Privatization and Restructuring: An Incomplete – Contract Approach

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Abstract

This paper deals with a special hold-up problem in privatization. Since the enterprise, which is to be privatized, has to be restructured in a situation of uncertainty and the restructuring investments are sunk when the final decision on the sale price is taken in renegotiations, there is an imminent danger that restructuring is not done on an efficient scale, and there is underinvestment. We consider, in turn, restructuring by the private buyer of the firm, by a government privatization agency, and by both. We show that in the first two cases — one–sided restructuring — a first best can be achieved. In the case of both–sided restructuring, however, the first best cannot be reached if both parties engage in restructuring after signing the contract.

Summary

This paper deals with restructuring and privatization of industrial enterprises in a transition economy. As was the case in East Germany, a government privatization agency sells the firms to private investors on the basis of bilateral negotiations. Since the government wants to privatize quickly, the contract between agency and investor is signed before the net value of the firm is known. The firm's value, moreover, depends decisively on how much has been invested in restructuring the firm in question. The net value of the firm and the restructuring investments are not verifiable before a court, hence only an incomplete contract can be written at the ex–ante stage.

Any form of policy advice in such a situation has to find answers to the following questions: should it be the government which restructures or the private buyer? Or should both share in the task of restructuring? What is the best sequencing of restructuring and privatization? These questions are addressed in the present paper and the answers are as follows: efficient restructuring can be guaranteed if only one party is responsible for restructuring: The private buyer can be induced to efficient restructuring by the choice of a lump–sum payment which is to be paid regardless of whether the firm is privatized or not. The privatization agency will restructure efficiently if the sale price is chosen fairly high and then renegotiated down to such an extent that the private buyer of the firm is just indifferent between buying the firm and not buying.

Unfortunately, if both privatization agency and buyer restructure after a contract has been written, at least one agent will always underinvest. However, if the privatization agency restructures before a contract is written, it correctly anticipates that it can induce the first–best setting of the buyer's restructuring and itself also chooses a first–best restructuring level.

1 Introduction

One of the main problems of privatization in transition economies is the non–viability of many industrial firms which are to be privatized: unless the firm is restructured, it should be closed down because it is not worthwhile to run the firm in a market–economic environment. Now consider the privatization of a single enterprise which can be made viable by appropriate restructuring activities. This raises the following questions: should it be the government which restructures or the private buyer? Or should both share in the task of restructuring? And if so, in which way should they share in this task? Moreover: what is the best sequencing of restructuring and privatization? These questions are addressed in the present paper.

Let us assume that for political reasons the government wants to privatize quickly. This makes it impossible to wait until the value of the firm is precisely known. At least part of the restructuring must be performed under a veil of uncertainty. These restructuring efforts of the government or of the private buyer are faced with a hold–up problem. Restructuring is firm–specific: it refers to the particular firm in question and cannot be resold to anybody else. Hence the restructuring investments have the same properties as the relationship–specific investments in the Williamson (1985) setting. Restructuring efforts are non–verifiable before a court. Moreover, the privatization contract cannot be made contingent on the value of the firm. At the moment of contracting, there is simply too much uncertainty about this value. Therefore, only an incomplete contract can be written at the ex–ante stage. The Williamson–type hold–up problem arises because the division of net surplus from the sale of the firm cannot be fixed ex ante and the contracting parties cannot be prevented from renegotiating the initial contract terms when the value of the firm finally has become known. At the moment of renegotiation, the restructuring costs are sunk; hence, they do not influence the division of the net surplus from privatization. The parties anticipate that their restructuring efforts will not be rewarded at the renegotiation stage and underinvest.

The hold–up problem in incomplete contracts has recently been addressed by quite a few excellent papers. Hart and Moore (1988) developed a formal framework of the problem in a model where one unit of a homogeneous good may be traded between a private seller and a private buyer who both engage in relationship–specific investments prior to the production of the good. Hart and Moore assume at–will contracts. This means that, in case of legal disputes between the parties, the court is unable to decide which party is responsible for an eventual breach of the initial contract. Accordingly, the inclusion of breach penalties into the initial contract is unfeasible; the completion of the project after the initial innovation phase is a voluntary decision of both agents. In this setting, Hart and Moore proved that there is no solution to the hold–up problem: there will always be underinvestment in the relationship–specific efforts. It is impossible in their model to achieve the first best, except in some singular cases. Further papers like Chung (1991), Aghion–Dewatripont–Rey (1994) and Nöldeke–Schmidt (1995) switched from the Hart–Moore setting to 'specific performance contracts' or to option contracts, respectively, and showed that then the first best can be achieved.

All of these papers deal with private trade[1] where a private seller and a private buyer enter a long–run relationship which consists of an innovation stage and a production stage. In the present paper this setting is transferred to privatization. The innovation stage is identified with restructuring under uncertainty, the production stage is identified with investments unter certainty which the buyer has to carry out in order to make the firm run. In a sense, we assume that the firm is 'produced' by the private buyer since the former socialist regime has only left an empty shell which must be filled with life in order to survive in a market–economic environment. We also transfer to privatization the idea of a long–run relationship. The government does not simply sell a firm (or the empty shell) at a fixed price and then leaves the buyer to cope with all further arising problems. The government is rather interested in achieving both welfare–optimal restructuring and welfare–optimal privatization. Hence it enters a contract which refers to both restructuring and privatization. Since restructuring influences the net value of the firm, it is not until this net value has become known that the actual decision on privatization is made. Then the original contract terms are renegotiated and the firm either is definitely privatized or not. No privatization takes place if the restructuring efforts have failed to turn the firm's net value into the positive; in this case the would–be–buyer might receive some compensation for his efforts (or, maybe, will have to pay some fee for the privilege to participate in the attempted privatization procedure) and the government privatization agency liquidates the firm.

The paper reflects some stylized facts of the privatization of key–sector enterprises (industry etc.) of the former German Democratic Republic.[2] The German government installed a special privatization agency, the Treuhand (pronounced troy–hahnt). In a well–known phrase, this agency's mission was denoted as "rapid privatization, decisive restructuring and careful liquidation". This agency sold each enterprise individually. It never engaged in bidding processes, but always acted on the basis of bilateral negotiations. The German government wanted the agency to privatize quickly. Therefore, the Treuhand often decided to sell a firm before the precise future prospects of demand for its products were known. (After the breakdown of demand from former communist countries, it was not clear how far this demand would recover and which alternative Western demand would originate.) Hence, the Treuhand obviously signed many incomplete contracts and, as could be expected, renegotiation of contract terms has become quite usual in East German privatization cases. On the other hand, the Treuhand cared about the way the firm was to be restructured, hence it explicitly negotiated job guarantees and investment pledges which the buyer had to abide by. Unfortunately, however, it did not write contracts of just that welfare–optimal type, which will be presented in this paper. Hence, we would have ex-

[1]Bös–Lülfesmann (1995, 1996) extend the Hart–Moore framework to the case of public procurement.
[2]Compare, for instance, Bös (1993a), Sinn–Sinn (1992).

pected underinvestment in restructuring, and in fact, there have been many complaints that neither Treuhand nor private buyers as widely as necessary.

The paper is organized as follows. In section 2 we present the stages of the game which is played by the privatization agency and the private buyer. This game is then solved by backward induction which implies that we begin the analysis with an explicit treatment of the renegotiation of the contract (section 3). Only then do we step back to deal with restructuring and finally with the question which contract should be written at the beginning of the relationship between the privatization agency and the private buyer of the firm. All this is contained in section 4, where we alternatively consider one–sided restructuring by the private buyer, one–sided restructuring by the government privatization agency and, finally, both–sided restructuring. Section 5 presents an extension of the basic model, where the privatization agency restructures before writing a contract with the private buyer. A brief conclusion summarizes the results and critically evaluates the privatization policy of the German Treuhand in the light of our incomplete–contract approach.

2 The Stages of the Game

There are two actors in our model. First, a government privatization agency. Second, a private investor who wants to buy the privatized firm in question.[3] This private buyer has been chosen by the privatization agency; to simplify the model we assume that he is the only potential bidder. Both actors are risk neutral and have symmetric information at all stages of the game. They perceive the other party's restructuring efforts as soon as they are made; the veil of uncertainty which initially covers the value of the firm is lifted for both agents at the same time. The privatization agency maximizes welfare, the private buyer maximizes profits. Precise definitions of the actors' objective functions at the various stages of the game will be given when the presentation of the paper unfolds.

As usual in papers of this kind, let us illustrate the sequence of events by the subsequent figure 1. A brief elaboration of the stages of the game is as follows. At *date 0* the agents write an incomplete contract which governs their complete future relationship with respect to the sale of a single firm. The incompleteness of the contract results from the (non)verifiability assumptions: neither the restructuring efforts a and e, nor value v or costs c can be verified before a court. Furthermore, if the initial contract on privatization is broken, a court cannot verify whether the government or the private buyer is to blame

[3] At the starting point of our model it has already been clarified how large the firm is which is possibly to be sold. This paper does not deal with the connection between privatization and restructuring by means of splitting up too large firms. For such an analysis in the UK context see Green–Price (1993, 1995). The problem has been equally important in transition economies; in East Germany several GDR combines had encompassed whole branches of the industry; the Treuhand in 1990 started with approximately 8000 key–sector enterprises (Sinn–Sinn, 1992, 96–8) which it split up into 13.816 enterprises by the end of 1994 (Treuhandanstalt, 1994).

0	1/2	1	3/2	2
contract signed (p_0, p_1)	restructuring (a, e)	nature draws v and c	decision on privatization; possibly renegotiation	payments

Figure 1: Game Structure

for the breach ('at–will' contract). Verifiable are only the ex–post events "sale" or "no sale" of the firm in question and, moreover, payments between the parties. The contract can only be conditioned on verifiable events. The only possible contract at date 0 therefore is as follows:

$$q = 1 \quad \Leftrightarrow \quad p = p_1, \tag{1}$$
$$q = 0 \quad \Leftrightarrow \quad p = p_0. \tag{2}$$

Here q is the quantity, either *1* (one firm sold) or *0* (firm not sold). If there is no sale, the private would–be–buyer has to pay a price p_0 which can be interpreted as a sort of fee which is to be paid for participating in a privatization procedure. Maybe the optimal fee is zero; it also could be negative, in which case the agency pays the buyer for his restructuring. On the other hand, in the case of privatization the buyer pays a price of p_1. Each dollar paid by the buyer allows the government to forgo one dollar of tax revenues *and* to avoid λ dollars of welfare–loss from distortionary taxation. $\lambda \in (0, 1)$ denote the shadow costs of raising public funds.[4] A payment of p_1 means a loss of p_1 for the private buyer, but a benefit of $(1 + \lambda)p_1$ for the government. If in a welfare context p_1 itself is considered as a welfare–neutral transfer, privatization still leads to an opportunity gain of λp_1 which has to be taken into account by the privatization agency.

We are interested in the question whether the privatization agency and the private buyer can be induced to choose the welfare–optimal extents of restructuring, in spite of the hold–up problem. This is a normative question. The achievement of the first best requires a strong position of the welfare–maximizing agency: therefore, we assume that at date 0 the agency makes a take–it–or–leave–it offer to the private investor. This is not too implausible an assumption since at date 0 the agency owns the firm which puts it in a strong position. When offering the contract to the private buyer, the agency has to consider his participation constraint: the buyer will not sign any contract unless his expected profit at

[4]In a *theoretical* setting, Laffont–Tirole's (1993) use of λ in their welfare considerations has become particularly well–known. Typical *empirical* estimations lead to $0 < \lambda < 1$, where values between 0 and 0.5 can be found more often, at least in developed countries; see in particular, Ballard–Shoven–Whalley (1985), 136. For a brief overview of various empirical estimates of λ see Jones–Tandon–Vogelsang (1990), 28-30.

date 0 is positive or at least zero. Since the agency's expected utility at date 0 is monotonically decreasing in the buyer's expected profit, it will always depress to zero the buyer's expected profit at date 0.

After signing the contract, the privatization agency and the private buyer engage in firm–specific restructuring investments, say at *date 1/2*. We denote the government's restructuring efforts by a and the efforts of the private buyer by e. Both effort levels are defined on the $[0,1]$–interval. They are observed by both parties, but are not verifiable before a court. The buyer's restructuring causes direct costs $\psi(e)$; this function is convex in its argument and $\psi(0) = \psi'(0) = 0; \quad \psi'(1) = \infty$. The privatization agency's investment–cost function $\mu(a)$ exhibits the same functional properties as $\psi(e)$. Since these restructuring costs must be financed by distortionary taxation, however, additional costs of $\lambda\mu(a)$ arise.

The restructuring a, e takes place under a veil of uncertainty. This veil is lifted at *date 1*. When contracting, the parties do not know the precise asset value of the firm v_i. They only know the set of possible values of the firm to be privatized $\{v_i | i = 1, \ldots, I\}$, from which at date 1 nature draws a particular realization. Moreover, when contracting, the parties do not know how much the private buyer will have to invest after date 1 in order to make the firm run. We denote these costs by c and assume that at date 1 nature draws a particular realization from the set of possible costs $\{c_j | j = 1, \ldots, J\}$. The draws of value and costs are stochastically independent. The probability for a particular value of the firm is denoted by $\pi_i(a)$; a particular realization of costs occurs with probability $\rho_j(e)$. Note that the buyer restructures both under uncertainty, spending $\psi(e)$, and under certainty, spending some amount c_j. Accordingly, it is natural to assume that higher effort e *reduces the expected costs* c to be spent after date 1. On the other hand, we assume that the agency engages in restructuring efforts which particularly *influence the value of the firm*. The agency has less comparative advantages when it comes to restructuring efforts which influence further costs c. Hence, the probability π_i is assumed to depend on a.

Following Hart–Moore (1988) we apply the Linear–Distributions–Function condition and define

$$\rho_j(e) = e\rho_j^+ + (1-e)\rho_i^- . \tag{3}$$

Here ρ^+ and ρ^- are probability distributions over $(c_1, \ldots, c_J)$ and ρ^+/ρ^- is increasing in j. This monotone–likelihood–ratio property implies first–order stochastic dominance. According to (3), a particular choice of restructuring determines a linear combination of the two probability distributions, ρ^+, ρ^-. Because of the monotone–likelihood–ratio property the buyer prefers the 'better' distribution ρ^+ which it can achieve more easily by higher restructuring efforts. Similarly, we specify $\pi_i(a)$, namely

$$\pi_i(a) = a\pi_i^+ + (1-a)\pi_i^- . \tag{4}$$

If necessary, at *date* 3/2, the initial contract is renegotiated. Since we deal with an at–will contract, a sale of the firm will occur if and only if both agents are better off in that case. The privatization agency is interested in welfare, including the welfare gains which result from substituting distortionary taxation with the payments p_1 or p_0, respectively. Accordingly, the agency is willing to sell the enterprise iff

$$v_i - c_j + \lambda p_1^T \geq \lambda p_0. \tag{5}$$

Here p_1^T is the realized sale price, that is, either the ex–ante contracted price p_1 or the modified price resulting from renegotiation. — The private buyer, on the other hand, is interested in profit. He will buy the firm if and only if

$$v_i - c_j - p_1^T \geq -p_0. \tag{6}$$

The objectives of seller and buyer are partly parallel $(v_i - c_j)$, partly antagonistic $(p_1^T - p_0)$. Note that the costs of firm–specific investments are sunk at date 3/2, hence they do not influence the actors' objectives when it comes to the definitive decision on privatization.[5]

Finally, at *date 2* in case of privatization the buyer invests c and pays p_1. If there is no privatization, the would–be–buyer pays p_0.

Since we deal with a multistage game, we apply the concept of subgame perfectness, beginning with date 2 of the model and working our way backward to date 0. Hence, we shall first deal with ex–post efficiency (section 3) and then proceed to ex–ante efficiency (section 4). The precise meaning of these efficiency concepts will always be defined at the beginning of the respective sections.

3 Ex–Post Efficiency (The Renegotiation Game)

We speak of *ex–post efficiency* if at date 3/2 trade takes place iff this increases welfare:

$$q^* = 1 \quad \Leftrightarrow \quad v_i \geq c_j, \tag{7}$$
$$q^* = 0 \quad \Leftrightarrow \quad v_i < c_j. \tag{8}$$

It can be shown that this ex–post efficiency is always attained in our setting. First, privatization in our model does not take place if $v_i < c_j$. This can be shown by contradiction. The buyer will only buy if $v_i - c_j \geq p_1^T - p_0$. Hence, if $v_i < c_j$, the buyer will only take over the firm if a negative price difference is chosen, $p_1^T - p_0 < 0$. The privatization agency, on the other hand, will only sell if $(v_i - c_j)/\lambda \geq -(p_1^T - p_0)$. Hence, if $v_i < c_j$, it will only agree to privatization if a positive price difference is chosen, $p_1^T - p_0 > 0$. This is a contradiction.[6]

[5]The actors' objective functions at dates 0 and 1/2, however, explicitly include these investment costs, see for instance equations (16) and (18) below.

[6]Taking together eqs. (5) and (6) shows that privatization requires $v_i - c_j \geq p_1^T - p_0 \geq -(v_i - c_j)/\lambda$. If $v_i - c_j > 0$, we have $-(v_i - c_j)/\lambda > 0$ whence the above requirement cannot be met.

If $v_i \geq c_j$, then privatization always takes place, possibly after appropriate renegotiation. We assume that in such a case the definitive sale price p_1^T is determined by a renegotiation game of the Hart–Moore (1988) style. In their paper, a renegotiation technology is employed where messages can be exchanged between the parties which in fact are renegotiation offers sent to each other. These renegotiation offers can voluntarily be revealed to the court in the case of a dispute after the final trade is completed. As a result of this renegotiation technology, Hart–Moore show that in subgame–perfect equilibrium the party which agrees to efficient trade under the initially contracted price holds all the bargaining power in the renegotiation. The ex–post utility of the other party is depressed to its no–trade payoff. For the details of this renegotiation we distinguish three different cases:

(i) $p_1 - p_0 > v_i - c_j > -(v_i - c_j)/\lambda. \quad (9)$

In this case the privatization agency wants to sell, but the private buyer does not want to buy. Therefore the agency offers a rebate which is just high enough to make the buyer indifferent between buying or not (and we assume that he buys in such a case):

$$p_1^T = p_0 + v_i - c_j < p_1. \tag{10}$$

Hence in this first case we have downward renegotiation of the ex–ante contracted price p_1.

(ii) $v_i - c_j \geq p_1 - p_0 \geq -(v_i - c_j)/\lambda. \quad (11)$

In this case both agents are interested in trading at the ex–ante price p_1; there is no renegotiation.

(iii) $v_i - c_j > -(v_i - c_j)/\lambda > p_1 - p_0. \quad (12)$

Here it is the buyer who wants to buy, whereas the privatization agency does not want to sell. Hence the private buyer offers a higher price p_1^T which is just high enough to make the privatization agency indifferent between selling or not (and we assume that it sells in such a case):

$$p_1^T = p_0 - (v_i - c_j)/\lambda > p_1. \tag{13}$$

Hence in this third case we have upward renegotiation of the ex–ante price p_1.

4 Ex–Ante Efficiency and First–Best Results

Ex–ante efficiency is attained if at date 1/2 the firm–specific investments a and e are chosen welfare–optimally:

$$a^*, e^* \in \text{argmax}_{a,e}\, \mathcal{W} = \sum_{\substack{i \\ v_i \geq c_j}} \sum_j \pi_i(a)\rho_j(e)(v_i - c_j) - \mu(a) - \psi(e). \tag{14}$$

In this definition of ex–ante efficiency, the eventual occurrence of ex–post efficiency has been internalized. Therefore, the welfare function $\mathcal{W}$ considers only positive net values of the firm to be privatized. We think of a^* and e^* as resulting from a benchmark model in which a social planner maximizes welfare $\mathcal{W}$ with respect to a and e. Note that the planner is subject to the same veil of uncertainty about the subsequent states of the world as the privatization agency and the private buyer. We assume that there is a unique solution of the benchmark model (14)[7] and that this solution can be described by the first–order conditions which are necessary and sufficient for an interior solution $a^*, e^* > 0$. The restructuring efforts a^*, e^* will be used as a benchmark to be compared with the actual choice of the two parties' restructuring at date 1/2.

A *first–best result* is attained if at date 0 the price difference $\Delta p \equiv p_1 - p_0$ is chosen so as to induce both ex–ante and ex–post efficiency in the framework of our model. Note that by an adequate choice of the absolute values p_0 or p_1 the ex–ante profit of the private buyer can be reduced to zero.

4.1 One–Sided Investments of the Buyer

Let us first deal with the case where it is only the private buyer who engages in restructuring. For this purpose we assume that $\pi(a) = \pi$ for all a. Hence, the agency has no incentive to invest and $a = 0$. Note that it may be necessary to grant the buyer access to the firm to enable him to proceed in his restructuring efforts. However, there are also many cases of restructuring by a private investor which do not require access to the firm, for instance all forms of information gathering, of spending time to look for the best machines to apply later on, of conceptualizing alternative blueprints for future restructuring under certainty, etc.

The buyer is not interested in welfare, but will only consider his own utility,

$$\underset{e}{\text{maximize}}\ U^B. \tag{15}$$

Anticipating the continuation of the game, in particular the outcomes of renegotiation, the buyer's utility function U^B at date 1/2 is as follows:

$$U^B = -p_0 + \sum_{\substack{i \\ v_i \geq c_j}} \sum_j \pi_i \rho_j(e) \left[v_i - c_j - \max\left\{\Delta p,\ -(v_i - c_j)/\lambda\right\}\right]^+ - \psi(e), \tag{16}$$

where $[x]^+$ means $\max\{x, 0\}$. Since the buyer is interested in profit, a priori we do not expect him to choose the welfare–maximizing restructuring effort. By way of an example, assume that ex ante the price difference has been chosen so high that for any possible realizations of v and c at date 3/2 the agents face a situation, where $p_1 - p_0 \geq v_i - c_j$. In this case,

[7] Formally, the existence of an interior solution is ensured since expected welfare as defined in (14) is concave in its argument and the Inada–conditions are assumed to be fulfilled.

there will always be downward renegotiation and the buyer's utility is $U^B = -p_0 - \psi(e)$. Hence, the buyer chooses restructuring according to $\psi'(e) = 0$ which implies $e = 0$, which is a clear case of underinvestment.

Ex–ante efficiency is only attained if the buyer's restructuring level at date 1/2 is identical to that level which results from the benchmark model.[8] Whether this is the case depends on the prices p_0, p_1 which are given to the buyer's problem when choosing the level of restructuring. Let us therefore step back and ask whether there is a price difference which can be stipulated at date 0 and induces the buyer to implicitly maximize welfare when he explicitly maximizes profit. It can directly be seen that this can be achieved by a price difference $\Delta p^* = 0$. This implies $p_1 = p_0$; hence, the contract at date 0 in fact stipulates a lump–sum payment of the buyer which is due regardless of whether the firm is privatized or not. The buyer faces a fixed payment for any state of the world and hence has an incentive to reduce his costs c efficiently. The price difference $\Delta p = 0$ guarantees that at date 3/2 the agents will always face case (ii) of ex-post efficiency: renegotiation never occurs. If $v_i \geq c_j$, the firm is privatized, otherwise it is liquidated by the privatization agency. In both cases the lump–sum $p_0 = p_1$ has to be paid. Since at date 0 the buyer's utility is depressed to zero ($U^B = 0$), this lump–sum payment equals

$$p_1 = p_0 = \sum_i \sum_j {}_{v_i \geq c_j} \; \pi_i \rho_j [v_i - c_j] - \psi(e), \tag{17}$$

which can be positive or negative.

4.2 One–Sided Investments of the Agency

In most former communist states it has been a matter of intense debate whether the private buyer or the government privatization agency should be responsible for restructuring.[9] Hence, in this subsection we will investigate how well a government agency might do when restructuring under a veil of uncertainty. To concentrate on one–sided restructuring of the agency we assume that $\rho(e) = \rho$ for all e. Hence, the buyer has no incentive to invest and $e = 0$. Note that the modelling of the present section implies a split–up of restructuring:[10] the privatization agency spends $\mu(a)$, under the veil of uncertainty, the private buyer spends c, after the veil has been lifted.

[8]Formally, optimization of (15) must lead to the same e^* as optimization of (14).

[9]See, for instance, Sinn–Sinn (1992, 99): "Whether it should be the responsibility of the Treuhand to reorganize the firm in the sense of undertaking reorganization and restructuring investment is an extremely controversial question. Most German economists prefer spontaneous privatization without reorganization, arguing that the new management is better suited for the reorganization job than a government trust". In former communist countries, where privatization is a slower process than in East Germany, it is often the managers of the state–owned firm who restructure; see for instance, Aghion–Blanchard–Burgess (1994). However, this is a setting quite different from that considered in the present paper.

[10]Compare Roland (1994), 1162–3.

The privatization agency maximizes the utility function U^S. The agency anticipates the continuation of the game, in particular the outcomes of renegotiation. Accordingly, the utility function at date 1/2 is as follows:

$$U^S = \lambda p_0 + \sum_{\substack{i \\ v_i \geq c_j}} \sum_j \pi_i(a)\rho_j \left[v_i - c_j + \lambda \min\{\Delta p,\, v_i - c_j\}\right]^+ - (1+\lambda)\mu(a). \tag{18}$$

As can clearly be seen, this optimization does not necessarily lead to ex–ante efficiency, that is to a restructuring effort a which is identical to that resulting from the benchmark (14). Let us, once again, illustrate the problem by means of an example. Assume that ex ante the price difference has been chosen so low that for any possible realizations of v and c at date 3/2 the agents face a situation, where $p_1 - p_0 < -(v_i - c_j)/\lambda$: in this case, there will always be upward renegotiation, and the agency's utility at date 1/2 is $U^S = \lambda p_0 - (1+\lambda)\mu(a)$. Hence, the privatization agency restructures according to $\mu'(a) = 0$, which implies $a = 0$ and is a clear case of underinvestment.

Which prices p_0, p_1 induce the privatization agency to maximize welfare (14) when adhering to its own utility maximization? It is easy to see that the optimal price difference has to be

$$\Delta p^* \geq \max_{v_i \geq c_j}\{v_i - c_j\}. \tag{19}$$

Hence, the ex–ante contracted price difference has to be chosen in such a way that at date 3/2 the agents will always face case (i) of ex-post efficiency: the price difference is pretty high, and by downward renegotiation a first best result is attained in any state of the world. The privatization agency is residual claimant; the buyer does not get any ex–post rent. This result is in strong contrast to the common belief that downward renegotiations must necessarily be a populist give–in of a privatization agency. In our model it is the optimal policy to be made.

4.3 Both–Sided Investments

In the previous subsections, restructuring under uncertainty was either performed by the private buyer or by the privatization agency. In both cases the first best could be achieved by appropriately chosen ex–ante prices. It seems to be a natural extension to ask for both–sided restructuring. Let us assume that the privatization agency engages in some restructuring *before* the buyer — but both agents restructure *after* writing the contract.[11] This sequencing is illustrated in figure 2.

Once again ex–post efficiency is always achieved, if necessary by renegotiation. However, ex–ante efficiency cannot be achieved in this case of both–sided restructuring investments. The proof is simple. Solving the game by backward induction, we recognize that at date

[11] For an alternative setting in which the agency restructures before writing a contract, see section 5 below.

0	1/4	3/4	1	3/2	2
contract signed (p_0, p_1)	restructuring by government agency (a)	restructuring by buyer (e)	nature draws v and c	decision on privatization; possibly renegotiation	payments

Figure 2

3/4 the buyer will restructure efficiently if and only if he faces efficient agency restructuring a^* and a price difference $\Delta p = 0$. However, these two requirements are incompatible. If we step back to date 1/4 and ask for the agency's decision on restructuring, we recognize that it will not restructure efficiently if $\Delta p = 0$. Therefore, it is impossible to achieve both–sided efficiency in restructuring.[12]

5 Extension: Agency Restructures Before Contract

The previous subsection showed that the first best cannot be achieved if both privatization agency and private buyer engage in restructuring. A natural way out of this dilemma is the following sequencing: let us assume that the agency engages in some restructuring before contracting with the buyer[13] — increasing the probability of higher values of the firm as expressed by $\pi_i(a)$. After contracting, but still under the veil of uncertainty on v and c, the buyer engages in firm–specific restructuring e, where higher effort e increases the probability of lower costs c as expressed by $\rho_j(e)$. Once again it is convenient to show the multistage sequencing in a simple diagram (figure 3).

-1/2	0	1/2	1	3/2	2
restructuring by government agency (a)	contract signed (p_0, p_1)	restructuring by buyer (e)	nature draws v and c	decision on privatization; possibly renegotiation	payments

Figure 3

The decisions at date 3/2 are as usual and ex–post efficiency is always guaranteed. With respect to the ex–ante efficiency of the buyer's restructuring at date 1/2, we achieve effi-

[12] A similar proof holds if the buyer restructures before the agency. If buyer and seller restructure simultaneously, both–sided investments are also impossible to attain; compare Bös–Lülfesmann (1996), appendix.

[13] This is exactly the sequencing assumed in De Fraja (1996).

cient restructuring if at date 0 the price difference $\Delta p^* = 0$ is chosen. This implies $p_0 = p_1$, where this lump–sum payment is determined as in equation (17) above.

The privatization agency restructures at date $-1/2$, anticipating all following stages of the game. It will choose the first–best restructuring effort, because it will maximize U^S subject to $U^B = 0$, an optimization problem which is equivalent to the benchmark optimization problem (14). This is possible because at date $-1/2$ the privatization agency is not bound by any contract and correctly anticipates that at date 0 it will be able to write a contract where $U^B = 0$. A bit more detailed, the analysis is as follows: anticipating $\Delta p^* = 0$, the privatization agency has utility

$$U^S = \lambda p_0 + \sum_{\substack{i \\ v_i \geq c_j}} \sum_j \pi_i \rho_j (v_i - c_j) - (1+\lambda)\mu(a) - \psi(e). \tag{20}$$

From condition $U^B = 0$ we learn that

$$p_0 = \sum_{\substack{i \\ v_i \geq c_j}} \sum_j \pi_i \rho_j (v_i - c_j) - \psi(e). \tag{21}$$

Substitution into U^S directly leads to a welfare function, whose optimization is equivalent to the maximization of equation (14).

6 Conclusion

This paper deals with an incomplete–contract approach to privatization and restructuring. The enterprise, which is to be privatized, has to be restructured in a situation of uncertainty. The restructuring investments are sunk when the final decision on the sale price is taken in renegotiations. Hence, there is an imminent danger that restructuring is not done on an efficient scale, but that there is underinvestment.

In this paper we show first that efficient restructuring can be guaranteed if only one party is responsible for restructuring under uncertainty (one–sided investments): The private buyer can be induced to efficient restructuring by the choice of a lump–sum payment which is to be paid regardless of whether the firm is privatized or not. The privatization agency will restructure efficiently if the sale price is chosen fairly high and then renegotiated down to such an extent that the private buyer of the firm is just indifferent between buying the firm and not buying.

Finally, we turn to the case where restructuring investments under uncertainty are set by both privatization agency and buyer (both–sided investments). If both privatization agency and buyer restructure after a contract has been written, it is impossible to induce both buyer and agency to restructure efficiently. At least one agent will underinvest. However, if the privatization agency restructures before a contract is written with the private buyer, it correctly anticipates that it can induce the first–best setting of the buyer's restructuring and itself also chooses a first–best restructuring level.

Let us finally evaluate the policy of the German privatization agency (the Treuhand) in the light of an incomplete–contract approach. The Treuhand was not so much interested in a high price p_1. It rather obliged the private buyer to particular job guarantees and investment pledges and if it considered an offer as good from the point of view of these guarantees and pledges, it was often willing to sell at a low price, sometimes even 1 DM.[14] As a result of this policy, at the end of its activity on December 31, 1994 the Treuhand reported job guarantees of 1.5 m employees and investment pledges of 211 bill DM (Treuhandanstalt, 1994). This particular procedure had been chosen by the Treuhand to guarantee the development of an industrialized economy in East Germany. It had been feared that West German investors would buy their East German potential competitors, not with the intention of innovating the outdated technology, but with the intention of closing down production and using the land for storage houses for their Western products to be sold in East Germany (Bös 1993b, 98).

Job guarantees and investment pledges obviously were meant as indicators of the buyer's restructuring efforts, both under uncertainty and under certainty. However, they are bad indicators. Whereas job guarantees have the advantage that the number of jobs in a firm is verifiable before a court, unexpected loss of jobs may well come from the break–down of markets in spite of high restructuring efforts of the buyer. On the other hand, the amount of investments may be a better indicator of restructuring efforts, however, it does not distinguish between restructuring under uncertainty (our e) and under certainty (our c). Moreover, the actual amount of investment is next to impossible to verify before a court. Needless to mention that renegotiation of job guarantees and investment pledges cannot cure these basic mistakes of the Treuhand policy. Applying the message of the present paper it would have been preferable to forgo a conditioning on jobs and investments, but to choose one of those long–run fixed–price contracts presented in this paper, which ensure first–best efficiency.

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[14]The Treuhand also considered the disposal of environmental contamination and of the firm's indebtedness to the state (formerly an important part of financing the East German government budget).

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