Does Inefficiency Justify Privatization? The Case of Intermediate Industry Monopolies

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Abstract

We use an infinitely lived agent model in which an intermediate good is provided either by a public or a private monopolist to study the effects of privatization on steady state levels of income. We allow for public sector inefficiencies(x-inefficiency) which shift down the intermediate goods technology as well as bureaucratic inefficiencies which decrease the amount of tax revenue which will actually be allocated to public investment. We solve the model numerically for reasonable parameter values. The results of the model indicate that the benefits of this type of privatizations depend crucially on the size of the relative inefficiency of public firms and the amount of public investment. Furthermore, the gains from privatization are found to be strongly related to the balance sheet of the public firm that is privatized. Privatization of public firms which run deficits (surpluses) typically generate increases (decreases) in steady state consumption.

1 Introduction

During the 1980s and the 1990s large scale privatizations of state owned enterprises (SOEs) took place throughout the world as governments attempted to reform their economic structure. In many instances, these privatization efforts focused on intermediate industries like electricity, telecommunications, oil, and others (See the World Bank's Bureaucrats in Business Report (1995)).

The divestiture of state monopolies from such industries is perhaps the most debated type of privatization. Even in developing regions, where large privatization processes have taken place, opinions are divided regarding these policies. On the one hand, privatization advocates argue that private firms bring along a gain in productive efficiency and that privatizations can free up public resources to be put to more beneficial uses. On the other hand, privatization opponents claim that private monopolies would cut production below a socially desired level. They also question the existence of any efficiency gains.

Much of the interest in privatization rests on the empirical evidence concerning the efficiency of private enterprises relative to public firms. Most theoretical and empirical investigations about privatization, however, concentrate their analysis on cases in which competition is introduced at roughly the same time of divestiture (see Sheshinski and Lopez-Calva (2003)). Only a few studies refer to the effects of the privatizations of state monopolies where the ownership and productive incentives change but market competition is not introduced.

Authors like LaPorta and Lopez-de-Silanes (1999) and Bourbakri and Cosset (1998), for

example, study the efficiency gains that take place after privatizations of both competitive and non-competitive industries. Both of them report relatively small gains for the case of privatization of non-competitive industries. Others like Vickers and Yarrow (1991) report no efficiency advantages for either private or public ownership under non-competitive conditions.

Regardless of their findings on the productive inefficiencies in SOEs (if any), all these studies exclude a list of important elements (that are likely to alter the economic effects of privatizations) from the analysis. Examples of such elements include the flow of resources from the government to the SOE that is privatized, the different constraints that public and private firms face when making investment decisions, the influence that the SOE in question has on other productive sectors of the economy, the welfare implications associated with privatizations, and others. Macroeconomic studies are better suited for these type of questions, but macroeconomic studies on these issues are rare.

Apart from the literature on privatization in the context of the post-Soviet reforms in Eastern Europe, which includes for example Aghion and Blanchard (1994), Alexeev and Kaganovich (2001), Blanchard (1997), Castanheira and Roland (2000) and Roland (2000), we are not aware of many other theoretical papers on privatization in mixed market economies. This post-Soviet privatization literature, however, does not look at the privatizations of intermediate sectors, but rather at a whole-scale privatization of (almost) all productive activity.

In this paper, we study the privatization of state monopolies found in intermediate industries. Using a theoretical model of an aggregate economy, we restrict our attention to

the case where the monopolistic structure is preserved in the process of privatization. We consider the presence of productive inefficiencies within the state monopolies as well as the impact of other bureaucratic inefficiencies. Additionally, we consider the effects of publicly financed deficits or surpluses within these SOEs.

The following section presents a macroeconomic model with two productive sectors: a competitive sector that produces final goods, and a monopolistic sector that produces an intermediate good. We use this model to simulate a shift from a public, inefficient intermediate monopoly whose investment decisions are controlled by the government to a private and efficient intermediate monopoly whose investment decisions are guided by the profit maximizing efforts of its owner. We refer to this shift as Privatization. We then use the results of the model to analyze the macroeconomic effects of such privatizations in terms of both steady state output and wealfare levels.

Using a similar theoretical model, Glomm and Mendez (2004) also study the economic impact of privatizing a intermediate public monopoly. They study how the benefits from privatization vary from a competitive to a noncompetitive environment and how this difference changes as the elasticity of substitution for the intermediate good in the aggregate production function changes. In contrast with this paper, they ignore any issues related to inefficiencies, SOE's deficits, or the potential welfare impacts of privatization.

Two closely related papers are Schmitz (2001), who finds sizeable effects of privatization on aggregate income and Gylfason, Herbertsson and Zoega (2001), who show that privatization has large growth effects. Schmitz does not consider the issue of monopoly power and

Gylfason , Herbelson and Zoege model public and private goods as perfect substitutes in consumption and do not focus on the role of government production in intermediate goods.

The next two sections of the paper present the theoretical framework of the model and a description of the results. Finally, the last section of the paper offers a summary of our conclusions and a tentative list of issues pending for future research.

2 Theoretical Set-up

The economy is populated by a large number of individuals, which is normalized to one. The individual lives forever and is endowed with k_0 units of capital at time zero and with one unit of labor in each period. At each point in time, he supplies labor and capital inelastically. The before-tax wage rate is w_t. The before-tax rental price of capital is q_t.

The individual's lifetime utility function takes the form

$$\sum_{t=0}^{\infty}\beta^t(\frac{c_t^{1-\sigma}}{1-\sigma}), \qquad (0<\beta<1, \quad \sigma>0), \tag{1}$$

where β is a discount factor, c_t represents consumption of final goods at time t and $1/\sigma$ is the elasticity of inter-temporal substitution. Every period the individual divides his total income between consumption at period t, c_t and investment at period t, i_t. In addition, it is assumed that capital depreciates at the rate δ regardless of the specific use to which it is put.

Two goods are produced in this economy: a final good Y_t is used for consumption and an intermediate good E_t is used completely in the production of final goods. In this sense, the

role of E_t is similar to the role of many intermediate goods like electricity, internet, telecommunications, gas, or general energy that are used in almost all production processes. For simplicity, we assume that this intermediate good is not consumed directly by the individuals.

The final good is produced competitively by a large number of firms that use the same constant returns to scale technology, which is given by

$$Y_t = A(\theta K_{F,t}^{\rho} + (1-\theta)E_t^{\rho})^{\frac{\alpha}{\rho}} N_{F,t}^{1-\alpha}. \tag{2}$$

Here $K_{F,t}$ and $N_{F,t}$ represent the amount of capital and labor used in the production of final goods at time t respectively, A is a constant measuring total factor productivity and ρ and α are constants that measure the degree of substitutability and the marginal products of the factors in the production function.

Since the technology exhibits constant returns to scale, we can assume that there is one firm and that Y_t is aggregate output. The representative final goods firm's problem can be expressed as

$$\underset{\{K_F, N_F, E\}}{Max} A(\theta K_{F,t}^{\rho} + (1-\theta)E_t^{\rho})^{\frac{\alpha}{\rho}} N_{F,t}^{1-\alpha} - q_t K_{F,t} - r_t E_t - w_t N_{F,t}, \tag{3}$$

given q_t, r_t, and w_t.

Here r_t represents the price per unit of intermediate good E at time t, and the firm takes all prices as given.

The intermediate good E is produced using the constant returns to scale technology

$$E_t = BK_{I,t}^{\gamma} N_{I,t}^{1-\gamma}, \tag{4}$$

where $K_{I,t}$ and $N_{I,t}$ represent the total units of capital and labor used in the production of intermediate goods at time t respectively, γ is a positive constant, and B is a number that represents the productive efficiency of the firm.

The assumption about constant returns to scale in the intermediate industry allows as to capture different possibilities regarding the nature of competition in this market. One possibility is that the monopolistic power was generated by laws that prevented an otherwise competitive industry; in that case, the production function in (4) can be though as the representative production technology . Another possibility is that the monopolistic condition is the result of fixed start-up costs to the firm; in that case, the production function in (4) would need to include a fixed cost as well. This last term, however, if sufficiently small would not influence any marginal decisions.

Using this basic framework, we construct two alternative models: one with a private intermediate monopoly and another one with a public intermediate monopoly. The private monopolist's problem can then be written as

$$\begin{aligned} &\underset{\{N_I, K_I\}}{Max}\ r(E_t) \cdot E_t - w_t N_I - q_t K_I, \\ &\text{s.t. } E_t = K_{I,t}^{\gamma} N_{I,t}^{1-\gamma}, \\ &\text{given } r(E_t),\ w_t,\ q_t. \end{aligned} \tag{5}$$

Here the inverse demand function $r(E_t)$ corresponds to the representative final good firm's input demand function resulting from its maximization problem as stated by (3) and the constant B is set to one to indicate full efficiency in the private sector.

If $B < 1$ ($B > 1$), the public sector monopoly is less (more) efficient than the private sector monopoly. The lower productive efficiency of public firms (often referred to as X-inefficiency) can be explained by the lack of managerial incentives, the mix of political interests into the objective function, the lack of clear monitoring efforts by the government, and others (See for example Kay and Thompson (1986), Vickers and Yarrow (1991), Plane (1992)). Here any such sort of inefficiency is summarized by the constant B.

Any profits generated by the public and the private monopolies are defined by π_g and π_p respectively. For the private monopoly case, we assume that profits π_p are distributed equally among the individuals. For the public monopoly case, we assume that profits π_g are collected by the government and used in the same way as any other type of revenue.

The government in these economies taxes labor and capital income at the common rate τ; this tax rate is exogenous and assumed to be constant over time. The government has only two types of expenditures: government transfers T and government investment.

Specifically, for the public monopoly case, we assume that a fraction Ψ of π_g is used for investments in the capital of the public firm. We allow for Ψ to be greater than one as long as the government budget is balanced and the transfers T are not negative[1]. We do not

[1] This is equivalent to assume that a fraction of total government revenue is invested and the other fraction used for Transfers. We choose to model public investment in this way because it facilitates the analysis of SOE deficits as opposed to fiscal deficits.

allow Ψ to be less than zero, since this would amount to selling the public capital (a form of privatization).

Public investments are further subject to bureaucratic degradation; that is, for each unit of funds allocated to investment only a fraction b of these funds is actually added to the capital stock. The constant b is introduced to capture the effects of corruption, red-tape, and political inferences that are more likely to be present in public enterprises. Both b and B are treated as exogenous variables. In principle, productive and bureaucratic inefficiency are separate phenomena; interestingly, as will be shown afterwards, the effects of changes in b and B are not identical in our model.

The equation of motion of public capital and the government's balanced budget condition can then be described as follows:

$$K_{I,t} = (1-\delta)K_{I,t-1} + b \cdot \Psi \cdot \pi_{g,t-1} \ ; \tag{6}$$

$$\tau(q_t k_t + w_t) + \pi_{g,t} = \Psi \pi_{g,t} + T_t. \tag{7}$$

The assumption of a government balanced budget implies that public investment is financed entirely with current government revenues. Having a balanced government budget constraint also allows us to isolate and study the effect of SOE's deficits (surpluses) on the economy. An SOE is said to have a deficit if net revenues cannot cover operating expenses plus investment. By this definition, the case of $\Psi > 1$ ($\Psi < 1$) corresponds to a deficit (sur-

plus) on the SOE balance and thus, to a reduction (increase) on the public funds available for other purposes. Similarly, the case of $\Psi = 1$ corresponds to a balanced SOE budget.

Given equations 6 and 7, the public monopolist problem can be written as

$$\begin{aligned} &\underset{\{N_I\}}{Max}\ r(E_t) \cdot E_t - w_t N_I, \\ &\text{s.t. } E_t = B \cdot K_{I,t}^{\gamma} N_{I,t}^{1-\gamma}, \\ &\text{given } \ r(E_t), K_{I,t},\ w_t,\ q_t,\ B. \end{aligned} \tag{8}$$

The inverse demand function $r(E_t)$ in equation (8) is exactly the same as before and the firm takes net investment in public capital as exogenous.

While the objective function of public sector enterprises is by no means uncontroversial, we assume that the public firm's objective is to maximize profits. Such an assumption might not be too far away from actual behavior since, as pointed out by Ramamurty (1991), accounting practices, executive management and performance measures for state-owned enterprises often resemble those of private firms. Additionally, this assumption provides a convenient comparison to the case of a private monopoly, where profit maximization is more natural.

The individual's utility maximization problem can be expressed as

$$\underset{\{c_t,i_t\}}{Max} \quad \sum_{t=0}^{\infty}\beta^t(\frac{c_t^{1-\sigma}}{1-\sigma}) \tag{9}$$

$$\text{s.t.}\sum_{t=0}^{\infty}p_t\{(1-\tau)(q_tk_t+w_t)+T_t+\pi_{p,t}\}=\sum_{t=0}^{\infty}p_t(c_t+i_t)$$

$$\text{and } k_{t+1}=i_t+(1-\delta)k_t$$

given T_t, $\pi_{p,t}$, w_t, q_t, p_t, τ, and $k_{0.}$

Here p_t represents the price of a unit of consumption at time t relative to a unit of consumption at time $t+1$ and $\pi_{p,t}=0$ for the public monopoly case.

Finally, in equilibrium the capital and labor markets must clear, that is to say, at all times it must be true that $N_{F,t}+N_{I,t}=1$ and that $K_t=K_{F,t}+K_{I,t}$; where $K_{I,t}$ enters the equation only for the private monopoly case.

The corresponding equilibrium for these two alternative economies is defined as a sequence $(c_t,\, K_t,\, E_t,\, Y_t,\, q_t,\, r_t,\, w_t,\, T_t,\, \pi_{p,t})_{t=0}^{\infty}$, such that:

- the individuals solve their utility maximization problem as given by (9),
- the final good firms solve their profit maximization problem as given by (3),
- the intermediate monopolist solves his maximization problem as given by (5) and (**??**) respectively
- the government budget is balanced in all periods, and
- all markets clear.

3 Solution of the models

Throughout the rest of the paper, we will focus on steady states and drop time subscripts whenever possible without the risk of confusion. We chose a value of ρ that is arbitrarily close to zero, such that the production function described by equation (2) can be approximated by the simpler Cobb-Douglas technology $Y_t = AK_{F,t}^{\alpha} E_t^{\varphi} N_{F,t}^{1-\alpha-\varphi}$. There are three reasons that support our choice for ρ. First, as reported in cross-country studies by Megginson et al. (1994) and Boubarki and Cosset (1998), the levels of employment of the privatized industries (absolute and relative to total employment) do not change much after privatization. In our model, the only value of ρ that generates this result is zero.

Second, although the empirical evidence about the value of the parameter ρ at the industry level is mixed (authors like Prywes (1986), for example, find values varying from -24 to 12 across different US industries); empirical studies at the macroeconomic level often find values that are closer to zero. Kemfert (1998) and Chang (1994), for example, estimate ρ to be -0.5 and -0.14 for Germany and Taiwan respectively.

Third, as shown by Glomm and Mendez (2004), when the value of ρ moves away from zero the changes in the output difference of the public and private monopoly cases is very small. Thus, we do not expect a big gain in understanding to arise from changes in the value ρ.

With this in mind, after solving the consumer's dynamic utility maximization problem and the final good firm's profit maximization problem we obtain the Euler equation for the

consumer and the first order conditions for the firm. These equilibrium conditions are stated in equations 10-13 respectively.

$$(\frac{C_{t+1}}{C_t})^{\sigma} = \beta(q_{t+1}(1-t) + (1-\delta)) \tag{10}$$

$$q = A\alpha K_F^{\alpha-1} E^{\varphi} N_F^{1-\alpha-\varphi} \tag{11}$$

$$r = A\varphi K_F^{\alpha} E^{\varphi-1} N_F^{1-\alpha-\varphi} \tag{12}$$

$$w = A(1-\alpha-\varphi) K_F^{\alpha} E^{\varphi} N_F^{-\alpha-\varphi} \tag{13}$$

Similarly, equations (14) and (15) show the profit maximizing conditions for the private monopoly.

$$w = A\varphi^2(1-\gamma) K_F^{\alpha} K_I^{\varphi\gamma} N_I^{(1-\gamma)\varphi-1} N_F^{1-\alpha-\varphi} \tag{14}$$

$$q = A\varphi^2\gamma K_F^{\alpha} K_I^{\varphi\gamma-1} N_I^{(1-\gamma)\varphi} N_F^{1-\alpha-\varphi} \tag{15}$$

Equation (16) shows the public monopoly's optimal amount of labor:

$$w = A\varphi^2 B^{\varphi}(1-\gamma) K_F^{\alpha} K_I^{\varphi\gamma} N_I^{(1-\gamma)\varphi-1} N_F^{1-\alpha-\varphi} \tag{16}$$

In both cases, the equilibrium system of equations can be solved to obtain a closed form solution for the steady state equilibrium [2] but the analytical comparison of the alternative models does not allow us to reach definitive conclusions regarding the gains from privatization. Whether the private monopoly economy outperforms the public monopoly one depends on the value of the key parameters studied here; namely, B, b and Ψ. Thus, in order to obtain tangible results, a numerical exercise was conducted.

3.1 Numerical Simulation

The values of the exogenous parameters for our base case simulations are shown in Table 1. Setting $A = 1$ is simply a normalization. The values for the capital's share of income and the rate of time preference are standard (See Gollin (2002)), and the values of $\tau = 0.2$ and $\delta = 0.1$ correspond to the government's share of GDP in relative poor countries and capital depreciation respectively.

[2] Closed form solutions of these systems of equations together with the solutions for the most relevant variables in the model are available upon request

Table 1. Base Case Parameters

Preference Parameters:	$\beta = 0.96$
	$\sigma > 0$
Consumption Goods Technology Paramenters:	$A = 1$
	$\alpha = 0.3$
	$\varphi = 0.15$
	$\rho = 0$
	$\delta = 0.1$
Intermediate Goods Technology Paramenters:	$B = 0.8$
	$\gamma = 0.4$
Government Parameters	$\tau = 0.2$
	$b = 0.7$
	$\Psi = 1.05$

The value for the parameter γ (the share of capital in the value of the intermediate input) was chosen to match the empirical observations about the role of capital in the production of several intermediate goods. In the case of Britain, for example, Bishop and Thompson (1992) reported capital to constitute 40.2% of total inputs used in the production of electricity, 44.4% in the production of gas, and 46.7% for the telecommunication industry. Values of $\gamma \in (0.3, 0.5)$ were also used without much change in the results.

In turn, the parameter φ, which measures the income share of the intermediate good E, was set to match the actual share of SOE's output to GDP as reported by the World Bank's Bureaucrats in Business report (1995). Since before the 1990s it was common for the government to control the production of intermediate goods like public utilities and telecommunications, this is a logical approximation. The average estimate of this ratio for developing economies, as reported in the World Bank's Bureaucrats in Business (BB) report

(1995) was close to 11% during the period 1978-1991. The value of φ that matches this result after accounting for all inefficiencies is 0.15.

With respect to the value of B, our base case choice is inspired by several empirical studies. Using a sample of 79 firms in over 21 developing countries, Boubakri and Cosset (1998) estimate a 14% gain in the sales-efficiency[3] of noncompetitive firms. In a similar study Megginson et al (1994) reported a 3% gain for the same measure. Others like La Porta and Lopez-De-Silanes (1999) report a cost per unit decrease of 34% in the noncompetitive Mexican privatizations. All of these authors report much greater income-efficiency[4] gains for all privatizations, but do not report them for the noncompetitive sector only. We chose a value of $B = 0.8$ as our base case, but analyze a wider range of values in what follows.

A similar approach is taken for the values of b and Ψ. Although some evidence about the investment costs associated with slow, cumbersome or corrupt bureaucracies is available (see for example Guash and Hahn (1998) or Brunetti et al. (1998)), it is difficult to pin down an exact number for b. We then explore values of b between 0.5 and 0.9, which we think cover must cases.

Finally, the parameter Ψ measures the flow of resources from the central government to the state owned enterprises. The actual value of these transfers varies greatly across developing regions of the world. According to the Bureaucrats in Business report (1995) the average flow of resources from the central government to all SOE's as a percentage of

[3]Sales efficiency is defined as Real Sales/Employees

[4]Income-efficiency is defined as Net Income/Employees

GDP averaged 1.4% in Asia, -1.6% in Latin America and 0.7% for Africa. We use a base case value of $\Psi = 1.05$ (resulting in a resource flow of 1.3% of GDP) but use many other values throughout the analysis.

Table 2 shows some facts about the importance and performance of SOEs in Africa, Asia and Latin America as well as the corresponding numbers from the base case simulation of our model for the public monopoly case. The statistics are derived from the World Bank's Bureaucrats in Business (1995) data set, which provides valuable information about the role of SOEs in the economic activity of over 50 developing countries during the years 1978-1991.

Table 2 shows four statistics from this data set. These statistics are the ratio of total SOEs economic product to total GDP (SOE/GDP), the ratio of SOE's investment to total GDP (INV/GDP), the share of SOE's employment to total employment (EMP), the net flow of resources from the central government to all SOEs (FLOW), and total SOE Balance before transfers (BAL)[5].

Table 2. SOEs Performance

	Asia	Latin America	Africa	Base Model
SOE/ GDP	8.3%	9.6%	13.9%	9.9%
INV/GDP	5.8%	3.5%	5.5%	10%
EMP (%)	2.9%	2.6%	20.6%	2.4%
FLOW (% GDP)	1.4%	-1.6%	0.7%	1.3%
BAL (%GDP)	-3.1%	-0.5%	-2.9%	-2.6%

As shown in Table 2, our base case model is able to replicate the average statistics from

[5]BAL is defined as total SOE revenues minus wages, factor rentals, depreciation and net capital expenditures.

the BB data set[6]. According to the data, Asia and Latin America exhibit several similarities, while African countries showed a much higher values for the share of SOE employment and production. Interestingly, Asia and Latin America have also followed very different policies regarding privatization resulting in very different growth patterns. We will return to this issue later in the paper.

The parameters B, b and Ψ may represent some of the most important sources of variation in public policies and we will study the implications of such variation on the effect of privatization programs in the next section.

4 Results

In order to answer our initial questions regarding the role that productive inefficiencies, bureaucratic inefficiencies and SOE's deficits (or surpluses) play in the privatization process, we depart from our base case in different ways. A natural starting point is to determine whether a public monopoly system that suffers from a x-degree level of inefficiency can match the production and welfare levels achieved by the private monopoly system.

Table 3 addresses this issue for many possible values of B. The second column of Table 3 shows the ratio of the total output generated by the public monopoly economy to the one generated by the private monopoly one (Ypub/Ypriv). Similarly, the third column of Table 3 shows the ratio of the steady state consumption levels for the two alternative models (Cpub/Cpriv). We use consumption levels as a measure of welfare.

[6]If the data is restricted to pre-1985 years (before privatization policies became wide spread), the data value for INV/GDP becomes approximately 7%; which is much closer to our base case of 10%.

Table 3. Changes in Productive Efficiency (b=0.7)

B	**Ypub/Ypriv**	**Cpub/Cpriv**
0.1	0.764	0.628
0.2	0.899	0.739
0.3	0.989	0.812
0.4	1.058	0.869
0.5	1.114	0.915
0.6	1.163	0.955
0.7	1.206	0.991
0.8	1.244	1.022
0.9	1.279	1.051
1	1.311	1.077

Ypriv = Total Output in the private monopoly case
Ypub = Total Output in the public monopoly case
Cpub = Consumption under the public monopoly case
Cpriv = Consumption under the private monopoly case

The calculations shown in Table 3 are replicated in Tables 4 and 5 using different levels of bureaucratic inefficiency. In all graphs, the results from the base case scenario are outlined (in tables 4 and 5 the only change from the base case is the change in b).

Table 4. Changes in Productive Efficiency (b=0.5)

B	**Ypub/Ypriv**	**Cpub/Cpriv**
0.1	0.740	0.608
0.2	0.871	0.716
0.3	0.958	0.787
0.4	1.025	0.842
0.5	1.080	0.887
0.6	1.127	0.926
0.7	1.168	0.960
0.8	1.206	0.990
0.9	1.239	1.018
1	1.270	1.043

Table 5. Changes in Productive Efficiency (b=0.9)

B	**Ypub/Ypriv**	**Cpub/Cpriv**
0.1	0.782	0.643
0.2	0.920	0.756
0.3	1.012	0.831
0.4	1.083	0.889
0.5	1.141	0.937
0.6	1.191	0.978
0.7	1.235	1.014
0.8	1.274	1.046
0.9	1.309	1.076
1	1.342	1.103

Starting with Table 3, our results suggest that inefficiencies have a negative and significant impact on both the level of output and the level of welfare generated in the public monopoly economy relative to the private monopoly case. Noticeably, however, our results suggest that the public monopoly economy can generate higher output and welfare levels than the private one even though it exhibits significant productive inefficiencies. This result emerge when the investments levels in the public monopoly exceed those of the private monopoly.

In fact, as shown in tables 3-5, as long as the productive efficiency of public firms remained above 80% ($B > 0.8$), the public monopoly economy generated higher income and welfare levels than the private one. It is only when productive efficiency falls below 70%-80 % that the situation is reversed and the welfare gains from privatization become positive (Cpub/Cpriv < 1).

The bureaucratic efficiency parameter b was assumed to take a lower value in Table 4 (b=0.5) and a higher value in Table 5 (b=0.9). Higher levels of bureaucratic efficiency yielded higher welfare levels in the public monopoly case and, thus, smaller gains from privatization

for all levels of B. Changing the level of bureaucratic efficiency had a similar but less severe impact than the one obtained by changing the productive efficiency parameter; in fact, our results from Table 3 are almost unaltered in Tables 4 and 5.

So far, however, we have assumed a fixed public investment parameter (Ψ). As a result, lower levels of productive efficiency B generate lower levels of output in the public monopoly relative to the private monopoly case. At this point then, a valid question is how would the results obtained so far change if (instead) the public investment parameter (Ψ) was allowed to change and the production level of the public monopoly economy was to match that one of the private monopoly economy.

We address this question in Table 6, where the public investment parameter value (Ψ) is forced to change until the output from the public monopoly economy matches that of the private monopoly one identically. In Table 6, columns (2) and (3) show the amount of public investment that is necessary in order for the public monopoly economy to match the total output generated by the private monopoly system. Column (2) shows this amount as a percentage of public monopoly profits and Column (3) as a percentage of total government revenues. Finally, Column (4) shows the ratio of the steady state consumption levels (public to private) achieved under these circumstances.

Table 6. Public Matches Private (b=0.7)

(1)	(2)	(3)	(4)
B	Ψ	Pinv/GR	Cpub/Cpriv
0.2	.	.	.
0.3	1.2055	0.5322	0.7973
0.4	0.5873	0.2593	0.8983
0.5	0.3362	0.1484	0.9394
0.6	0.2131	0.0941	0.9595
0.7	0.1450	0.0640	0.9706
0.8	0.1038	0.0458	0.9773
0.9	0.0773	0.0341	0.9817
1	0.0594	0.0262	0.9846

Pinv =Public Investment **GR** =Government Revenue

Two conclusions are taken from Table 6. First, that even when both private and public systems yield the same level of total output, the private monopoly generates higher welfare levels. This is the result of the assumed inefficiencies in the public sector and the smaller disposable income the agents have under the public system. Thus, if the public monopoly case is to yield higher welfare levels than the private monopoly case, it must generate higher output levels as well.

Second, the steady state income level for the public monopoly matches the private monopoly one without much burden on public revenues even at considerable levels of bureaucratic and productive inefficiency. Using a value of $B = 0.4$ (a low value by all empirical measures), for example, the necessary amount of public investment does not surpass 26% of total government revenues. For values of $B < 0.3$, however, it is not possible for the public monopoly to match the private monopoly's performance. Using our more realistic base-case value for $B = 0.8$, the amount of resources needed to match the performance of the private monopoly is surprisingly low: approximately 5% of government revenues.

Furthermore, the match in output is achieved without any pressure on the SOE's budget; in fact, only at levels of $B < 0.4$ is it necessary for the SOE to finance its investment with deficits. As a result, one is tempted to think that the effects of productive inefficiencies could be easily overcomed with additional public investment and that higher levels of public investment would be associated with lower gains from privatizations. As we show next, this is not always the case.

Table 7 goes back to the base case paramenters and explores the impact of changing the amount of public investment above and below the SOE's balanced budget level of investment. As shown in Table 7, although increasing public investment always increases output, such an increase in output ultimately comes at the expense of lower transfers and lower consumption levels.

Table 7. The Effects of Public Investments (b=0.7, B=0.8)

Ψ	**Ypub/Ypriv**	**Cpub/Cpriv**	**Pinv/GR**
0.1	0.9980	0.9745	0.0441
0.2	1.0650	1.0226	0.0883
0.4	1.1365	1.0541	0.1766
0.6	1.1806	1.0565	0.2649
0.8	1.2128	1.0458	0.3532
1	1.2385	1.0275	0.4415
1.2	1.2598	1.0041	0.5298
1.4	1.2782	0.9770	0.6180
1.6	1.2943	0.9471	0.7063
1.8	1.3086	0.9149	0.7946

The results from Table 7 also suggest that the gains of privatization processes of intermediate monopolies are strongly related to the balance sheet of the public firm in question. In Table 7, deficits in the intermediate public monopoly firm equal to or greater than 20%

of their profits (levels of $\Psi \geq 1.2$) always generate welfare levels below the ones generated by a private intermediate monopoly. In other words, privatizations of deficitary SOEs are associated with welfare gains.

In contrast, privatizations of SOEs that generate surpluses yield welfare losses under most scenarios considered in this paper. As long as the level of public investment is enough to surpass the output level of an alternative private firm, public monopolies with surpluses yield higher consumption levels than private monopolies. In Table 7, this difference is maximized for $\Psi = 0.6$.

The results from Table 7 were recalculated for a case of lower efficiency in Table 8 and for a case of higher efficiency in Table 9. As shown in these tables, for low enough efficiency levels the private monopoly case generates higher welfare levels than the public monopoly case regardless of the level of public investment. In contrast, for high enough efficiency levels it is the public monopoly that generates the higher welfare for most cases.

Table 8. The Effects of Public Investments (b=0.5, B=0.7)

Ψ	**Ypub/Ypriv**	**Cpub/Cpriv**	**Pinv/GR**
0.1	0.937	0.915	0.044
0.2	1.000	0.960	0.088
0.4	1.067	0.989	0.176
0.6	1.108	0.992	0.264
0.8	1.138	0.982	0.353
1	1.163	0.964	0.441
1.2	1.183	0.942	0.529
1.4	1.200	0.917	0.618
1.6	1.215	0.889	0.706
1.8	1.228	0.859	0.794

Table 9. The Effects of Public Investments (b=0.9, B=0.9)

Ψ	**Ypub/Ypriv**	**Cpub/Cpriv**	**Pinv/GR**
0.1	1.050	1.025	0.044
0.2	1.120	1.076	0.088
0.4	1.196	1.109	0.176
0.6	1.245	1.111	0.264
0.8	1.276	1.100	0.353
1	1.303	1.081	0.441
1.2	1.325	1.056	0.529
1.4	1.345	1.028	0.618
1.6	1.362	0.996	0.706
1.8	1.377	0.962	0.794

Noticeable, in all Tables 7-9 the effect of deficits in the intermediate public monopoly on the aggregate wealfare gains from privatization is consistently negative. Higher deficits are associated with higher gains from privatizations for all cases. Even in those cases where the privatization of SOEs was found to generate a welfare loss, the losses become smaller as the deficit becomes larger.

Going back to Table 2, we are able to relate this conclusion to the different regions of the world. According to the data presented in Table 2, the average Latin American country is the most likely to have non-deficitary SOEs (they are the only region with a negative average for FLOW); whereas the average Asian country is the least likely. Thus, for a common level of productive and bureaucratic efficiencies, our results would suggest that Latin American countries would benefit less from privatizations than Asian countries would. This conclusion is subject to the caveat that the efficiency levels of public Latin American firms could be very different from the respective levels of Asian public firms.

In general, as mentioned in the preceeding sections, the available evidence does not show

an indication for severe SOEs deficits for any developing region and points only to medium or low levels of public inefficiencies. In such a scenario of low inefficiency and low deficits, the results of our model would predict small (if any) gains from privatization whenever privatization is not followed by increased competition.

5 Conclusions

In this paper we have addressed the issue of how x-inefficiency and bureaucratic inefficiency influence the welfare implications of the privatization of intermediate goods industries. We have focused on steady state analysis. Issues that might be interesting to pursue in the future are:

(i) The desirability of any fiscal policy reform depends crucially on what is going on along the entire transition and not only in the steady state. In order to study the welfare consequences of large scale privatizations it will thus be useful to study the transitional dynamics of privatization.

(ii) In this paper the output of the industry to be privatized was only an intermediate good in the production of the final consumption good. Most examples mentioned in this paper such as electricity and phone service also serve as final consumption goods. We leave this generalization to future work.

(iii) The role of the government in this paper has been very simple in that the government only has two functions, to run the SOEs and to carry out transfers programs. In this model the cost of using tax revenue to prop up inefficient public sector enterprises

might be relatively small, since the cost of propping up these enterprises is only lost transfer payments. The cost of running public sector enterprises with a tax financed deficit might be substantially higher if financing these deficits comes at the expense of productive government expenditures such as infrastructure investments.

(iv) Finally, governments typically have different wage compensation schemes than the private sector. Large scale privatization then might have substantial distributional consequences.

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