

## Privatization and Management Incentives in the Transition Period in Eastern Europe<sup>1</sup>

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The paper develops a simple theoretical framework in which the impact of different governance structures on management incentives, the efficiency of restructuring, and the social costs of the adjustment process in the transition period in Eastern Europe can be analyzed. The model shows that immediate privatization leads not only to strong management incentives to restructure but also to high social costs of bankruptcies and layoffs. If the government stays in control social costs will be lower. However, in this case managers face a soft budget constraint and have less incentive to restructure. The model also suggests which companies should be privatized first. *J. Comp. Econom.*, June 1993, 17(2), pp. 264–287. University of Bonn, D-53113 Bonn, Germany. © 1993 Academic Press, Inc.

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### 1. INTRODUCTION

Privatization is probably the most important and the most difficult element in the transformation process of the economies in Eastern Europe. Although considerable progress has been made in privatizing small- and medium-sized firms, the bulk of large industrial enterprises is still owned by the state. Companies of comparable size in western economies are owned and controlled within a complex system of private and public institutions

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that have developed over decades to their present form. It is clearly impossible to create such a system instantaneously. The question is what governance structure should be established for these firms in the transition period, i.e., before a modern market economy with all its institutions has been developed.

Several economic advisers and academic economists have offered detailed proposals on how to restructure and privatize these firms. Their arguments in favor of or against different schemes are based on the experiences with privatization in other countries and on the basic lessons of economic theory. These arguments are a valuable guide to the transformation process. Nevertheless, at this stage additional insights can be obtained by making these ideas more precise in formal models designed to capture the main peculiarities of the transition phase. The purpose of this paper is to develop a simple theoretical framework with which we can analyze systematically the impact of different corporate governance structures on management incentives, the efficiency of restructuring, and the social costs of the adjustment process.

Our analysis focuses on large industrial companies. They account for a high proportion of output and employment in Eastern Europe and pose the greatest challenge for reform, because many of them are overstaffed and need painful restructuring before they can become profitable and because it is difficult to find private investors to take them over.

We distinguish two stylized approaches that lead to two different governance structures for these companies in the transition period. Proponents of the market approach argue that the best way to proceed is to privatize as fast as possible by distributing the shares of large state-owned companies in one way or another to the general population. Given the lack of entrepreneurs and the atomistic ownership structure resulting from a mass distribution scheme, financial intermediaries such as holding companies, mutual funds, pension funds, and investment banks will play a crucial role in the transition period. They will diversify risk and actively control the managers of the companies they own.

Proponents of the government approach suggest that at least some coarse restructuring should be done by a government agency. Thereafter, this agency should try to sell each company individually to a core investor who commits his investment to the company for several years. Finding such an entrepreneur may take a considerable amount of time, during which the company will continue to be owned by the state and controlled by a government agency. We describe these two approaches in more detail in Section 2.

Before we model different governance structures we must specify the economic environment in which they are expected to function. Our working hypothesis is that the transition period in Eastern Europe will be characterized by rapidly changing market conditions, economic and political instabil-

ity, and a high degree of uncertainty about the future. Referring to well-known results in contract theory, we discuss what kind of incentive contracts should be used in such an environment in Section 3. Among other things we argue that stock options and performance-based compensation schemes will be of limited use in the transition period, but that the threat of bankruptcy may play an important role in motivating managers to restructure their firms efficiently.

In Section 4 we introduce the formal model, which captures the two stylized governance structures of the market and the government approach and reflects the informal discussion of feasible incentive schemes in the transition period. The model generates two conclusions. First, if firms are controlled by a government agency, then the social costs of the adjustment process will be lower than if a privately owned holding company is in control. The government agency will take profits from successful firms to cross-subsidize unsuccessful ones. This reduces the social costs of liquidation, but the government agency may subsidize to an inefficiently large degree and keep firms that should be closed down in operation. This delays the necessary adjustment process.

The second conclusion is that the manager of a firm will work harder and restructure more efficiently if his company is owned by a private holding than if it is controlled by the government agency. The reason is that the manager knows that his firm is less likely to go bankrupt under government control. If his firm fails, the government will try to rescue the firm in order to avoid the social costs of liquidation. Thus the manager faces a soft budget constraint, and he will not carry through a painful restructuring of his firm or spend enough effort to modernize the production process because he rationally anticipates that the government will bail him out in case he fails.<sup>2</sup>

In our model, privatization is a commitment device of the government not to subsidize unsuccessful firms. A similar point has been made by Sappington and Stiglitz (1987), who argue that public ownership generally facilitates intervention by the government, while intervention is more difficult if the enterprise has been privatized. Intervention is beneficial if it allows rapid adaptation to unforeseen contingencies, but it also undermines the incentives of the management to control costs, because the government is likely to subsidize cost overruns. We try to make this argument more precise in a formal model that captures some of the distinctive features of the transition period in Eastern Europe.

In Section 5 we point out some implications of the model and discuss intermediate governance structures. For example, the government need not

<sup>2</sup> This effect is similar to the soft budget constraint for managers in socialist economies as described by Kornai (1980).

privatize all the firms at the same time. Our model gives some insights into which firms should be privatized immediately and which ones should be kept under the control of a government agency during the transition period. Also, the model shows that it may be beneficial for the government to keep only a fraction of the shares, which yields a limited commitment not to cross-subsidize unsuccessful firms too much. A similar commitment can be obtained if the government owns no shares but assumes the right to replace the directors of a privately owned holding company. Section 6 concludes.

## 2. PRIVATIZATION PROPOSALS

Most economic advisers agree that large industrial companies should be corporatized or commercialized; i.e., they should be formally separated from the branch ministries and set up as legally independent corporations.<sup>3</sup> Although the government still owns such a corporation, it is no longer involved in the day-to-day activities of the firm but rather controls the strategic decisions and the performance of the management through a board of directors. Corporatization facilitates the transfer of ownership of these companies to private investors, but how this transfer should be carried out is very controversial.

### *Goals of Privatization*

Before we discuss alternative privatization proposals let us briefly summarize the main goals to be accomplished through corporatization and privatization in the transition period:

—*Efficient management control*: Governance structures that give managers the correct incentives to run and restructure their companies efficiently must be established.

—*Restructuring of the economy*: The large industrial firms are more vertically and horizontally integrated than comparable firms in western economies. Many of these firms still hoard too much labor and will have to lay off a significant fraction of their work force. Furthermore, some companies are expected to be nonviable and will have to be closed down, either because the markets for their products have disappeared or because their production technologies are hopelessly outdated.

—*Limit the social costs of adjustment*: Even if a large company is not expected to be profitable in the future, it may be socially inefficient to shut it down immediately. High unemployment rates and the economic desolation of entire regions may have considerable external effects that must be taken

<sup>3</sup> See, e.g., Fischer (1991).

into account. Furthermore, social and political unrest may jeopardize the transition process as a whole.

—*Attract foreign capital and expertise:* Given the lack of domestic savings, foreign investments will play an important role in economic growth. Furthermore, foreign investments are expected to lead to a transfer of technological knowledge and managerial techniques that are crucial to modernizing the economy.

—*Create competitive market structures:* Some conglomerates must be split up to reduce their market power, and the government must regulate natural monopolies.

—*Fair initial distribution of wealth:* Since the existing capital stock is owned by the state, it is widely felt that each adult citizen has an equal claim on these assets, and that capitalism should start with an egalitarian distribution of this wealth.

—*Protect government revenues:* In all socialist countries, government revenues were raised mainly through the transfer of profits to the state budget, while a tax system comparable to that in western industrialized countries did not exist. If all state-owned companies were privatized before a functioning tax system had been established, the state would lose its main source of revenues.

Naturally, different privatization schemes put different weights on different objectives. However, the main distinctive feature of the different proposals is the role of the government in achieving these objectives during the transition period. Two main approaches can be distinguished. Proponents of the market approach believe that 40 years of socialism have shown that governments are incapable of guiding the efficient restructuring of the economy. Thus, the best way to proceed is to privatize as rapidly as possible and to leave the rest to market forces, with as little government interference as possible. In contrast to this position proponents of the government approach stress the lack of entrepreneurs and of established market institutions in Eastern Europe. There is no well-functioning stock market and no system of experienced financial intermediaries to rely on. They claim that, given the scope of the transformation and the risks involved, a strong lead by the government is unavoidable.

In the following we outline these two stylized approaches in more detail. However, most actual privatization schemes take an eclectic position. It is beyond the scope of this paper to discuss this literature and the recent developments in Eastern Europe in detail. For our purpose it is sufficient to survey the basic arguments.<sup>4</sup>

<sup>4</sup> For a survey of the different privatization proposals see Borensztein and Kumar (1991) and Fischer (1991). We do not consider proposals to give or sell the companies to their employees. For a discussion of some of the problems involved with labor-managed firms see Hinds (1990).

*The Market Approach*

Ownership and control rights should be transferred to private investors as fast as possible. Since privatization through initial public offerings or individual sales would take very long (see the arguments given below), a mass privatization scheme with free distribution of shares must be employed. A fraction of nonvoting shares could be given to workers and managers to compensate them for their loss of control. The government could also retain some fraction of shares as a source of future revenues, but this fraction should be either nonvoting or sufficiently small that the government cannot interfere with the strategic decisions of the companies.

The majority of shares will be distributed either directly through a voucher scheme to the general public or indirectly to financial intermediaries like holding companies, investment banks, and mutual funds, which are, in turn, owned by the public. If a voucher scheme is employed each adult citizen can bid on a pseudo-stock market for the shares of the individual companies. The problem is that there are thousands of firms to be privatized, there is very little information about their future profitability available, and the transaction costs for each citizen to acquire at least some information are high in comparison to the value of his voucher. Therefore, investment funds will enter the market and compete for the vouchers of the citizens in return for a stake in the investment fund. Most of the actual bidding on the pseudo-stock market will then be done by these financial intermediaries. They will be large enough to diversify risks in their portfolios, and they will hold a significant fraction of the shares of a company so that the resulting ownership structure will not be atomistic.

However, the organization of a voucher scheme and of the initial pseudo-stock market may be very complicated and time consuming and involve high transaction costs.<sup>5</sup> Furthermore, this procedure may result in a very concentrated ownership structure, where a whole industry is controlled by a single investment fund. To avoid these problems the government could distribute the firms to be privatized directly to some financial intermediaries; let us call them holding companies. Their portfolios could be designed such that competitors in the same industry are allocated to different holdings. Furthermore, for each holding there should be some other holding companies with similar portfolios in order to facilitate relative performance evaluations. The holdings are owned by the general public, with each adult citizen getting an equal share that he can disentangle and trade on the stock market.

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Bonin (1992) discusses the actual implementation of privatization schemes in Poland and Hungary. For the special case of Eastern Germany see Bös (1991) and Sinn (1991). An overview of the programs in other countries can be found in RFE/RL Research Report (1992).

<sup>5</sup> For a discussion of the mechanics of the voucher scheme which is being used in Czechoslovakia see Brada (1992).

Both procedures allow for a rapid privatization of the whole economy and start with a fair initial distribution of wealth. The restructuring of the economy is then left to the market. The stock market should operate freely from the very beginning. A manager of a holding company or investment fund can be given an incentive contract that conditions his salary on the absolute and relative performance of his portfolio. Thus he has an incentive to actively monitor and control the managers of companies whose shares he holds and to maximize the value of his portfolio. In particular he is supposed to shut down unprofitable firms and to split up conglomerates if they are excessively vertically integrated. Furthermore, he will sell a firm to domestic or foreign investors if he gets an offer that is higher than the stock price of the company. A manager of an individual firm will be actively controlled by the financial intermediaries and will have additional incentives through stock options and the threat of bankruptcy. He will try to attract foreign capital and expertise in order to maximize the probability of survival and the profits of his firm. To ensure competitive market conditions the government should commit to a free trade policy. As far as nontradables or natural monopolies are concerned, antitrust laws and regulatory authorities as in western economies will be necessary.

The social costs of adjustment will be very high during the transition period, but they are unavoidable. The government should not interfere with the market to slow down the process, but rather deal with these costs directly by granting unemployment benefits and subsidizing retraining and regional development. Government revenues should come predominantly from taxes.

### *The Government Approach*

Before any privatization takes place the government should undertake some coarse restructuring of firms. Conglomerates and monopolies should be broken up to avoid anticompetitive behavior in the future. Grossly overstaffed companies should be slimmed down to make them more attractive to private investors. If a company is hopelessly unprofitable it should be shut down by the government.

Again some fraction of the stock of each company may be given away or sold at a discount to workers and managers, which could be conditional on future privatization, and the government could retain a minority stake for itself. Then the government tries to sell the majority of the shares of each firm to private investors. Some companies may be sold through initial public offerings on the stock market. If there are several investors interested in buying the entire company the government could auction it off. In smaller companies, highly leveraged management buyouts are also possible. However, in many cases the government will have to look actively for a potential

buyer, domestic or foreign, and to bargain with him over the terms of privatization. To reduce the social costs of future layoffs, the government could insist on employment or investment guarantees to be given by the private owner in exchange for a lower price, the cancellation of outstanding debt, the guarantee of future subsidies, or other privileges.<sup>6</sup>

The sale of each individual firm will be a difficult and time-consuming process. There is no reliable way to estimate the market value of a company. Since these firms operated in the past under severely distorted prices, trade structures, and management objectives, an estimate of the value of the enterprise cannot be based on past experience. If the government sells them too cheaply, it loses potential revenues and creates unfair windfall profits for the lucky investors. If it bargains too hard, potential buyers may lose interest. Given the lack of domestic savings and entrepreneurs it will often be difficult to find a potential buyer at all, in particular for the biggest conglomerates that need much painful restructuring and huge investments before they may become profitable.

Thus, the privatization process will take a considerable amount of time, at least 5 to 10 years, until most of the large industrial companies are sold. In the meantime the firms are run as joint stock companies, owned by the state and controlled by a board of directors that is selected by a government agency. The board monitors and controls the management and tries to induce profit-maximizing behavior. If the company is unprofitable it can go bankrupt. However, the government will take the social costs of liquidation into account and may subsidize the firm in order to smooth the adjustment process.

The revenues from privatization and the profits of the state-owned companies can be used to reduce social adjustment costs in the transition period. The rest may either be distributed to the population or be retained by the government to reduce current and future taxes.

### 3. MANAGEMENT INCENTIVES

In this section we take a closer look at what kind of incentives can be given to managers under the different proposals. This discussion prepares the ground for the assumptions made in the formal analysis of the efficiency of production and restructuring under different governance structures. There are three different kinds of managers to be distinguished. First, there are the managers who run the individual firms and who carry out the painful restructuring during the transition period. Second, if the individual firms are owned by financial intermediaries, which we call holdings for simplicity, even though all the arguments given below apply for mutual funds, pension funds,

<sup>6</sup> The German *Treuhand-Anstalt* employs this policy frequently. See Sinn (1991).



or investment banks as well, then the managers of the holding company have to monitor and control the firms in their portfolio. We call these managers directors in order to distinguish them from the managers on the firm level. Third, if the individual firms have not been privatized yet, they are owned by the state and controlled by a government agency. The managers of this agency are called administrators. In the following we discuss what kind of incentive mechanisms can be given to each of these groups under the conditions of the transition period in Eastern Europe.<sup>7</sup>

### *Incentives at the Firm Level*

The standard approach to giving a manager the right incentives to produce and to invest efficiently is to link his salary to the firm's performance by offering bonuses and/or stock options. Bonuses are conditional on accounting data, e.g., profits, revenues, and output, and can be used by both privatized and state-owned companies. However, they have several drawbacks. First, under rapidly changing exogenous conditions there is no baseline of enterprise performance, and no one knows what good performance will be. Second, bonuses distort incentives because they are not conditional on the long-term value enhancement of the firm but rather on profits or revenues of the current period. Thus they discourage a long-term strategy to restructure the company. Third, in the transition period the environment of the enterprises will be very noisy; input and output prices will change rapidly, political decisions will have a major impact on the profitability of many markets, and the macroeconomic instability will impose additional risks. This noise is reflected in the accounting data, which is therefore a poor measure of management performance. Finally, the accounting system in Eastern European companies is still in its infancy and there are few accountants trained to deal with modern corporations. Thus the data will also be inaccurate and may be subject to manipulation.

Stock options can be used only if a company has already been privatized and if its shares are traded on the stock market. In contrast to bonuses, they do not distort incentives because they are conditional on the stock market evaluation of the value of the company. However, in the transition period they will be of limited use too. First, a well-functioning stock market does not yet exist and will take some time to develop. Second, in the transition period the environment of the companies will be constantly changing, which has a much stronger impact on the long-term prospects of the company than variations in the performance of the management. Thus, market analysts will concentrate on predicting changes in market conditions rather than on

<sup>7</sup> For a more detailed survey on different incentive mechanisms and in particular the role of the stock market see the excellent discussion in Tirole (1991).

monitoring managers. Furthermore, given the lack of reliable and undistorted accounting data, it is also very difficult for market analysts to assess how efficiently a firm is run. Thus, in the transition period share prices will contain very little information about the performance of a manager, but rather will reflect the noise of his environment. Making the manager's salary very responsive to the stock price gives only weak incentives to increase efficiency but exposes him to a considerable risk. Therefore, the manager should be given a flat incentive scheme.<sup>8</sup>

Managers are also motivated by career concerns. If the managerial labor market observes a signal about the manager's performance, this signal will be used to update the market evaluation of the manager's ability. Thus it will influence his outside job prospects and his salary. Unfortunately the signal will also contain a lot of noise in the transition period, and there is little a company can do to improve this mechanism.

Another important device that disciplines managers is the threat of bankruptcy. If a firm goes bankrupt the manager loses his job and the rents and perquisites associated with controlling the company. Furthermore, bankruptcy gives a strong signal about the manager's ability to the managerial labor market, lowering his future job prospects. Since bankruptcy is a serious possibility for firms that fail to adapt to rapidly changing market conditions in the transition period, this threat can be a powerful incentive for managers of privatized and of state-owned companies.

Takeovers are possible only if the company has already been privatized. The standard argument is that if the management is incompetent or inefficient, share prices will be lower than the potential value of the firm. Thus, a raider could take it over, replace the incumbent management, thereby increasing the value of the company, and make a profit. However, even in western economies the role of takeovers as a device to discipline managers is limited and controversial.<sup>9</sup> In the transition period there is the additional problem of a lack of domestic savings and entrepreneurs. Furthermore, the banking system is hardly developed, making it difficult to finance a leveraged takeover.

<sup>8</sup> For a formal model of this argument see Holmström and Milgrom (1987). Milgrom and Roberts (1992, p. 221) summarize the results of the literature on performance pay in the Incentive Intensity Principle, which states that the optimal intensity of incentives depends on four factors: the incremental profits created by additional effort, the precision with which the desired activities can be assessed, the agent's risk tolerance, and the agent's responsiveness to incentives. Our main argument here is that during the transition period the measurement precision will be so poor that the incentive intensity must be very small. For an interesting application of this principle in a western industrialized country see Ghemawat (1993).

<sup>9</sup> See Shleifer and Summers (1988) and Schnitzer (1992) for possible negative side effects of takeovers on the incentives of managers and other stakeholders.

Finally, managers can be monitored and controlled by the board of directors or by a government agency. From the experience in western economies it seems unlikely that these supervisory institutions are able to exercise a tight control of the efficiency of the manager's operations.<sup>10</sup> However, they can replace an obviously incompetent manager, and they can enforce major strategic decisions, e.g., whether to liquidate the firm.

#### *Incentives for Directors of Holding Companies*

While there is little scope for stock market incentives at the firm level, this is not the case for financial intermediaries. A holding company pools firms of many different industries in its portfolio, which reduces the volatility of its own stock price. Thus, stock options expose the directors of the holding to less risk than the manager of a firm. Furthermore, by having several holding companies with similar portfolios it is possible to give financial incentives based on relative performance evaluations.<sup>11</sup>

The threat of bankruptcy or of a takeover, however, will not play a significant role in managerial incentives. These events are very unlikely given the size of the holdings.

The directors of financial intermediaries may be subject to government control. This can be beneficial if a grossly incompetent management team has to be replaced. On the other hand, the more the government can intervene, the more it will impose its own objectives on the holding. For example, the government could press the directors not to shut down an unprofitable enterprise. Since the losses have to be paid by the holding, this policy expropriates the shareholders of the holding.<sup>12</sup>

#### *Incentives for Administrators of a Government Agency*

It is very difficult to give administrators of a government agency an incentive to care about efficiency. The main difference from directors of a holding company is that for a government agency there is no stock market, no possibility of takeovers or bankruptcy, and no performance-based compensation.

<sup>10</sup> See Tirole (1991, p. 226).

<sup>11</sup> Relative performance evaluations can be very useful for filtering out noise and thus reducing the risk the manager has to bear. See Holmström (1982).

<sup>12</sup> An interesting example for such a policy is the Treuhandanstalt. Although the Treuhand is not a joint stock company owned by East German shareholders, the profits of the Treuhand are supposed to be distributed to East German savers as a compensation for their losses during monetary unification. Detlef Rohwedder, the Treuhand's first chief executive, estimated the revenues from privatization to be 600 billion DM. However, in order to get employment and investment guarantees the Treuhand has reduced its prices so much that even though it has only sold the most profitable enterprises to date, it already runs a deficit, which will be covered by the government. See Dornbusch and Wolf (1992).

Administrators receive a fixed salary and will behave like bureaucrats, trying to increase their budget and their sphere of influence. However, they have career concerns and do react to political pressures. For example, the higher the political pressure not to close down a firm, the harder they will try to find cross-subsidies to rescue it.

### *Summary*

In the transition period in Eastern Europe there are only limited possibilities to give efficient incentives to managers. On the firm level incentives will come mainly from the threat of bankruptcy and the career concerns of the managers. Privately owned financial intermediaries can base the compensation of their directors on the stock market, using stock options and relative performance evaluations. In a government agency administrators will behave like bureaucrats and react to political pressure.

## 4. A SIMPLE MODEL

In this section we compare two different governance structures in the transition period: a privately owned holding company and a government agency. These institutions reflect the two stylized cases of the market approach and the government approach described in Section 2. The theoretical insights obtained from this analysis will also be useful for better understanding the intermediate proposals. The model focuses on the incentives for the manager of a firm to restructure efficiently and on the decision of the directors or administrators whether to keep an unprofitable firm in operation. We do not consider the incentive of a government agency to sell the companies to private investors after the transition period.

Consider a set of  $n$  firms, indexed by  $i = 1, \dots, n$ , all of which are controlled either by a holding company or by a government agency. There may be many other firms in the economy that are run by different holding companies or different government agencies. In this section we take the portfolio of the  $n$  firms as given. In Section 5 we address the question of how to structure this portfolio optimally.

Each of the  $n$  firms is run by a manager. In the transition period the environment of these firms changes rapidly. How well a firm adjusts to new market conditions depends on the effort of the manager to restructure his firm efficiently. We model this in a highly stylized way. For each firm  $i$  there are two states of the world, called success and failure. If a firm succeeds, its expected net present value from staying in business, denoted  $V_i$ , is higher than its liquidation value, which we denote  $V_i^L$ . If it fails, however, its liqui-

dation value exceeds  $V_i$ .<sup>13</sup> Thus, there are only two possible realizations of  $V_i$ ,  $V_i \in \{V_i^L, \bar{V}_i\}$ , with  $V_i^L < V_i^H < \bar{V}_i$ . The probability of success,  $p_i(a_i)$ , is a function of an action  $a_i$  taken by the manager. A natural interpretation is that  $a_i$  reflects the effort that manager  $i$  spends in reorganizing his company. His effort is measured in units of utility costs for the manager; i.e., if the manager spends effort  $a_i$  he incurs the disutility  $a_i$ ,  $a_i \in \mathbb{R}_0^+$ . The notion of effort is quite general here. Suppose that the reorganization requires the manager to lay off redundant workers or to shut down a division of the firm in order to buy from a more efficient outside supplier. These restructurings are painful to the manager because he has to carry them out against the resistance of the workers. Or suppose that the manager has to actively look for foreign expertise and investors. This takes time and effort, the manager has to adapt to a different business culture, and he may lose part of the control of his company.

*Assumption.* The probability of success,  $p_i(a_i)$ , is increasing and strictly concave in  $a_i$ , with  $0 < p_i(a_i) < 1$  for all  $a_i \in \mathbb{R}_0^+$ . The  $p_i(a_i)$  are stochastically independent across firms.<sup>14</sup>

If the net present value of a firm is smaller than its liquidation value, then a profit-maximizing owner will shut it down and sell off its assets. In a frictionless world the assets will be redeployed to their next best use, and workers and managers will find employment at the going wage in other industries. In this case the owner bears all the costs of failure of his firm. However, this is not a realistic scenario for the transition period in Eastern Europe. The liquidation of a large industrial company may have considerable external effects that are not taken into account by a profit-maximizing owner:

Due to the high level of general unemployment, workers and managers will have a hard time finding new jobs in other sectors, and their human resources may be left unused for an extended amount of time. Even if they find another job, their firm-specific human capital is lost. Furthermore, if the company dominates a town or an entire region, part of their physical assets, especially real estate, will be devalued.

<sup>13</sup> The model does not address potential conflicts of interest between equity holders and creditors. We are not concerned about bankruptcy of the firm but rather about liquidation. A firm that produces on average variable costs that are lower than the market price may go bankrupt because it cannot pay off its creditors. However, this firm would not be liquidated. Either the banks will forgive part of the debt or a new owner will buy the firm's capital at a reduced price, but in both cases it is kept in operation. To avoid these cases we define  $V_i$  as the net present value of expected future revenues minus future costs, not including capital costs which have been committed in the past. We are grateful to Josef Brada for pointing this out to us.

<sup>14</sup> Stochastic independence of the  $p_i(\cdot)$  is clearly not realistic. However, allowing for correlation between firms does not affect our results and does not yield any additional insights.

Outsiders may also be affected since the liquidation of a large industrial company affects its suppliers in other sectors of the economy who may also be forced into liquidation. Liquidation may cause the economic decline of the town or region dominated by the firm, and it may lead to social unrest, which increases macroeconomic and political instability.

It is useful to distinguish among workers, the manager, and the rest of the society. Let  $\Delta_i^w$  be the utility loss incurred by workers if their company  $i$  is liquidated and  $\Delta_i^m$  and  $\Delta_i^s$  be the respective utility loss of the manager and of the rest of society. The total social cost of liquidation of firm  $i$  is denoted  $\Delta_i = \Delta_i^w + \Delta_i^m + \Delta_i^s$ . The amount of these welfare losses is assumed to be positive and exogenously given. Thus, from a welfare-maximizing point of view, a firm that failed should be liquidated if and only if  $V_i^L - V_i > \Delta_i$ .<sup>15</sup>

What are the incentives of the manager of firm  $i$  to work hard? Because his effort is unobservable, his wage cannot be made contingent on  $a_i$ . Furthermore, we argued in Section 3 that there is little scope for bonuses and stock options in the transition period. Thus, we assume that the manager gets a fixed salary, the net present value of which is denoted  $w$ . He may have an incentive to spend some effort because of career concerns. We do not incorporate this into the model, but take it as exogenously given, assuming that this incentive induces some minimal level of effort,  $a_i$ , which we normalize to 0. The manager may be induced to work harder than  $a_i = 0$  in order to reduce the probability that his firm is liquidated. If his firm is closed down, he incurs a utility loss  $\Delta_i^m$ . Let  $x_i \in \{0, 1\}$  denote the decision whether to close down firm  $i$  ( $x_i = 0$ ) or to keep it in operation ( $x_i = 1$ ). Then the manager's utility function is given by<sup>16</sup>

$$U_i = w_i - (1 - x_i)\Delta_i^m - a_i. \quad (1)$$

The board of directors is not involved in the day-to-day decisions of the manager. In particular, we assume that the board cannot observe  $a_i$ , the effort level of the manager. However, the board does observe the realization of  $V_i$ , and the board makes the long-term decision whether the company is shut down or kept in operation.

The incentives of the board of directors depend on the governance structure employed in the transition period. If the firm is privatized and owned by a holding company, then the directors of the holding dominate the board

<sup>15</sup> Note that the social cost of *not* liquidating is exactly  $V_i^L - V_i$ . The firm could have generated  $V_i^L$  in liquidation, while its possibly negative profits are only  $V_i < V_i^L$  if it is kept in operation.

<sup>16</sup> Recall that, without loss of generality, we have scaled  $a_i$  such that the utility function of manager  $i$  is linear in  $a_i$ . This formulation has the advantage that we have to impose assumptions only on the shape of  $p_i(\cdot)$  but not on the shape of the effort cost function.

and decide whether to shut down an unprofitable firm. In this case the shares of the individual firms and of the holding are traded on the stock market. As we argued in Section 3, the directors of the holding should be rewarded with stock options and according to relative performance evaluations. We assume that these incentives are powerful enough to induce them to shut down a firm that loses money.<sup>17</sup>

If the company is owned by the state, the administrators of a government agency control the board. Since the company is not traded on the stock market, share prices cannot be used as incentives. The managers of the government agency will receive fixed salaries and are essentially bureaucrats. What are their objectives? They do not want to transfer the money they control to the general budget, but rather want to use it to maximize their sphere of influence. Thus they will try to transfer the profits of the firms that succeeded to those that failed in order to stay in control of them. Furthermore, the managers of the government agency are sensitive to political pressure. For each failing firm, there will be a pressure group urging the government agency to keep this particular firm alive. As a first approximation we assume that the political pressure is proportional to the social cost of liquidation of each firm.<sup>18</sup> So the government agency will try to minimize the social costs of liquidations. Note that the objectives of the government and of the administrators partially coincide. If a firm fails and the social cost of liquidation is higher than the net present value of its future losses, then both want to keep it in operation. However, the administrators also want to subsidize firms that should be closed down.

If the government had detailed information about the profits and losses of each individual firm so that it could control cross-subsidization, then it might be possible for the government to interfere with the policy of its agency and to prevent wasteful subsidies. In practice, however, this information will be incomplete. On grounds of realism we assume that the government has no effective control over the agency. However, our main results are unaffected if we make the opposite assumption that the government can perfectly control its agency. We comment on this possibility as we go along.

The time structure of the model is summarized in Fig. 1.

<sup>17</sup> It may be that the incentive to do so is not strong enough. For example, the manager of the holding may receive private benefits from sitting on the board, so that he has an interest in keeping this position. Or he may be bribed by the manager and collude with the firm. Although these are serious concerns, we do not consider them in the formal model.

<sup>18</sup> This is a very rough approximation. Typically, the political pressure is higher if there is a small but well-organized group which is strongly affected by the decision and lower if the social costs of the decision are widely spread out across society. Thus it might be more realistic to assume that the political pressure depends only on  $\Delta_i^w + \Delta_i^m$ , but not on  $\Delta_i^l$ . This would yield an additional distortion under government control.

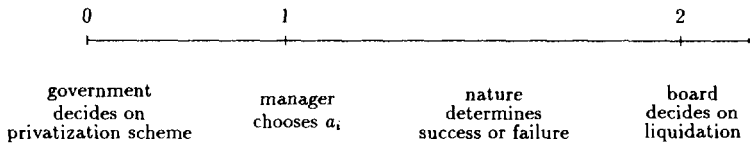


FIG. 1. Time structure of the model.

### *The Socially Optimal Allocation*

As a benchmark consider the unconstrained first-best allocation. At date 2, social welfare associated with firm  $i$  is given by

$$W_i = \begin{cases} V_i - a_i & \text{if } x_i = 1 \\ V_i^L - \Delta_i - a_i & \text{if } x_i = 0. \end{cases} \quad (2)$$

Clearly, no firm with  $V_i > V_i^L$  should be closed down. If  $V_i < V_i^L$ , firm  $i$  should be liquidated if and only if  $V_i^L - \Delta_i > V_i$ , i.e., if the expected future losses are higher than the social costs of liquidation.

The welfare-maximizing effort level of the manager satisfies

$$a_i^{FB} \in \arg \max_{a_i \in \mathbb{R}_0^+} \{ p_i(a_i) \cdot \bar{V}_i + (1 - p_i(a_i)) \cdot \max \{ V_i^L - \Delta_i, V_i \} - a_i \}. \quad (3)$$

Given that  $p_i(a_i)$  is strictly concave,  $a_i^{FB}$  is uniquely defined by the first-order condition

$$p'_i(a_i^{FB}) \cdot \min \{ \bar{V}_i - V_i^L + \Delta_i, \bar{V}_i - V_i \} = 1; \quad (4)$$

i.e., the manager should increase his level of effort until the marginal social benefit equals his marginal cost.

### *Private Control: The Case of a Holding*

The director of the holding company gets part of his salary from stock options, which gives him an incentive to maximize the profits of the holding. Thus, at date 2 he will shut down a firm (choose  $x_i = 0$ ) if and only if  $V_i < V_i^L$ , i.e., if the firm is privately unprofitable. He does not take into account the external effect of his decisions on society, i.e., the social costs of liquidation borne by workers, the manager, and the rest of society, and there will be an inefficient number of liquidations.

Consider now the decision of the manager at date 1 on how much effort to spend. The manager anticipates that  $x_i^p = 0$  iff  $V_i < V_i^L$ , and he chooses  $a_i^p$  such that



$$a_i^p \in \arg \max_{a \in \mathbb{R}_0^+} \{ w - (1 - p_i(a_i)) \Delta_i^m - a_i \}. \quad (5)$$

His utility-maximizing effort level is uniquely characterized by

$$p'_i(a_i^p) \Delta_i^m = 1; \quad (6)$$

i.e., the manager equals marginal private benefits with marginal costs. Suppose that  $V_i^L - \Delta_i \geq \underline{V}_i$ , i.e., it would be socially efficient to shut down the firm in case of a failure. Comparing (6) and (4) it is clear that

$$\Delta_i^m < \min \{ \bar{V}_i - V_i^L + \Delta_i, \bar{V}_i - \underline{V}_i \} = \bar{V}_i - V_i^L + \Delta_i, \quad (7)$$

because  $\bar{V}_i > V_i^L$  and  $\Delta_i = \Delta_i^w + \Delta_i^m + \Delta_i^s$ . Hence, concavity of  $p_i(\cdot)$  implies that  $a_i^p < a_i^{\text{FB}}$ , and so the manager expends too little effort compared with the first-best. If  $V_i^L - \Delta_i < \underline{V}_i$  the result may be ambiguous. However, we consider large companies, and thus it is most likely that the manager's rent is small compared to the difference in net present values of the company, so that

$$\Delta_i^m < \bar{V}_i - \underline{V}_i. \quad (8)$$

Thus, the manager is likely to spend inefficiently little effort in this case too.<sup>19</sup> Although the outcome is clearly inefficient compared to the first-best, the more interesting question is how it compares with what would have happened under government control.

#### *Government Control: The Case of a Government Agency*

At date 2 the government agency has to decide which firms to close down subject to the constraint that the subsidies that have to be paid to keep negative net present value firms alive do not exceed the profits earned by profitable firms. The idea is that the government agency can take the positive net present values of the profitable firms to cross-subsidize the losses of some companies that failed. In practice, profits and losses are flows, and there may be a liquidity problem if the government agency does not have access to a perfect capital market. We do not consider this problem formally. One way to think about it is to assume that at date 2, i.e., after the transition period, the government agency sells or closes down all companies. A profitable firm can be sold for its net present value, so it yields a revenue  $\bar{V}_i$ . This money is used to commit subsidies to unprofitable firms that are sold for an effectively

<sup>19</sup> If  $\Delta_i^m > \bar{V}_i - \underline{V}_i$  the manager works too hard. Recall that we are in the case where it would be efficient to keep the company in operation after it failed, but where the holding will close it down. Thus, under private control the manager's rent is lost in case of a failure, while in the first-best case the loss is only  $\bar{V}_i - \underline{V}_i$ . Therefore the manager's private return to an increase in effort is bigger than the social return.

negative price. If the sum of the revenues obtained from selling the successful firms exceeds the sum of subsidies that have to be committed to keep all unsuccessful firms in operation, then the surplus is transferred to the state budget.<sup>20</sup> Thus the government agency faces the standard discrete linear programming problem

$$\min_{\{x_i\}} \sum_{i=1}^n (1 - x_i) \Delta_i \quad \text{s.t.} \quad \sum_{i=1}^n x_i V_i + (1 - x_i) V_i^L \geq 0. \quad (9)$$

If we ignore the integer problem this program has a straightforward solution<sup>21</sup>: Keep all firms with  $V_i > V_i^L$  in operation. Index the firms that failed by  $j \in \{1, \dots, f\}$ , such that

$$\frac{\Delta_j}{V_j^L - V_j} \geq \frac{\Delta_{j+1}}{V_{j+1}^L - V_{j+1}}, \quad (10)$$

and subsidize them in the order of their indices until the budget is exhausted. Note that the order of subsidization is socially efficient. However, the amount of subsidies paid to the firms is inefficient. Two cases can be distinguished:

The budget of the government agency is exhausted before all firms that failed but satisfy  $V_j^L - V_j < \Delta_j$  have been subsidized, and too many firms are closed down. However, since there are fewer inefficient liquidations than under private control, the outcome is socially more efficient than the one induced by the holding company.

The budget exceeds the amount of subsidies necessary for these firms, and thus some enterprises that should have been closed down will be kept alive. In this case the efficiency comparison with the holding company is ambiguous. Note that if the government could control wasteful subsidies this case would never arise.

Consider now the decision problem of manager  $i$  at date 1. His action  $a_i$  determines the probability  $p_i(a_i)$  with which his firm succeeds. If it succeeds he will keep his rent  $\Delta_i^m$  for sure. In case of a failure, his firm may or may not be closed down depending on whether the government agency has enough funds left to help him out of trouble.

Given that firm  $i$  failed there are  $2^{n-1}$  possible outcomes of successes and failures of all other firms. The probability of each outcome depends on  $a_{-i} = \{a_1, \dots, a_{i-1}, a_{i+1}, \dots, a_n\}$ . Let  $L_i$  be the set of outcomes which lead to a liquidation of firm  $i$  and let  $q_i(a_{-i}) = \text{Prob}(L_i | a_{-i})$  be the probability that

<sup>20</sup> The German Treuhandanstalt is a good example of such a policy.

<sup>21</sup> This program is a classical knapsack program. A computational problem may arise because  $x_i$  is restricted to be in  $\{0, 1\}$ . See, e.g., Dantzig (1963, Chap. 26) for how this problem can be solved. The solution is standard and not interesting in our context.

firm  $i$  will be shut down if it fails. Then the manager's problem is to pick  $a_i$  such that

$$a_i \in \arg \max_{a_i \in \mathbf{R}_0^+} \{ w - [1 - p_i(a_i)] \cdot q_i(a_{-i}) \cdot \Delta_i^m - a_i \}. \quad (11)$$

In equilibrium the utility-maximizing level of effort for manager  $i$ , denoted  $a_i^g$ , is uniquely characterized by the FOC

$$p'_i(a_i^g) \cdot q_i(a_{-i}^g) \cdot \Delta_i^m = 1. \quad (12)$$

Comparing (12) to (6) it is clear that

$$q_i(a_{-i}^g) \cdot \Delta_i^m \leq \Delta_i^m. \quad (13)$$

Note that (13) holds with equality only if it is certain that the government agency will not have the funds to subsidize firm  $i$ . In this case there is no difference between private and government control. However, if (13) holds with strict inequality, then  $p'_i(a_i^g) \geq p'_i(a_i^p)$  and concavity of  $p_i(\cdot)$  implies that the manager spends less effort if his firm is controlled by the government agency than if it is owned by the private holding. He foresees that even if he fails, the government agency will help him out of trouble with probability  $(1 - q_i)$ , which diminishes his incentive to restructure efficiently.

## 5. IMPLICATIONS OF THE MODEL

Both governance structures generate an inefficient allocation compared to the first-best. The inefficiency results from the impossibility of aligning perfectly the incentives of the managers with social welfare maximization. Consider first management incentives at the level of the holding company and the government agency. If there were no externalities, i.e., if the net present value of future profits of each firm equals the social benefits of keeping the firm in operation, then the profit-maximizing decision of the director of a holding company on whether to liquidate the firm would be socially optimal. However, if there are large social costs of liquidation that are not borne by the owner, then a privately owned holding will shut down more firms than is socially efficient. The administrator of a government agency, on the other hand, will shut down fewer firms because he is inclined to subsidize as much as possible. While this may be beneficial in reducing the number of *ex post* inefficient liquidations, it has a detrimental effect on *ex ante* efficiency because it dilutes the incentives of the managers on the firm level.

Under both regimes the manager of an individual firm is likely to spend an inefficiently low amount of effort, but he will work harder if his company is privately controlled than if it is under the control of a government agency.<sup>22</sup>

<sup>22</sup> Even if there are no social costs of liquidation and the liquidation decision is socially efficient, the manager on the firm level will not choose the first-best level of effort, because effort is not observable and there is a standard moral hazard problem.

Government control leads to a soft budget constraint for the manager. He rationally anticipates that the government agency will try to help him out of trouble because liquidation of his firm involves high social costs. Privatization hardens his budget constraint. Under private control the manager knows that a private owner, who does not care about social welfare, will not subsidize his losses.

In the model privatization is a commitment device of the government. If the firm is under private control there will be no cross-subsidization from other firms. The question whether this commitment is credible arises. If the government is concerned about the social costs of liquidation of a particular firm it could step in and subsidize the losses of this firm, so that it will not be closed down by the holding. There are clearly some cases in which this is going to happen, but it can happen only to a limited extent. The reason is that these subsidies have to come from the general budget. The government cannot expropriate shareholders of the holding company by transferring the profits of successful firms directly to the unsuccessful ones, which is possible only if these firms are owned by the state.<sup>23</sup> In the transition period the budget will be tight, the government will be credit rationed on international capital markets, and there will be a strong pressure from international organizations like the IMF or the World Bank not to undermine macroeconomic stability by giving soft credits to unprofitable firms or by financing the budget deficit through the central bank. Thus, the scope for subsidies is limited.<sup>24</sup> Furthermore, to the degree that subsidies from the general budget are feasible, they would probably also be paid to the government agency. Thus, they affect both regimes symmetrically and do not alter the basic trade-off.

### *How to Structure the Portfolio of Firms*

Not all the firms have to be privatized at the same time. The government could give some of them to private holding companies and leave the rest under the control of government agencies for some time. If it does so, the question of which firms should be privatized first arises.

Our model suggests that all the firms with  $V_i^L - V_i > \Delta_i$  should go immediately to private holdings. If these firms fail, the social costs of liquidation are lower than the expected future losses, and they should not be kept alive. Under the control of a government agency there is a positive probability that

<sup>23</sup> However, the government could partially expropriate stockholders by increasing the tax rate on corporate profits. Goldfeld and Quandt (1991) analyze the impact of such a policy on input demands of the firm.

<sup>24</sup> This argument does not hold for the case of Germany. For a more subtle argument why privatization in western industrialized countries can be a commitment device to restrict the amount of subsidies see Schmidt (1990). For other models of the soft-budget constraint see Goldfeld and Quandt (1991) and Schaffer (1989).

such a firm will fail and that there will be enough funds left to subsidize it. This is socially wasteful and it weakens the incentive of the manager to work hard. The holding company, on the other hand, will not hesitate to close down this firm in case of a failure. This is not only socially efficient; it also gives a stronger incentive to the manager to restructure, so that the probability of failure is smaller.

What can be said about firms that are more important for social welfare, those whose  $V_i^L - V_i < \Delta_i$ ? In this case expected social welfare under private control is higher than that under government control if and only if

$$W_i^p = p_i(a_i^p)\bar{V}_i + (1 - p_i(a_i^p)) \cdot [V_i^L - \Delta_i] - a_i^p > p_i(a_i^g)\bar{V}_i + (1 - p_i(a_i^g)) \cdot [(1 - q_i)V_i + q_i(V_i^L - \Delta_i)] - a_i^g = W_i^g, \quad (14)$$

where  $a_i^p$  and  $a_i^g$  are characterized by (6) and (12), respectively. Suppose that  $q_i$  is close to 1; i.e., the probability that the government agency will have the funds to rescue the firm is small. In this case there is little difference between governmental and private control. Under both governance structures the firm will be closed down if it fails and the incentives for the manager are the same. Now suppose that  $q_i$  is considerably smaller than 1. In this case the manager's incentives are weaker under government control, so that  $a_i^g < a_i^p$  and  $p_i(a_i^g) < p_i(a_i^p)$ . However, if the firm fails it will be cross-subsidized with probability  $(1 - q_i)$ , which is socially efficient.

As can be seen from (14), private control is more likely to be optimal (i) if the prize in the case of success ( $\bar{V}_i$ ) is high, (ii) if the incentive effect is strong,  $p_i(a_i^p) - p_i(a_i^g)$  is large, or (iii) if the net social loss of liquidation  $V_i - V_i^L + \Delta_i$  is small. The intuition for this result is straightforward. First, if  $\bar{V}_i$  is large, then it is very important that the firm be successful, so the manager should be given an incentive to increase the probability of success, even if this is possible only at the price of considerable social costs in case of failure. On the other hand, if  $\bar{V}_i$  is small, then it is more important to prevent the social costs of liquidation rather than to give better incentives to the manager. Second, if the action of the manager has a strong impact on the probability of success, then his incentives are more important than they are in the case where his action hardly affects the prospects of the firm. Finally, if the social cost of shutting down the firm is not much higher than the social cost of keeping it in operation then it is more important to give better incentives to the manager than to prevent future liquidation.

To summarize, there are two kinds of firms that should be privatized immediately:

firms with little social significance that should not be subsidized anyway in case of a failure.

firms for whom the incentives of the manager are very important, either because efficient restructuring by the manager has a strong impact on the probability of success or because the firm will be very profitable if it succeeds.

On the other hand, firms that either have very high social costs of liquidation or will fail anyway no matter how hard the manager works should be kept under governmental control. Note that this will often include the firms that would have been subsidized by the government even if they were under the private control of a holding.

When the government structures the portfolios of the holdings and of the government agencies, it will also take revenue considerations into account. If a company with high expected profits is given to a holding, then these profits are lost as a source of revenue for a government agency. This is desirable if the government wants to limit wasteful subsidies of its agencies. However, if the government is afraid that there will not be enough funds available to cross-subsidize, it will give this firm to a government agency as a source of revenue, even if from the firm's point of view immediate privatization would have been optimal.<sup>25</sup>

### *Intermediate Governance Structures*

Two proposals by Lipton and Sachs (1990) and Blanchard et al. (1991), which have found considerable attention in the literature, can be seen as intermediate governance structures that yield a limited commitment of the government not to subsidize too much. Lipton and Sachs (1990) suggest that the government agency keeps 25 to 30% of the shares that, in the long run, should be sold to a core investor. Thus, only part of the profits of successful firms goes to the government agency and can be used for cross-subsidization. This reduces the probability that the government agency subsidizes too much and hardens the budget constraint for the manager at least to some extent.

Blanchard et al. (1991) favor privately owned holding companies, the managers of which are appointed and can be fired by the government. The holding managers are given some incentives to maximize profits, through stock options, but they will also respond to the pressure of the government. Thus they will probably prevent the socially most costly liquidations. In some cases this is desirable. However, there will also be cases where a harder budget constraint would have improved social welfare. The advantage of this scheme is that the government cannot force the holding managers to cross-subsidize too much, because of the political pressure of the shareholders of the holding who do not want to be expropriated.

<sup>25</sup> This may be an important reason why most governments in Eastern Europe do not want to privatize natural monopolies, but rather keep them in state ownership and protect their profits by restricting market entry.

## 6. CONCLUSIONS

The model developed in this paper is oversimplistic in many respects. In particular, it assumes that there are only two possible outcomes for each firm, success and failure, and that for each of these outcomes the size of the firm and the number of employees are given. In reality there will be a continuum of possible outcomes and the board of directors and the manager will have considerable discretion about how much labor to employ. For example, the government agency could force a profitable firm to keep an inefficient amount of workers in order to reduce the social costs of layoffs and additional unemployment. Or it could subsidize an unprofitable firm to a limited extent, so that only a fraction of the original company will survive. A thorough analysis of these possibilities with a more detailed and complicated model is an important project for future research. However, we believe that the basic trade-off derived in our very simple model will carry over to more complex cases. Government control will lead to more cross-subsidization and lower social costs than private control, but it will have adverse effects on management incentives. Managers anticipate that the budget constraint under government control will be soft, and they will spend less effort to restructure efficiently.

## REFERENCES

- Blanchard, Olivier, Dornbusch, Rüdiger, Krugman, Paul, Layard, Richard, and Summers, Lawrence, *Reform in Eastern Europe*. Cambridge, MA: MIT Press, 1991.
- Bös, Dieter, "Privatization in East Germany: A Survey of Current Issues." Mimeo, International Monetary Fund, 1991.
- Bonin, John, "Privatization and Efficient Contracts: The Worker's Stake in the Transition." *J. Comp. Econom.* **16**, 4:716-732, Dec. 1992.
- Borenstein, Eduardo, and Kumar, Manmohan, "Proposals for Privatization in Eastern Europe." *IMF Staff Pap.* **38**, 2:300-326, June 1991.
- Brada, Josef, "The Mechanics of the Voucher Plan in Czechoslovakia." *RFL/RL Res. Rep.* **1**, 17:42-45, April 24, 1992.
- Dantzig, George, *Linear Programming and Extensions*. Princeton, NJ: Princeton Univ. Press, 1963.
- Dornbusch, Rüdiger, and Wolf, Hugo, "East German Economic Restructuring." Mimeo, MIT, 1992.
- Fischer, Stanley, "Privatization in Eastern European Transformation." NBER Working Paper 3703, 1991.
- Ghemawat, Pankaj, "A Case Study in Organizational Efficiency: Competitive Position and Internal Organization." *J. Comp. Econom.* **17**, in press, 1993.
- Goldfeld, Stephen, and Quandt, Richard, "Effects of Bailouts, Taxes, and Risk-Aversion on the Enterprises." *J. Comp. Econom.* **16**, 2:150-167, 1992.
- Hinds, Manuel, "Issues in the Introduction of Market Forces in Eastern European Socialist Economies." Internal Discussion Paper, The World Bank, Washington, DC, 1990.
- Holmström, Bengt, "Moral Hazard in Teams." *Bell J. Econom.* **13**, 324-340, 1982.
- Holmström, Bengt, and Milgrom, Paul, "Aggregation and Linearity in the Provision of Intertemporal Incentives." *Econometrica* **55**, 303-328, 1987.

- Kornai, Janos, *Economics of Shortage*. Amsterdam: North-Holland, 1980.
- Lipton, David, and Sachs, Jeffrey, "Privatization in Eastern Europe: The Case of Poland." *Brookings Pap. Econom. Act.* 293-333, 1990.
- Milgrom, Paul, and Roberts, John, *Economics, Organization and Management*. Englewood Cliffs, NJ: Prentice-Hall, 1992.
- RFE/RL Research Report, "Radio Free Europe/Radio Liberty Research Report," Vol. 1, 1992.
- Sappington, David, and Stiglitz, Joseph, "Privatization, Information and Incentives." *J. Policy Anal. Management* 6, 4:567-582, 1987.
- Schaffer, Mark, "The Credible-Commitment Problem in the Center-Enterprise Relationship." *J. Comp. Econom.* 13, 3:359-382, 1989.
- Schmidt, Klaus, "The Costs and Benefits of Privatization." Discussion Paper A-287, SFB 303, University of Bonn, 1990.
- Schnitzer, Monika, "Breach of Trust in Takeovers and the Optimal Corporate Charter." Discussion Paper 92-10, MIT, 1992.
- Shleifer, Andrei, and Summers, Lawrence, "Breach of Trust in Hostile Takeovers." In A. Auerbach, Ed., *Corporate Takeovers: Causes and Consequences*. Chicago, IL: Univ. of Chicago Press, 1988.
- Sinn, Hans-Werner, "Privatization in East Germany." Working Paper 3998, NBER, Cambridge, 1991.
- Tirole, Jean, "Privatization in Eastern Europe: Incentives and the Economics of Transition." *NBER Macroeconom. Annu.*, 221-259, 1991.