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Bankruptcy as a Control Device in Economies in Transition[1]

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We examine in this paper the design of a liquidation, or bankruptcy, policy in a partially centralized economy characterized by imperfect information. We employ a two-period model to analyze the effects of an optimal liquidation rule on the efficiency of resource allocation and choice of managerial effort when managers have private information about effort and firm productivity. First-period investment is used by the regulator to discipline the manager and to extract information. The tradeoff between disciplinary effect and information extraction might be best solved by implementing inefficient liquidation policies. Inefficiencies in liquidation policies can occur even if the regulator believes that he is facing a given type of firm with probability close to one. *J. Comp. Econom.*, June 1995, **20**(3), pp. 265–301. Cornell University, Ithaca, New York 14853-7601. © 1995 Academic Press, Inc.

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1. INTRODUCTION

Bankruptcy laws form an important institutional component of market economies but one that was missing from the formerly socialist economies. Reformers in the postsocialist economies are recognizing that bankruptcy rules are one of the foundations upon which to base the transition to a market economy. This paper analyzes the optimal design of a liquidation, or bankruptcy, policy for a firm in an economy that is effectively beginning such a transition. The economy is partially centralized and is characterized by imper-

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fect information between lenders and borrowers. Partial centralization in this context means that no well-functioning, competitive credit market exists. Lending decisions are made by one agent, whom we call a regulator.

The relationship between the regulator and manager may last for two periods. The regulator observes neither managerial effort nor a firm's productivity and possesses all of the bargaining power for contracting.[2] The investment resources that the regulator controls may be used for productive investment in either period or for expenditures for the bailout of loss-making firms at the end of the first period. The source of these investment resources is a limited, exogenous budget available at the beginning of period 1.[3] The regulator is thus financially constrained; for example, he is prevented from issuing money to finance investment of either type, productive or bailout. Given that the regulator faces a fixed investment budget, his choice of investment at the beginning of the first period effectively commits him to a particular bailout policy and to a maximum amount of investment for period 2. The regulator does not commit, however, to the second-period reward that the manager will receive or, equivalently, to the second-period payoff required from the project. The absence of commitment regarding second-period payoffs introduces the possibility of a ratchet effect, such as that analyzed by Freixas *et al.* (1985) and Laffont and Tirole (1988).

We address the following question: given that the regulator can commit to a policy of liquidation, how successful is the optimal liquidation rule? That is, what are the effects of the optimal bankruptcy rule on the allocation of resources and choices of effort? We pay particular attention to the implications of the bankruptcy rule for resource allocation, noting whether the rule calls for bailing out (not bailing out) a firm that the regulator would have chosen to bail out (not to bail out) in the first-best situation.

Our model provides understanding of some of the limitations of imposing bankruptcy rules in the early stages of transition in the formerly socialist economies. Until recently financially troubled firms in socialist economies were bailed out with virtual certainty. Passage of bankruptcy laws was argued to be a necessary condition, albeit not the only one, for hardening the firm's soft budget constraint,[4] thereby improving the efficiency of resource allocation and imposing financial discipline on managers.

[2] In much of the recent literature on debt contracts the assumption of competition in the credit market leads to the situation where the entrepreneur possesses all of the bargaining power. Our assumption can be justified in a symmetric manner: competition among potential borrowers provides the investor with the bargaining advantage.

[3] For example, this budget may be decided upon and allocated from a higher level in an administrative hierarchy or from an independent budgetary source. See below for the justifications for making this assumption regarding the investment budget.

[4] This term was originated by Kornai (1980).

Some authors (e.g., Schaffer, 1989; Dewatripont and Maskin, 1990) have asserted that the inability of government authorities to commit not to bail out firms constituted the source of soft budget constraints. Taxation of profitable firms to subsidize loss-making ones and accommodation of the money supply to the credit demands of loss makers were the primary activities that perpetuated soft budget constraints. Policy makers in the reforming economies acknowledged the credibility problem and have implemented reforms that have eliminated subsidies to loss-making enterprises and have limited the power of those making investment decisions to access unlimited funds for bailouts.[5] Fear of inflation and pressure from international organizations such as the IMF and the World Bank have imposed severe constraints on the size of government budget deficits. The creation of two-tiered banking systems in the reforming economies has separated investment decisions from decisions regarding money creation. Money creation has been further limited by the use of direct, quantitative controls on credit by commercial banks, in addition to the indirect tools of monetary policy that are more common in the West.[6]

These reforms appear to have had some impact. Schaffer (1992) argues that as of December 1991, "[p]ressures on the [Polish] government to bail out ailing enterprises [were] largely resisted," and "state-owned enterprises in 'transition Poland' have had a fairly hard budget constraint." The passage of a new bankruptcy law, with an automatic triggering clause, that took effect on January 1, 1992[7] attests to the ability of the Hungarian government to commit to hardening budget constraints. By the end of September, 1992, 4509 reorganization procedures and 7859 liquidation procedures had been initiated.[8]

We argue that developments in the reforming economies justify our assumption that the regulator in a partially centralized economy can commit to a bankruptcy rule.[9] In addition, we feel that the manner by which we formalize

[5] Among the authors who have documented the elimination of subsidies and/or access to credit on preferential terms are Brada (1991), Dyba and Svejnar (1992), Hare (1991), Lipton and Sachs (1990), and Wellisz (1991).

[6] See Estrin, *et al.* (1992), PlanEcon (1991), and OECD (1992), for discussions of the use of quantitative credit controls in Hungary, Czechoslovakia, and Poland.

[7] Although Hungary had had a bankruptcy law on its books since 1986, authorities had not succeeded in inducing creditors to use bankruptcy to harden the budget constraints of borrowers. The new law with an automatic trigger was a reaction to this creditor passivity. See Mitchell (1993) for an analysis of creditor passivity in the economies in transition.

[8] The condition that triggered bankruptcy was draconian. Any firm that had a debt overdue for a period of 90 days was required to initiate bankruptcy. Because of the massive number of firms that entered bankruptcy, the court system became overloaded. Liquidation values of firms were also severely depressed because of the flood of firms on the market. In September 1993, an amendment to the bankruptcy law rescinded the trigger.

[9] Our model analyzes a relationship between a regulator and one firm. In reality the regulator may have more than one firm in which to invest; hence, the possibility of cross-subsidization,

commitment, through a fixed investment budget, reflects the spirit of reforms such as the elimination of government subsidies, lowering of budget deficits, and the use of instruments for controlling commercial bank credit.[10] Indeed, one financial reform under discussion in Poland in 1992 and 1993 involved the use of an investment fund, labeled the intervention fund, for the reorganization of enterprises that are deemed difficult to liquidate because of macroeconomic or social considerations. Managers of the fund would have a fixed budget to allocate among all potential candidates, and they would be required to decide not only how much to invest in each firm but also whether to invest at all.[11]

One of the results that our model indicates is that the optimal bailout policy, which is a function of the regulator's beliefs concerning the firm's type, high or low profitability, often entails an inefficient allocation of resources. The regulator may bail out a firm that he would have wanted to liquidate in the first-best situation, or he may liquidate a firm that he would have wanted to bail out. This result may not appear surprising at first; it is well known that bankruptcy laws in developed market economies may result in either premature or overdue liquidations.[12] The inefficiency of liquidation in the developed economies, however, is not the intention of lawmakers. What differs in our model is that premature or overdue liquidations arise because the regulator chooses to implement them.

The explanation for the inefficiency of resource allocation lies in the use of the bankruptcy rule as an incentive mechanism. There is a tradeoff between incentives and the efficiency of resource allocation, and the regulator may choose to implement an inefficient bailout policy because of its incentive effects. Similarly, although the disciplinary effect of bankruptcy, i.e., a higher

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or using the profits of one firm to cover the losses of another firm, arises. We address the issue of cross-subsidization in Section 6.

[10] Sah and Weitzman (1991) suggest that precommitments to enforce incentive mechanisms involving liquidation may be made more credible if an outside funding agency imposes such commitments. The pressure that the World Bank and IMF appear to be exerting on governments to limit their budget deficits may have such an effect.

Laffont and Tirole (1993, p. 681) suggest that constitutional prohibitions against transfers by a regulator to a regulated firm in a market economy can be used as a means of hardening the firm's budget constraint. One can interpret our fixed investment budget as a limit on transfers that the regulator may make to the firm. Recently, Tirole (1992) has argued for the control of a regulated firm by different principals with different interests; in particular, Tirole suggests that giving the control of financial decisions to a ministry whose objective is to balance the budget is a way to harden the budget constraint of the firm.

[11] Information obtained in private interviews.

[12] For discussions of U.S. bankruptcy see Bulow and Shoven (1978), Gertner and Scharfstein (1991), Harris and Raviv (1992), Hart and Moore (1989), and White (1980, 1989). Mitchell (1990) compares the U.S. bankruptcy law with those of four other industrialized economies.

level of effort being exerted when the threat of liquidation exists, is easily verified in the first-best situation, it is more difficult to isolate when both moral hazard and adverse selection exist. Bankruptcy's role in improving resource allocation clouds its role in disciplining firm management.

Through its combination of the incentive aspects of bankruptcy with questions regarding efficient resource allocation, this paper contributes to the growing literature on bankruptcy and creditor–debtor relations and to the literature on dynamic models of regulation. A few previous papers (e.g., Grossman and Hart, 1982, and Jensen, 1986) have considered the incentive effects of bankruptcy on managers' willingness to divert productive resources to nonproductive uses. These papers have not, however, examined the effect of bankruptcy on managers' choices of productive effort nor have they addressed the question of the optimal design of a bankruptcy rule given its incentive properties. A number of other papers have focused on bankruptcy's effects upon the efficiency of resource allocation, cf. note 12, above, or upon the form of optimal financial contracts (e.g., Gale and Hellwig, 1985) without considering incentives.

One paper that resembles ours in its focus on reforming economies is that of Dewatripont and Maskin (1990). These authors contrast project selection in a centralized credit market, in which a single existing creditor is assumed unable to commit not to refinance, with that in a decentralized market, where the quantity of funds and number of creditors is unlimited but where creditors with limited funds can credibly make a commitment not to refinance. One may interpret the model of Dewatripont and Maskin as comparing an economy before and after financial reform. Our model, in contrast, may be considered to apply to the financial transition, during which financial reform has begun but has not yet been completed. During the transition the quantity of funds and the number of creditors is limited. In addition, major creditors as well as debtors remain under state ownership.

The remainder of the paper is organized as follows. In Section 2 we present the model and analyze the first-best policies. Sections 3 and 4 contain the technical analysis of continuation equilibria and may be skipped by the reader interested primarily in the model and the major results. In Section 5 we compare the continuation equilibria and derive general results regarding the equilibrium of the game for extreme values of beliefs. We also compute equilibria for all possible beliefs in a numerical example. We conclude the paper in Section 6. Appendix A contains a table of notation used in the model. Appendix B contains the proofs of results stated in Sections 2 and 3 of the text. Appendix C contains the proofs of results stated in Sections 4 and 5.

2. THE MODEL

The relationship between the regulator R and the manager M may last for at most two periods. The relationship will last for only one period if R decides to liquidate the firm at the end of the first period or if M decides to leave, at the end of the first period, a firm that R wishes to operate during the second period. In each period there are two possible realizations of returns on investment, y_H or $-y_L$, with $y_L > 0$. The probability of realizing return y_H given an investment I is given by $\theta \cdot p(I) + e$, where θ is a productivity parameter for the firm and e is M's effort. Similarly, the probability of realizing $-y_L$ is $(1 - \theta \cdot p(I) - e)$.

R has access to an investment budget of size Z that he may allocate across periods; total investment in periods 1 and 2 may not exceed Z. Moreover, funds for productive investment and for bailouts must come from this budget. If $-y_L$ is realized at the end of the first period and there remain insufficient funds to cover these losses, then R has no choice but to liquidate the firm. The liquidation value of the assets is assumed to be a constant $L < y_L$; therefore, the net value of period 1 losses in this case is $K \equiv y_L - L$, and the firm does not operate in period 2. On the other hand, if period 1 investment I_1 is such that $Z - I_1 \geq y_L$, then R has the option of using y_L from this fund to bail out the firm at the end of period 1 and to maintain it in operation in period 2. The total amount available for additional productive investment in period 2 in this case would then be $Z - I_1 - y_L$. A necessary condition, then, for bailout to be possible is that $Z - I_1 \geq y_L$. Hence, the choice of investment may guarantee a credible commitment to liquidating a firm that earns losses in period 1.

We suppose that neither R nor M can commit in the first period for the second period. R cannot commit not to use the information generated during the first period for designing second-period contracts, and M has the option of not participating, i.e., M can freely exit the firm at the end of the first period. Figure 1 is a simplified representation of the timing of events and of the actions that R and M may take.

We make the following assumptions throughout the paper.

A1. $e \in [0, \delta]$, $0 \leq \delta < 1$; $\theta \in \Theta = \{\overline{\theta}, \underline{\theta}\}$, $\overline{\theta} > \underline{\theta} > 0$.
A2. $0 \leq \overline{\theta} \cdot p(I) \leq 1 - \delta$, $\forall I \in [0, Z]$.

Assumptions A1 and A2 guarantee that $\theta \cdot p(I) + e$ is a well-defined probability measure over the relevant range of investment.

We assume that R either invests all of his budget in the first period or holds exactly the amount of reserves that will cover the loss $-y_L$.

A3. $I_1 \in \{Z, Z - y_L\}$.

A3 imposes a restriction; however, relaxing it would introduce analytical complications into the model that would obscure the qualitative results without altering them. Unlike other models of bankruptcy (e.g., Hellwig, 1977) in which the initial quantity of credit extended may influence the lender's ability

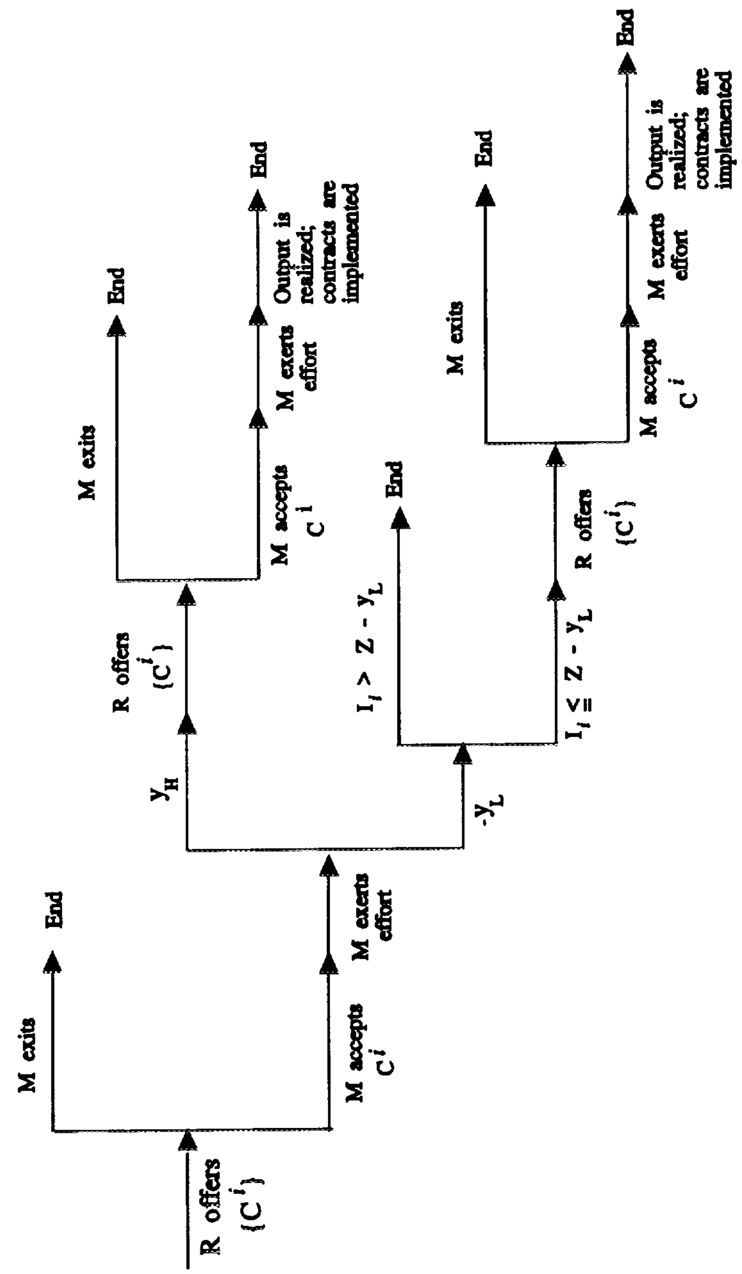

FIG. 1. Timing of the game.

to commit not to refinance, the regulator's ability to commit to liquidation or to bailout in our model does not change if he chooses an initial investment level lower than $Z - y_L$. We will make assumptions that guarantee that the regulator will always want to invest during period 2 any part of the investment budget that remains at the end of the first period; therefore, the only reason that he might want to hold a reserve greater than y_L in the first period is for incentive purposes. The size of the initial investment influences the size of the rent that must be paid to the high-profitability firm; hence, there may exist circumstances where the regulator is better off investing something less than $Z - y_L$ in the first period. In this case, he would nonetheless bail out the firm at the end of the first period, if necessary, and invest the remaining funds in the second period. Imposing assumption A3 allows us to focus more clearly on the question of efficient resource allocation while still allowing for an investigation of the use of the liquidation policy as an incentive device.

The following assumptions specify objective functions and reservation values for the two players.

A4. R maximizes expected profit, and M maximizes expected utility. M has a quasi-linear utility function, where effort cost is denoted by $V(e)$.

A5. M's one-period reservation utility for period 2 if the firm continues in operation is given by $\underline{U}$; M's reservation utility for period 2 if the firm is liquidated at the end of period 1 is assumed to be $U^0 \leq \underline{U}$; M's two-period reservation utility is given by $\hat{U}$.

Assumption A5 gives M's reservation utility levels under different contingencies. As is usual in the literature, we assume that the reservation utility levels are independent of M's type. We assume that $U^0 \leq \underline{U}$; i.e., that M suffers a cost, such as a reputation cost, in terms of expected utility if she is forced to leave the firm at the end of period 1 due to liquidation. This assumption reflects the fact that bankruptcy generally imposes costs on all of a firm's claimants.

M's reservation utility places lower bounds on the utilities that R can implement in the second-best; however, no lower bounds are imposed on wages. The manager thus has unlimited liability. We can easily interpret a negative salary as a loss of the benefits (such as an anticipated year-end bonus or the nonpecuniary benefit of career advancement) that would often accompany good performance in state-owned firms. One of the principal motivations for the assumption of unlimited liability is nevertheless analytical convenience; the extension to limited liability is straightforward.[13]

[13] The analysis with limited liability, however, would entail an additional notational cost. Our methodology in Sections 3 and 4 is to reduce R's problem of choice of high and low salaries for each type to a choice of incentive-compatible effort levels and utility levels. Without limited

The following two assumptions ensure that there is a solution, $e \in [0, \delta)$, to M's optimization problem.[14]

A6. $\exists \tau > 0$ such that $V'(e) \geqslant \tau$, $V''(e) \geqslant 0$, $\forall e \in [0, \delta]$.
A7. $V(0) = 0$, $V(\delta) = \infty$, for $\delta > 0$.

The final assumption guarantees that R always prefers to invest in the firm than not to invest at all. In particular, this assumption is always satisfied if we choose a large enough y_H.

A8. $\underline{\theta} \cdot p(Z - y_L) \cdot (y_H + K) - K \geqslant Z + \hat{U}$.

The inequality in A8 implies that the expected return when M exerts a zero level of effort must be greater than the sum of the initial budget Z, which can be looked upon as R's reservation utility, and of M's reservation utility.

2.1. *The First-Best*

We now characterize the first-best contracts, or the contracts that would be offered in the case of perfect observability of types and perfect enforceability of effort levels. Let M have productivity θ. Then her expected utility in the second period, given that the firm operates, is given by

$$U_2(\theta, e, I) = (\theta \cdot p(I) + e) \cdot (w_2^H - w_2^L) + w_2^L - V(e), \tag{2.1}$$

where

$w_2^H \equiv$ the salary received when y_H is realized
$w_2^L \equiv$ the salary received when $-y_L$ is realized
$I \equiv$ the cumulative productive investment.[15]

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liability, we can always find contracts that generate the desired levels of utility. With limited liability this may not be possible since, for instance, binding the individual rationality constraint of $\underline{\theta}$ might involve setting $w^L < 0$.

Sappington (1983) shows that when agents have limited liability it may not be possible to implement the first-best outcome with risk-neutral agents even when only moral hazard exists. This is true in our model as well, albeit with the caveat that it is always possible to enforce the optimal effort levels, which depend on salary differentials only, and optimal bailout policies. *The effect of limited liability in our model is to decrease R's expected utility through the payment* of higher wage levels.

[14] An example of disutility function satisfying assumptions A6 and A7 is $V(e) = \delta/(\delta - e)$. For this function, the constant τ in assumption A6 is $\tau = 1/\delta$.

[15] The total quantity of investment I that affects the probability of realizing y_H is *cumulative;* in period 2 it represents the sum of I_1 and any additional productive investment in period 2. We implicitly assume that the effects of investment on the probability of achieving return y_H do not deteriorate over time. For example, investment might be thought of as adding to the firm's capital stock, which influences the probability of realizing high return but does not depreciate.

R's expected utility in period 2, given that the firm operates, is

$$G_2(\theta, e, I) = (\theta \cdot p(I) + e_2) \cdot (y_H - w_2^H) + (1 - (\theta \cdot p(I) + e_2)) \cdot (-K - w_2^L) - I_2, \quad (2.2)$$

where I_2 denotes either productive investment in period 2 or bailout expenditures. Expected profits are defined as expected return minus salaries minus investment.[16] Note that if $I_1 = Z - y_L$, then I_2 always equals y_L: if y_H is realized in period 1, y_L will be used as productive investment in period 2, whereas if losses occur in period 1, y_L will be required for bailout.[17] Cumulative investment in period 2, then, will equal Z; cumulative productive investment in period 2 will equal Z minus any amount used to cover losses from period 1. That is, I equals Z if y_H occurs in period 1 and $Z - y_L$ if $-y_L$ occurs. Note that, if losses occur in period 2, R liquidates the firm at the end of the period in order to cover a portion of the losses and earns $-K$ rather than $-y_L$.

Using expression (2.1) for M's utility, we may rewrite R's expected utility in period 2 as

$$G_2(\theta, e, I) = (\theta \cdot p(I) + e) \cdot (y_H + K) - K - U_2(\theta, e, I) - V(e) - I_2. \quad (2.3)$$

By the concavity of G_2 in e, it is always optimal for R to enforce an effort level e_2 in period 2 such that $V'(e_2) = y_H + K$. Denote by e_2^* this level of effort. The fact that the optimal second-period effort level is independent of the productivity type θ or of the realization of the return is an important simplification in this model. This fact is due to the special form of the probability density, i.e., additive separability in effort.

Second-period contracts must be individually rational. That is, M must be ensured a minimal level of utility of $\underline{U}$. (Recall that the firm continues to exist only if a high return was realized at the first period or if the initial investment was $Z - y_L$.) It is always optimal for R to set $U_2(\cdot) = \underline{U}$.

As stated in A3, R chooses between two investment policies in period 1, Z or $Z - y_L$. If $I_1 = Z$, R commits credibly to liquidating the firm if a bad outcome is realized in period 1; we call such a policy a *no-bailout policy* and we will use the index N to represent it. If $I_1 = Z - y_L$, R commits to bailing out the firm if a bad outcome is realized; we then say that R commits to a *bailout policy* and we use the index B to represent it.

It is optimal for R to bind the individual rationality constraints of each

[16] We do not require that the investment budget be used to cover M's salary; we assume that salaries are paid from a separate fund.

[17] For ease of comparison of the bailout and liquidation policies, we record bailout expenditures of y_L as an investment cost in period 2 rather than as a loss in period 1.

type, i.e., to set $U_B(\theta, e_B(\theta)) = U_N(\theta, e_N(\theta)) = \hat{U}$, where $U_T(\theta, e_T(\theta))$ is the utility of θ given policy T. Moreover, by the convexity of V, it is optimal for R to enforce first-period effort levels $e_B(\theta)$, given bailout, and $e_N(\theta)$, given no bailout, defined by

$$V'(e_T(\theta)) = \Psi_T(\theta), \quad \forall T \in \{B, N\},$$

where $\Psi_B(\theta)$ and $\Psi_N(\theta)$ are given in Appendix B. $\Psi_T(\theta)$ can be interpreted as the intertemporal marginal productivity of effort of type θ facing bailout policy T.

Define

$$G_B(\theta, e) \equiv (\theta \cdot p(Z - y_L) + e) \cdot \Psi_B(\theta) + (\theta \cdot p(Z - y_L) + e_2^*) \cdot (y_H + K) - K - V(e) - V(e_2^*)$$

$$G_N(\theta, e) \equiv (\theta \cdot p(Z) + e) \cdot \Psi_N(\theta) - K - V(e) + U^0.$$

Then the expected utility levels of R corresponding to the optimal efforts and salaries are for bailout and no bailout, respectively, $G_B(\theta, e_B(\theta)) - \hat{U}$ and $G_N(\theta, e_N(\theta)) - \hat{U}$. (See Appendix B for a proof of this claim.) A firm is called a *bailout* firm if $G_B(\theta, e_B(\theta)) - G_N(\theta, e_N(\theta)) > 0$; i.e., if R prefers to commit to bailout. A firm is a *no-bailout* firm if $G_B(\theta, e_B(\theta)) - G_N(\theta, e_N(\theta)) < 0$.

We describe in Appendix B some of the properties of the functions G_T and e_T, $T \in \{B, N\}$, that are relevant for the analysis. Among these properties are: $e_T(\theta)$ is increasing in θ; $e_N(\theta) > e_B(\theta)$; $G_T(\theta, e_T(\theta))$ is a strictly increasing, strictly convex function of θ; and $G_T(\theta, e)$ is a concave function of e. The property that $e_N(\theta) > e_B(\theta)$ implies that a liquidation policy has a disciplinary effect so that a manager of any given productivity θ will exert more effort when faced with the threat of liquidation than when assured of bailout.

The first-best analysis leads to a somewhat surprising proposition. There always exists an environment that satisfies assumptions A1–A8, for which there are types $\underline{\theta}$ and $\overline{\theta}$, with $\underline{\theta} < \overline{\theta}$, such that $\overline{\theta}$ is a bailout firm and $\overline{\theta}$ is a no-bailout firm.

PROPOSITION 2.1. *There exist environments for which the first-best bailout policy is to bail out type $\underline{\theta}$ and to liquidate type $\overline{\theta}$, where $\underline{\theta} < \overline{\theta}$.*

The numerical example presented in Section 5 serves as the proof of Proposition 2.1 and provides some intuition for the result. The intuition derives from the disciplinary effect of bankruptcy. As type θ increases, the magnitude of the disciplinary effect grows in terms of the difference $e_N(\theta) - e_B(\theta)$. That is, $e_N(\theta)$ increases at a faster rate than $e_B(\theta)$.

In fact, we find in our example in Section 5 that the first-best policies are no-bailout for very low values of θ, bailout for an intermediate range of values of θ, and no-bailout for very high values. This fact illustrates the interdependence of the issues of resource allocation and discipline. That the first-best efforts $e_N(\theta) > e_B(\theta)$ for all θ proves that the disciplinary effect always exists. However, the importance of this effect varies and may be overshadowed by the resource-allocation effect, the firm's type. For very low values of θ the resource-allocation effect is so weak that it is worth investing all the funds in period 1 in order to maximize the probability of success. The disciplinary effect of potential liquidation further raises this probability. In the intermediate range of θ, however, the resource-allocation effect dominates the disciplinary effect. The probability of success due to the firm's type is high enough that it is worth holding a reserve to keep the firm in operation if it earns losses. Yet, the disciplinary effect is not strong enough to dominate or to encourage the regulator not to hold a reserve. For very high values of θ the disciplinary effect dominates. It is once again worth taking the risk of holding no reserves because of the increase in effort provided.[18]

Although Proposition 2.1 demonstrates the theoretical possibility that R would prefer to bailout type $\underline{\theta}$ and not to bail out $\bar{\theta}$, we will assume for the remainder of the paper that the first-best policies are to bail out $\bar{\theta}$ and not to bail out $\underline{\theta}$. We therefore make the following assumption:

A9. $\bar{\theta}$ is a bailout firm and $\underline{\theta}$ is a no-bailout firm.

2.2. *The Second-Best: Nature of the Equilibria*

We are interested in the game with imperfect information, where R observes neither M's type nor her effort. The timing of events illustrated in Fig. 1 is as follows. Nature moves first and selects with probability x a firm $\bar{\theta}$ and with probability $(1 - x)$ a firm $\underline{\theta}$, where $\underline{\theta} < \bar{\theta}$.[19] M observes her type, but R does not. At the beginning of period 1 R offers a menu of period-one investment and salary contracts to M of the form $(I_1(\theta), w_1^H(\theta), w_1^L(\theta))$, where $\theta \in \{\underline{\theta}, \bar{\theta}\}$.[20] M selects a contract, thereby announcing a type; she chooses

[18] Bolton and Scharfstein (1993) find a similar type of result in a model of the choice of the structure of debt finance for a firm. The optimal debt structure for firms with very low credit quality is one that involves features that make it very difficult to renegotiate debt upon default. The probability of liquidation upon default is thus high. The same type of debt structure is optimal for firms with very high credit quality. Firms with medium credit quality, however, have optimal debt structures that make renegotiation or bailout easier. Credit quality in the model of Bolton and Scharfstein plays a role that is similar to the θ of our model.

[19] The parameter x may also be interpreted as the proportion of firms in the economy that are of high productivity.

[20] We restrict ourselves to pure strategies; hence, there is no loss of generality in supposing that R offers the choice between only two contracts indexed by θ. As is known, e.g., Laffont and Tirole (1993, p. 388 f.), in the absence of commitment, two-period optimal contracts can

an effort, and return is realized in period 1. At the end of period 1, R either liquidates the firm or allows it to continue in operation. If the return is y_H, the firm will continue to operate only if the liquidation value is less than the expected utility level for R. We will assume that this is the case. If the return is $-y_L$, then the firm can continue in operation only if R has held enough funds in reserve to cover the losses and bail out the firm. If the firm continues in operation, R then offers a menu of second-period contracts to M of the form $(I_2(\theta), w_2^H(\theta), w_2^L(\theta))$, where $\theta \in \{\underline{\theta}, \overline{\theta}\}$. M selects one of these contracts, chooses an effort, and return is realized in period 2. The firm is liquidated at the end of period 2 if return is $-y_L$.

Our concept of equilibrium is perfect Bayesian. Thus, M chooses a contract and an effort level in order to maximize her expected utility at each period, and R chooses contracts and bailout policy optimally, given his beliefs. R's beliefs at the second period must be consistent with Bayes' law. If only adverse selection exists in the model or if only moral hazard exists, then R is able to implement the first-best contract in the game with imperfect information. That is, R can invest efficiently in the first period and induce M to reveal her type or exert the correct effort in the first period without having to offer a rent to her in either period. The proofs of these claims are straightforward.[21] When both adverse selection and moral hazard exist, R is unable to implement the first-best contract. This result is the content of Lemma 3.2, below.

A contract may deviate from first-best in the standard sense of paying a rent to an agent or implementing inefficient efforts; however, a contract may also deviate by implementing bailout policies that are not the first-best policies. We identify conditions under which this latter type of inefficiency occurs. When we refer to efficient investments, we mean the first-period investments or choice of bailout policies that R would have made in the first-best situation. In contrast, when we refer to efficient levels of effort, we mean the effort levels that maximize R's first-period expected utility in the absence of asymmetric information and given a particular bailout policy. Hence, $e_S(\theta)$, $S \in \{B, N\}$

be quite complex; they could involve stochastic pooling, i.e., the two types randomizing over contracts in a menu and selecting the same contract with positive probability. Such contracts necessarily involve inefficiencies in resource allocation. Therefore, if it is optimal, when M is restricted to pure strategies, for R to offer a menu that leads to an inefficient resource allocation, it is also optimal for R, when mixed strategies are allowed, to offer a menu that leads to an inefficient resource allocation.

[21] *The fact that R can implement the first-best contract in the pure adverse-selection version* of our model is due to the limited role of salaries in this model. Terms involving investment appear in M's utility function as a multiple of terms involving salary differentials, $w_H - w_L$. By manipulating the salary differentials, R can ensure that changes in investment levels have no effect on M's level of utility. For example, R sets first-period salaries $w_1^H(\overline{\theta}) - w_1^L(\overline{\theta})$ equal to zero and $w_1^H(\underline{\theta}) - w_1^L(\underline{\theta}) = U^0 - \underline{U}$.

is the efficient level of effort for type θ, given bailout policy S, but S may be an inefficient investment policy for R.

Given that R is unable to implement first-best contracts, there are five types of continuation equilibria to consider when M is restricted to pure strategies, according to the investment decisions associated with each type and whether R induces separation in period 1 or in period 2.[22] We refer to continuation equilibria in which types are revealed in period 1 as *separating* and equilibria in which types are not revealed until period 2 as *pooling*.

We label continuation equilibria by their investment policies in the order of the policies intended for type $\overline{\theta}$, then for type $\underline{\theta}$. For example, the separating-continuation equilibrium BN is the equilibrium with the efficient bailout policies; type $\overline{\theta}$ will be bailed out and type $\underline{\theta}$ will not. The first-best investment contracts are then $I_1(\overline{\theta}) = Z - y_L$ and $I_1(\underline{\theta}) = Z$. The pooling-continuation equilibrium BB is that where both $\overline{\theta}$ and $\underline{\theta}$ are bailed out and types are not revealed in the first period.

In the remainder of the paper, we characterize and compare the continuation equilibria. The assumption of only two productivity types enables us to parametrize our model by the belief x; this parameterization leads to an analytical comparison of continuation equilibria as x varies in $[0, 1]$. Comparison of the continuation equilibria for a given value of x yields the equilibrium of the game.

3. SEPARATING-CONTINUATION EQUILIBRIA

Consider a separating-continuation equilibrium of type ST, where $S \in \{B, N\}$ and $T \in \{B, N\}$. R offers first-period contracts $\{C(\theta) = (I(\theta), w_1^H(\theta), w_1^L(\theta)); \theta \in \{\overline{\theta}, \underline{\theta}\}\}$ in such a way that each type accepts the contract intended for it. $I(\theta)$ corresponds to the bailout policy that R wants to follow for θ. For instance, $I(\overline{\theta}) = Z$ if $S = N$ and $I(\overline{\theta}) = Z - y_L$ if $S = B$.

Because the two types separate in the first period, R has degenerate beliefs at the beginning of the second period; if the contract $C(\theta)$ is chosen, R believes with probability one that the firm's type is θ. Consequently, R will offer second-period contracts that are consistent with full information. There is still a problem of moral hazard in the second period; nevertheless, moral hazard by itself does not generate inefficiencies.

LEMMA 3.1. *In any separating-continuation equilibrium, if the contract $C(\theta)$ was chosen in the first period, R will offer a second period contract*

[22] A continuation equilibrium is an equilibrium that is induced from a given choice of investment policies and first-period payoffs. In his quest for the optimal contract, R will compare his maximum expected utility levels for different investment policies, hence for different continuation equilibria, and choose the policy that yields the highest expected utility.

that induces a first-best level of effort e_2^* from θ and that binds the individual rationality constraint of θ.

If type θ accepts the contract $C(\theta)$, she will have an expected utility equal to

$$U(\theta, e) = (\theta p^{\mathrm{H}} + e)(w^{\mathrm{H}}(\theta) - w^{\mathrm{L}}(\theta) + \underline{U} - U^0) + U^0 + w^{\mathrm{L}}(\theta) - V(e), \quad \text{if } I(\theta) = Z,$$

$$U(\theta, e) = (\theta p^{\mathrm{L}} + e)(w^{\mathrm{H}}(\theta) - w^{\mathrm{L}}(\theta)) + \underline{U} + w^{\mathrm{L}}(\theta) - V(e), \quad \text{if } I(\theta) = Z - y_{\mathrm{L}},$$

and will exert in equilibrium a level of effort $e(\theta)$ that maximizes U.

M can experience first- and second-period gains from misrepresenting her type in the first period. Moreover, even if there are first-period losses from misrepresenting her type, the second-period gains might more than compensate for these short-term losses. Hence, the incentive-compatibility constraints faced by R must take into account the second-period rent that M can earn by misrepresenting her type in the first period. It is straightforward to show that if θ accepts the contract that is designed for $\hat{\theta}$, she will have a second-period expected utility equal to $U + \alpha^i$ if $\theta = \overline{\theta}$ and to $U - \alpha^i$ if $\theta = \underline{\theta}$, where

$$\alpha^i \equiv (\overline{\theta} - \underline{\theta})p^i(y_{\mathrm{H}} + K), \quad i = \mathrm{H, L}. \tag{3.1}$$

Because $\underline{\theta}$ can exit at the end of the first period and ensure herself a level of utility $\underline{U}$, provided the firm has not been liquidated, if she deviates and misrepresents her type in the first period, she will always exit at the end of the first period. If $\overline{\theta}$ misrepresents her type in the first period, she will accept the second-period contract that R designed for $\underline{\theta}$ and obtain a second-period rent equal to α^i.

Let $U(\hat{\theta}\,|\,\theta)$ be θ's expected utility from deviating in the first period and acting optimally thereafter. Incentive compatibility requires that $U(\theta) \geqslant U(\hat{\theta}\,|\,\theta)$, for each θ, $\hat{\theta}$. Therefore, the best continuation-separating equilibrium is given by the following optimization problem for R (the functions $G_S(\overline{\theta}, e)$ and $G_T(\underline{\theta}, e)$ are defined in Appendix B):

$$(P_{ST}) \quad \max_{\{e(\theta), U(\theta)\}} \; x\{G_S(\overline{\theta}, e(\overline{\theta})) - U(\overline{\theta})\} + (1 - x)\{G_T(\underline{\theta}, e(\underline{\theta})) - U(\underline{\theta})\}.$$

$$\text{s.t. } U(\theta) \geqslant U(\hat{\theta}\,|\,\theta), \quad \forall\theta, \forall\hat{\theta} \neq \theta, \tag{IC}$$

$$U(\theta) \geqslant \hat{\mathrm{U}}, \quad \forall\theta. \tag{IR}$$

We will say that the vector $\{e(\overline{\theta}), e(\underline{\theta}), U(\overline{\theta}), U(\underline{\theta})\}$ is *ST*-implementable by a menu of *ST* contracts $\{C(\theta), \theta \in \{\underline{\theta}, \overline{\theta}\}\}$ if (IC) and (IR) hold.

In solving for the separation-continuation equilibrium, we must consider two cases, the first where $e(\underline{\theta})$ is an interior solution and the second where $e(\underline{\theta})$ is a corner solution (at $e(\underline{\theta}) = 0$). A standard result of models with adverse selection is that the incentive-compatibility constraint of $\bar{\theta}$ is binding at the optimum. This result is true here only when $\underline{\theta}$'s choice of effort is an interior solution. When the contracts are designed so that $\underline{\theta}$ exerts a zero level of effort, then neither incentive-compatibility constraint needs to be binding.

We solve for the best separating-continuation equilibrium as follows. We first derive R's expected utility given that he offers contracts that induce an interior solution for the effort of $\underline{\theta}$. We then derive R's expected utility given that he induces a corner solution for $\underline{\theta}$. Finally, we compare R's expected utility in the two cases and choose the case with the higher value. We show that the contracts that R offers will induce $\underline{\theta}$ to choose a positive level of effort, an interior solution, for all values of x up to some critical value x^* and a zero level, a corner solution, for all values of x above x^*.

Consider the case where $e(\underline{\theta})$ is an interior solution. We may express the incentive-compatibility constraints for each type via the double inequality

$$\text{rent}_T(e(\underline{\theta})) \leqslant U(\bar{\theta}) - U(\underline{\theta}) \leqslant (\bar{\theta} - \underline{\theta})p(I(\bar{\theta}))V'(e(\bar{\theta})), \qquad (3.2)$$

where $T \in \{\text{B}, \text{N}\}$, $\text{rent}_\text{N}(e(\underline{\theta}))$, and $\text{rent}_\text{B}(e(\underline{\theta}))$ are defined in Appendix B. The inequality on the left-hand side of (3.2) is the incentive-compatibility constraint for $\bar{\theta}$, whereas the inequality on the right-hand side is the constraint for $\underline{\theta}$. The rent that $\bar{\theta}$ will obtain when the contracts are chosen optimally by R will be exactly equal to the left-hand side of (3.2), or $\text{rent}_T(e(\underline{\theta}))$. Any rent greater than this level would make it more difficult to satisfy $\underline{\theta}$'s incentive-compatibility constraint. In addition, $\underline{\theta}$'s individual rationality constraint must be binding, i.e., $U(\underline{\theta}) = \hat{U}$, otherwise it is possible to lower both utility levels without violating incentive compatibility. We note that the rent that $\bar{\theta}$ obtains is a function of the bailout policy faced by $\underline{\theta}$ and of the effort that $\underline{\theta}$ is induced to take. Some of the properties of the functions $\text{rent}_T(e(\underline{\theta}))$, $T \in \{\text{B}, \text{N}\}$ are summarized in Appendix B.

It follows from (3.2) that for any bailout policies S and T, the first-best effort levels $(e_S(\bar{\theta}), e_T(\underline{\theta}))$ are not ST-implementable. This confirms our earlier claim that the presence of adverse selection and moral hazard leads to outcomes that are not first-best in effort levels.

LEMMA 3.2. *$(e_S(\bar{\theta}), e_T(\underline{\theta}))$ is not ST-implementable for all pairs of bailout policies S, $T \in \{B, N\}$.*[23]

[23] The proof of Lemma 3.2 demonstrates that it is the incentive-compatibility constraint for type $\underline{\theta}$ that prevents R from implementing the first-best efforts for both type $\bar{\theta}$ and type $\underline{\theta}$. In order to remove the incentive for $\underline{\theta}$ to lie about her type then exit the firm at the end of period 1, R must implement a high level of effort for $\bar{\theta}$. In contrast, if the relationship between R and

Proof. See Appendix B.

We may rewrite R's objective function, given that an interior solution for $\underline{\theta}$ is implemented, as

$$G_{ST}(x) \equiv xG_S(\overline{\theta}, e(\overline{\theta})) + (1 - x)G_T(\underline{\theta}, e(\underline{\theta})) - x \cdot \text{rent}_T(e(\underline{\theta})) - U(\underline{\theta}),$$

where $e(\overline{\theta})$ and $e(\underline{\theta})$ must satisfy incentive compatibility. Since the rent that $\overline{\theta}$ receives depends only on the contract faced by $\underline{\theta}$, it is optimal to choose $e(\overline{\theta})$ in order to maximize the function $G_S(\overline{\theta}, e(\overline{\theta}))$. The concavity of G_S implies that the effort for type $\overline{\theta}$ will be either the first-best action $e_S(\overline{\theta})$ or the effort for which both incentive-compatibility conditions bind. The lemma given below summarizes these observations.

LEMMA 3.3. *Let $\phi_{ST}(e(\underline{\theta}))$ be the effort for $\overline{\theta}$ for which both incentive-compatibility conditions bind.*

(i) *The best separating-continuation equilibrium ST in which an interior solution for $\underline{\theta}$ is implemented leads to a level of expected utility for R of*

$$G_{ST}(x) \equiv \text{Max}_{e \in [0, e_T(\overline{\theta})]} x\{G_S(\overline{\theta}, \max[e_S(\overline{\theta}), \phi_{ST}(e)])\} + (1 - x)\{G_T(\underline{\theta}, e)\} - x \cdot \text{rent}_T(e) - \hat{U}.$$

(ii) *$G_{ST}(x)$ is a convex function of x.*

Proof. See Appendix B.

The objective function in part (i) of Lemma 3.3 provides a simple illustration of the tradeoffs that R is facing. The term $\text{rent}_T(e)$ represents the incentive cost that must be paid to $\overline{\theta}$ when $\underline{\theta}$'s choice of effort is an interior solution. It is intuitive that as x, the probability of facing $\overline{\theta}$, increases, R wants to minimize this incentive cost. R can do so by lowering the effort that $\underline{\theta}$ exerts. Eventually, as x approaches 1, R will have $\underline{\theta}$ exert a zero effort level.

One would expect that if $\underline{\theta}$ takes a zero effort level, $\overline{\theta}$ should not obtain a positive rent. Indeed, this outcome can be achieved by considering the case in which $\underline{\theta}$'s effort is a corner solution and by defining the wages appropriately.

LEMMA 3.4. *If R wants to implement $e(\underline{\theta}) = 0$, then it is optimal to choose first-period contracts that implement the first-best effort $e_S(\overline{\theta})$ for $\overline{\theta}$ and in*

M is governed by the principle of fairness, as defined in Baron and Besanko (1987), then the possibility of lying about her type and exiting the firm is unavailable to M. As a consequence, first-best efforts are implementable when fairness prevails.

which both types receive their reservation utilities $\hat{U}$. In this case R's expected utility is given by the function

$$W_{ST}(x) = xG_S(\overline{\theta}, e_S(\overline{\theta})) + (1 - x)G_T(\underline{\theta}, 0) - \hat{U}.$$

Proof. Immediate.

We show in Proposition 3.1, below, that there is no loss of generality in choosing optimal effort levels for $\underline{\theta}$ that are a decreasing function of x. This result is intuitive enough; as the probability of facing the type $\overline{\theta}$ increases, it becomes optimal to reduce the effort that $\underline{\theta}$ exerts in order to reduce the rent that needs to be paid to $\overline{\theta}$ and to lower the bound $\phi_{ST}(e(\underline{\theta}))$ that will make $\overline{\theta}$'s effort incentive-compatible. The lower the bound ϕ_{ST} is, the easier it is to achieve the maximum value $G_S(\overline{\theta}, e_S(\overline{\theta}))$.

PROPOSITION 3.1. (i) There exists $x_{ST} \in (0,1)$ *such that* $e(\underline{\theta}) > 0$ *if* $x \leq x_{ST}$ *and* $e(\underline{\theta}) = 0$ *if* $x \geq x_{ST}$. *R's expected utility equals* $G_{ST}(x)$ *if* $x \leq x_{ST}$ *and* $W_{ST}(x)$ *if* $x \geq x_{ST}$.

(ii) *The equilibrium effort level of* $\underline{\theta}$ *is a decreasing function of* x.

Proof. See Appendix B.

The tradeoff between incentives and efficiency of resource allocation in our model does not guarantee that the bankruptcy rule will induce either the high- or the low-profitability manager to exert the efficient level of effort. Proposition 3.1 shows that in a separating equilibrium a range of beliefs exists about the manager's type ($x < x_{ST}$), over which neither the high- nor the low-profitability manager exerts a first-best level of effort, even though it is feasible to implement the efficient effort for one of the types. Moreover, in this range of beliefs, the low-profitability type exerts less than the efficient level of effort whereas the high-profitability type may exert greater than the efficient level. Incentive-compatibility constraints for both high and low profitability types are binding over this range.

This result has implications for wage spreads. M's effort is determined by the difference in her payoff when the firm earns profits relative to her payoff when the firm earns losses. For $x < x_{ST}$ the high-profitability manager earns a greater payoff in the good state of the world relative to the bad state than she would earn in the first-best situation.

4. POOLING-CONTINUATION EQUILIBRIA

If a single contract is offered in the first period and if both types are expected to accept the contract, R does not gain any information about M's type when M accepts the contract. R will, however, gain some information by observing the level of output at the end of the first period because the probability distribution over output levels is a function of the effort level that M exerts in the first period. Let I be the first period investment and suppose that type θ is expected to exert a level of effort $e(\theta)$. When y_H is realized, the probability that M's type is $\bar{\theta}$ is given by the function $q^H(\cdot)$,

$$q^H(e(\bar{\theta}), e(\underline{\theta}), x, I) = \frac{x\cdot(\bar{\theta}\cdot p(I) + e(\bar{\theta}))}{x\cdot(\bar{\theta}\cdot p(I) + e(\bar{\theta})) + (1-x)\cdot(\underline{\theta}\cdot p(I) + e(\underline{\theta}))}, \quad (4.1)$$

and when $-y_L$ is realized, this probability is given by the function $q^L(\cdot)$,[24]

$$q^L(e(\bar{\theta}), e(\underline{\theta}), x, I) = \frac{x\cdot(1 - \bar{\theta}\cdot p(I) - e(\bar{\theta}))}{x\cdot(1 - \bar{\theta}\cdot p(I) - e(\bar{\theta})) + (1-x)\cdot(1 - \underline{\theta}\cdot p(I) - e(\underline{\theta}))}. \quad (4.2)$$

For any realization of the output, the second-period problem is equivalent to a static contracting problem in which the distribution of types is given by $(q, 1-q)$, where q is obtained by (4.1) or (4.2). We observe that when $x \in (0,1)$, $q \in (0,1)$. Hence, we invoke the revelation principle and consider second-period contracts in which the two types separate.

The optimal second-period contract in a pooling-continuation equilibrium bears a number of similarities to the first-period contract in a separating-continuation equilibrium. First, there is a critical value of q, labeled q^{*i}, $i = H, L$, such that $\underline{\theta}$'s effort will be zero for all values of q greater than the critical value and positive for all values of q less than q^{*i}. When $q \geq q^{*i}$, R sets salaries such that each type earns its reservation utility; therefore, $\bar{\theta}$ earns no rent. Finally, the second-period effort of type $\underline{\theta}$ is a decreasing function of q. Lemma C.1 in Appendix C formally states these properties.

The second-period rent in the pooling continuation equilibrium is related to the second-period rent that $\bar{\theta}$ gets in a separating-continuation equilibrium. In the separating-continuation equilibrium, the incentive problem arises in the first period, whereas in the pooling-continuation equilibrium, the incentive problem arises in the second period. Because $\underline{\theta}$'s effort satisfies $e_2^i(q) \leq e_2^* = e_2^i(0))$, it is always true that the second-period rent is lower with pooling than with separation. This result illustrates the tradeoffs that R faces when choosing separation versus pooling in the first period. Separation is more costly than pooling from an incentive point of view; however, separation

[24] The comparative statics properties of the functions q^i are given in Appendix C.

allows more degrees of freedom in the choice of effort levels and bailout policies.[25]

In the first period of the pooling-continuation equilibrium, R offers the best single contract, given that the second-period optimal contract is characterized by Lemma C.1. The second-period contract is a function of the posterior q, which is itself a function of the first-period effort levels and hence of the first-period contract. Let (I, w^H, w^L) be the first-period contract. Suppose that R expects θ to exert an effort $e(\theta)$. Then, upon accepting this contract, type θ's expected utility of exerting effort e is

$$U(\theta, e) = (\theta p(I) + e)A_\theta + B_\theta - V(e), \tag{4.3}$$

where A_θ and B_θ are functions parameterized by I and are dependent on θ, the anticipated effort levels $(e(\overline{\theta}), e(\underline{\theta}))$, and the prior belief x. These functions are given in Appendix C. A_θ incorporates the second-period utility levels, which depend on the beliefs of R in the second period. When θ changes her effort level, she takes the coefficients A_θ and B_θ as given because R cannot obtain information about effort. Hence, R's second-period beliefs depend on the anticipated effort levels and the outcome of the first-period production but not on the actual effort levels. Obviously, in equilibrium, the anticipated effort levels must equal the realized effort levels.

If there is no solution to the equation $V'(e) = A_{\underline{\theta}}$, then $e(\underline{\theta}) = 0$. It is immediate that, for any bailout policy $S \in \{B, N\}$, whenever $\underline{\theta}$ exerts a zero effort, R's expected utility in the pooling-continuation equilibrium is inferior to $W_{SS}(x)$, the level that R can obtain in a SS separating continuation equilibrium with $e(\underline{\theta}) = 0$. Any pooling-continuation equilibrium in which $\underline{\theta}$ exerts a zero level of effort is therefore dominated by a separating-continuation equilibrium; hence the overall equilibrium will not involve pooling and zero level of effort for $\underline{\theta}$. For this reason, we restrict ourselves to effort levels that solve $V'(e(\underline{\theta})) = A_{\underline{\theta}}$ and characterize the continuation-pooling equilibria under this restriction. Because of the restriction that we impose, we will call the outcome a *truncated* pooling-continuation equilibrium.

Given that $\underline{\theta}$ exerts an effort level that solves $V'(e(\underline{\theta})) = A_{\underline{\theta}}$, it follows that $\overline{\theta}$ will exert a level of effort such that

$$V'(e(\overline{\theta})) - V'(e(\underline{\theta})) = A_{\overline{\theta}} - A_{\underline{\theta}}. \tag{ICP}$$

A pair of effort levels is implementable by a pooling equilibrium if (ICP) holds. It is possible to show that when $I = Z$, (ICP) implies that $e(\overline{\theta}) \geqslant e(\underline{\theta})$; however, when $I = Z - y_L$, it is possible that $e(\overline{\theta}) < e(\underline{\theta})$. In particular, $e(\overline{\theta})$

[25] Obviously, if R discounts the second-period profit, then separation in the first period becomes more attractive than it would be if discounting did not occur.

$= 0$ is a theoretical possibility. We show in Lemma C.2 in Appendix C that, for given prior beliefs x, investment I, and effort of $\underline{\theta}$, there exists a unique effort for $\overline{\theta}$ that satisfies (ICP).

We can identify the rent that $\overline{\theta}$ receives in a truncated pooling-continuation equilibrium by calculating the difference of the expected utility levels of $\overline{\theta}$ and $\underline{\theta}$ when $\underline{\theta}$ exerts action e and $\overline{\theta}$ exerts the level of effort $\phi_S^p(e, x)$ that just satisfies (ICP). Define

$$\text{rent}_S^p(e, x) \equiv U(\overline{\theta}, \phi_S^p(e, x)) - U(\underline{\theta}, e).^{26}$$

Regardless of whether $\overline{\theta}$ exerts a greater effort than $\underline{\theta}$, $\text{rent}_S^p(e, x)$ is positive,[27] hence, we can interpret $\text{rent}_S^p(e, x)$ as the rent that $\overline{\theta}$ receives above $\hat{U}$ in the continuation equilibrium. We observe that rent_S^p is a function of x here.

Using the previous results, we can express R's optimization problem as a function of the effort of $\underline{\theta}$ and of x only. There are two aspects of the truncated pooling-continuation equilibrium worth noting. First, once the effort of $\underline{\theta}$ is given, the effort of $\overline{\theta}$ is uniquely determined by (ICP). Second, $\underline{\theta}$ will, in general, exert an inefficient effort level in the second period. $\underline{\theta}$'s individual rationality constraint will be binding in equilibrium, while $\overline{\theta}$ will get a positive rent. It follows that for incentive-compatible effort levels the expected utility to R of having $\overline{\theta}$ accept the contract is $G_S(\overline{\theta}, \phi_S^p(e, x)) - \hat{U} - \text{rent}_S^p(e, x)$, and the expected utility of R of having $\underline{\theta}$ accepting the first period contract is given by $G_S^p(e, x) - \hat{U}$, where $G_S(\overline{\theta}, \cdot)$ and $G_S^p(e, x)$ are defined in Appendix C.

We can now characterize the truncated pooling-continuation equilibria.

Proposition 4.1. *There exists $\bar{e} \in [0, \delta)$ such that for each $S = B, N$ and each $x \in [0,1]$, R's expected utility in a truncated pooling-continuation equilibrium is equal to*

$$\text{Pool}_S(x) = \max_{e \in [0, \bar{e}]} xG_S(\overline{\theta}, \phi_S^p(e, x)) + (1 - x)G_S^p(\underline{\theta}, e, x) - x \cdot \text{rent}_S^p(e, x) - \hat{U}.$$

Proof. The form of the objective function follows our previous discussion. Continuity of $\phi_S^p(e, x)$ in e implies the continuity of the objective function in e. We observe that the values of the functions G_S and G_S^p tend to $-\infty$ as e goes to δ; therefore, an interior solution exists.

5. EQUILIBRIA OF THE GAME: RESULTS AND AN EXAMPLE

Having characterized separating-continuation and pooling-continuation equilibria for all beliefs x, we may identify the equilibrium of the game for

[26] Observe that we can write rent_S^p as a function of e and ignore the salaries w', since $V'(e) = A_\theta$.

[27] See Lemma C.3 in Appendix C.

any x by choosing the separating or the pooling-continuation equilibrium which yields the highest expected utility for R. We find that the equilibrium may involve either inefficiencies of resource allocation, i.e., an inefficient bailout policy, or inefficient efforts for both types $\overline{\theta}$ and type $\underline{\theta}$. We demonstrate these results by first presenting propositions describing the equilibria for low and high values of x and then presenting a numerical example in which we compute the equilibrium for each value of x. Both the general propositions and the numerical simulation illustrate the inefficiencies that may arise in the equilibrium.

Simple intuition would suggest that when R's beliefs are not diffuse, i.e., when x is close to 0 or to 1, inefficient bankruptcy policies should not be observed. However, this intuition is not entirely correct. As x approaches the boundary of [0, 1], that is, as R becomes more certain of the type that he is actually facing, then the expected payoff to R does indeed approach the first-best level. Locally, the moral-hazard problem is more severe than the revelation problem, and deviations from the first-best policy for the most likely type generate first-order losses but only second-order benefits. While the policy for the type that is very likely will be first-best, it may be optimal for R to implement bailout policies that are not first-best for the other type. Propositions 5.1 and 5.2, below, provide conditions for which bailout policies that are not first-best arise in equilibrium for high and for low values of x.

PROPOSITION 5.1. *There exists an* $x^+ < 1$ *such that for each* $x \in [x^+, 1]$

(i) *the equilibrium will be either a separating equilibrium of type BB or a separating equilibrium of type BN, and*

(ii) *the equilibrium will be separating of type BN if and only if* $G_N(\underline{\theta}, 0) > G_B(\underline{\theta}, 0)$.

Proof. See Appendix C.

When R faces type $\overline{\theta}$ with near certainty, he will choose the efficient bailout policy for $\overline{\theta}$ but may choose an inefficient bailout policy for $\underline{\theta}$. Hence, a bailout policy, rather than a no-bailout policy, may be chosen for $\underline{\theta}$. Although bailing out a firm that should be liquidated in the first-best resembles the regulatory behavior that prevailed under soft budget constraints, the intuition underlying the behavior here is quite different. Recall that in any separating equilibrium the effort of type $\underline{\theta}$ is zero for x close to 1. This is so that R does not have to pay a rent to $\overline{\theta}$. In this range of x, then, the type of bankruptcy policy chosen, bailout or liquidation, has no incentive effect on the manager $\underline{\theta}$. The policy that R will choose depends on the relative values of $G_N(\underline{\theta}, 0)$ and $G_B(\underline{\theta}, 0)$. Note that since the first-best policy was defined assuming that the manager exerts the first-best effort level, it is possible that $G_B(\underline{\theta}, 0) > G_N(\underline{\theta}, 0)$ even though $G_B(\underline{\theta}, e_B(\underline{\theta})) < G_N(\underline{\theta}, e_N(\underline{\theta}))$, where $e_T(\underline{\theta})$, $T \in \{B, N\}$ represents the first-best effort for $\underline{\theta}$.

When R faces type $\underline{\theta}$ with certainty, the equilibrium will involve choosing the efficient bailout policy for $\underline{\theta}$. The equilibrium for values of x in the neighborhood of 0 will thus be one in which the no-bailout policy is applied to $\underline{\theta}$. The questions in this case are which policy will be applied to $\overline{\theta}$, bailout or no bailout, and whether the equilibrium will involve pooling or separation. It is possible to show that pooling NN dominates separating NN for an x in the neighborhood of zero. The reason for this is that R is able to implement close to the first-best effort for $\underline{\theta}$ in a pooling NN continuation equilibrium but not in a separating NN. Given, however, that N is not the efficient bailout policy for $\overline{\theta}$, the relevant question is whether R can raise his utility by applying a policy of bailout to $\overline{\theta}$, even though he induces something other than the first-best effort level $e_B(\overline{\theta})$ in that case. For x close to 0, it is optimal for $\underline{\theta}$ to exert the first-best effort level $e_N(\underline{\theta})$; by incentive compatibility, in a pooling-continuation equilibrium NN, $\overline{\theta}$ will exert effort $e_N(\overline{\theta})$ and in a separating equilibrium BN, $\overline{\theta}$ will exert an effort $\phi_{BN}(e_N(\underline{\theta})) > e_B(\overline{\theta})$. Therefore, the optimal policy for type $\overline{\theta}$ when x is close to 0 is to have a policy of bailout if, and only if, $\phi_{BN}(e_N(\underline{\theta}))$ is less than a trigger value.

PROPOSITION 5.2. *There exists an $x^- > 0$ such that for all $x \in [0, x^-]$*
(i) *the equilibrium will be either pooling equilibrium NN or separating equilibrium BN, and*
(ii) *the equilibrium will be separating of type BN if and only if $G_B(\overline{\theta}, \phi_{BN}(e_N(\underline{\theta}))) > G_N(\overline{\theta}, e_N(\overline{\theta}))$.*

Proof. See Appendix C.

Propositions 5.1 and 5.2 characterize the equilibria for extreme values of x. They imply that for high and low values of x, the bailout policy may not be first-best; however, the type for which the bailout policy is not first-best is that with the lower probability of appearing. These results suggest that the inefficient bailout policy, if it is applied, may be applied to type $\overline{\theta}$ up to some critical value of x, beyond which there is a switch to another equilibrium in which the inefficient bailout policy, if it is chosen, applies to type $\underline{\theta}$. We present below an example for which the equilibria indeed exhibit this property; there exists a critical value x^* such that the first-best bailout policy is chosen for $\underline{\theta}$ for $x < x^*$, and the first-best policy is chosen for $\overline{\theta}$ if and only if $x \geq x^*$. Moreover, for each $x \in [0, 1]$, the equilibrium involves identical bailout policies for each type.

EXAMPLE. The numerical example that we have solved involves the following parameter values and functional form: $V(e) = \delta/(\delta - e)$, $e \in [0, \delta)$; $\delta = 0.28$; $y_H = 20$; $K = 0$; $p^L = 0.26$; $p^H = 0.35$; $U^0 = 3$; $\hat{U} = 4$; $\underline{U} \in (3, 4)$, $\underline{\theta} = 0.4$, $\overline{\theta} = 0.8$.

The first result of the numerical analysis is that stated in Proposition 2.1; there exist parameter values such that for types $\overline{\theta}$ and $\underline{\theta}$, with $\overline{\theta} > \underline{\theta}$, the efficient bailout policies are no-bailout for $\overline{\theta}$ and bailout for $\underline{\theta}$. In fact, if we examine the function $G_B(\theta, e_B(\theta)) - G_N(\theta, e_N(\theta))$, which determines whether the first-best policy is bailout or no-bailout for a given θ, we find that in our example it is strictly concave, negative for small and large values of θ and positive for intermediate values of θ. The first-best policies in our example are thus no-bailout for small values of θ, bailout for an intermediate range of θ, then no bailout for large values of θ. If, for instance, $\theta^1 = 1.3$ and $\theta^0 = 0.7$, then the first-best bailout policies are bailout for θ^0 and no-bailout for θ^1. This result proves Proposition 2.1.

We now state the main results of the numerical analysis.

Result. Let $x^* = 0.645$. For $x \leqslant x^*$, the equilibrium is pooling *NN*. For $x \geqslant x^*$, the equilibrium is separating *BB*, where type $\underline{\theta}$ exerts a zero level of effort.

For $x > x^*$, the equilibrium value of R's utility is W_{BB}, defined in Lemma 3.5, and involves the low type exerting a zero level of effort. For values of x away from the boundaries of [0, 1], the only values for which the equilibrium involves separation are those in which R's utility is given by $W_{BB}(x)$. The numerical analysis shows that the pooling-continuation equilibrium *NN* dominates the pooling-continuation equilibrium *BB*. Therefore, equilibria that are not separating equilibria are pooling *NN*.

6. CONCLUSION

We ask whether a bankruptcy policy achieves the goals intended for bankruptcy, namely an efficient allocation of resources and efficient managerial effort in a postsocialist economy in the early stages of transition. We identify the inefficiencies that may arise in both the type of bailout policy applied to the firm (resource allocation) and the managerial effort that is induced. The inefficiencies in the bailout policy that arise in our model are not due to the standard problem of soft budget constraints; rather, they correspond to an explicit desire of the planner to provide incentives to managers.

We find that the optimal bailout policy may always involve inefficient resource allocation, meaning that a firm may be bailed out that should have been liquidated or a firm may be liquidated that should have been bailed out. A regulator who believes that with high probability he faces one of the types, however, always applies the inefficient bailout policy only to the other type of firm if an inefficient policy is applied. For example, if the regulator is optimistic that he faces a high profitability firm, then he will choose the efficient bailout policy for that firm but may well apply an inefficient bailout policy to the low profitability firm.

While it is well known that models with information asymmetries result in inefficiencies, it is not clear in the context of our model what should be the expected effect of the information asymmetry on the bailout policy applied to a firm. The result that the inefficient bailout policy is applied only to the type of firm which is less likely to appear is not an obvious one, since the choice of a policy for one type affects in a nontrivial way the incentive problem for the other type and the rent that must be paid. Indeed, it may actually appear surprising that the outcome exhibits this property.

A natural question to ask is how much a model of regulatory design of a firm-specific bankruptcy rule can say about bankruptcy in general in the economies in transition. We believe that the model is indeed relevant to these economies. First, bankruptcy laws have not been passed in most of these economies until at least one or two years into the transition. Firms' fates have been left, directly or indirectly, in regulators' hands. Second, even when bankruptcy laws are drafted, their implementation may be postponed. For example, Czechoslovakia passed a bankruptcy law in October 1991, yet the law was not implemented until April 1993. Finally, even when bankruptcy laws are being implemented, many of the more important firms still receive individual regulatory attention.

Furthermore, one would expect that if it is possible to achieve the goals intended for bankruptcy, it would be easier to achieve them when bankruptcy rules are firm-specific. That is, inefficiencies that we find with firm-specific bankruptcy rules will exist to an even greater extent with bankruptcy laws. Because bankruptcy laws consist of identical rules that apply to all firms, they automatically embody either the risk that firms that should be liquidated are bailed out or the risk that firms that should be bailed out are liquidated. For example, a bankruptcy law without a reorganization phase, or with strict rules governing the reorganization phase, creates the risk that firms that should be bailed out are liquidated. On the other hand, a bankruptcy law with a lenient reorganization phase (such as Chapter 11 of the U.S. bankruptcy code) creates the risk that firms that should be liquidated are not. We find that even when the regulator can tailor the policy, bailout or no bailout, to the individual firm, thereby avoiding the problem of a law that is too strict or too lenient with respect to that firm's type, inefficiencies still exist. At the same time, our results indicate that when the probability is high that firms in an economy are of a particular type, a law that implements for all firms the first-best resource allocation policy for the predominant type may be consistent with the optimal firm-specific policy.

A crucial feature of the model is the ability of the regulator to commit to a fixed budget. As we have argued, governments in the economies in transition are increasingly recognizing the need to make such a commitment, and third parties like the IMF or the World Bank have likely played a role in reinforcing the commitment through their emphasis on strict monetary and fiscal policies.

If more than one firm were controlled by the regulator, then cross-subsidization would be possible and the ability to commit to liquidation would be weakened. The effect of cross subsidization would be to lower the probability of liquidation to a positive value less than one whenever the regulator does not hold a reserve for a given firm. The fixed budget, however, would still allow the regulator to commit to some positive probability of liquidation. Indeed, one can think of a continuum of commitment probabilities ranging from one when the regulator faces only one firm to zero when there is an infinite number of firms. We choose the extreme version both for analytical ease and to contrast with regulators' previous complete inability to commit to liquidation. The tradeoffs that we examine would still exist for any intermediate probability of liquidation generated by considering lending to more than one firm. Furthermore, cross-subsidization would give rise to both costs and benefits; the cost would be to worsen the incentive problem, but the benefit would be to allow the regulator to keep some firms in operation for which it is optimal to do so but which would have been liquidated in the absence of cross-subsidization. This suggests that the optimal span of regulatory control should be part of the social optimization problem. While the question of optimal span of control is interesting, it is beyond the scope of this paper.[28]

APPENDIX A: NOMENCLATURE

y_H	High realization of return.
$-y_L$	Low realization of return.
$p(I)$	Probability of achieving y_H, given productive investment I.
e	Managerial effort.
θ	M's productivity type.
x	Probability that M's type is $\overline{\theta}$.
Z	Size of R's investment budget.
L	Liquidation value of firm.
$K \equiv y_L - L$	Net liquidation value of firm if low return.
δ	Maximum possible effort e.
$V(\cdot)$	Disutility of effort.

[28] The tradeoff between weakened incentives and efficient liquidation is analyzed to some extent in Schmidt and Schnitzer (1993). While Schmidt and Schnitzer do not discuss it, the span of regulatory control, i.e., the number n of firms subject to the control of the given agency, could be optimally determined in their model.

$U(\cdot)$	M's utility.
w_i^k	Salary offered in period i if firm's return is y_k.
$G_B(\theta, e)$	R's expected payoff gross of M's utility level with a policy of bailout when type θ exerts effort e.
$G_N(\theta, e)$	R's expected payoff gross of M's utility level with a policy of no-bailout when type θ exerts effort e.
$e_B(\theta)$, $e_N(\theta)$	First-best effort of type θ, given policies of bailout and no-bailout, respectively.
Ψ_B, Ψ_N	Marginal revenue functions (per unit of effort), given policies of bailout and no-bailout, respectively.
$p^H \equiv p(Z)$	Probability of achieving y_H in period 2, given a realization of y_H in period 1.
$p^L \equiv p(Z - y_L)$	Probability of achieving y_H in period 2, given a realization of y_L in period 1.
$d_B(e)$, $d_N(e)$	First-period effort that type $\overline{\theta}$ will exert in a separating-continuation equilibrium if she deviates and chooses the contract intended for $\underline{\theta}$, given policies of bailout and no bailout, respectively.
$\phi_{ST}(e)$	The effort of $\overline{\theta}$ that satisfies both incentive-compatibility constraints with equality in a separating-continuation equilibrium ST.
$\text{rent}_T(e)$	The rent that $\overline{\theta}$ earns in a separating-continuation equilibrium, given a bailout policy T applied to $\underline{\theta}$ and given an effort of e by $\underline{\theta}$.
α^i	The second-period gain in utility to $\overline{\theta}$ in a separating-continuation equilibrium when she misrepresents her type.
q	Posterior probability (in a pooling continuation equilibrium) that M is of type $\overline{\theta}$.
$e_2^H(q)$, $e_2^L(q)$	Second-period effort of type $\underline{\theta}$ in a pooling continuation equilibrium, given realization of y^H and y^L, respectively.
$q^H(\cdot)$, $q^L(\cdot)$	Posterior probability that M is of type $\overline{\theta}$, given realization of y^H and y^L, respectively, and given the first-period effort levels.
q^{*i}	Critical value of q such that $\underline{\theta}$'s second-period effort is positive for $q < q^{*i}$ and zero for $q \geqslant q^{*i}$.
$\phi_S^p(e, x)$	First-period effort of $\overline{\theta}$ that satisfies the incentive-compatibility constraint with equality in a pooling-continuation equilibrium SS, given effort e of type $\underline{\theta}$.
$\text{rent}_S^p(e, x)$	Rent that $\overline{\theta}$ receives in a pooling-continuation equilibrium SS.

$G^{p}_{S}(e, x)$ R's expected payoff from facing $\underline{\theta}$, gross of utility that $\underline{\theta}$ will receive, in a pooling-continuation equilibrium SS, given first-period effort e by $\underline{\theta}$.

$\Psi^{p}_{S}(e, x)$ Marginal revenue function (per unit of effort of type $\underline{\theta}$) in a pooling-continuation equilibrium SS.

APPENDIX B[29]

Derivation of R's Expected Utility

The expected utility levels of R at the beginning of period 1 under the investment policies for bailout may be expressed as[30]

$$H_B(\theta, e) = (\theta \cdot p(Z - y_L) + e) \cdot [y_H - w_1^H + (\theta \cdot p(Z) + e_2^*) \cdot (y_H + K) - K - \underline{U} - V(e_2^*)] + (1 - \theta \cdot p(Z - y_L) - e) \cdot [-w_1^L + (\theta \cdot p(Z - y_L) + e_2^*) \cdot (y_H + K) - K - \underline{U} - V(e_2^*)] + Z - (Z - y_L) - y_L,$$

or, after rearranging,

$$H_B(\theta, e) = G_B(\theta, e) - U_B(\theta, e),$$

where

$$G_B(\theta, e) = (\theta \cdot p(Z - y_L) + e) \cdot \Psi_B(\theta) + (\theta \cdot p(Z - y_L) + e_2^*) \times (y_H + K) - K - V(e) - V(e_2^*),$$

$$\Psi_B(\theta) \equiv y_H + \theta \cdot (p(Z) - p(Z - y_L)) \cdot (y_H + K),$$

$$U_B(\theta, e) = (\theta \cdot p(Z - y_L) + e) \cdot (w_1^H - w_1^L) + w_1^L + \underline{U} - V(e).$$

Similar computations lead to

$$H_N(\theta, e) = G_N(\theta, e) - U_N(\theta, e),$$

[29] Some results in this Appendix are stated without proofs. The proofs appear in our working paper and are available upon request.

[30] R's expected utility is written in the following form: expected (2-period) revenues minus salaries, given that positive profit is earned in period 1 plus expected revenues minus salaries, given that a loss is incurred in period 1 plus Z minus investment costs. We implicitly assume that the opportunity cost of holding Z is zero; R derives utility from any reserve $Z - I_1 - I_2$ that is not used for investment during the firm's lifetime. As is evident from our assumptions, however, total investment in periods 1 and 2 just exhausts Z.

where

$$G_N(\theta, e) \equiv (\theta \cdot p(Z) + e) \cdot \Psi_N(\theta) - K - V(e) + U^0,$$

$$\Psi_N(\theta) \equiv y_H + (\theta \cdot p(Z) + e_2^*) \cdot (y_H + K) - V(e_2^*) - U^0,$$

$$U_N(\theta, e) = (\theta \cdot p(Z) + e) \cdot (w_1^H - w_1^L) + w_1^L + U^0 - V(e).$$

Properties of the Functions $G_T(\cdot)$ and $e_T(\cdot)$

(i) $\forall T \in \{B, N\}$, $\forall \theta \in \Theta$, $(de_T(\theta)/d\theta) > 0$.

(ii) $\forall T \in \{B, N\}$, $G_T(\theta, e_T(\theta))$ is a strictly increasing, strictly convex function of θ.

(iii) $\forall T \in \{B, N\}$, $\forall \theta \in \Theta$, $G_T(\theta, e)$ is a concave function of e.

(iv) $\forall \theta \in \Theta$, $e_N(\theta) > e_B(\theta)$.

(v) If $U^0 \leq e_2^* \cdot (y_H + K) - V(e_2^*)$, then $G_B(0, e_B(0)) - G_N(0, e_N(0)) > 0$.

Proof. Available upon request.

Derivation of Eq. (3.2)

Let $U(\theta, e)$ denote the first-period expected utility of type θ when she accepts contract $C(\theta)$. Suppose that the bailout policies for $\overline{\theta}$ and $\underline{\theta}$ are S and T, respectively. Then,

$$U(\theta, e) = (\theta p(I(\theta)) + e)A(\theta) + B(\theta) - V(e),$$

where, if $I(\theta) = Z$,

$$A(\theta) = w^H(\theta) - w^L(\theta) + \underline{U} - U^0,$$

$$B(\theta) = U^0 + w^L(\theta),$$

and, if $I = Z - y_L$,

$$A(\theta) = w^H(\theta) - w^L(\theta),$$

$$B(\theta) = \underline{U} + w^L(\theta).$$

Let $e(\theta)$ maximize $U(\theta, e)$ and let $U(\theta) \equiv U(\theta, e(\theta))$. We suppose that $A(\underline{\theta})$ is such that $V'(e(\underline{\theta})) = A(\underline{\theta})$.

Let $U(\hat{\theta} | \theta)$ denote the maximum expected utility that θ can attain when she chooses the contract $C(\hat{\theta})$ in the first period and when R and θ act optimally thereafter. The observations in the text concerning the second-period contracts lead to the expressions

$$U(\underline{\theta}|\bar{\theta}) = \text{Max}_e\{(\bar{\theta}p(I(\underline{\theta})) + e)(A(\underline{\theta}) + \Delta\alpha) + \text{B}(\underline{\theta}) - V(e)\},$$

$$U(\bar{\theta}|\underline{\theta}) = \text{Max}_e\{(\underline{\theta}p(I(\bar{\theta})) + e)A(\bar{\theta}) + B(\bar{\theta}) - V(e)\},$$

where $\Delta\alpha \equiv \alpha^{\text{H}}$ if $I(\underline{\theta}) = Z$ and $\Delta\alpha \equiv \alpha^{\text{H}} - \alpha^{\text{L}}$ if $I(\underline{\theta}) = Z - y_{\text{L}}$. Note that $\Delta\alpha > 0$. Let $d_S(e(\bar{\theta}))$ denote the effort level of $\underline{\theta}$ when in the first period $\underline{\theta}$ selects the contract $C(\bar{\theta})$ and acts optimally thereafter, i.e., the effort for which $U(\bar{\theta}|\underline{\theta})$ is attained (an analogous definition holds for $d_T(e(\underline{\theta}))$).

It is immediate that $d_S(e(\bar{\theta})) = e(\bar{\theta})$, and that $d_T(e(\underline{\theta}))$ is such that $V'(d_T(e(\underline{\theta}))) = V'(e(\underline{\theta})) + \Delta\alpha$. After simple substitutions and algebraic manipulations, we obtain

$$U(\bar{\theta}|\underline{\theta}) = U(\bar{\theta}) + (\underline{\theta} - \bar{\theta})p(I(\bar{\theta}))V'(e(\bar{\theta}))$$

$$U(\underline{\theta}|\bar{\theta}) = U(\underline{\theta}) + \text{rent}_T(e(\underline{\theta})),$$

where $\text{rent}_T(e(\underline{\theta}))$ is defined as

$$\text{rent}_{\text{N}}(e(\underline{\theta})) \equiv (\bar{\theta}p^{\text{H}} + e(\underline{\theta}))\alpha^{\text{H}} + (\bar{\theta} - \underline{\theta})p^{\text{H}} \cdot V'(e(\underline{\theta})) + V(e(\underline{\theta})) - V(d_{\text{N}}(e(\underline{\theta}))) + [d_{\text{N}}(e(\underline{\theta})) - e(\underline{\theta})] \cdot V'(d_{\text{N}}(e(\underline{\theta})))$$

$$\text{rent}_{\text{B}}(e(\underline{\theta})) \equiv (\bar{\theta}p^{\text{L}} + e(\underline{\theta})) \cdot (\alpha^{\text{H}} - \alpha^{\text{L}}) + (\bar{\theta} - \underline{\theta})p^{\text{L}}V'(e(\underline{\theta})) + V(e(\underline{\theta})) - V(d_{\text{B}}(e(\underline{\theta}))) + [d_{\text{B}}(e(\underline{\theta}))) - e(\underline{\theta})] \cdot V'(d_{\text{B}}(e(\underline{\theta}))) + \alpha^{\text{L}}.$$

Incentive compatibility implies that $U(\bar{\theta}) \geqslant U(\underline{\theta}) + \text{rent}_T(e(\underline{\theta}))$ and that $U(\underline{\theta}) \geqslant U(\bar{\theta}) + (\underline{\theta} - \bar{\theta})p(I(\bar{\theta}))V'(e(\bar{\theta}))$. Combining these two inequalities, we obtain (3.2).

Properties of the Rent Functions

LEMMA B.1.

(i) $\forall T = \text{B, N}, \forall e, \text{rent}_T(e) = G_T(\bar{\theta}, d_T(e)) - G_T(\underline{\theta}, e)$.

(ii) $\forall T = \text{B, N}, \forall e$, $\text{rent}_T(e)$ *is strictly positive and strictly increasing.* $\forall e \in [0, \delta)$, $d\, \text{rent}_{\text{N}}/de > d\, \text{rent}_{\text{B}}/de$.

(iii) $\text{rent}_{\text{B}}(e_{\text{B}}(\underline{\theta})) > \text{rent}_{\text{N}}(e_{\text{N}}(\underline{\theta}))$ *and* $\text{rent}_{\text{B}}(0) > \text{rent}_{\text{N}}(0)$.

Proof. Available upon request.

Proof of Lemma 3.2

Suppose that $\underline{\theta}$ faces a policy of no-bailout. We show that incentive compatibility implies a lower bound on the difference between the marginal disutility of effort for the two types and that this bound is strictly greater than the difference when each type uses her first-best effort level. This proves that the first-best effort levels are not incentive compatible.

The incentive compatibility condition given by (3.2) implies that

$$(\bar{\theta} - \underline{\theta})[p(I(\bar{\theta}))V'(e(\bar{\theta})) - p^{H}V'(e(\underline{\theta}))] - \bar{\theta}p^{H}\alpha^{H} \geqslant e(\underline{\theta})\alpha^{H} + V(e(\underline{\theta}))$$
$$- V(d_S(e(\underline{\theta}))) + (d_S(e(\underline{\theta}))) - e(\underline{\theta}))V'(d_S(e(\underline{\theta}))) > 0,$$

where the second inequality follows the convexity of V and the fact that $d_S(e(\underline{\theta})) > e(\underline{\theta})$. Since $p^{H} \geqslant p(I(\bar{\theta}))$, it follows that

$$V'(e(\bar{\theta})) - V'(e(\underline{\theta})) > \frac{\bar{\theta}}{\bar{\theta} - \underline{\theta}}\alpha^{H}$$
$$> \alpha^{H}.$$

The first-best effort levels are defined by $V'(e_S(\theta)) = \Psi_S(\theta)$. From the definition of $\Psi_N(\theta)$, $V'(e_N(\bar{\theta})) - V'(e_N(\underline{\theta})) = \alpha^{H}$. It follows that the first-best effort levels are not *NN* implementable.

By definition of Ψ_B,

$$\Psi_B(\bar{\theta}) - \Psi_N(\underline{\theta}) = \alpha^{H} - [(\bar{\theta}p^{L} + e_2^{*})(y_H + K) - V(e_2^{*}) - U^{0}],$$

where the term in brackets is equal to R's second-period expected utility in the first-best when the outcome of the first period is $-y_L$. By assumption A8, this term in brackets is positive. Therefore, the difference in marginal disutility for effort at the first-best effort levels is strictly less than α^{H}. Hence, the first-best efforts are not BN-implementable.

Now suppose that $\underline{\theta}$ faces a policy of bailout. Let S be the policy faced by $\bar{\theta}$. Suppose that $(e_S(\bar{\theta}), e_B(\underline{\theta}))$ is incentive-compatible when the bailout policies are *SB*. Then,

$$(\bar{\theta} - \underline{\theta})p(I(\bar{\theta}))V'(e_S(\bar{\theta})) \geqslant \text{rent}_B(e_B(\underline{\theta}))$$
$$> \text{rent}_N(e_N(\underline{\theta})),$$ by property (iii) of the rent functions.

Therefore $(e_S(\bar{\theta}), e_B(\underline{\theta}))$ is incentive-compatible when the bailout policies are *SN*. This contradicts what we have proved for the case where $\underline{\theta}$ faces a policy of no-bailout.

Proof of Lemma 3.3

(i) We remark that it is always optimal for R to choose first-period contracts such that $U(\underline{\theta}) = \hat{U}$. Hence, R's problem can be written as

(P_{ST}) $\text{Max}_e xG_S(\overline{\theta}, \max[e_S(\overline{\theta}), \phi_{ST}(e)]) + (1 - x)G_T(\underline{\theta}, e) - x\ \text{rent}_T(e) - \hat{U}$.

Suppose that $e > e_T(\underline{\theta})$. Then, by decreasing e to $e_T(\underline{\theta})$, $G_T(\underline{\theta}, e)$ increases (by definition of the first-best effort), and $\text{rent}_T(e)$ decreases (by Lemma B.1 (ii)). Since $\phi_{ST}(e)$ is increasing in e, $G_S(\overline{\theta}, \max[e_S(\overline{\theta}), \phi_{ST}(e)])$ increases. Therefore, there is no loss of generality in supposing that $e \leqslant e_T(\underline{\theta})$. We note that the objective function is continuous in e and that e takes compact values; therefore, $G_{ST}(x)$ is well defined.

(ii) It is well known (for instance, see Dixit 1976) that if a function $f(z, x)$ is convex in the parameter $x \in \mathbb{R}$, then if for any x there exists a solution $z(x)$ to the problem Max $\{f(z, x) | z \in \Omega\}$, then the function $F(x) \equiv f(z(x), x)$ is convex in x (note that Ω is independent of x). In our case, the objective function is linear, hence convex, in the parameter x. The result follows.

Proof of Proposition 3.1

(i) Observe that $\lim_{x\to 0} G_{ST}(x) = G_T(\underline{\theta}, e_T(\underline{\theta})) > G_T(\underline{\theta}, 0) = W_{ST}(0)$ and that $W_{ST}(1) = G_S(\overline{\theta}, e(\overline{\theta})) > G_S(\overline{\theta}, \max[e_S(\overline{\theta}), \phi_{ST}(0)]) - \text{rent}_T(0) = \lim_{x\to 1} G_{ST}(x)$. (Note that G_{ST} is not continuous at $x = 1$.) Since W_{ST} is a linear increasing function of x and since G_{ST} is a convex function of x, the graphs of these two functions intersect only once on (0, 1). This proves the statement.

(ii) Let $e(x)$ be the value of e for which $G_{ST}(x)$ is attained in the problem in Lemma 3.4. Hence, $G_{ST}(x) = F_{ST}(e(x), x)$, where

$$F_{ST}(e, x) \equiv G_T(\underline{\theta}, e) + x\{G_S(\overline{\theta}, \max[e_S(\overline{\theta}), \phi_{ST}(e)]) - G_T(\overline{\theta}, d_T(e))\} - x\ \text{rent}_T(e) - \hat{U}.$$

We note that $F_{ST}(e, x)$ is linear in x. Suppose that $e(x)$ is not decreasing. Since $e(x)$ is continuous in x and since $e(0) = e_T(\underline{\theta})$ and $e(x) \leqslant e_T(\underline{\theta})$, there must exist two values x_1 and x_2 such that $e(x_1) = e(x_2) = e^*$. Let $x_\lambda \equiv \lambda x_1 + (1 - \lambda)x_2$ for $\lambda \in (0, 1)$. Then, for any $\lambda \in (0, 1)$, $F_{ST}(e^*, x_1) \geqslant F_{ST}(e(x_\lambda), x_1)$ and $F_{ST}(e^*, x_2) \geqslant F_{ST}(e(x_\lambda), x_2)$. By linearity in x, it follows that $\lambda F_{ST}(e^*, x_1) + (1 - \lambda)F_{ST}(e^*, x_2) \geqslant F_{ST}(e(x_\lambda), x_\lambda)$, which must hold with an equality since $e(x_\lambda)$ maximizes $F(e, x_\lambda)$. Therefore, $e(x)$ is constant for $x \in [x_1, x_2]$. So $e(\underline{\theta}, x)$ cannot be strictly increasing over any range of x.

APPENDIX C

Comparative Statics Properties of q^i

Let $\partial_k q^i$ be the first-order partial derivative of q^i with respect to the kth variable (e.g., ∂_1 is the partial with respect to the effort of $\overline{\theta}$). Simple computations show that $\partial_1 q^H > 0$, $\partial_2 q^H < 0$, $\partial_1 q^L < 0$, $\partial_2 q^L > 0$. The second-order partial derivatives satisfy $\partial^2_{11}q^i < 0$, $\partial^2_{22}q^i > 0$ for i = H, L; the sign of the cross-derivative $\partial^2_{12}q^i$ is positive if, and only if, the expected first-period probability of obtaining state i is positive. Hence, for any $I \in \{Z, Z - y_L\}$,

$$\partial^2_{12}q^H \geq 0 \Leftrightarrow x(\overline{\theta}p(I) + e(\overline{\theta})) + (1 - x)(\underline{\theta}\, p(I) + e(\underline{\theta})) \geq 0.$$

$$\partial^2_{12}q^L \geq 0 \Leftrightarrow x(1 - \overline{\theta}p(I) - e(\overline{\theta})) + (1 - x)(1 - \underline{\theta}p(I) - e(\underline{\theta})) \geq 0.$$

We use these comparative statics results to prove many of the results of Section 4.

LEMMA C.1. *Let p^i, i = H, L, be the value of $p(\cdot)$ at the beginning of the second period and let $q \in (0, 1)$ be the probability that M is of type $\overline{\theta}$.*

(i) *It is optimal to have type $\overline{\theta}$ exert the efficient level of effort e^*_2 and to have type $\underline{\theta}$ exert an effort level $e^i_2(q) \leq e^*_2$.*

(ii) *Let $f(\theta, e) \equiv (\theta p^i + e)(y_H + K) - V'(e)$. Then R's second-period expected utility is given by the function $qf(\overline{\theta}, e^*_2) + (1 - q)f(\underline{\theta}, e^i_2(q)) - \underline{U} - q\alpha^i(e^i_2(q))$, and the second-period expected utilities of each type are $U(\overline{\theta}) = \underline{U} + \alpha^i(e^i_2(q))$, and $U(\underline{\theta}) = \underline{U}$, where*

$$\alpha^i(e^i_2(q)) = (\overline{\theta} - \underline{\theta})\cdot p^i \cdot V'(e^i_2(q)), \quad \text{if } q \leq q^{*i} \qquad (C.1)$$

$$= 0, \quad \text{if } q > q^{*i}.$$

(iii) *There exists a $q^{*i} < 1$ such that $\forall q \geq q^{*i}$, $e^i_2(q) = 0$ and $e^i_2(q)$ is a decreasing function of q on $[0, q^{*i})$.*

(iv) *For all $q \leq q^{*i}$, $e^i_2(q)$ solves the equation*

$$(1 - q)\cdot(y_H + K - V'(e)) = q\cdot(\overline{\theta} - \underline{\theta})\cdot p^i \cdot V''(e). \qquad (C.2)$$

Proof. Available upon request.

Functions A_θ and B_θ

For $I = Z$,

$$A_{\overline{\theta}} = w^H - w^L + \underline{U} - U^0 + \alpha^H(e^H_2(q^H(\cdot))),[31]$$

$$B_{\overline{\theta}} = B_{\underline{\theta}} = U^0 + w^L.$$

For $I = Z - y_L$,

[31] The arguments of the functions q^H and q^L are $e(\overline{\theta})$, $e(\underline{\theta})$, x, and I. The functions q^i are defined by equations (4.1) and (4.2) in the text and the functions α^i and e^i_2 are defined in Lemma C.1.

$$A_{\underline{\theta}} = w^{\mathrm{H}} - w^{\mathrm{L}}$$

$$A_{\bar{\theta}} = w^{\mathrm{H}} - w^{\mathrm{L}} + \alpha^{\mathrm{H}}(e_2^{\mathrm{H}}(q^{\mathrm{H}}(\cdot))) - \alpha^{\mathrm{L}}(e_2^{\mathrm{L}}(q^{\mathrm{L}}(\cdot))),$$

$$B_{\bar{\theta}} = B_{\underline{\theta}} = \underline{U} + w^{\mathrm{L}}.$$

Since $\alpha^i(\cdot)$, $i \in \{\mathrm{H, L}\}$, is a function of q, which is a function of x, the solution to (ICP) is also an implicit function of x. Let e be the effort level of $\underline{\theta}$ and let $\phi_S^p(e, x)$, the superscript p stands for pooling and the subscript S stands for the bailout policy, be the effort level of $\bar{\theta}$ such that $(\phi_S^p(e, x), e)$ satisfies (ICP).

LEMMA C.2. *Let x and I be given. For a given effort level $e(\underline{\theta})$, there exists a unique effort level $e(\bar{\theta}) \equiv \phi_S^p(e(\underline{\theta}), x)$, $S \in \{B, N\}$, such that the pair $(e(\bar{\theta}), e(\underline{\theta}))$ satisfies (ICP). $\phi_S^p(e(\underline{\theta}), x)$ is continuous in $e(\underline{\theta})$.*

Proof. Available upon request.

LEMMA C.3. *For each policy $S = B, N$, each prior belief $x \in (0, 1)$, and each effort level $e \in [0, \delta)$, $rent_S^p(e, x) \geqslant 0$.*

Proof. To economize notation, let α^i denote $\alpha^i(e_2^i(q^i(\phi_{\mathrm{B}}^p(e, x), e, I)))$, $i = \mathrm{H, L}$.

If $I = Z$, $\phi_{\mathrm{N}}^p(e, x) \geqslant e$ for each x and each e. Since $\alpha^{\mathrm{H}} \geqslant 0$, $U(\bar{\theta}, e) > U(\underline{\theta}, e)$. Since $\bar{\theta}$ chooses optimally to use $\phi_{\mathrm{N}}^p(e, x)$, it follows that $\mathrm{rent}_{\mathrm{N}}^p(e, x) \geqslant 0$ for each e.

If $I = Z - y_{\mathrm{L}}$ and if $\phi_{\mathrm{B}}^p(e, x) \geqslant e$, then $\alpha^{\mathrm{H}}(\cdot) - \alpha^{\mathrm{L}}(\cdot) \geqslant 0$, and by using the same argument as above, $\mathrm{rent}_{\mathrm{B}}^p(e, x) \geqslant 0$. If $\phi_{\mathrm{B}}^p(e, x) < e$, i.e., if $\alpha^{\mathrm{H}} < \alpha^{\mathrm{L}}$, we observe that

$$\mathrm{rent}_{\mathrm{B}}^p(e, x) = (\bar{\theta} - \underline{\theta})p^{\mathrm{L}}V'(e) + (\bar{\theta}p^{\mathrm{L}} + e)\alpha^{\mathrm{H}} + (1 - \bar{\theta}\, p^{\mathrm{L}} - e)\alpha^{\mathrm{L}}$$
$$+ [(\phi_{\mathrm{B}}^p(e, x) - e)(V'(e) + \alpha^{\mathrm{H}} - \alpha^{\mathrm{L}}) - V(\phi_{\mathrm{B}}^p(e, x)) + V(e)].$$

The term in brackets is positive since $\phi_B^p(e, x) < e$ and since $V'(\phi_{\mathrm{B}}^p(e, x)) \geqslant V'(e) + \alpha^{\mathrm{H}} - \alpha^{\mathrm{L}}$. It follows that $\mathrm{rent}_{\mathrm{B}}^p(e, x) > 0$.

Functions $G_S^p(e, x)$

If $S = N$,

$$G_{\mathrm{N}}^p(e, x) \equiv (\underline{\theta}p^{\mathrm{H}} + e)\, \Psi_{\mathrm{N}}^p(e, x) - K - V(e) + U^0$$

$$\Psi_{\mathrm{N}}^p(e, x) \equiv y_{\mathrm{H}} + [\underline{\theta}p^{\mathrm{H}} + e_2^{\mathrm{H}}](y_{\mathrm{H}} + K) - U^0 - V(e_2^{\mathrm{H}}),$$

where e_2^{H} stands for $e_2^{\mathrm{H}}(q^{\mathrm{H}}(\cdot))$.

If $S = \mathrm{B}$,

$$G_{\mathrm{B}}^{\mathrm{p}}(e, x) \equiv (\underline{\theta}p^{\mathrm{L}} + e)\Psi_{\mathrm{B}}^{\mathrm{p}}(e, x) - K - V(e) + (\underline{\theta}p^{\mathrm{L}} + e_2^{\mathrm{L}})(y_{\mathrm{H}} + K)$$

$$\Psi_{\mathrm{B}}^{\mathrm{p}}(e, x) \equiv y_{\mathrm{H}} + [\underline{\theta}(p^{\mathrm{H}} - p^{\mathrm{L}}) + e_2^{\mathrm{H}} - e_2^{\mathrm{L}}](y_{\mathrm{H}} + K) - V(e_2^{\mathrm{H}}) + V(e_2^{\mathrm{L}}),$$

where e_2^i stands for $e_2^i(q^i(\cdot))$.

The marginal revenue functions $\Psi_{\mathrm{N}}^{\mathrm{p}}(e, x)$ and $\Psi_{\mathrm{B}}^{\mathrm{p}}(e, x)$ are analogous to the functions $\Psi_{\mathrm{N}}(\underline{\theta})$ and $\Psi_{\mathrm{B}}(\underline{\theta})$ defined in Appendix B in the case of separation.[32]

Proof of Proposition 5.1

In a neighborhood, chosen small enough, of $x = 1$, R's expected utility in a separating continuation equilibrium is given by the function $W_{ST}(x)$, which involves a zero effort for $\underline{\theta}$ and a zero rent for $\overline{\theta}$. As we have argued in Section 4, a separating-continuation equilibrium dominates a pooling continuation equilibrium in this case. As x approaches 1 the optimal bailout policy should be first-best for $\overline{\theta}$; hence we need only compare $W_{\mathrm{BB}}(x)$ and $W_{\mathrm{BN}}(x)$ in a neighborhood of $x = 1$. By definition of the function $W_{ST}(x)$, $W_{\mathrm{BN}}(x) > W_{\mathrm{BB}}(x)$ if and only if $G_{\mathrm{N}}(\underline{\theta}, 0) > G_{\mathrm{B}}(\underline{\theta}, 0)$.

Proof of Proposition 5.2

At $x = 0$, R's utility with either a pooling NN or separating SN, $S \in \{\mathrm{B}, \mathrm{N}\}$, equals the first-best utility $G_{\mathrm{N}}(\underline{\theta}, e_{\mathrm{N}}(\underline{\theta})) - \hat{U}$. By definition of the first-best bailout policy for $\underline{\theta}$, each of these continuation equilibria dominates pooling BB and separating SB, where $S \in \{\mathrm{B}, \mathrm{N}\}$. We compute the derivatives with respect to x of the expected utility of R in the three continuation equilibria. The following equalities follow from the results of Sections 3 and 4 and from the envelope theorem:

$$\mathrm{Pool}_{\mathrm{N}}'(0) = G_{\mathrm{N}}(\overline{\theta}, e_{\mathrm{N}}(\overline{\theta})) - G_{\mathrm{N}}(\underline{\theta}, e_{\mathrm{N}}(\underline{\theta})) - \mathrm{rent}_{\mathrm{N}}(e_{\mathrm{N}}(\underline{\theta}))^{33}$$

$$G_{S\mathrm{N}}'(0) = G_S(\overline{\theta}, \phi_{S\mathrm{N}}(e_{\mathrm{N}}(\underline{\theta})) - G_{\mathrm{N}}(\underline{\theta}, e_{\mathrm{N}}(\underline{\theta})) - \mathrm{rent}_{\mathrm{N}}(e_{\mathrm{N}}(\underline{\theta})).$$

From Lemma B.1 (i), $\mathrm{rent}_{\mathrm{N}}(e) = G_{\mathrm{N}}(\overline{\theta}, d_{\mathrm{N}}(e)) - G_{\mathrm{N}}(\underline{\theta}, e)$. Since $d_{\mathrm{N}}(e_{\mathrm{N}}(\underline{\theta})) = e_{\mathrm{N}}(\overline{\theta})$, it follows that $\mathrm{Pool}_{\mathrm{N}}'(0) = 0$. From Lemma 3.2, $\phi_{\mathrm{NN}}(e_{\mathrm{N}}(\underline{\theta})) \neq e_{\mathrm{N}}(\overline{\theta})$,

[32] It is possible to show that for each $e \in [0, \delta)$, $\Psi_{\mathrm{N}}^{\mathrm{p}}(e, x) < \Psi_{\mathrm{N}}(\underline{\theta})$ and $\Psi_{\mathrm{B}}^{\mathrm{p}}(e, x) < \Psi_{\mathrm{B}}(\underline{\theta})$, i.e., the marginal revenue from $\underline{\theta}$'s effort is larger with pooling than with separation if, and only if, the inefficient investment policy is used.

[33] As $x \to 0$, it is clear that $\mathrm{rent}_{\mathrm{N}}^{\mathrm{p}}(e, x) \to \mathrm{rent}_{\mathrm{N}}(e)$, since $e_2^{\mathrm{H}}(q^{\mathrm{H}}) \to e_2^*$.

since the first-best effort levels are not implementable in a separating continuation equilibrium; therefore, $G'_{NN}(0) < 0$. We are thus left with comparing pooling NN and separating BN. It is immediate that pooling NN will be chosen if and only if $G_B(\overline{\theta}, \phi_{BN}(e_N(\overline{\theta}))) < G_N(\overline{\theta}, e_N(\overline{\theta}))$. Note that this inequality is possible since $\overline{\theta}$ is a bailout type.

REFERENCES

Baron, David P., and Besanko, David, "Commitment and Fairness in a Dynamic Regulatory Relationship." *Rev. Econom. Stud.* **54,** 301–322, 1987.

Brada, Josef C., "The Economic Transition of Czechoslovakia from Plan to Market." *J. Econom. Perspect.* **5,** 4:171–178, Fall 1991.

Bolton, Patrick, and Scharfstein, David, "Optimal Debt Structure with Multiple Creditors." CEPR Working Paper 32, Mar. 1993.

Bulow, J., and Shoven, John, "The Bankruptcy Decision." *Bell J. Econom.* **9,** 437–456, Autumn 1978.

Dewatripont, Mathias, and Maskin, Eric, "Credit and Efficiency in Centralized and Decentralized Economies." Manuscript, 1990.

Dixit, Avinash, *Optimization in Economic Theory.* Oxford, UK: Oxford Univ. Press, 1976.

Dyba, Karel, and Svejnar, Jan, "Stabilization and Transition in Czechoslovakia." Working Paper 7, CERGE, Charles University, Prague, June 1992.

Estrin, Saul, Hare, Paul, and Suranyi, M. "Banking in Transition: Development and Current Problems in Hungary." London School of Economics, Centre for Economic Performance Discussion Paper 68, Mar. 1992.

Freixas, Xavier, Guesnerie, Roger, and Tirole, Jean, "Planning under Incomplete Information and the Ratchet Effect." *Rev. Econom. Stud.* **52,** 173–191, 1985.

Gale, Douglas, and Hellwig, Martin, "Incentive-Compatible Debt Contracts: The One-Period Problem." *Rev. Econom. Stud.* **52,** 647–663, 1985.

Gertner, Robert, and Scharfstein, David, "A Theory of Workouts and the Effects of Reorganization Law." *J. Finance* **46,** 1189–1222, Sept. 1991.

Grossman, Sanford J., and Hart, Oliver, D., "Corporate Financial Structure and Managerial Incentives." In John McCall, Ed., *The Economics of Information and Uncertainty.* Chicago: Univ. of Chicago Press, 1982.

Hare, Paul, "Hungary: In Transition to a Market Economy." *J. Econom. Perspect.* **5,** 4:195–202, Fall 1991.

Harris, Milton, and Raviv, Arthur, "The Design of Bankruptcy Procedures." Mimeo, Univ. of Chicago, 1992.

Hart, Oliver D., and Moore, John, "Default and Renegotiation: A Dynamic Model of Debt." MIT Working Paper 520, May 1989.

Hellwig, Martin. "A Model of Borrowing and Lending with Bankruptcy," *Econometrica* **45,** 8:1879–1906, Nov. 1977.

Jensen, Michael C., "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." *Amer. Econom. Rev.* **76,** 323–329, May 1986.

Kornai, Janos, *The Economics of Shortage.* Amsterdam: North-Holland, 1980.

Laffont, Jean-Jacques, and Tirole, Jean, "Comparative Statics of the Optimal Dynamic Incentives Contract." *European Econom. Rev.* **31,** 909–926, 1987.

Laffont, Jean-Jacques, and Tirole, Jean, "The Dynamics of Incentive Contracts." *Econometrica* **56,** 5:1153–1175, 1988.

Laffont, Jean-Jacques, and Tirole, Jean, *A Theory of Incentives in Procurement and Regulation.* Cambridge, MA: MIT Press, 1993.

Lipton, David, and Sachs, Jeffrey, "Privatization in Eastern Europe: The Case of Poland." *Brookings Papers Econom. Activity* **2,** 293–334, 1990.

Mitchell, Janet. "Creditor Passivity and Bankruptcy: Implications for Economic Reform." In Colin Mayer and Xavier Vives, Eds., *Financial Intermediation.* Cambridge, UK: Cambridge University Press, 1993.

Mitchell, Janet, "The Economics of Bankruptcy in Reforming Socialist Economies." Final Report to the National Council for Economic Research, 1990.

OECD, "Economic Surveys: Poland." Annex IV, July 1992.

PlanEcon, "Recent Czechslovak Economic Performance." Report 7, 40–41, 8 Nov. 1991.

Sah, Raaj, and Weitzman, Martin, "A Proposal for Using Incentive Precommitments in Public Enterprise Funding." *World Develop.* **19,** 6:595–605, 1991.

Sappington, David, "Limited Liability Contracts between Principal and Agent." *J. Econom. Theory* **29,** 1–21, 1983.

Schaffer, Mark E., "The Credible-Commitment Problem in the Center-Enterprise Relationship." *J. Comp. Econom.* **13,** 3:359–382, 1989.

Schaffer, Mark E., "The Economy of Poland." Manuscript, London School of Economics, 1992.

Tirole, Jean, "The Internal Organization of Government." Institute for Policy Reform, Working Paper IPR41, June 1992.

Wellisz, Stanislaw, "Poland Under 'Solidarity' Rule." *J. Econom. Perspect.* **5,** 4:211–217, Fall 1991.

White, Michelle J., "The Corporate Bankruptcy Decision." *J. Econom. Perspect.* **3,** 2:129–152, Spring 1989.

White, Michelle J., "Public Policy Toward Bankruptcy: Me-First and Other Priority Rules." *Bell J. Econom.* **11,** 550–564, Autumn 1980.