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THE PROBLEM OF BAD DEBTS: CLEANING BANKS' BALANCE SHEETS IN ECONOMIES IN TRANSITION

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ABSTRACT

The Problem of Bad Debts: Cleaning Banks' Balance Sheets in Economies in Transition*

Many countries, including economies in transition, have suffered banking crises in recent years. This paper develops a general framework for analysing trade-offs between policies for cleaning banks' balance sheets of bad debt. The framework – a two-tier hierarchy consisting of regulators, banks, and firms – is applied to analyse three types of policies that have been advocated or employed in the economies in transition. Hidden information and moral hazard are present at each tier of the hierarchy. The analysis identifies two types of effects of policy choice: a direct effect of the policy on bank behaviour and an indirect effect on firm behaviour as a reaction to the bank response. Both effects are important determinants of policy trade-offs. The analysis demonstrates that differing policies applied to financially distressed banks have differing real effects on firms' and banks' asset values, even when all firms and banks are state-owned.

JEL Classification: G21, G38, P5
Keywords: banking crises, bad debts, economies in transition, creditor passivity

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NON-TECHNICAL SUMMARY

Many countries throughout the developing and industrialized world have suffered banking crises in recent years. Governments have intervened via a variety of policies to resolve these crises. Despite the widespread occurrence of banking crises, the problem of policy choice in dealing with bad debts on banks' balance sheets has been little studied. This paper develops a general framework for analysing trade-offs between different policies that a government might employ to 'clean' banks' balance sheets. The framework is applied to analyse three policies that have been either advocated or employed to clean banks' balance sheets in economies in transition. The policies considered are *debt transfer*, whereby the debt is left on firms' balance sheets but transferred from commercial banks' balance sheets to a specialized, 'bad debt' bank; *self-reliance*, whereby the debt is left on firms' and commercial banks' balance sheets and the banks are required to work out their problems; and *debt cancellation*, whereby the debt is cancelled from the firms' and the commercial banks' balance sheets. It is straightforward to extend the framework to analyse additional policies or to adapt it to treat other environments.

The paper is the first to formally analyse trade-offs between policies for cleaning banks' balance sheets. It demonstrates that differing policies have differing real effects on both banks' and firms' asset values, even when all banks and firms are state-owned as they are at the beginning of transition. Indeed, the analysis identifies two types of effects of the government's policy choice: a direct effect on bank behaviour in response to the policy, and an indirect effect on firm behaviour as a reaction to the bank's response. Both effects are important for determining policy trade-offs. Existing literature focuses on relations between regulators and banks and on bank closure policies and takes into account only the direct effects of policies.

The framework used to analyse policy trade-offs is a two-tier hierarchy, consisting of regulators, banks, and firms. Regulators select a policy, however, they are not able to observe the exact level of default on banks' balance sheets. Bank managers choose between passively rolling over (rescheduling) their debt in default or 'working out' (i.e. actively pursuing) their claims. Because commercial bank managers obtain private benefits from operating banks that are believed to be solvent, managers of troubled commercial banks may decide to roll over debt in default in order to hide the default. The regulator's choice of policy to clean banks' balance sheets will influence banks' decisions to roll over versus working out their debt in default.

On the other hand, banks cannot costlessly observe whether a borrower firm's manager is dissipating the firm's assets (or otherwise appropriating returns) that could be used for future debt repayments. Such asset dissipation confers current private benefits to the firm's manager but lowers the future value of the firm. When a bank chooses workout, it pays a resource cost that allows it to observe and to slow or halt asset dissipation of its defaulters. In contrast, when it chooses rollover it cannot observe asset dissipation (or the firm's continuation versus liquidation values). The benefit to banks from rolling over loans in default is that the level of default is not detected. The cost to rollover is that the bank's recovery on loans in default is lower than with workout.

Firm managers choose the level of asset dissipation to maximize their utility, where the utility function embodies a trade-off between higher current private benefits the manager receives from increasing asset dissipation and potentially lower future benefits the manager would receive from operating a firm with lower value. The level of asset dissipation chosen by managers is also a function of the bank's choice of workout versus rollover of debt in default. Levels of asset dissipation will be higher when banks roll over their loans in default than when banks actively work out the loans, since workout allows the bank to slow or halt asset dissipation.

The regulator chooses a policy, before the amount of default on banks' balance sheets is observed, to maximize the expected values of firms and banks, where the expectation is taken over the level of default on banks' balance sheets. Trade-offs between policies include the following: the commercial bank is assumed to acquire 'inside' information about its borrowers that permits it to fully halt asset dissipation with workout, however, some of this information is lost when debt is transferred to the bad debt bank. As a result, the bad debt bank can only slow, but not halt, asset dissipation when it undertakes workout. Thus, a policy of self reliance and workout by the commercial bank yields a higher value of firms' and banks' assets than does a policy of debt transfer and workout by the bad debt bank. On the other hand, if commercial banks are in financial difficulty, they may choose to roll over debt in default when self reliance is the policy. In this case firms' and banks' values are lower than with the policy of debt transfer.

Rollover of debt with a policy of self-reliance not only hides default but also leaves a debt overhang on firms' books. This debt overhang lowers the potential for future survival of firms which might otherwise have remained viable in the absence of the overhang and, therefore, further encourages firm managers to dissipate assets. In economies in transition the chosen method of privatization of firms can also affect the seriousness of this problem.

The policy of debt cancellation eliminates the debt overhang and may thus result in a reduction of levels of asset dissipation by firm managers relative to self reliance and rollover. On the other hand, because debt cancellation removes the possibility of default, it also eliminates the mechanism of 'workout' for defaulters, which permits information gathering regarding firms' values and a reduction or halt of asset dissipation by those firms. Consequently, debt cancellation may be preferred to self-reliance and rollover, however, it would not be preferred to self-reliance and workout if the problem of asset dissipation by firms is non-trivial. The indirect effects (levels of asset dissipation) of the regulator's policy choice influence policy trade-offs.

Whether debt cancellation would be preferred to debt transfer will be determined by the ultimate skill of the bad debt bank at slowing asset dissipation with workout. If the bad debt bank is able only to slightly reduce asset dissipation with workout, then the resource costs of workout may not justify the gains, and debt cancellation may be preferred to the policy of debt transfer.

These policy trade-offs demonstrate that no policy will be optimal under all circumstances. Which policy is optimal in a given economy will depend upon the expected levels of default on banks' balance sheets, the seriousness of the problem of asset dissipation among firms, and the potential skill of a bad debt bank relative to commercial banks at recovering loans. It should be a straightforward task in practice to quantify or to evaluate the importance of each of these factors in a given economy; therefore, the trade-offs analysed here can be useful for policy-makers in the actual selection of policies.

1 Introduction

Many countries throughout the developing and industrialized world have suffered banking crises in recent years. Governments have intervened in a variety of ways to resolve these crises. The economies in transition (EITs) are no exception. Large quantities of bad loans on commercial banks' balance sheets have motivated governments to devise policies designed to "clean" the banks' balance sheets.[1]

The problem of policy choice in dealing with bad debt crises has been little studied. This paper develops a general framework for analyzing tradeoffs between different policies that a government might employ to clean banks' balance sheets. It applies the framework to analyze three policies that have been either advocated or employed to clean banks' balance sheets in economies in transition. Despite the emergence of a large literature describing governments' attempts to clean banks' balance sheets in EITs, no formal analysis has been undertaken.[2] This paper is the first to formally analyze policy tradeoffs. It demonstrates that differing policies for cleaning banks' balance sheets have differing real effects on banks' and firms' values, even when all firms and banks are state-owned, as they are at the beginning of transition.

More generally, the paper is the first to analyze both the direct effects of a regulatory policy on bank behavior and the indirect effects on borrower behavior created by bank response to a policy. Both effects influence the value of banks' assets.[3] Indeed, policy tradeoffs analyzed in this paper are shown to be sensitive to the magnitude of the indirect effects of policies. The framework used is a two-tier hierarchy consisting of regulators, banks, and firms. Capital market imperfections–such as asymmetric information between "insiders" and "outsiders" of banks and firms regarding their values, and the ability of firm

[1] IMF estimates of the percentages of bank loans that were nonperforming in 1992 were 15-20% for the Czech Republic, 15-20% for Hungary, and 25-60% for Poland. (Dittus (1994))

[2] See, for example, Abel and Bonin (1993), Begg and Portes (1993a, 1993b), Bonin (1993), Bonin and Schaffer (1995), Brainard (1991a, 1991b), Calvo and Frenkel (1991), Caprio and Levine (1992), Coricelli and Thorne (1993), Dornbusch (1991), Estrin, Hare, and Suranyi (1992), Levine and Scott (1992), Marrese (1994), Saunders and Sommariva (1993), and Thorne (1993).

[3] Papers such as Boot and Thakor (1993) and Mailath and Mester (1994) have focused on the direct effects on bank behavior of the threat of bank closure by regulators, where the behavior studied is banks' choices of riskiness of investment.

managers to divert resources for their own benefit–generate problems of hidden information and moral hazard at each level of the hierarchy. With respect to the relationship between regulators and banks, regulators cannot observe the level of default on banks' balance sheets. The choice of policy will influence whether banks work out debt in default rather than rolling it over. The latter action is a means of keeping the level of default hidden. In the relationship between banks and firms, the bank's choice of workout or rollover will influence the extent to which firm managers are able to dissipate assets or appropriate returns of the firm that could be used for future loan repayment. The bank can observe and slow (or halt) asset dissipation with workout, although not with rollover. Expected bank action in response to default may also influence the incentives of firm managers to take actions, such as restructuring, *ex ante* to avoid default.

In addition to the result that different policies to clean banks' balance sheets have differing real effects, a principal results of the analysis is that policies that leave debt from a past regime on firms' books may be beneficial. Default on debt triggers a process of information gathering and valuation of the firm. (See Harris and Raviv (1990).) If the information allows the creditor to better monitor the firm manager and slow asset dissipation, then the sum of the net worths of the bank and the firm will be higher than it would have been by cancelling the inherited debt from firms' and banks' balance sheets. The result that policies will not be neutral in their effects on the value of firms and banks is significant, since one of the primary arguments made by a number of economists advocating cancelling the inherited debt from state-owned banks' and firms' balance sheets at the beginning of transition is that the operation will have no net effect on the value of state-owned assets.[4] The prospect of cancelling past loans is also being discussed in the reform of the Chinese banking system, although the economic transition has been in progress for several years.

Another result of the paper is that different policies that leave bad debt on firms' books differ in their effects on asset values. Two types of policies that leave debt on the firms' books and that are analyzed in this paper are *debt transfer*, whereby the debt is transferred from the commercial banks' balance sheets to a special "bad debt" bank, and *self reliance*, which refers to policies that leave the debt on the banks' balance sheets and require that the

[4]See, for example, Begg and Portes (1993a), Blanchard et al (1991, p. 49), Calvo and Frenkel (1991), and Dornbusch (1992).

banks work out or restructure the debt on their own. Self reliance may allow a commercial bank to make use of inside information about the debtor, which a bad debt bank does not possess, in working out loans. On the other hand, a commercial bank that is in financial distress may have the incentive to roll over rather than actively pursue its bad debt. This passivity on the part of commercial banks worsens the problems associated with the bad debt.

A final result of the analysis is that the method of privatization of state-owned firms can influence tradeoffs between policies to clean banks' balance sheets in EITs when these policies are implemented prior to the privatization of firms. For example, if firms are privatized by sale and if the state breaks up or liquidates firms that it has been unable to sell, then the policy of self reliance may lead to some excessive liquidation of firms. On the other hand, if firms are privatized via mass privatization or if when firms are privatized by sale the unsold firms are given away to their employees, then self reliance may lead to excessive survival of firms. Whether or not self reliance can lead to excessive liquidation or excessive survival of firms relative to other policies obviously influences policy tradeoffs.

This paper is one of a few papers to study banks' actions in response to debt in default, as opposed to banks' *ex ante* choices of riskiness of investment. Papers relating to bank choices in response to default in EITs are Mitchell (1993, 1997), Perotti (1993), and Aghion, Bolton, and Fries (1996). Papers treating bank response to default in developed market economies are O'Hara (1993) and Rajan (1994).

Mitchell (1993) formulates the notion of creditor passivity (rolling over of debt in default) in EITs and discusses policy implications. Mitchell (1997) analyzes a model where creditors may choose to be passive in response to default and where regulators may decide to undertake multiple bank rescues if the number of troubled banks becomes "too large." The latter paper complements the current paper by taking account of the systemic effects of a banking crisis on regulatory response to the crisis. Aghion, Bolton, and Fries (1996) extend the current paper by applying the framework developed here to analyze the tradeoffs between additional policies not addressed in this paper. Perotti (1993) studies the incentives of banks to "throw good money after bad" as a result of the debt overhang created by inherited debt at the beginning of transition.

In the literature concerning bank behavior in developed economies, O'Hara (1993) iden-

tifies the possibility of banks in developed economies rolling over their bad loans in response to market-value (as opposed to book-value) accounting rules. Rajan (1994) analyzes a model of bank behavior where banks may choose to be passive (lenient, in his terminology) in response to a negative reputational effect associated with revelation of loan defaults.

The paper proceeds as follows. Section 2 outlines the merits of the policy of debt cancellation in EITs and describes the actual choices of debt transfer and self reliance applied in Hungary, Poland, and the Czech Republic. Section 3 presents the model and analyzes the tradeoffs between the policies of debt cancellation, debt transfer, and self reliance. Section 4 characterizes necessary and sufficient conditions for optimality of each of the three policies. Section 5 discusses extensions of the model. Section 6 concludes.

2 Policies to clean banks' balance sheets

Commercial banks in all of the economies in transition were created by breaking off divisions of the central (monopoly) bank in the previous regimes. The banks inherited nondiversified portfolios with large portions of bad assets. Yet, the quantities of bad debt also increased in the first few years following the banks' inception.

The criterion employed in this paper to evaluate tradeoffs between policies to clean banks' balance sheets is the effect of the policy on the value of the firms' and banks' assets, which are all assumed initially to be state-owned. Although the objective function determining a government's choice of policy to clean banks' balance sheets in the EITs is likely to contain several variables, the value of state-owned banks' and firms' assets is likely to be one of the important arguments. State-owned banks will eventually be privatized, hence their net worth is important. The net worth of state-owned firms that are being privatized is also important, whether firms are privatized by sale or through voucher methods. Privatization by sale yields government revenue. The net worth of a firm that is privatized through voucher methods will determine the probability that the firm stays out of bankruptcy and the size of dividends that the firm may distribute. Both of these factors are important for maintaining political support for privatization and possibly for the entire transition process.

The assumption that firm managers may appropriate returns or the firm's assets for

their personal benefit is commonly employed in the economics and finance literature.[5] This assumption is especially relevant to the EITs, where property rights are only fuzzily defined. The devolution of control from central authorities to state-owned firms' managers at the beginning of transition resulted in a lack of effective corporate governance and has created a potential leakage of assets to the private sector, through managerial diversion of resources for perquisites and through direct transferral of assets to managers. Because of managers' ability to divert resources from state-owned firms, the timing of privatization of firms is also an important determinant of the value of firms. The longer the required time for privatization, the greater the potential for leakage and subsequent reduction in firms' values.[6]

Debt cancellation entails writing off the inherited debt at the beginning of transition.[7] Because debt cancellation lowers the (book) value of banks' assets, it will likely need to be accompanied by recapitalization in order to restore bank solvency.[8] Similarly, since the policy of debt transfer involves removing the inherited assets from the banks' balance sheets, this policy will also require recapitalization of banks. In addition, if the policy of self reliance results in banks' writing off of a large quantity of debt, recapitalization will also be necessary. Recapitalization has accompanied both debt transfer and self reliance in practice.

The obvious motivation for the recommendation of debt cancellation is that if the inherited debt no longer exists, then it cannot pose any of the problems associated with large quantities of bad debts on banks' balance sheets. In the absence of capital market imperfections, the argument that debt cancellation will eliminate problems associated with

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

[6]Most discussions of privatization in the EITs acknowledge the problem of managerial malfeasance and dissipation of asset values. See, for example, Lipton and Sachs (1990), Blanchard et al (1991, p. 36), and Boycko, Shleifer, and Vishny (1993). None of the discussions of the problem of bad debt on banks' balance sheets has recognized the relevance of this phenomenon.

[7]It may appear to be an extreme assumption that all of the inherited debt is written off; however, the actual problem of identifying the portion of the inherited debt that was bad in the economies in transition has been extremely difficult. More generally, in most countries where some bad debt has been discovered on banks' balance sheets, it has proven difficult to determine the true amount of bad debt.

[8]Alternatives to recapitalization are to lower banks' liabilities or to inflate away the value of the inherited debt.

bad debt without changing the net worth of government assets appears compelling. Yet, debt cancellation has almost never occurred in practice.[9] 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.[10]

The feature of debt cancellation that gives rise to the credibility problem, however, is recapitalization rather than cancellation of the debt *per se*. If banks were not recapitalized in conjunction with debt cancellation, then they would oppose this policy, since it would require them to write down their assets. Since recapitalization has accompanied both debt transfer and self reliance policies that governments have actually implemented, these latter policies also give rise to an analogous credibility problem.[11] The credibility argument, then, cannot completely explain why policies other than debt cancellation have been chosen. This paper offers an alternative explanation relating to the effects of policy choices on banks' and firms' asset values. The table in Appendix 1 describes the actual policies of debt transfer and self reliance implemented in the Czech Republic, Hungary, and Poland.

3 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. Total debt repayments for a firm equal $d(1+s)$, where s represents the interest rate. Interest 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 level of default on debt is known, the government (G) chooses a policy: debt cancellation; debt transfer; or self reliance.

At the beginning of period 1 firms learn their types (good or bad debtors) as well as their continuation and liquidation values. Firms' period-1 income is also realized. All of this information is private to firms. Banks then receive income from good debtors, and they observe default by bad debtors if debt cancellation has not been chosen. (When debt

[9] Bulgaria undertook a cancellation of bank debt in 1993.

[10] See Calvo and Frenkel (1991) for a discussion of the importance of credibility in financial reform.

[11] This point has been noted by several authors, e.g., Bonin (1993), Brainard (1991a), and Marrese (1994).

cancellation is chosen, loans are written off the banks' and the firms' books, and default does not occur in period 1.) Information regarding default is private to the bank. If default has occurred, banks decide whether to roll over or work out the loans in default. Firms then choose levels of asset dissipation. Workout of a loan enables a bank to value the firm and to slow or halt the dissipation of assets.[12] The process of valuation, however, is assumed to be costly.

During period 1 firms operate under government ownership (either pure state ownership or a "corporatized" form). Asset dissipation and managerial appropriation of profit will occur during this period (if managers have chosen positive levels of asset dissipation) unless managers' activities have been constrained as a result of a loan workout. At the beginning of period 2 all firms are privatized (or possibly liquidated).[13] If asset dissipation has occurred during period 1, the value of a firm's assets that will be realized upon privatization will be lower than the value that would have been realized had no asset dissipation occurred. Loans that are still outstanding at the beginning of period 2 are repaid at the point of privatization.

The timing of events is summarized below.

Period 0

G chooses a policy

Period 1

Firms learn their types and their continuation/liquidation values

Default on loans occurs

Banks observe default

Banks choose action

[12] The term workout will be used to denote any action, such as a bankruptcy proceeding or an out-of-court workout, in which the bank attempts to recover some of its loan and possibly to reorganize the firm.

[13] Although the assumption of state ownership of firms in period 1, followed by privatization in period 2, allows for analysis of the effects of differing methods of privatization on policy tradeoffs, this assumption is not essential to the analysis of policy tradeoffs. The framework developed here can be easily applied to economies with privately owned firms. The latter situation would correspond to one in which firms that are not liquidated in period 1 automatically continue in operation in period 2. The policy tradeoffs would thus be similar to those discussed in Section 5 under the assumption of mass privatization in period 2. See Aghion, Bolton, and Fries (1996) for an application of the framework to a setting where privatization of firms does not occur.

Firms choose level of asset dissipation

Period 2

Privatization of firms

The bank that observes default in period 1 and that decides whether to work out or roll over debt will be the bad debt bank if debt transfer is the policy choice and the commercial bank if self reliance has been selected.

Privatization of firms at the beginning of period 2 is assumed in this and the following section to occur through individual sale. There are assumed to be a sufficient number of buyers so that if a firm's continuation value minus its outstanding debt obligations exceeds its liquidation value, the firm will be privatized. Discussion of the effects on results when firms are privatized via mass privatization appears in Section 5.

3.1 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* $\overline{\Delta} \leqslant 1$.

$\overline{\Delta}$ is determined by existing institutions and regulations and will differ from economy to economy. For instance, if regulation of managerial behavior is nonexistent, then managers are free to steal the firm's assets and $\overline{\Delta} = 1$.

Denote the continuation value (gross of debt repayments) for firm i in period 2 and for a given level of asset dissipation Δ in period 1 by $x_i(\Delta) = \max[\overline{x}_i - g(\Delta), 0]$, where $\overline{x}_i$ represents the period-2 continuation value of the firm in the absence of any asset dissipation and where $g(0) = 0$ and $g(\cdot)$ increasing. Asset dissipation during period 1 lowers the firm's period-2 continuation value. The liquidation value of the firm is defined similarly: $l_i(\Delta) = \max[\overline{l}_i - h(\Delta), 0]$, with $h(0) = 0$ and $h(\cdot)$ increasing. The value of the firm in period 2, gross of debt repayments, is given by $V_i(\Delta) = \max\{x_i(\Delta), l_i(\Delta)\}$.

There are two sources of managerial benefits affected by the asset-dissipation decision: asset dissipation confers current (period-1) private benefits on managers but reduces future private benefits linked to privatization of the firm. Denote the value of current private benefits from a level Δ of asset dissipation by $b(\Delta)$, with $b(0) = 0$ and $b(\cdot)$ increasing. Assumption 2 states that asset dissipation is inefficient.

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

The manager's future private benefits from privatization of the firm are assumed to be given by $P_i(\Delta) = I \cdot \xi \cdot [x_i(\Delta) - d]$,where I is an indicator variable with value 1 if the firm is privatized and zero otherwise, and ξ is a coefficient whose value ranges from 0 to 1 and represents the degree to which the manager's benefits from privatization are tied to the firm's value. For example, if the manager is the sole owner of the privatized firm, $\xi = 1$. On the other hand, if the manager is sure to have no relationship with the privatized firm, $\xi = 0$. ξ is determined at least partly by the method of privatization. The expression $x_i(\Delta) - d$ represents the firm's continuation value in period 2 net of debt repayments. Because $x_i(\cdot)$ is decreasing in Δ, $P_i(\cdot)$ is also decreasing in this variable. Clearly, if the firm is liquidated in period 2, $P_i(\Delta) = 0$.

Assumption 3: *The manager's utility is* $U_i(\Delta) = b(\Delta) + P_i(\Delta)$.[14]

The manager's salary from working in the firm is normalized to zero in the utility function specified by Assumption 3. This function reflects the tradeoff between current and future benefits that the manager faces in dissipating the firm's assets.

There are two types of firms in the model: good debtors and bad debtors.

Definition 1: A *good debtor* is a firm whose period-1 income exceeds interest payments sd and for which $x_i(0) - d \geq 0$ and $x_i(0) > l_i(0)$.

Definition 2: A *bad debtor* is a firm whose period-1 income is less than sd and for which $V_i(0) - d < 0$.

Definitions 1 and 2 combine assumptions on period-1 income levels and the economic viability of firms. The implicit assumptions on income flows are for expositional convenience only and do not affect the qualitative results of the model.[15] Definition 1 implies that all firms that earn enough income in period 1 to meet their interest obligations are solvent, in the sense that total future earnings (in the absence of asset dissipation) exceed total debt repayments, and the continuation value of the firm exceeds its liquidation value. Definition 2 implies that all firms that default in period 1 are insolvent and, simultaneously, that all

[14] For expositional simplicity I assume no discounting in the managerial utility function or in bank profit.

[15] 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.

firms that are insolvent earn insufficient income in period 1 to meet interest repayments. Assumptions on income flows that would be consistent with the above definitions are, for example, that good debtors earn period-1 income equal to *sd* and bad debtors earn period-1 income equal to 0.

The assumption that firms' types are realized (exogenously) at the beginning of period 1 is made to simplify the exposition and can be justified in the current context by the fact that at the beginning of transition changes in relative prices in the economy due to price and trade liberalization will cause some firms to become profitable and others not. The assumption of exogenous determination of types is not essential to the model. Results that would obtain with a more general model in which firms choose levels of asset dissipation in period 0 and where their choices determine their type in period 1 are discussed in Section 5.

The assumption on realization of firm types implies that some firms will become good debtors and others bad debtors as a result of luck.[16] Bad debtors have so much debt on their books relative to potential earnings that default is inevitable. That these firms have a large debt overhang does not necessarily imply, however, that their continuation values gross of debt repayments are less than their liquidation values. Some of the firms may be viable once the debt overhang is removed.

The level of asset dissipation chosen by a firm manager will be a function of the firm's type (good or bad debtor), G's choice of policy, and bank response to default (when debt cancellation is not the policy choice). In the subsections below I analyze bank behavior and firms' asset dissipation decisions for each policy.

3.2 Self reliance

Assumption 4: *The banker's objective function is* $W(\Pi, \rho) = \max[\Pi, 0] + \rho$, *where* Π *represents two-period bank profit and* ρ *represents a private benefit to the banker of maintaining the bank in operation.*[17]

The private benefit ρ can actually be interpreted in a number of ways. One interpreta-

[16] Indeed, one of the problems with using profitability as an indicator of success of restructuring early in the transition is the difficulty of distinguishing higher profitability due to luck and that due to restructuring.

[17] This objective function is also employed in Aghion, Bolton, and Fries (1996).

tion is that given in the assumption: ρ is 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 and if the insolvency is not discovered until profit is realized in period 2, the bank manager still enjoys the private benefit of keeping the bank in operation during period 1. In contrast, if the insolvency is observed in period 1, the manager will lose the private benefit and will have a level of utility of zero. 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 more general interpretation of ρ is that it represents a private benefit from managing a solvent bank. The implicit assumption here is that $\rho = 0$ if the bank is known to be insolvent, even if the government rescues the bank. That is, the bank manager's reputation or future career advancement—e.g., the likelihood of staying on as the manager once the bank is privatized—is greatly diminshed if the manager is known to be in charge of an insolvent bank, even if the insolvent bank is recapitalized by the government.

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

Workout:

(i) Bank pays an exogenous cost $c(\alpha)$, which allows it to learn $V_i(\Delta)$ for each firm in default and to halt asset dissipation. $c'(\cdot) > 0$; $c''(\cdot) \geqslant 0$.

(ii) Bank may write off some debt.

Rollover:

Loans are rolled over; therefore, the bank's balance sheet does not reflect the bad debt.

The function $c(\alpha)$ reflects costs associated with the process of information gathering and valuation of the firm that must accompany workout, whether it is out-of-court or through a bankruptcy reorganization procedure. Even if the bank has access to inside information concerning its debtors, the process of valuation and of determining the best course of action for the firm is costly. The function $c(\cdot)$ may also reflect the increased costs of raising

[18] I assume that the bank either works out or rolls over all of its debt. Its optimal strategy in some cases may be to work out some portion of its defaulting debt and to roll over the rest. Allowing for partial workout and partial rollover does not change the qualitative results.

deposits when the bank is known to be financially troubled.Note that $c(\cdot)$ is assumed to be linear or strictly convex. This assumption, though not essential to the analysis, significantly simplifies the exposition. Namely, it guarantees that if the commercial bank chooses rollover for some $\widehat{\alpha}$,it will choose rollover for all $\alpha > \widehat{\alpha}$.

Assumption 5: *When the bank incurs costs $c(\alpha)$ to value its debtors, this activity and the value of α are observable.*

Assumption 5 states that the bank cannot surreptitiously incur cost $c(\alpha)$ and value its debtors without revealing α. If firms default and the bank rolls over the loans, the value of α is unobserved, yet at the same time, the bank does not know the continuation and liquidation values of the firms. It does know, however, the probability distribution of continuation and liquidation values of bad debtors and can thus calculate an expected value of a firm, given that it is a bad debtor.

Define the expected value in period 2 of a bad debtor by $V(\Delta \mid B) = E\{\max[x_i(\Delta \mid B), l_i(\Delta \mid B)]\}$, where the expectation is taken over the joint conditional distribution of $x_i(\Delta \mid B)$ and $l_i(\Delta \mid B)$, which represent continuation and liquidation values given that the debtor is bad and given a level of asset dissipation Δ. The expected value in period 2 for a good debtor is defined analogously: $V(\Delta \mid G) = E\{\max[x_i(\Delta \mid G), l_i(\Delta \mid G)]\}$. These expected values will influence the bank's decision regarding whether to work out or roll over loans in default.

According to definition 2 of bad debtors, a firm i in default has an asset value that is lower than the face value of its debt: $V_i(0) - d < 0$. This implies that if none of the debt is written off, the firm will not be sold in period 2 when it is put up for privatization. This raises the question of how the government will treat firms that it does not succeed in selling in period 2. I consider two potential reactions on the part of G: liquidation of unsold firms, and giveaway of unsold firms to their employees. In the analysis of this section and section 4, I assume that the government breaks up or liquidates firms that it has been unable to sell as a whole through privatization by sale. In Section 5 I discuss how policy tradeoffs change if G gives away unsold firms to their employees.

Assumption 6: *The government liquidates firms that it is unable to sell through the privatization process in period 2.*

Assumption 6 implies that a defaulter whose loan is rolled over will be liquidated in

period 2, and the bank will receive $l_i(\Delta)$, even if $x_i(\Delta) > l_i(\Delta)$. That is, when the bank chooses rollover, it effectively announces that $\alpha = 0$, and it is not able to write off any debt. A bad debtor whose loan is rolled over will be liquidated, since there is no nonnegative price that a buyer would be willing to pay for the firm. The debt overhang combined with Assumption 6 imply that rollover may cause some firms to be inefficiently liquidated.

In contrast, during the course of a workout the bank is assumed to learn $x_i(\cdot)$ and $l_i(\cdot)$ and can halt asset dissipation; therefore, it can write off a level of debt that is sufficient to allow the firm to be privatized. If $x_i(0) > l_i(0)$, the bank will write off debt equal to $d - x_i(0)$. A private buyer will pay a price of zero to purchase the firm, then will pay $x_i(0)$ to the bank.

Definition 3: A bad debtor i is *viable* if $x_i(0) \geq l_i(0)$.

According to Assumption 6 viable bad debtors will be inefficiently liquidated when the bank rolls over loans in default. Rollover may thus lead to two sources of inefficiency: firms' values are lower than they would be if there were no asset dissipation; and some fims may be inefficiently liquidated. As is discussed in more detail in Section 5, if G were to give away unsold firms in period 2 to their employees or if firms are privatized via mass privatization, then the risk of inefficient liquidation with rollover is eliminated. On the other hand, firms that are not viable will be privatized, and rollover will lead to excessive survival of firms.

In order to evaluate bank profit given a choice of workout or rollover, it is necessary to know the level of asset dissipation that would be chosen by firms, given the bank's action.

3.2.1 Asset dissipation by good debtors.

Although definition 1 of good debtors states that these firms are solvent, it does not rule out the possibility that the good debtor's manager (referred to as a "good" manager) dissipates assets during period 1 to the point where the firm's continuation value falls below its debt obligation in period 2 and is liquidated. Note that Assumption 2, which guarantees the inefficiency of asset dissipation, does not suffice to prevent this outcome. The reason is that the manager benefits from only a fraction of the continuation value of the firm in period 2. Assumption 7 does rule out this case.

Assumption 7: $P_i(0) > b(\overline{\Delta})$ *for all good debtors* i.[19]

[19]This assumption implicitly imposes restrictions on parameter values. For example, if $\xi = 0$, then

This assumption implies that if $\overline{\Delta}$ is large enough so that $P_i(\overline{\Delta}) = 0$ (i.e., $[x_i(\overline{\Delta}) - d] \leqslant 0$), then $U_i(0) = P_i(0) > U_i(\overline{\Delta}) = b(\overline{\Delta})$. Hence, the good manager will not choose $\Delta = \overline{\Delta}$. Assumption 7 further implies in this case that the level of asset dissipation chosen by the good manager will never be high enough so that the firm is liquidated in period 2, since the only reason to dissipate assets to that point would be to choose the maximum level $\overline{\Delta}$. Note that if $P_i(\overline{\Delta}) > 0$, then it is possible that the good manager will choose $\overline{\Delta}$, since $U_i(\overline{\Delta}) = b(\overline{\Delta}) + P_i(\overline{\Delta})$ may be greater than $U_i(0) = P_i(0)$. The choice of $\overline{\Delta}$ in this case, however, would not lead to default in period 2.

To this point there has been no discussion of the possibility of strategic default in period 1 by good debtors. Strategic default would correspond to the situation where, at the beginning of period 1, the good firm's manager absconds with the firm's income, thus generating default. Yet, by so doing, the manager takes the risk that the bank will choose workout, in which case the bank will be able to halt the asset dissipation and the manager will then be restricted to a level of asset dissipation $\Delta = 0$. Since Assumption 7 guarantees that the manager does not want to dissipate assets to the point of default in period 2 and since the manager can effectively dissipate the desired level of assets during period 1 without risking default and workout, there is no need to engage in strategic default.

The following claim, which follows directly from Assumption 7, characterizes the asset dissipation decision of the good manager.

Claim 1: *The good debtor i will choose a level of asset dissipation* $0 \leqslant \Delta_i^G \leqslant \overline{\Delta}$, with $\Delta_i^G < \overline{\Delta}$ if $[x_i(\overline{\Delta}) - d] \leqslant 0$.

Note that Δ_i^G is independent of the bank's choice of action following default of bad debtors.

3.2.2 Asset dissipation by bad debtors.

Workout. If the bank undertakes workout of its defaulters, it will be able to halt asset dissipation. Thus, the firm manager's utility will be equivalent the payoff that she would

$P_i(0) = 0 < b(\overline{\Delta})$. The assumption is made to simplify the exposition. In the absence of this assumption good debtors might choose to dissipate assets to the point of default in period 2. Given this possibility the bank would have to make a decision in period 1 about monitoring good debtors during this period. Including a monitoring decision would complicate the model without adding insights.

receive in the absence of asset dissipation: $U_i(\Delta) = b(0) = 0$. (Note that $P_i(\Delta) = 0$ in this case even if debt is written off and the firm privatized, since the remaining level of debt repayment just equals $x_i(0)$.) Since $U_i(\Delta) = 0$ for all Δ, the manager has no incentive to choose a positive level of Δ.[20]

Rollover. If the bank rolls over the loan of a firm in default, then asset dissipation will not be halted. The debt overhang implies that the firm will be liquidated in period 2. The manager's utility is thus $U_i(\Delta) = b(\Delta)$. The manager maximizes utility by choosing $\Delta = \overline{\Delta}$.

Claim 2: *The bad debtor will choose* $\Delta = 0$ *if the commercial bank chooses workout and* $\Delta = \overline{\Delta}$ *if the bank chooses rollover.*

Claim 2 illustrates that asset dissipation is higher with rollover than with workout.

3.2.3 Banks' actions.

Bank two-period expected profit given a proportion α of the portfolio in default and given workout is[21]

$$\Pi^w(\alpha) = (1-\alpha)(1+s)d + \alpha \cdot V(0 \mid B) - c(a) - H. \tag{1}$$

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

$$\Pi^r(\alpha) = (1-\alpha)(1+s)d + \alpha \cdot l(\overline{\Delta} \mid B) - H. \tag{2}$$

Assumption 8: $\alpha \cdot [V(0 \mid B) - l(\overline{\Delta} \mid B)] > c(a)$ *for all* α.

Assumption 8 implies that workout is socially desirable: $\Pi^w(\alpha) > \Pi^r(\alpha)$ for all α. The presence of ρ in the banker's objective function, however, motivates the banker to choose to roll over loans whenever $\Pi^w(\alpha) \leqslant 0$. Define α^* by the value of α such that $\Pi^w(\alpha^*) = 0$. The bank manager chooses rollover for all $\alpha \geq \alpha^*$.[22]

[20] The manager is actually indifferent between all levels of Δ.

[21] I assume that deposits are not withdrawn until period 2.

[22] In this simple version of the model only managers of insolvent banks ever choose roll over. In a more general model solvent but financially distressed banks would also choose to roll over loans. For example,

3.3 Debt Cancellation

With debt cancellation the inherited debt is cancelled from the commercial banks' and the firms' balance sheets in period 0, and the banks are recapitalized via government securities. Because no default occurs in period 1, the bank has no choice to make between workout and rollover. Yet, because there is no default in period 1, there is no mechanism to halt asset dissipation. It is straightforward to show that the level of asset dissipation chosen by a "good debtor" i (i.e., a firm whose period-1 income and asset values satisfy definition 1) remains Δ_i^G, the level chosen with self reliance. Although the private benefits from privatization for a good debtor are now $\xi \cdot x_i(\Delta)$ 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." For the nonviable bad debtors, i.e., those for which $x_i(0) < l_i(0)$, the level of asset dissipation remains at $\overline{\Delta}$. Elimination of the debt overhang for these firms has no effect on their asset dissipation decisions since they will still be liquidated in period 2. On the other hand, for the bad debtors which are viable, the level of asset dissipation may change because $P_i(\Delta) = \xi \cdot x_i(\Delta)$ now turns positive. Define $\Delta_{i,dc}^B$ to be the value of Δ that maximizes the utility of a manager of viable firm i when there is no debt overhang. Then $\Delta_{i,dc}^B \leqslant \overline{\Delta}$. Lemma 1 states that $\Delta_{i,dc}^B$ will only be strictly less than $\overline{\Delta}$ when the firm's continuation value strictly exceeds its liquidation value.

Lemma 1: *If $\Delta_{i,dc}^B < \overline{\Delta}$ for some viable bad debtor i, then $x_i(\Delta_{i,dc}^B) > l_i(\Delta_{i,dc}^B)$.*

Proof: Suppose that $x_i(\Delta_{i,dc}^B) \leqslant l_i(\Delta_{i,dc}^B)$. Then, the manager's utility is $U_i(\Delta_{i,dc}^B) = b(\Delta_{i,dc}^B)$ since the firm will be liquidated in period 2. But $U_i(\Delta_{i,dc}^B) < b(\overline{\Delta}) = U_i(\overline{\Delta})$; therefore, $\Delta_{i,dc}^B$ cannot be optimal.‖

The policy of debt cancellation generates two tradeoffs relative to the policy of self reliance. On the one hand, the asset dissipation of bad debtors is not halted, whereas with workout it is. Firms that could be restructured are not. On the other hand, if $\Delta_{i,dc}^B < \overline{\Delta}$ for some viable bad debtors, then the amount of asset dissipation chosen by bad debtors will be lower with debt cancellation than with self reliance and rollover. That rollover may lead to

Mitchell (1997) shows that if rollover is a riskier action than workout, then solvent but financially troubled banks may choose rollover. The motivation for rollover in this case is not to hide loan losses but rather to take advantage of the deposit insurance put option. Solvent banks may also choose to roll over loans for reputational reasons in Rajan (1994).

some inefficient liquidation leaves scope for debt cancellation to result in an improvement over self reliance. In the absence of inefficient liquidation, $\Delta^B_{i,dc} = \overline{\Delta}$ and debt cancellation would never dominate self reliance.

3.4 Debt Transfer

With debt transfer all of the commercial banks' bad debt is transferred to a bad debt bank in period 0, and the commercial banks are recapitalized. The commercial bank's behavior is, therefore, the same as with the policy of debt cancellation. The bad debt bank is created for the sole purpose of working out the debt and is assumed to be closed upon termination of its duties. Because the bad debt bank is not a commercial bank and does not accept deposits, its "solvency" is not an issue. I assume that G is able to structure the compensation scheme of the bad debt bank's managers so that they have an incentive to maximize the returns from debt. Thus, the bad debt bank will always choose workout (when the gains from workout exceed the costs).

Obviously, if G is not able to induce the bad debt bank manager to maximize the returns from debt, then this manager may sometimes choose rollover, in which case additional tradeoffs between policies will be introduced into the model. Indeed, there are a number of reasonable, but competing, assumptions that one could make regarding the functioning of a bad debt bank. Each assumption would yield a slightly differing set of tradeoffs between policies. I indicate below how the tradeoffs would change if the assumptions concerning the bad debt bank were altered. Establishing a definitive model of a bad debt bank, to the extent that such an endeavor is possible, is beyond the scope of this paper. Rather, the goal is to demonstrate that there exist real tradeoffs between policies and to analyze these tradeoffs under a set of reasonable assumptions regarding bad debt bank operation.

It is shown below that if the costs of workout for the bad debt bank are the same as workout costs for commercial banks and if the bad debt bank 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 bad debt bank may not be as effective as the commercial bank in undertaking workout. In particular, if the commercial bank possesses inside information about borrowers' values, then workout by the bad debt bank will not be as effective as workout by the comnercial bank. The assumption that commercial banks

possess inside information concerning their borrowers is common in the finance literature.[23]

Assumption 9: *Due to informational asymmetries between commercial banks and bad debt banks, commercial banks are better able to determine their borrowers' values and to recover loan repayments.*

Assumption 9 can be translated into an assumption that the bad debt bank is able to slow, but not to halt, asset dissipation when this bank undertakes workout. Let $\widehat{\Delta}_{DT}$, where $0 < \widehat{\Delta}_{DT} \leqslant \overline{\Delta}$, be the expected level of asset dissipation that remains unrecovered when the bad debt bank undertakes workout. The expected value of a bad debtor is thus $V(\widehat{\Delta}_{DT} \mid B)$, with $V(\overline{\Delta} \mid B) \leqslant V(\widehat{\Delta}_{DT} \mid B) < V(0 \mid B)$. Because $\widehat{\Delta}_{DT}$ of asset dissipation remains uncovered, the manager of a bad debtor receives utility of $b(\widehat{\Delta}_{DT})$ when the bad debt bank undertakes workout, as opposed to a utility of zero when the commercial bank undertakes workout. The manager of the bad debtor thus chooses $\Delta = \widehat{\Delta}_{DT}$, when debt transfer is the policy.

Claim 3: *The bad debtor will choose $\Delta = \widehat{\Delta}_{DT}$ when debt transfer is the policy.*

4 G's policy choice

G must choose a policy before α is known.[24] G's objective is to select the policy which yields the highest expected net worth of state-owned assets, where the expectation is taken over α and where G takes into account banks' and firms' optimal behavior at every value of α. The optimal policy will thus depend upon G's prior distribution over α and upon other parameter values. Pairwise comparison of policy choices provides the intuition for characterization of the optimal policy. G's balance sheets with workout, rollover, debt cancellation, and debt transfer are given in Appendix 1.

[23] Indeed, Slovin et al (1993) present empirical evidence that commercial banks acquire inside information regarding their clients. James (1991) presents evidence that the return on assets of troubled banks is lower when institutions other than commercial banks take over bad loans.

[24] This assumption is not as extreme as it might appear at first glance. G's prior over α may have been established on the basis of earlier monitoring of banks and even the discovery of some level of default in previous periods. It is nevertheless true that even when regulators have monitored banks and know that some default has occurred, they generally do not have a precise idea of the true amount of bad debt, as witnessed by the number of banks in recent years that have failed after having received favorable ratings by regulators in the previous year.

4.1 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 workout with self reliance. Define $V(\Delta_{dc}^B \mid B)$ to be the expected value of a "bad debtor" given a policy of debt cancellation. Comparison of G's balance sheets with workout and debt cancellation indicates that G will prefer workout to cancellation if $\alpha \cdot [V(0 \mid B) - V(\Delta_{dc}^B \mid B)] > c(\alpha)$. Note that if all bad debtors are nonviable, then $\Delta_{dc}^B = \overline{\Delta}$ for all bad debtors and $V(\Delta_{dc}^B \mid B) = l(\overline{\Delta} \mid B)$; therefore, workout is preferred to debt cancellation. (This follows directly from Assumption 8.) Even if some debtors are viable, it may still be the case that $\Delta_{dc}^B = \overline{\Delta}$ for these debtors (for example, if ξ is low enough). If, in addition, $x_i(\overline{\Delta}) \leqslant l_i(\overline{\Delta})$ for all bad debtors, then $V(\Delta_{dc}^B \mid B) = l(\overline{\Delta} \mid B)$, and workout is preferred.

On the other hand, if the proportion of viable bad debtors is large enough and if Δ_{dc}^B is low enough, then the policy of debt cancellation may be preferred to workout for some values of α. This could only be the case when removal of the debt overhang enables bad managers to gain enough private benefits from firm privatization that they no longer have a strong incentive to dissipate the firm's assets.

Now consider a value of $\alpha \geq \alpha^*$. Debt cancellation will be preferred to rollover if $V(\Delta_{dc}^B \mid B) \geq l(\overline{\Delta} \mid B)$. This inequality always holds. Debt cancellation is thus preferred (possibly only weakly) to self reliance for all $\alpha \geq \alpha^*$.

4.2 The choice between debt transfer and self reliance.

Consider a value of $\alpha < \alpha^*$. Debt transfer will be preferred to workout if and only if $V(\widehat{\Delta}_{DT} \mid B) \geq V(0 \mid B)$. This equality never holds (Assumption 9); therefore, workout is preferred to debt transfer for all $\alpha < \alpha^*$. For a value of $\alpha \geq \alpha^*$, debt transfer will be preferred to rollover if and only if $\alpha[V(\widehat{\Delta}_{DT} \mid B) - l(\overline{\Delta} \mid B)] - c(\alpha) > 0$. Debt transfer will be preferred to rollover if the bad debt bank is "skilled enough" in undertaking workout, or if $V(\widehat{\Delta}_{DT} \mid B)$ is large enough relative to $l(\overline{\Delta} \mid B)$.

4.3 The choice between debt transfer and debt cancellation.

Debt transfer will be preferred to debt cancellation for all values of α such that $\alpha\{V(\widehat{\Delta}_{DT} \mid B) - V(\Delta_{dc}^B \mid B)\} - c(\alpha) > 0$. Whether or not this inequality holds depends upon the skill of

the bad debt bank in undertaking workout and upon the degree to which debt cancellation mitigates the problem of asset dissipation of viable bad debtors.

4.4 The optimal policy.

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 with respect to the optimal policy. First, note that the asset dissipation of good managers is invariant to G's policy choice. The policy choice influences only the behavior of bad managers.

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

Definition 4: A bad debt bank is *effective* if

$$\int_0^1 \left\{\alpha[V(\widehat{\Delta}_{DT} \mid B) - V(\Delta_{dc}^B \mid B)] - c(\alpha)\right\} f(\alpha)d\alpha > 0, \tag{3}$$

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

A bad debt bank will be called effective if the expected net benefit to G of a policy of debt transfer relative to debt cancellation is positive. If the bad debt bank is not effective, then debt cancellation is preferred to debt transfer.

Proposition 1 states necessary and sufficient conditions for debt cancellation to be the optimal policy.

Proposition 1 *Necessary and sufficient conditions for debt cancellation to be optimal are:*
(i) the bad debt bank is not effective;
(ii) $\int_0^{\alpha^*} \{\alpha[V(0 \mid B) - l(\overline{\Delta} \mid B)] - c(\alpha)\} f(\alpha) < E(\alpha) \cdot \{V(\Delta_{dc}^B \mid B) - l(\overline{\Delta} \mid B)\}$.

Proof: See Appendix 2.

Condition (i) of Proposition 1 is obvious: debt cancellation can only be optimal if it is preferred to debt transfer. Condition (ii) follows from comparison of G's balance sheets with self reliance and debt cancellation. This condition states that in order for debt cancellation

to be optimal, the expected net gains to workout relative to rollover with self reliance, for the range of α for which the commercial bank would choose workout, must be less than the expected net gain to debt cancellation relative to rollover, where the expectation is taken over all α. Clearly, the greater is α^*, the less likely is debt cancellation to be optimal.

Corollary 1 *Necessary conditions for debt cancellation to be optimal are:*

(i) the bad debt bank is not effective;

(ii) a positive proportion of bad debtors is viable;

(iii) $V(\Delta_{dc}^{B} \mid B) > l(\overline{\Delta} \mid B)$.

Conditions (ii) and (iii) of Corollary 1 follow directly from condition (ii) of Proposition 1. They pertain to the problems of asset dissipation and debt overhang associated with rollover. Condition (ii) restates the earlier result that the only condition under which debt cancellation could ever dominate self reliance is that in which rollover leads to inefficient liquidation. Condition (iii) states that even when there is some inefficient liquidation with rollover, debt cancellation can only dominate self reliance if the asset dissipation of viable bad debtors is reduced enough that the values of these firms with debt cancellation rise above their liquidation values with $\overline{\Delta}$.

An implication of the corollary is that when asset dissipation problems among bad debtors are serious—i.e., when high levels of asset dissipation would occur even with debt cancellation—then debt cancellation cannot be the optimal policy. Conditions (ii) and (iii) point to two motivations for high levels of asset dissipation among bad debtors: poor prospects for privatization (a high proportion of nonviable bad debtors) and high degrees of opportunism by viable bad debtors' managers who would derive only low levels of personal benefits even if their firms are privatized (Δ_{dc}^{B} close to $\overline{\Delta}$).

Corollary 2 *A sufficient condition for debt cancellation to be the optimal policy is that* $\Delta_{dc}^{B} = 0$ *for all bad debtors.*

Corollary 2 states the obvious result that if the problem of asset dissipation is trivial—i.e., if debt cancellation results in no asset dissipation by bad debtors–then debt cancellation will be the optimal policy.

When problems of asset dissipation are serious enough, the optimal policy will be either self reliance or debt transfer. As discussed above, whether or not debt transfer is the

optimal policy in this case depends upon the bad debt bank's ability to value firms and to recover repayments with workout, which are captured in the model by the bad debt bank's ability to halt asset dissipation.

The following proposition restates an obvious result concerning the optimality of debt transfer.

Proposition 2 *A sufficient condition for debt transfer to be optimal is that the bad debt bank is effective and* $\widehat{\Delta}_{DT} = 0$.

Proposition 2 illustrates the fact that the assumptions regarding the functioning of the bad debt bank affect the tradeoffs between policies. If the bad debt bank is able to completely halt asset dissipation (i.e., is as skilled as the commercial bank at workout), then debt transfer will dominate self reliance, since debt transfer never results in rollover.

What are the necessary conditions for debt transfer to be optimal? Clearly, a necessary condition for debt transfer to be the optimal policy is that the bad debt bank be effective. Given that self reliance dominates debt transfer for values of $\alpha < \alpha^*$ (which follows from Assumption 9), another necessary condition for debt transfer to be optimal is that debt transfer dominates self reliance for at least some values $\alpha \geq \alpha^*$.

Define $\widehat{\alpha}$ as the value of α such that $\widehat{\alpha} \cdot [L(\widehat{\Delta}_{DT} \mid B) - l(\overline{\Delta} \mid B)] - c(\widehat{\alpha}) = 0$. $\widehat{\alpha}$ represents the value of α such that G is indifferent between workout by the bad debt bank and rollover. For all $\alpha > \widehat{\alpha}$, self reliance (and rollover) is preferred to debt transfer. Then a necessary condition for debt transfer to be optimal is that $\widehat{\alpha} > \alpha^*$. There must exist some range of α for which debt transfer is preferred to self reliance. Proposition 3 summarizes the discussion.

Proposition 3 *Necessary conditions for debt transfer to be the optimal policy are: (i) the bad debt bank is effective; and (ii)* $\widehat{\alpha} > \alpha^*$.

Remark: It is possible to interpret $\widehat{\alpha}$ more generally. If the compensation scheme offered to the bad debt bank manager does not succeed in motivating the choice of workout for all α, then let $\widehat{\alpha}$ be the value of α at which the bad debt bank begins rolling over debt. The condition that $\widehat{\alpha} > \alpha^*$ is necessary for debt transfer to dominate self reliance. If the bad debt bank rolls over debt more often than the commercial bank, debt transfer can never be optimal.

On the basis of the above discussion, it is now possible to identify sets of sufficient conditions and of necessary conditions for self reliance to be optimal.

Corollary 3 *A sufficient condition for self reliance to be optimal is* $\widehat{\alpha} < \alpha^*$ *and all bad debtors are nonviable.*

Condition (i) of the corollary is sufficient for self reliance to dominate debt transfer. Condition (ii) implies that there is no inefficient liquidation with rollover; therefore, self reliance dominates debt cancellation.

Corollary 4 *Necessary conditions for self reliance to be optimal are: (i)* $\widehat{\Delta}_{DT} > 0$; *(ii)* $\Delta^B_{dc} > 0$.

If $\widehat{\Delta}_{DT} = 0$, then debt transfer dominates self reliance. If $\Delta^B_{dc} = 0$, the problem of asset dissipation (among bad debtors) is nonexistent; therefore, debt cancellation dominates self reliance.

5 Discussion and Extensions

Several of the assumptions of the model analyzed above have an effect on the tradeoffs between policies. In this section I address a number of key assumptions and indicate how relaxing each would affect the policy tradeoffs.

5.1 Asset dissipation influences probability of default

One of the assumptions in the model is that the firm's type (good or bad debtor) is determined exogenously. While this is a reasonable assumption in light of the high degree of uncertainty surrounding product and factor prices at the beginning of transition, it is interesting to consider how the results would change if firm managers' asset dissipation decisions (or, similarly, restructuring decisions) could affect the probability of default. A modification of the timing of events and of the definition of firm types permits such a question to be addressed.[25]

[25] One might ask why this version of the model is not analyzed in the body of the paper rather than summarized here. The reason is that the analysis is significantly more complicated and requires more notation, without yielding important new insights.

Suppose that in period 0, after G has announced a policy, firms learn whether they are "high" or "low" types, and they must choose a level of asset dissipation to be begun in period 0 and continued in period 1. At the beginning of period 1 firms learn whether they have become good or bad debtors (where the definitions of good and bad debtors remain identical to those in the existing model). In the absence of any asset dissipation high-type firms have a positive probability of becoming good debtors in period 1; however, asset dissipation lowers the probability that the high type will become a good debtor and raises the probability that it will become a bad debtor. In contrast, low-type firms become bad debtors with certainty, even if their level of asset dissipation is zero.

Asset dissipation now raises the probability of default (of high types), in addition to the other effects present in the original model. After firms choose in period 0 their levels of asset dissipation, they observe in period 1 whether they have become good or bad debtors, and default occurs. Banks then choose whether to work out or roll over loans in default.

Analysis of this model reveals that with the policies of self reliance or debt transfer, low-type firms will always choose $\Delta = \overline{\Delta}$, independently of the bank's expected response to default. In contrast, high-type firms' choices of asset dissipation will depend upon G's policy choice and the bank's expected response. It is possible to show that the level of asset dissipation chosen by high types when self reliance is the policy and when they expect commercial banks to choose rollover is always at least as high as the level when banks are expected to choose workout. With respect to the policy of debt transfer, it is possible to show that high types' levels of asset dissipation will be at least as high as with self reliance and rollover but no greater than the level with self reliance and workout by the commercial bank. Debt transfer leads to an intermediate level of asset dissipation by high types.

High types' asset dissipation decisions will depend upon not only G's policy choice but also depend upon the proportion of firms in the economy that are low types in period 0. In fact, when self reliance is the policy, it is necessary to distinguish three cases, depending on the proportion of low-type firms in period 0. If this proportion is very low, then the level of default on banks' balance sheets will be low even if high types dissipate assets, and banks will choose workout of their defaulters in period 1. In this case high-type firms will choose in period 0 a level of asset dissipation that is consistent with banks' choosing workout in period 1. On the other hand, if the proportion of low-type firms is very high (so

as to render banks insolvent even when high types do not dissipate assets), then banks will choose rollover in period 1. In this case high-type firms will select in period 0 a level of asset dissipation consistent with banks' choosing rollover in period 1. Finally, for intermediate proportions of low-type firms, the high-types' choices of asset dissipation and their resulting levels of default will critically determine banks' solvency and thus their response to default in period 1. In this case there exist multiple equilibria. In one equilibrium high-type firms choose levels of asset dissipation in period 0 consistent with workout by banks in period 1, in which case the firms' choices of low levels of asset dissipation actually lead to low levels of default, and banks choose workout. In the other equilibrium high-type firms may choose levels of asset dissipation in period 0 consistent with rollover by banks in period 1, in which case the firms' choices of high levels of asset dissipation actually lead to high levels of default, and banks choose rollover in period 1.

Whereas the analysis of firms' asset dissipation decisions becomes more complicated than in the original model, the analysis of bank choice between workout and rollover is similar to the original analysis. Commercial banks will choose rollover when their expected profit is negative. The tradeoffs between debt cancellation and self reliance, however, change. As before, there is a potential benefit of debt cancellation relative to self reliance and rollover due to inefficient liquidations with rollover. Levels of asset dissipation chosen by low-type firms may fall below $\overline{\Delta}$ when debt cancellation is the policy choice. On the other hand, the levels of asset dissipation of high-type firms may *increase* with debt cancellation. Since debt cancellation now removes the possibility of default, asset dissipation by high types no longer has an effect on the probability of default. Removal of this "cost" of asset dissipation may raise levels of asset dissipation. The net gain to debt cancellation relative to self reliance and rollover now becomes more ambiguous. This gain will depend upon the relative proportions of high and low-type firms in period 0 and upon the degrees to which levels of asset dissipation change for each type when debt cancellation is chosen relative to self reliance. Obviously, if with debt cancellation the effect of an increase in Δ by high types dominates the effect of a decrease in Δ by low types, then debt cancellation will never dominate self reliance.

5.2 Changes in assumptions regarding privatization

Asssumption 6 in Section 3 states that G breaks up or liquidates firms that it has been unable to sell in period 2. Thus, viable firms with a large enough debt overhang may be inefficiently liquidated. If this assumption were modified so that unsold firms are given to their employees, then the policy tradeoffs would resemble those that are created by a mass privatization program in period 2 and discussed below.

A mass privatization program will alter the set of firms that are privatized in period 2 relative to the assumption of privatization by sale combined with Assumption 6. As would be expected, all good debtors are still privatized. If the bank undertakes workout of bad debtors, we may assume that the bank forces liquidation of all nonviable bad debtors, since $l_i(0) > x_i(0)$ and $l_i(0) < d$ for each of these firms. Thus the bank's expected profit with workout does not change, and the value of α^* does not change. Yet, if the bank chooses rollover for bad debtors, the default of these firms remains hidden, and they will be privatized in period 2. Rollover now leads to inefficient survival of firms, since nonviable bad debtors are privatized. Bad debtors' period 2 values now become their continuation values, since these firms remain in operation. The bank's expected repayment from a bad debtor whose loan has been rolled over is now $x(\Delta \mid B)$,instead of $l(\Delta \mid B)$, for some choice of Δ by bad debtors.

The question arises as to the appropriate specification of managers' private benefits from privatization. If private benefits remain $P_i(\Delta) = I \cdot \xi \cdot [x_i(\Delta) - d]$, then $P_i(\Delta) = 0$, since $x_i(\Delta) - d < 0$ for bad debtors. All managers of bad debtors still choose $\overline{\Delta}$ with rollover.

With regard to the policy of debt cancellation, contrary to the case of privatization by sale, debt cancellation does not alter the set of firms that are privatized in period 2, relative to those that are privatized with rollover. There is still inefficient survival with debt cancellation. Yet, removal of debt repayments raises private benefits $P_i(\Delta)$, which now equal $I \cdot \xi \cdot [x_i(\Delta)]$ and are positive. As a result, the level of asset dissipation of bad debtors, both viable and nonviable, may fall below $\overline{\Delta}$. Thus, it is the potential reduction in asset dissipation with debt cancellation relative to rollover that provides scope for debt cancellation to be preferred to self reliance.

Another change in tradeoffs introduced by mass privatization is that there will be no

inefficient survival of firms with the policy of debt transfer. The bad debt bank works out debt for all firms and liquidates those firms for which $l_i(\widehat{\Delta}_{DT}) > x_i(\widehat{\Delta}_{DT})$. The elimination of inefficient survival of firms increases the benefit of debt transfer relative to self reliance and rollover and also relative to debt cancellation.

5.3 Good debtors that undertake strategic default

Assumption 7 in the above model prevents the good debtor from dissipating assets to the point of default in period 2 or in engaging in strategic default in period 1. If Assumption 7 is relaxed, then these actions become possible. It is safe to assume that, since good debtors must choose to default before the bank selects workout or rollover, strategic default will only occur if good debtors wish to dissipate assets to the point of default in period 2. If the latter situation is the case, then the good debtor chooses between strategic default in period 1 and between not defaulting in period 1 and dissipating a large amount of assets during that period. As mentioned in a footnote above, the possibility of the latter action would necessitate inclusion in the model of a monitoring decision by banks. Whether the firm undertakes strategic default or not will, therefore, depend upon the probability of the bank's choosing rollover of its defaulters (in which case the firm is sure to dissipate the level of assets that it wishes) and the probability of monitoring of good debtors during period 1. If, for example, α is known to good debtors and α is high enough that the bank is insolvent, then good debtors will use strategic default, since the bank will roll over loans in default.

5.4 Systemic effects of policies

The analysis in Section 4 of policy choice does not explicitly take into account systemic issues, such as the tradeoffs associated with applying policies to a large number of banks, behavior of regulators as a function of the number of distressed banks, and the credibility of the government in implementing *ex post* the policy announced *ex ante*. In order to address such issues, it is necessary to specify the government's cost functions for each policy, as well as the functional dependence of these costs on the number of banks to which the policy is applied. One issue arising from these considerations is whether regulators may credibly apply tough policies to insolvent (or passive) banks when they discover that most or all of

the banks in the economy are troubled. Another issue is the degree to which prudential regulations established *ex ante* (before a banking crisis occurs) affect the credibility of the regulator's policy applied to banks *ex post*.

It is not feasible to combine the analysis in the current paper of the direct and indirect effects of a wider range of polices with an analysis of systemic issues and the subgame perfection of policies. Analysis of such questions is beyond the scope of this paper and is the subject of a separate paper (Mitchell (1997)). The latter studies the influence of the number of banks in distress upon a regulator's policy response to the discovery of distressed banks. The complexity of the analysis, however, requires limiting the number of policies analyzed to two. The regulator is faced with a choice of a "soft" policy of rescuing and recapitalizing distressed banks versus adopting a "tougher" policy. If "too many" banks in the financial system are discovered to be in financial distress, then the social costs of rescuing and recapitalizing banks may be less than the costs of closing all of them (or removing bank managers), and a situation of "too many to fail" is triggered. Moreover, banks may generate a situation of "too-many-to-fail" through simultaneously choosing rollover versus workout of debt.

6 Conclusion

This paper proposes a new framework for analysis of the tradeoffs between policies applied to financially distressed banks. This framework is used to analyze the tradeoffs between three policies–debt cancellation, debt transfer, and self reliance–which have either been advocated or applied to clean banks' balance sheets in economies in transition. It is straightforward to extend the framework to analyze a wider range of policies, to treat firms and banks in developed economies, and to include restructuring or asset dissipation decisions of firms that affect their probability of default. Section 5 of the paper discusses the effects of the latter extension.

One contribution of the paper is to demonstrate that policies to clean banks' balance sheets have differing real effects on banks' and firms' values. A second contribution is to show that regulatory policies applied to financially distressed banks have both direct effects on bank behavior and indirect effects on borrower behavior. The indirect effects are an

important determinant (in addition to the direct effects) of the outcome of a policy on banks' asset values.

A final result of the paper is that privatization methods can also influence tradeoffs between policies applied in EITs to clean banks' balance sheets. Privatization of firms by sale may cause the policy of self reliance to lead to inefficient liquidation of firms when banks choose to roll over their bad loans. In this case a potential advantage of debt cancellation relative to self reliance is the elimination of such inefficient liquidation. In contrast to the privatization of firms by sale, mass privatization methods can cause self reliance and rollover to lead to inefficient survival of firms. Firms that should be liquidated are privatized. In this case debt cancellation does not eliminate the inefficient survival of firms, although debt transfer does.

Appendix 1

Policies adopted to clean banks' balance sheets in three East European economies

CZECH REPUBLIC - **Debt transfer and self reliance**

-Three commercial banks created Jan. 1, 1990

-40% of loans to two largest banks were revolving inventory credits extended at negative interest rates

-2/3 of revolving inventory credits transferred in 1991 to Consolidation Bank

-Commercial banks recapitalized with government securities

HUNGARY - **Self reliance; switch to debt transfer**

-Five commercial banks created Jan. 1, 1987

-Bank provisioning and bankruptcy used until 1993

-Loan consolidation program begun in 1993

-Banks recapitalized in 1991, 1992, 1993, and 1994 (Total recapitalization estimated at $3.5 billion)

POLAND - **Self reliance**

-Nine commercial banks created in Feb., 1989

-Banks instructed to create bad loan divisions in 1992

-Law on financial restructuring in 1993 required banks to undertake U.S. Chap. 11-type restructuring agreements

G's balance sheets for differing policy choices

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

G's balance sheet with workout:

Assets

Expected income from good debtors:	$(1-\alpha)\cdot(y_G + V(\Delta^G \mid G))- (1-\alpha)\cdot(1+s)d$
Expected bank net worth	$(1-\alpha)\cdot(1+s)d + \alpha\cdot V(0 \mid B) - c(\alpha) - H$

Liabilities

None

G's balance sheet with rollover:

Assets

Expected income from good debtors:	$(1-\alpha)\cdot(y_G + V(\Delta^G \mid G) - (1-\alpha)\cdot(1+s)d$
Expected bank net worth	$(1-\alpha)\cdot(1+s)d + \alpha\cdot l(\overline{\Delta} \mid B) - H$

Liabilities

None

G's balance sheet with debt cancellation:

Assets

Expected income from good debtors	$(1-\alpha)\cdot(y_G + V(\Delta^G \mid G))$
Expected income from bad debtors	$\alpha\cdot V(\Delta^B_{DC} \mid B)$
Expected bank net worth	$B(1+s) - H$

Liabilities

Securities	$B(1+s)$

G's balance sheet with debt transfer:

Assets

Expected income from good debtors	$(1-\alpha)\cdot(y_G + V(\Delta^G \mid G))- (1-\alpha)\cdot(1+s)d$
Expected commercial bank net worth	$B(1+s) - H$
Expected bad debt bank net worth	$(1-\alpha)\cdot(1+s)d + \alpha\cdot V(\widehat{\Delta}_{DT}) - c(\alpha)$

Liabilities

Securities	$B(1+s)$

Appendix 2

Proof of Proposition 1: (i) In order for debt cancellation to be preferred to debt transfer, the bad debt bank must be ineffective. (ii) In order for debt cancellation to be preferred to self reliance,

$$\int_0^{\alpha^*} \{\alpha[V(0 \mid B) - V(\Delta_{dc}^B \mid B)] - c(\alpha)\} f(\alpha) + \int_{\alpha^*}^1 \alpha\{l(\overline{\Delta} \mid B) - V(\Delta_{dc}^B \mid B)\} f(\alpha) < 0.$$

Adding and subtracting $\int_0^{\alpha^*} \alpha[l(\overline{\Delta} \mid B)] f(\alpha)$ and rearranging yields

$$\int_0^{\alpha^*} \{\alpha[V(0 \mid B) - l(\overline{\Delta} \mid B)] - c(\alpha)\} f(\alpha) < \int_0^1 \alpha\{V(\Delta_{dc}^B \mid B) - l(\overline{\Delta} \mid B)\} f(\alpha),$$

which yields the inequality stated in the proposition.‖

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