THE TRANSITION TO FREE MARKETS: WHERE TO BEGIN PRIVATIZATION

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Abstract

This essay formally models the sequencing of privatization within an industry and across industries. Following Hayek (1945) we assume that the ability to acquire and respond to information is one of the primary advantages of private enterprise. When a primary advantage of private over public ownership is this responsive to information about consumer demand and input costs, then privatization should begin where uncertainty or ignorance is greatest, and in areas that transmit information to other agents. In particular, we show that privatizing middlemen may be particularly valuable when surrounding sectors are also private. We also show that industries facing elastic demand should be privatized first.

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I. Introduction

Privatizing state-run enterprises begs three questions: (1) Should privatization occur at all?, (2) How fast should privatization be?, and (3) Where should privatization begin? Barone (1935) formalized the first question: "Will it be beneficial for some of the capital to become collective property and for production to be socialized?" Hayek (1945), Marx (1893) and the utopian socialist school provided some early answers to this query. More recent contributions to this topic include Boyko, Shleifer and Vishny (1993) and Tirole (1991); Kikeri, Nellis and Shirley (1992) suggest that a current consensus supporting privatization now exists.

The second question -- the optimal speed of privatization -- is less ancient. Aghion and Blanchard (1993) and Murphy, Shleifer and Vishny (1991) both discuss the costs and benefits of hasty privatization. Aghion and Blanchard argue that the social costs (unemployment) of fast restructuring should slow the rate of transition. Other reasons for delayed privatization include (1) benefits of using early experiments in privatization to design later privatization efforts, (2) potentially diminishing returns to selling state enterprises all at once and (3) difficulties in amassing sufficient government resources to lead multiple, simultaneous privatizations. As Murphy, Shleifer and Vishny argue, there are also costs of partial reform.

Given a slow (or, at least, not immediate) rate of adjustment, the last question becomes critical: Where should privatization begin? In what sectors of the economy will the rapid change to free markets have the best results and where will it be relatively cheap to leave industry in public hands? This question has received the least formal attention. In this paper, we explore the answers to this question provided by an informational model of the benefits of privatization.

Following Hayek (1945), we will assume that the failure of public enterprises comes ultimately from the inability of central planners to acquire and process information.¹ When privatization allows industry to observe and respond

¹This information problem may be connected to the well known incentive problems in government agencies (see Tirole (1971)). Arrow (1970) stressed that informational difficulties

to market conditions, an optimal sequencing of reforms emerges.² In many cases, the informational gains from privatization will be less important than the gains coming from eliminating particularly incompetent or thieving government agents. While there are undoubtedly many gains to privatization beyond the informational benefits of private ownership, we still believe that the informational model is a useful starting point for thinking about where to begin privatization.

The assumption that private actors can respond to more information than government agents may be justified on several grounds. Central planners may be removed from industry (physically or by levels in a hierarchy) and may not observe conditions directly. Central planners may lack expertise in a specific industry's products or training in analyzing market demand. Bureaucrats may lack the incentives to invest in industry-specific information. Even if government agents have equally good information as the private sector at any point in time, the government may be institutionally required to fix its choices earlier than private businessmen. Bureaucrats are restricted by red tape, political concerns³ and lack of information about new events, and thus government decisions may be less up-to-date and based on coarser information sets.⁴ While decentralization or corporatization may achieve some of the information advantages of full private ownership, these reforms will be imperfect because of (1) remaining government interference, (2) weak incentives for information acquisition, and (3) the absence of a securities market which will redirect the enterprise if that enterprise is no longer economically profitable.⁵

ultimately are the root of incentive problems. This fact is true whether the incentive problems are of the standard principal-agent variety (where perfect information usually allows first best contrast) or in the imperfect contracting literature (see Grossman and Hart (1986)) where poor information makes complete contracts (and perfect incentives) impossible.

²Husain and Sahay (1992) extended our (Scheinkman and Glaeser (1990)) examination of the informational gains from privatization and find somewhat different results.

³Boyko, Shleifer and Vishny (1993) emphasize the role that political concerns play in making government managers chase different objectives than would private owners of the same industry.

⁴Assuming that the government is forced to make output decisions earlier than private firms, or that it cannot react to new information is theoretically equivalent to assuming that the government has worse initial information initially.

⁵By having a firm's shares publicly traded, a large number of information gathering agents will acquire information about the firm's costs and returns and these agents may take over or

Arguments about the limits of governmental knowledge have a long tradition in economics. Hayek (1945) argued that free market prices play a critical role in providing information, and arguments of this kind date back to Smith (1976). Empirical observations also support this assumption. Rutland (1993) provides a detailed discussion of the failures of Soviet central planning to accurately assess consumer demand. A good example is light bulb production where the government overacted to perceived scarcity and created an overwhelming glut. The failure of central planners in gauging market demand is also evident in Rutland's discussion of Soviet "anti-products," or goods nobody wanted.⁶

Our paper presents a base model of privatization in a single industry with three sectors: an upstream producer, a downstream producer and a retailer. The informational framework suggests that privatizing the retailer first never makes sense since the retailer makes no production decisions. Privatizing upstream is preferable to privatizing downstream (if only one sector is to be privatized) when upstream uncertainty is high, downstream uncertainty is low and the upstream input is a large part of the final product.

When privatizing two sectors, it does not make sense to privatize the upstream and retail sectors: any information that would be generated by a private retail sector is lost because the public downstream firm cannot respond to this information, and the public downstream firm cannot transmit this information the upstream firm. The middle firm (the downstream producer) will always be part of a two sector privatization, because of its value in transferring information. This basic conclusion, that it makes sense to privatize sectors that interact, is quite robust.

We find that when demand uncertainty is high, upstream uncertainty is low and the upstream share of production is low, it makes sense to privatize the downstream and retail sectors, otherwise privatizing the upstream and

otherwise force the firm to change its actions if its perceived costs are greater than its returns. A publicly held firm will never have the advantage of being directed by these investors.

⁶Presumably the author means "at the price being charged."

⁷This conclusion is not robust to perturbations in the model that lead to gains from properly allocating the goods across consumers.

downstream sectors is optimal. Interestingly it is possible (when demand uncertainty is large) for the optimal policy to be privatizing upstream when privatizing one sector, but for the optimal policy to not include privatizing upstream when privatizing two sectors. In that case, it may be optimal for the downstream sector to be privatized first, even if privatizing that sector yields low returns in the short run, because privatizing that sectors makes it possible to realize later gains coming from privatizing the retail sector. There is value to privatizing intermediate sectors, even when the benefits of flexibility in that sector's inputs are not that large, because these middlemen interact with more neighboring sectors.

Across industries, it makes sense to privatize industries that will be competitive and industries with a low elasticity of demand (when uncertainty is about costs). Furthermore those industries with large amounts of cost or demand uncertainty should be privatized first. We also find that entry of new firms may be either a complement or a substitute to production by preexisting firms. We also discuss the interrelationship between incentive gains and informational gains from privatization.

Our informational model is supported by the experience of privatization in Eastern Europe. Russia has been unable to privatize retail trade (for a variety of political reasons). As a result, information about market demand cannot flow to upstream producers, and the entire society suffers relative to its neighbors. Outside Russia, private retailers have contributed to economic success by transmitting information about demand through prices.⁸

II. A Model

This model presents a simple framework for analyzing the optimal structure of privatization. The model's basic assumption is that there are shocks that are unobserved by the central planner, or, equivalently, the central planner observes the true state of the world with error. The central planner in this model fixes his quantity of production, or the cash amount of his purchases, without observing the state of the world. Private firms observe their costs

⁸We owe this example to Andrei Shleifer.

and demand, public firms must make do with an expectation of those costs and demand.

Figures 1 and 2 illustrates the basic losses from public ownership. In Figure 1, welfare triangles A and B represent the losses due to underproduction or overproduction when demand is higher than average or lower than average respectively. Moving to privatization allows firms (by assumption) to change their quantities as demand changes. This flexibility eliminates the welfare losses. In Figure 2, welfare triangles A and B represent the losses due to underproduction or overproduction when costs are lower than average or higher than average respectively. Again, moving to privatization allows firms to eliminate these losses by moving production.

We assume that there is an interval (of measure one) of consumers in this economy. Each consumer chooses consumption to maximize his utility:

$$F(Q) + X$$
 subject to $Y \ge PQ + X$, (2.1)

where F(.) is a concave function, Q is the good produced by the industry under consideration for privatization, X is a composite commodity normalized so that its price equals 1, Y is income and includes any profits or losses from private and state run industries, and P is the price of the good Q. We assume that F(Q) is equal to ALnQ, where A is a demand shifter. Consumers maximize utility observing income and prices which implies:

F'(Q)=P or
$$\frac{A}{O} = P$$
. (2.2)

This is the demand curve for the good for each consumer and for the economy as a whole (since there is a measure one set of identical consumers). A is a random variable that can be observed by private entrepreneurs but not by the central planner.

We assume a downstream industry with access to a constant returns to scale, Cobb-Douglas, technology that transforms primary inputs (denoted I) and secondary inputs (denoted S) into the final good so that:

Production=
$$I^{\alpha}S^{1-\alpha}$$
 (2.3)

Primary inputs are created at a cost C_1 by an upstream producer and then sold to the downstream producer. Secondary inputs are produced at a cost C_5 by the downstream producer and then combined with the primary inputs in creating the final good which is then sold to retailers (or the government retail firm) who then sells to the public. With these assumptions, we know that optimizing expected social welfare created by this industry requires maximizing:

$$E(A\alpha LnI + A(1-\alpha)LnS - C_II - C_SS)$$
 (2.4)

where E(.) is the expectations operator. As discussed above our primary assumption is that private producers make decisions with more information than public producers. We denote \hat{Z} as the expectation of any random variable. We assume that A, C₁ and C₅ are independent random variables and that the central planner's decisions are based only on \hat{A} , \hat{C}_{I} , and \hat{C}_{S} , the expectations of these variables.

Our central assumption on government behavior is that before observing any states of the world the government must (1) determine the quantity of the input that they use and (2) determine the dollar quantity of their purchases. We also assume that the government does not allow surpluses -- it sells completely its quantity of goods provided.⁹ It would be possible to assume variations on these assumptions: the government might have to fix its price, not its quantity produced, or the government fixes a physical quantity not a dollar quantity of purchases. We believe our assumptions are the most reasonable (fixed quantities seems more plausible than fixed prices). Also, the majority of variations lead to little difference in the qualitative results.

⁹Wasted surpluses would be clearly suboptimal. This reasoning predicts that the government will often underprice, because shortages have no social costs but surpluses have large social costs. Thus, we should expect to see pervasive shortages in centrally planned economies (which we do).

Private firms sell at marginal cost when they are selling to other private firms and the quantity sold is determined by the intersection of supply and demand. Private firms that sell to public firms simply supply the quantity demanded by the public firm (with price equaling marginal cost). Private firms that purchase from public firms acquire the full quantity of public goods supplied (at some cost).

Private vs. Public Upstream Producer

In the case that the upstream producer is public, he determines a fixed quantity of primary input without any information and sells that quantity (at some price low enough to clear the market) to the downstream producer. The primary input producer chooses the quantity of primary input to maximize:

$$E(A\alpha LnI + A(1-\alpha)LnS - C_1I - C_SS)$$
(2.5)

The first order condition for this is:

$$\frac{\hat{A}\alpha}{\hat{C}_{I}} = I \tag{2.6}$$

In the case that a private primary input producer is seller to a private downstream producer, the price and quantity of the primary input is determined by supply and demand. The primary input producer stands ready to sell any quantity of the primary input to the secondary industry at a price C_I . When a primary input producer faces a public downstream producer, who demands a fixed dollar quantity of the primary input (denoted Θ_I), the price (which denote as P_I) again equals C_I and the quantity is determined by Θ_I/C_I .

Private vs. Public Downstream Producer

In the case of a public downstream producer, that producer must determine (1) a fixed dollar quantity of input to purchase and (2) a quantity of secondary input to use. The public downstream producer chooses both of these amounts to maximize:

$$E(A\alpha Ln\frac{\Theta_I}{P_I} + A(1-\alpha)LnS - \Theta_I - C_SS)$$
 (2.7)

where Θ_I equals P_II , the fixed dollar quantity of the primary input. The first order conditions for this maximization are:

$$\frac{\hat{A}\alpha}{\Theta_I} = 1$$
, or $\frac{\hat{A}\alpha}{P_I} = I$ and (2.8)

$$\frac{\hat{A}(1-\alpha)}{\hat{C}_S} = S \tag{2.9}$$

In the case that the primary input producer is private $P_I=C_I$. When the primary input producer is public, I is fixed, and P_I fluctuates to satisfy (2.8).

In the case where the downstream producer is private, that firm chooses I purchased and S used to maximizes profits or:

$$E(P_w I^\alpha S^{1-\alpha} - P_I I - C_S S) \tag{2.10}$$

where P_{W} is the wholesale price of the product paid by retailers. The first order conditions are:

$$\frac{P_w}{QP_I} = I \text{ and} ag{2.11}$$

$$\frac{P_w}{QC_s} = S \tag{2.12}$$

When the upstream firm is public I will be fixed, so P_I will fluctuate to clear the market. When the upstream firm is private P_I will equal C_I .

Public vs. Private Retailer

In the case of a public retail firm, the firm fixes a set quantity in dollars of total goods demand and then resells this quantity to the public. We denote the quantity demand as Θ which equals P_WQ . The retailer observes neither demand nor input price. The quantity of goods demanded (and resold) maximizes social welfare or:

$$E(ALn\frac{\Theta}{P} - \Theta) \tag{2.13}$$

which has first order condition:

$$\frac{\hat{A}}{Q} = P_{W} \tag{2.14}$$

In the case of a private retailer, if that retailer is facing a private downstream supplier, the price and quantity of the final good will be determined by supply and demand, which means that the sale price will equal A/Q. When a private retailers are facing a public firm, the retailers will end up purchasing all of the final goods produced at some price (those goods will be in fixed supply -- the price is, in fact, not relevant for the welfare calculations) and then reselling those goods.

III. The Benefits of Partial Privatization

This section details the welfare gains from various forms of partial privatization. The results of this section are summarized in Figure 3.

Case 1: Public Upstream, Public Downstream, Public Retail

In this case, all quantities are chosen without any information. Using the above formulation we know that $\hat{A}\alpha/\hat{C}_I = I$ and $\hat{A}(1-\alpha)/\hat{C}_S = S$. With these values total social welfare is:

$$\hat{A}Ln\hat{A} - \hat{A}\alpha Ln\frac{\alpha}{\hat{C}_{I}} - \hat{A}(1-\alpha)Ln\frac{1-\alpha}{\hat{C}_{S}} - \hat{A}$$
(3.1)

This quantity is the lowest total social welfare we will observe, and for all subsequent cases we will use this as a benchmark and look at the gains from partial privatization relative to this quantity.

Case 2: Public Upstream, Public Downstream, Private Retail

Despite the presence of a private retail unit there are no gains here from privatization whatsoever since the public upstream unit and the public downstream unit still fix their quantities before observing anything. This result would be mitigated if retailers played some other role (other than transmitting information about demand) such as (1) storage or (2) allocation between consumers. However, in our framework where public entities must fix their inputs before observing anything there is no gain to privatizing retail if that is the only sector to be privatized.

Case 3: Public Upstream, Private Downstream, Public Retail

In this case the quantity of upstream inputs provided is fixed at $\hat{A}\alpha/\hat{C}_I = I$, and the total quantity demanded by the retailer, Q equals \hat{A}/P_w . Substituting this into the private downstream agents first order condition tells us that $\hat{A}/C_S = S$. Using these values we can compute the expected gains (relative to complete public ownership) of this partial privatization:

$$\hat{A}(1-\alpha)(Ln\hat{C}_s - E(LnC_s)) \tag{3.2}$$

The expected gains are higher when α is small or when there is a great deal of uncertainty about secondary input costs.

Case 4: Private Upstream, Public Downstream, Public Retail

In this case the quantity of secondary inputs provided is fixed at $\hat{A}(1-\alpha)/\hat{C}_S = S$, and the total quantity of the input demanded by the downstream producer equals $\hat{A}\alpha/P_I = I$, combining this with the fact that

 $P_I = C_I$ tells us that $\hat{A}\alpha/C_I = I$. The expected gains of this partial privatization are:

$$\hat{A}\alpha(Ln\hat{C}_{l} - E(LnC_{l})) \tag{3.3}$$

The expected gains are higher when α is large or when there is a great deal of uncertainty about primary input costs. This quantity is also always positive from Jensen's inequality.

Case 5: Private Upstream, Public Downstream, Private Retail

In this case the quantity of secondary inputs provided is fixed at $\hat{A}(1-\alpha)/\hat{C}_S = S$, and the total quantity of the input demanded by the downstream producer is still equal to $\hat{A}\alpha/P_I = I$ so again $\hat{A}\alpha/C_I = I$. The expected gains of this partial privatization is still:

$$\hat{A}\alpha(Ln\hat{C}_{l} - E(LnC_{l})) \tag{3.4}$$

There are no gains in privatizing retail when the public downstream firm is public because information about downstream prices cannot be transferred either to the public downstream firm or through the public downstream firm to the private upstream firm.

Case 6: Private Upstream, Private Downstream, Public Retail

In this case the retailer's demand for upstream product is $\hat{A}/Q = P_w$. The downstream supplier sets $P_w/QP_I = I$ and $P_w/QC_S = S$, and the upstream supplier sets $P_I = C_I$. Given these conditions it is true that $\hat{A}/P_I = I$ and $\hat{A}/C_S = S$, and thus the gains from privatization are:

$$\hat{A}\alpha(Ln\hat{C}_t - E(LnC_t)) + \hat{A}(1-\alpha)(Ln\hat{C}_s - E(LnC_s))$$
(3.5)

These gains include the benefits of matching both input supplies to input costs.

Case 7 Public Upstream, Private Downstream, Private Retail

Here the public upstream firm supplies a fixed quantity of the primary input $\hat{A}/\hat{C}_I = I$,, and the private sector downstream supplies $P_w/QC_S = S$ which the private retail sector sets $A/Q = P_w$. Combining these terms yields: $A/C_S = S$. If we substitute these terms into the social welfare function to determine the gains from privatization we find:

$$\hat{A}(1-\alpha)((Ln\hat{C}_I - E(LnC_I)) + (1-\alpha)(E(ALnA) - \hat{A}Ln\hat{A})$$
(3.6)

From the concavity of LnX and the convexity of XLnX and from Jensen's inequality we know that this quantity is positive. We also know that is falling in α and rising in the amount of uncertainty surrounding A.

Case 8: Private Upstream, Private Downstream, Private Retail

In the complete privatization case, the retails sector sets $A/Q = P_w$, the secondary sector sets $P_w/QC_s = S$ and $\hat{A}\alpha/P_I = I$ and the primary input producers let $P_I = C_I$. With these values we know that $A/C_s = S$ and $A/C_I = I$ which mean are the first best quantities, so the gains from total privatization are:

$$\hat{A}(1-\alpha)((Ln\hat{C}_I - E(LnC_I)) + \hat{A}\alpha((Ln\hat{C}_S - E(LnC_S)) + (E(ALnA) - \hat{A}Ln\hat{A})$$
(3.7)

These gains contain three portions, the gains from adjusting to primary input prices, the gains from adjusting to secondary input prices and the gains from adjusting to demand.

IV. Comparison of Different Privatization Approaches

This section compares the welfare gains of different approaches to privatization. While some approaches are plainly inferior, regardless of parameter values, the relative benefits of most approaches depend on the values of particular parameters. Our goal then here is to find comparative statics the parameters of the model. To formalize the comparative statics on uncertainty, we consider the special case when A takes on values $\hat{A} + \varepsilon_A \hat{A}$ or

 $\hat{A} - \varepsilon_A \hat{A}$ each with equal probability, C_S takes on values $\hat{C}_S + \varepsilon_S \hat{C}_S$ or $\hat{C}_S - \varepsilon_S \hat{C}_S$ each with equal probability, and C_I takes on values $\hat{C}_I + \varepsilon_I \hat{C}_I$ and $\hat{C}_I - \varepsilon_I \hat{C}_I$ each with equal probability.

Comparison # 1: Privatizing a Single Sector of an Industry

In this case, we can clearly rejecting privatizing retail alone. That action yields no benefits. Privatizing upstream is preferred to privatizing downstream if:

$$-\alpha(Ln(1+\varepsilon_1)+Ln(1-\varepsilon_1)) > -(1-\alpha)(Ln(1+\varepsilon_S)+Ln(1-\varepsilon_S))$$
 (4.1)

Privatization upstream is more advantageous as (1) upstream uncertainty (ε_I) rises, (2) downstream uncertainty (ε_S) falls and (3) the share of upstream sector in production (α) goes up.

Comparison # 2: Privatizing Two Sectors of an Industry

Privatizing both the retail sector and the upstream sector is clearly suboptimal in this case. By separating the information generating sectors, information is lost. The need for privatizing adjoining sectors is a primary implication of our research. Thus, the relevant comparison becomes between privatizing both the downstream and the retail sector and privatizing both the upstream and the downstream sectors. Here the inequality that determines if privatizing upstream and downstream is preferable to privatizing upstream and retail is:

$$-\alpha(Ln(1+\varepsilon_I)+Ln(1-\varepsilon_I))>(1-\alpha)((\hat{A}+\varepsilon_A\hat{A})Ln(1+\varepsilon_A)+(\hat{A}-\varepsilon_A\hat{A})Ln(1-\varepsilon_A))(4.2)$$

Privatizing upstream and downstream is more advantageous when (1) upstream uncertainty (ε_I) is high, (2) the share of the upstream industry (α) is high, and (3) demand uncertainty (ε_A) is low.

It is worth noting that it is possible that given one industry to privatize it makes sense to privatize the upstream industry, but given two industries to

privatize it makes sense to privatize downstream and retail. This situation can occur if demand uncertainty is large relative to cost uncertainty. If this occurs and privatization occurs one industry at a time then it is necessary to weight the (1) immediate benefits of privatizing the upstream industry first, with the (2) delayed losses of privatizing upstream and downstream rather than downstream and retail when two industries are privatized. These comparative statics depend on the length of time during which only one industry is privatized (relative to the length of time where two industries are privatized) and the rate of time preference.

The correct interpretation of these results is that it occasionally makes sense to privatize an intermediate sector first, even if on its own, that sector is not the most important to privatize. Since intermediate sectors interact with a wider range of other sectors, as privatization proceeds, private intermediate sectors allow information to flow. In the case, the flow of information occurred between retail and the downstream sector. When the intermediate sector in this case (the downstream producer) is not private, the flow of information stops and privatizing retail is useless. The two implications are that (1) there are dynamic concerns in privatization and it is occasionally useful to privatize a less immediately useful industry for longer term gains and (2) intermediate industries are particularly important to privatize because they facilitate the flow of information.

Comparison # 3 Privatizing Two Sectors in Two Industries vs. Privatizing Two Sectors in One Industry

In this section we compare the benefits of privatizing two sectors in the same industry with privatizing one sector in two industries. For simplicity we assume that the industries are identical. The benefits of privatizing two sectors in two industries is two times the maximum of $\hat{A}\alpha(Ln\hat{C}_l - E(LnC_l))$ and $\hat{A}(1-\alpha)(Ln\hat{C}_s - E(LnC_s))$. The benefits of privatizing two sectors in a single industry is the maximum of privatizing downstream and retail or privatizing upstream and downstream. In the case that maximizing upstream and downstream is preferable to maximizing downstream and retail, it always makes sense to maximize across industries first because

 $\hat{A}\alpha(Ln\hat{C}_I - E(LnC_I)) + \hat{A}(1-\alpha)(Ln\hat{C}_S - E(LnC_S))$ is always less than twice the maximum of its components.

In the case that maximizing downstream and retail is the preferred two sector privatization strategy then the concentrating privatization within a single industry makes sense if:

$$\hat{A}(1-\alpha)((Ln\hat{C}_S - E(LnC_S)) + (1-\alpha)(E(ALnA) - \hat{A}Ln\hat{A}) >$$

$$2Max[\hat{A}(1-\alpha)((Ln\hat{C}_S - E(LnC_S)), \hat{A}\alpha((Ln\hat{C}_I - E(LnC_I)))]$$

$$(4.4)$$

This equation is more likely to hold if demand uncertainty is large. The other comparative statics depend on whether privatizing upstream is preferable to privatizing downstream. If privatizing upstream is preferable, then the incentives to concentrate privatization fall with upstream uncertainty, rise with downstream uncertainty fall with the relative importance of downstream production. If privatizing downstream is preferable, then the incentives to concentrate privatization fall with downstream uncertainty.

Comparison # 4 Comparing Complete Industries

Using the assumption on the distributions for the two costs and the demand shifter, we can find the relevant comparative statics for the gains from privatizing a complete industry. These comparative statics tell us which industries will benefit most from privatization. Rewriting equation (3.7), gives us the basic formula for the gains from total privatization:

$$-\hat{A}(1-\alpha)((Ln(1+\varepsilon_I)+Ln(1-\varepsilon_I))-\hat{A}\alpha((Ln(1+\varepsilon_S)+Ln(1-\varepsilon_S)) + (\hat{A}+\varepsilon_A\hat{A})Ln(1+\varepsilon_A)+(\hat{A}-\varepsilon_A\hat{A})Ln(1-\varepsilon_A))$$

$$(4.5)$$

These gains are rising in ε_{l} , ε_{s} and ε_{A} . The gains from privatization are also rising in \hat{A} -- as demand becomes larger it makes more sense to privatize a particular industry.

An Aside on Demand Elasticity and Cost Uncertainty

In this section we assume a more flexible function form for F(Q) to determine the comparative statics on demand elasticity; we let $F(Q) = Q^{\sigma}/\sigma$ Our basic result can be seen in Figure 2. As demand becomes more inelastic the gains from privatization falls. In the extreme where demand is completely inelastic at a given price, privatization yields no social gains whatsoever. To make this extension simple we assume only one supplying sector that supplies at cost C, where again C is stochastic and in this case takes on values $1-\varepsilon_c$ and $1+\varepsilon_c$ each with equal probability (so $\hat{C}=1$). In this case, public ownership sets Q to maximize expected social welfare or Q=1. Private, profit maximizing behavior of a competitive industry leads to $C^{\frac{-1}{1-\sigma}}=Q$. The difference in expected social welfare between private and public ownership is:

$$\frac{(1-\sigma)}{2\sigma}[(1+\varepsilon_c)^{\frac{-\sigma}{1-\sigma}} + (1-\varepsilon_c)^{\frac{-\sigma}{1-\sigma}} - 2] \tag{4.6}$$

This term is rising in ε_c (of course), and it is also rising in 1- σ , the absolute value of the elasticity of demand. The intuition for the second comparative static is that as the elasticity of demand rises, it becomes easier to substitute out of the good when the cost of the good changes. Thus the value of information about costs rises, because more can be done with that information. In the extreme case of perfectly inelastic demand, it is obvious that information about costs is totally irrelevant to social welfare. 10

This result implies that goods with highly elastic demands should be privatized first. In particularly, industries with close substitutes in consumption are natural candidates for privatization because it is in those cases that the welfare gains from quantities reflecting costs are most important. Industries with foreign competitors are also natural candidates for privatization, because consumers can and should switch to those competitors when domestic costs rise.

 $^{^{10}}$ This reasoning does not necessarily hold if there is demand uncertainty instead of cost uncertainty.

V. Extensions

This section provides a series of extensions of the model. We do not formally model these extensions, but hopefully it is clear how many of these ideas would be incorporated into the previous model.

Monopoly

Obviously we have so far stacked the deck against any possible gains from leaving industry in private hands. There is a well known litany of market imperfections that may act to reduce the gains from privatization. In general, incorporating these market imperfections into the above framework is fairly straightforward. In the overall analysis of an industry's privatization the advantages of informational gains from privatization must be weighed against whatever other market problems are associated with placing the industry in public hands. If these market imperfections are more present in downstream, upstream or retail segments of the industry, then privatizing downstream or upstream will fall in attractiveness with those market imperfections.

While, in general, a problem in the free market will simply act to lower the gains from privatization, certain market problems will act also directly against the informational gains from privatization. For example, if the privatized industry will be a monopoly, then there are welfare losses (of course) from the presence of a monopoly. But the monopoly also limits, in many cases, the reaction to demand variability. Since monopolists price only along the elastic portion of the demand curve, shocks to any inelastic portions of the demand curve will not be reflected at all in quantity changes. To the extent that monopoly power lowers firm reaction to consumer desires, the primary gain from privatization is limited by monopoly in the privatized industry.

The value of privatizing where monopolies are unlikely to exist supports privatizing the retail sector (as the second sector privatized). Optimal size for retail units is often smaller than for upstream production and retail sectors are less likely to be natural monopolies. As a result, privatizing the retail sector will have less chance of creating the problems of monopoly. A further

advantage of creating privatization of a highly competitive retail is that the widespread private ownership this may create may help build a political base supporting further privatization.

Entry by Other Firms

Privatizing existing firms is only one road to free markets. The second path relies on the entry of new firms into industries previously monopolized by the state producer. We can ask whether new entry should be limited or focused towards particular sectors and whether privatization should be centered where new entry is expected to be quickest. Should the government privatize most when a large stream of potential new entrants is expected, or should the government privatize where there are few potential new firms?

Conventional wisdom emphasizes the substitution effects between new entry and public firms. New entrants and privatized public firms both provide the same goods. If consumers are benefiting from a stream of new private entrants fulfilling their needs, it may not be necessary to privatize the existing public firms so quickly. Other negative interactions between privatization and new entry also exist. Slowly privatizing companies may be driven out of existence prematurely by free entry. Free entry of new firms might create political actors who have a stake in keeping public firms public to avoid competition.

There is even an informational substitution effect. If the government can base decisions on what the new private entrants are doing, the public enterprise may gain more flexibility and may become more like a private firm without actually becoming private. These arguments all suggest that privatization is a substitute to free entry and should occur first in industries where free entry is difficult or impossible.

We believe that the case is much less clear than this simple substitution argument. It may make sense to privatize where we expect most new entrants. The informational argument for privatizing where we expect new

¹¹Of course, this may be desirable in some cases.

entry is that existing firms in public hands provide potential newcomers with no information about profitability or best business practices. When public firms become private, their experiences provide the newcomers with knowledge on topics ranging from profitability to optimal structure of operations to the state of demand. This knowledge may serve both to convince this potential supply of new entrants to enter and to make their entry as efficient as possible. The informational spillovers generated by private incumbents might create complementarities between privatization of existing firms and new entry.

A second reason for privatizing simultaneously with new entry is that we expect the conditions for new entry and successful privatization to be similar. Industries that are more profitable to private entrepreneurs will be centers for success in both activities. The potential supply of new firms then should be taken as a signal by the government, that this sector is one where private ownership can quickly succeed.

New entry may also serve to lessen any monopoly power possessed by the old firms. The problems with monopoly (discussed above) make it possible that privatization should only occur when the industry is competitive. Finally, as long as one of the players in an industry is in public hands, the private firms will always fear that industry may receive particular government support. By privatizing, the government guarantees the new entrants that they will not be playing on an uneven field.

We have so far only considered interactions between free entry and privatization when they are at the same level of production. When free entry exists among a sectors suppliers or consumers, there will also be interactions between free entry and the gains from privatization. In Brazil privatization of steel was opposed by steel consuming industries who feared that prices would rise with privatization. Free entry of steel-consuming firms created a lobby that worked against privatization. Alternatively, free entrants to steel-consuming production might have welcomed privatization because of more efficiency and lower prices in steel production. A fuller analysis of these interactions is beyond the scope of this paper, but again it is possible that free

entry and privatization are either substitutes or complements here (across sectors) as well.

Incentives

Standard discussion of the benefits of privatization tend to focus on incentive problems. Private ownership is often claimed to lead towards higher effort levels, and better monitoring of subordinates than a government led organization. Many observers of the old U.S.S.R. have documented production inefficiency.

A rarely stressed issue in the incentive problems of public ownership is that incentive effects are ultimately related to information. On a theoretical level, the role that poor information plays in creating incentive difficulties is well understood. On an applied level the connection is also clear. Much of the difficulties that the central bureaucracy had in creating the right incentives came from the fact that they were separated from the factories actually turning out production.

Despite the fact that information lies at the heart of incentive problems, the informational gains of privatization are distinct from the incentive gains from privatization. Putting ownership into private hands provides the right incentives for someone to monitor and properly structure production. The Grossman and Hart (1986) emphasis on residual claimants suggests that by creating owners with a right to cash flows should greatly improve the incentive problems.

We cannot go into a full analysis of these problems here. However, we do believe that any model of incentive gains from privatization should suggest that privatization should begin in those industries with (1) the greatest gains from good incentives and (2) the biggest incentive problems under government ownership. The gains from good incentives may well be related to the industries that benefit most informationally from privatization. It is possible that inflexibility of bureaucrats is the result of poor incentives. By privatizing both problems are solved.

There should be a connection between industries that are particularly hard for governments to monitor and industries that benefit most informationally from privatization. Industries that are complex and highly volatile are the ones that are the most difficult to monitor. Providing strong incentives is easy when tasks are simple and when conditions are unchanging. As conditions become more volatile and as the principal has more difficulties in directly observing the costs and opportunities faced by the agent, appropriate incentives are more difficult to achieve. This is just the point that it easy to provide good incentives with a whip for rowing a galley, but hard to provide good incentive for innovating in computer software.

Complexity and change make (1) incentives more difficult to achieve in a public system, and (2) the benefits of flexibility and information acquisition in a public system greater. The directions for privatization given by an incentive view and by an information view are the same. Areas that are complicated and face a great deal of volatility should be centers for speedy privatization.

VI. Conclusion

Economists since Hayek (1945) have realized that one of the primary advantages of free markets is that private owners excel in acquiring information. That information is quickly disseminated through prices. State ownership is notoriously poor at forecasting demand and at adapting to changing conditions.

We believe that this informational advantage of privatization provides a basis for thinking about the sequence of privatizing industries. Sectors that benefit from flexibility most and sectors that will create the most benefits for other industries in improved information should be privatized first. In particular, it is important to privatize intermediate sectors which transfer information both upstream and downstream. Also, industries with more elastic demand should be privatized first.

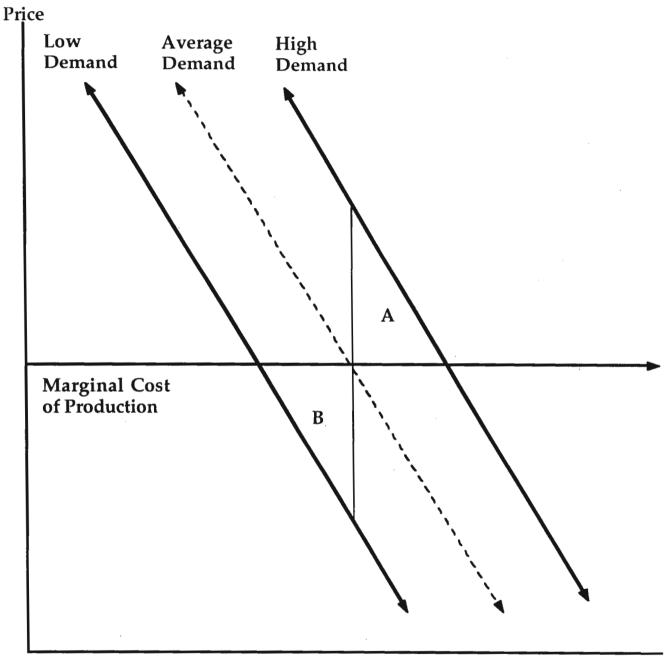
The sequencing of privatization suggested by maximizing the private gains from better incentives is similar to the sequence suggested by maximizing the flow of information and the ability to react to that information. Complicated

industries that face volatile conditions merit quick privatization for both informational and incentive reasons. Finally, the view that new entry and privatization are substitutes and should proceed in separate sectors seems to us potentially wrong. We believe that there are many advantages for coordinating privatization and new entry.

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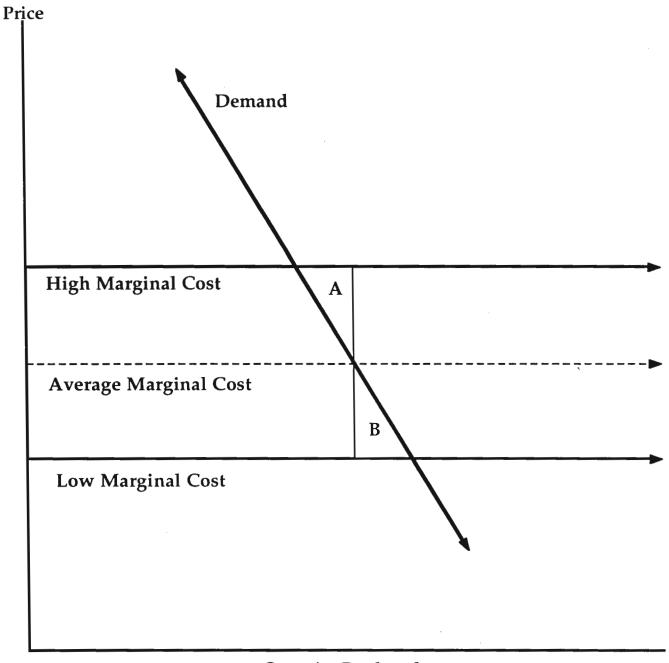
Figure 1: The Gains from Privatization, Demand Uncertainty



Quantity Produced

The triangles marked A and B represent the social costs of central planning. The central planner bases his output on average demand instead of observing and responding to the actual state of demand (high or low).

Figure 2: The Gains from Privatization, Cost Uncertainty



Quantity Produced

The triangles marked A and B represent the social costs of central planning. The central planner bases his output on average costs instead of observing and responding to the actual costs of production.

Figure 3: The Gains from Partial Privatization

	Public Retail	Private Retail
Public Upstream, Public Downstream	0	0
Private Upstream, Public Downstream	$\hat{A}\alpha(Ln\hat{C}_I - E(LnC_I))$	$\hat{A}\alpha(Ln\hat{C}_{l}-E(LnC_{l}))$
Public Upstream, Private Downstream	$\hat{A}(1-\alpha)(Ln\hat{C}_s-E(LnC_s))$	$\hat{A}(1-\alpha)((Ln\hat{C}_S - E(LnC_S)) + (1-\alpha)(E(ALnA) - \hat{A}Ln\hat{A})$
Private Upstream, Private Downstream	$\hat{A}\alpha(Ln\hat{C}_{l} - E(LnC_{l})) + \hat{A}(1-\alpha)(Ln\hat{C}_{s} - E(LnC_{s}))$	$\hat{A}(1-\alpha)((Ln\hat{C}_I - E(LnC_I)) + \hat{A}\alpha((Ln\hat{C}_S - E(LnC_S)) + (E(ALnA) - \hat{A}Ln\hat{A})$

This figure details the gains from different forms of partial privatization.