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On the Sequencing of Privatization in Transition Economies

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Comments Welcome

ON THE SEQUENCING OF PRIVATIZATION
IN TRANSITION ECONOMIES

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Abstract

This paper presents an empirical criterion for establishing privatization priorities for state-owned enterprises. The approach uses firm performance as the basis for deciding the sequence in which firms are privatized. Sequencing is relevant because the order in which a group of state enterprises are taken up for privatization has efficiency implications, and an appropriate sequence based on efficiency considerations can be beneficial. Privatizing inefficient enterprises before efficient ones is a superior sequence as compared to one which reverses this order, and the size of the firms to be privatized is an important contingency. An improvement index is constructed for individual firms, and the index makes possible a comparison of multiple firms, thus, facilitating the construction of a priority schedule. This approach is demonstrated using a sample of Indian service sector firms, and the approach can aid policy-makers in transition economies as they undertake the privatization of state-owned enterprises.

1. INTRODUCTION

The experience of economies trying to privatize large numbers of state-owned enterprises indicates that the privatization process is likely to be slow, and drawn out, rather than swift and all encompassing (Laban and Wolf, 1993; Roland, 1994). Big-bang, or mass privatization, does not appear to be feasible for most transition economies. Therefore, the issue of sequencing in privatization acquires policy importance, raising two questions: first, is sequencing required; and, second what principles might underlie this sequencing? In this paper we address these questions. We suggest that sequencing is relevant in that the order in which a group of state enterprises are taken up for privatization has efficiency implications, and an appropriate sequence based on efficiency considerations can lead to welfare gains. We then develop a criterion with which to target state enterprises for privatization, one which will be relevant for policy-makers in constructing a privatization sequence, and use data for a group of Indian state enterprises to illustrate how the criteria that we develop may be actually applied in practice.

There are a number of activities to be undertaken by governments during the process of economic transition. Firms may have to be restructured, deals with workers and union leaders have to be negotiated, firms' finances have to be cleaned up, the regulatory environments, if any, have to be redesigned, changes to competition policy have to be made and the firms have to be marketed to potential buyers (Ramamurti, 1996a). As the 1996 World Development Report notes "Privatizing large and medium-sized enterprises has proved far more difficult than originally thought. Policy makers have to weigh complex and often competing goals, satisfy a multitude of competing stakeholders and cope with the administrative difficulty of privatizing thousands of firms in a relatively short period of time and without mature, functioning capital markets" (World Bank, 1996: 50). Therefore, the availability of a criterion can considerably aid policy makers in their task of privatization, as they simultaneously grapple with the multitude of tasks that comprise the transition process.

This paper unfolds as follows. In section two we first discuss the basic rationale for privatization. We address the issue of what is it that policy-makers seek as they attempt to privatize state-owned enterprises, and suggest that there is likely to be heterogeneity in performance which researchers and policy-makers ignore. We then discuss the motivations

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associated with big-bang privatization and the necessity of adopting a gradual approach to privatization. The empirical consequences of a mass privatization approach on which some evidence has emerged are also described. In section two we also demonstrate that the temporal sequence in which firms are privatized is important and show that the privatization of inefficient enterprises earlier with relatively efficient enterprises being privatized later leads to inter-temporal efficiency gains. In section three we evaluate the performance differences which exists between state enterprises in India, and develop a priority schedule for the privatization of state enterprises in the services sector based on our approach. Section four contains a discussion of a number of issues related to the contemporary privatization process in transition and developing economies.

2. PRIVATIZATION: KEY ISSUES AND EXPERIENCES

(a) The Motivation for Privatization

Privatization is one of the policy reforms which is meant to improve the efficiency of state-owned enterprises (Bishop, Kay and Mayer, 1994; Caves, 1990). One reason advanced for the existence of performance differences between private and government-owned enterprises is that there is a misalignment of incentives in the public sector, and the argument is as follows. To the extent that ownership composition varies, principal-agent issues arise. Property-rights over the enjoyment and disposal of assets are attenuated in government-owned enterprises because a market for corporate control is absent. Consequently, there is a lack of capital market discipline to which state-owned enterprise agent-managers can be subjected to by owner-principals. Additionally, public sector firms are subject to soft-budget constraints (Kornai, 1979), which increases financial profligacy and mutes incentives for attaining efficiencies. Privatization is a commitment device of governments to credibly cut-back on subsidies if enterprise cost levels are too high (Schmidt, 1996).

A substantial body of evidence for a variety of countries, as reported in Boardman and Vining (1989), finds that private sector firms do outperform firms in the public sector. For India, too, the private sector is found to be more efficient than the state-owned sector, whether aggregate data are reviewed (Majumdar, 1995) or disaggregate data are analyzed (Majumdar, 1996). The most recent World Development Report (World Bank, 1996) states that in established market economies and middle-to-high income developing countries there is little doubt that

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private ownership is a significant determinant of economic performance, and over two-thirds of a sample of sixty-one divested firms studied showed improvements in post-privatization economic performance.

Take the two key inputs of a firm: physical capital and human capital. With respect to physical capital, state ownership leads to the centralization of decision-making in the bureaucracy, loss of managerial autonomy and modification of firms' investment priorities for political ends (Jalan, 1991). Incentives and opportunities for firms' managers to be progressive are restricted, leading to lowering of the levels of technological expertise and resulting in low quality of products or services. With respect to human capital, the provision of life-time employment leads to labor indiscipline and interventions in disputes for political reasons, consequently limiting the capabilities of firms to deliver products or services efficiently (Nayar, 1989).

One assumption in the literature is that, holding ownership constant, private and public sector managers have equal operating freedom. This, however, is not always so. In India, there is the complex reality of the institutional and political environment surrounding government-owned enterprises, leading to low performance. Government decision-making is surrounded by a constellation of interests forming specialized coalitions interested in government-enterprise operations. The various actors include politicians, unions, trade associations, consumer groups and members of the bureaucracy itself who pressurize other civil servants into directing government-owned bodies into acting in manners which are consistent with their own special interests (Bardhan, 1984; Bhagwati, 1993).

Take Indian state-owned enterprises; these firms have been prey to inappropriate location, size and technology choice decisions, irrational product mixes, and imposed marketing arrangements (Jalan, 1991). These decisions have been made for political considerations and bureaucratic rent seeking, and have not been based on economic criteria. The performance impact of such pulls and pressures is likely to be negative because such factors do tend to make the management process in government-owned enterprises complex, uncommercial and unfocussed; few choices and incentives are given to managers to maximize economic residue, and the Indian state-owned sector's performance is, consequently, characterized by very large inefficiencies (Majumdar, 1995; 1997). Privatization is expected to reduce

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the state's micro-management and political ad-hocism in the conduct of enterprise business activities, thereby enhancing firms' potential for superior performance.

Privatization may also lead to higher rates of industrial growth and improved allocative efficiency, though improvements in these parameters of performance is also a function of how macro-economic reforms interact with other key micro-economic reforms such as changes in competition policy and trade policy. In sum, improvement in enterprise productivity due to privatization resulting from one or more of the following factors: first, privatization leads to a change in the objective function of the firm. The multiplicity of social objectives and political agendas, operationalized via interference and re-distribution to favored interest groups, are replaced by a less ambiguous objective: profit maximization. Second, privatization leads to a hardening of the budget constraint by ensuring that neither funds nor survival are assured in the new environment. Third, privatization leads to superior monitoring by interested owners and brings the pressures of the capital market to bear upon the managers of the privatized enterprise, leading to changes in their incentive structures.

There is, however, little evidence as to why countries privatize, but Vickers and Yarrow (1988) and Ramamurti (1996a) document some of the firm-level consequences of privatization. In addition, Ramamurti (1992), in probably the only empirical study of the determinants of privatization at the country level, finds that high budget deficits, high dependence on international agencies like the International Monetary Fund and the World Bank and high debt levels are some macroeconomic factors which place fiscal pressures and cause countries to privatize. Privatization is expected to lead to a decline in the supply of soft capital for erstwhile state owned firms, lessening government budget pressures.

Economic factors such as capital intensity, the potential for the misuse of market power by private firms and the prevalence of natural monopoly conditions have historically led to the creation of the state owned sector in many countries (Jones and Mason, 1981). In India such considerations were also important when the state owned sector was established (Marathe, 1989). Nevertheless, many firms were brought into the state owned sector rationale only for political reasons. Such ownership changes, from the private sector to the state owned sector, have taken

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place in countries such as India, Nicaragua and the Philippines (Ramamurti, 1992). Privatization is also expected to correct for past mistakes that have taken place in the composition of firms' ownership structures.

Privatization has also been undertaken to widen share ownership in many countries, such as Chile, Great Britain and Turkey. A number of economic motives are at play. These include the reduction of stock price volatility, allowing investors to diversify their portfolios and the reduction of risk (Seth, 1989). Volatility is reduced because block trading of shares is minimized when there are many investors. Availability of shares of state owned enterprises allows investors to broaden their portfolio of shares, while the risks transferred to the equity market are borne by a large number of market participants. Additionally, there are political consequences of wider share ownership. A wider share ownership makes future nationalization efforts difficult to follow through, thereby committing a country to a private sector oriented economic system.

Privatization implies an expansion of the private sector's role in the economy of a country, per-se, and privatization plays a role in expanding the number of new entrepreneurs; it also plays a role in enhancing the prominence of a number of hitherto smaller private sector groups within an economy. The process of privatization enables existing entrepreneurs to enter new areas of business activities and can trigger restructuring of existing private sector operations. For example, the purchase of state-owned enterprises by private entrepreneurs may necessitate mergers between similar operations carried out by private firms and former state-owned enterprises, thereby enhancing the overall industrial efficiency within a nation (Hoshino, 1996).

(b) The Need for Firm-Level Analysis

The points covered above, in essence, encapsulate the economic benefits associated with privatization. The ideas are important, but may not be adequate for policy-making purposes on two counts. First, as Stern (1996) has noted, theory has been silent on issues relating to the transition process in general and on specific issues relating to the privatization process. Existing privatization ideas are articulated in an a-temporal context and cannot be used to address questions with a temporal dimension. Second, existing concepts do not enable an exploration of the fact that the benefits of privatization may accrue unequally. Some enterprises may already be

efficient, while others are relatively inefficient. Many other factors, such as management differences, can lead to significant performance variations even between state-owned firms (Aharoni, 1993). The privatization logic may, then, be more applicable to certain firms than to others. For instance, some firms may enjoy better managerial supervision and relative freedom from state intervention. Such firms may already be efficient and stand to benefit relatively little from privatization. On the other hand, there may be firms which are performing extremely poorly and would, therefore, benefit significantly from privatization. This variation in the performance of state-owned firms is a contingency that existing concepts have not taken into account.

Specifically, the focus of our paper is at the level of the firm. While growth in aggregate industrial output is one measure of a country's economic performance, if the consumption of inputs rise at the same or at a faster rate then economic progress remains stagnant or falls. Therefore, attainment of industrial efficiency is a qualitatively much more important variable, and countries in which there is high industrial efficiency tend to forge ahead in generating high income levels to support superior standards of living. Nevertheless, as Chandler (1990) has argued, industrial efficiency attainment is fundamentally a firm-level phenomenon. It was the continuous search by firms of ways to enhance their functional and operational efficiencies that drove industrial progress in the United States.

Successful use of national industrial capabilities implies that the capacity which is built up is utilized effectively, and growth is sustained by long-term increases in productivity. Thus, the attainment of static and dynamic efficiencies is one of the basic building blocks of industrial success (Nelson, 1981). As Lall (1990) points out, firms do not instantly gain in static efficiency; rather, the attainment of efficiency is a dynamic process which involves the acquisition of skills and knowledge which then have to be organizationally configured. A primary factor that plays a role in the acquisition of skills and knowledge is the nature of incentives available to firms so as to enjoy the property rights that accrue from the possession of the skills and knowledge, so that the benefits of efficiency gains can be internalized. In countries where a large proportion of firms are owned by the state, the provision of such incentives, via the process of privatization so that firms

seek to enhance their efficiencies, has considerable implications for the overall industrial and economic progress of these countries.

(c) The Need for Sequencing

Why does sequencing matter? The big-bang approach to privatization has envisaged fast-paced privatization through the mass selling-off of state enterprises, leading to a completion of the process in a very short span of time. Among the objectives driving a high-speed approach has been the necessity of achieving a critical mass of private ownership, the need for getting the state out of micro-management of the economy and preventing the large scale de-capitalization of state enterprises. These were some of the reasons cited for pushing urgency in the privatization process (Roland, 1994). Private property provides the incentives necessary for superior performance; otherwise, there is a danger of inertia for firms because of the existence of public hand-outs and the lack of a need to respond to market signals. Also, if the state has an interventionist orientation it cannot but help interfere in the economic activities of the population, with an especially strong predilection to do so in state-owned enterprise over which it has control.

The big-bang approach has found significant conceptual and policy support at the beginning of a transition period as a means of undertaking economic change in the presence of a prolonged economic crisis as in Poland, and the sudden collapse of a system as in erstwhile East Germany (Ahluwalia, 1994; Popov, 1991; Sachs, 1992). At that time there is a clear discontinuity in a country's history. During this period there is an unusual willingness to suspend self-interest seeking political behavior and act for the common good (Grindle and Thomas, 1991; Williamson and Haggard, 1994). The introduction of major reforms in a short period of time makes the change process acceptable, and look irreversible by destroying the power of those who oppose the change (Tsang, 1996). In addition, a reforms minded government may have to signal its commitment to the process by initiating reforms at a pace that an uncommitted government will never undertake reforms at (Haggard and Webb, 1993).

Consequently, high-speed privatization has been tried out in erstwhile Czechoslovakia, Poland and Russia. Its desirability, however, has been increasingly questioned (Lipton and Sachs, 1990). Further, the feasibility of high-speed privatization has been challenged given the gap

between the observed rate of privatization and the size of the state-owned sector that still exists in most transitional economies (Laban and Wolf 1993). Political constraints, lack of an institutional infrastructure, inadequate depth in capital markets, and macroeconomic instability problems are some of the many important reasons suggested that make rapid privatization unlikely (Dewatripont and Roland, 1992; Portes, 1994).

Rapid privatization is not just operationally unlikely, but also likely to be socially undesirable given the scale of privatization in transition and developing economies. Implementation difficulties, with a privatization program being carried out at a rapid pace, may significantly outstrip a country's capabilities in providing resources to oversee the transition or lead to administrative resources being seconded from other areas of a state's activities crucial to economic development (Paul, 1985). In addition, the potential assessment that high-speed transition may fail may make forecasts of such failure come true. The idea of privatization may not, then, catch on. Therefore, in order to avoid such self-fulfilling forecasts the government may need to announce a flexible policy of privatization (Aghion and Blanchard, 1993).

Second, the macro-economic impact of large-scale adjustments may be formidable, and even possibly politically untenable, under schemes of instantaneous reorganization. This is likely in developing countries where a large proportion of the population often exists well below the poverty line (Sattar, 1989). Aghion and Blanchard (1993) show that privatization, which can necessitate the closing of inefficient firms, can lead to greater than acceptable levels of unemployment and derail the transition process. Simultaneously, if unemployment grows too rapidly then there is a necessity to fund new labor market policies such as unemployment benefits and training subsidies. These funding requirements divert resources away from infrastructure building activities which can aid in the development of private sector businesses that help supplant output losses which take place as a result of the closure of state owned firms (Aghion, Blanchard and Burgess, 1993).

Third, the sudden abolition of command and planning ways of doing business in complex and highly inter-dependent economic systems, such as in India, can significantly impair overall economic coordination. This disruption affects the levels of both useful and unwanted production

from state owned units. The fall in output and the associated delay in recover is higher in contexts where there has been a greater reliance on central planning systems; and the more a central planning system is disrupted the slower will be the development of new market-oriented coordinating mechanisms which enable private sector businesses to flourish (de Melo, Denizer and Gelb, 1996).

Fourth, a number of centrally planned economies have established a series of industries in which the outputs of some industries provide the inputs for other downstream industries. For example, in India the steel industry was established in the public sector. To supply steel making machinery, heavy machine building plants were set up in the public sector. To supply a number of critical raw materials for steel making, a number of companies were also set up in the public sector. For example, the National Minerals Development Corporation was set up to provide iron ores supplies for steel making. The need to enhance productivity in steel making firms can lead to a change in strategy of these firms, so that the iron ore based steel making process is replaced with the scrap metal using steel making process. Such a change in the steel making firm can leave other members of the overall supply chain in precarious economic positions. For the machine building firms restructuring may also become necessary, while the iron ore supplier may be able to supplant lost domestic sales with export sales but after a period of adjustment. Since privatization can have significant downstream and upstream consequences, the sequencing of privatization can help minimize output disruptions in inter-connected industries.

(d) Experiences of Some Countries

The experience of economies attempting rapid privatization provides instances of pitfalls. Specifically, in Russia about 15,000 enterprises were privatized in 1994. These enterprises employed about 70 percent of the industrial workforce. The mass privatization strongly favored workers and managers, leading to a high degree of insider ownership. Workers retained 50 percent of the shares, though a part of that was non-voting, managers retained 10 percent, 20

percent was in state hands and 20 percent was with outside investors. In Russia, hopes that high-speed mass privatization would be followed by reforms and restructuring have not been realized. Former managers retain control of enterprises and have blocked sale of further shares, limiting liquidity, while the state apparatus lacks the resources to implement corrective action. With capital market discipline and state oversight both absent, incentives for efficiency have been muted in these enterprises (Joskow, Schmalensee and Tsukanova, 1994). Hence, the objective of increasing efficiency through privatization has been defeated.

The Czech Republic has had two waves of mass privatization. The first was launched in mid-1992 when Czechoslovakia was an integrated country. It created 8.5 million shareholders out of a total Czechoslovakian population of 15.5 million persons. The second wave was completed in the spring of 1995. About 70 percent of the vouchers distributed to the public were placed with investment funds which used them to purchase shares in state owned enterprises.

In the Czech Republic fast-paced privatization has created an extra-ordinary system of governance: privatized firms are owned by investment companies which are managed by large banks. These banks, in turn, are owned by the state and the former state enterprises are heavily indebted to these banks. The banks have been reticent to call in the loans, even if they look bad; at the same time the state authorities have attempted to follow a conscious policy of not allowing bankruptcies to occur, thus perpetuating the soft-budget situation for firms with resulting non-positive consequences on expected efficiency (Portes, 1994). Additionally, six large state owned banks have recently collapsed under a cloud of embezzlement, fraud and bad loans, calling into question the success of the transition process in the Czech Republic (Jay, 1997).

In Chile, the second phase of the privatization program, undertaken between 1975 and 1983, attempted a similar fast-paced transformation of the industrial sector, with unfortunate consequences. In an attempt to maximize revenue for the state, many enterprises were rapidly privatized, often without adequate financial and managerial resources. This resulted in the creation of a large number of poorly-managed, highly-leveraged enterprises unequipped to

withstand the turbulence of an economy in transition. The subsequent failure of many of these enterprises resulted in their being returned to state control (Vickers and Yarrow, 1991).

The British privatization, in general recognized as a relatively orderly and successful program, provides a useful counterpoint to these experiences. In an economy with functioning market mechanisms and infrastructure, and no macro-economic adjustments or property rights problems to deal with, nevertheless it took over fifteen years for the state to divest itself from the bulk of its enterprises (Vickers and Yarrow, 1988). Yet, state enterprises in Britain accounted for only 10.6 percent of the GDP when the privatization began in 1980 (Caves, 1990), a proportion significantly smaller than the share of state enterprises' output in the GDP of most transition economies. The challenge for dissimilar countries, therefore, is a major one given that the state owned sector accounts for a very considerable share of the GDP in all transition economies.

(e) A Framework for Privatization Sequencing

Any attempt at developing a framework for privatization sequencing must face several issues. First, such a framework must recognize that privatization is likely to influence economic welfare through both allocative efficiency and technical efficiency mechanisms. By enabling greater output from given resources privatization can improve technical efficiency. However, if this increase in technical efficiency is accompanied by greater disparity between prices and marginal costs in the post-privatization regime then the losses in allocative efficiency may well undo the gains from increased technical efficiency. An appropriate framework should therefore account for both these sets of considerations (Caves 1990).

The relationship between technical and allocative efficiency and privatization can be complex. Central to this relationship is the role of market structure. An earlier section of the paper highlighted the role of superior management incentives and control under privatization as possible sources of improved technical efficiency. A firm being privatized into a competitive market may see an enhancement of these effects, as the inducements to technical efficiency are increased by the presence of several efficient competitors. A competitive market structure can, thus, reinforce the discipline of privatization. In less competitive markets, however, or markets with a structure providing an enduring advantage to incumbents, the final impact of privatization on technical

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efficiency may be indeterminate. In the absence of additional safeguards the technical efficiency gains theoretically possible from improved monitoring and control may not materialize due to unavailable or reduced product-market discipline.

Similarly, the existing structure of the market can have allocative efficiency implications in the context of privatization decisions. A firm privatized into an industry without any prospects of immediate or foreseeable competition can enjoy the benefits of market power and reduced governmental oversight. In the joint absence of governmental restraints and viable competition a newly privatized unit may pursue socially inoptimal pricing and output strategies. On the other hand firms privatized into competitive or contestable markets are unlikely to suffer allocative efficiency losses.

The direct relationship between privatization and improved technical efficiency also has implications. As noted earlier, the prospects of enhancing technical efficiency are likely to apply differentially to different firms. Firms close to an efficiency frontier will have significantly less improvements in performance to make than firms further away from it. For the most efficient enterprises marginal gains from privatization may be small. For the truly inefficient enterprises, the transformation to private ownership may help in unlocking significant value. From a temporal perspective it is, therefore, useful to privatize firms which are likely to provide the greatest gains in efficiency earlier than firms likely to demonstrate only marginal gains. Such a sequence can provide significant inter-temporal efficiency gains as the largest efficiency increases are obtained earliest and carried through the longest period, while the smaller efficiency gains are taken later.

The preceding discussion suggests that enterprises are likely to vary along two dimensions: (a) the degree to which privatization is likely to improve technical efficiency; and (b) the degree to which privatization can worsen allocative efficiency. In Figure 1 we consider a simple representation of the joint effects of allocative and technical efficiency in the context of privatization. For simplicity, we consider enterprises as falling into two categories, low or high, on each of the above dimensions. This representation results in a four-way classification of enterprises: (1) enterprises where privatization is likely to be accompanied by large gains in technical efficiency and limited or no worsening of allocative efficiency; (2) enterprises where

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privatization is likely to be accompanied by small gains in technical efficiency and limited or no worsening of allocative efficiency; (3) enterprises where privatization is associated with large gains in technical efficiency, but where significant worsening of allocative efficiency may also result; and finally, (4) enterprises where privatization is likely to generate only small gains in technical efficiency, but where there can be significant worsening of allocative efficiency. This representation helps in providing insights toward generating an appropriate privatization sequence.

For enterprises in category (4) it is questionable as to whether privatization should take place. Limited gains from technical efficiency, accompanied by the prospect of significant losses of allocative efficiency, suggest that such enterprises are better left under continuing state control. Omitting them from current privatization priorities is beneficial in terms of the political economy and managerial resource constraints. Maintaining the status-quo for such enterprises reduces dislocation and economizes on the resources needed to manage the privatization process.

For enterprises falling in the category (3) the prospect of technical efficiency gains is accompanied by the possibility of significantly worsened allocative efficiency. An optimal governance arrangement for such enterprises should be one that obtains the increase in technical efficiency while providing safeguards against the possible loss of allocative efficiency. One arrangement that may make this possible is the sharing of ownership between state and private owners, with the state serving as monitor of allocative efficiency while the technical efficiency impetus comes from the private owners.

A key issue, in such a situation, is the degree of privatization or the proportion of ownership that is transferred to private owners. Although the specific proportion will depend on the institutional contexts, which vary between nations, the need to change existing work practices and provide a credible commitment of state disengagement to private owners may necessitate that a controlling interest be given to the private owners. A significant equity stake for the stake which permits active monitoring of such enterprises by the state can serve to limit potentially negative allocative efficiency consequences.

For the enterprises in the remaining two cells, (1) and (2), the absence of adverse allocative efficiency consequences suggests that technical efficiency gains through privatization is the primary efficiency criterion for assessing their privatization prospects. However, even within the group of enterprises that can be privatized, there remains a need to establish a privatization sequence. A useful approach towards the sequencing of such enterprises is then to consider the likely productivity or technical efficiency gains from the privatization of these enterprises.

The expected gains from improved technical efficiency from an enterprise can be decomposed into two components: (a) the degree to which an enterprise can be expected to improve its ratio of outputs to inputs, or its productive efficiency; and (b) the volume over which this improvement is achieved. Ceteris paribus, enterprises that are already on an efficiency frontier prior to privatization can be expected to post only limited improvements in efficiency. Enterprises which are distant from an efficiency frontier, on the other hand, can make significant improvements in performance. Size, however, is an important contingency which can magnify or dampen the overall efficiency gains.

Our analysis, details of which are provided in the Appendix, indicates that in constructing an appropriate sequence it is necessary to account for both size and performance levels of the enterprises to be privatized. Privatization of small and efficient enterprises is likely to contribute relatively little in overall performance improvements; conversely, the privatization of large and inefficient enterprises will contribute larger performance gains. The principle that large gains in efficiency, made in earlier time-periods and sustained over time, leads to greater cumulative output can be used to develop privatization policy. Accordingly, the focus of privatization effort should be, first, on the large and inefficient enterprises, leaving the small and efficient enterprises to be dealt with last. Enterprises that are intermediate in size and efficiency should be dealt with after the large and inefficient enterprises have been dealt with, but before dealing with the small

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and efficient ones. The matrix in Figure 2, which again is a four-way classification, reflects these privatization priorities.

3. AN EMPIRICAL ILLUSTRATION

(a) Context and Data

While the framework for privatization sequencing suggests a priority, based on efficiency and size considerations, policy makers need to have an ordering of the firms to be dealt with. For this purpose, we demonstrate the application of a simple improvement index. The computation of this index is based on a technique called data envelopment analysis, which is one of the techniques permitting firm-level efficiency analysis. This section contains details of empirical analysis, using Indian data, that helps illustrate the application of the improvement index in privatization sequencing.

In India, the "commanding heights" theme was dominant in guiding the development of state-owned enterprises (Marathe, 1989). According to this theme, the under-development of the Indian industrial sector at independence meant that the government had a critical role to play in establishing large enterprises. The private sector was unable to fulfill this role because of a lack of funds to make the investments required, and also did not possess the requisite entrepreneurial and technological capabilities. In addition, the government as shareholder would receive dividends which would be ploughed back into the firms or other industries, thus encouraging the growth process in Indian industry (Jalan, 1991).

The implementation of the policy has resulted in the setting-up of a number of giant state-owned enterprises. A characteristic is large scale; state-owned enterprises in India are substantial in size, both in terms of capital investment and employment of manpower. Of the twenty-five largest enterprises in India, twenty are state-owned. Whether the large sizes of these state-owned enterprises permits them to enjoy the increasing returns and associated economies that scale permits is an important economic issue that we also empirically explore in this paper.

Our sample consists of twenty five service-sector Indian state-owned enterprises in the services sector for which we have been able to collect firm-level data for seven years: 1987 to 1993. Data are obtained from the Center for Monitoring the Indian Economy in Bombay, India and the Department of Public Enterprises of the Ministry of Industry, Government of India, New Delhi, India. We pool the data for all seven years for all firms. Thus, we have a panel of one hundred and seventy five firm-level observations. We use one key output: the value of gross output, which has been used at the output variable in a number of prior empirical studies of Indian industry by Ahluwalia (1985) and Majumdar (1996). Capabilities are encapsulated in physical capital and human capital; we, therefore, use two inputs: fixed capital and the number of employees. In 1993 these 25 firms generated in total gross output valued at over Rs. 10,000 crores (Rs. 100 billion) and employed over 200,000 persons.

Capital inputs can be actual book-values of physical capital given in the data. In measuring capital input, the use of undeflated book-values amounts is inaccurate and the book value series is deflated by a price index. The weakness of using deflated data alone is that it does not take into account assets of different vintages bought at different points of time. Therefore, following Goldsmith (1962) and Hulten (1990) the perpetual inventory method is used. That involves assuming for some base year an amount as beginning capital stock, and an annual rate of capital consumption. These assumptions, as to beginning capital stock and capital consumption are contingent on researchers' biases, and capital input valuations may vary between researchers. However, the perpetual inventory method is a preferred mode of measuring capital inputs.

The data on the Indian state-owned firms include capital stock data at net book value and depreciation. Combining these yields the gross capital stock. One issue is that state-owned firms' asset bases include large amounts spent on social overhead, such as staff housing, staff welfare centers, and community development projects. In the sample of firms analyzed, all the firms will have incurred

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expenditures for these activities. Therefore, to the extent that capital stock amounts are over-stated by the inclusion of capital expenditures which do not enter directly enter into the production process, they are over-stated for all the observations.

A real capital stock series, using an approach similar to that adopted by Lieberman, Lau and Williams (1990), is constructed using a perpetual inventory capital adjustment method, given by the equation: $K_t = (1 - D)K_{t-1} +$ deflated gross investment, where K_t is the capital stock to be used for each year, gross investment is the change in the firms undepreciated capital stock since the preceding year, and D is the rate of depreciation taken at 10 percent, which is suggested by Hulten and Wyckoff (1981) as a consistent representation of the weighted average rate, over asset categories, of the economic depreciation. The initial capital stock, K_0, equals the net book value of the capital stock for 1987 which is computed as gross book value less the economic depreciation.

(b) Estimation Procedures

We first compute efficiency scores for the enterprises using data envelopment analysis. This is a linear programming approach which has been used to measure productive efficiency in many contexts. We note from our results, that we discuss later on in this section, that there is marked heterogeneity in the performance of the evaluated state-owned enterprises. Both relatively efficient and highly inefficient enterprises co-exist within the same sector. Hence, the assumption that the state-owned-sector is marked by significant performance heterogeneity finds empirical support, at least in the Indian context. We then use the conditions derived in section 4 to construct an illustrative privatization schedule for state-owned enterprise in the services sector of the Indian economy.

Charnes, Cooper and Rhodes (1978) [CCR] develop and Banker, Charnes and Cooper (1984) [BCC] extend an efficiency measure first developed by Farrell (1957) using a fractional program where the ratio of the weighted outputs to weighted inputs of each observation in the data-set is maximized.

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For each observation a statistic ranging between 0 and 1, which is a measure of how efficient each observation is in converting a set of multiple inputs jointly and simultaneously into a set of multiple outputs, is calculated. Using only observed output and input data, and without making any assumptions as to the nature of underlying technology or functional form, the algorithm calculates an ex-post measure of the efficiency of each observation, accomplished by constructing an empirically-based frontier, and by evaluating each observation against all others included in the data set.

Each observation rated as efficient is used to define an efficiency frontier, and firms not so rated are evaluated by comparison with a firm on the frontier with broadly similar output or input mixes as the firm being compared. Thus, data from efficient firms are used to create a frontier based on the principle of envelopment. The efficiency measure gives an indication of how well each firm performs relative to its potential and to other firms. The best firms score 1, on a scale of 0 to 1, and for the inefficient firms the difference in score gives an idea of the efficiency improvement that is possible.

The advantage of DEA also lies in its approach. DEA optimizes for each observation, in place of the overall aggregation and single optimization performed in statistical regressions. Instead of trying to fit a regression plane through the center of the data, DEA floats a piece-wise linear surface to rest on top of observations. This is empirically-driven by the data, rather than by assumptions as to technology or functional forms. The only assumptions made are that of piece-wise linearity and convexity of the envelopment surface, and the DEA algorithms also take each observation's idiosyncrasies into account in the computation of relative efficiency score, unlike in regression-based estimation techniques where efficiency parameters are calculated based on an averaging process (Seiford and Thrall, 1990). DEA is similar to other techniques which provide detailed information on intra-firm performance parameters.

The generalized DEA model is presented by the following formulation:

Max $e_{0,0}$ (1)

subject to: $e_{j,0} \leq 1$, $\forall j$; $\mu_{r0} \geq \in$, $\forall r$; and $v_{i0} \geq \in$, $\forall i$; where $j > 1,....n$ is the index for observations, 0 being used as the index for the observation being specifically evaluated and $e_{0,0}$ is the efficiency score for that observation, $r = 1,....R$ is the index for the outputs ($y_{rj} \geq 0$ is output r of observation j), $i = 1,....I$ is the index for the inputs ($x_{ij} \geq 0$ is input i of observation j), $e_{j,0}$ is the relative efficiency of observation j when observation 0 is evaluated, μ_{r0}, v_{i0} are the output and input weights, respectively, associated with the evaluation of observation 0, and $\in$ is a non-Archimedean infinitesimal quantity. In (1), the input (x_{ij}) and output (y_{rj}) factors are known quantities observed from the activities of the observations, the factor weights (μ_{r0} and v_{i0}) are the decision variables and the CCR DEA model can be defined as:

$$e_{j,0} = \sum_{r=1}^{R} \mu_{r0} \bullet y_{rj} \bigg/ \sum_{i=1}^{I} v_{i0} \bullet x_{ij} \qquad (2).$$

Linear-programming based approaches (Dorfman, Samuelson and Solow, 1958) used in empirically evaluating economic phenomena have been subject to a constant returns to scale constraint, a condition useful for theoretical purposes but not of practical use (Hicks, 1989). The original Farrell and the CCR models do also incorporate this constraint. Banker, Charnes and Cooper (1984) show that the constant returns to scale constraint implicit in the CCR model can be relaxed. The BCC algorithm assumes that variable returns to scale exist for firms, and a variable u_0 is added in the programming formulation so that the hyperplanes for each observation do not pass through the origin, while in the CCR model hyperplanes pass through the origin because constant returns to scale are assumed. In the constraint set for the linear programming model, this variable is kept unconstrained so that it can take on values, depending on the data, which are negative (denoting increasing returns to scale may exist), 0 (denoting constant returns to scale may exist) or positive (denoting decreasing returns to scale may exist) for each jth observation. The CCR model generates a total efficiency score comprising a scale efficiency component and a technical efficiency component, while the BCC model generates a technical efficiency score. Dividing the CCR score by the BCC score generates a measure of the scale efficiency of each observation (Majumdar and Chang, 1996).

The concept of scale efficiency is of theoretical and practical use. Within an industry firms of different sizes can exist because each firm operates at a different scale of output generation (Silberston, 1972). Due to reasons relating to, say, the financial, marketing and risk-bearing capabilities of firms, there may be no one optimal size, dictated by technological considerations, or a master production function for the industry as a whole; each firm may, however, have a most productive scale size for its given capability sets and its operating production function (Robinson, 1932). The concept of scale efficiency measures the extent to which firms deviate from their most productive scale size, the point on the cost curve where constant returns to scale exist (Gold, 1981), though firms may be either enjoying increasing returns or suffering from decreasing returns while being scale inefficient. Scale inefficiency is a measure of the divergence between present scale of operations and the most productive scale size attainable by individual firms.

Additionally, the concept of increasing returns is central in the theory of the firm (Penrose, 1959). It denotes that greater than proportional unit increases in output are generated for proportional increases in the unit of input, reflecting the marginal productivity with which resources are deployed (Stigler, 1958). The source of such productivity is generally assumed to be an enhancement in the organizational and technological scale of operations (Clark, 1923). The term that is in more common usage is that of increasing returns to scale; its corollary term is economies of scale which is a more aggregative concept (Silberston, 1972). For each specific firm the DEA algorithm generates a returns to scale parameter, and a parameter value of 1 denotes constant returns to scale, a parameter value of less than 1 denotes increasing returns to scale, while a parameter value greater than 1 denotes decreasing returns to scale (Banker, Charnes and Cooper, 1984).

(c) Results and Administrative Implications

For the firms analyzed, overall efficiency, scale efficiency and returns to scale characteristics are computed from the data. Table 1 provides descriptive statistics for the inputs and outputs for the firms, while Tables 2 and 3 provide summary details of the overall efficiency score, the scale inefficiency score and the returns to scale parameter over time. As the three tables show, there is significant heterogeneity between the firms studied. Table 1 shows a great deal of variation in the composition of state enterprises. A review of the standard deviation, minimum and

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maximum values for output, capital inputs and employment show a great deal of variation in the composition of the firms. Efficiency variations between firms can be assessed by examining data with respect to the standard deviation, the minimum and maximum values of the two efficiency scores and the returns to scale parameter. Again, these data show that there are wide performance variations within the Indian state enterprises belonging to one sector alone.

Other than inter-firm variations, the data reveal that the average overall efficiency of Indian state-owned enterprises is low. Prior research (Majumdar, 1997) has established that when compared with both domestically-owned and foreign-owned private sector firms state-owned enterprises are significantly inefficient. Data from the current study reveal that even when these enterprises are evaluated on a comparative basis only amongst themselves their average performance is low, as shown by the average overall efficiency score which ranges between 0.311 and 0.370 over the seven years. Correspondingly, the scale efficiency score ranges between 0.716 and 0.747 over the seven years. The average score of less than 1 for the scale efficiency score denotes that state-owned firms diverge from their most productive scale size.

The scale efficiency data do not shed light on the question of whether state-owned firms still have the potential to scale-up and enjoy increasing returns to scale, or whether they suffer from decreasing returns to scale and, therefore, need to be restructured. The scale inefficiency score denotes whether or not each firm is operating at the bottom of the cost curve or how far from the optimal point each firm is; but, whether the firms are in the left-hand arc (the increasing returns to scale arc) or the right-hand arc (the decreasing returns to scale arc) of the cost curve cannot be ascertained from the value of this score. The returns to scale parameter augments the scale efficiency data and provides direct evidence for each firm as to what arc of the cost curve it operates in. For the firms studied, the average value of the returns to scale parameter ranges between 1.29 and 1.62 for the seven years analyzed. This means that decreasing returns to scale is the production characteristic that describes the average state-owned enterprise studied, and implies that downsizing, which leads to a reduction in the scale of a firm, is a necessary condition for economic efficiencies to be attained.

A specific benefit from using DEA is the generation of firm-specific performance parameters. We use the analysis developed in section 2 to draw up illustrative privatization schedules for the firms in our sample, and construct an improvement index for the firms in the sample. We use overall efficiency and scale efficiency data for individual firms in the construction of these privatization schedules. Specifically, we use the seven-year average overall efficiency and scale efficiency scores for each firm for this purpose. To construct these schedules, we subtract each firm's seven-year average efficiency scores from the maximum obtainable score of 1, and call this the efficiency gap. We use average output value as a measure of each firm's size. The improvement indices for each firm equals the product of its size and its efficiency gap. Tables 3 and 4 provide details of the computations of the improvement indices for all the firms, and their analysis raises a number of interesting micro-level implications for Indian privatization policy.

First, we find that a few large and inefficient enterprises have very large improvement index scores, while many firms have relatively small improvement index scores. In policy terms, this implies that the focus of privatization activities on a few large corporations is important so as to remove the bulk of the inefficiency within the state enterprises that have been evaluated. Specifically, the four firms which have the highest privatization priority, in order of priority, are [1] Mahanagar Telephone Nigam (MTNL), [2] Air India, [3] Indian Airlines and [4] Shipping Corporation of India. This priority order for privatization stays the same whether the efficiency index based on either the overall efficiency score (Table 3) or the scale efficiency score (Table 4) is reviewed.

Second, the abilities of many transition economy governments to undertake the privatization of a large number of units are limited by the availability of technical competence within the requisite government departments. For example, in India the Ministry of Finance is required to devote a lot of effort to macro-economic and fiscal related issues, while the Ministry of Industry has to expend effort in encouraging foreign investment. Both these Ministries are simultaneously directly concerned with privatization of state-owned enterprises, yet do not have the necessary intellectual resources to handle all the firms in the state-owned sector that have to be privatized. Tackling the four key firms identified helps focus administrative attention on the

specific cases that can generate the maximum economic benefits as outcomes of the privatization process.

(d) Policy Implications Arising from the Empirical Analysis

First, the firm-level data help us examine some issues relating to the links between ownership, market structure and firms' performance, since, as Caves (1990) and Vickers and Yarrow (1988) suggest, managerial incentive structures are determined via interactions between factors such as ownership as well as the degree of product market competition. Theory (Vickers and Yarrow, 1988) and empirical research (Borcherding, Pommerehne and Schneider, 1982; Caves and Christiansen, 1980) establish that given the presence of a competitive environment performance differences between privately-owned and publicly-owned enterprises, which are a function of differences in how corporate control is exercised, disappear. What matters is not ownership but the presence of market contestability. In this literature, private and public sector firms are assumed to face similar entry, exit and labor market conditions. These conditions are assumed to have similar incentive effects for private and public sector managers, thus vitiating any egregious incentive effects that public ownership might have on firms' performance.

Because of institutional and political constraints, in spite of the fact that Indian many state-owned firms face contestable market conditions their performance is unremarkable. For the four firms: Air India, Indian Airlines, MTNL and Shipping Corporation of India, which have been listed as having the top privatization priority, time-wise details of their overall efficiency score, scale efficiency scores and returns to scale parameters are provided in Table 4. The data in this table provide the basis for tracking the performance of these firms over the seven years relative to the average overall efficiency score, the average scale efficiency score and the average returns to scale parameter for all the firms.

Figures 1, 2 and 3 show the relative performance of these four firms, for each year, compared to the average performance of all the firms as a whole. Specifically, Figure 1 shows the overall efficiency trends, Figure 2 shows scale efficiency trends and Figure 3 shows the returns to scale parameter trends. Figure 1 shows that there is some variation between firms in their overall efficiency performance in that two of the firms, Air India and Shipping Corporation of India, are above the average overall efficiency score for the seven years, while the overall efficiency scores

for Indian Airlines and MTNL are, by and large, below average. In particular, the overall efficiency score for MTNL is particularly low for all of the seven years.

Given that, of the 25 firms studied, both Air India and Shipping Corporation of India face extremely contestable global market conditions, these two firms should have been the frontier definers for the entire sample. Their overall scores are only somewhat above the sample average initially, but does rise somewhat over time. Figures 2 and 3 shows that, on the other hand, the scale efficiency scores and the returns to scale parameters for the four firms are consistently below the sample average for all the seven years studied. For Air India and the Shipping Corporation of India, though highly-contested market conditions are faced, their overall performance can be rated as quite sub-standard.

The issue of extra-market forces' interference in state-owned enterprises is illustrated by evidence for Air India, which is second in terms of privatization priority. Air India is India's national carrier, yet it carries only 30 percent of India's international passenger traffic, down from the 45 percent that it carried in 1977. This may be because of the fact that in the 1980s the market for international traffic to India more than doubled, inducing a large number of international air carriers to start operating services to India. and Air India has not been able to cash in on this travel boom. Air India's level of operational capacity has remained static and consequently its market share has declined. The lack of commercial and operational autonomy that Air India suffers from has particularly constrained it from responding to the market in a timely manner; for example, it is reported that the control of the airline's affairs by the controlling ministry amounts to a stranglehold. Airline autonomy is guaranteed in the Air Corporations Act of 1953; however, it remains on paper. Every single policy decision, whether related to aircraft acquisition, wage revision or the construction of a hangar, must be referred to the controlling ministry, and then passes through a labyrinthine process. When more than one ministry is involved, then the process becomes more complex and time-consuming (Nayar, 1994).

The above points capture the nature of interference exercised in Air India's commercial and operational matters by the bureaucracy. Such interference has resulted in a stagnant fleet, which is advanced in age. As a result, severe maintenance problems arise and frequent

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breakdowns occur leading to a decline in the quality of Air India's service (Nayar, 1994). Consequently, Air India has been consistently losing market share over the years. The market share decline is also indirectly reflected in the scale efficiency scores and the returns to scale parameters for Air India. Figure 5 shows Air India's performance relative to the sample averages. Air India's scale efficiency score remains stagnant at around the 0.500 mark for the seven years studied, which suggests that it is far from its most productive scale size, and the scale efficiency scores are well below the sample average for all the years studied.

The returns to scale parameter for Air India increases between 1987 and 1993. The parameter value goes up from 2.18 in 1987 to 3.20 in 1993, denoting that Air India's decreasing returns to scale condition is worsening over time. Thus, Air India may be caught in a vicious cycle. Its current fleet capacity is unexploited because of frequent aircraft breakdowns and the lack of customer attention that follows for its service, leading to diseconomies of scale. Concomitantly, through an inability to exploit scale economies via the increasing returns process that high capacity utilization brings about in the airline industry, it cannot generate the necessary funds that will enable it to acquire new aircrafts which are both technologically sophisticated and have larger passenger capacities. Thus, its future competitiveness may worsen.

In the Indian context, the contestability of the market may be inadequate to eliminate the incentive problems that arise with public ownership because of institutional constraints, which primarily make their way felt via bureaucratic interference. Therefore, privatization has to mean not just a token sale of shares to enhance government receipts, but also the handing over of full operational and strategic control of state-owned enterprises to the private sector. At the level of the firm, this implies that majority control has to be given up by the government. Otherwise, the government will remain in a position to interfere in commercial and operational decisions, vitiating against the very efficiency benefits that privatization is expected to bring.

Therefore, a proposal to sell only a small proportion of Air India's shares to the public and retain full operational and strategic control by the Ministry concerned is unlikely to benefit its long-run performance. For the Indian privatization policy to be successful, the implications are that the four firms identified as likely to benefit maximally from privatization not only have to be

dealt with on a priority basis, but government control of these firms has to be fully surrendered to the new owners. This means that the majority shareholding of 51 percent has to be sold in the enterprises that are to be privatized. The proposal to sell a maximum ownership stake of 49 percent, with the government retaining 51 ownership percent, is unlikely to enable the privatized enterprises to become efficient and viable commercial entities.

Second, the firm-level analysis can be used to assess issues of market structure conditions in certain industries. As the data in table 5 reveal, the performance of MTNL is the worst among the four firms for which details are provided. MTNL is not only government owned, but also operates as an unregulated monopoly in an industry which due to its production characteristics requires regulation. From the data it is difficult to disentangle how much of the relatively poor performance of MTNL is due to either state ownership, market power or the lack of regulation; it is probably due to a combination of all of these factors. Ownership is, however, held constant for the four firms. Therefore, MTNL's low performance relative to the three other firms for which data are given in Table 5 can be due to a lack of competition, a lack of regulation or both. Air India, Indian Airlines and the Shipping Corporation of India all operate in competitive markets; this factor may, in part, account for their superior performance relative to that of MTNL.

An enhancement in the competitiveness of the market environment has led to significant performance improvements for firms in the telecommunications industry in United States (Banker, Chang and Majumdar, 1996). Therefore, given MTNL's poor performance, the need for the Indian government to take a close look at market structure and competition policy issues in the Indian telecommunications industry cannot be stressed too lightly. The data for MTNL in Table 5 reveal that the returns to scale parameter is considerably over 1. In fact, it has increased from 4.89 in 1987 to 6.58 in 1993. Therefore, increasing returns to scale is just not a production characteristic of MTNL. The key characteristic of a firm which is a natural monopoly is the ability to enjoy economies of scale, which is driven by a process of increasing returns. The non-enjoyment of scale economies by MTNL, as well as the size of MTNL's increasing returns to scale parameter, suggest that changes in competition policy whereby new entrants are allowed entry into MTNL's territories to provide local telephone services will be of economic benefit.

5. DISCUSSION

(a) The Approach of this Paper

Gradual privatization of state owned enterprises is necessary for a number of practical reasons, as set out earlier in this paper. We argue that, in a scheme of gradual privatization, the fact that different enterprises are performing at different efficiency levels has important implications. These implications arise on account of the temporal dimension of the privatization problem. If all enterprises cannot be privatized in the same period then some enterprises will need to be privatized earlier than others. Enterprises which are privatized earlier will post improved performance for a longer period than enterprises which are privatized later. Given this scenario, it makes sense to prioritize the privatization of those enterprises which are likely to post the largest improvements in performance. Such a scheme will ensure that the largest gains are taken earliest and the relatively smaller gains are taken only later in the transition period; hence, cumulative efficiency gains over the transition period are maximized.

Our analysis shows that privatizing inefficient enterprises before efficient ones is a superior sequence as compared to one which reverses this order. The analysis also demonstrates that the size of the firms to be privatized is an important contingency moderating the result. Specifically, privatization sequencing should account for both performance levels and size of the enterprises. Our analytical work also enables us to construct an improvement index for individual firms. This index, which takes into account both size and relative performance levels, makes possible a comparison of multiple firms. Thus, it facilitates the construction of a priority schedule. We use this index approach to construct such a schedule for a sample of Indian state owned firms.

The improvement index based approach to sequencing of privatization provides a number of advantages. It provides a systematic basis for understanding the efficiency consequences associated with the sequencing of privatization. Privatization policy based on a clear and consistent efficiency based logic can help reduce investor uncertainty, and enhance state credibility by indicating the presence of a government in control of the process. For makers of policy within government departments the index helps focus their energies and attention on firms that need most attention, and in the identification of which there have been no prior guidelines.

Because our approach provides a micro firm-level focus, it moves beyond the sectoral or macro approach that has dominated the transition debate (Portes, 1994). Such a micro-level focus provides firm-level information which can be incorporated directly into the policy making process; thus, actions can be targeted to focus on specific firms which are the major sources of inefficiency, rather than on more broadly-defined sectors. For instance, our approach can draw attention to the need for improving, an electric utility which is under performing rather than trying to reform the entire utilities sector all at once. Additionally, the targeting of one major electric utility can provide substantial efficiency gains within the power sector as a whole all at once. Such an approach can be of considerable help in conserving and utilizing scarce state-resources with respect to enterprise reform.

The improvement index is a measure of potential output increases. Using output increases as a measure of the enhancement of welfare is a simplification. For instance, pre-privatization output levels which are determined by criteria other than cost-minimization, as discussed in section 2, may be sub-optimally high. The welfare-maximizing output level may, then, entail reduction in outputs rather than enhancement. The intent is to, however, use the improvement index to identify firms that are under-performing, given their level of resources, rather than serve as a precise measure of welfare increases. Thereafter, under-performing firms can be down-sized to reduce input usage and output if their pre-privatization output levels are sub-optimally high, as shown by the firms' returns to scale parameter and if such a parameter denotes decreasing returns. Or these firms can be made more efficient in extracting outputs from given inputs, if pre-privatization output was sub-optimally low, with the final choice of appropriate output level being left to the management in the new regime. Under either circumstance, welfare increases are expected to be correlated with the improvement index. For down-sized firms the resources released from their current employment can be productively employed elsewhere to generate additional output. In the case of firms made more efficient we expect welfare enhancements to occur through increased outputs from given resources.

(b) Additional Ways of Enhancing State Owned Firms' Efficiency

While privatization is one approach towards enhancing the efficiency of state owned firms, as a consequence of change of ownership, there are a number of other ways to enhance their

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efficiency prior to privatization. The hardening of budget constraints, such as the removal of debt subsidies and the withdrawal of guaranteed support prices at which products or services are to be sold, can force enterprises to enhance their efficiency. For example, in Poland after an initial wave of privatization, major privatization was delayed; however, budget constraints were hardened for the key firms that were still owned by the state. This forced managers of these to-be-privatized but still state owned firms to increase enterprise productivity (Pinto, Belka and Krayewski, 1993). Additionally, research has also shown that the prospect of privatization itself can lead to gains in technical efficiency taking place which are of a magnitude similar to that gained through privatization itself (Yarrow, 1986). A government committed to enhancing industrial efficiency can send signals to appropriate enterprises that their fate will be in the hands of new owners, with different sets of priorities, who may radically alter the status-quo.

Another pre-privatization approach to the enhancement of efficiency of state owned firms is commercialization (Stern, 1996). Even if state owned firms face contestable market conditions, bureaucratic interference can vitiate against their ability to operate as commercial entities. Commercialization of state owned firms' operations, and the associated removal of bureaucratic interference, is also an important way to improve performance. Commercialization and hardening of budget constraints can induce state owned firms to undertake initial restructuring prior to their privatization, as noted in the 1995 Transition Report (European Bank for Reconstruction and Development, 1996). These restructuring operations make the enterprises viable for later sale. Whether, however, these steps required for efficiency enhancement can occur without an ownership change depends strongly on the political will of the government to reform the state owned sector (Williamson and Haggard, 1994), and, therefore, on the level of commitment to privatization and reform.

(c) Other Factors Necessary in the Management of the Privatization Process

For privatization to enhance efficiency a number of other factors become material. First, the financial need to sell government owned industrial assets rather than give these away via vouchers means that appropriate market values have to be obtained for privatized firms on their sale (Vickers and Yarrow, 1991). In erstwhile command and socialist regimes there have been

implicit contracts with the public at large about the ownership of property and assets. Therefore, ownership questions which can be highly contested have to be settled fairly. Otherwise, privatization may turn out to be spurious because though the process may mimic what is supposed to be a privatization transaction, the right of the transferor to convey the rights is uncertain (Stephan, 1996).

As Summers (1990) also points out, in the generally uncertain environment within which privatization is carried out assets have a low ex-ante value. If after privatization things work out well, there is a sense that those who acquired or received the assets stole them. There is then likely to be pressure to go after the windfall gains and undercut private property rights. If after privatization things do not work out well, that is also not. a good outcome. The possible resolution of such a dilemma is to let privatization occur through an evolutionary process when the intrinsic value of the assets that are to be sold become clear.

Second, in the evolution of privatization programs, governments have often underpriced shares, both in order to widen share ownership and to garner wide-spread political support. Adams, Cavendish and Mistry (1992) have argued that underpricing is necessary to establish the credibility of a privatization program. Therefore, initial underpricing will be offset by subsequent sales at higher prices. Yet, as Shafik (1996) notes, there is no evidence that underpricing diminishes over time. Rather, governments prefer a combination of underpricing and lower fees, which arise because the capital sums raised from a share privatization are smaller than sums raised from comparable private sector share issues, because the distributional consequences of a wider base of share ownership has greater political pay-offs.

Because proper asset valuation has been one of the major political stumbling blocks, for the valuation process to be equitable and transparent requires the establishment of accountancy, capital market, property rights and legal mechanisms. The presence of well-developed capital market mechanisms, accounting rules and systems, and legal safeguards of property rights makes privatization politically acceptable, and also enables privatized businesses to operate efficiently and freely. In their absence, the emergence of a large number of newly privatized enterprises may lead to a further reduction in the efficacy of allocative mechanisms because the inherited political

influence continues to be the primary means of obtaining and utilizing resources (Joskow, Schmalensee and Tsukanova, 1994). Yet, while absolutely necessary, the development of rules, safeguards and systems may take a considerable amount of time.

Third, for the institutional frameworks to develop in the former command economies a strong government is necessary. Weingast (1995), however, highlights a dilemma: a government strong enough to develop and enforce an institutional framework is also strong enough to confiscate wealth. Therefore, to attract citizens and corporate investors to purchase shares in enterprises that are to be privatized, the concerned governments must credibly commit to restraining politically-oriented behavior and arbitrary administrative actions on the part of government servants (Levy and Spiller, 1994). Hence, the reform of pay structures, incentives and administrative systems within government departments, and the creation of independent appeals tribunals is a necessary condition for successful privatization as is the development of appropriate institutional frameworks.

Fourth, as Balcerowicz (1993) points out, the speed of the privatization process depends on the knowledge and abilities of the reformers. Privatization processes are gradual because they require time, but the speed is dependent on operational considerations. The maximum speed with which the privatization process evolves is constrained by the inherent human limitations of information processing and learning. To the extent that there are only a limited number of individuals involved in the process of privatization, finite knowledge limits place upper bounds on the abilities of reformers to simultaneously make changes in institutional mechanisms and systems as well as undertake privatization. Even if there are a large number of individuals to be involved in the privatization process, learning is necessary so that there is diffusion of knowledge among all the individuals involved in the transition process.

Where changes in macroeconomic policies, such as changes in interest rates or removal of subsidies, are concerned these reforms can be carried out by a small group of people and the process of reform is technically simple. During the privatization process institutions have to be created or redesigned, strategic and organizational changes have to be carried out in organizations and new enterprise forms have to be created in countries where the state owned sector has been

very large. In such circumstances, where all-pervasive microeconomic changes have to be made, a great deal of very detailed technical knowledge is necessary. The learning effort is, therefore, commensurately more complex and time-consuming. While learning is often a tacit and evolutionary process, the training of policy makers and codification of the many detailed administrative procedures which are involved in microeconomic reforms is necessary, so that the policy makers who succeed each other in positions dealing with the privatization process have clear operating guidelines.

(d) Corporate Governance Issues

The experiences of the Czech Republic and Russia with respect to the lack of success of their privatization efforts, referred to earlier, arises not only due to the big-bang nature of privatization, but also due to the method of privatization followed. The Czech and Russian method of privatization was based on vouchers, and the voucher method is an approach to acquire political buy-in for the privatization process from citizens who are likely to become shareholders. Eligible individuals either received vouchers enabling them to invest in funds which would then invest in enterprises or received vouchers entitling them to a direct ownership stake in the enterprises. An alternative method of privatization is the direct sale of shares to domestic and foreign investors, the approach followed in the privatization of state owned enterprises in Hungary.

The method of privatization has considerable consequences for corporate governance. The nature of corporate governance, in turn, defines the nature of restructuring to be carried out if privatized enterprises are to attain efficiency. Voucher-based mass privatization leaves control in the hands of insiders, such as workers and managers. Restructuring of enterprises in transition economies is necessarily going to require fundamental organizational changes which are likely to cause significant loss of rents to insiders, since management turnover is necessary so that people with new skills more suitable to a market economy are in charge; therefore, the likelihood of firms being substantially restructured is reduced where control lies in the hands of insiders. For example, the evidence that has emerged with respect to the Czech Republic and Russia shows that

such insider control has significantly hampered restructuring efforts (Barberis, Boycko, Schleifer and Tsukanova, 1996; Frydman, Pistor and Rapaczynski, 1996; Stern, 1996).

Privatization based on insiders deals involving managers of state owned firms perform the first step of terminating state ownership and also politically legitimizing the privatization process among the key front-ranking personnel within an industrial economy. Such deals, nevertheless, do not leave the new owners with readily defensible claims to the assets of the enterprises that have been taken over. The resulting insecurity of the owners raises their cost of capital, since the assets of the enterprises cannot be used as collateral for obtaining debt, and investors providing new equity are also likely to be discouraged from making infusions of capital (Stephan, 1996).

Conversely, where control is exercised by outside investors who have purchased the enterprises and can exercise a dominant role, then the likelihood of fundamental restructuring taking place so that eventually the enterprise will be viable, and its viability attracts other investors, also rises (Aspe, 1997; European Bank for Reconstruction and Development, 1996). This has also been the experience in Hungary, where shares have been sold principally to foreign companies rather than being distributed via vouchers, as the recent evidence shows (Beck, 1997). Romania is, however, following the Czech method of voucher-based privatization, leaving control in the hands of workers and managers. Consequently, Romania may face many of the same problems faced in the Czech Republic. Additionally, in Romania shares in small and medium-sized firms are being sold to employees via management and employee buy-outs. Again, such an ownership structure can make radical strategic and staff deployment changes impossible to implement.

Second, the sale of a controlling block of shares to either a foreign or domestic investor can be at odds with the political desire of policy makers to have a broad base of share ownership among the citizens of a country. Private mutual funds and insurance companies, as institutional investors, can exercise control over the strategies and management of the companies that have been privatized (Majumdar and Nagarajan, 1997). Therefore, the growth of institutional investors in countries that are privatizing has implications for corporate governance because as dominant owners institutional investors can influence the occurrence and speed of restructuring. The growth

of investing institutions also facilitates wide-spread and diversified ownership of shares among the citizens of a country, which is a desired outcome of the privatization process (Seth, 1989). This outcome is attained because institutions provide a low-cost conduit for the aggregation of individual shareholders' investible funds (Levy and Spiller, 1994). Financial sector reforms involving the privatization of state owned financial bodies, the entry of private sector domestic and foreign financial institutions into financial markets and the introduction of financial sector regulations need to be concomitantly planned.

(e) The Role of Competition and Regulatory Policies

In an earlier section we have stated that privatization is likely to influence economic welfare through both allocative and technical efficiency mechanisms. Privatization is one component of overall micro-economic reforms, but its implementation has impact on changes in competition policy and the quality of regulation. All three policy variables, jointly and separately, can influence the behavior and performance of firms. Therefore, we stress that simultaneous attention has to be paid to both changes in competition policy as well as regulatory policy. Privatization, without concomitant changes in competition policy, allowing new firms entry if technically feasible in sectors which are monopolized by one or a few firms, can convert publicly owned monopolies into privately owned monopolies. This happened in Great Britain in the immediate aftermath of the privatization of British Telecom. Nevertheless, as Ramamurti (1996a) contends, in the short-term the privatization of monopolies is unlikely to be accompanied by a strengthening of competition because it is easier to sell a state firm with market power than without market power.

In the long-term, however, privatization increases the possibility that competition will increase in monopolistic industries. Privatized firms in monopolistic industries, as well as new entrants, are more likely to heed the statements from governments which propose the introduction of competition when privatization has taken place than without privatization. This is because the state has no longer an incentive in protecting the interests of a firm it no longer owns. Therefore, the potential for opportunistic behavior by the state is reduced. Whether the introduction of competition, if technically feasible within an industry, takes place in the short-term as it should be

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for improvements in efficiency to be maximized, or takes place in the long-term is, again, dependent on political considerations underlying the overall reforms process.

The introduction of regulations in sectors which are monopolistic, however, needs to be undertaken in the short-term; otherwise the absence of regulations can lead to market failures. Privatization leads to a clarification of the position of government in influencing enterprise behavior and performance, since ownership and regulatory roles of the government are no longer blurred. Additionally, the impact of regulations on firms is likely to be stronger in circumstances where the government is not the owner since the implementation of unpopular regulatory decisions are unlikely to cause losses of government revenue.

For example, in Great Britain though British Telecom remained a monopoly for a number of years after privatization immediately on privatization in 1984 it came under the purview of the Office of Telecommunications, which was the telecommunications regulatory body. On the other hand, the privatization of Telmex, the monopoly telecommunications carrier in Mexico, was not accompanied by immediate competition policy reforms or regulatory reforms (Ramamurti, 1996b). In fact, while the ministry responsible for telecommunications was reorganized to become the telecommunications regulatory agency, the actual process of implementing regulatory changes has been considerably slower (Saunders, Warford and Wellenius, 1994).

Therefore, even if competition policy changes may not occur in the short-term, changes in regulatory policies, or the introduction of regulations in countries such as India which have not had a regulatory framework for important infrastructural sectors such as power and telecommunications, can constrain newly privatized monopolies from behaving in a manner detrimental to consumer welfare. Hence, along with privatization and changes in competition policy, changes in regulatory policies are equally necessary and important aspects of the reforms process which can lead to changes taking place in the behavior and performance of firms.

APPENDIX: AN ANALYTICAL MODEL FOR PRIVATIZATION SEQUENCING

This appendix develops an analytical model for privatization sequencing. We argue that, faced with a pool of state enterprises to be privatized, there are efficiency and welfare implications of choosing different sequences of privatization that policy makers have to take into account. These implications arise from two conditions which are likely to hold in most transition economies; first, there are significant variations in performance even amongst state-owned enterprises; and, second, privatization occurs over a period of time. To illustrate these we consider the case of an economy with two state-owned enterprises, operating at two different levels of efficiency: one designated the high efficiency level (G_H), and one designated the low efficiency level (G_L). By definition, $G_H > G_L$. We assume that in any given period only one of these enterprises can be privatized. Further, we assume that efficiency gains through privatization remain possible in both enterprises.

We define efficiency in terms of the ability of firms to transform a given set of inputs into a set of outputs, relative to an efficiency frontier. A firm's efficiency is captured through an efficiency score constructed by calculating the firm's output to input ratio relative to the output to input ratio of the most efficient firm in the sample. So computed, the efficiency score is bounded in the interval [0,1]. Firms that are unable to generate any output from their inputs are assigned a score of 0 (unlikely in practice), while the most efficient firms in the sample will have an efficiency score of 1. Our assumption that efficiency gains remain possible through privatization for both enterprises then implies that $G_H < 1$ and $G_L < 1$.

Two issues arise; does the order in which the enterprises are privatized have welfare implications; and, if so, what order is normatively desirable? We consider three cases: case (a), when the post-privatization efficiency levels (P) and size are the same for both kinds of enterprise; case (b), when the post-privatization efficiency levels differ for the two kinds of enterprises, but ·size remains the same; and case (c), when the post-privatization efficiency levels as well as sizes differ for the two kinds of enterprises. In the last two cases we designate P_L as the efficiency level attained by the formerly inefficient enterprise, while P_H is the post-privatization efficiency level of the formerly efficient enterprise. We assume that privatization leads to an improvement in

efficiency; therefore, post-privatization efficiency levels are higher than pre-privatization efficiency levels. In case (a) this implies that $P > G_H > G_L$. In the two subsequent cases, (b) and (c), we treat the post-privatization efficiency levels as stochastic and assume that the distributions of P_H and P_L are centered at a mean higher than the observed pre-privatization efficiency levels $G_H > G_L$. However, in these cases we also allow a positive probability for the event that post-privatization efficiency levels are lower than pre-privatization efficiency levels.

Under the above conditions the relationship between the efficiency score of a firm and its output is as follows. The total output of a firm is the product of its efficiency score, its input volume, and a scaling constant γ which reflects the ratio of outputs to inputs in the most efficient firm. As stated above, for the first two parts of the analysis, we assume all firms are identical in size. Without loss of generality we normalize the input volumes of these equal sized firms to one unit for the first two cases. The total output for a firm in these cases is given by the product of its efficiency score and the scaling constant γ. For our subsequent analysis we ignore this constant γ as it applies to all firms identically, and is thus of no relevance in sequencing comparisons between firms. With these simplifications the efficiency score of each firm is identically equivalent to its output in the case of equal sized firms.

In case (c) where we look at unequal-sized firms, the input volume of firms is allowed to vary. The output of a firm in this case is the product of its efficiency score and its input volume, (ignoring the scaling constant γ, as before). In comparing different sequences of privatization we use total output for the economy as our measure of welfare. Since in each case the compared sequences involve usage of the same amount of inputs, the sequence that yields greater output is more desirable, ceteris paribus.

We analytically illustrate the three cases we have earlier referred to, using a three-period scenario over which transition takes place for each case. In Period 1, neither firm is privatized; in Period 2, one of the firms is privatized but not the other; and, in Period 3, the remaining firm is also privatized.

CASE 1: Same Post Privatization Level of Efficiency - P

Sequence 1: The efficient firm is privatized in the first period, and the inefficient firm is privatized in the second period.

Sequence 2: The inefficient firm is privatized in the first period, and the efficient firm is privatized in the second period.

Description of Case

	Sequence 1		Sequence 2	
Period	Efficiency Level of Efficient Enterprise	Efficiency Level of Inefficient Enterprise	Efficiency Level of Efficient Enterprise	Efficiency Level of Inefficient Enterprise
PERIOD 0	G_H	G_L	G_H	G_L
PERIOD 1	P	G_L	G_H	P
PERIOD 2	P	P	P	P

The welfare implications (W) are as follows:

Welfare implications of No Privatization (W0):

W0: Three period output if neither unit is privatized: $3(G_H+G_L)$ (3)

Welfare Implications of Sequence 1 (W1):

W1: Three period output if privatization is through Sequence 1: $G_H + 2G_L + 3P$.   (4)

Therefore, $\Delta W1$: Increase in output through Sequence 1: $W1 - W0 = 3P - 2G_H - G_L$ (5)

Welfare Implications of Sequence 2 (W2):

W2: Three period output if privatization is through Sequence 2: $G_L + 2G_H + 3P$ (6)

Therefore, $\Delta W2$: Increase in output through Sequence 2: $W2 - W0 = 3P - 2G_L - G_H$ (7)

As $G_H > G_L$, $\Delta W1 < \Delta W2$ (8)

RESULT 1: In the case of both enterprises reaching the same level of post-privatization efficiency, welfare gains are possible through an appropriate sequence of privatization.

Specifically, *the sequence of privatizing inefficient enterprises first, and efficient enterprises later, is welfare-superior to the alternate sequence of privatizing efficient enterprises first and inefficient enterprises later.*

The economic intuition underlying this result is straightforward. The efficiency gains of the enterprise that is privatized earlier are available for a longer period than the efficiency gains of the enterprise that is privatized later. If the quantum of these gains differ, then the two sequences cannot have the same welfare implications. Privatizing the inefficient enterprise first ensures that the larger efficiency gains are taken earlier, and carried through a longer period. This is superior to the alternate sequence that entails taking the smaller gains first and carrying them through the longer period.

A numerical illustration makes this point clear. Assume that $P = 0.75$, $G_H = 0.50$, and $G_L = 0.25$. Then, the efficiency improvement in the inefficient enterprise $(P-G_L)$ translates to an increase of 0.5 units, and the efficiency improvement in the efficient enterprise $(P-G_H)$ translates to an output increase of 0.25 units. Then, if we follow sequence 1, efficient enterprise privatized first, over the period of the transition we obtain an output increase of 1 unit (0.25 units x 2 years + 0.50 units x 1 year). Under sequence 2, inefficient enterprise privatized first, the increase is 1.25 (0.50 units x 2 years + 0.25 units x 1 year). Thus, having a larger efficiency increase early makes its benefits available for more periods, and, hence, adds to cumulative output over time. The longer the transition, and the greater the difference in the marginal improvements of the two units, the greater this effect.

In the above analysis, however, we make two assumptions. First, we assume that both enterprises rise to the same level of efficiency after privatization. Second, we assume that both enterprises are of the same size. Given firm-level heterogeneity, we generalize the analysis to consider two further cases. First, we consider the case in which the firms rise to different levels of post-privatization efficiency, but retain the assumption of identical sizes. Second, we allow both size and post-privatization efficiency levels to vary.

CASE 2: Post Privatization Levels of Efficiency Differ for the Two Enterprises- P_H & P_L

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P_H is the post-privatization efficiency level for the *efficient* enterprise. P_L is the post-privatization efficiency level for the *inefficient* enterprise.

SEQUENCE 1: The efficient firm is privatized in the first period and the inefficient firm is privatized in the second period.

SEQUENCE 2: The inefficient firm is privatized in the first period and the efficient firm is privatized in the second period.

Description of Case

Period	Sequence 1		Sequence 2	
	Efficiency Level of Efficient Enterprise	Efficiency Level of Inefficient Enterprise	Efficiency Level of Efficient Enterprise	Efficiency Level of Inefficient Enterprise
PERIOD 0	G_H	G_L	G_H	G_L
PERIOD 1	P_H	G_L	G_H	P_L
PERIOD 2	P_H	P_L	P_H	P_L

Now, the welfare implications are:

W0: Three period output if neither unit is privatized: $3(G_H+G_L)$ (9)

W1: Three period output if privatization is through Sequence 1: $G_H + 2G_L + 2P_H + P_L$ (10)

Therefore, $\Delta W1$: Increase in output through Sequence 1: $2P_H - 2G_H + P_L - G_L$ (11)

W2: Three period output if privatization is through Sequence 2: $2G_H + G_L + P_H + 2P_L$. (12)

Therefore, $\Delta W2$: Increase in output through Sequence 2: $2P_L - 2G_L + P_H - G_H$ (13)

Again, sequencing becomes relevant given that total output gains are, in general, different under the two sequences. Specifically, it can be shown that:

$\Delta W1 > \Delta W2$ iff $P_H - P_L > G_H - G_L$ (14)

$\Delta W1 < \Delta W2$ iff $P_H - P_L < G_H - G_L$ (15)

$\Delta W1 = \Delta W2$ iff $P_H - P_L = G_H - G_L$ (16)

In the case of both kinds of enterprises rising to the same post-privatization efficiency level we noted that the *inefficient enterprises first* sequence was unambiguously welfare-superior. In the situation where they rise to different levels of efficiency, the result is conditional. While sequence is relevant, except in the case when differences in post-privatization efficiency are identically equal to differences in pre-privatization efficiency, the welfare-superiority of a particular sequence depends on the occurrence of the conditions stated above. If the event $P_H - P_L > G_H - G_L$ is expected to occur with certainty, then clearly Sequence 1 is preferable as it leads to higher output. On the other hand, if the event $P_H - P_L < G_H - G_L$ is expected to occur with certainty then Sequence 2 is preferable.

However, it is likely that ex-ante it is not known with certainty which of these events will occur. In such a situation it is the *relative likelihood* of occurrence of these two events which determines the optimal course of action. If the event $P_H - P_L > G_H - G_l$ is *more likely* to occur than the event $P_H - P_L < G_H - G_L$, then choosing Sequence 1 is optimal. Conversely, if the event $P_H - P_L < G_H - G_l$ is *more likely* to occur than the event $P_H - P_L > G_H - G_L$, then choosing Sequence 2 is optimal. If both events are equally likely to occur, then the decision maker is indifferent between the two sequences.

To evaluate the relative likelihood of these various events we need information on the possible values of P_H and P_L. We assume that the post-privatization efficiency levels can be represented by a probability distribution. We believe that after privatization moderate improvements in efficiency are most likely, and extremely large or extremely small improvements are less likely. The normal distribution appropriately reflects this composition of outcomes. Extremely large or small improvements in efficiency correspond to the tails of the distribution and moderate efficiency increases reflect the central part of the distribution. Accordingly, we analyze the relative likelihood of the events $P_H - P_L < G_H - G_L$, $P_H - P_L > G_H - G_L$, and $P_H - P_L = G_H - G_L$, under the assumption that P_H and P_L are normally distributed.

As analysis below indicates, under this assumption, the outcome $P_H - P_L < G_H - G_L$ occurs with a probability strictly greater than 0.5, while the event $P_H - P_L > G_H - G_L$ occurs with a probability strictly less than 0.5. Thus, the event $P_H - P_L < G_H - G_L$ is more likely to

occur than the event $P_H - P_L > G_H - G_L$ and, therefore, choosing Sequence 2 is preferable to choosing Sequence 1 when post-privatization efficiency levels are not known with certainty. Hence, even in the case of varying post-privatization efficiency levels, in the absence of any other information, the decision-maker is still better off choosing Sequence 2 over Sequence 1.

We assume, as before, that $0 \leq G_L < G_H < 1$ (by definition of G_H and G_L and the assumption that efficiency gains remain possible for all enterprises). For exposition convenience, we classify the distances $0 - G_L$ as α, and $0 - G_H$ as β. Hence $\beta > \alpha$. Our interest lies in establishing the relative likelihood of $P_H - P_L > G_H - G_L$ vs. $P_H - P_L < G_H - G_L$ or, in other words, *Prob [(P_H - P_L) > (\beta - \alpha)]*, and *Prob [(P_H - P_L) < (\beta - \alpha)]*.

We assume that P_L and P_H are both random variables drawn independently from normal distributions centered on the difference between current efficiency level (G_L or G_H respectively) and the maximum possible efficiency score which is: 1. This specification allows post-privatization efficiency levels to fall below G_H or G_L respectively, or rise beyond the maximum currently observed efficiency score, with positive probabilities, while concentrating the probability mass over the likely to be observed mid-range values. Thus, while being general, this specification retains the advantage of representing the entire range of possible outcomes.

Symbolically, $P_L \sim N(\mu_L, \sigma_L^2)$ and $P_H \sim N(\mu_H, \sigma_H^2)$, where μ_H, μ_L and σ_H^2, σ_L^2 are the parameters of the respective normal distributions. To obtain values for these parameters from the given information we use the approach suggested by Judge, et al. (1988:289). If μ_L is centered on the difference between G_L and 1, $\mu_L = (1+\alpha)/2$. If μ_H is centered on the difference between G_H and 1, $\mu_H = (1+\beta)/2$. We know that $1 - \alpha \cong 6\sigma_L$ as 6σ covers 99.9 percent of the normal distribution. Similarly, $1 - \beta \cong 6\sigma_H$. Hence,

$$\sigma_L \cong (1-\alpha)/6 \text{ and,} \tag{17}$$

$$\sigma_H \cong (1-b)/6. \tag{18}$$

Therefore, $P_L \sim N((1+\alpha)/2, (1-\alpha)/6)^2$ and $\tag{19}$

$$P_H \sim N((1+\beta)/2, (1-\beta)/6)^2. \tag{20}$$

This parameterization provides a complete specification of the two distributions.

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Given this, we know that the random variable $P_H - P_L$, being a difference of two independent normal variables, will itself be normally distributed. Further, it can easily be shown that $P_H - P_L$ will have a mean equal to the difference of the means of the two parent distributions, and a variance equal to the sum of the variances of the two distributions (Ross, 1983). Accordingly, we have

$$P_H - P_L \sim N((\beta - \alpha)/2, ((1 - \beta)^2 + (1 - \alpha)^2)/36) \tag{21}$$

$$\text{Now,} \quad Prob[(P_H - P_L) > (G_H - G_L)] = Prob[(P_H - P_L) > (\beta - \alpha)]. \tag{22}$$

To obtain the probability associated with a normal random variable taking a certain set of values, we transform it to the standard normal variable z, and use the standard normal distribution to compute the desired probability. Accordingly, we have

$$Prob[(P_H - P_L) > (\beta - \alpha)] = Prob(z > z_0), \tag{23}$$

where z is the standard normal variable and z_0 is the transformation of the desired $P_H - P_L$ value to the standard normal. Thus, we obtain

$$z_0 = ((\beta - \alpha) - (\beta - \alpha)/2)/(\sqrt{(1 - \beta)^2 + (1 - \alpha)^2}/6) \tag{24}$$

$$= 3(\beta - \alpha)/\sqrt{(1 - \beta)^2 + (1 - \alpha)^2}, \tag{25}$$

and, therefore, $Prob(z > z_0) = Prob(z > 3(\beta - \alpha)/\sqrt{(1 - \beta)^2 + (1 - \alpha)^2})$ (26)

We know that $z_0 \geq 0$, since z_0 is a standard normal variable and its sign is determined by its numerator, as the denominator is a standard deviation and therefore, positive. Here, the numerator is *strictly* positive as $\beta > \alpha$, and, given this, it can be stated that: $z_0 > 0$ for all permissible values of β and α. If $z_0 > 0$ then *Prob(z > z_0) < 0.50 for all permissible values of β and α*, as values of 0 or less occur with a probability of 0.50 in the standard normal distribution. Therefore, $Prob[(P_H - P_L) > (G_H - G_L)] < 0.50$, and, further, as, $P_H - P_L$ is a continuous random variable the probability of it taking any individual value is 0. Therefore, *Prob[($P_H - P_L$) = ($G_H - G_L$)] = 0. Hence, Prob[($P_H - P_L$) < ($G_H - G_L$)] > 0.50.*

RESULT 2: Even with differing post-privatization efficiency levels, welfare gains are possible through an appropriate sequence of privatization. *Specifically, the sequence of privatizing*

inefficient enterprises first, and efficient enterprises later, will lead to welfare gains with a probability strictly greater than 0.5. Further, to the extent that z_0 takes on values greater than 0, which will always be the case, the probability of welfare gains through Sequence 2 increases.

Examining the economic intuition underlying this result is instructive. Even though post-privatization efficiency levels are permitted to vary freely in this case, the inefficient enterprises first sequence remains superior. This occurs because firms that are inefficient have greater scope to post large increases in efficiency than do firms that are already close to the efficiency frontier. The welfare effects of sequencing depend upon the relative magnitude of improvements in the two enterprises. Large improvements in efficiency are more unlikely for firms that are already very efficient. Hence, ceteris paribus, it still makes sense to privatize inefficient enterprises first.

The assumption of equal-sized enterprises is unlikely in reality., and in the erstwhile socialist and command economies the state has involved itself in a myriad of activities involving firms of widely-differing sizes. Accordingly, we need to investigate whether result 2 holds when firm sizes differ. Consequently, we consider the case when both post-privatization efficiency levels and the size of the enterprises differ.

CASE 3: **When Firm Size Differs**

Let δ_L = size of inefficient enterprise

δ_H = size of efficient enterprise

Three period output if neither firm is privatized:

$$W_0 = 3\delta_H G_H + 3\delta_L G_L \tag{27}$$

W1: Three period output if privatization is through Sequence 1

$$:\delta_H G_H + 2\delta_H P_H + 2\delta_L G_L + \delta_L P_L \tag{28}$$

Therefore, DW1: Increase in output through Sequence 1:

$$2\delta_H (P_H - G_H) + \delta_L (P_L - G_L) \tag{29}$$

W2: Three period output if privatization is through Sequence 2:

$$2\delta_H G_H + \delta_H P_H + \delta_L G_L + 2\delta_L P_L \tag{30}$$

Therefore, DW2: Increase in output through Sequence 2:

$$\delta_H (P_H - G_H) + 2\delta_L (P_L - G_L) \tag{31}$$

Let $k = \dfrac{\delta_H}{\delta_L}$ (*ratio of sizes of the two firms*)

Then it can be shown that:

$$\Delta W1 > \Delta W2 \quad \text{iff} \quad kP_H - P_L > kG_H - G_L \tag{32}$$

$$\Delta W1 < \Delta W2 \quad \text{iff} \quad kP_H - P_L < kG_H - G_L \tag{33}$$

$$\Delta W1 = \Delta W2 \quad \text{iff} \quad kP_H - P_L = kG_H - G_L \tag{34}$$

Our interest, as before, lies in establishing the relative likelihood of these three conditions.

We assume, as in Case 2, $P_H \sim N\left(\dfrac{(1+\beta)}{2}, \left(\dfrac{1-\beta}{6}\right)^2\right)$ and $P_L \sim N\left(\dfrac{(1+\alpha)}{2}, \left(\dfrac{1-\alpha}{6}\right)^2\right)$ $\quad$ (35)

then

$$kP_H - P_L \sim N\left(\frac{k(1+\beta)-1-\alpha}{2}, k^2\left(\frac{1-\beta}{6}\right)^2 + \left(\frac{1-\alpha}{6}\right)^2\right)$$ as, kP_H - P_L is a linear combination of

two normally distributed, independent random variables. (36)

Now, $\text{Prob}\left[(kP_H - P_L) > (kG_H - G_L)\right] = \text{Prob}\left[(kP_H - P_L) > (k\beta - \alpha)\right].$ (37)

To obtain the probability associated with a normal random variable taking a certain set of values, we transform it to the standard normal variable z, and use the standard normal distribution to compute the desired probability. Accordingly, we have $\text{Prob}\left[(kP_H - P_L) > (k\beta - \alpha)\right] =$ $\text{Prob}\left[z > z_0\right]$ where z is the standard normal variate and z_0 is the transformation of the given kP_H - P_L value, $k\beta$-α, to the standard normal;

$$z_0 = \frac{(k\beta - \alpha - k + 1)}{2\sqrt{k^2\left(\frac{1-\beta}{6}\right)^2 + \left(\frac{1-\alpha}{6}\right)^2}} \tag{38}$$

The sign of this expression is determined by the numerator as the denominator is a standard deviation. Positive values of z_0 imply that the Prob ($z > z_0$) must be less than 0.5, and hence the Prob ($z < z_0$) is greater than 0.50.

It can be seen that the numerator of z_0 will be positive iff

$$k < \frac{1-\alpha}{1-\beta} \quad \text{i.e.} \quad \frac{\delta_H}{\delta_L} < \frac{1-\alpha}{1-\beta} \tag{39}$$

Result 3: *If firms differ in size and post-privatization efficiency levels Result 2 holds, provided the relative sizes of the enterprises satisfy the equation above.*

In the case of equal-sized firms we had noted that Sequence 2 was associated with a higher probability of welfare gains relative to Sequence 1. Here we note that this result holds only for values of k which satisfy the above condition. The intuition for this result is that while Result 2 holds for equal-sized enterprises it may not hold if one of the enterprises is very large relative to the other. If the large enterprise is also a very inefficient one, result 2 will hold, a-fortiori, as privatizing it early will provide potentially large efficiency gains (large increases in efficiency over a large volume); however, if the efficient enterprise is relatively large this result may be overturned as even small increases in efficiency over a large volume, may be larger than large increases over a small volume. While sequencing will have welfare implications, the appropriate order will need to be based on computations accounting for both efficiency levels and sizes of the enterprises.

Our condition $\frac{\delta_H}{\delta_L} < \frac{1-\alpha}{1-\beta}$, then, can be rewritten as: $\delta_H(1-\beta) < \delta_L(1-\alpha)$. In this form its intuitive content becomes clearer. The left hand side of the inequality is a product of the size of the first enterprise and its distance from the efficiency frontier. It represents the total potential for improvement in that enterprise. We call this product the *improvement index*. The right hand side of the inequality represents the *improvement index* for the second enterprise. Our condition then implies simply that the enterprise with the higher *improvement index* should be chosen for earlier privatization. The *improvement index*, thus, provides us with a basis for establishing a sequence among any number of corporations. Computing the *improvement index* for a group of firms and ranking them on the basis of these scores, will provide a list of privatization priorities consistent with inter-temporal efficiency maximization.

The above analysis indicates that sequencing in privatization clearly has welfare implications. Further, it indicates that in constructing an appropriate sequence it is necessary to account for both size and performance levels of the enterprises to be privatized. Privatization of small, efficient enterprises is likely to contribute relatively little in output improvements, whereas

privatization of large, inefficient enterprises will contribute large gains. Based upon the principle that taking large gains in efficiency, made in earlier time-periods and sustained over time, leads to greater cumulative output, privatization policy should focus on large, inefficient enterprises first, and leave small efficient enterprises to be targeted last. Enterprises that are intermediate in size and efficiency should be targeted after the large inefficient enterprises, but before the small efficient ones. The matrix in Figure 2 reflects these privatization priorities and provides guidelines for policy-making.

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FIGURE 1:

POST PRIVATIZATION TECHNICAL AND ALLOCATIVE EFFICIENCIES

		LIKELIHOOD OF WORSENING ALLOCATIVE EFFICIENCY AFTER PRIVATIZATION	
		LOW	HIGH
LIKELIHOOD OF IMPROVING TECHNICAL EFFICIENCY AFTER PRIVATIZATION	LOW	*Privatize*	*Leave State-Owned*
	HIGH	*Privatize*	*State retains Minority Shareholding*

FIGURE 2:

PRIVATIZATION PRIORITIES FOR POLICY MAKERS

		SIZE OF STATE ENTERPRISE	
		LARGE	SMALL
PRE-PRIVATIZATION	LOW	*Highest Priority for Privatization*	*Intermediate Priority for Privatization*
EFFICIENCY	HIGH	*Intermediate Priority for Privatization*	*Lowest Priority for Privatization*

TABLE 1: DESCRIPTIVE STATISTICS OF THE DATA USED FOR ANALYSIS

	1987	1988	1989	1990	1991	1992	1993
Output Value (Deflated):							
Average	173.55	178.32	190.89	206.55	209.34	326.39	237.05
Standard Deviation	261.30	264.17	291.05	315.24	326.78	347.04	368.39
Minimum	10.23	11.41	8.57	9.18	8.31	8.08	6.79
Maximum	890.32	925.61	996.18	1106.04	1192.86	1219.30	1383.46
Capital Value (Deflated):							
Average	207.19	219.34	233.97	276.10	291.71	289.86	301.07
Standard Deviation	381.61	407.91	434.47	507.02	538.66	535.97	563.22
Minimum	0.68	0.70	0.67	0.67	5.04	4.16	3.82
Maximum	1508.29	1580.13	1502.14	1644.73	1842.84	1683.97	1883.79
Employees (Actual Number):							
Average	8051	8026	8101	8307	8178	8526	8453
Standard Deviation	11330	11163	11424	11825	11769	11922	12363
Minimum	657	648	662	669	657	641	610
Maximum	45313	47271	49678	49731	49269	50927	54511

TABLE 2: EFFICIENCY SCORES

	1987	1988	1989	1990	1991	1992	1993
Overall Efficiency Score:							
Average Score	0.323	0.323	0.321	0.337	0.311	0.361	0.370
Standard Deviation	0.206	0.214	0.228	0.250	0.208	0.266	0.281
Minimum Score	0.056	0.037	0.038	0.038	0.025	0.034	0.030
Maximum Score	0.813	0.839	0.95	1.000	0.798	1.000	1.000
Scale Efficiency Score:							
Average Score	0.731	0.746	0.742	0.747	0.716	0.734	0.732
Standard Deviation	0.228	0.237	0.2663	0.244	0.246	0.247	0.239
Minimum Score	0.290	0.264	0.149	0.248	0.161	0.215	0.184
Maximum Score	0.998	0.994	0.999	1.000	0.996	1.000	1.000
Returns to Scale Parameter:							
Average	1.50	1.48	1.52	1.41	1.29	1.52	1.62
Standard Deviation	1.48	1.49	1.63	1.24	1.15	1.39	1.58
Minimum	0.10	0.10	0.10	0.11	0.11	0.15	0.13
Maximum	5.81	6.11	6.62	5.83	5.26	6.46	6.58

TABLE 3: PRIORITIES: OVERALL EFFICIENCY BASED IMPROVEMENT INDEX

NAME OF SERVICE-SECTOR STATE-OWNED CORPORATION	RANK ORDER BY OUTPUT	EFFICIENCY GAP: 1 - AVERAGE EFFICIENCY SCORE	DEFLATED OUTPUT VALUES	IMPROVEMENT INDEX: GAP * OUTPUT VALUE	PRIVATIZATION PRIORITY
AIR INDIA	1	0.627	1101.97	691	2
MAHANAGAR TELEPHONE NIGAM	2	0.865	865.23	748	1
INDIAN AIRLINES	3	0.744	852.72	635	3
SHIPPING CORPORATION OF INDIA	4	0.626	795.55	499	4
VIDESH SANCHAR NIGAM LIMITED	5	0.340	290.69	99	5
INDIAN RAILWAYS CONSTRUCTION	6	0.464	177.15	82	7
DELHI TRANSPORT CORPORATION	7	0.928	103.35	96	6
NATIONAL BUILDINGS CONSTRUCTION	8	0.393	101.83	40	14
INDIA TOURISM DEVELOPMENT	9	0.851	88.21	75	8
COMPUTER MAINTENANCE CORPORATION	10	0.568	82.25	47	10
METALLURGICAL CONSULTANTS	11	0.606	77.12	47	10
CENTRAL WAREHOUSING CORPORATION	12	0.919	72.25	66	9
ENGINEERING PROJECTS INDIA	13	0.251	72.03	18	21
ENGINEERS INDIA LIMITED	14	0.747	62.85	47	10
DREDGING CORPORATION OF INDIA	15	0.756	53.72	41	13
SMALL INDUSTRIES CORPORATION	16	0.640	47.13	30	17
CENTRAL MINE PLANNING AND DESIGN	17	0.852	44.12	38	15
RAIL INDIA TECHNICAL SERVICES	18	0.635	43.33	28	19
MINERAL EXPLORATION CORPORATION	19	0.906	37.29	34	16
HOTEL CORPORATION OF INDIA	20	0.921	31.46	29	18
NATIONAL SEEDS CORPORATION	21	0.713	26.11	19	20
CENTRAL COTTAGE INDUSTRIES	22	0.276	15.48	4	25
STATE FARMS CORPORATION	23	0.911	14.18	13	22
CENTRAL INLAND WATER TRANSPORT	24	0.965	11.59	11	23
HOOGHLY DOCKING AND PORT ENGINEERS	25	0.861	9.14	8	24

TABLE 4: PRIORITIES: SCALE EFFICIENCY BASED IMPROVEMENT INDEX

NAME OF SERVICE-SECTOR STATE-OWNED CORPORATION	RANK ORDER BY OUTPUT	EFFICIENCY GAP: 1 - AVERAGE EFFICIENCY SCORE	DEFLATED OUTPUT VALUES	IMPROVEMENT INDEX: GAP * OUTPUT VALUE	PRIVATIZATION PRIORITY
AIR INDIA	1	0.452	1101.97	498	2
MAHANAGAR TELEPHONE NIGAM	2	0.629	865.23	544	1
INDIAN AIRLINES	3	0.435	852.72	435	3
SHIPPING CORPORATION OF INDIA	4	0.359	795.55	287	4
VIDESH SANCHAR NIGAM LIMITED	5	0.052	290.69	15	8
INDIAN RAILWAYS CONSTRUCTION	6	0.161	177.15	29	5
DELHI TRANSPORT CORPORATION	7	0.125	103.35	13	9
NATIONAL BUILDINGS CONSTRUCTION	8	0.045	101.83	5	16
INDIA TOURISM DEVELOPMENT	9	0.013	88.21	1	24
COMPUTER MAINTENANCE CORPORATION	10	0.039	82.25	4	18
METALLURGICAL CONSULTANTS	11	0.025	77.12	2	21
CENTRAL WAREHOUSING CORPORATION	12	0.132	72.25	3	20
ENGINEERING PROJECTS INDIA	13	0.137	72.03	10	10
ENGINEERS INDIA LIMITED	14	0.031	62.85	2	21
DREDGING CORPORATION OF INDIA	15	0.537	53.72	29	5
SMALL INDUSTRIES CORPORATION	16	0.017	47.13	1	24
CENTRAL MINE PLANNING AND DESIGN	17	0.254	44.12	6	14
RAIL INDIA TECHNICAL SERVICES	18	0.047	43.33	2	21
MINERAL EXPLORATION CORPORATION	19	0.252	37.29	9	12
HOTEL CORPORATION OF INDIA	20	0.493	31.46	16	7
NATIONAL SEEDS CORPORATION	21	0.237	26.11	6	14
CENTRAL COTTAGE INDUSTRIES	22	0.254	15.48	4	18
STATE FARMS CORPORATION	23	0.716	14.18	10	10
CENTRAL INLAND WATER TRANSPORT	24	0.752	11.59	9	12
HOOGHLY DOCKING AND PORT ENGINEERS	25	0.539	9.14	5	16

TABLE 5: TIME-WISE EFFICIENCY SCORE DETAILS FOR FIRMS WHICH ARE HIGH PRIVATIZATION PRIORITY

OVERALL EFFICIENCY	1987	1988	1989	1990	1991	1992	1993
AIR INDIA	0.348	0.363	0.381	0.422	0.478	0.483	0.540
INDIAN AIRLINES	0.345	0.365	0.358	0.272	0.251	0.273	0.251
MAHANAGAR TELEPHONE NIGAM	0.114	0.129	0.161	0.158	0.159	0.170	0.168
SHIPPING CORPORATION	0.390	0.316	0.416	0.509	0.525	0.587	0.566
SCALE EFFICIENCY							
AIR INDIA	0.532	0.534	0.582	0.549	0.546	0.532	0.540
INDIAN AIRLINES	0.376	0.367	0.358	0.530	0.587	0.599	0.615
MAHANAGAR TELEPHONE NIGAM	0.394	0.375	0.347	0.377	0.395	0.355	0.352
SHIPPING CORPORATION	0.633	0.699	0.674	0.628	0.629	0.608	0.614
RETURNS TO SCALE PARAMETER							
AIR INDIA	2.18	2.25	2.32	2.60	2.79	2.78	3.20
INDIAN AIRLINES	5.81	6.11	6.35	2.13	1.97	2.13	1.98
MAHANAGAR TELEPHONE NIGAM	4.89	5.43	6.62	5.83	5.26	6.46	6.58
SHIPPING CORPORATION	1.84	1.51	1.62	1.88	1.87	2.03	1.98

FIGURE 1: OVERALL EFFICIENCY TRENDS
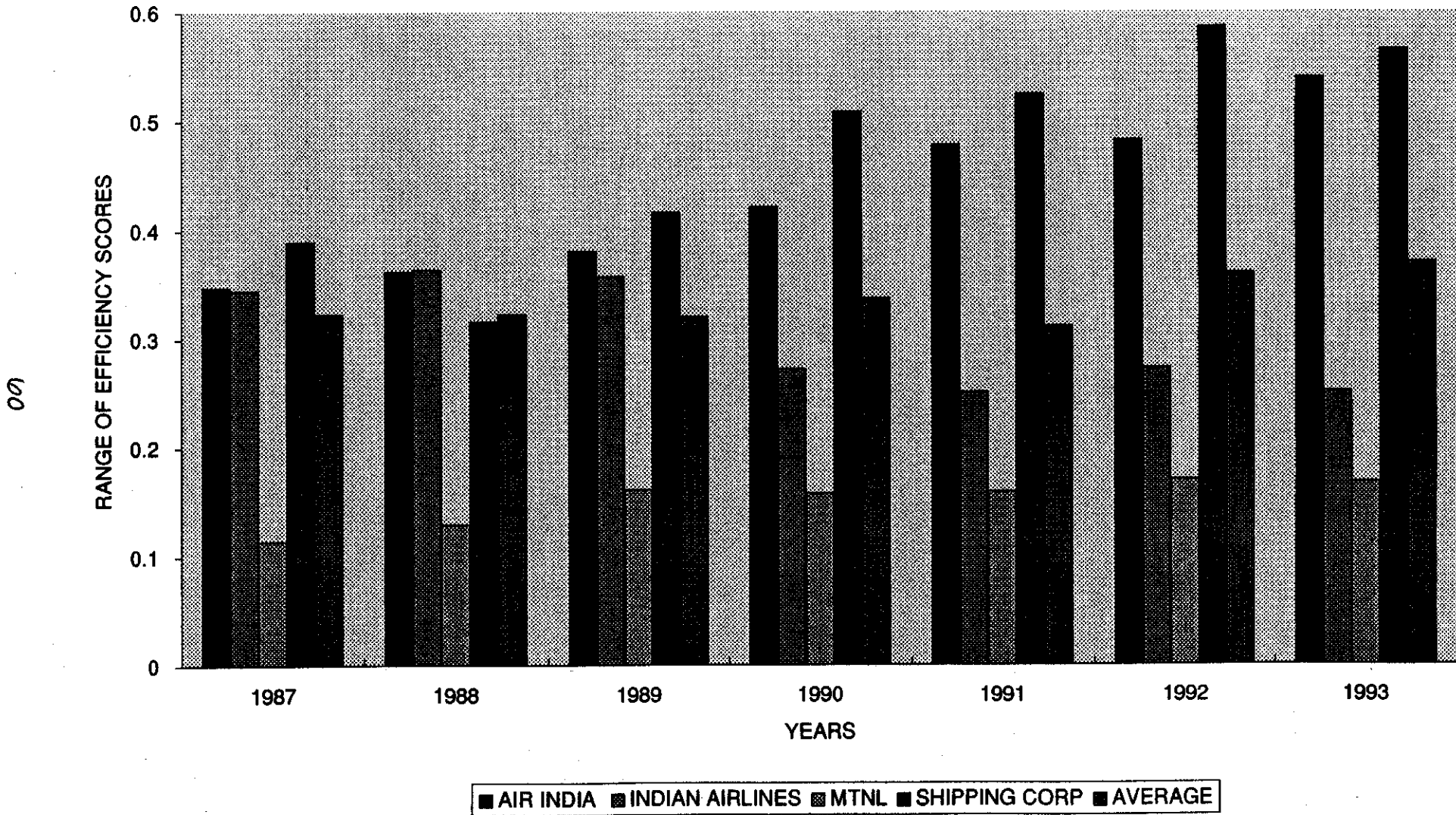TOP 4 PRIVATIZATION PRIORITY FIRMS

■ AIR INDIA   ▨ INDIAN AIRLINES   ▨ MTNL   ■ SHIPPING CORP   ▨ AVERAGE

FIGURE 2: SCALE EFFICIENCY TRENDS
TOP 4 PRIVATIZATION PRIORITY FIRMS

RANGE OF EFFICIENCY SCORES

YEARS

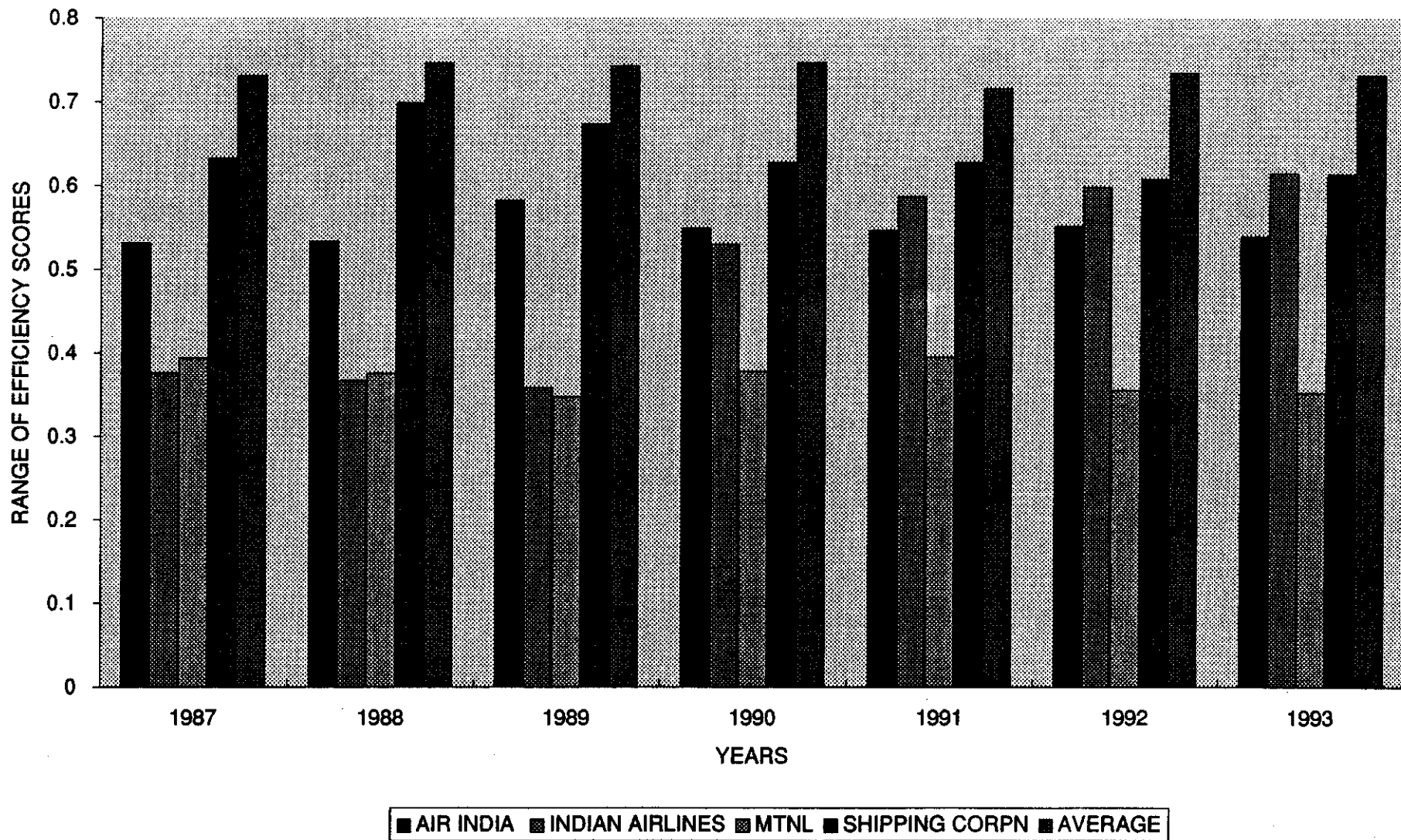■ AIR INDIA ▨ INDIAN AIRLINES ▨ MTNL ■ SHIPPING CORPN ■ AVERAGE

FIGURE 3: RETURNS TO SCALE PARAMETER
TOP 4 PRIVATIZATION PRIORITY FIRMS