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Does Sequencing of Privatization Matter in Reforming Planned Economies?

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Abstract

Although a centerpiece of the reform process in Central and Eastern Europe, large-scale privatization cannot be undertaken all at once and policymakers inevitably face the choice of privatizing some sectors before others. This paper analyzes the allocative efficiency implications of alternate sequences of privatization in a reforming planned economy with two sectors--an input-producing upstream sector and a final goods-producing downstream sector. The model focuses on the link, through a market for intermediate inputs, between the two sectors. The impact of exogenous shocks to the two sectors are highlighted to show how the inflexibility of public firms in responding to shocks constrains the production response of private firms operating in perfectly as well as imperfectly competitive markets.

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Summary

Rapid privatization in the reforming planned economies of Central and Eastern Europe has become a popular policy prescription among economists. A primary virtue of private ownership, they argue, is that it enhances firms' ability to respond to market signals, thereby helping the economy achieve an efficient allocation of resources. However, simultaneous privatization of all economic sectors in a short time is largely precluded by these countries' limited administrative capacity. Under these circumstances, some sectors will necessarily be privatized before others. A relevant question to ask, then, is whether privatization can be optimally sequenced in different sectors.

This paper assesses allocative efficiency gains that accrue under alternate sequences of privatization of different sectors in an economy. Specifically, it analyzes an economy linked vertically with two sectors--an upstream sector producing intermediate inputs and a downstream sector producing final goods. Two types of market signals--the market price of raw materials (reflecting their scarcity) and the market price of final goods (reflecting consumer demand)--are introduced in the model. A distinction between public and private firms is made by assuming that private firms are more responsive to the market signals than are public firms.

Efficiency gains are shown to be maximized when the sector facing relatively less uncertainty is privatized first. Thus, if shocks to the demand for final goods are more critical than those to the supply of raw materials, it is optimal to privatize the upstream sector first. On the other hand, if supply shocks are relatively large, the downstream sector should be privatized first.

An important characteristic of the formerly centrally planned economies is the high concentration of firms in almost all sectors. This gives rise to fears that privatization could potentially lead to the creation of monopolies or oligopolies. Thus, distortions that may be introduced by privatizing highly concentrated sectors must be considered when determining the optimal sequencing of privatization.

When oligopolistic markets and inflexibilities associated with state ownership are considered jointly, the optimal sequencing of privatization depends on market structure considerations--the number of firms and the elasticity of demand and supply in the two sectors--as well as on the relative variability of the shocks the two sectors face. If the market structures of the two sectors are similar, the choice of which sector to privatize first should be based on the variability of supply shocks relative to demand shocks. On the other hand, if the variability of the shocks in the two sectors is comparable, the sector with the less concentrated market structure should be privatized first.

I. Introduction

The virtues of rapid privatization in reforming planned economies have gained prominence in recent times. A key argument in favor of private ownership of productive assets is that it is an integral aspect of a market economy where individual agents receive and respond to market signals in the quickest possible way. Therefore, privatization assumes importance since that it allows for smooth information flows.

Most recent discussions on privatization, especially in the case of Central and Eastern European countries, emphasize the need for a rapid and complete change in the ownership of assets. 1/ The limited experience of these economies in selling or transferring public enterprises to the private sector, however, has already unmasked a myriad of complications. The lack of a competitive environment could lead to highly concentrated ownership and create undesirable monopolistic market structures. There are also fundamental problems arising from the absence of financial markets--how are shares to be valued, sold, or distributed, and how are modern instruments of savings to be developed? 2/

While the importance of a rapid transfer of ownership in enhancing economic efficiency cannot be overstated, there are alternative solutions that need to be explored in the interim period, particularly in view of the practical limitations in undertaking large-scale privatization in a short span of time. These solutions typically involve initiating state enterprise reforms and structural reforms that create a competitive and market-oriented environment. Thus, during the transition period, privatization in imperfectly competitive as well as in the newly created competitive environment will be taking place. Whatever the circumstances, it appears almost inevitable that privatization will have to occur in some sectors before others.

In this paper we assume, as is being observed in most Central and Eastern European countries (Table 1 summarizes the recent progress made in privatization.), that simultaneous privatization of all sectors is not possible. An important question to ask, then, is whether privatization can be optimally sequenced in different sectors under different market structures--competitive as well as noncompetitive. This question becomes particularly interesting when the various sectors of an economy are interdependent, and the ability of a newly privatized sector to respond quickly to market signals may be limited by its dependence on sectors which remain under state control.

1/ See, for example, Sachs (1991) and Murphy, Shleifer, and Vishny (1991).

2/ Calvo and Frenkel (1991) identify several obstacles hindering reform in centrally planned economies.

Table 1: Selected Market Economy Indicators in Central and Eastern European Countries

	Albania	Bulgaria	CSFR	Hungary	Poland	Romania
Privatization Law	Approved by Parliament in Aug'91	Draft law submitted to Parliament in Dec'91	Passed in stages during 1990-91	Passed in stages during 1988-91	Passed in July'91	Enacted in Aug'91
Progress in Privatization	Small-scale: some to previous owners Large-scale: none	Small-scale: some through leasing Large-scale: none	Small-scale: over half auctions and restitutions Large-scale: very few, starting in March'92	Small-scale: 900 firms sold Large-scale: Started in 1990, very few sold	Small-scale: significant Large-scale: few, through a combination of schemes	Small-scale: some in retail Large-scale: None
Output Share in Private Sector	Agri: 10% Industry: 0% (1990)	Agri: 70% Industry: 5%	N.A.	N.A.	Agri: most Industry: 17%	Agri: 80% Industry: 0%
Price Liberalization	Less than 20% in CPI (Nov'91)	80-90% in CPI (Feb'91)	Nearly 95% in total turnover	More than 90% in CPI	83% in CPI	83% in CPI
Trade Liberalization	Generally liberalized since Aug'91 Licensing for some items remain	Nearly 100%, (tariffs exist)	All (except gas, oil, narcotics, and arms)	90% freed from licensing in 1991	All (except imports of military and radioactive material)	Nearly 100% (tariffs exist)

Source: Based on data provided by national authorities during 1991.

There is surprisingly little analytical work available on the optimal sequencing of privatization. Even policy discussions in this regard have tended to focus on the sequencing of reforms during the early stages of transformation. 1/ Although the importance of freeing goods markets and establishing financial markets as preconditions to privatization have been emphasized, discussions on the actual sequencing of privatization have been limited to equity and cost considerations. These discussions have generally come to the conclusion that it is better to privatize small firms first, both because it is more practical in the absence of well developed financial markets and because it leads to a more equitable distribution of former state-owned assets. 2/ Table 2 indicates the various privatization schemes proposed in Central and Eastern European countries.

As economies move to more advanced stages of reform, allocative efficiency considerations, rather than issues of equity and the actual mechanics of the transfer of state assets, are likely to become important. Moreover, the ability of firms to adjust production in response to changes in market prices of both inputs and outputs will be critical in achieving an efficient allocation of resources. Price uncertainty in the formerly centrally planned economies has increased rapidly as these economies have become more market-oriented, 3/ and, as Tirole (1991) points out, "two key specificities of the Eastern European transition process are the unusually high level of uncertainty in the firms' environment and the nonstationarity in its level." Thus, private ownership, because it enhances firms' flexibility and adaptability to change, is of critical importance. Furthermore, if privatization of different sectors affects the overall flexibility of the economy in different ways, the sector to be privatized first can be chosen to provide the greatest gains in allocative efficiency, through the increased flexibility of firms in that sector.

Among the few authors addressing sequencing issues in privatization are Scheinkman and Glaeser (1990), who divide the economy into two sectors--an "upstream" sector producing intermediate inputs and a "downstream" sector producing final goods. They argue that sectors facing greater uncertainty should be privatized first because the gains from private ownership--the ability to respond to shocks--are greatest in those sectors. Although a useful first step in trying to understand sequencing issues, the model in Scheinkman and Glaeser has two shortcomings that have an important bearing on the results. First, although the two sectors are labelled "upstream" and

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1/ See, for example, Genberg (1991). Demekas and Khan (1991) describe the start of the reform process in Romania, and Lane (1991) discusses the reforms in Poland.

2/ Borensztein and Kumar (1991), in their survey of the various privatization proposals in Eastern Europe, describe the distributive aspects of several privatization schemes.

3/ The collapse of CMEA trade and terms of trade shocks have affected state enterprises significantly. In addition, uncertainty over commercial, trade, and domestic policies during the transition has increased.

Table 2: Proposed Privatization Schemes in Central and Eastern Europe

	Small-scale sector	Large-scale sector
Albania	first offer of lease or sale to previous owners, followed by auction to citizens, followed by auction to foreigners	initially break up of large firms; combination of sale and vouchers (rudimentary stage of preparation)
Bulgaria	sale through auction of small establishments in trade, services, and tourism	first create competitive environment through price and trade liberalization, break up of monopolies; schemes being discussed are a combination of free distribution, sale of shares, and restitution to previous owners
CSFR	frequent auctions to citizens; significant number of small businesses returned to previous owners	through free distribution of equity to public through voucher schemes, direct sales
Hungary	sale to existing managers or auction to new buyers; leased initially in case of restitution problems	sale to single buyers, including foreigners, or through public share offerings (mainly due to budgetary reasons)
Poland	direct sales; few converted to joint stock companies	mass privatization through voucher schemes; mutual funds being developed to ensure equity; commercialization; direct sales
Romania	leasing; management contracts; early sale of enterprises, including to current managers	sale mainly through creation of holding companies in the interim period (7 years); 30% to be distributed freely through creation of mutual funds

Source: Based on information provided by national authorities, various articles and newspapers.

"downstream", their interdependence is not explicitly incorporated. One obvious link between the two sectors is through a market for intermediate goods. To the extent that downstream firms rely on the upstream sector to produce their inputs, the ability of privatized downstream firms to expand production in response to a positive shock to final goods demand will surely be constrained by the inability of upstream firms which continue to be owned by the state, to supply more inputs. 1/ Similarly, if upstream firms are privatized, their production decisions will be constrained by the inability of state-owned downstream firms to absorb more inputs.

Second, although Scheinkman and Glaeser acknowledge that the presence of oligopolistic market structures will affect their results on the optimal sequencing of privatization, they do not analyze this effect. The belief in the economies of large-scale production in the formerly centrally planned economies has led to the creation of monolithic production units at the expense of encouraging competition. Privatization of such units is likely to give rise to highly concentrated markets, and could result in rent-seeking behavior by the newly privatized monopolies. 2/ The existence of highly concentrated markets raises questions regarding the efficiency losses associated with privatizing oligopolistic markets and whether consideration of these losses could influence the optimal sequencing of privatization.

This paper analyzes allocative efficiency gains that accrue under alternate sequences of privatization by explicitly incorporating a vertical link between the upstream and downstream sectors through an intermediate goods market, as well as allowing for imperfect market structures. The focus is on a transforming economy with two sectors. 3/ Prices of all goods are allowed to adjust to clear the market. The two sectors are subject to exogenous shocks--the upstream sector is subject to a raw material supply shock while the downstream sector is subject to a final goods demand shock. It is assumed that public firms are less flexible in responding to exogenous shocks than private firms in the following sense: inputs are chosen by state-owned firms <u>after</u> they have observed shocks in their own sector but <u>before</u> those in the other sector, whereas the private

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1/ Sahay (1991) presents a mixed economy framework with private downstream and public upstream sectors. Her model highlights the allocative inefficiency that arises when the upstream suppliers allocate intermediate input quotas to downstream firms on the basis of installed capacity.

2/ Opening up the economy to foreign trade may be a way of creating a competitive environment. However, as argued by Newbery (1991), concentrated industries are well placed to lobby for protection. In addition, trade liberalization does little to impose competitive pressure on nontraded sectors.

3/ While recognizing the importance of several factors that are currently inhibiting the privatization process, for analytical purposes we assume that the bare elements of structural and institutional reforms required to begin privatization are in place.

sector is able to make its production decisions after observing the shocks in both sectors.

The analysis under perfect competition indicates that the remaining allocative distortion in the economy after partial privatization can be minimized by privatizing the sector which is subject to smaller shocks. Because of the link between sectors through the intermediate goods market, the ability of this stylized economy to respond to both demand and supply shocks depends on the flexibility of the less responsive sector--the sector which is kept under state control. Since the relatively inflexible state sector responds only to shocks within its own sector and not to those in the other sector (while the private sector responds to all shocks), the higher the relative uncertainty in the state sector, the higher will be the capacity of the economy to react to shocks. Hence, if supply shocks are relatively important, the optimal sequencing of privatization involves privatizing the downstream sector first. If, on the other hand, demand shocks are critical, the upstream sector should be privatized first.

The model is extended to assess the effects of imperfectly competitive sectors on optimal sequencing. Optimal sequencing involves, as expected, privatization first of the less oligopolistic sector--that is, the sector with more firms and less oligopoly rents. When the distortions due to both imperfect market structures and the public sector inflexibility are considered jointly, the optimal sequence of privatization depends on whether the resulting distortions reinforce each other or work in opposing directions. 1/

The remainder of this paper is organized as follows: Section II describes the framework and Section III outlines the benchmark model of a private economy. Section IV analyzes privatization under the assumption of perfect competition while Section V is devoted to privatization under imperfect competition. Some conclusions and policy implications for Central and Eastern Europe are presented in Section VI.

II. The Framework

Consider a reforming planned economy with two sectors--upstream and downstream. Firms in a typical upstream sector use raw materials (M) to produce an intermediate good (I) which is then used by firms in the

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1/ If, for example, demand shocks are considerably more critical than supply shocks, it may be desirable to privatize the upstream sector first even if there are few upstream firms and the elasticity of supply of raw materials is low.

downstream sector to produce a final good (Y). 1/ There are two exogenous sources of uncertainty in the vertically linked sectors, and both have an important bearing on the efficient allocation of resources. First, the cost of raw materials (v), which reflects their scarcity, can vary. Second, the price of the final good (P), which reflects consumer demand, is also uncertain. Suppose that v is equal to v_G with probability p and v_B with probability (1-p), where $v_G < v_B$, and P is equal to P_g with probability q and P_b with probability (1-q), where $P_g > P_b$. Both v and P are exogenous and cannot be influenced by the two sectors. 2/ Some examples of vertically linked sectors are provided in Table 3.

Suppose that the planned economy wishes to move to a market-oriented one, but faces the constraint that only one of the two sectors may be privatized. The question addressed in this paper is whether the choice of which sector to privatize first affects the overall efficiency gains arising from the reform. To focus on this issue, the distinction between public and private firms needs to be clarified.

Some significant ways in which a public firm may be distinguished from a private firm are (1) a public firm, facing a soft budget constraint, has distorted incentive structures whereas the private firm does not; (2) a public firm cannot lay off workers as easily as a private firm; and (3) a public firm is saddled with a rigid hierarchical system where bureaucratic delays and coordination problems in decision making are common, with the result that public firms are less flexible, relative to private firms, in responding to exogenous shocks. Since it is virtually impossible to look at all aspects simultaneously, this paper focuses exclusively on the last distinction. We do not wish to underplay the importance of other considerations; rather, the purpose here is simply to isolate one of the important distinctions between public and private firms that has largely been neglected in the literature.

The way in which a public firm is distinguished from a private firm in this model is that the former must choose its inputs before observing some shocks while the latter may continuously vary its purchases of inputs. The managers of state-owned as well as private firms maximize profits. At the beginning of the period, each of the two shocks is observed by firms in one

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1/ There are many sectors in a typical economy; the purpose here is to look at any two sectors that are linked to each other through an intermediate goods market. In this sense, the analysis presented here is within a partial equilibrium framework. Alternatively, the analysis under perfect competition may be thought of as relevant to an open economy in which raw materials and final goods are traded goods, while the intermediate input is nontraded.

2/ The subscripts G and g stand for the good states of nature while B and b for bad states of nature. The state of nature is good when final goods prices are high and raw material prices are low, and bad when the reverse holds.

Table 3: Examples of Interlinkages between Sectors

Raw material (input of upstream sector)	Intermediate input (output of upstream sector) (input of downstream sector)	Final good (output of upstream sector)
fertilizer	agricultural produce	processed food
fossil fuels	electricity	industrial goods
trees	lumber	wood products
livestock	hides and skins	leather products
labor	building material	buildings
transport equipment	distribution services	retail trade

sector--upstream firms observe the supply shock while downstream firms observe the demand shock. Thus, public firm managers form an expectation over all possible states of nature which may prevail in the private sector and choose inputs to maximize expected profits. Once this input choice has been made, information on shocks in both sectors becomes available to all agents in the economy and private firms make their optimal production decisions. 1/

III. Benchmark Model

In a competitive market economy, firms in both sectors are privately owned and all price information is available at the time firms make their production choices. The representative upstream firm of type i, where i=G,B, chooses a quantity of raw materials (M) to maximize

$$\max_{M} \; r_{ij}H(M) - v_i M \tag{1}$$

where r_{ij} is the market price of intermediate goods when the upstream sector is of type i and the downstream sector is of type j. The representative downstream firm of type j, where j=g,b, chooses the optimal quantity of intermediate goods (I) to maximize:

$$\max_{I} \; P_j F(I) - r_{ij} I \; . \tag{2}$$

F and H are twice continuously differentiable concave production functions satisfying the Inada conditions and F(0)=H(0)=0. The associated first order conditions are:

$$r_{ij}H'(M^*) = v_i \tag{3}$$

and

1/ This informational assumption highlights the inability of state-owned firms to adjust production to the optimum level. Alternative assumptions regarding the ability of public and private firms to respond to shocks can also be made. The qualitative results would remain unchanged, however, as long as public firms are less responsive to shocks in the private sector than private firms.

$$P_j F'(I^*) = r_{ij} \quad . \tag{4}$$

Each firm takes the intermediate goods price as given when choosing its optimal production level. In equilibrium, however, the supply of intermediate goods must equal demand ($H(M^*)=I^*$). For ease in aggregation, it is assumed that the number of upstream and downstream firms is equal. Using the first order conditions, equilibrium requires:

$$H'(M^*)\,F'(H(M^*)) = \frac{v_i}{P_j} \quad . \tag{5}$$

In other words, the combined marginal product of raw materials equals its real cost. Thus, the optimal choice of raw materials, M^*, depends on both i and j. Furthermore,

$$M^*_{ig} > M^*_{ib} \;\; \forall\, i \;,\; and \;\; M^*_{Gj} > M^*_{Bj} \;\; \forall\, j \;. \tag{6}$$

Given the assumptions regarding the production functions of both sectors, a higher level of M implies a higher level of final output Y.

This simple model highlights the link between the different sectors of a vertical economy. For example, the optimal response of downstream firms to a shock in the final goods price depends not only on the size of the shock but also on the induced change in the intermediate goods price. Since the price of intermediate goods adjusts to equate the supply of intermediate goods to its demand, the choice of raw materials used by the upstream firm determines the amount of final goods produced downstream. 1/ In equilibrium, this choice depends on the shocks in both sectors, and all exogenous price information in the economy is efficiently utilized.

IV. Privatization under Perfect Competition

There are many firms in the upstream and the downstream sectors such that each firm is assumed to be a price taker. The scenario in this section typifies an economy where the creation of a competitive environment has largely preceded privatization on a wide scale.

1/ Productivity shocks can easily be introduced without altering the basic thrust of the arguments presented in this paper.

1. Downstream privatization

Consider a reforming economy in which the final goods-producing downstream sector has been privatized but the intermediate inputs-producing upstream sector is publicly owned. Assume that the only difference between this economy and the benchmark is that the representative manager in the public upstream sector is constrained to choose the input level before observing the downstream shock. 1/ Thus, the manager of the public firm maximizes profits based on the expectation of the intermediate goods price:

$$\max_{M_i} \quad qr_{ig}H(M_i) + (1-q)\,r_{ib}H(M_i) - v_iM_i \quad . \tag{7}$$

The first-order condition is:

$$\hat{r}_iH'(\check{M}_i) = v_i \quad , \tag{8}$$

where

$$\hat{r}_i = qr_{ig} + (1-q)\,r_{ib} \quad . \tag{9}$$

The manager simply chooses an input level to equate expected marginal revenue with marginal cost. Expected marginal revenue depends on the marginal product of raw materials as well as on the price of intermediate inputs (I), which in turn depends on both supply and demand for I. The demand for intermediate goods when the downstream sector is privately owned is contained in (4). Combining the first order conditions for both sectors (equations (4) and (8)) and noting that the equilibrium level of I does not depend on the downstream state, the equilibrium choice of M in this economy ($\check{M}_i$) must satisfy

$$H'(\check{M}_i)\,F'(H(\check{M}_i))\left\{\frac{\hat{P}}{P_j}\right\} = \frac{v_i}{P_j} \quad , \tag{10}$$

1/ Such an assumption provides a simple way of capturing public sector rigidities and analyzing their effects. All other forms of public sector inefficiency are abstracted from. The objective here is to highlight how public sector rigidities affect the flexibility of the private sector, hence affecting the choice of which sector to privatize first.

where

$$\hat{P} = qP_g + (1-q)P_b \quad . \tag{11}$$

The term inside the curly brackets in (10) is the distortion associated with upstream public ownership. For given $\hat{P}$, this distortion is large if the difference between P_g and P_b is large. Hence, a mean preserving spread around $\hat{P}$, representing increased uncertainty in the downstream sector, increases the distortion.

Figure 1 illustrates the market for intermediate goods in this economy. D_g and D_b are the demand curves when the downstream sector is of type g and b, respectively. Ceteris paribus, a downstream firm will demand more inputs when the final goods price is high than when it is low. The greater the difference between P_g and P_b, the further apart will be the two curves.

The upstream manager must choose M, which amounts to choosing I since H(M)=I, before observing the true demand curve. Once the manager has committed to the optimal choice ($\check{M}_i$), the downstream sector's type is revealed and production takes place. The supply of I is just the vertical line through $\check{I}_i$, and the equilibrium intermediate goods price is $\check{r}_{ig}$ if the final goods price is P_g and $\check{r}_{ib}$ if it is P_b.

In order to compare this economy to the benchmark, the true intermediate goods supply curve (S_i) is included in Figure 1. If the manager of the public firm did not have to choose how much to produce before observing demand, the supply curve would be obtained from expression (3). The benchmark equilibrium output of I, then, would be $I^*_{i\ g}$ in state g and $I^*_{i\ b}$ in state b. The shaded areas correspond to the efficiency losses due to state ownership of the upstream sector. Note that the efficiency loss in each state (the area of the triangle corresponding to that state) depends on the difference between the benchmark output in that state and the output level when there is public ownership of the upstream sector. This difference is large if the difference between P_g and P_b, given $\hat{P}$, is large. 1/ Therefore, the inefficiency associated with downstream privatization (and upstream state-ownership) is large if downstream uncertainty is large.

A positive final goods demand shock has no impact on output and the allocation of productive resources in this economy. Although private downstream firms observe this shock and respond to it by demanding more inputs, upstream inflexibility constrains the ability of downstream firms to expand production. In this simple model, output cannot expand at all and

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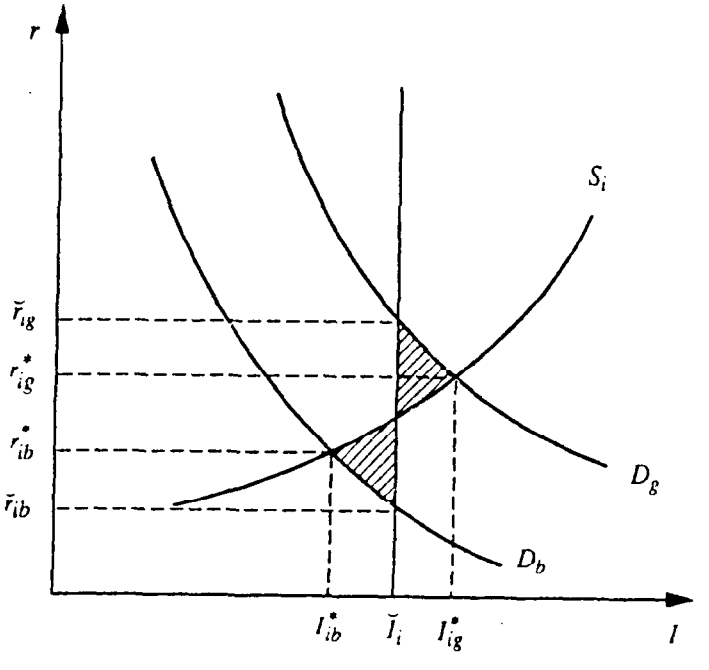
1/ Alternatively, as $\hat{P}$ approaches P_j (no downstream uncertainty), the allocation to upstream public firms approaches the optimal allocation of resources in the benchmark case and efficiency losses go to zero.

Figure 1: Downstream Privatization



the shock is reflected entirely in a higher intermediate goods price. Hence, the publicly owned sector acts as a shock absorber to final goods demand changes, and keeps the economy from utilizing the information contained in these shocks.

2. Upstream privatization

Now suppose that upstream, instead of downstream, firms are privatized. The downstream public firms must decide on their demand for intermediate inputs before their price can be observed. The manager of a representative public firm chooses I_j, then, to solve the optimization problem:

$$\max_{I_j} \; P_j F(I_j) - p r_{Gj} I_j - (1-p) r_{Bj} I_j \quad . \tag{12}$$

The optimal choice (I_j) must satisfy the first-order condition:

$$P_j F'(\tilde{I}_j) = \hat{r}_j \quad , \tag{13}$$

where

$$\hat{r}_j = p r_{Gj} + (1-p) r_{Bj} \quad . \tag{14}$$

The supply of intermediate goods is contained in expression (3), the first order condition for a private upstream firm. Combining (3) and (13), and recalling that the intermediate goods market must clear (I=H(M)), the equilibrium choice of M when the upstream sector is privately owned must satisfy:

$$H'(\tilde{M}_j) F'(H(\tilde{M}_j)) \left\{ \frac{v_i}{\hat{v}} \right\} = \frac{v_i}{P_j} \quad , \tag{15}$$

where

$$\hat{v} = p v_G + (1-p) v_B \quad . \tag{16}$$

The term inside the curly brackets in equation (15) measures the distortion associated with downstream public ownership. For a given $\hat{v}$, this distortion is large when the difference between v_G and v_B is large. Thus, greater

upstream uncertainty--captured by a mean preserving spread around $\hat{v}$--increases this distortion.

Figure 2 depicts the intermediate goods market in an economy with downstream public ownership. S_G and S_B are the supply curves when the upstream sector is of type G and B, respectively. More intermediate goods are supplied when the cost of raw materials is low (v_G occurs) than when it is high (v_B occurs), and the greater the difference between v_G and v_B, the further apart are S_G and S_B.

The vertical line through I_j is the public sector's demand curve and the equilibrium price is $\tilde{r}_{Gj}$ and $\tilde{r}_{Bj}$ in states G and B, respectively. D_j is the true (benchmark) demand curve and the shaded regions correspond to the efficiency losses associated with downstream public ownership. The magnitude of the efficiency loss (the area of the shaded region) is proportional to the difference between the benchmark level of I ($I^*_{i\ j}$) and I_j. This difference is large if the distortion associated with downstream public ownership is large.

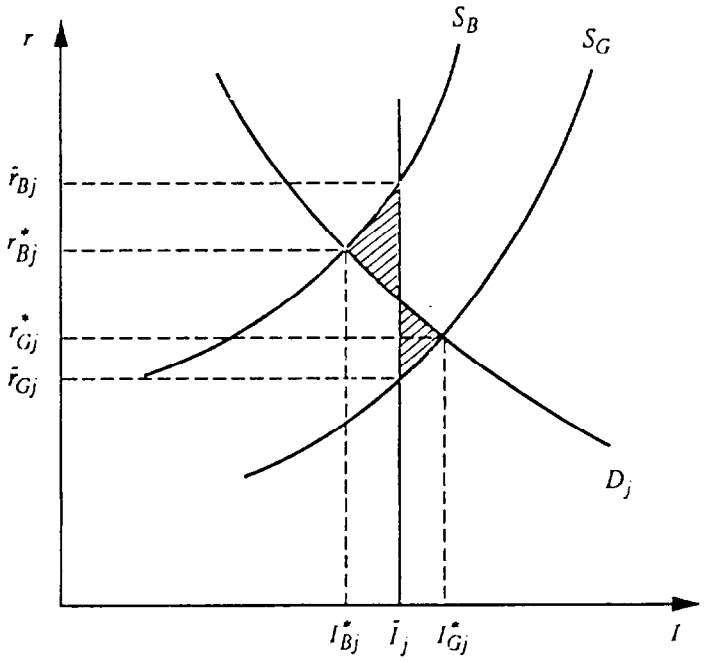
The responsiveness to upstream shocks of an economy with downstream public ownership is limited. For example, a positive shock in the availability of raw materials (reflected in a lower price of raw materials) does not lead to an increase in final output. Even though upstream private firms face lower costs in the wake of such a shock, the inability of the state-owned downstream sector to absorb an increased quantity of intermediate inputs prevents upstream firms from expanding production levels. The positive supply shock, then, is reflected entirely in a lower intermediate goods price.

3. Optimal sequencing of privatization

The preceding analysis can now be used to discuss which sector should be privatized first. Since privatization allows firms to respond more quickly to market signals, and given that only one of the two sectors may be privatized at this stage of the reform process, the objective of partial privatization should be to remove the largest distortion in the economy.

The analysis presented above indicates that the distortion associated with state ownership of a sector is large if uncertainties faced by the other sector are large. Hence, the sector with relatively less uncertainty should be privatized first. This result contrasts with Sheinkman and Glaeser's (1990), who argue that since privatization allows firms to respond more quickly to shocks, the sector with the greatest uncertainty should be privatized first. The intuition for our result derives from two aspects of our model which differ from Scheinkman and Glaeser. First, we stress the interdependence of the two sectors by assuming that there are no substitutes

Figure 2: Upstream Privatization



for the intermediate input. 1/ Second, we make a less restrictive assumption regarding the ability of public firms to respond to shocks. In our model, public firms can react to some shocks, while in Scheinkman and Glaeser's model they do not react to any shocks. Although private firms are more flexible than public enterprises, their ability to adjust production levels in response to price signals depends on their ability to purchase additional inputs (in the case of downstream firms) or their ability to sell more of their output (in the case of upstream firms). Thus, the inflexibility associated with public ownership in one sector is transmitted to the other sector, and the responsiveness of the two sectors as a whole to price signals is effectively determined by the state-owned sectors.

Figures 3 and 4 illustrate the importance of differing relative uncertainties in the two sectors on the optimal choice of which sector to privatize first. In Figure 3, shocks to final goods demand are larger than shocks to raw materials supply. In this case, the equilibrium quantity of intermediate goods produced under upstream privatization (I_g or I_b) is closer to the benchmark than the quantity produced under downstream privatization ($\check{I}_G$ or $\check{I}_B$). On the other hand, if supply shocks are relatively large, as in Figure 4, the true intermediate goods supply curves (S_i's) would be further apart than the true demand curves (D_j's). In this case, downstream privatization gets the economy closer to the benchmark than upstream privatization.

V. Privatization under Imperfect Competition

Using a simple model of imperfect competition, this section considers the implications of privatizing an oligopolistic sector when the other sector is under state control. In order to isolate the distortions associated with imperfectly competitive markets, we first model a private economy in which both sectors are oligopolistic. We then turn to the two alternative cases of partial privatization. In the first case, the downstream sector is perfectly competitive and state-owned, while the upstream sector is an oligopoly with private firms. The second case is with perfectly competitive state-owned upstream and private oligopolistic downstream sectors. 2/ In both cases the market for intermediate goods is assumed to be competitive, and private firms in the oligopolistic sector

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1/ For example, it is difficult to imagine how a downstream potato chip producer can expand production without more potatoes. Even if substitutes for the intermediate input exist, downstream firms can only expand production if more of the substitutes are available. As long as the substitutes are also produced by state enterprises, however, additional inputs will not be available.

2/ Firms in the state sector could also be modeled to behave like oligopolists. The assumption of perfect competition in the state sector helps in isolating the distortions associated with the inflexibility of the public firms.

play a Cournot game. Finally, it is assumed that the upstream sector consists of m firms while the downstream sector has n firms. 1/

1. Upstream and downstream oligopoly

An interesting yet simple way of incorporating imperfectly competitive markets into the model is by introducing Cournot competition. 2/ In contrast to the previous section, suppose that input decisions of upstream firms affect the price of raw materials in the following way:

$$v_i = w_i + aN \quad , \tag{17}$$

where

$$N = \sum_{k=1}^{m} M^k \tag{18}$$

and M^k is the input choice of the kth firm. The term w_i is a supply shock, and equals w_G with probability p and w_B with probability (1-p), where $w_G < w_B$. Suppose also that the downstream sector faces the demand curve:

$$P_j = O_j - bY \quad , \tag{19}$$

where

$$Y = \sum_{k=1}^{n} F(I^k) \tag{20}$$

1/ Different numbers of firms in each sector are introduced to highlight their significance on the results under oligopoly. Note, however, that the primary distinction between perfectly and imperfectly competitive firms arises from the assumption regarding price-taking behavior and not from the number of firms that exists in that sector.

2/ In a Cournot game, each firm conjectures that when it changes its output the other firms will keep their output fixed. In equilibrium, no firm has the incentive to change its level of output given the output of other firms.

Figure 3: Privatization when Demand Shocks Dominate

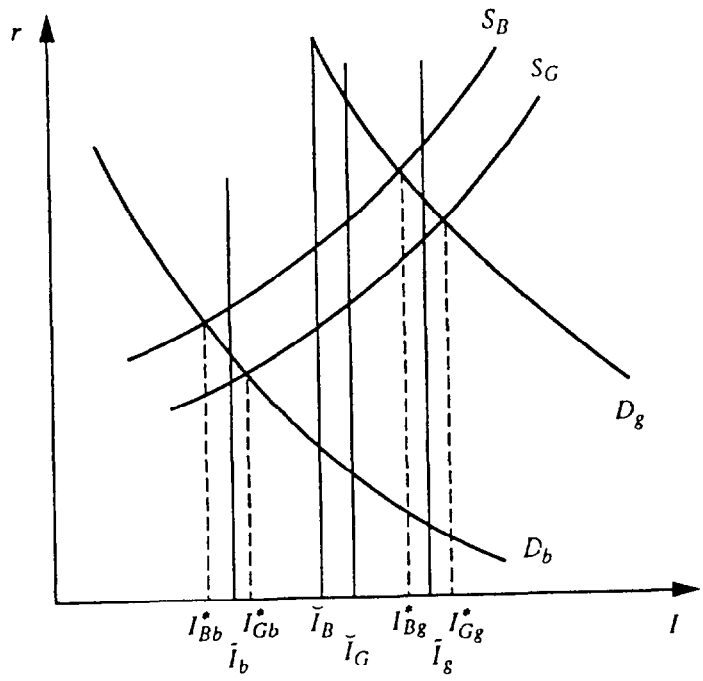
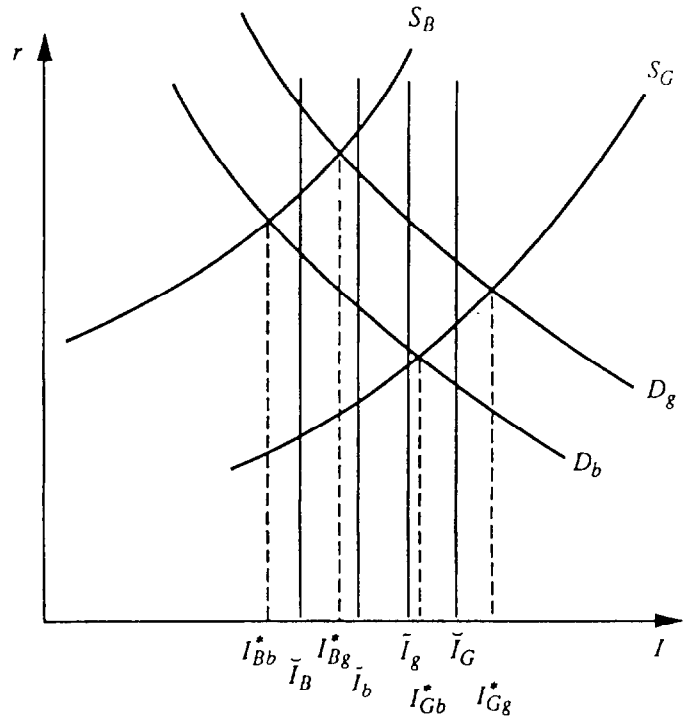


Figure 4: Privatization when Supply Shocks Dominate



Y is the final output and I^k is the input choice of the kth downstream firm. 1/ The demand shock O_j equals O_g with probability q and O_b with probability (1-q), and $O_g > O_b$.

The kth upstream firm's problem, then, is:

$$\max_{M^k} \; r_{ij}H(M^k) - v_i M^k \tag{21}$$

with the first-order condition:

$$r_{ij}H'(M^k) = v_i + aM^k \quad . \tag{22}$$

The optimization problem of the kth oligopolistic firm in the downstream sector is:

$$\max_{I^k} \; P_j F(I^k) - r_{ij} I^k \tag{23}$$

and the first order condition for profit maximization is:

$$P_j F'(I^k) - bF(I^k)F'(I^k) = r_{ij} \quad . \tag{24}$$

In equilibrium, since all upstream firms are assumed to be identical, the quantity of intermediate goods supplied by each firm is the same (and is equal to M) and the market supply (I^S) is:

$$I^S = \sum_{k=1}^{m} H(M^k) = mH(M) \quad . \tag{25}$$

Similarly, since all downstream firms are identical, they all use the same quantity of intermediate goods in equilibrium (each firm uses I) and the market demand for intermediate goods (I^D) is:

1/ The simple linear demand and supply functions are assumed for analytical convenience.

$$I^D = \sum_{k=1}^{n} I^k = nI \quad . \tag{26}$$

Equating the quantity of intermediate goods supplied with the quantity demanded:

$$H(M) = \frac{n}{m} I \quad . \tag{27}$$

Finally, combining the first order conditions for firms in both sectors with the equilibrium condition:

$$H'(M)\, F'(\frac{m}{n} H(M)) \; \frac{\left\{1 - \frac{1}{ne_D}\right\}}{\left\{1 + \frac{1}{me_S}\right\}} = \frac{v_i}{P_j} \quad , \tag{28}$$

where e_D is the elasticity of final goods demand and e_S is the elasticity of raw materials supply.

The distortion associated with the upstream oligopoly is captured by the term in the denominator of the left hand side of (28). If the number of upstream firms is small or if the supply of raw materials is relatively inelastic, thereby allowing upstream oligopolists to capture more rents, this distortion is large. The term in the curly brackets in the numerator of the left hand side of (28) is the distortion associated with the downstream oligopoly. This distortion is large if the number of downstream firms is small. Also, if demand is relatively inelastic, oligopolists can extract more rents and this distortion is large. Note that both distortions reduce the equilibrium quantity of raw materials used in the economy, and hence the equilibrium quantity of final goods produced.

2. <u>Privatization of downstream oligopoly</u>

As in Section III, upstream public firms choose inputs before observing the state of nature downstream. The representative kth firm chooses inputs to maximize:

$$\max_{M^k} \; q r_{ig} H(M^k) + (1 - q)\, r_{ib} H(M^k) - v_i M^k \quad . \tag{29}$$

Furthermore, the public firm is assumed not to extract any monopoly rents. Thus, the manager of the public firm does not internalize the effect of his input choice on the market price for raw materials, and the first order condition for the upstream firm's problem is:

$$\hat{r}_i H'(M^k) = v_i \quad , \tag{30}$$

where $\hat{r}_i$ is as defined in (9).

To solve for equilibrium in this economy, we combine (30) with the first-order condition for the kth downstream firm in (23) and the market-clearing condition (27) to yield:

$$H'(M)\, F'(\frac{m}{n} H(M)) \left\{ \frac{\hat{P}}{P_j} - \frac{1}{ne_D} \right\} = \frac{v_i}{P_j} \quad , \tag{31}$$

where

$$\hat{P} = qO_g + (1 - q)\, O_b - bY \quad . \tag{32}$$

The terms inside the curly brackets in (31) are the combined distortion arising from upstream public ownership and downstream oligopoly. The first part of the distortion is due to the relative inflexibility of state-owned firms to respond to external shocks, and the distortion is large if the variability of final goods demand is large. The second part of the distortion is related to the market structure--the number of firms and the elasticity of demand in the downstream sector. If this market is highly concentrated or if final goods demand is very inelastic, the distortion will be large. Depending on the state of nature, the two distortions (inflexibility of state-owned firms and existence of oligopoly) would either reinforce or offset each other. Expression (30) indicates that the two terms in the curly brackets distort the equilibrium choice of inputs in the same direction in the good state of nature downstream (j=g) and in opposite directions in the bad state of nature downstream (j=b). The intuition is as follows: oligopoly always causes underproduction; based on expected prices of the final good the upstream sector will supply less than the optimal amount of intermediate inputs in the good state, thus reinforcing underproduction caused by oligopoly, while the upstream sector will supply more than optimal amount of intermediate inputs in the bad state, thus offsetting underproduction caused by oligopoly. Of course, if the two distortions exactly offset, the efficient "first best" quantity of Y is produced in state j=b.

3. Privatization of upstream oligopoly

Now suppose that the upstream sector is privatized and the downstream sector is kept under state control. The downstream manager, then, must choose inputs for the kth firm before observing the state of raw materials supply, and his optimization problem is:

$$\max_{I^k} P_j F(I^k) - p r_{Gj} I^k - (1 - p) r_{Bj} I^k \quad . \tag{33}$$

The first-order condition is:

$$P_j F'(I^k) = \hat{r}_j \quad , \tag{34}$$

where $\hat{r}_j$ is as defined in (14). Combining (34) with the first-order condition for an upstream oligopolist (expression (24)) and the market-clearing condition (equation (27)), we get:

$$H'(M)\, F'\left(\frac{m}{n} H(M)\right) \frac{1}{\left\{\frac{\hat{v}}{v_i} + \frac{1}{m e_s}\right\}} = \frac{v_i}{P_j} \quad . \tag{35}$$

The combined distortion in this economy is the term inside the curly brackets in (35). The first term is the distortion associated with downstream public ownership, while the second term is related to the upstream market structure. If the variability of raw materials supply is large, the associated distortion is large. Also, if there are very few upstream firms or if the supply of raw materials is relatively inelastic, the associated distortion is also large. Again, as in the previous subsection, the distortion in the aggregate depends on whether underproduction caused by oligopoly is reinforced (as in the good state of nature) or offset (as in the bad state of nature).

4. Optimal sequencing

The simple oligopoly model highlights the distortions arising from imperfect market structures on the allocation of resources in the economy. Although the objective of (partial) privatization is to minimize the remaining inefficiencies, the gains from privatization may be partly offset by losses due to imperfect competition.

In the absence of state ownership and its associated rigidities, the distortion due to the presence of an oligopoly in a sector is a decreasing function of the number of firms in that sector and the elasticity of market

supply/demand that the sector faces. Thus, if there are fewer upstream than downstream firms and if the elasticity of raw materials supply is less than the elasticity of final goods demand, the inefficiencies arising from the imperfect market structure upstream are more than the inefficiencies due to the oligopoly downstream. On the basis of imperfect market structure considerations alone, the allocative distortion in such a case would be lower if the downstream sector were privatized first and allowed to exercise oligopoly power than if the oligopolistic upstream sector were turned over into private hands.

When inefficiencies arising from state ownership and imperfect competition are considered jointly, however, this implication may be reversed. If either demand or supply uncertainty is relatively large, the distortion imposed by state ownership could become more important than the distortion due to imperfect market structures. For example, if supply shocks are considerably larger than demand shocks, privatizing the upstream sector first may well result in greater efficiency gains even if the upstream sector is more concentrated and there are more oligopoly rents than in the downstream sector. Thus, variability of raw materials supply and final goods demand as well as their elasticities and the concentration of firms in both sectors must be considered in determining the optimal sequencing of privatization.

A final interesting question is whether one should privatize at all (the alternative being the creation of competitive markets before beginning any privatization) if concentration ratios are high across all sectors. Under certain conditions 1/, it may even be better to privatize one of the two sectors despite the existence of oligopoly because of the relative gains associated with increased flexibility of private firms in responding to exogenous shocks. 2/

VI. Conclusions and Policy Implications

As the countries of Central and Eastern Europe move to transform their economies and allow market forces to determine the efficient allocation of resources, the ability of firms to observe and react quickly to market signals will be critical. Thus, private ownership of productive units is important since it enhances firms' flexibility in adjusting production in response to market signals. Since complete privatization of these economies

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1/ The model with both sectors being publicly owned is not developed in the paper, but can easily be demonstrated analytically.

2/ An important caveat to this argument is that if on relative efficiency grounds privatization were to occur despite oligopoly considerations, experience from market economies shows that some form of regulation will ultimately have to be enforced either through anti-trust laws or by ensuring easy entry of new firms in this sector in the future.

cannot be undertaken in one step, an important question to ask is whether it matters which sectors of the economy are privatized first.

Two types of market signals are considered in the model--the market price of raw materials (reflecting their scarcity) is introduced in the upstream sector, and the market price of final goods (reflecting consumer demand) is introduced in the downstream sector. Since prices can vary, an efficient allocation of resources in the economy requires that firms respond quickly to changes in both prices. Efficiency gains resulting from privatization, then, arise from the increased flexibility of the privatized sector in adjusting to these market signals.

Efficiency gains under perfect competition are shown to be maximized when the sector facing relatively less uncertainty is privatized first. Thus, if shocks to final goods demand are more critical than shocks to raw materials supply, it is optimal to privatize the upstream sector first. On the other hand, if supply shocks are relatively large, the downstream sector should be privatized first.

An important characteristic of the formerly centrally planned economies, moreover, is the high industrial concentration in almost all sectors. This gives rise to fears that privatization could potentially lead to the creation of monopolies or oligopolies, which could exercise market power and distort the allocation of resources in the economy. 1/

Various solutions are currently being offered to address the problems created by concentrated market structures before beginning the privatization process. One quick way, it is argued, of ensuring a competitive environment is to open up the economy. As Table 1 indicates, all countries listed (with the exception of Albania), have largely liberalized their price and trade regimes. However, opening up the economy is insufficient for ensuring competition in all sectors. Trade liberalization will not necessarily ensure competition in the nontraded sectors; also, if there are strong interlinkages with traded sectors, inefficiencies in nontraded sectors will be transmitted to all sectors.

Second, since opening up the economy appears to be insufficient in ensuring competition in all sectors, Tirole (1991) and Newbery (1991) have forcefully argued that a competition-oriented restructuring, involving the break-up of large firms into smaller production units before privatizing them, is required. Table 2 indicates, however, that Bulgaria is the only country that has taken a clear decision to break up large enterprises <u>before</u>

1/ To the extent that such firms already extract oligopoly rents (even when they are under state ownership), privatizing these firms will not <u>create</u> new distortions.

starting its privatization program. 1/ In the other countries, then, optimal sequencing under imperfect competition is likely to become an important issue.

The model presented in the paper is extended to incorporate imperfect market structures. Not surprisingly, the analysis suggests that when the privatization of a sector leads to the creation of an oligopoly, the associated distortion is minimized by privatizing the sector which is less concentrated and less capable of extracting oligopoly rents.

When all factors are taken into account, optimal sequencing of privatization under imperfect competition involves, on the one hand, maximizing the gains arising from increased flexibility, and on the other, minimizing the distortion arising under oligopoly. Thus, the sector facing relatively less uncertainty and containing the relatively less concentrated industrial structure should be privatized first. Both these attributes, however, may not be found in the same sector. In such a case, the relative importance of the two aspects must be ascertained. If demand shocks are much larger than supply shocks, and market concentration in both sectors is roughly similar, flexibility considerations dominate the sequencing decision and the upstream sector should be privatized first. On the other hand, if the upstream sector is much more concentrated than the downstream sector, and the variability of both supply and demand shocks is small, then additional flexibility is less valuable and market structure considerations indicate that the downstream sector should be privatized first. To take an example, available data on four-firm concentration ratios in Yugoslavia (Table 4) suggests that upstream sectors (such as coal, oil, and rubber) are considerably more concentrated than downstream sectors (such as leather, textiles, and paper). Thus, as long as the variability of raw materials supply is comparable to the variability of final goods demand, the downstream sector should be privatized first. In general, then, the optimal sequence of privatization depends on the attributes of the economy, and is likely to be different for economies with different attributes.

1/ This is not to say that some enterprise restructuring is not proceeding in other countries of Central and Eastern Europe; this restructuring, which includes breaking up some large enterprises, is not holding up their privatization process.

Table 4. Yugoslavia: Output Share of Four Largest Firms, 1973

Sector	Output share (in percent)
Coal	84
Oil	90
Ferrous metals	84
Nonferrous metals	98
Shipbuilding	86
Electrical goods	73
Chemicals	72
Building materials	53
Wood	26
Paper	52
Textiles	31
Leather	53
Rubber	100
Food	44
Tobacco	60

Source: Estrin (1983).

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