An Empirical Measurement Model of the Reaction of Output into the Private Sector

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Abstract

This paper attempts to consider the reaction of output to privatization. The public sector produces goods of lower quality, and at lower prices, than the private sector. By driving a quality and price wedge between private and public output, an excessive public sector distorts production and reduces its overall quality. The elimination of this distortion increases both the level of output and its rate of growth over time.
The main message of the paper is that privatization, by reducing or removing distortions caused by excessive subsidies and taxes and by thus increasing the overall quality of output, can play an important role in encouraging the reallocation of resources and the reorganization of production that are necessary to foster a favorable development of output and employment after the initial post-reform slump. In particular, privatization not only helps raise the level of output per head, but also its rate of growth over time. In this respect, the quality and price distortion resulting from an excessive public sector, is no different from the distortions that result from price controls or trade restrictions or from high inflation. The same general framework fits all three phenomena - liberalization, stabilization and privatization.

Keywords: privatization, efficiency, economic growth, stabilization, reallocation

JEL Classification: O40, P11

1. Introduction

This paper attempts to extend the above story to consider the reaction of output to privatization. The public sector produces goods of lower quality, and at lower prices, than the private sector. By driving a quality and price wedge between private and public output, an excessive public sector distorts production and reduces its overall quality. The elimination of this distortion increases both the level of output and its rate/of growth over time.

Specifically, the aim of the paper is

(a) to show how the intersectoral reallocation of resources resulting from privatization ultimately increases total output at full employment by increasing economic efficiency as if a relative price distortion were being removed through either liberalization or stabilization, even though output may fall in the short run;

(b) to develop a simple formula in which the potential static output gain from reallocation through privatization is proportional to the square of the original quality and price distortion that has channelled too much of the country's resources into the public sector;

(c) to extend the formula by adding the output gain from reorganization *(viz.,* increased X-efficiency) to the output gain from intersectoral reallocation following privatization;

(d) to consider also the potential dynamic output gain, or growth bonus, from privatization when economic growth is endogenous in the presence of constant returns to capital in a broad sense; and

(e) to provide a rough quantitative assessment of the potential static and dynamic output gains from privatization by numerical simulations of conceivable scenarios.

The analysis to follow is not confined to the path of output from plan to market in Central and Eastern Europe, where privatization has been only one of several factors (including, not least, the legacy from the past) influencing the behavior of output. On the contrary, the analysis is intended to be general and thus applicable to the relationship between the size of the public sector and economic growth in other parts of the world.

The main point of the paper is that privatization, by reducing or removing distortions caused by excessive subsidies and taxes and by thus increasing the overall quality of output, can play an important role in encouraging the reallocation of resources and the reorganization of production that are necessary to foster a favorable development of output and employment after the initial post-reform slump. In particular, privatization not only helps raise the level of output per head, but also its rate of growth over time. In this respect, the quality and price distortion resulting from an excessive public sector is no different from the distortions that result from price controls or trade restrictions or from high inflation. The same general framework fits all three phenomena—liberalization, stabilization, and privatization.

2. A static approach to the role of privatization and output

Output Y is produced in two ways, in the private sector (Y_{priv}) and in the public sector (Y_{pub}). Private and public output are one and the same good, but they differ in quality (see Blanchard, 1997).

Private output is superior to and, therefore, commands a higher price than public output:

$$P_{priv} = (1+p)P_{pub} \tag{1}$$

where q>0 represents the quality and price differential. This may stem, for example, from subsidies (at rate *s)* to public production and taxes (at rate *t*) on private production, so that, for consumers and producers to be willing to buy and sell both private and public output, we must have

$$(1-t)P_{priv} = (1+s)P_{pub} \tag{2}$$

Equations (1) and (2) imply that

$$1+q=\frac{1+s}{1-t} \qquad (3)$$

where *q* is simply a composite measure of the subsidies to public production and taxes on private production, which tend to direct resources from the private sector to the public sector, thereby reducing the overall quality of output. Privatization involves a reduction in the quality and price differential *q*, through less subsidies to public production or less taxes on private production or both. By full privatization is meant the transfer of (almost) all public enterprises to the private sector; this brings *q* down to zero by reducing both *s* and *t* to zero. The production frontier is quadratic:

$$Y_{pub}=a-\frac{1}{2b}Y_{priv}^2 \qquad (4)$$

where *a* and *b* are positive parameters. The frontier is described by the curve CEFD in Figure 2, where *OC=a* and *OD=*$\sqrt{2ba}$. Later on, an increase in private-sector productivity will be represented by an increase in *b,* which moves the intercept *D* of the production frontier and the horizontal axis to the right.

Total net output (i.e., national income) at constant prices, *Y'*, is the sum of private and public output adjusted for taxes and subsidies:

$$Y'=(1-t)Y_{priv}+(1+s)Y_{pub} \qquad (5)$$

A balanced budget would require subsidies to be financed by taxes, i.e., $sY_{pub}=tY_{priv}$, in which case $Y'=Y_{priv}+Y_{pub}$.

If total output is expressed in terms of public output, with $Y=Y'(1+s)$, then it follows from equation (5) that

$$Y=\left(\frac{1}{1+q}\right)Y_{priv}+Y_{pub} \qquad (6)$$

where 1/(1+q) represents the net (i.e., after tax and subsidy) price ratio between private and public output. Equation (6) depicts the price line tangential to the production frontier at point *E* in Figure 2.

Figure 2 describes the optimal allocation of all available labor and capital between the two sectors. At point *E* in the figure, the marginal rate of transformation equals the net price ratio:

$$\frac{dY_{pub}}{dY_{priv}}=-\left(\frac{1}{b}\right)Y_{priv}=-\left(\frac{1}{1+q}\right) \qquad (7)$$

so that, at *E*, we have

$$Y_{priv}=\frac{b}{1+q} \qquad (8)$$

This amount of Y_{priv} is shown by the distance OG in the figure. Hence, a decrease in subsidies or taxes, and thereby also in the quality and price differential *q,* increases private production. 'Full' privatization makes *q*=0, bringing the economy from E to F, where $Y_{priv}=b$. This amount of Y_{priv} is shown as *OH* in the figure.

The change in Y_{priv} from *E* to *F* following full privatization (i.e., the distance *GH* in the figure) is therefore

$$\Delta Y_{priv} = b - \frac{b}{1+q} = \frac{bq}{1+q} \quad (9)$$

The proportional increase in private output is simply

$$\frac{\Delta Y_{priv}}{Y_{priv}} = q \quad (10)$$

Thus, the greater the initial quality and price differential between private and public output, the greater is the proportional increase in private production necessary to eradicate the differential through privatization.

The corresponding decrease in public output following privatization is found by a second-order Taylor expansion around point F in Figure 2:

$$\Delta Y_{pub} = f'(\Delta Y_{priv}) - \frac{1}{2} f''(\Delta Y_{priv})^2 = -\left(\frac{1}{b}\right) b\left(\frac{bq}{1+q}\right) - \frac{1}{2}\left(-\frac{1}{b}\right)\left(\frac{bq}{1+q}\right)^2 \quad (11)$$

where *f* is the quadratic function (4) and *f′* and *f′′* are its first and second derivatives.

By adding equations (9) and (11), the change in total output resulting from privatization can be shown to equal

$$\Delta Y = \frac{b}{2}\left(\frac{q}{1+q}\right)^2 \quad (12)$$

The direct, static output gain from privatization at full employment is thus proportional to the square of the initial quality and price distortion.

Equation (12) can also be derived as follows. Before privatization, when the economy is in equilibrium at point E in Figure 2, total output can be measured in units of private output by the distance *OA = OG + GA = OG + GE*, because the slope of the line *EA* is -1. This gives

$$Y_E = \frac{b}{1+q} + a - \frac{1}{2b}\left(\frac{b}{1+q}\right)^2 \quad (13)$$

After full privatization, when the economy has reached equilibrium at point F in the figure, where *q* has dropped to zero, total output is *OB = OH + HB = OH + HF*. This gives

$$Y_F = b + a - \frac{1}{2b} b^2 \quad (14)$$

Subtracting equation (13) from equation (14) and simplifying we again get equation (12). The increase in total output from E to F is the distance *AB* in the figure.

At the margin, at point E, the effect on total output of an increase in *q* can be found by differentiating Y_E with respect to *q* in equation (13):

$$\frac{dY}{dq} = -\frac{bq}{(1+q)^3} < 0 \quad (15)$$

Therefore, the elasticity of *Y* with respect to *q*, evaluated at the initial values of *Y* and Y_{priv}, is

$$\frac{dY}{dq}\frac{q}{Y} = -\frac{bq^2}{(1+q)^3 Y} = -\left(\frac{Y_{priv}}{Y}\right)\left(\frac{q}{1+q}\right)^2 \quad (16)$$

The initial share of public output in total output can be found from equations (4), (6), and (8):

$$\frac{Y_{pub}}{Y} = \frac{2a(1+q)^2 - b}{2a(1+q)^2 + b} \le 1 \qquad (17)$$

The share of the public sector varies directly with *q* and tends to 1 as *q* tends to infinity, but it does not vanish when *q*=0, as long as *a>b/2.*

By dividing through equation (12) by total post-privatization output *Y,* we can express the proportional rate of change of total output from E to F in Figure 2 as follows:

$$\frac{g}{1+g} = \frac{1}{2}\left(\frac{Y_{priv}}{Y}\right)\left(\frac{q}{1+q}\right)^2 \qquad (18)$$

where *g* is the proportional change in output (with initial output as a base, i.e., *AB/OA* in the figure) and Y_{priv}/Y is the preprivatization share of the private sector in total output; see equation (17). The change in output varies directly with (i) the scale of the privatization (the larger the chunk of public production that is transferred to the private sector, the greater will be the resulting increase in output) and (ii) the magnitude of the initial quality and price distortion *q* (the greater the distortion, the greater will be the gain from removing it).

3. Reallocation *versus* reorganization

The efficiency gains discussed thus far arise solely from the reallocation of resources from the public sector to the private sector. There is reason to expect, however, that privatization also encourages reorganization within the private sector and thus increases its productivity in addition to the gains from intersectoral reallocation. To deal with this possibility, let us now extend the model by assuming that private-sector productivity increases in proportion to the initial quality and price differential, according to[1]

$$\frac{\Delta b}{b} = kq \qquad (19)$$

where it is a positive constant. When productivity growth is added to the model, the production frontier moves to the right from *OCD* to *OCM* as shown in Figure 3. A new equilibrium is reached at point *K.* The reallocation gain is shown as before by the distance *AB* in Figure 2, and the reorganization gain is shown as *BQ* in Figure 3.

Let us now proceed and develop the expression for the latter gain, from reorganization.

The production frontier in equation (4) needs to be changed to

$$Y_{pub} = a\frac{1}{2b(1+kq)}Y_{priv}^2 \qquad (20)$$

to reflect the outward shift shown in Figure 3, where $OM = \sqrt{2ab(1+kq)}$, and $OD = \sqrt{2ba}$ and *OC = a* as before. In view of equation (19), the coefficient *b* in equation (4) has been replaced by *b(1 + kq)* in equation (20) to reflect the assumed increase in private-sector productivity.

We proceed in two steps. First, let us find the increase in private output. At point *K* in the figure, where $dY_{pub}/dY_{priv} = -1$, we see from equation (20) that $Y_{priv} = b(1+kq)$. Comparing this with $Y_{priv} = b$ at point *F,* we see that the increase in private output from F to *K* is

[1] For a different way of introducing increased X-efficiency into a static model of intersectoral resource allocation, see Gylfason (1995).

$$\Delta Y_{priv} = b(1+kq) - b = bkq \qquad (21)$$

This increase is shown by the distance *HL* in Figure 3. The proportional increase in Y_{priv} is *kq.*

The corresponding decrease in public output is found by plugging these equilibrium values of Y_{priv} at *F* and *K* in Figure 3 back into equation (20). Geometrically, we see from the figure that the additional decrease in Y_{pub} amounts to *HF-LK in* the figure, which is equal to *HB - LQ,* because the slope of the lines *FB* and *KQ* is -1. We find *HF* by substituting $Y_{priv} = b$ at F into equation (4) to get $Y_{pub} = a - b/2$. Therefore, at post-reform prices (i.e., with *q = 0),* $Y = Y_{priv} + Y_{pub} = a + b/2$, as in equation (14). To find *LK,* we substitute $Y_{priv} = b(1+kq)$ at *K* into equation (20) to findy $Y_{pub} = a - b(1+kq)/2$. Adding Y_{priv} and Y_{pub} at *K,* we obtain

$$Y_K = a + \frac{b(1+kq)}{2} \qquad (22)$$

The change in public output from F to *K* is given by

$$\Delta Y_{pub} = \left(a - \frac{b(1+kq)}{2}\right) - \left(a - \frac{b}{2}\right) = -\frac{bkq}{2} \qquad (23)$$

Adding equations (21) and (23) shows that total output has increased by *bkq - bkq 12 = bkq/2.* Equivalently, the increase in output from F to *K* can be measured directly as

$$\Delta Y = \left(a + \frac{b(1+kq)}{2}\right) - \left(a + \frac{b}{2}\right) = \frac{bkq}{2} \qquad (24)$$

This expression represents the gain from reorganization. Adding this to the gain from reallocation shown in equation (12), we get the following result for the total output gain from privatization:

$$\Delta Y = \frac{b}{2}\left[\left(\frac{1}{1+q}\right)^2 + kq\right] \qquad (25)$$

Equation (25) simplifies to equation (12) when the gains from reorganization are left out *(k* = 0).

Equations (8), (9), and (21) imply that the proportional increase in private output from E to K is

$$\frac{\Delta Y_{priv}}{Y_{priv}} = \frac{bq\left(\frac{1}{1+q} + k\right)}{\frac{b}{1+q}} = q\left[1 + k(1+q)\right] \qquad (26)$$

Thus, the greater (i) the initial quality and price differential between private and public output and (ii) the stimulus to productivity in the private sector, the greater is the proportional increase in private production necessary to eradicate the distortion through privatization. Equation (26) simplifies to equation (10) when productivity does not respond to privatization (*k* = 0).

The share of public-sector output in total output at the final equilibrium point *K* in Figure 3 is

$$\frac{Y_{pub}}{Y} = \frac{2a - b(1+kq)}{2a + b(1+kq)} \leq 1 \qquad (27)$$

The corresponding share of private output in total output at *K* is

$$\frac{Y_{priv}}{Y} = \frac{2b(1+kq)}{2a + b(1+kq)} \qquad (28)$$

The sum of the two shares in equations (27) and (28) is 1.

At last, the proportional increase *g* in total output from E to J? is found by dividing through equation (25) by total output at *K* and using equation (28):

$$\frac{g}{1+g} = \frac{1}{2}\left(\frac{Y_{priv}}{Y}\right)\left[\left(\frac{q}{1+q}\right)^2 + kq\right]\left(\frac{1}{1+kq}\right) \qquad (29)$$

The ultimate output gain from privatization, from E to F in Figure 2 or from E to *K* in Figure 3, may be preceded by an economic downturn and increased unemployment. Privatization involves the restructuring or closure of bankrupt enterprises, and the reallocation of labor and capital released in the process to new firms in other industries or locations may take time. In particular, the decrease in incomes in the public sector may reduce purchases from the private sector, so that both sectors decline in the early stages of reform. Therefore, output may follow a path such as Eί/F in Figure 2. At *I*, private output is restored to its pre-reform level, and at *J*, national income is restored to its pre-reform level, before it settles at *F*.

4.Empirical findings

The model outlined above enables us to quantify the output gains from privatization. For example, equation (18) enables us to assess the output gain from reallocation on the basis of just two parameters: (i) the post-reform share of the private sector in total output Y_{priv}/Y from equation (17) and (ii) the pre-reform quality and price differential *q* from equations (1) to (3). If, for instance, the share of the private sector in total output is increased to 8/9 and if *q* = 1, then *g* = 0.125 by equation (18).

Consider now a somewhat more elaborate numerical example to get a better feel for the model. Set *s = 05* and f = 0.25; then *q=1* as before. Further, set *a* = 125 and *b* = 200 in equation (4). Then, initially, $Y^E_{priv} = 100$ by equation (8) and $Y^E_{pub} = 100$ by equation (4). Therefore, total output at the initial equilibrium point E in Figures 2 and 3 is Y_E = 100+100 = 200, assessed at the post-reform price ratio (which is 1 when *q = 0).*[2] Suppose, to start with, that *k = 0.* Privatization then increases Y_{priv} by 100 by equation (9) and decreases Y_{pub} by 75 by equation (11), so that total output *Y* increases by 25 (= 100 - 75), or by 12.5 percent, from *E* to F in the figures. This is consistent with Y_E = 200 and Y_F = 225 from equations (13) and (14). The share of the private sector in total output has increased to 8/9 (= 200/225), as confirmed by equation (17) when *q* = 0. Substituting this value of Y_{priv}/Y into equation (18) further confirms that total output has increased by 12.5 percent. This is the reallocation effect of privatization.

[2] By equation (6), however, *Y = 05*-100+ 100 = 150, evaluated at the pre-reform price ratio (which is **Vi** when *q = 1).* The initial share of the public sector in total output is thus 2/3 (= 100/150), see also equation (17).

Now consider also the reorganization effect and set *k = 02.* Privatization now increases Y_{priv} by 100 from *E* to F as before and further by 40 by equation (21) and becomes 240 (= 100 + 100 + 40), which is an increase by 140 percent *in toto*, see equation (26). As before, Y_{pub} decreases by 75 from E to F by equation (11) and further by 20 by equation (23) and becomes 5 (= 100 - 75 - 20). Total output Y increases as a result by 45 (= 140 - 95), or by 22.5 percent, as is confirmed by comparing Y_K = 245 from equation (22) with Y_E = 200 from equation (13). The same result obtains by computing *g* = 0.225 from equation (29), using the result that privatization reduces the share of the public sector in total output from 2/3 to 1/49 by equations (17) and (27). Full privatization, resulting in *q = 0,* thus does not result in the eradication of public production in this case.

In order to get a fuller picture of the possible macroeconomic and empirical significance of increased efficiency in the allocation of resources through privatization, let us now experiment with plausible parameter values in equation (29). This is clearly a highly speculative exercise in consideration of the simplicity of the formula and the unavailability of reliable evidence about the explanatory parameters.

Let us assume the price of public output initially to be out of line with the price of private output by a factor of 2, 3, 4, or 5, so that q takes the values 1, 2, 3, and 4, see equation (1). Further, assume the share of the private sector in total output following privatization to range from 0.5 to 0.9. For comparison, the average share of state-owned enterprises in economic activity in 8 industrial countries and 40 developing countries in 1988 was 6 percent and 11 percent, respectively (see World Bank 1995). At last, set *k* equal to 0 in Panel A and 0.2 in Panel B. The proportional output gains that follow from these assumptions are shown in Table 1.

Table 1. Static Output Gains From Privatization

Panel A. Gains from reallocation

k = 0	Y_{priv} = 0.5	Y_{priv}/Y = 0.7	Y_{priv}/Y = 0.9
q = 1	g = 0.07	g = 0.10	g = 0.13
q = 2	g = 0.13	g = 0.19	g = 0.25
q = 3	g = 0.16	g = 0.25	g = 0.34
q = 4	g = 0.19	g = 0.29	g = 0.40

Panel B. Gains from reallocation and reorganization

k = 0.2	Y_{priv}/Y= 0.5	Y_{priv}/Y = 0.7	Yp_{riv}/Y = 0.9
q=1	g = 0.10	g = 0.15	g = 0.20
q = 2	g = 0.18	g = 0.27	g = 0.37
q = 3	g = 0.22	g = 0.34	g = 0.49
q = 4	g = 0.25	g = 0.39	g = 0.56

Source: Author's computations based on equation (29).

Subject to the underlying assumptions made about the parameters of the model, the numbers in Table 1 imply that the proportional static output gains from privatization can range from 7 percent to 56 percent once and for all. These gains are permanent, *ceteris paribus.* A greater reaction of private-sector productivity to privatization would result in still higher numbers in Panel B.

Given a discount rate of 5 percent per year, the present value of these gains amounts to 1.4 to 11.2 times annual national income once and for all. For comparison, the smallest figure in the table (*g* = 0.07) exceeds the rough estimates of the permanent static output gains expected to emerge gradually from the market unification of Europe in 1992 according to Cecchini (1988).

If these numbers are at all indicative of the results that would emerge from detailed empirical case studies, it seems reasonable to conclude that failing to privatize may be expensive indeed, provided that the initial slump in output is not too deep and long-lasting.

5. The Growth through efficiency

How do the static output gains from privatization reported in the preceding section influence economic growth over time?

According to the neoclassical growth model, the effects of increased static efficiency on growth can only be temporary. They may be large and they may last long, even for decades, but eventually they will peter out, because growth is ultimately an exogenous variable in the neoclassical model.

Here, instead, we adopt the simplest possible learning-by-doing version of the theory of endogenous growth (see, e.g., Romer 1986 and 1989). Suppose output is produced by labor L and capital K through to a Cobb-Douglas production function

$$Y = AL^{a}K^{1-a} \qquad (30)$$

Let the accumulated technological know-how represented by A be tied to the capital/labor ratio by

$$A = E(K/L)^{a} \qquad (31)$$

where E is a constant. This is what is meant by learning-by-doing: by using capital, workers learn how to use it more efficiently. Then

$$Y=EK \quad (32)$$

where E reflects efficiency. Output Y depends solely on the capital stock K and the efficiency E with which it is used in production. Output depends, in other words, on the quantity and quality of capital. Because E is a constant, output and capital must grow at the same rate, g.

Suppose now that saving S is proportional to output and equals gross investment, that is, $I=\Delta K+\delta K$, where δ is the depreciation rate. Then

$$S = sY = I = \Delta \mathrm{K} + \delta \mathrm{K} = \frac{\Delta \mathrm{Y}}{\mathrm{E}} + \frac{\delta \mathrm{Y}}{\mathrm{E}} \qquad (33)$$

for given E, so that

$$g = sE-\delta \quad (34)$$

The rate of economic growth, in words, equals the multiple of the saving rate s and the efficiency of capital use E less the depreciation rate δ. This is simply a restatement of the Harrod-Domar model of growth, with the addition, due to Romer (1986), that output growth here is not constrained by population growth.[3] Profit maximization requires that the marginal product of capital be equal to the gross rate of interest, $r + \delta$:

$$\frac{dY}{dK} = (1-a)\frac{Y}{K} = (1-a)E = r + \delta \qquad (35)$$

In a closed economy, r can be viewed as an endogenous variable and E as an exogenous variable: $r = (1-\alpha)E-\delta$ by equation (35). If, for example, the capital share $1-\alpha=1/3$, $E=03$, and $\delta = 0.06$, then $r = 0.04$. If the Golden Rule holds, then $s=1-a$ and, hence, $g=r$ by equations (34) and (35). Therefore, an exogenous increase in E —for example, through privatization— will raise both r and g. In a small open economy, the roles of E and r are reversed: r, the domestic interest rate, then mirrors the foreign interest rate, which is exogenous from the home country's point of view, and E becomes endogenous.

Generally, E reflects the efficiency of resource allocation and organization in the economy. Therefore, all improvements in efficiency—due, for instance, to privatization, price reform, trade liberalization, and

[3] See also Grossman and Helpman (1991).

education—result not only in a permanently higher level of output by equation (25), but also a permanently higher rate of growth of output by equation (34).[4] Therefore, the economy follows the sickle-shaped path *EIJFKT* rather than *EIJFKV* in Figure 4, where the labelling of the vertical axis conforms to Figures 2 and 3. The shaded area *KTV* represents the dynamic output gain from economic reform.

How large is this potential growth bonus? Consider, as an example, an economy where saving is 20 percent of output (s=0.2), depreciation is 6 percent of the capital stock (δ=0.06), and the efficiency parameter E is 0.3 initially, which implies a capital/output ratio of 3.3. Then, by equation (34), the growth rate g is zero as shown in Table 2. If the efficiency of capital use increases by 20 percent in the sense that output rises by that much for a given capital stock, see Table 1, then E becomes 0.36 and the rate of growth rises from zero to 1.2 percent per year. This increase in growth is permanent by the construction of the production function (32).

Specifically, the mechanisms that prevent more efficiency and more saving from stimulating growth permanently in the Harrod-Domar model and in the neoclassical model are absent here, because the production function (32) exhibits constant returns to capital. In the neoclassical model, increased static efficiency through privatization is equivalent to a technological innovation that raises the rate of growth of output only as long as it takes the economy to move from one steady-state growth path to another, higher path. However, this adjustment process may take a long time. The medium-term properties of the neoclassical model may, therefore, be difficult to distinguish empirically from the long-run properties of the endogenous-growth model employed here.

Table 2. Dynamic Output Gains From Privatization

δ = 0.06	E = 0.30	E = 0.36	E = 0.45
s = 0.10	g = -0.03	g =-0.024	g = -0.015
s = 0.20	g = 0	g = 0.012	g = 0.03
s = 0.30	g = 0.03	g = 0.048	g = 0.075
s = 0.40	g = 0.06	g = 0.084	g = 0.12

Source: Author's computations based on equation (34).

At an annual rate of growth of 3 percent, output per head will double every 24 years, *ceteris paribus.* Given E = 0.3, each 10 point increase in the saving rate would increase growth by 3 percentage points. A simultaneous 10 point increase in the saving rate (say, from 0.20 to 0.30) and a 20 percent increase in efficiency would raise the growth rate from nothing to 4.8 percent per year, and would double output per head in less than 15 years, and so on.

What if there is no learning-by-doing? Then we are back in the neoclassical world, where economic growth is exogenous. If the production function is rewritten in *per capita* terms: $y = Ak^{1-\alpha}$, where $y = Y/L$ and $k = KIL$, then equation (35) becomes $dy / dk = (1-a)Ak^{-\alpha}$ =r+d. Solving this equation for k, substituting the result into the production function, and applying the Golden Rule, we obtain the following approximation to per *capita* output:[5]

$$Y = A^{\frac{1}{a}} s^{\frac{1-a}{a}} (r+\delta)^{-\left(\frac{1-a}{a}\right)} \qquad (36)$$

whereby the long-run steady-state level of *per capita* output varies directly with technology (i.e., efficiency) and the saving rate and

[4] See Easterly (1993) for a model of the linkages between production distortions and endogenous growth.

[5] The approximation involved is harmless. An exact formulation requires replacing the exponents $1/a$ and $(1-a)/a$ in equation (36) by $1/(1-s)$ and $s/(1-s)$ in full compliance with the Golden Rule. The Golden Rule is equivalent to the Ramsey Rule when the intertemporal elasticity of substitution is 1 and the discount rate is 0.

inversely with the rates of interest and depreciation. In this case, if there is no dynamic growth in A, meaning that privatization produces only static gains in efficiency, as in Section II, there will be no growth in y either (Y grows at the same rate as L, the population).

Even so, static efficiency gains can exert a strong influence on steady-state *per capita* output in the long run. Suppose, for instance, that *a = 213.* Then, by equation (36), a 20 percent increase in efficiency will raise *per capita* output by 30 percent, and a 50 percent increase in *A* will raise *y* by 75 percent, *ceteris paribus.* Observed differences in *per capita* output across countries do not seem to exceed the possibilities suggested by equation (36). If we set *r* = 0 for simplicity and a = 2/3 as above, the ratio of a rich country's *per capita GNP,* y_R, to that of a poor country, y_P, is approximately

$$\frac{Y_R}{y_P} = \left(\frac{A_R}{A_p}\right)^{\frac{2}{3}} \left(\frac{S_R}{S_P}\right)^{\frac{1}{2}} \left(\frac{\delta_P}{\delta_R}\right)^{\frac{1}{2}} \qquad (37)$$

Thus, if the rich country saves twice as much as the poor country and depreciates its capital stock at only half the latter's pace (because of the former's more profitable investment in the past), then a tenfold difference in income means a threefold difference in efficiency.[6] On the same assumptions about s and *δ*, an income ratio of y_R *I* y_P = 20 implies A_R IA_P = 4.7.

To take a concrete case, consider Korea and Uganda, whose purchasing-power-parity-adjusted *per capita* GNP in 1993 was USD 10,540 and USD 940. Their saving (or rather investment) rates were 38 percent and 14 percent. Then, even if their depreciation rates were the same, the income ratio of 11.2 between the two countries implies an efficiency differential of 3.6. It seems safe to conclude that differences between efficiency, saving and investment rates, and depreciation across countries can go a long way towards explaining why their living standards—and, by implication, their growth rates on their way to their steady states—differ.

6. Concluding Remarks

In this paper an attempt has been made to clarify the effects of privatization on the level of national income and its rate of growth over time. The static output gain from privatization was modelled as involving the elimination of a quality and price differential between private and public output. Within the framework of a two-sector full-employment general-equilibrium model, the efficiency gain from eliminating the quality and price distortion involved was captured in a simple formula in which the gain is related to the square of the original distortion. Substitution of plausible parameter values into the formula suggests that the total output gain from privatization may be substantial. Because of the efficiency boost that results from the intersectoral reallocation of resources and from reorganization, economic growth increases permanently according to the new theory of endogenous growth, or at least for a time according to the neoclassical growth model. The dynamic output gain is also likely to be large.

[6] The result is about the same if the exponents in equation (37) are changed in accordance with the Golden Rule; see the preceding footnote. The result is also about the same if the interest rate is set at, say, 4 percent rather than 0.

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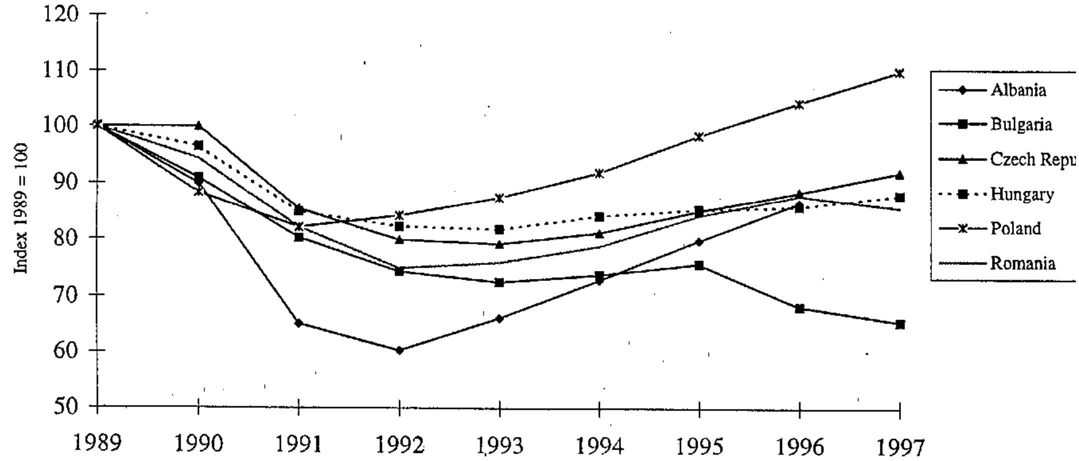
Figure 1. Central and Eastern Europe:
The Path of Output 1989-1997



Note: 1996 estimate and 1997 projection. There are no 1997 data available for Albania.
Source: European Bank for Reconstruction and Development, Transition Report Update, April 1997.

Figure 2. Reallocation Gains from Privatization

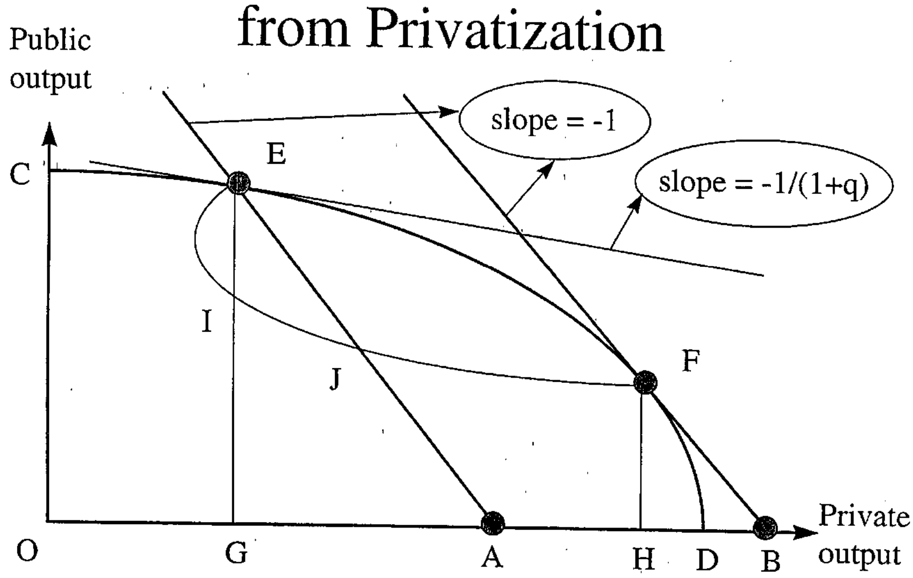


Figure 3. Reorganization Gains from Privatization

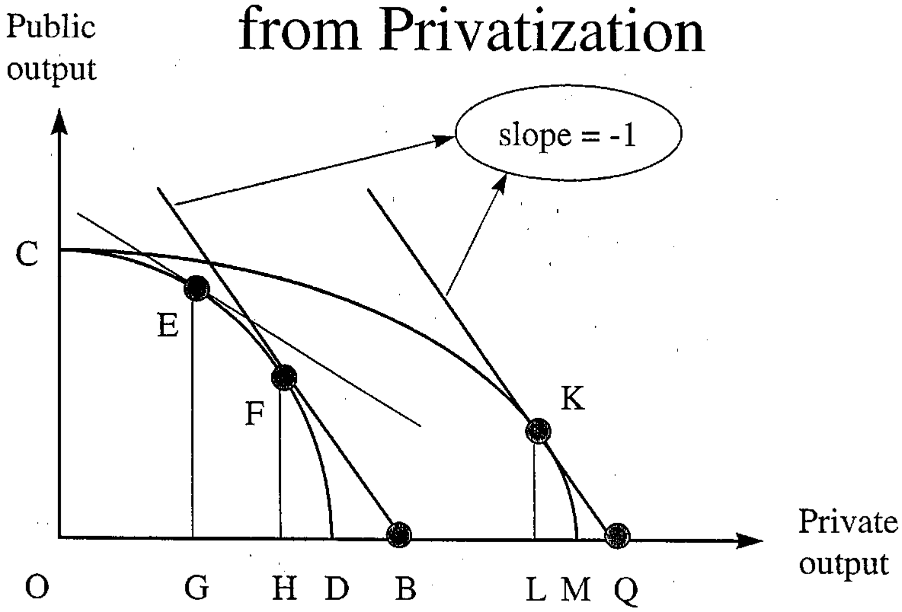


Figure 4. The Path of Output Following Privatization