PRIVATIZATION AND RESTRUCTURING: FRIENDS OR ENEMIES?

1. Introduction

One observation shared by most economists and policy makers dealing with economic transformation in the formerly socialist countries of Central and Eastern Europe, is that state owned enterprises (SOEs) suffered from over-employment, obsolete capital equipment, inefficient composition of outputs and inputs, inefficient internal organization etc.[1] Restructuring (including changes in production, investment in new technologies, changes in organization and unbundling of idle resources and financial restructuring) is hence viewed as a necessary condition for improved economic performance. In a parallel development, most countries in the region have prepared (and some of them carried out) extensive privatization programs.

This paper analyzes the impact of an expected privatization on whether or not the incumbent manager of an SOE will restructure prior to privatization. The issue is important since privatization is often delayed and pre-privatization restructuring would hence be desirable.

The first theoretical treatment of this issue was provided by Aghion, Blanchard and Burgess (1994).[2] They argue that expected privatization is an enemy of restructuring. They assume that managers will be fired after privatization. Since managers will not benefit from restructuring and will incur part of the costs of restructuring, they will not restructure. Aghion, Blanchard and Burgess (ABB) develop this argument in a model where the pre-privatization manager forfeits his/her job after privatization. Without privatization, managers restructure if and only if it is socially desirable. The key result of the ABB model is that as the probability of privatization increases, managers are less likely to restructure.

The ABB model presents a clear and strong prediction. However, it follows directly from equally strong assumptions. Perhaps the strongest of these is the assumption that the pre-privatization managers always lose their positions after privatization. This is obviously not the case, and for good reason. Managerial resources are scarce in both developed and transforming economies. Without well established markets for managers and without sufficient information on managers' past performance (as is the case in most of the transforming economies), finding

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[1] See e.g. Carlin et al. (1994).

[2] For empirical analyses of restructuring, see Pinto, Belka and Krajewski (1993) for Poland and Lizal, Singer and Svejnar (1995) for the former Czechoslovakia, or Estrin et al. (1995).

a good manager is especially difficult. Finally, owners should be reluctant to fire managers since they have firm specific human capital. All of these arguments make replacing an incumbent manager with a new one a costly activity with an uncertain result. Hence, the assumption that a new owner automatically fires the incumbent manager needs to be replaced with the assumption that the new owner makes this decision only after a rational cost-benefit analysis.

This paper develops a signalling model of pre-privatization restructuring based on the assumption of a rational new owner (RNO). The model uses the structure and the assumptions of the ABB model except for the key assumption that all managers are fired after privatization. Both models assume there are two types of incumbent managers: high quality managers and low quality mangers. It is assumed that the new owner does not know a priori the quality of the incumbent manager, but he/she does observe whether or not the manager restructures. Based on this observation, the new owner updates his/her beliefs about the quality of the manager and only then decides to fire or keep the manager. The incumbent manager knows that the owner's posterior beliefs are effected by whether or not there is restructuring, and hence he/she uses restructuring as a signal of his/her value. If the benefit of restructuring generated by the low type manager is too small, he/she reveals his/her low quality by not restructuring (stagnation). The high type will restructure, except when he/she perceives that the RNO is not responding to the signal. Hence the decision on the manager's future is made by a new post privatization owner in a signalling game of asymmetric information.

The RNO model has, as do other signalling models, multiple equilibrium outcomes. Four types of equilibria are found and described below. The two most interesting types are i) the separating equilibria and ii) the pooling equilibria, where neither type of manager restructures.

In the separating equilibrium, the two possible types of managers are separated by different pre-privatization behavior: the high type restructures and the low type stagnates. The new owner thus knows that the manager who has chosen to restructure is the high quality one and therefore he/she should not fire the manager. The separating equilibrium sharply contradicts the ABB results as it yields pre-privatization restructuring and moreover it does so when it is socially optimal.

In the stagnation pooling equilibrium, neither type of manager restructures and the new owner threatens to fire anyone who does. This result is equivalent to the outcome of the ABB model. The ABB is thus nested within the RNO model in two ways: i) its outcome is equivalent to one of the possible equilibrium outcomes of the RNO model and ii) it is a special case of the

RNO model where the owner has a strategy restricted to firing the manager.

The multiplicity of equilibria is a major weakness of the model since it generates conflicting predictions about the impact of privatization on efficiency. The question therefore arises as to whether one can reasonably narrow down this set of equilibria and identify the more plausible ones. Competition among the potential new owners is one (economically motivated) mechanism that ensures that the separating equilibria dominate the pooling ones. In particular, the new owner playing the ABB pooling equilibrium does not exploit the resources of the skilled manager and his expected profit is thus lower than that of the owner who trusts the signal and keeps the manager who restructures. If potential new owners compete for firms in the privatization process, the owners who trust the signal will tend to submit higher bids and hence acquire the firms.

The paper is organized as follows. The benchmark ABB model is briefly outlined in Section 2. In Section 3 the rational new owner is introduced into the ABB framework and a simple signalling game is developed. In Section 4 it is demonstrated that competition among privatization bidders eliminates the multiplicity of equilibria; bidders playing equilibria with higher payoffs are more likely to win the privatization race and the incumbent managers act accordingly. The relationship of restructuring and privatization is compared across the ABB and the RNO models in Section 5. The major conclusions are presented in Section 6.

2. The Generic ABB Model

The ABB model is simple but powerful. In its simple version, it demonstrates that privatization may have strong negative effect on the incentives of the pre-privatization managers. This effect is due to the manager's unclear future after privatization.

The ABB model is build on the following assumptions: Time is collapsed into two periods. The firm has a linear production function; production is equal to employment. Initial employment and production of the firm are given.

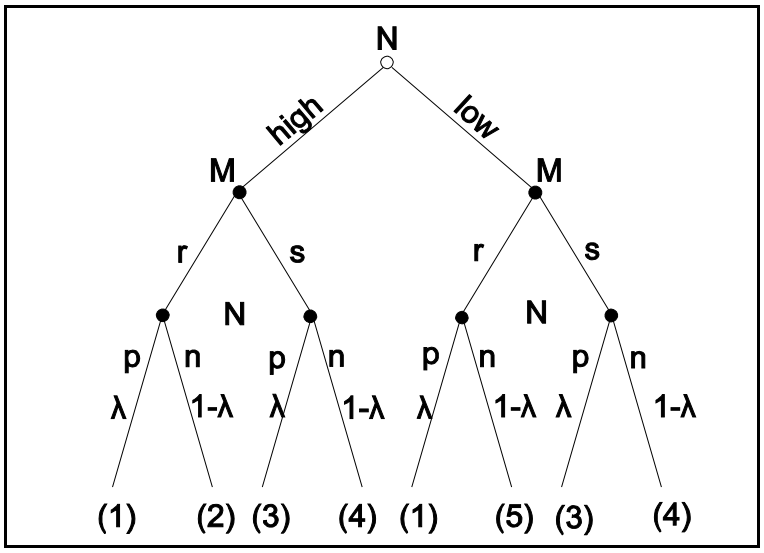

Figure 1: The Generic ABB Model

N: nature, M: manager, high, low: move determining the type of the manager. r: restructure, s: stagnate, p: privatize, n: do not privatize. Payoffs to the manager: (1) 1-x, (2) $2-2x+z_h$, (3) 1, (4) 2-y, (5) $2-2x+z_l$.

With no loss of generality, initial employment is normalized to 1.[3] In period one, the manager has to decide whether to restructure or not (see moves r for restructure and s for stagnating in Figure 1). Restructuring consists of firing a share of the workforce (x) in period 1. Production and employment in period 1 under restructuring is equal to (1-x). One benefit of restructuring is that it enables the firm to increase production in period 2 by an amount z; production in period 2 under restructuring is 1-x+z. Not restructuring implies no change in the output level in period 1 but a drop in output to (1-y) in period 2, which is given by the hardening of the budget constraint during transition. Avoiding this loss in period 2 is the second benefit of restructuring.

The values of the parameters are exogenous. The size of restructuring costs, expressed in parameter x, is determined by obsolescence of firms machinery, products etc. Stagnation costs y are determined by hardening budget constraint and other factors associated with transition (e.g. collapse of CMEA markets). Parameter z depends on the quality (type) of the manager. Managers can be of either high or low type with restructuring gains z_h and z_l, where $z_h > z_l$, and the probability that the manager is of either type is 1/2.

[3]Not so in the original Aghion et al. (1994) paper, in which the initial employment is assumed at level N.

The ABB model assumes that privatization is an exogenous random event which occurs at the beginning of period 2 with probability λ. The manager's compensation is given by a fraction of production in periods when he/she is employed; if there is no privatization, the manager's compensation is a fraction of the sum of production over the two periods, under privatization, he/she gets compensation for the first period only, since he/she is fired after privatization. The manager's decision on restructuring is based purely on his/her expected compensation.[4] He/she will restructure if the compensation under restructuring (left hand side of the inequality below) is higher than that under stagnation (right hand side):

$$(1-x) + (1-\lambda)(1-x+z) \geq 1 + (1-\lambda)(1-y). \quad (1)$$

Note that the second period payoff is discounted with discount factor equal to the probability of privatization, since the manager gets nothing in the case of privatization. The relationship between privatization and restructuring is even more clear after solving (1) for the parameter z, which yields

$$z \geq \frac{2-\lambda}{1-\lambda} x - y; \quad (2)$$

the expression on the RHS showing how the break-even value of z for which (1) is satisfied increases in λ. (2) contains the ABB's answer on whether privatization and restructuring are friends or enemies: they are enemies, since the more likely privatization is, the more better quality managers, who would restructure without privatization, decide not to restructure. This decision rule differs from the socially optimal rule. Restructuring is socially optimal under the condition that the total production in both periods is higher under restructuring than with stagnation:

$$(1-x)+(1-x+z) > 1+(1-y). \quad (3)$$

Equation (3) can be rearranged to obtain the following condition on managerial quality for restructuring to be socially optimal:

$$z > 2x-y \equiv \xi. \quad (4)$$

The parameter $\xi \equiv 2x-y$ is a break-even value of z, such that for z less than ξ, restructuring is not

[4]Because the manager's compensation is given as a constant share of production, the manager's preferences are simply given as the amount of production. In the following text, the manager compares only production; the parameter denoting his/her share on production is omitted.

socially optimal, but is socially optimal for z higher. The economic meaning of it is that ξ represents the cost of restructuring incurred over the two periods, i.e. 2x, net of the costs of stagnation, y, born in the period two. Thus, ξ denotes the net costs of restructuring.

Equations (2) and (4) capture the essence of the ABB model. When the probability of privatization λ is equal to zero, equations (2) and (4) are the same. This means that if there is no threat of privatization the managers restructures if and only if it is socially optimal. However, once $\lambda > 0$ and privatization is possible, some of the managers who would restructure if there were no privatization, and who should restructure according to social optimality rule do not. The reason is that as the probability of privatization λ increases, so does the break-even value of z from (2) which is the minimal value of z for which the manager has an incentive to restructure.

As λ approaches unity and privatization becomes an almost certain event, the break even value converges to infinity and no manager will restructure. The reason is straightforward: the manager has no chance to benefit from the increase of production in the second period (and from sparing the firm of the stagnation costs y), but will suffer from the production drop of x in period 1. This makes his/her expected payoff under restructuring 1-x, whereas the stagnation payoff is 1. Therefore the manager's best choice is stagnation.t5

The ABB model thus concludes that privatization is restructuring-unfriendly. In the extreme case, when privatization becomes certain, the manager stops restructuring without respect to how large the effect of restructuring z is and how costly is stagnation. In practical terms, no restructuring should be observed in firms which will be privatized almost for sure.

This rather strong result stems purely from the assumption that the manager has no benefit from restructuring in the case of privatization. This is highly unrealistic, especially in countries where there is a shortage of qualified managers. In such cases, the assumption of no future for the incumbent manager within the privatized firm can be hardly justified.[5]

3. Privatization and Restructuring with Signalling: an Extreme Case

The key result of the ABB model is that if privatization occurs with certainty, i.e. $\lambda = 1$, no manager will ever restructure. As will be demonstrated below, this result fails unless the new owner blindly fires the incumbent manager, without considering his/her quality and the cost of his/her replacement. This section presents a simple model with two types of managers in which

[5]Estrin (1994) challenges both the view of restructuring as a pure firing of redundant labor and the either/or relationship between privatization and restructuring (which is a direct consequence of the no-future-assumption). I will follow mainly the latter criticism.

the rational new owner (the RNO) decides on the manager's future right after privatization such that he/she

a) fires the manager if he/she believes that the manager is the low quality type,

b) keeps the manger if he/she believes that the manage is the high quality type and

c) updates the beliefs on the manager's quality using the observed fact that the manager did or did not restructure in period 1.

Even for the extreme case with privatization occurring with certainty, the RNO model has three types of equilibria in which the high type manager restructures and only one type of equilibrium in which he/she does not.

The most robust of all of these is the separating equilibrium, which directly contradicts the ABB results. In this equilibrium, the high type of manager always restructures whereas the low type never does so. Observing whether the manager did or did not restructure in period one gives the new owner full information on the manager's type. The high type of manager is thus able to signal the new owner his/her quality and thus preserves his/her managerial position after privatization. These results of the RNO model contradict the ABB model, but are fully consistent with the ABB's socially efficient outcome.

Structure of the RNO model

The RNO model retains all the basic features of the ABB model, including notation. Payoffs to the manager are changed slightly: the manager gets zero in the second period only when privatization occurs and the RNO decides to fire him/her. The probability that the manager retains his/her position if he/she restructures (which is given by the strategy of the RNO) will be denoted π_r, while the probability if he/she stagnates is π_s. In the ABB model, both π_r and π_s are equal to zero.

Table 1: Payoffs to the RNO and the Manager for Different Combinations of their Actions

Action of the Rational New Owner:	Action of the Manager: restructuring	stagnation
firing the manager	1-x; 1-x	1-y; 1
keeping the manager	1-x+z; 2-2x+z	1-y; 2-y

The payoffs to the RNO are constructed in the same spirit as those for the managers, being a linear proportion of production of the privatized firm in period 2. The RNO gets 1-y if the manager stagnates no matter what happens to the manager. The manager's type makes no difference to payoffs under stagnation, nor does the new owner's decision on firing or keeping the manager (see column "stagnation" in Table 1). If the manager restructures, RNO gets 1-x if he/she fires the manager, and 1-x+z (high or low) if he/she keeps the manager after privatization.

The fact that the RNO can eliminate the manager's contribution z is the key assumption of the RNO model. The RNO decides on firing or keeping the incumbent manager based on whether the expected z of this manager exceeds 0. Note that firing the manager does not imply that restructuring has no positive effect at all, since it has still eliminated the loss from stagnation y.

Implicitly, this assumption means that the contribution of a newly hired manager from the market is normalized to 0. Assumption that $z_h > 0$ thus means that a high type incumbent manager is better than the average manager, and $z_l < 0$ means that a low type performs worse. The RNO is making his/her decision based on the expected value of z. Positive prior E(z) (based on prior probabilities) denotes that the average incumbent is better than the average outsider (e.g. due to his/her firm specific human capital); negative E(z) means that the average incumbent is worse than the outside average (e.g. because of a politically distorted selection process in SOEs).

Similarly as in the ABB model, z can have two values, z_l or z_h. The following two technical assumptions restrict the number of cases and focus the analysis on the most important ones:

A1 $z_l < 0 < z_h$ and

A2 $z_l < 2x\text{-}y \equiv \xi < z_h$.

Assumption A1 says, that in a world of complete information, the RNO will always want to keep the high type of manager. However, he/she will always want to fire the low type and replace him/her with a newly hired manager from the market whose quality is normalized to 0. Assumption A2 makes sure that in the absence of privatization, it is individually rational for the high type of manager to restructure and for the low type to stagnate. These assumptions eliminate degenerate cases where either both types should restructure or stagnate, or cases in which the RNO fires or keeps both types under full information.

In the simple version of the RNO model, privatization occurs with certainty; the ABB model predicts for this case that the manager will never restructure. Once we introduce the

rational new owner, there is a possibility that the RNO keeps the manager after privatization. The game tree shown in Figure 2 thus differs from the original ABB game tree (see Figure 1) in two respects: it does not contain the random move of the nature in the period 2 (privatization happens with certainty), but, instead, it contains a move of the RNO who decides on whether to keep or to fire the manager. The decision to fire or keep the manager is made at the beginning of period 2, so that the owner does not yet know the manager's true type. The decision is therefore based on the knowledge of:

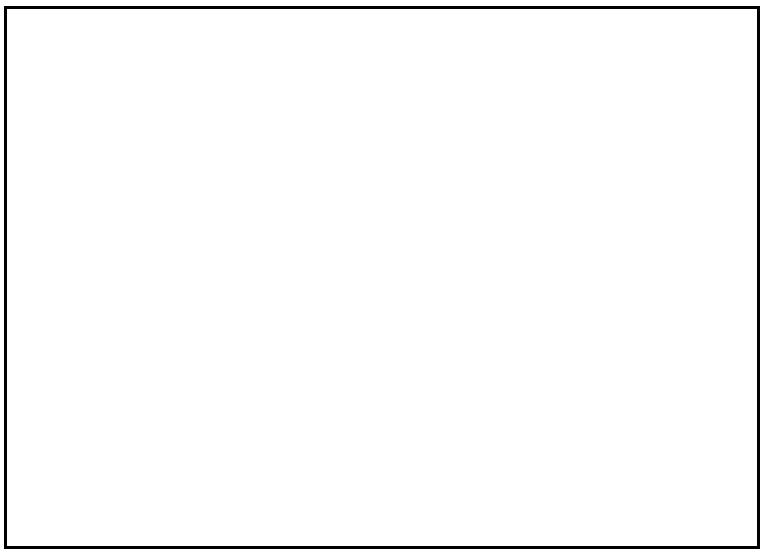

Figure 2: The RNO Model, Simple Version
M, N, r, s, p, n: see notation bellow Figure 1. New notation: NO = new owner, k - keep the manager, f - fire the manager. Payoffs to the manager and the RNO: (1) $2-2x+z_h$; $1-x+z_h$, (2) 1-x; 1-x, (3) $2-2x+z_l$; $1-x+z_l$, (4) 2-y; 1-y, (5) 1; 1-y.

(i) objective (prior) probabilities that the manager is of the high or low type, $p(z_l) = p(z_h) = ½$,[6]

(ii) whether the manager restructured or stagnated in the period 1 and

(iii) equilibrium strategies of the different types of managers.

In the RNO model, the manager (sender) signals his/her quality by restructuring or

[6]The assumptions on managers' types and their probabilities are taken from Aghion et al. (1994).

stagnating[7], and the RNO (receiver) updates his/her prior beliefs about the manager's quality according to the signals. Since the high type manager can benefit more from restructuring (in fact, within our assumptions, the low type manager can benefit from restructuring only in very limited number of situations), it is natural that, through restructuring, the high type will signal his/her high quality.[8] Within the RNO model (unlike in the generic ABB model), restructuring has two potential benefits for the manager: first, it brings him/her a proportion of restructuring gain z and eliminates the stagnation costs y if he/she retains his/her position. Second, it is a signal to the RNO of the manager's type and it can thus increase the probability that the manager is kept after privatization. This second effect, which makes the game a signalling game, is a pro-restructuring one, and occurs only with privatization. It can reduce, and in an important class of cases it fully eliminates, the anti-restructuring effect of privatization described by the ABB model.

Solution Concept for the RNO Model Equilibria

The equilibrium concept used in this paper is the Perfect Bayesian equilibrium (PBE). It is based on the same principle as the Nash equilibrium: every player chooses a strategy which maximizes his/her payoff given the strategy of all other players. The specificity of PBE is that it is used for dynamic games of incomplete information. In these games, one player (receiver) is not certain about the type of the other player (sender), and the best (maximizing) response of the receiver differs for different types of sender. The receiver knows the probability distribution of the sender's type and, moreover, he/she observes the action taken by the sender before making the decision on his/her response. Equilibrium strategies are assumed to be common knowledge. Therefore, if the receiver observes an action, which is played by at least one type of sender with a positive probability, he/she can calculate posterior probabilities using Bayes rule. If he/she observes an action which is played with probability zero by all types of the sender, i.e. if the sender deviated from his/her equilibrium strategy and chose an off-equilibrium-path action, any posterior beliefs are possible. Based on these beliefs, the receiver calculates expected payoff for

[7]The fact that the manager uses restructuring as a signal does not mean that he/she uses it as a signal only. Signalling is only one of effects of restructuring; though an extremely important one.

[8]Aghion et al. (1994) are aware that a "signalling model is natural" for modelling the decisions of the pre-privatization managers; however, they insist that their model is "a simpler way, which makes most of the points" . As it is demonstrated below, a signalling model based on similar assumptions yields the opposite results than the ABB model.

different strategies and chooses strategy which gives the maximum possible one.

The updating rule works as follows: if the equilibrium strategy of the high type of manager (sender) is to restructure, and the low type one's is to stagnate, and the RNO observes that the manager in the privatized firm did not restructure in period 1, he/she knows that the manager is of the low type with probability 1. The RNO's decision is thus made with full information about the manager's type.

If the equilibrium strategy of both types of managers is to restructure and the RNO observes restructuring, his/her prior beliefs remain unchanged. The RNO has to decide on firing or keeping the manager based on his/her prior beliefs; if $E(z) \geq 0$, the RNO will prefer to keep the incumbent manager, since by replacing him/her by a new hire he/she would lose the positive expected z, whereas if $E(z) < 0$, the RNO tries a newly hired manager and fires the incumbent one.

However, if both types should stagnate in equilibrium and the RNO observes restructuring (because of a mistake of the manager, or because of the manager's attempt to switch to another equilibrium), Bayes rule (and the concept of PBE) gives him/her no advice on what to think about the manager's type. This is important, since the RNO's off-path choices can change the manager's on path decisions substantially.[9]

Definition 1: A PBE is a set of strategies and beliefs satisfying the following conditions:

(a) the type i (i = l,h) manager's strategy (i.e. the probability that he/she restructures p_r) maximizes his/her expected payoff given the RNO's strategy (π_s and π_r):

$$p_r(z_i) \in \text{argmax } \{p_r([1-x+\pi_r(1-x+z_i)]+(1-p_r)[1+\pi_s(1-y)]\} \quad (5)$$

(b) the RNO's strategy (i.e. the probability of keeping the manager if he/she restructures (π_r) or stagnates (π_s)) maximizes the RNOs expected payoff given strategies of both types of manager:

$$\pi_r \in \text{argmax } \{\pi_r[1-x+\mu(z_h|R)z_h+\mu(z_l|R)z_l]+(1-\pi_r)(1-x)\} \text{ and}$$

$$\pi_s \in \text{argmax } \{(\pi_s(1-y)+(1-\pi_s)(1-y)\} = 1-y; \quad (6)$$

(c) the RNO's beliefs are given by Bayes rule, provided that the observed action of the manager is played with positive probability.

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[9]Other useful solution concept for the RNO model is sequential equilibrium (Kreps and Wilson, 1982). For a two period game, the sets of perfect Bayesian equilibria and sequential equilibria coincide (Fudenberg and Tirole, 1991). Our choice of PBE is given purely by its simpler definition.

$$:_i|R) = 1/2\frac{p_r(z_i)}{1/2p_r(z_l)+1/2p_r(z_h)} = \frac{p_r(z_i)}{p_r(z_l)+p_r(} \quad (7)$$

for $p_r(z_h) + p_r(z_l) > 0$ and

$$\mu(z_i|S) = \frac{1-p_r(z_i)}{[1-p_r(z_l)]+[1-p_r(z_h)]} \quad (8)$$

for $[1-p_r(z_h)] + [1-p_r(z_l)] > 0$, where $\mu(z_i|R)$ is the probability attributed by the RNO to the state when the manager who restructured is of type i, where i is either h or l. For $\mu(z_i|S)$, the probability relates to the stagnating manager.

Less formally, the RNO updates his/her beliefs so that it increases the posterior probability of types which play observed action with higher probability compared to types which play with smaller probability. The relative change of posteriors for two distinct types playing the observed action with positive probability is proportional to the relative likelihood that these types play the observed action, as it is given by their equilibrium strategies. Moreover, this updating rule excludes those types which play the observed strategy with probability zero, provided that there is at least one type playing the observed strategy with a positive probability; otherwise, the receiver can update beliefs arbitrarily. An important feature of PBE, one which makes it an equilibrium refinement concept, is that players have to optimize even at off-path nodes. However, in the RNO model this feature has only limited impact. In equilibria where nobody restructures, and the possible off-path node is achieved if the manager did restructure, both responses by the RNO can be justified by proper beliefs. Note also that the RNO is indifferent on π_s once stagnation was played; his/her payoff is 1-y in such case and is invariant in π_s.

Assumption 3:

In a non-hybrid PBE, the RNO keeps the manager if he/she is indifferent between keeping or firing the manager.

In a non-hybrid PBE, the manager restructures if he/she is indifferent between restructuring and stagnation.

Assumption 3 spares us from discussing multiplicity of equilibria which would occur at single points in the parameter space; since we are working with parameters in continuous space, the likelihood that such points are reached is zero and so is the impact of the assumption 3 on the model's practical relevance. However, its positive impact on the clarity of the model is quite

substantial.

Definition 2:

The restructuring individual rationality condition (IRC) is satisfied if and only if the manager's payoff under restructuring is higher than that under stagnation. The IRC for the high type manager is:

$$1\text{-}x+\pi_r(1\text{-}x+z_h) \geq 1+\pi_s(1\text{-}y). \quad (9)$$

The restructuring IRC for the low type is

$$1\text{-}x+\pi_r(1\text{-}x+z_l) \geq 1+\pi_s(1\text{-}y). \quad (10)$$

Stagnation IRCs are

$$1\text{-}x+\pi_r(1\text{-}x+z_h) < 1+\pi_s(1\text{-}y) \quad (11)$$

for the high type and

$$1\text{-}x+\pi_r(1\text{-}x+z_l) < 1+\pi_s(1\text{-}y) \quad (12)$$

for the low type manager.

Corollary:

The manager restructures if and only if the restructuring IRC of his/her type is satisfied. The manager stagnates if and only if the stagnation IRC of his/her type is satisfied.

The Corollary is a direct consequence of condition a) in the Definition 1 and Assumption 4. Proof is omitted for being trivial.

Equilibria of the Simple RNO Model

The simple RNO model has four types of perfect Bayesian equilibria. Three of them, separating, hybrid and restructuring pooling equilibria, contradict the predictions of the ABB model while stagnation pooling equilibria confirm them. Among the former, separating equilibria are consistent with the ABB's no-privatization case ($\lambda = 0$), in which the individual rationality of the manager coincides with social efficiency. In the other two types of equilibria, not only does the high type manager restructure with certainty, but even the low type restructures with a positive probability: hybrid equilibria and restructuring pooling equilibria. In the hybrid equilibria, the high type manager always restructures while the low type randomizes, and in the latter, both types of managers restructure with probability one. There is actually more restructuring in these equilibria than in the ABB's no-privatization case. The only type of equilibrium of the RNO model which fully supports the results of the ABB model are the

stagnation pooling equilibria[10] in which neither type of manager restructures. In these equilibria, the RNO's beliefs are such that the best response of the RNO to restructuring is to fire the manager.

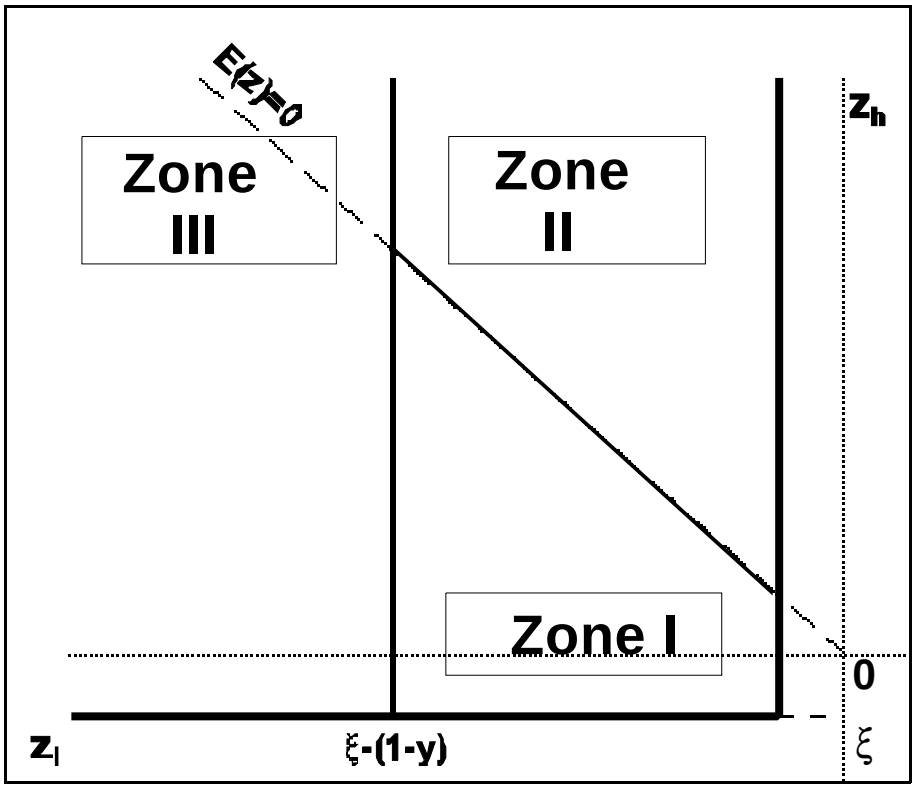

Figure 3: The Simple RNO Model Equilibria for Different Combinations of Parameters

Stagnation pooling equilibria (the ABB equilibria) and Separating equilibria exist in all three zones. In Zone III, these two are the only equilibria existing. The Zones I and II contain such combinations of parameters that the low type manager can be induced to restructure if the RNO keeps the manager who restructures and fires the stagnating manager. In the Zone I, i.e. for $E(z)<0$, hybrid equilibria are third type of existing ones, whereas in the Zone II, i.e. for $E(z)\geq 0$, restructuring pooling ones exist.

Out of these four types of equilibria, only the stagnation pooling (with the same outcome

[10]The plural used for every single type of equilibria is not used accidentally; an equilibrium is defined by a set of strategies of every player and set of beliefs of the new owner. In the RNO model, set of equilibria of certain type (separating, restructuring pooling etc.) consists from continuum of equilibria, which differ by off path actions and beliefs, and by responses to stagnation which are irrelevant to the equilibrium payoff structure for the RNO.

as the ABB model) and separating (with the same outcome as ABB's no-privatization benchmark model) exist for any combination of parameters z_h and z_l within the assumptions A1 and A2; in Figure 3, these equilibria exist in all Zones. The hybrid and restructuring pooling equilibria, in which the low type of manager restructures with a positive probability exist only if z_l is relatively close to ξ, so that the RNO can stimulate the low type manager to restructure by a feasible strategy. In particular, hybrid equilibrium exists in Zone I (since the average incumbent manager brings to the RNO a negative expected z, he/she would be fired for sure unless the low type randomizes), and restructuring pooling equilibrium exists in Zone II because the expected z is positive and the RNO keeps the manager in spite of knowing that he/she may be the low type.

To summarize, there are three important sets of combinations of parameters z_l and z_h within which there exist different sets of possible equilibria (see Figure 2):

Zone I: z_l is close enough to ξ, so that the low type may restructure if he/she is stimulated to do so. On average, incumbent managers' quality is low enough that the RNO would fire the manager who restructures in a restructuring equilibrium. The upper limit of the Zone is the 45° line; at this line $z_l = z_h$; given the ABB's assumption on prior probabilities, this gives E(z) equal to zero. For combinations of z_l and z_h below it, $E(z) < 0$ and the RNO fires the restructuring incumbent unless the low type randomizes. For parameters within this zone, stagnation pooling, separating and hybrid equilibria exist.

Zone II: z_l is close enough to ξ and the average quality of the incumbent manager is high enough (combination of z_l and z_h above the 45° line) so that the RNO keeps the manager who restructures in a restructuring pooling equilibrium. In Zone II stagnation pooling, separating and restructuring pooling equilibria exist.

Zone III: z_l is so low that the low type manager never restructures. Therefore, the only existing equilibria in this zone are stagnation pooling and separating.

Separating equilibria

In a separating equilibrium, each type of manager chooses the opposite pre-privatization action. Consequently, in the separating equilibria the signalling effect is the strongest one: observing the action taken by the manager in period one, the RNO learns the manager's type and makes his/her decision on firing or keeping the manager with full information.

Definition 3:

Separating equilibria are PBE in which the good manager restructures and the poor manager

stagnates.

In a separating equilibrium, the RNO knows that the manager who restructures is of high type and the one who stagnates is of the low type. From the Definition 1, RNO's posterior beliefs are fully underpinned by Bayes rule since both actions are observed with positive probability. Solving equations (7) and (8) for $p_r(z_h) = 1$ and $p_r(z_l) = 0$ yields $\mu(z_h|R) = 1$ and $\mu(z_l|S) = 1$; common sense does the same faster. As a result, the RNO will never fire a manager who restructures, since, in a separating equilibrium, such a manager is certainly of high quality. Separating equilibrium thus reveals all information and, moreover, generates the socially efficient result which ABB obtain only in the absence of privatization.

Proposition 1:

If assumptions A1 and A2 are satisfied, the RNO has a separating equilibrium.

Proof:

If the high type manager restructures with probability 1 and the low type restructures with probability 0, new owner's beliefs are determined by (7):

$$\mu(z_h/R) = .5[1/(.5) = 1; \qquad (13)$$

according to (6), the RNO has to choose $\pi_r = 1$ by assumption A1. From (6), it is also clear that any π_s is optimal. Assume that the RNO plays $\pi_s = 1$; in such case, the RNO keeps the manager whether he/she restructured or not.

The high type will restructure (5) is maximized for probability of restructuring equal to 1, i.e. if the his/her restructuring IRC (9) is satisfied. After substitution of the optimal strategies of the RNO, we get

$$2\text{-}2x+z_h \geq 2\text{-}y. \qquad (9^a)$$

Note that (9^a) is equivalent to (4) of the ABB's no-privatization case, and, after rearranging, it yields the condition (4), namely $z_h \geq 2x\text{-}y \equiv \xi$. This is satisfied by assumption A2.

The low type will stagnate provided that his/her restructuring IRC (12) is satisfied. After the same substitution and rearranging, (12) is reduced to $z_l < 2x\text{-}y \equiv \xi$, which is satisfied by assumption A2.

Q.E.D.

The only complication connected with the separating equilibria is that the low type has to stagnate. For z_l very small (i.e. for low type of manager producing sizeable negative personal contribution), this is not a problem: even the strongest incentive does not force him/her to restructure. This is true for any combination of z_l and z_h which occurs in the Zone III of Figure

3.

The intuitive reason why the RNO wants the low type manager not to restructure is obvious: the RNO does not want to suffer the damage caused by low type's negative z_l. The way the RNO achieves this goal, i.e. keeping the manager who stagnated is not very intuitive and, indeed, it is more a property of the model than a feature transplanted into the model from the real world. There are two reasons why such a strategy is an equilibrium strategy:

a) the model has just two periods. Once the manager stagnates in period 1, there is no reason to restructure in period 2, since there is no period 3 in which this restructuring would yield its benefits. In a multi-period model, the RNO would fire the low type manager and hire another one to restructure with one period delay, and

b) the payoff to the RNO is invariant to the manager's type and to whether the manager was fired or kept after privatization.

Both of these features of the model are not realistic. There are two reasons why not to build a more complex and realistic model not based on these simplifying assumptions. The simple model is fully comparable with the ABB model. Moreover, the most important result of the RNO model, the existence of the separating equilibria along with the stagnation pooling equilibria, would remain unaffected.

Lemma 1:

For $z_l < \xi-(1-y) = 2x-1$ the low type manager never restructures.

Proof:

Provided that the new owner keeps any manager who restructures, the low type should restructure if the following restructuring IRC holds

$$2-2x+z_l \geq 1+\pi_s(1-y). \qquad (14)$$

By assumption, $z_l < 2x-1$. This implies that $2-2x+z_l < 2-2x+(2x-1) = 1$; but since $\pi_s \in (0,1)$ and $y \in (0,1)$, $1+\pi_s(1-y) \geq 1$ and thus (14) is never satisfied and the low type never restructures.

Q.E.D.

For z_l higher (smaller in absolute value), the RNO's strategy of keeping the manager who restructures may attract the low type provided that the RNO's strategy is to fire the manager who stagnates. The RNO has to stimulate the low type manager not to restructure by giving him/her high enough chance to preserve the job after privatization even if the manager stagnates.

Lemma 2:

For $z_l > 2x-1$, the response of the RNO to stagnation consistent with separating equilibrium

satisfies

$$\pi_s > \frac{1-2x+z_l}{1-y}. \qquad (15)$$

Proof:

The low type stagnates in a separating equilibrium if (12) is satisfied for $\pi_r = 1$*:*

$$2-2x+z_l < 1+\pi_s(1-y). \qquad (12^a)$$

For the RHS of (12[a]), given that π_s *satisfies (15), the following inequality holds:*

$$1+\pi_s(1-y) > 1+[(1-2x+z_l)/(1-y)].(1-y) = 2-2x+z_l, \qquad (12^b)$$

which is nothing else then (12[a]). *Q.E.D.*

Restructuring pooling and Hybrid equilibria

The model gets more complicated when the low type of manager is not low enough (with z_l sufficiently close to ξ, i.e. in the Zones I and II) to keep him/her with stagnation strategy under any circumstances. If the RNO keeps the manager who did restructure (plays $\pi_r = 1$), as he/she does in separating equilibria, he/she can attract the low type manager to restructure as well.

This will never happen if the RNO keeps the manager who stagnates. However, by a threat that he/she will fire the manager who stagnates, i.e if the RNO plays π_s either equal to 0 or small enough to break (15) and thus the stagnation IRC for the low type, the bad manager chooses to restructure.[11]

Once the strategy of both types is the same, restructuring does not give the RNO any new information on the manager's type and his/her prior beliefs remain unchanged as posterior beliefs[12]. If the average quality of the incumbent manager is higher than that of an average outsider, i.e. if $E(z) \geq 0$ (parameters z_l and z_h within the Zone II), the fact that even the low type manager restructures does not change the optimal response of the RNO to restructuring. By firing the incumbent he/she would lose positive E(z) and thus he/she would rather keep the manager, in spite of the risk that the manager may be of low quality and restructuring pooling equilibrium prevails.

Definition 4:

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[11] If the new owner plays $\pi_s = 0$, the costs of stagnation y are increased by the foregone payoff in period 2, which are equal to 1-y; total costs of stagnation are thus equal to 1.

[12] PBE constraints equilibrium beliefs; since restructuring is played by both types with probability one, Bayes rule fully determines the RNO's beliefs.

Restructuring pooling equilibria are PBE in which both types of managers restructure.

Proposition 3:

Assume that A1 and A2 are satisfied. The RNO model has a restructuring pooling equilibrium, such that the high type of the manager restructures with probability 1 and the low type randomizes if and only if

(i) $E(z) \geq 0$ and

(ii) $z_l \geq \xi-(1-y) = 2x-1$.

Proof:

a) sufficient condition for existence

If (i) is satisfied and both types of manager restructure in the equilibrium, the RNO will keep the manager - $\pi_r = 1$ satisfies condition (b), provided that his/her beliefs are formed according to Bayes rule (c).

If z_l is high enough that (ii) is satisfied, and the RNO's strategy is such that $\pi_s = 1$ (which is consistent with the conditions (b) on the RNO's equilibrium behavior from Definition 1 of PBE, since the RNO gets the same payoff under stagnation without respect to whether he/she fires the manager), the IRC for restructuring of the low type of manager becomes

$$2-2x+z_l \geq 2-y; \qquad (10^a)$$

but since (ii) is satisfied,

$$2-2x+z_l \geq 2-2x+2x-y = 2-y \qquad (10^b)$$

which assures that for a sufficiently high π_s, the low type's IRC is satisfied and thus restructuring pooling PBE exists.

b) Necessary condition for existence

Assume that (i) is not satisfied. The RNO's best response to restructuring is then to fire the manager who restructures, i.e. $\pi_r = 0$. However, both types' restructuring IRC than becomes

$$1-x > 1+\pi_s(1-y); \qquad (9^c)$$

and, since π_s and y are from the interval [0;1], this is never satisfied and both the types of manager choose to stagnate.

Assume that (ii) is not satisfied and that $z_l < 2x-1$. Because of assumption (i), the RNO will keep the restructuring manager and thus play $\pi_r = 1$; and let us assume that the RNO plays the most anti-stagnation strategy, namely $\pi_s = 0$ (the manager gets fired if he/she stagnates). The restructuring IRC of the low type is then

$$2-2x+z_l \geq 1; \qquad (10^d)$$

but since $z_l < 2x-1$, the LHS $2-2x+z_l$ is strictly less than one and the IRC (10^d) can not be satisfied. *Q.E.D.*

Lemma 3:

In a restructuring pooling equilibrium, the RNO's response to stagnation has to satisfy

$$\pi_s \leq \frac{1-2x+z_l}{1-y}. \qquad (16)$$

Proof:

Assume it does not. Then the low type's payoff will be

$$1+\pi_s(1-y) > 1+\frac{1-2x+z_l}{1-y}(1-y) = 2-2x+z_l; \qquad (12^a)$$

which is (as the number of the expression indicates) nothing else than the low type's stagnation IRC. The low type will thus not restructure.

Q.E.D.

For z_l sufficiently close to ξ but average quality of the incumbent manager too low, so that $E(z) < 0$ (i.e. for parameters within the Zone I), restructuring pooling fails to exist. In a restructuring pooling equilibrium, the posterior expected value of z is unchanged from the prior one. Since $E(z) < 0$, the best response of the new owner to restructuring is to fire the manager. However, for $\pi_r = 0$, the low type of manager will not restructure, and the RNO will be again interested in keeping the manager who restructures - provided that there is a good chance he/she is a good one. The conflict between the low type's willingness to restructure if the RNO keeps the restructuring manager, and the RNO's willingness to keep the high type but fire the low type manager is just balanced in a hybrid equilibrium.

Definition 5:

Hybrid equilibria are PBE in which the good manager always restructures and the poor manager randomizes between restructuring and stagnation.

The purpose of this randomization is to make the low-type manager indifferent between restructuring and stagnation and the RNO indifferent between keeping or firing the restructuring manager. Only in such a case, if both the RNO and the low type of the manager get the same payoff without respect to what action they will take, we can possibly see randomization.

Lemma 4:

In a hybrid equilibrium of the RNO game, the new owner keeps the manager who restructures with a probability satisfying

$$\pi_r = \frac{x+\pi_s(1-y)}{1-x+z_l} \qquad (17)$$

and the stagnating manager with a probability given by (16); the low type of manager restructures with a probability

$$p_r(z_l) = - z_h/z_l. \qquad (18)$$

Proof:

The RNO randomizes between firing and keeping the manager only if E(z|R) = 0:[13]

$$E(z|R) = \mu(z_l|R)z_l + [1-\mu(z_l|R)]z_h = 0; \qquad (19)$$

Since both actions of the manager, restructuring and stagnation, are observed with a positive probability, $\mu(z_l|R)$ is given by Bayes rule; plugging it into (19), we get:

$$\mu(z_l|R)z_h + \mu(z_l|R)z_l = \frac{1}{p_r(z_l)+1}z_h + \frac{p_r(z_l)}{p_r(z_l)+1}z_l \qquad (20)$$

Multiplying (20) by $p_r(z_l)+1$ and dividing by z_h, we obtain (17).

The condition (16) restricting π_s assures that π_r as prescribed by (17) is from the interval [0,1]. For π_s less than specified by (16), (17) results in $\pi_r > 1$ which is not feasible. Economically it means that the low type will never restructure unless (16) holds, which is proven in the Lemma 2.

The manager randomizes between restructuring and stagnation only if the RNO's randomization between keeping and firing the manager makes the manager indifferent between the two actions. His/her IRC (10) has to be satisfied with equality:

$$1-x+\pi_r(1-x+z_l) = 1+\pi_s(1-y). \qquad (10^e)$$

Subtracting 1-x from both sides and dividing by $(1-x+z_l)$, we obtain (19). *Q.E.D.*

Any deviation from these mixed strategies causes a collapse of the hybrid equilibrium: if the poor manager restructures with higher probability than prescribed by (20), the RNO's

[13] I am fully aware of the limited intuitive appeal of mixed equilibria in one shot games. However, for certain ranges of parameters (for $2x-y < z_l < (2-\lambda)x/(1-\lambda)$, no other equilibrium than hybrid exists. This range is not analyzed in this paper (because of assumption A2).

posterior expected z becomes negative and hence the manager is fired. On the other hand, if the RNO chooses different combination of π_s and π_r, the low-type manager either always stagnates or always restructures.

Proposition 3:

Assume that A1 and A2 are satisfied. The RNO model has a Hybrid equilibrium, such that the high type of the manager restructures with probability 1 and the low type randomizes if and only if

(i) $E(z) < 0$ and

(ii) $z_l \geq \xi-(1-y) = 2x-1$.

Proof:

a) sufficient condition for existence

If (i) is satisfied and the low type manager randomizes between stagnation and restructuring as prescribed by (17), and the high type restructures for sure, the RNO's posterior beliefs are fully underpinned by Bayes law. His/her posterior E(z/R) = 0 (see equation (20), and thus the RNO is indifferent between firing and keeping the manager; any randomized strategy is thus compatible with condition (b) of the Definition 1 of PBE.

Condition (ii) assures that the low type can be stimulated to restructure with positive probability. If the RNO randomizes according to equation (17), the low type's restructuring IRC will be satisfied as an equality:

$$1-x+\frac{x+\Pi_s(1-y)}{1-x+z_l}(1-x+z_l) = 1+\Pi_s(1-y). \qquad (10^f)$$

For $\pi_s = 0$, condition (ii) assures that (10^f) is well defined and that $\pi_r \in [0,1]$. Since the low type's IRC is satisfied as an equality, any randomized strategy is optimal for the low type manager. Since the stagnation IRC is satisfied with equality, the high type's restructuring IRC is satisfied since

$$1-x+\pi_r(1-x+z_h) > 1-x+\pi_r(1-x+z_l) \qquad (21)$$

by assumption A1; hybrid PBE thus exists.

b) Necessary condition for existence

Assume that (i) is not satisfied and that the high type restructures with certainty and the low type randomizes. The RNO's E(z/R) will be higher than E(z) (this is given by Bayes rule) and his/her best response to restructuring is then to keep the manager who restructures. i.e. $\pi_r = 1$. However,

since low type's restructuring IRC was satisfied with equality, it will be satisfied with inequality for $\pi_r = 1$*:*

$$2\text{-}2x+z_l > 1\text{-}x+\pi_r(1\text{-}x+z_l) = 1+\pi_s(1\text{-}y). \qquad (10^g)$$

The low type will restructure with certainty in such a case and the hybrid equilibrium collapses. Assume that (ii) is not satisfied and that $z_l < 2x\text{-}1$*. From the Lemma 1 we know that the low type manager with* $z_l < 2x\text{-}1$ *never restructures since his/her stagnation IRC is satisfied for every combination of* π_s *and* π_r*; the low type will thus never randomize.* *Q.E.D.*

Stagnation pooling equilibria

An important set of equilibria of the RNO model are the separating equilibria. Separating equilibria in the simple version fully support the prediction of the ABB model. Moreover, separating equilibria in the simple RNO model always exist (see Proposition 4). However, as it will be shown below, they exist only for a very special state of mind of the new owner.

Definition 6:

Stagnation pooling equilibria are PBE in which both types of managers stagnate.

Proposition 4:

If assumptions A1 and A2 are satisfied, the RNO has a stagnating pooling equilibrium.

Proof:

According to Definition 6, no type of manager restructures in a stagnation pooling equilibrium. Definition 1 of the PBE imposes no restriction on the RNO's beliefs if restructuring is observed. Let the RNO's beliefs be such that

$$\mu(z_l/R) = 1; \qquad (22)$$

but then the new owner's $E(z/R) = z_l < 0$ *by assumption A2. The RNO's best response to restructuring is thus* $\pi_r = 0$*. The manager's IRC for restructuring is then*

$$1\text{-}x \geq 1+\pi_s(1\text{-}y). \qquad (23)$$

Since both $\pi_s \in (0,1)$ *and* $y \in (0,1)$*,* $1+\pi_s(1\text{-}y) \geq 1 > 1\text{-}x$ *and the IRC (23) is never satisfied; the high type manager thus never restructures. (23) holds for the low type as well, so that no manager restructures and stagnation pooling equilibrium prevails.* *Q.E.D.*

The key to understanding stagnation pooling equilibria is the RNO's response to deviation (i.e. restructuring) by firing the manager. The RNO has to believe that the manager who restructured is the low type, or, at least that he/she is the low type with sufficiently high probability (see Lemma 5 for details). Since restructuring is an off-path action, any posteriors are

possible under PBE.

Lemma 5:

In a stagnation pooling equilibrium, the RNO's posterior beliefs after he/she observed that the manager restructures have to satisfy

$$\mu(z_l|R) > - z_h/(z_l-z_h). \quad (24)$$

Proof:

The RNO's posterior expected payoff is 1-x+E(z|R). If the posterior expected value of z, E(z|R) is positive, the RNO should keep the manager; if it is negative, he/she should fire the manager. The posterior beliefs consistent with stagnation pooling equilibria are such that:

$$E(z|R) = \mu(z_l|R)z_l + \mu(z_h|R)z_h < 0. \quad (25)$$

The belief that the manager who restructures is with a high probability the low type does not violate condition c) of the definition of PBE; but it is still quite an awkward one. Clearly, the high type can easily benefit from restructuring, provided that the RNO changes his/her strategy and keeps the restructuring manager. For the low type manager, this is either impossible (for parameters in the Zone III), or at least far less likely.

For $E(z) \geq 0$, the updating rule which generates beliefs described in Lemma 5 has to be quite perverse: the RNO has to strictly increase his/her subjective probability that the restructuring is of the low type compared to prior beliefs. Such an updating rule is highly pessimistic. It's only possible rationalization is the following: "Everybody knows that the RNO fires the manager who restructures. The best response to this strategy for the manager (of both types) is to stagnate. If the RNO observes the manager deviating from the equilibrium and restructuring instead of stagnating, he/she takes it as a proof of low type's incompetence (lack of ability to play the equilibrium strategy) and fires the manager".[14]

For $E(z) < 0$, firing the manager is intuitively more acceptable, since firing the manager is the optimal strategy even for the prior beliefs. Since the RNO learns nothing about the manager's type using Bayes rule, it seems quite legitimate that the RNO does not change his/her beliefs from the prior ones. To keep the manager, the RNO would have to update his/her beliefs in an optimistic way, so that the opposite of (25) is satisfied.

Once the RNO's strategy is to fire the manager who did restructure, both good and bad managers will stagnate; the stagnation IRC (11) and (12) are satisfied for any possible reply of

[14]However, this rationalization seems to be quite weak, especially in comparison with the cui bono reasoning, based on comparing who is more likely to gain from the deviation.

the RNO to stagnation π_s. However, firing the manager who restructures is possible only in the case of the pessimistic (or non-optimistic) beliefs described in the previous paragraph. These are feasible only because in a stagnation pooling equilibrium restructuring is an off-path action which is never observed if everybody keeps his/her equilibrium strategy. Thus the PBE concept imposes no restriction on the RNO's beliefs.

Summary of the section

Introducing signalling into the privatization and restructuring game has a major impact on the predicted outcomes of the model. Whereas the ABB model predicts that privatization (if perceived by the management as unavoidable) stops all restructuring, the RNO model shows that other equilibria not only restore the no-privatization paradise in which managers restructure if it is socially optimal (separating equilibria), but that the signalling effect may cause even the low type managers, who should not restructure from the point of view of social optimality, to restructure in order to improve their chances of retaining their positions after privatization. The results of the ABB model are also supported by perfect Bayesian equilibria in the RNO model; however, they sustain only for a very special state of mind of the RNO which I call (for $E(z) \geq 0$) pessimistic beliefs.[15] As it is demonstrated in section 6, these special conditions are very restrictive and their satisfaction is in reality quite unlikely.

4. Competition among Privatizers as a Tool of Equilibrium Selection in the RNO Model

The RNO model gives quite interesting results; however, as with many other signalling models, suffers from a multiplicity of equilibria. Even worse, outcomes of these different equilibria give opposite answers to the main question this paper deals with. The stagnation pooling equilibria support the ABB hypothesis, separating equilibria support the outcome which is used as a benchmark of social efficiency in the ABB model, whereas hybrid and restructuring pooling equilibria support another hypothesis, namely that the signalling effect can cause excessive restructuring compared to a socially efficient outcome. A natural question at this point: why would one trust one set of equilibria more than other?

Quite a strong argument can be made to eliminate the multiplicity of equilibria if privatization takes place in a competitive environment. If at least some of the competing privatization bidders (potential future RNOs) play the equilibria with higher payoffs, one should expect that these bidders are more likely to become the new owners than those playing equilibria

[15]These results hold also for the generalized RNO model with probability of restructuring between 0 and 1 and for z_l and z_h beyond assumptions A1 and A2.

with lower payoffs. The rationale for this is that the former bidders will submit higher bids than the latter ones, since the privatized firm will bring them higher profits and thus has a higher net present value. The managers (provided that they are aware of the competitive nature of the privatization process) will therefore play the equilibria with higher payoffs as well.[16]

This idea can be illustrated in an even simpler version of the RNO model based on the following assumptions (which apply for this paragraph only): there is only one type of the manager. The payoff matrix of the simple game is:

$$\begin{array}{lcc} & \text{fire} & \text{keep} \\ \text{stagnate} & .5;\,0 & 0;0 \\ \text{restructure} & 0;.5 & 1;1 \end{array}. \qquad (26)$$

This game has two Nash equilibria (there is no information asymmetry which would force us to use PBE). One is stagnate and fire, under which the manager gets .5 (he/she saved the costs of restructuring in the period 1) and the RNO gets nothing. Other is restructure and keep, in which both RNO and the manager get 1, since restructuring was allowed to bring its benefit; by firing the manager who did restructure, the RNO would lose the manager's contribution z. The competitiveness argument made above claims, that if there are many potential RNOs competing for privatizing the firm, those of them playing the stagnate-fire equilibrium will bid less than those playing restructure-keep equilibrium. E.g. for a second price sealed bid auction, the former type of RNO will bid 0 whereas the latter will bid 1 and will clearly win the auction. Since the managers are aware of the competitive nature of privatization, they expect that the restructure-keep equilibrium will be played after privatization and therefore they chose to restructure prior to privatization.

The general RNO model is slightly more complicated than that described above, but the principle remains. We have to compare the RNO's payoff under different equilibria; the competitiveness argument implies that the equilibrium with the higher payoff will prevail.

Payoff for the RNO under stagnation pooling equilibrium is 1-y, since both managers stagnate with probability 1. Under separating equilibrium, the high type, who occurs with probability ½, restructures and the RNO's payoff is then $1-x+z_h$, whereas the low type stagnates with payoff 1-y; the expected payoff to the RNO is thus $\frac{1}{2}(1-x+z_h)+\frac{1}{2}(1-y)$. Under hybrid equilibrium (which exists for $E(z) < 0$), the high type restructures and the low type randomizes;

[16]Identical reasoning was used in Rotschild and Stiglitz' (1976) article on insurance markets.

the expected payoff of the RNO is

$$½(1-x+\pi_r z_h) + ½(-z_h/z_l(1-x+\pi_r z_l) + ½(1+z_h/z_l)(1-y) =$$
$$= ½(1-z_h/z_l)(1-x) + ½(1+z_h/z_l)(1-y); \quad (27)$$

apparently, the expected payoff of the RNO is a convex combination of a restructuring pooling equilibrium such that the RNO fires the manager. The z_h and z_l have disappeared from the payoff under restructuring because of the low type's randomization. Restructuring pooling, which exists only for $E(z) \geq 0$, gives the new owner expected payoff equal to $1-x+E(z)$.

Table 2: Expected Payoff to the RNO under Different Equilibria

Type of Equilibrium	Expected Payoff to the RNO
Stagnation pooling	$1-y$
Separating	$½(1-x+z_h)+½(1-y)$
Restructuring pooling	$1-x+E(z)$
Hybrid	$½(1-z_h/z_l)(1-x)+½(1+z_h/z_l)(1-y)$

Given the payoff structure for the RNO (see Table 2), we can analyze which equilibria will eliminate all the others in a competitive privatization process:

a) <u>separating equilibrium will always eliminate stagnation pooling.</u> Separating equilibria give the RNO higher payoff than stagnation pooling equilibria if

$$½(1-x+z_h)+½(1-y) > 1-y; \quad (28)$$

solving the inequality (28) for z_h, we obtain

$$z_h > x-y. \quad (29)$$

But since $z_h \geq \xi \equiv 2x-y$ by assumption A2, and since x is positive, $2x-y > x-y$, the RNOs playing separating equilibrium will always get a higher payoff than those playing stagnation pooling. The ABB result will therefore never prevail if the competitiveness argument applies.

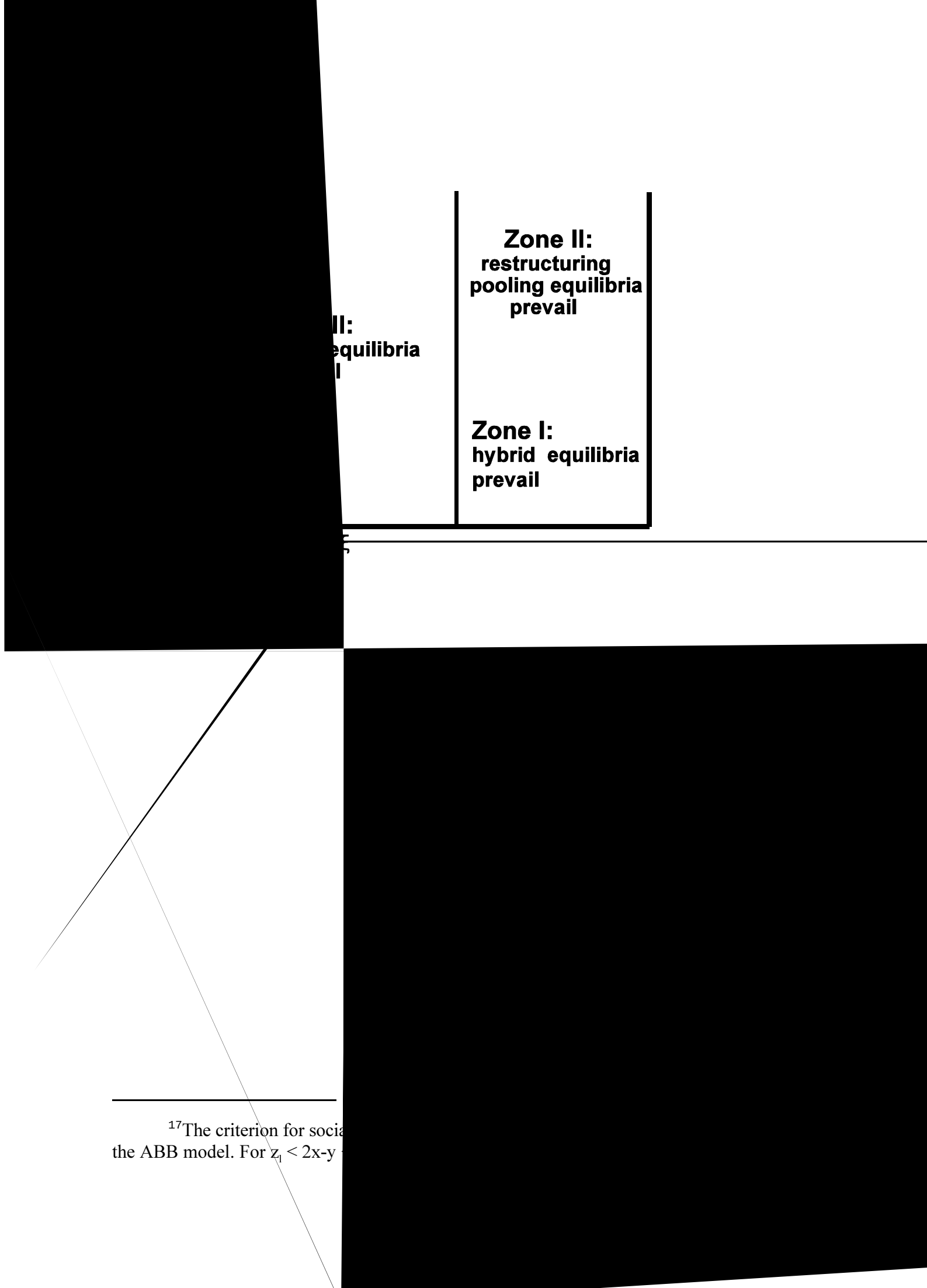
b) <u>separating equilibria eliminate restructuring pooling and hybrid equilibria if $z_l < x-y$.</u> Separating equilibria give the RNO a higher payoff than restructuring pooling ones if

$$½(1-x+z_h) + ½(1-y) > ½(1-x+z_h) + ½(1-x+z_l) \quad (30)$$

which is equivalent to

$$z_l < x-y. \quad (31)$$

This is clearly feasible within our assumption, but, on the other hand, so is the opposite:



[17]The criterion for socia
the ABB model. For $z_l < 2x-y$

the payoff of the rational RNO depends on the second period production of the privatized firm. Since costs of restructuring are paid in both periods, whereas losses from stagnation are concentrated in second period, the RNO disregards first period costs of restructuring and prefers excessive restructuring.

5. Privatization and Restructuring

The key result of the rational RNO model is that it shows that the signalling effect offsets the anti-restructuring effect of privatization described in Aghion et al. (1994). Results of the ABB model survive as perfect Bayesian equilibria even in the presence of signalling, but are extremely vulnerable to equilibrium refinement as well as to argument based on competition among bidders.

The most robust equilibria of the RNO model seem to be the separating equilibria. These equilibria, the outcome of which are identical with the outcome of the no-privatization socially optimal benchmark model of ABB, implies that restructuring is privatization neutral. The other two equilibria which can prevail in a competitive environment are the restructuring pooling and hybrid equilibria. In both of these, privatization is restructuring friendly, since the more likely privatization is, the stronger is the threat that stagnation will be punished by firing the manager. It should be noted that both of these equilibria contain excessive restructuring.

Of course, there are cases when we can expect that the incumbent manager will be fired after privatization even if the new owner is rational. In particular, takeovers done by foreign companies from the same industry do very often end up with a change of management, or, at least, in substantial reduction of incumbent managers' power and shifting the power to the foreign company. Within our model, such a type of a new owner would have some special return from firing the incumbent manager. The probability that the SOE will be sold to such a new owner would then have to be treated differently - its effects would be similar to those of privatization under ABB model.

Even in such cases, the "no future" assumption on the manager's post privatization role seems to be quite strong. In the Czech Republic, direct sales to the foreign owner were mostly proposed by the incumbent managers[18] - if their assessment of a post privatization career under

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and the low type is fired after restructuring. With incomplete information this first best solution is not achievable.

[18]See Kotrba (1995).

new owners was as disastrous as suggested by ABB, they would hardly cooperate on the sale of "their" SOEs to foreign partners.

On the other hand, privatization schemes based on employee/management ownership (such as the Russian one), imply entirely different principal agent problems than that analyzed in Aghion et al. (1994) and this paper. Instead of fears of the future after privatization, managers will adjust the pre-privatization behavior of their firms with the goal of privatizing their SOEs under the best possible conditions - i.e. they will try to deter competing bidders.[19]

6. Conclusions

The most important result of the paper is that it proves that the signalling effect of restructuring may reduce, or even fully eliminate, the anti-restructuring effect of privatization as analyzed by Aghion et al. This does not mean that the pre-privatization period, in which the manager knows that privatization will take place, has necessarily a stimulating effect on restructuring. In addition to reasons analyzed within the RNO model (i.e. that the manager is of low quality), several other factors may hinder restructuring in this period. Namely, the manager may perform weaker to deter other bidders in the case that insider privatization is allowed in competition with an outsider privatization. Moreover, preparing the privatization transaction demands a lot of effort from the management, so that restructuring may be delayed simply because of the usage of human capital for the privatization transaction. This is, however, not an argument against privatization, but for high speed of it.

In spite of the generality of the RNO model, we can draw some policy relevant conclusions from it. The first, quite unambiguous one is that pre-privatization policy towards management matters. By firing at least the worst managers (given the knowledge that the government has as pre-privatization owner), even if it considers immediate privatization, the state can improve the average quality of incumbent managers. As we have seen above, for very low average quality incumbent managers, the arguments that the socially optimal combination of equilibria will prevail are rather strong.[20]

The RNO model shows that in some cases, excessive restructuring may be a source of social inefficiency. Excessive restructuring is - from a practical point of view - hardly the major

[19]For analysis of insider privatization see Cornelli and Li (1995) and Blanchard and Aghion (1995). For descriptive study of the Russian case see Boycko et al. (1994) or Bornstein (1994).

[20]With the exception of the "excessive restructuring" equilibria.

problem. The RNO model exhibits excessive restructuring only due to the fact that payoff to the new owner do not reflect the costs of restructuring incurred in period one and are thus irrelevant to the new owner. Once the pre-privatization costs of restructuring are transferred to the new owner, this inefficiency may be eliminated by competition among privatizers. This can be realized by discounts from the purchasing price for un-restructured firms (which contradicts e.g. the common practice in the Czech Republic, where the purchasing price was based on the so called book value.)

The privatization and restructuring game with a rational new owner (RNO model) has multiple equilibria which can deviate from the socially optimal (or at least best possible) outcome in two different ways: there can be both excess and insufficient restructuring. However, the equilibria suggesting that insufficient restructuring is the major problem seem to be quite fragile. This is particularly true for economies where the pre-privatization managers are on average of higher quality than outsiders taken from the market for managers.

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