies are significant. A final result is that it may not be optimal to cancel bad debts that have been inherited from a previous regime, even if these debts are responsible for the onset of the banking crisis. When corporate governance is weak, the indirect effects of policies may be strong and cancellation of debt can then have the negative effect of removing the only disciplinary device for firm managers. In this case firm values (and repayments to banks) turn out to be lower than if the debt were not canceled. This result is significant for TEs, where corporate governance is extremely weak, and it runs counter to the intuition invoked by those who have advocated debt cancellation for these countries. Interestingly, debt cancellation has also been proposed in the reform of the Chinese banking system despite the fact that China's economic transition has been in progress for several years.

This paper is related to a small set of papers that analyze regulatory responses to banking crises in the presence of asymmetric information. (See Aghion *et al.* (1999), Corbett and Mitchell (2000), and Mitchell (1998).)⁸ A natural question arising in this literature is whether regulators can induce accurate revelation by banks of their bad loans simply by offering to recapitalize the banks (assuming that the bank managers who accept the recapitalization are not dismissed). In an approach similar to this paper Aghion *et al.* (1999) show that if insolvent banks are

⁷ See Bhattacharya *et al.* (1998) for a discussion of this literature.

⁸ O'Hara (1993) and Rajan (1994) model banks' treatment of bad loans under the assumption of asymmetric information between insiders and outsiders; however, the contexts are quite different from this paper. Dewatripont-Tirole (1994) also assume asymmetric information between regulators and banks; however, they do not endogenize the bank's choice or analyse the regulator's bank closure decision.

recapitalized and bank managers not dismissed, insolvent banks will reveal their bad debt; however, now a new tradeoff arises: solvent banks will have an incentive to overstate their levels of bad debt in order to qualify for recapitalization. Mitchell (1998) analyzes the effect of a regulator's inability to commit not to rescue banks when a situation labeled "too many to fail" occurs, in which enough banks have been discovered to be in trouble that the social costs of closing the banks become higher than the costs of rescuing them. When banks believe that too-many-to-fail will be triggered, insolvent banks have the incentive to reveal their bad loans; however, solvent but troubled banks now have an incentive to roll over their bad loans, thereby lowering their expected net worth in the expectation of being recapitalized. Corbett and Mitchell (2000) consider banks' reactions to a regulator's offer of recapitalization when bankers' private benefits from operating the bank are endogenously determined reputations. They show that even when conditions accompanying recapitalization are very "soft" on the banker, bankers' reputational concerns can cause them to reject recapitalization offers, which has the effect of prolonging the banking crisis.

The paper proceeds as follows. Section 2 presents the model and identifies the tradeoffs between the policies of debt cancellation, debt transfer, and self-reliance. Section 3 analyzes the regulator's choice of optimal policy. Section 4 discusses the role of some of the assumptions and concludes.

2. THE MODEL

The timing of events is as follows. In period 0 each commercial bank in the economy has a continuum of debtors of measure 1 with loans equal to d for each debtor. Each bank has an amount H in deposits.⁹ Total debt repayments for a firm equal $d(1 + s)$, where s represents the interest rate. Interest sd is assumed to come due in period 1, whereas principal d comes due in period 2. Prior to the beginning of period 1, and before the precise level of default on banks' balance sheets is known, the government chooses a policy: debt cancellation, debt transfer, or self-reliance. One may think of a situation where the government, as a result of past bank monitoring, realizes that problems (or a crisis) are developing in the banking sector; however, the government has decided against closing troubled banks, perhaps on the belief that many banks in the system are affected.

At the beginning of period 1 firms realize their period-1 income and learn their continuation and liquidation values. The combination of income and continuation and liquidation values determines each firm's type (good or bad debtor). All of this information is private to firms. After firms realize their income and learn their types, they make interest repayments to banks. More precisely, good debtors

⁹ I assume that banks are identical in terms of size, leverage, etc. This assumption has the effect of simplifying notation, especially the terms containing the regulator's expectations over levels of default on banks' balance sheets. All of the qualitative results of the paper would go through if banks' differed in size and leverage. I return to this point in Section 4.

will make interest repayments (if debt cancellation has not been chosen), whereas bad debtors will have no choice but to default on these repayments. (When debt cancellation is chosen, loans are written off the banks' and the firms' books prior to period 1, and default does not occur in period 1.)

Information regarding loan defaults is private to the bank. If default has occurred, banks decide whether to roll over or to invoke bankruptcy (or out-of-court workout) for the loans in default. Note that invoking bankruptcy can imply the initiation of a bankruptcy reorganization procedure or a liquidation procedure for the firm. I will use the term "bankruptcy" generically, to denote any action—including out-of-court workout, bankruptcy reorganization, or bankruptcy liquidation—in which the bank attempts to value the firm and recover some of its loan and to reorganize or liquidate the firm. Choosing "bankruptcy" for a loan enables the bank to value the firm at a cost and to slow or halt the dissipation of assets.

Once banks have chosen between *bankruptcy* and *rollover* for their defaulting loans, firms choose their levels of asset dissipation to undertake during period 1. If firm managers choose positive levels of asset dissipation, this dissipation will occur during period 1, unless managers' activities are constrained as a result of a bankruptcy procedure for a defaulting loan.

The term asset dissipation refers to any use of the firm's assets in an activity that is not profit-maximizing. Asset dissipation can include any of a range of behaviors: consumption of perquisites by the firm manager, investment in projects that yield private benefit to the manager but that are not profit-maximizing for the firm, diversion of firm profit through sales of the firm's output at artificially low prices to another firm in which the manager has a stake, or transfer of the firm's assets to another firm. Each of these types of activities lowers the firm's continuation and liquidation values.

All outstanding loans are repaid in period 2. If asset dissipation has occurred during period 1, the value of the firm's assets that is realized at this point (and the available funds for repaying loans) will be lower than the value that would have been realized had no asset dissipation occurred.

The timing of events is summarized below.

Period 0

Government regulator chooses a policy: self-reliance, debt transfer, or debt cancellation

Period 1

Firms realize income, learn their continuation/liquidation values (hence, learn their types)

Default on loans occurs

Banks observe default

Banks choose action (bankruptcy or rollover)

Firms choose level of asset dissipation

Period 2

Outstanding loans repaid

The institution that observes default in period 1 and that decides whether to choose bankruptcy or rollover will be an AMC if debt transfer is the regulator's policy choice and the commercial bank if self-reliance has been selected.

2.1. Firm Behavior

The amount of asset dissipation that occurs during period 1 affects the firm's value in period 2. Let the proportion of the firm's assets that are dissipated be given by Δ .

Assumption 1. The maximum feasible value of Δ is given by $\bar{\Delta} \leq 1$.

The maximum level of assets $\bar{\Delta}$ that can be diverted from the firm's productive activities is determined by existing regulations and institutions of corporate governance; therefore, the value of $\bar{\Delta}$ will differ across countries. In economies such as the United States where institutions of corporate governance are strong, $\bar{\Delta}$ is positive but probably far from 1. Yet, even in this context asset diversion occurs, and the assumption that firm managers may appropriate returns or the firm's assets for their personal benefit is commonly employed in the finance literature.¹⁰ In Europe, where firms are often owned through complicated pyramid structures and where institutions of corporate governance are weaker than those in the United States, the value of $\bar{\Delta}$ is likely to be higher. Finally, in economies such as Russia, where corporate governance mechanisms are virtually nonexistent, $\bar{\Delta}$ is probably close to 1: firm managers are virtually free to steal the firm's assets. Indeed, this type of "spontaneous privatization" of state-owned firms' assets occurred in each of the TEs at the beginning of their transitions from socialist to capitalist economies. Although firms in these countries were still formally state-owned at the beginning of the transition, state regulators relinquished their control over the firms, and many firm managers were able to divert assets to newly formed private firms.¹¹

Let $x_i(\Delta)$ denote the continuation value (gross of debt repayments) in period 2 for firm i and for a given period-1 level of asset dissipation Δ . $x_i(\Delta)$ is assumed to be decreasing in Δ , with $x_i(0) = \bar{x}_i$ and $x_i(1) = 0$. The value $\bar{x}_i$ represents the period-2 continuation value of the firm if no asset dissipation occurs in period 1. This is the maximum possible continuation value of the firm. Asset dissipation during period 1 lowers the firm's period-2 continuation value; when $\Delta = 1$, there are no assets left in the firm to operate in period 2.

Define the liquidation value $l_i(\Delta)$ of firm i in period-2 in a manner similar to the continuation value. $l_i(\Delta)$ is nonnegative and decreasing, with $l_i(0) = \bar{l}_i$ and $l_i(1) = 0$.

¹⁰ Examples include Bolton and Scharfstein (1990, 1994), Grossman and Hart (1982), Hart and Moore (1995, 1996), Jensen (1986), and Shleifer and Vishny (1992).

¹¹ The timing of privatization of firms in TEs is also a potentially important determinant of asset dissipation; the longer the required time for privatization, the greater the potential for asset diversion. Although most of the discussions of privatization in the TEs acknowledged the problem of asset dissipation, none of the discussions of the problem of bad debt on banks' balance sheets recognized the relevance of this phenomenon.

Firm i 's period-2 value, gross of debt obligations, is then given by the maximum of the continuation and liquidation values: $V_i(\Delta) = \max\{x_i(\Delta), l_i(\Delta)\}$. If the firm is continued in operation in period 2 and if the debt obligation remains on the firm's books, then its period-2 value net of debt obligations will be given by $x_i(\Delta) - d$.

A firm will be called *viable* if its maximum continuation value is greater than its maximum liquidation value; that is, in the absence of any asset dissipation and in the absence of a debt overhang, its value in continuation would be greater than its liquidation value.

DEFINITION 1. Firm i is viable if $\bar{x}_i > \bar{l}_i$.

It is useful to distinguish the concept of viability from that of solvency. The latter depends upon the amount of outstanding debt on the firm's books. The solvency of the firm in period 2 will be important for the manager's asset dissipation decision in period 1.

DEFINITION 2. Let d_i represent the debt of firm i owed to the bank in period 2. Let x_i denote firm i 's period-2 continuation value gross of debt repayments. Then firm i is *solvent* if $x_i \geq d_i$.

Asset dissipation by firm managers in period 1 determines two sources of private managerial benefits. On one hand, asset dissipation confers current (period-1) private benefits on managers. On the other hand, asset dissipation reduces the future value of the firm and thus potentially reduces the manager's future private benefits if the firm continues in operation. Denote the value of current private benefits generated by a level Δ of asset dissipation by $b(\Delta)$, where $b(0) = 0$ and $b(\cdot)$ increasing.

Denote the manager's future private benefits by a function $P_i(\Delta) = \xi \cdot \text{Max}[0, \text{firm's (net) continuation value}]$, where the parameter ξ takes on a value between 0 and 1 and represents the degree to which the manager's future private benefits from continued operation of the firm are tied to the firm's value. If the debt is left on the firm's balance sheet in period 2 and if the firm continues in operation in this period, then the firm's (net) continuation value will be $x_i(\Delta) - d$, and $P_i(\Delta) = \xi \cdot \text{Max}[0, x_i(\Delta) - d]$. The value of ξ will depend upon institutions of corporate governance, the manager's time horizon with the firm, and the extent to which the manager's remuneration or control over assets is linked to the firm's value. If the manager is the sole owner of the firm in period 2, $\xi = 1$. On the other hand, if the manager is sure to have no relationship with the firm, $\xi = 0$.¹² Note that since $x_i(\cdot)$ is decreasing in Δ , $P_i(\cdot)$ is also decreasing in this variable. Clearly, if the firm is liquidated before period 2, $P_i(\Delta) = 0$.

Assumption 2. The manager's utility is $U_i(\Delta) = b(\Delta) + P_i(\Delta)$.¹³

The manager's salary from working in the firm is normalized to 0 in the utility function specified by Assumption 2. This function reflects the tradeoff

¹² In TEs the value of ξ will also be influenced by the method of privatization of state-owned firms.

¹³ For expositional simplicity I assume no discounting in the managerial utility function or in bank profit. Note that the parameter ξ could also include a discounting factor.

between current and future benefits that the manager faces in dissipating the firm's assets.

Assumption 3 guarantees that asset dissipation is inefficient.

Assumption 3. One dollar's reduction in period-2 firm value yields less than a dollar's increase in current private managerial benefits.

There are two types of firms in the model: good debtors and bad debtors. Definitions of the types reflect combinations of assumptions on period-1 incomes and on the solvency of firms. Good debtors are assumed to be solvent, and they are also liquid. That is, all solvent firms are assumed to earn enough income in period 1 to meet interest repayments in that period. Bad debtors are assumed to be insolvent, and they are also illiquid; i.e., firms whose maximum period-2 continuation values cannot cover period-2 debt repayments d also earn insufficient income in period 1 to meet interest repayments sd . These strong assumptions regarding liquidity of good and bad debtors are made for expositional convenience only and do not affect the qualitative results of the model.¹⁴

DEFINITION 3. A *good debtor* has the following characteristics: (1) period-1 income exceeds interest payments sd , and (2) $\bar{x}_i - d \geq 0$.

DEFINITION 4. A *bad debtor* has the following characteristics: (1) period-1 income is less than sd , and (2) $V_i(0) - d < 0$.

These definitions imply that the good debtor can remain solvent as long as the value of Δ chosen by the manager is not too large. Bad debtors have so much debt on their books relative to potential earnings that default in period 1 is inevitable even if $\Delta = 0$. An assumption on income flows that would be consistent with these definitions is that solvent firms earn period-1 income equal to sd and insolvent firms earn period-1 income equal to 0.¹⁵

The level of asset dissipation chosen by a firm manager is endogenous. It will be a function of the firm's type (good or bad debtor), G 's choice of policy, and the bank's response to default. In the sections below I analyze bank behavior and firms' asset dissipation decisions for each policy.

2.2. Self-Reliance

Assumption 4 describes the banker's utility function.

Assumption 4. The banker's objective function is $W(\Pi, \rho) = \max[\Pi, 0] + \rho$, where Π represents expected two-period bank profit and ρ represents a private benefit to the banker of maintaining the bank in operation.¹⁶

¹⁴ More precisely, these assumptions rule out the need to take into account the case where defaulters are illiquid but not insolvent and the case where nondefaulters are insolvent but liquid.

¹⁵ The assumption that firms' types are realized exogenously at the beginning of period 1 is made to simplify the exposition. This assumption is not essential to the model. Similar results can be obtained with a model in which firms' choices of levels of asset dissipation prior to period 1 determine their type.

¹⁶ This objective function is also employed in Aghion *et al.* (1999). A similar objective function is employed in Rajan (1994).

The parameter ρ in Assumption 4 represents the private benefit of keeping the bank in operation (under the implicit assumption that the bank will be closed or the manager replaced if the bank becomes insolvent), where in this model two-period bank profit is equivalent to bank net worth. Note that if the bank is insolvent but liquid in period 1 and if the insolvency is not discovered until period 2 when the bank's negative net worth is observed, the bank manager still enjoys the benefit ρ of keeping the bank in operation during period 1.¹⁷ In contrast, if the insolvency is discovered in period 1, the manager will lose the private benefit and will have a level of utility of 0. The presence of ρ in the bank manager's objective function thus creates an incentive to hide the bank's insolvency by rolling over loans in default.

A bank with some proportion α of its loan portfolio in default chooses between two actions: bankruptcy or rollover.¹⁸ Bankruptcy and rollover policies are defined as follows.

Bankruptcy: (i) At a cost $c(\alpha) > 0$, with $c''(\cdot) \geq 0$, the bank learns $V_i(\Delta)$ for each defaulting firm and can halt asset dissipation.

(ii) The bank may write off some debt.

Rollover: Loans are rolled over; therefore, on the bank's balance sheet the loans appear to be performing.

The definition of the action *bankruptcy* implies that when the bank chooses this action, it will learn at a cost the value of its defaulting debtors and will be able to liquidate nonviable firms and halt asset dissipation of viable firms. The assumption that it is costly to learn the debtor's value is consistent with the literature on costly state verification (initiated by Townsend (1979)). The cost function $c(\alpha)$ includes resource costs that are incurred with either out-of-court workouts or bankruptcy proceedings. These costs arise from information-gathering activities and valuation of the firm, coordination with other creditors, and negotiations with the debtor and with other creditors. (Administrative bankruptcy costs are also an obvious component of these costs when bankruptcy procedures are invoked against borrowers.) Even if the bank has better access to inside information concerning its debtors than do other outsiders, the process of valuation and of determining the best course of action for the firm is nevertheless costly.

The presence of costly activities associated with the action *bankruptcy* has an important implication: it is impossible for banks to undertake full-fledged out-of-court workouts (or bankruptcy proceedings) for defaulting debtors without these activities being observed by the regulator.¹⁹ Thus, a bank cannot simultaneously roll over its loans so as to disguise its loan defaults and surreptitiously

¹⁷ It is quite common for insolvent banks to be able to remain liquid. Many of the failed Savings and Loans in the U.S. Savings and Loans crisis were liquid up until the day that they were closed.

¹⁸ I assume that the bank applies the same action to all of its debt. Its optimal strategy in some cases may be to use bankruptcy for some portion of its defaulting debt and to roll over the rest. Allowing for partial bankruptcy and partial rollover does not change the qualitative results.

¹⁹ It is obvious that initiation of a bankruptcy proceeding against a defaulting debtor will be observable to outsiders.

undertake a workout to value its debtors and increase loan repayment.²⁰ Assumption 5 formalizes this idea.

Assumption 5. The bank's choice of bankruptcy is observable and its value of α becomes known when it chooses bankruptcy.

A consequence of Assumption 5 is that although rollover of loans involves no explicit cost, it does entail an implicit cost: lower bank net worth due to lower loan recovery than with bankruptcy, since nonviable firms will remain in operation when the bank chooses rollover and the bank will recover only the firm's continuation value. Another potential cost of rollover relative to bankruptcy is lower loan recovery due to unhalted asset dissipation by firm managers.

Although when the bank chooses rollover it does not learn the continuation or liquidation values of any given defaulter, it is assumed to know the general probability distribution of continuation and liquidation values of bad debtors and can thus calculate the conditional expected value of a firm given that it is a bad debtor. These expected values will influence the bank's choice of bankruptcy or rollover for loans in default given a policy of self-reliance.

The conditional expected value of a firm calculated by the bank will be a function of both the firm's type (good or bad debtor) and of the level of asset dissipation that is expected to be chosen by the firm manager. Define the conditional expected continuation and liquidation values (gross of debt repayments) in period 2 of a firm, given that it is a bad debtor and given some level of period-1 asset dissipation Δ , by $x(\Delta | B)$ and $l(\Delta | B)$, respectively. The conditional expected period-2 value of the firm given that it is a bad debtor is then given by $V(\Delta | B) = E\{\max[x(\Delta | B), l(\Delta | B)]\}$. The conditional expected value in period 2 for a good debtor is defined analogously: $V(\Delta | G) = E\{\max[x(\Delta | G), l(\Delta | G)]\}$.

Recall that by Definition 4 bad debtors are insolvent; their maximum possible asset values are lower than the face value of their debt. By definition of rollover, all defaulting firms whose loans are rolled over will continue in operation in period 2; hence their values (gross of debt obligations) will be their continuation values $x_i(\cdot)$. Given that for all bad debtors $x_i(\Delta) \leq V_i(0) < d$, the bank will receive as debt repayment in period 2 the entire continuation value $x_i(\Delta)$ of each bad debtor i . The continuation of a bad debtor in period 2 as a consequence of rollover will be inefficient if the firm is nonviable, since in this case $\bar{l}_i > x_i(\Delta)$.

A second source of inefficiency with rollover is unhalted asset dissipation by firm managers. Note that in contrast to rollover, the choice of bankruptcy by banks will avoid both of these inefficiencies. During the course of a workout or bankruptcy proceeding in period 1 the bank learns $x_i(\cdot)$ and $l_i(\cdot)$ for each bad debtor, and it can

²⁰ The assumption that $c''(\cdot) \geq 0$ implies only that there are no economies of scale in the treatment of bad loans. This assumption is made for technical reasons only and is not essential for the results.

In a similar manner, the assumption that banks may completely halt asset dissipation when they choose bankruptcy is unnecessarily strong. As will become evident below, the only assumption that is needed is that the commercial bank is better able than the AMC to slow asset dissipation when bankruptcy is chosen.

also halt asset dissipation. If firm i is nonviable ($\bar{x}_i < \bar{l}_i$), the bank will liquidate the firm and will recover $\bar{l}_i$.

In order for the bank to evaluate its expected profit with bankruptcy and with rollover and to choose between these actions for its defaulters, it must know the level of asset dissipation that would be chosen by firms, given the bank's action. Firms' choices of asset dissipation are identified in the following sections. These choices are then taken into account in standard dynamic programming fashion in the banks' computation of conditional expected firm values, which are incorporated in the expression for the bank's expected profit given a choice of action with respect to defaulters.

2.2.1. Asset Dissipation by Good Debtors

Call the manager of a good debtor a "good" manager. It is tempting to conjecture that since asset dissipation is inefficient (by Assumption 3) and since good debtors are solvent (provided that Δ is not too large), good managers will always choose a lower level of asset dissipation than will managers of bad debtors. This intuition, however, is not entirely correct. The fact that a manager's private benefit from continuation of the firm constitutes only a fraction of the firm's period-2 value may give even the good manager the incentive to dissipate the maximum possible amount of assets in period 1, leading ultimately to default of the good debtor on its principal repayments in period 2.

Only if the fraction ξ in the manager's future private-benefit function $P_i(\Delta) = \xi \cdot [x_i(\Delta) - d]$ is "high enough" or if the firm's period-2 continuation value $x_i(0) - d$ is high enough will the good manager be encouraged to choose less than the maximum level of asset dissipation. The following technical assumption is sufficient to guarantee that good managers will not dissipate assets to the point of default on debt repayments in period 2.

Assumption 6. $P_i(0) > b(\bar{\Delta})$ for all good debtors i .²¹

The following lemma follows directly from Assumption 6 and characterizes the asset dissipation decision of the good manager.

LEMMA 1. *The good debtor i will choose a level of asset dissipation Δ_i^G , such that $0 \leq \Delta_i^G \leq \bar{\Delta}$, with $\Delta_i^G < \bar{\Delta}$ if $[x_i(\bar{\Delta}) - d] \leq 0$.*

Lemma 1 states that the good manager will never choose asset dissipation equal to $\bar{\Delta}$ if so doing would cause the firm to become insolvent in period 2. Note that Δ_i^G is independent of the bank's choice of bankruptcy or rollover for bad debtors.

²¹ This assumption holds for $\bar{\Delta}$ low enough, for $x_i(0)$ high enough, and for d low enough. The assumption is made only to simplify the exposition. If good debtors had the incentive to dissipate assets to the point of default in period 2, the bank would have to make a decision in period 1 about the level of monitoring of good debtors during this period. Including a monitoring decision would complicate the model without adding new results.

2.2.2. Asset Dissipation by Bad Debtors

Observe first that the fact that bad debtors are insolvent implies that $P_i(\Delta) = 0$ for all Δ , whether the bank chooses rollover or bankruptcy in response to default. To see this, suppose that the bank chooses rollover. Then the debt overhang is not removed, and the firm continues in operation in period 2. Then $x_i(\Delta) - d < 0$ for all Δ and $P_i(\Delta) = \xi \cdot \text{Max}[0, x_i(\Delta) - d] = 0$. Now suppose that the bank chooses bankruptcy. In this case if the bad debtor is viable, the bank will allow it to continue in operation. The bank may write off enough debt so that the firm is no longer insolvent; i.e., the bank will write off an amount of debt that leaves the new level of debt repayment exactly equal to $\bar{x}_i$. (Recall that the bank is able to halt asset dissipation with workout.) Thus, if $\tilde{d}$ is the amount of debt remaining on firm i 's balance sheet, $\bar{x}_i - \tilde{d} = 0$. Again, $P_i(\Delta) = 0$.

Since $P_i(\Delta) = 0$ for all bad debtors regardless of the bank's action, there no longer exists a tradeoff for the firm manager between current and future private benefits of asset dissipation: increasing the current dissipation of assets does not result in a reduction of future private benefits. It is now possible to identify bad debtors' choices of asset dissipation.

Bankruptcy. Since asset dissipation is halted, the firm manager i 's utility will be equivalent to the payoff that she would have received in the absence of any asset dissipation. That is, since $U_i(\Delta) = 0$ for all Δ , the manager has no incentive to choose a positive level of Δ .

Rollover. When the bank rolls over the loan of a firm in default, asset dissipation is not halted. The manager's utility is thus $U_i(\Delta) = b(\Delta) + P_i(\Delta) = b(\Delta)$. The manager maximizes utility by choosing $\Delta = \bar{\Delta}$. Lemma 2 follows immediately.

LEMMA 2. *The bad debtor will choose $\Delta = 0$ if the commercial bank chooses bankruptcy and $\Delta = \bar{\Delta}$ if the bank chooses rollover.*

Lemma 2 illustrates that asset dissipation is higher with rollover than with bankruptcy.

2.2.3. Banks' Actions

The bank's two-period expected profit incorporates firms' responses to the bank's action. Expected bank profit given a proportion α of the portfolio in default and given the action bankruptcy is²²

$$\Pi^b(\alpha) = (1 - \alpha)(1 + s)d + \alpha \cdot V(0 \mid B) - c(\alpha) - H. \quad (1)$$

Equation (1) shows that when bankruptcy is the bank's action, the bank's expected repayments from defaulters will equal the maximum expected firm value, $V(0 \mid B)$,

²² I assume that deposits are not withdrawn until period 2.

of bad debtors. The value $V(0 | B)$ represents the expected continuation value for viable firms and the expected liquidation value for nonviable firms.

Bank two-period expected profit given α and rollover, taking into account bad debtors' choices of asset dissipation, is

$$\Pi^r(\alpha) = (1 - \alpha)(1 + s)d + \alpha \cdot x(\bar{\Delta} | B) - H. \quad (2)$$

In contrast to bankruptcy, rollover results in the bank recovering repayments equal only to the continuation values $x(\bar{\Delta})$ of all bad debtors subject to their maximum levels of asset dissipation.

Assumption 7 guarantees that bankruptcy by the commercial bank will always be socially desirable; i.e., $\Pi^b(\alpha) > \Pi^r(\alpha)$ for all α .

Assumption 7. $\alpha \cdot [V(0 | B) - x(\bar{\Delta} | B)] > c(\alpha)$ for all α .

Assumption 7 states that the expected gain in repayment to the bank from bankruptcy relative to rollover exceeds the bankruptcy costs $c(\alpha)$ for all α . Yet, although bankruptcy is actually more profitable than rollover, the presence of the private benefit ρ in the banker's objective function will motivate the banker to roll over loans whenever $\Pi^b(\alpha) \leq 0$.

LEMMA 3. *Define α^* by the value of α such that $\Pi^b(\alpha^*) = 0$. The bank manager will choose rollover for all $\alpha \geq \alpha^*$.²³*

Lemma 3 implies that managers of insolvent banks will choose rollover.

2.3. Debt Cancellation

With debt cancellation the inherited debt is canceled from the commercial banks' and the firms' balance sheets in period 0, and the banks are recapitalized.²⁴ Because the debt has been canceled, no default occurs in period 1 and the bank has no choice to make between bankruptcy and rollover. Yet, because there is no default in period 1, there is no mechanism to halt asset dissipation by firms. It is straightforward to show that the level of asset dissipation chosen by a "good debtor" i (i.e., a firm that would have been a good debtor if the debt had not been canceled) remains Δ_i^G , the level chosen with self-reliance. Although the future private benefits

²³ The assumption $c''(\alpha) \geq 0$ guarantees that if the bank rolls over loans for a proportion α^* of the portfolio in default, it will roll over loans for all $\alpha > \alpha^*$. If $c''(\alpha) < 0$, then there may exist some values of $\alpha > \alpha^*$ for which the bank begins using bankruptcy again. The assumption of nonconcavity of bankruptcy costs eases notation.

²⁴ It may appear to be an extreme assumption that all of the inherited debt is written off. In fact, this is not an unreasonable assumption for TEs. It has been extremely difficult, if not impossible, to determine whether loans inherited from the pretransition period were performing, since loan performance was not tracked prior to the transition. In other economies where debt is inherited from a regime with state-owned banks, it may also be difficult to determine which of the inherited loans are bad, since the government may have been willing to automatically reschedule overdue loan payments. In this case defaults would not have appeared on the banks' books.

for a good manager are now given by $P(\Delta) = \xi \cdot x_i(\Delta)$ rather than $\xi \cdot [x_i(\Delta) - d]$, the value of Δ that maximizes the manager's objective function does not change.

Now consider "bad debtors," or firms that would have been bad debtors if the debt were not canceled. The future private benefits for bad manager i become $P_i(\Delta) = \xi \cdot x_i(\Delta)$, rather than $P_i(\Delta) = 0$. Given the higher level of future private benefits and the dependence of these benefits on Δ , managers of bad debtors now face a tradeoff between current and future private benefits and may well have an incentive to choose $\Delta < \bar{\Delta}$. Define $\Delta_{i,dc}^B$ to be the value of Δ that maximizes the utility of a bad manager i when debt cancellation is the policy; $\Delta_{i,dc}^B \leq \bar{\Delta}$. Factors affecting the level of $\Delta_{i,dc}^B$ relative to $\bar{\Delta}$ will include the degree of viability of bad debtors and the degree to which managers derive future private benefits from firms (i.e., the value of ξ). The greater the viability of firms (i.e., the higher is $\bar{x}_i$ relative to $\bar{l}_i$) the greater the incentive to reduce asset dissipation.

The policy of debt cancellation generates two potential tradeoffs relative to the policy of self-reliance. On one hand, when institutions of corporate governance are weak, the asset dissipation of bad debtors is not halted with debt cancellation, whereas with self-reliance and bankruptcy it is. In this case removal of debt from firms' balance sheet removes the disciplining device; firms' values are lower with debt cancellation than they would have been if self-reliance had been the policy and bankruptcy undertaken by banks. On the other hand, removal of the debt overhang with debt cancellation raises the continuation values of bad debtors relative to their values with self-reliance and rollover and, if institutions of corporate governance are strong enough, may result in lower levels of asset dissipation relative to levels that would have occurred with self-reliance and rollover by banks.

2.4. Debt Transfer

With debt transfer the commercial banks' inherited debt is transferred to an AMC in period 0 and the commercial bank is recapitalized. I assume that the AMC is created for the purpose of working out the debt and will be closed upon termination of its duties. Because the AMC is not a commercial bank and does not accept deposits, its "solvency" is not an issue. I assume that the regulator is able to structure the compensation scheme of the AMC's managers so that they have an incentive to maximize debt collection and to choose bankruptcy. If the AMC is a public institution, the regulator can simply instruct the AMC to choose bankruptcy for all defaulting loans.

Because all of the inherited debt on commercial banks' balance sheets is transferred to the AMC, the pricing of the transferred loans is not an important issue in determining banks' willingness to transfer their loans (although the amount of recapitalization offered by the government must be sufficient for banks to cover their liabilities). This analysis of debt transfer nonetheless applies more generally to any policy targeting a specific type of debt for transfer (such as revolving inventory loans), where removal of this type of debt from banks' balance sheets together with recapitalization would restore insolvent banks to solvency. It also

applies to the situation where transferred loans are not inherited from a previous regime but are priced so that banks are willing to accurately reveal and transfer their bad loans. (Aghion *et al.* (1999) derive such a pricing scheme.)

I show below that if the costs for the AMC of applying bankruptcy are the same as the costs for commercial banks and if the AMC is as skilled as the commercial bank at recovering loans, then debt transfer will always be preferred to self-reliance. There is, however, reason to believe that the AMC may not be as effective as the commercial bank in implementing the activities subsumed under bankruptcy. In particular, if the commercial bank has access to inside information about borrowers' values, then bankruptcy by the AMC will not be as effective as bankruptcy by the commercial bank.

Assumption 8. Due to commercial banks' access to inside information about their borrowers, commercial banks are better able than the AMC to determine their borrowers' values and to recover loan repayments with bankruptcy.

Assumption 8 is formally equivalent to an assumption that the AMC is able to slow, but not to halt, asset dissipation when this bank undertakes bankruptcy. Let $\hat{\Delta}_{DT}$, where $0 < \hat{\Delta}_{DT} \leq \bar{\Delta}$, be the expected level of asset dissipation that remains unrecovered when the AMC uses bankruptcy. If bad debtors choose a level of asset dissipation at least as great as $\hat{\Delta}_{DT}$, the conditional expected value of a bad debtor given bankruptcy by the AMC will be $V(\hat{\Delta}_{DT} | B)$, where $V(\bar{\Delta} | B) \leq V(\hat{\Delta}_{DT} | B) < V(0 | B)$. Furthermore, because $\hat{\Delta}_{DT}$ of asset dissipation remains unrecovered, the manager of a bad debtor receives utility of $b(\hat{\Delta}_{DT})$ even when the AMC uses bankruptcy,²⁵ as opposed to a utility of 0 when the commercial bank chooses bankruptcy.

LEMMA 4. The bad debtor will choose $\Delta = \hat{\Delta}_{DT}$ when debt transfer is the policy.

The level of asset dissipation chosen by bad debtors with debt transfer is greater than that chosen with self-reliance and bankruptcy but less than the level chosen with self-reliance and rollover.

3. THE GOVERNMENT'S POLICY CHOICE

The government regulator must choose a policy before α is known. The objective is to select the policy that yields the highest expected net worth of banks and firms, where the expectation is taken over α and where the regulator takes into account banks' and firms' behavior at each value of α . The optimal policy will thus depend upon the regulator's prior over α and upon other parameter values. Pairwise comparison of policy choices provides the intuition for characterization of the optimal policy. The aggregate balance sheets with self-reliance and bankruptcy,

²⁵ For the same reasons cited in Section 2.2.2, $P_i(\Delta) = 0$ for all bad debtors i and for all Δ .

self-reliance and rollover, debt cancellation, and debt transfer are given in the Appendix.

3.1. The Choice between Debt Cancellation and Self-Reliance

Consider a value of $\alpha < \alpha^*$, i.e., a value of α for which the bank would choose bankruptcy with self-reliance. Define $x(\Delta_{dc}^B | B)$ to be the conditional expected continuation value of a firm given that it is a “bad debtor” and given a policy of debt cancellation. Comparison of the aggregate asset values with bankruptcy and debt cancellation indicates that the regulator will prefer self-reliance to debt cancellation for this value of α if $\alpha \cdot [V(0 | B) - x(\Delta_{dc}^B | B)] > c(\alpha)$. This inequality states that the gain in the value of firms with bankruptcy by the commercial bank relative to expected firm value with debt cancellation exceeds the cost of bankruptcy. While Assumption 7 guarantees that $\alpha \cdot [V(0 | B) - x(\bar{\Delta} | B)] > c(\alpha)$ for all α , it does not guarantee that the above inequality holds. That is, if Δ_{dc}^B is low enough, the policy of debt cancellation may actually be preferred to self-reliance and bankruptcy for some values of α . This can only be the case, however, if institutions of corporate governance are very effective; i.e., if removal of the debt overhang results in managers choosing low levels of asset dissipation.

Now consider a value of $\alpha > \alpha^*$, or such that the commercial bank chooses rollover with self-reliance. Examination of aggregate asset values reveals that debt cancellation will be preferred to self-reliance if $x(\Delta_{dc}^B | B) \geq x(\bar{\Delta} | B)$. This inequality always holds; therefore, debt cancellation is preferred (possibly only weakly) to self-reliance for all $\alpha \geq \alpha^*$.

3.2. The Choice between Debt Transfer and Self-Reliance

Consider a value of $\alpha < \alpha^*$. Comparison of asset values reveals that debt transfer will be preferred to self-reliance for this value of α if and only if $V(\hat{\Delta}_{DT} | B) \geq V(0 | B)$. This equality never holds (Assumption 8); therefore, self-reliance is preferred to debt transfer for all $\alpha < \alpha^*$. Now consider a value of $\alpha > \alpha^*$. Debt transfer will be preferred to self-reliance if and only if $\alpha[V(\hat{\Delta}_{DT} | B) - x(\bar{\Delta} | B)] - c(\alpha) > 0$, i.e., only if the expected increase in firm value with bankruptcy by the AMC relative to expected firm value with rollover by the commercial bank justifies the cost of bankruptcy.

3.3. The Choice between Debt Transfer and Debt Cancellation

Debt transfer will be preferred to debt cancellation for all values of α such that

$$\alpha \{V(\hat{\Delta}_{DT} | B) - x(\Delta_{dc}^B | B)\} - c(\alpha) > 0. \quad (3)$$

This inequality states that the gain in the expected value of bad debtors with debt transfer relative to the value with debt cancellation exceeds the expected costs of bankruptcy by the AMC. The gain in the value of bad debtors with debt

transfer relative to debt cancellation has two potential sources: a reduction in the level of asset dissipation ($\hat{\Delta}_{DT}$ vs Δ_{dc}^B) and the liquidation of nonviable firms with debt transfer versus continuation of all firms with debt cancellation (leading to expected firm values given by $V(\cdot)$ and $x(\cdot)$, respectively). The gain to debt transfer is entirely reflected in loan recovery by the AMC since all bad debtors are insolvent.

3.4. The Optimal Policy

The optimal policy is the policy that yields the highest expected value of bank and firm assets where the expectation is taken over the regulator's prior over α . While it is obvious from the above discussion that the optimal policy will depend upon parameter values and upon the distribution of α , there are nonetheless some general observations that can be made. First, note that the asset dissipation of good managers is invariant to the regulator's policy choice. The policy choice influences only the behavior of bad managers.

The fact that a number of observers have proposed the policy of debt cancellation for transition economies raises the question of the conditions under which this policy would be optimal. Obviously, a necessary condition for debt cancellation to be optimal is that it is preferred to debt transfer. The following definition aids the discussion.

DEFINITION 5. An AMC is *effective* if

$$\int_0^1 \{ \alpha [V(\hat{\Delta}_{DT} | B) - x(\Delta_{dc}^B | B)] - c(\alpha) \} f(\alpha) d\alpha > 0, \quad (4)$$

where $f(\alpha)$ represents the regulator's prior over α .

An AMC will be called effective if the expected value of bank and firm assets (where the expectation is taken over α) with debt transfer is greater the expected value with debt cancellation. The inequality of Definition 5 is simply the expectation taken over α of the inequality (3).

It is clear from Definition 5 that the greater the ability of the AMC to slow asset dissipation, the more likely it is that the AMC will qualify as effective. It is also clear, however, that the problem of asset dissipation with debt cancellation is important: the higher is Δ_{dc}^B the more likely it is that the AMC will qualify as effective.

The following proposition provides necessary and sufficient conditions for debt cancellation to be optimal.

PROPOSITION 1. *Debt cancellation is optimal if and only if: (i) the AMC is not effective; (ii) the expected gains to self-reliance and bankruptcy relative to debt cancellation are less than the expected losses of self-reliance and rollover relative*

to debt cancellation; i.e.,

$$\begin{aligned} & \int_0^{\alpha^*} \{ \alpha [V(0 | B) - x(\Delta_{dc}^B | B)] - c(\alpha) \} \cdot f(\alpha) \\ & < \int_{\alpha^*}^1 \alpha \{ x(\Delta_{dc}^B | B) - x(\bar{\Delta} | B) \} \cdot f(\alpha). \end{aligned}$$

Condition (i) follows directly from Definition 5. Condition (ii) follows from taking the expectation over α of the inequalities presented in Section 3.1 and accounting for the endogeneity of the commercial bank's bankruptcy/rollover decision as a function of α . It is clear from condition (ii) that the greater is the probability that $\alpha > \alpha^*$ and the lower is Δ_{dc}^B , the more likely is debt cancellation to be preferred to self-reliance.

As mentioned above, some economists who have advocated debt cancellation for transition economies have cited the benefit of this policy as deriving from the removal from firms' balance sheets of a burden from the past. Indeed, as the discussion of Section 2 has shown, the elimination of the debt burden translates into higher continuation values for firms for each level of asset dissipation Δ . However, because of firm managers' potential ability to dissipate their firms' assets, the increased continuation value of firms will not necessarily translate into a higher total value of firms relative to their values with other policies. These observations demonstrate that when corporate governance mechanisms are weak and problems of asset dissipation among firms are serious, debt cancellation cannot be optimal. Whether debt transfer or self-reliance will be optimal in this case depends upon the skill of the AMC at workout. The following proposition provides conditions for the optimality of debt transfer.

PROPOSITION 2. *Necessary and sufficient conditions for debt transfer to be optimal are: (i) the AMC is effective; and (ii) the expected gains to debt transfer relative to self-reliance and rollover are greater than the expected losses to debt transfer relative to self-reliance and bankruptcy; i.e.,*

$$\begin{aligned} & \int_0^{\alpha^*} \{ \alpha [V(0 | B) - V(\hat{\Delta}_{DT} | B)] \} \cdot f(\alpha) \\ & < \int_{\alpha^*}^1 \alpha \{ V(\hat{\Delta}_{DT} | B) - x(\bar{\Delta} | B) - c(\alpha) \} f(\alpha). \end{aligned}$$

Condition (i) follows from Definition 5. Condition (ii) follows from Section 3.2, taking into account the endogeneity of the commercial bank's workout/rollover decision. The left-hand side of the inequality represents the expected loss in firm values with debt transfer relative to self-reliance and bankruptcy; the right-hand side represents the expected gain to debt transfer relative to self-reliance and rollover. The lower is the value of α^* and the greater is the probability that $\alpha > \alpha^*$, the more likely is debt transfer to dominate self-reliance. It is obvious from this

proposition that if the AMC is as skilled as the commercial bank at bankruptcy (i.e., $\hat{\Delta}_{DT} = 0$), then debt transfer will be preferred to self-reliance.

Proposition 2 also gives rise to a simple necessary condition for debt transfer to dominate self-reliance, which is stated in the following corollary.

COROLLARY 1. *A necessary condition for debt transfer to dominate self-reliance is that*

$$\alpha^* \cdot [V(\hat{\Delta}_{DT} | B) - x(\bar{\Delta} | B)] - c(\alpha^*) > 0.$$

Recall from Section 3.2 that self-reliance dominates debt transfer for all $\alpha < \alpha^*$. In order for debt transfer to dominate self-reliance, it must be preferred for at least some values of $\alpha \geq \alpha^*$. This implies the condition stated in the corollary. More generally, define $\hat{\alpha}$ as the minimum value of α such that $\hat{\alpha} \cdot [V(\hat{\Delta}_{DT} | B) - x(\bar{\Delta} | B)] - c(\hat{\alpha}) = 0$. The value $\hat{\alpha}$ is the critical value of α at which the costs of bankruptcy by the AMC begin to exceed the gains to this policy relative to self-reliance and rollover. If $\hat{\alpha} < 1$, then there exist some values of α for which the gains to bankruptcy by the AMC relative to rollover of loans do not justify the costs of bankruptcy. Obviously, if this point is reached for $\hat{\alpha} < \alpha^*$, debt transfer cannot dominate self-reliance. One may restate the condition in the corollary as $\hat{\alpha} > \alpha^*$.

The results of this section illustrate how information asymmetries, corporate governance, and bank and firm behavior determine the optimal policy for cleaning banks' balance sheets. These results also point to another observation: the severity of the banking crisis will influence the optimal choice of policy. Specifically, if at the point at which regulators discover or acknowledge the crisis and select a policy commercial banks are suspected to be insolvent, then self-reliance cannot be optimal. The extreme example would be the case in which $F(\alpha^*) = 0$, where $F(\cdot)$ is the cumulative distribution function for α . Note that the severity of the banking crisis may be a consequence either of the cause of the crisis (e.g., a macroeconomic shock) or of the point in the crisis at which regulators decide to intervene. In many countries prudential regulations and bank supervisory capacity are weak, so that regulators do not recognize a banking crisis until banks have already become insolvent. At this point a policy of self-reliance cannot be optimal.

4. DISCUSSION AND CONCLUSION

This paper illustrates how troubled banks may react to loan defaults by passively rolling over loans and how this behavior affects tradeoffs among policies designed to clean banks' balance sheets. The paper proposes a framework, consisting of a two-tier hierarchy comprised of a regulator, banks, and firms, for analyzing policy tradeoffs. This framework is used to analyze the tradeoffs between three policies: self-reliance, debt transfer, and debt cancellation.

The analysis indicates how policies to clean banks' balance sheets have differing real effects on banks' and firms' asset values. Policies have direct effects on banks'

treatment of defaulting loans and indirect effects on firm managers' activities relating to the use of the firm's assets. The indirect effects can be an important determinant (in addition to the direct effects) of the outcome of a policy on banks' asset values.

In this section I examine several assumptions of the model and discuss the effects of changes in these assumptions on the results. One assumption is that all banks are identical in size and leverage. If banks were not identical and if some were better capitalized than others, the expression for the regulator's expected utility would become more complicated. The parameter α would have to be expressed as a vector of levels of default for each bank (since the critical values of α would differ according to each bank's capitalization), and the probability density function of this vector would become the regulator's prior. The qualitative results, however, would remain unchanged. The optimality of any given policy would still be a function of the regulator's prior, the effectiveness of the AMC, and the strength of corporate governance.

Another of the assumptions is that bankers are risk-neutral. While this assumption is standard in the banking literature, one may nevertheless ask how the results might be affected by an assumption of risk-averse bankers. An initial answer to this question is that given the current specification of the outcomes of the bank's actions of bankruptcy or rollover, neither of these actions is riskier than the other; therefore, risk aversion on the part of the banker would have no effect on the results. On the other hand, if the model were modified to allow a bank to invest period-1 profit in a risky new loan or if the choice of rollover were modeled as a riskier action than bankruptcy, then the assumption of risk aversion would have an effect. In technical terms allowing the bank to invest in a risky, new loan with negative net present value would be formally equivalent to assuming that rollover of defaulting loans is riskier and has lower expected return than bankruptcy. Both actions have the effect of overstating period-1 earnings at the expense of period-2 net worth (see Rajan (1994) for a discussion of this issue). Consider the assumption that rollover is a riskier action than bankruptcy, and assume that the banker is risk-neutral. Then loan rollovers would be increased relative to the current model. More precisely, if rollover were a riskier action than bankruptcy, solvent but troubled banks would now have the incentive to roll over defaulting loans (the intuition for this being identical to that for the deposit insurance put option), whereas in the current model only insolvent banks roll over defaulting loans. (Mitchell (1998) analyzes a model in which rollover is a riskier action than bankruptcy.) Now, if bankers are assumed to be risk averse, the risk aversion will diminish the incentive of solvent banks to roll over defaulting loans. Whether the end result would be greater or fewer loan rollovers relative to the current model would depend upon the relative strengths of the effects of the deposit insurance put option and of risk aversion.

Another question of model specification concerns the assumptions made regarding the AMC. Other possible specifications for this institution are certainly conceivable. Indeed, a number of open questions regarding the appropriate design and operation of AMCs have received attention in policy discussions. (See, for

example, Ingves and Lind (1997), Dziobek and Pazarasioglu (1997).) These questions include whether the AMC should be closed after it has finished handling the debt that has been transferred to it, whether the AMC receives good as well as bad assets, whether the AMC should be privately or publicly funded, and whether there should be one AMC as opposed to several, each being associated with a particular commercial bank. Countries that have established AMCs have in fact differed in the ways in which they have answered these questions. The question of optimal AMC design has not been explicitly addressed in this paper; however, it is straightforward to see how the results would change if the manager of the AMC had incentives to roll over defaulting loans for some values of α (for example, in order to keep the institution operating for a longer period of time). The optimality of debt transfer would now be affected by the value of α at which the AMC begins rolling over loans, in much the same way as the optimality of self-reliance is affected by the commercial bank's incentive to roll over loans.

Finally, the model can be used to illustrate how differing privatization methods in transition economies influence the tradeoffs between policies applied in these economies to clean banks' balance sheets. Interestingly, privatization of firms by sale followed by the piecemeal sale of firms that the government has not been able to sell as a whole may actually cause the policy of self-reliance to lead to inefficient liquidation of firms. This is due to the fact that banks' loan rollovers leave the debt overhang on firms' balance sheets, which reduces the firms' values in a sale. More firms will thus be sold piecemeal (i.e., liquidated). In contrast, if privatization of firms by sale is followed by government giveaways of unsold firms (to the firms' workers, for example) or if firms are privatized via mass privatization methods (which are similar to giveaways), then self-reliance and rollover lead to inefficient continuation of firms, as in the model of this paper.

APPENDIX

Total Asset Values for Firms and Banks for Differing Policy Choices

Assume that y_G is the expected period-1 income earned by a good debtor and that the expected period-1 income of a bad debtor is zero. Denote by R the value of government securities used to recapitalize banks when debt cancellation or debt transfer is chosen.

Self-reliance and bankruptcy

Assets

$$\text{Expected income from good debtors: } (1 - \alpha) \cdot (y_G + V(\Delta^G | G)) \\ - (1 - \alpha) \cdot (1 + s)d$$

$$\text{Expected bank net worth } (1 - \alpha) \cdot (1 + s)d \\ + \alpha \cdot V(0 | B) - c(\alpha) - H$$

Government Liabilities

None

Self-reliance and rollover

Assets

Expected income from good debtors: $(1 - \alpha) \cdot (y_G + V(\Delta^G | G))$
 $- (1 - \alpha) \cdot (1 + s)d$

Expected bank net worth $(1 - \alpha) \cdot (1 + s)d$
 $+ \alpha \cdot x(\bar{\Delta} | B) - H$

Government Liabilities

None

Debt cancellation

Assets

Expected income from good debtors $(1 - \alpha) \cdot (y_G + V(\Delta^G | G))$

Expected income from bad debtors $\alpha \cdot x(\Delta_{dc}^B | B)$

Expected bank net worth $R - H$

Government Liabilities

Securities R

Debt transfer

Assets

Expected income from good debtors $(1 - \alpha) \cdot (y_G + V(\Delta^G | G))$
 $- (1 - \alpha) \cdot (1 + s)d$

Expected commercial bank net worth $R - H$

Expected AMC net worth $(1 - \alpha) \cdot (1 + s)d$
 $+ \alpha \cdot V(\hat{\Delta}_{DT}) - c(\alpha)$

Government Liabilities

Securities R

REFERENCES

- Aghion, P., Bolton, P., and Fries, S. (1999). Optimal design of bank bailouts: The case of transition economies, *J. Institut. Theoret. Econ.* 155, 51–70.
- Begg, D., and Portes, R. (1993). Enterprise debt and economic transformation: Financial restructuring in Central and Eastern Europe, in “Capital Markets and Financial Intermediation” (C. Mayer and X. Vives, Eds.), pp. 230–255. Cambridge Univ. Press, Cambridge, UK.
- Bhattacharya, S., Boot, A. W. A., and Thakor, A. V. (1998). The economics of bank regulation, *J. Money Credit Banking* 30, 745–770.
- Blanchard, O., Dornbusch, R., Krugman, P., Layard, R., and Summers, L. (1991). “Reform in Eastern Europe,” MIT Press, Cambridge, MA.
- Bolton, P., and Scharfstein, D. (1990). A theory of predation based on agency problems in financial contracting, *Amer. Econ. Rev.* 80, 93–106.
- Bolton, P., and Scharfstein, D. (1994). Optimal debt structure and the number of creditors, *J. Polit. Econ.* 104, 1–25.
- Bonin, J. (1993). On the way to privatizing commercial banks: Poland and Hungary take different roads, *Comparative Econ. Stud.* 35, 103–119.
- Bonin, J., and Schaffer, M. (1995). Banks, firms, bad debts, and bankruptcy, CEPR Discussion Paper 234.
- Boot, A. W. A., and Thakor, A. (1993). Self-interested bank regulation, *Amer. Econ. Rev.* 83, 206–212.

- Boyd, J., Chang, C., and Smith, B. (1998). Moral hazard under commercial and universal banking, *J. Money Credit Banking* **30**, 426–467.
- Brainard, L. (1991). Strategies for economic transformation in Central and Eastern Europe: Role of financial market reform, in “Transformation of Planned Economies: Property Rights Reform and Macroeconomic Stability” (H. Blommestein and M. Marrese, Eds.), pp. 95–108. OECD, Paris.
- Calomiris, C. (1997). “The Postmodern Bank Safety Net: Lessons from Developed and Developing Economies,” AEI Press, Washington, D.C.
- Calvo, G., and Frenkel, J. (1991). Credit markets, credibility, and economic transformation, *J. Econ. Perspect.* **5**, 139–148.
- Caprio, G., and Honohan, P. (1999). Restoring banking stability: Beyond supervised capital requirements, *J. Econ. Perspect.* **13**, 43–64.
- Caprio, G., and Levine, R. (1992). Reforming finance in transitional socialist economies, World Bank Policy Research Working Paper 898.
- Coricelli, F., and Thorne, A. (1993). Dealing with enterprises’ bad loans, *Econ. Transition* **1**, 112–115.
- Corbett, J. (1999). Japan’s banking crisis in international perspective, in “Finance, Governance, and Competitiveness in Japan” (M. Aoki and G. Saxonhouse, Eds.). Oxford Univ. Press, Oxford.
- Corbett, J., and Mitchell, J. (2000). Banking crises and bank rescues: The role of reputation, *J. Money Credit Banking* **32**, 474–512.
- Demirgüç-Kunt, A., and Detragiache, E. (1998). Financial liberalization and financial fragility, paper presented at World Bank Annual Conference on Development Economics.
- Dewatripont, M., and Tirole, J. (1993). “The Prudential Regulation of Banks,” MIT Press, Cambridge, MA.
- Diamond, D., and Rajan, R. (1998). Liquidity risk, liquidity creation, and financial fragility: A theory of banking, Manuscript, University of Chicago.
- Dornbusch, R. (1991). Strategies and priorities for reform, in “Transition to a Market Economy” (P. Marer and S. Zecchini, Eds.). OECD, Paris.
- Dreyfus, J.-F., Saunders, A., and Allen, L. (1994). Deposit insurance and regulatory forbearance: Are caps on insured deposits optimal? *J. Money Credit Banking* **26**, 412–438.
- Dziobek, C., and Pazarasioglu, C. (1997). Lessons and elements of best practice, in “Systemic Bank Restructuring and Macroeconomic Policy” (W. Alexander, Ed.), pp. 75–143. IMF, Washington.
- Estrin, S., Hare, P., and Suranyi, M. (1992). Banking in transition: Development and current problems in Hungary, CEPR Discussion Paper 68.
- Gil-Diaz, F. (1998). The origin of Mexico’s 1994 financial crisis, *Cato J.* **17**.
- Grossman, S. J., and Hart, O. D. (1982). Corporate financial structure and managerial incentives, in “The Economics of Information and Uncertainty” (J. McCall, Ed.), pp. 107–140. Univ. of Chicago Press, Chicago.
- Harris, M., and Raviv, A. (1990). Capital structure and the informational role of debt, *J. Finan.* **45**, 321–349.
- Hart, O., and Moore, J. (1995). Debt and seniority: An analysis of the role of hard claims in constraining management, *Amer. Econ. Rev.* **85**, 567–585.
- Hart, O., and Moore, J. (1996). Debt, default, and renegotiation, manuscript, MIT.
- Ingves, S., and Lind, G. (1997). Loan loss recoveries and debt resolution agencies: The Swedish experience, in “Banking Soundness and Monetary Policy” (C. Enoch and J. H. Green, Eds.), pp. 421–442. IMF, Washington.
- James, C. (1991). The losses realized in bank failures, *J. Finance* **46**, 1223–1242.
- Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers, *Amer. Econ. Rev.* **76**, 323–329.

- Levine, R., and Scott, D. (1992). Old debts and new beginnings: A policy change in transitional socialist economies, World Bank Policy Research Working Paper 876.
- Lindgren, C.-J., Garcia, G., and Saal, M. I. (1996). "Bank Soundness and Macroeconomic Policy," IMF, Washington.
- Mailath, G., and Mester, L. (1993). When do regulators close banks: When should they? *J. Finan. Intermed.* **3**, 272–299.
- McQuerry, M. (1999). The banking sector rescues in Mexico, *Federal Res. Bank Atlanta Econ. Rev.* **84**, 14–29.
- Marrese, M. (1994). Banking sector reform in Central and Eastern Europe, Manuscript, IMF.
- Mitchell, J. (1998). Strategic creditor passivity, regulation, and bank bailouts, CEPR Discussion Paper 1780.
- O'Hara, M. (1993). Real bills revisited: Market value accounting and loan maturity, *J. Finan. Intermed.* **3**.
- Petersen, M., and Rajan, R. (1997). Trade credit: Some theories and evidence, *Rev. Finan. Stud.* **10**, 661–692.
- Rajan, R. (1994). Why bank credit policies fluctuate: A theory and some evidence, *Quart. J. Econ.* **109**, 399–442.
- Rochet, J.-C., and Tirole, J. (1996). Interbank lending and systemic risk, *J. Money Credit Banking* **28**, 733–762.
- Saunders, A., and Sommariva, A. (1993). Banking sector and restructuring in Eastern Europe, *J. Banking Finan.* **17**, 931–957.
- Shleifer, A., and Vishny, R. (1992). Liquidation values and debt capacity: A market equilibrium approach, *J. Finance* **47**, 1343–1366.
- Slovin, M., Sushka, M., and Polonchek, J. (1993). The value of bank durability: Borrowers as bank stakeholders, *J. Finance* **48**, 247–266.
- Steigum, E. (1992). Financial deregulation, credit boom, and banking crisis: The case of Norway, Norwegian School of Economics and Business Administration Discussion Paper 15/92.
- Thorne, A. (1993). Eastern Europe's experience with banking reform, *J. Banking Finan.* **17**, 959–1000.
- Townsend, R. (1979). Optimal contracts and competitive markets with costly state verification, *J. Econ. Theory* **21**, 265–293.