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Ownership and Growth

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This article suggests how state enterprises can be incorporated into the theoretical and empirical growth literature. Specifically, it shows that if state enterprises are less efficient than private firms, invest less, employ less skilled labor, and are less eager to adopt new technology, then a large state enterprise sector tends to be associated with slow economic growth, all else remaining the same. The empirical evidence for 1978–92 indicates that, through a mixture of these channels, an increase in the share of state enterprises in employment by one standard deviation could reduce per capita growth by one to two percentage points a year from one country to another.

The debate over private versus public enterprise has played an important part in the history of economic ideas and of the world. State ownership of all factors of production was a cornerstone of communism, as practiced in the former Soviet Union and its satellites. Even under capitalism, the state (especially European states) has sometimes been deeply involved in economic affairs. The state in developing economies has been particularly inclined to take a prominent role in producing goods and services and allocating resources to investment and other economic needs.

Despite valiant efforts by many governments in recent years to get bureaucrats out of business, state enterprises remain prominent around the world. The unweighted average share of state enterprises in nonagricultural economic activity in 40 developing economies reporting to the World Bank (1995, table A2) was 13 percent in 1991, the same as in 1978. The comparable figure for eight industrial countries in 1988 was 7 percent, down from 8 percent in 1979. The unweighted average share of state enterprises in gross domestic investment in 55 developing countries was 18 percent in 1991, down from 23 percent in 1978. For 10 industrial countries it was 11 percent in 1988 and 13 percent in 1978.

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I. A Model with State Enterprises

Recent worldwide interest in privatization derives, in part, from empirical evidence that seems to indicate that private enterprise is generally more efficient than state enterprise. This evidence was reviewed in detail in World Bank (1995). Phelps (1993) provides a useful classification by suggesting five main reasons for the superior efficiency of private enterprise. Private firms may be more entrepreneurial. Managers of private firms may find it easier to act on their intuition about what products or production processes will be successful. State enterprises may be more susceptible to pressure from interest groups, whereas private firms can focus solely on maximizing profits. Private investors generally have a long time horizon for acquiring assets that can be sold, whereas politicians' electoral assets tend to be more fleeting. Last, private firms may have more difficulty getting public assistance, so the penalty for failing to maximize profits is harsher, though the fruits of success may also be sweeter. In his presidential address at the 110th meeting of the American Economic Association, Arnold Harberger (1998, 23) airs similar views: "In most countries state-owned enterprises operate under a series of constraints that seriously get in the way of real cost minimization in a comparative-static sense and real cost reduction in a dynamic sense." Even so, several empirical studies have reported mixed evidence of the relative efficiency of public and private firms (see Stiglitz 1988 for a review of this evidence). The dearth of unambiguous empirical evidence is not surprising in view of the long-standing debate on the relative merits of public and private enterprise, especially when the inefficiency that can arise from principal-agent (owner-manager) relations in private industry is taken into consideration.[1] The public sector has no monopoly on inefficiency in production.

But if transferring state property to more productive uses in the private sector enhances efficiency, by replacing soft budget constraints with harder ones, for example, then the composition of corporate ownership would be expected to play a role in generating and sustaining long-term economic growth. This is a direct implication of the theory of endogenous growth: virtually anything that increases static efficiency stimulates growth. This result follows particularly clearly from endogenous growth models featuring constant returns to capital (the so-called AK model where A denotes the output to capital ratio, which may be viewed as a measure of macroeconomic efficiency, and K denotes capital stock).

In these models, the long-run rate of growth of output per head equals the multiple of the saving rate, s, and efficiency, A, less the depreciation rate, δ: $g = sA - \delta$. Any policy undertaking or external event that increases static efficiency by increasing the amount of output that can be made from given capital thus also increases the rate of economic growth, permanently. In the neoclassical theory of economic growth, increasing efficiency increases economic growth, possibly for a long time,

1. Important contributions to this debate include Vickers and Yarrow (1988), Laffont and Tirole (1993), and Stiglitz (1994), among others.

but eventually the rate of growth returns to its exogenously determined initial equilibrium value. Either way, this link between efficiency and growth explains why, for example, education is good for growth. It also explains why liberalization, stabilization, and—yes, why not?—privatization are probably also good for growth.

Which brings up the question of private or public ownership and economic growth. Using an index of private ownership from Milanovic (1989), Palia and Phelps (2000) find for a sample of 43 countries that a strong private sector is good for growth. Rather than appealing to the simple framework of an *AK*-type model, which might mask the more complex interactions that have been debated in the literature on the efficiency of state enterprises (see Rama 1999), this article presents a more fully articulated model. It goes beyond the *AK* model to show how efficiency can be related to growth by incorporating into an endogenous growth framework the idea that state enterprises may be less inclined to invest and employ skilled labor and less innovative than private firms. State enterprises sometimes fail to adopt new products and processes invented in the private sector, reducing their efficiency. The article places this hypothesis within a clear conceptual framework, to facilitate discussion of how growth may be affected by the form of corporate ownership. The model developed here bridges the analytical literature on the static efficiency of state enterprises and the empirical tests of dynamic efficiency and economic growth reported below. This modeling strategy rests on a microeconomic foundation and derives testable macroeconomic hypotheses.

These hypotheses about the linkages among state enterprises, efficiency, investment, education, and economic growth are tested on new data from the World Bank (1995) on the share of state enterprises in employment for a cross-section of 34 developing economies for 1978–92. A significant inverse relationship emerges between the size of the state enterprise sector and economic growth, partly through investment and partly through education.

In a similar attempt to find a relationship between the size of the state enterprise sector and economic growth, the World Bank (1995, 52) reports that "there was insufficient time-series data on state enterprise sector size for enough countries over a sufficiently long time to conduct satisfactory growth regression analysis." Even so, the World Bank concludes that "the microeconomic evidence, the experience of the centrally planned economies, and the strong negative effect SOEs [state enterprises] have on fiscal deficits all collectively support the premise that large SOE sectors can hinder growth. Moreover, because SOE sectors tend to be larger in low-income countries, SOEs are likely to be most costly in the countries that can least afford them" (50–51). The empirical findings reported here support that conclusion.

It is important in this kind of analysis to distinguish the adverse growth effects of state involvement in production and in the allocation of resources from any effects of big government on growth. The effects of government spending, taxes, and transfers on growth depend on how the government spends tax rev-

enue (see Barro 1990). It is possible for increased government expenditure to boost growth despite a concurrent negative relationship between the size of the state enterprise sector and economic growth (on education, for example, see Glomm and Ravikumar 1992).

The first step is to embed state enterprises in one model of economic growth to demonstrate that ownership can matter for growth and thus belongs in growth theory. In this model, derived from Romer (1990), growth arises from an expanding variety of inputs. Because the hypotheses will be tested using data for developing economies, it is natural to think in terms of the adoption or adaptation of leading-edge technology rather than the invention of new technology. The model is intended only to illustrate some—but by no means all—of the channels through which efficiency influences economic growth. The intention is to show by example how state enterprises can be incorporated into the growth literature and the standard determinants-of-growth regression framework. The empirical tests presented later are not meant as tests of the particular model selected as the vehicle, because other points of entry, such as the *AK* model, could as well have been chosen.

In this version of the Romer model, output is produced in both private and public sectors, and in both sectors, output levels are set to maximize profits. Unlike private firms, however, state enterprises have to satisfy further constraints and objectives (regulations on work hours, on where to buy inputs, and the like) that affect labor productivity and the propensity to adopt new inputs. These firms are thought of as being run by bureaucrats on whom political authorities have imposed multiple goals and constraints.

The model features full employment, free entry in the competitive private sector, and infinite substitutability between private and public output. With free entry, the inherent static and dynamic inefficiency of state-owned firms means that they must be kept afloat by a government subsidy financed by a tax on private firms. State enterprises may produce goods and services (such as cars and computers, as in France, and banking services, as in India) that are no different from similar goods and services produced by more competitive, privately owned companies, but cost more to produce. So why do state enterprises exist? Because of their size, inefficient state enterprises may be important for the local economy: firms that employ workers that are not easily employable elsewhere are tempting targets for politicians striving to gain popularity with job-saving measures. An even stronger motivation for public ownership is the strategic importance of certain industries, such as aircraft, utilities, and armaments. Other examples abound, especially in developing economies, where export and import-competing industries are often of great importance to the local economy, yet face stiff foreign competition.

In sum, this modeling strategy is intended to draw the attention of growth analysts to public versus private ownership and to shed some light on the consequences of state enterprises, which, while competing with the private sector at home or abroad, are saddled with an inefficient cost structure and social respon-

sibility for the local economy. The model is illustrative; it is not intended as a general framework for studying the *raison d'être* of state enterprises.

Preferences and Utility Maximization

Consumers derive utility from the consumption of final output, which is sold in a perfectly competitive market. Public output Y^s and private output Y^p are perfect substitutes. Total consumption equals $C = C^p + C^s$. Though indifferent between consuming private and public output, the typical consumer maximizes the present discounted value of lifetime utility from total consumption. As in Blanchard (1985), workers face a constant probability of death π, and new cohorts are continuously being born. This prevents Ricardian equivalence. This matters because inefficient state enterprises are often responsible for mounting public debt, which may reduce saving. Preferences are described by an isoelastic utility function, $u = c^{1-1/\sigma}/(1 - 1/\sigma)$, where c is per capita consumption and σ is the elasticity of intertemporal substitution. This gives the following Euler equation (equation 1) for the optimal aggregate consumption profile ($C = cL$, where L, the total labor force, is fixed).

$$\frac{\dot{C}}{C} = \sigma(r-\rho) - \left\{\left[\sigma\rho + \pi - (\sigma - 1)r\right]\pi\right\}\frac{W}{C} \tag{1}$$

where r is the real interest rate, p is the pure rate of time preference, and W is total wealth, which consists of the total value of firms and outstanding public debt, D. This debt has been accumulated to sustain the operation of state enterprises in the past.

Technology and Profit Maximization

Both sectors, private and public, use labor and other inputs, which are produced solely by private firms. With Romer (1990) as a starting point, production technology in the two final-goods sectors is shown in equations 2 and 3.

$$Y^p = A^p\left(e^p L^p\right)^{1-\alpha}\sum_{j=1}^{N}\left(X_j^p\right)^{\alpha} \tag{2}$$

$$Y^s = A^s\left(e^s L^s\right)^{1-\alpha}\sum_{j=1}^{pN}\left(X_j^s\right)^{\alpha} \tag{3}$$

where L^i is employment in sector i, e^i is the efficiency of labor in that sector, X^i_j is the use of input j in that sector, $i = s, p$. N is the number of inputs produced and used in the private sector, and p is the probability that a new input will be adopted by state enterprises. Possible sources of (static) inefficiency in the public sector are:

1. Public enterprises may be less efficient—waste more resources—than private firms. This means that $A^s < A^p$ in equations 2 and 3. Managers of state enterprises may not have the same incentive as management in private firms

do to organize production efficiently and to invest in sound projects, partly because the penalty of failure is less threatening when the state coffers are within reach and partly because the rewards of success are typically smaller.

2. State firms may be less efficient in organizing labor within the firm and may employ less well educated labor than private firms. Therefore, $e^s < e^p$. Wages are generally lower in state enterprises than in the private sector (see Gyourko and Tracy 1988). Also, wage setting in the public sector tends to be less flexible and thus less incentive compatible—less conducive to increased work effort and improved efficiency—than in the private sector (World Bank 1995). Moreover, in many countries, the public sector tends to be overstaffed because state enterprises do not make hiring and firing decisions solely on the basis of profitability. Workers in state enterprises generally enjoy greater protection from cyclical layoffs than do workers in the private sector.
3. Each newly invented input is bought by private firms, but in the public sector this occurs with probability p. The hypothesis is that state enterprises are not as innovative as private firms—and so not as likely to invest in new machinery and equipment that embodies new and productive technology (Phelps 1993). Thus there is a fixed probability $p \leq 1$ that a new input will be adopted by state enterprises. For this reason, fewer types of inputs—less high-tech capital—may be used in the public sector than in the private sector: $pN < N$.

With free entry, private firms enter until average profits in the sector are driven to zero. The question of the viability of public enterprises is bound to arise in light of the constant returns to scale nature of the production technology in both sectors. This issue is resolved by assuming that state enterprises receive a subsidy s per unit of output from the government financed by a tax t on the output of private firms. The effective subsidy $s + t$ is then equal to the difference between average long-run costs in public and private enterprises and can be written (see equation 4) for the case of $N = 2$ and $p = 1$.

$$s+t=\left[\left(\frac{w}{e^s}\right)^{1-\alpha}\left(\frac{1}{A^s}\right)-\left(\frac{w}{e^p}\right)^{1-\alpha}\left(\frac{1}{A^p}\right)\right]\lambda P^{\alpha} \tag{4}$$

where $\lambda=\left[\left(\frac{1-\alpha}{\alpha}\right)^{\alpha}+\left(\frac{1-\alpha}{\alpha}\right)^{-(1-\alpha)}\right]$ and P is the real price of an input. The government budget constraint is added next to solve for the subsidies and taxes (equation 5).

$$sY^s + rD = tY^p \tag{5}$$

The effective subsidy is a decreasing function of e^s and A^s and an increasing function of e^p and A^p as expected. If $e^s = e^p$ and $A^s = A^p$, then $s + t = 0$ by equation 4. This system of taxes and subsidies is the basis for the continued existence of state enterprises, given their presumed inefficiency.

Firms in both sectors decide on employment and the use of other inputs to maximize profits. The first-order conditions for labor (in efficiency units) and other inputs are shown in equations 6 and 7.

$$w=(1-\alpha)\frac{Y^p(1-t)}{e^pL^p}=(1-\alpha)\frac{Y^s(1+s)}{e^sL^s} \tag{6}$$

$$X_j^p=e^pL^p\left(\frac{\alpha A^p(1-t)}{P_j}\right)^{\frac{1}{1-\alpha}},\ X_j^s=e^sL^s\left(\frac{\alpha A^s(1+s)}{P_j}\right)^{\frac{1}{1-\alpha}} \tag{7}$$

where P_j is the real price of input j.

The price of inputs is set by the monopolists that invented them, but the wage w is determined by supply and demand in labor markets, so that $L=(1-\alpha)\left[\frac{Y^p(1-t)}{e^pw}+\frac{Y^s(1+s)}{e^sw}\right]$ where L, the labor force, is fixed.

Input Pricing, Output, and Growth

Each intermediate input is produced by its inventor, who has a permanent monopoly in production. The production technology involves turning one unit of the final good into a unit of input at zero cost. The monopolists' profits can be written as $(P_j-1)X_j$ where P_j is the (monopoly) real price of the input in terms of final goods. The monopolist then sets the price of the input to maximize current profits by taking factor demand (equation 7) into account; no intertemporal considerations enter the pricing decision. The monopoly price is $P_j = 1/\alpha$. Plugging this price into factor demand equations 7 yields the steady-state value of a new invention, assuming a constant rate of real interest, r (equation 8).

$$V=\frac{1}{r}\left[e^pL^p\left(A^p[1-t]\right)^{\frac{1}{1-\alpha}}+pe^sL^s\left(A^s[1+s]\right)^{\frac{1}{1-\alpha}}\right]\left(\frac{1-\alpha}{\alpha}\right)\alpha^{\frac{2}{1-\alpha}} \tag{8}$$

In a steady state with a growing variety of inputs and free entry, the expected value of a new invention has to equal the cost of inventing a new input, η. The total value of firms is therefore equal to $N\eta$. This gives the equilibrium interest rate and, through equation 1, the rate of economic growth (equation 9)

$$\begin{aligned} g=\sigma&\left[\left(\frac{e^p(1-v)L}{\eta}\left(A^p[1-t]\right)^{\frac{1}{1-\alpha}}+p\frac{e^svL}{\eta}\left(A^s[1+s]\right)^{\frac{1}{1-\alpha}}\right)\theta-\rho\right] \\ &-\left(\left(\sigma\rho+\pi-(\sigma-1)r\right)\pi\right)\frac{N\eta+D}{C} \end{aligned} \tag{9}$$

where $v = L^s/(L^s + L^p)$, L^s, and L^p are determined by equation 6 and $\theta=\left(\frac{1-\alpha}{\alpha}\right)\alpha^{\frac{2}{1-\alpha}}$.

Apart from the usual effects of changes in the cost of innovation, η, the size of the total labor force, $L = L^s + L^p$, and the rate of time preference, ρ, on growth, the equation suggests that

1. The rate of growth is a decreasing function of the size of the state sector, v, as long as $A^p(1 - t)/A^s(1+ s) > (pe^s/e^p)^{1-\alpha}$, because the transfer of labor from the private sector to the public sector reduces demand for inputs. Thus $A^p(1 - t) \geq A^s(1 + s)$ and $e^p \geq e^s$ are a sufficient but not necessary condition

for the expansion of the state enterprise sector from one time or place to another to reduce economic growth, as long as $p < 1$. This is the main hypothesis.

2. The rate of growth is an increasing function of the productivity of labor in state enterprises, e^s (as well as in private firms, e^p), for given taxes and subsidies.
3. The rate of growth is an increasing function of the level of technology and the efficiency of organization in state enterprises, A^s (as well as in private firms, A^p), for given taxes and subsidies.
4. The rate of growth is an increasing function of the probability that state enterprises adopt newly invented inputs, p, which is interpreted as a sign of their willingness to invest.
5. The rate of growth is a decreasing function of public debt, D, which is assumed to have been, at least in part, accumulated by state enterprises in the past. A higher level of debt increases consumption and hence leaves less output for investment in research and development of new types of inputs.

II. Empirical Evidence

Under ideal conditions, the next task would be to gather the data and test all the hypotheses derived from growth equation 9. This is an impossible task, however, because several of the variables that drive economic growth in this model cannot be directly observed: the efficiency of organization (A^s and A^p), the productivity of labor (e^s and e^p), and the probability that state enterprises adopt newly invented inputs (p).

Hypothesis 1 can be tested directly by estimating the partial correlation between the state enterprises' share in the labor force, $\upsilon = L^s/(L^s + L^p)$, for which data are widely available from the World Bank (1995), and economic growth, controlling for other potential determinants of growth. If the conjecture that this correlation is negative is confirmed, that is an indication that the state enterprise sector is less well organized, less efficient, or less innovative than the private sector in such proportions that $A^p(1 - t)/A^s(1 + s) > (pe^s/e^p)^{1-\alpha}$.

Hypotheses 2–5 can be tested only indirectly, however, because of lack of data. To test hypotheses 2 and 3, labor productivity and efficiency of organization are assumed to vary directly with investment and the education of the labor force. To test hypothesis 4, the propensity to invest is assumed to reflect, in part, the willingness to adopt newly invented inputs. This is the case when the intermediate inputs are capital goods. Therefore, if state enterprises are generally more prone than private firms to waste resources on unproductive investments ("white elephants") and to divert government spending from social needs, including education (Mauro 1998), and less willing to adopt new inputs, as conjectured, then this is an additional link between the size of the state enterprise sector and economic growth.

Together, hypotheses 1–4 imply that increased state enterprise activity can hurt economic growth directly as well as indirectly through investment and edu-

cation. A fifth hypothesis is that the impact of investment on growth varies inversely with the size of the state enterprise sector. To test hypothesis 5, state enterprises are assumed to bear responsibility for a substantial part of public external indebtedness. The empirical results reported below need to be viewed in the light of these qualifications.

A Preview

These hypotheses are tested using cross-sectional data from the Penn World Tables (see Summers and Heston 1991) and the World Data Bank (World Bank 1997) covering 1978–92 (1978–91 for state enterprises). Table 1 reports summary statistics for the share of state enterprises in employment (*SOE/Labor*) and in nonagricultural GDP (*SOE/GDP*) and for the external debt of state enterprises as a proportion of GDP (*SOE/Debt*).

The share of state enterprises in employment was remarkably steady, averaging 12 percent in both the first and last years of the period.[2] Several countries significantly downsized their state enterprise sector. Chile reduced the sector's share in employment from 4 percent to 1 percent and its share in nonagricultural GDP from 12 percent to 8 percent. Argentina reduced the employment share from 4 percent to 2 percent and the share in GDP from 6 percent to 2 percent, and Botswana reduced the public sector's share in employment from 3 percent to 2 percent and the sector's share in GDP from 9 percent to 6 percent. At the other end of the spectrum, Ghana increased the share of state enterprises in employment from 29 percent to 45 percent, while their share in GDP declined from 8 percent to 7 percent.

It would be unwise, however, to ascribe rapid growth in Chile since the mid-1980s and in Argentina since the early 1990s until recently in part to privatization (or, for that matter, to ascribe slow growth in Ghana in part to the failure to privatize). For one thing, causation can run both ways. Although the model suggests a link from privatization to growth, and privatization was an important ingredient of the reforms that started in Chile in the 1970s and in Argentina in the 1980s, it also seems reasonable to suppose that brisk growth in Chile and Argentina may have helped create conditions favorable to further privatization and other reforms. Even so, the high unemployment that accompanied the rapid growth in Argentina and Chile, by exerting political pressure not to endanger jobs in the state sector, seems likely to have weakened this reverse linkage from growth to privatization. By the same token, sluggish growth and high unemployment in Ghana (and elsewhere, no doubt) contributed to the expansion of employment in the state enterprise sector, even if the sector's share in GDP was declining.

The main point, however, is this: if private enterprise is good for growth, as hypothesized, that does not mean that growth is not good for private enterprise. The same argument applies to other potential determinants of economic growth: trade, investment, education, and so on. The discussion that follows emphasizes

2. Due to gaps in the data, the first year and the last year vary from country to country.

TABLE 1. Summary Statistics

	Mean	SE	Min	Max	Number of countries
SOE/Labor	0.13	0.14	0.008	0.698	41
SOE/GDP	0.15	0.14	0.013	0.717	76
SOE/Debt	0.07	0.06	0.000	0.289	82

Note: See World Bank (1995) for definition of variables.

the link from privatization to growth, even though the relationship between the two may well be more complex.

Correlation Analysis

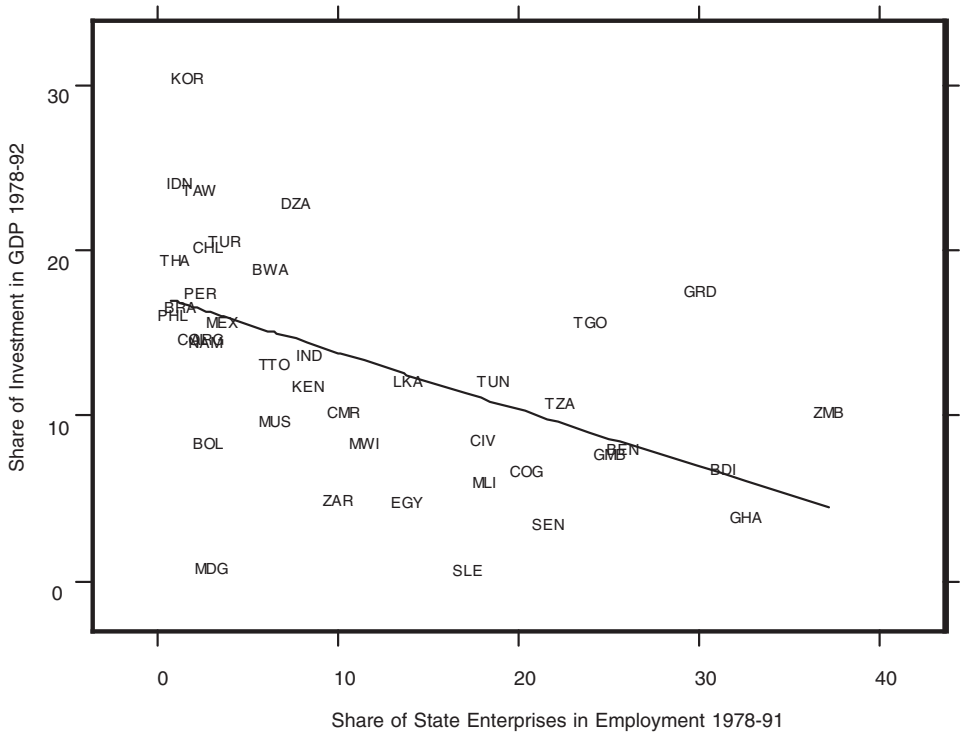
Correlation analysis can further illuminate the relationships between the size of state enterprises and growth. Some key bivariate correlations are between the relative size of the state sector, measured by state enterprises' share of employment (*SOE/Labor*), and the accumulation of physical and human capital—two key determinants of economic growth.

A scatterplot of state enterprise employment and the share of investment in GDP across countries, both measured as averages over the period 1978–1991/92, shows the relationship to be economically and statistically significant (figure 1).[3] The regression line in figure 1 is based on robust estimation to reduce the weight of potential outliers (the same applies to figures 2–3). An increase in the employment share of state enterprises by one standard deviation is associated with a decrease in investment of 4.5 percent of GDP, all else remaining the same. The correlation r is –0.51 ($t = 3.6$). Similar results ($r = –0.42$, $t = 2.9$) obtain when the initial rather than average value is used to measure *SOE/Labor*. This suggests that causation runs from *SOE/Labor* to investment rather than the other way round. This result supports the hypothesis that state enterprises are less inclined than private firms to invest in new machinery and equipment and to adopt new technology and may thus impede economic growth.

A second scatterplot shows the correlation of state enterprise employment during 1978–91 and the rate of enrollment in secondary schools in the base year, 1978, a commonly used measure of education in the growth literature (figure 2). An increase in the employment share of state enterprises of one standard deviation goes along with a decrease in secondary school enrollment of 1.5 percentage points, all else remaining the same. The correlation is –0.58 ($t = 4.1$). The pattern is similar ($r = –0.51$, $t = 3.4$) when the initial rather than average value is used to measure *SOE/Labor*. This pattern seems consistent with the hypothesis that state enterprises are less inclined than private firms to employ skilled labor and perhaps less likely to adopt new technology and thus may inhibit economic

3. *SOE/Labor* is exceptionally large in Guinea (70 percent). This outlier is excluded from figures 1–3 and from equations 2 and 3 in table 2.

FIGURE 1. State Enterprises and Investment (percent)



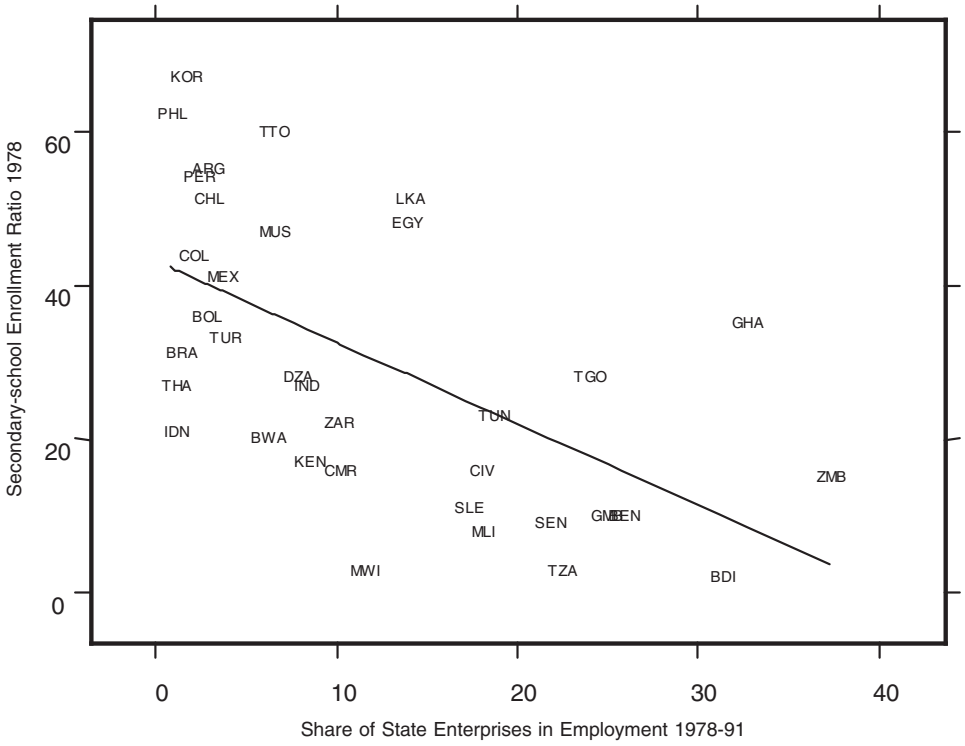
Source: Penn World Tables and the World Bank.
Note: Country abbreviations are defined in the Appendix.

growth. Other interpretations are also conceivable; for example, low standards of education may generate unemployment and thus exert pressure on the authorities to create jobs through state enterprises.

In sum, the data suggest that state enterprises may slow economic growth by discouraging investment (figure 1) and education (figure 2). Figure 3 confirms this: it shows an inverse correlation (–0.35, t = 2.2) between state enterprises' employment share and economic growth across countries. An increase in state enterprises' employment share of one standard deviation is associated with a decrease in the annual rate of economic growth of about 1 percent. The economic and statistical significance of this correlation is preserved when economic growth is regressed on the state enterprises' employment share and initial GDP using ordinary least squares (OLS) and when the initial rather than average value is used to measure *SOE/Labor* (r = –0.29, t = 1.8).

These correlations suggest that a small state enterprise sector (where state enterprises account for 5 percent or less of employment) can be associated with both rapid growth, as in Indonesia, the Republic of Korea, Taiwan (China), and Thailand, and slow or even negative growth, as in Bolivia, Madagascar, and Peru. A large state enterprise sector, however, generally goes hand in hand with slow

FIGURE 2. State Enterprises and School Enrollment (percent)



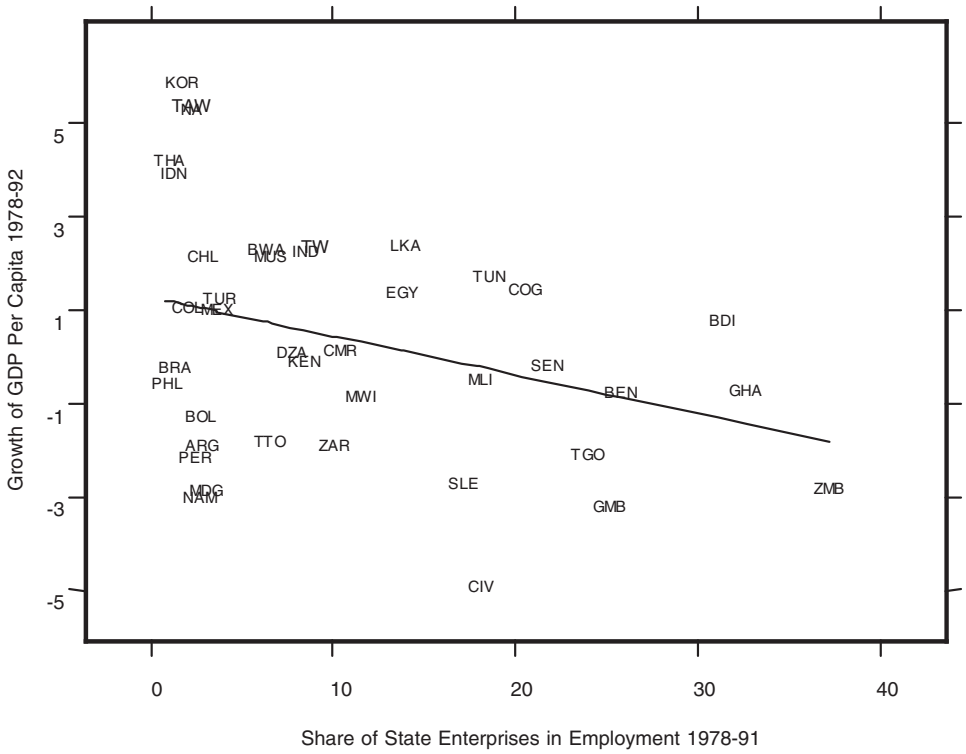
Source: The World Bank.
Note: Country abbreviations are defined in the Appendix.

growth, as in Ghana and Zambia. Except for Sri Lanka, all countries whose state enterprise sector accounted for 10 percent or more of total employment had economic growth of less than 2 percent a year on average over the period (a majority had negative growth).

Does this inverse correlation between the employment share of state enterprises and economic growth stem from inefficiency in the state enterprise sector, as hypothesized? Or does the size of the state enterprise sector simply reflect flaws in economic policy that hinder economic growth? If the second, the share of state enterprises in employment could be expected to be positively correlated with inflation, a common measure of policy failure. That is not the case, however. The correlation between state enterprises' share in employment (*SOE/Labor*) and a measure of inflation distortion (defined as $\frac{\pi}{1+\pi}$ where π is the rate of inflation) is –0.31 (t = 1.9).[4]

4. The correlation between *SOE/Labor* and the share of government expenditure in GDP in the sample is 0.48 (t = 3.2), but government expenditure is not in itself a sign of policy weakness or inefficiency, certainly not if the government spends its tax revenue mostly on productive infrastructure, education, and health care.

FIGURE 3. State Enterprises and Economic Growth (percent)



Source: Penn World Tables and the World Bank.
Note: Country abbreviations are defined in the Appendix.

Next, the simple correlations between the size of the state sector and investment, education, and growth are subjected to closer econometric scrutiny.

Regression Analysis

The model is estimated as a system using seemingly unrelated regression (SUR).[5] That allows the marginal processes for investment, education, and growth to be modeled simultaneously to investigate the direct and indirect effects of state enterprises on economic growth. First, however, a basic Barrovian growth regression is estimated to explain the growth rate alone.

The results for regression 1 in table 2 are for a cross-sectional OLS regression of average growth on the logarithm of the initial level of GDP and the average share of investment in GDP. The negative coefficient on initial income (although not statistically significant) is a sign of β-convergence, but quite slow: it implies a convergence speed of 0.3 percent a year rather than the 2–3 percent rate usually reported in the literature (Barro and Sala-i-Martin 1995). However, this result

5. The models were also estimated independently using OLS (not reported). The results remained virtually the same.

TABLE 2. Empirical Results

	Economic growth, 1978–92					Investment, 1978–92			Education, 1978		
	(1)	(2a)	(3a)	(4a)	(5)	(2b)	(3b)	(4b)	(2c)	(3c)	(4c)
Initial GDP	–0.003	–0.008	–0.010	–0.008	–0.007	0.024	0.023	0.053	0.147	0.147	0.240
	(1.19)	(2.12)	(1.78)	(1.74)	(1.59)	(1.73)	(1.69)	(7.99)	(4.47)	(4.47)	(13.16)
Investment	0.172	0.131	0.213	0.208	0.162	—	—	—	—	—	—
	(4.74)	(3.64)	(4.08)	(4.16)	(3.87)						
Secondary education	—	0.029	0.014	0.914	0.023	—	—	—	—	—	—
		(2.08)	(0.56)	(0.87)	(1.34)						
SOE/Labor	—	—	—	—	—	–0.267	–0.278	—	–0.419	–0.416	—
						(2.58)	(2.68)		(1.71)	(1.70)	
SOE/GDP	—	—	—	—	—	—	—	0.078	—	—	0.036
								(1.73)			(0.30))
SOE/Debt	—	—	—	—	–0.096	—	—	—	—	—	—
					(2.48)						
SOE/Labor × *Investment*	—	—	–0.695	—	—	—	—	—	—	—	—
			(2.06)								
SOE/GDP × *Investment*	—	—	—	–0.219	—	—	—	—	—	—	—
				(2.30)							
Constant	0.003	0.038	0.056	0.032	0.034	–0.016	–0.011	–0.272	–0.730	–0.731	–1.463
	(0.16)	(1.46)	(1.42)	(1.11)	(1.11)	(0.14)	(0.10)	(5.11)	(2.79)	(2.79)	(10.00)
SE	0.019	0.018	0.018	0.018	0.019	0.056	0.056	0.052	0.125	0.125	0.138
Adj. R^2	0.22	0.25	0.36	0.26	0.22	0.33	0.33	0.44	0.55	0.55	0.72
Number of countries	96	88	34	67	71	39	39	74	35	35	69
Estimation method	OLS	SUR	SUR	SUR	OLS	SUR	SUR	SUR	SUR	SUR	SUR

Note: t values appear within parentheses below the coefficients.

is in line with other studies when such variables as human capital, trade, and political instability are excluded.

The higher the share of investment in GDP, the more rapid is economic growth in all the regressions; this effect is quite robust. According to point estimates, increasing the investment ratio from 20 to 30 percent from one country to another increases growth by 1.3 to 2.1 percent, all else remaining the same. These estimates are broadly similar to those reported by Levine and Renelt (1992), Sachs and Warner (1995), Gylfason and Herbertsson (1996), and Gylfason (1999).[6] The exclusive focus here on developing economies, where diminishing returns to capital have not yet set in fully, may explain why investment in some cases appears to have a slightly stronger effect on growth than in some of the abovementioned studies (Sachs and Warner, in particular), which include industrial as well as developing countries.

In regression 2a, the education variable is the usual secondary school enrollment rate from Barro and Lee (1993), measured at the beginning of the sample period (1978), as is customary to avoid simultaneity bias. The effect of education on growth is statistically—and economically—significant: an increase in the initial secondary school enrollment rate from 50 to 80 percent increases the average rate of growth by almost a whole percentage point, all else remaining the same.

Regression 2a is estimated as part of a system of three equations, in which equations 2b and 2c describe the dependence of investment and secondary education on initial income and the share of state enterprises in employment (recall figures 1 and 2). An increase in state enterprise employment discourages both investment (regression 2b) and education (regression 2c)—education only marginally, however—and thus reduces growth, as shown in regression 2a. The total indirect effect of an increase in the employment share of state enterprises on economic growth is $0.131 \times (-0.267) + 0.029 \times (-0.419) = -0.035 - 0.012 = -0.047$ ($t = 2.5$).[7] The indirect effect of state enterprises on growth through investment is statistically significant ($t = 2.1$), but the indirect effect through education is not ($t = 1.3$).[8] When initial rather than average values of the *SOE/Labor* variable are used to guard against the possibility of reverse causation and omitted-variable bias, a broadly similar pattern emerges. This reduces the likelihood that the results are driven by the effects of economic growth and investment on the size of the state enterprise sector (for example, growth slowdowns that make governments more willing to expand state enterprise employment, or investment booms that make state enterprise employment and growth increase simultaneously).

6. Barro and Sala-i-Martin (1995) report smaller and less significant effects of investment on economic growth.

7. The composite t values are computed by Taylor expansion following Staiger and others (1997).

8. The total effect of initial income on growth is, by similar arithmetic, smaller than the direct effect, as is reasonable: conditional convergence does not necessarily generate absolute convergence.

Regression 3a adds the multiple of the employment share of state enterprises and the investment ratio to test for the direct impact of state enterprises' employment share on growth. This makes the effect of investment on growth dependent on the size of the state enterprise sector. The idea is that state enterprises tend to buy inferior capital, which adds less to output. The coefficient on the *SOE/Labor* term is significant and implies that a one-standard-deviation increase in state enterprises' employment share (0.14) reduces economic growth by –0.695 × 0.153 × 0.14 = –0.015, or 1.5 percentage points, evaluated at the sample mean of the investment ratio (0.153). The investment rate survives the introduction of the interaction term involving employment share, but the education variable drops in both size and significance. Auxiliary regressions 3a and 3b are similar to regressions 2b and 2c. The total effect of an increase in state enterprise employment on economic growth is –0.695 × 0.153 + 0.213 × (–0.278) + 0.014 × (–0.416) = –0.106 – 0.059 – 0.006 = –0.171 (t = 3.4).[9]

Therefore, when the share of state enterprises in employment increases by one standard deviation, economic growth decreases by 2.4 percentage points, all else remaining the same, directly as well as through investment. The indirect growth effect of state enterprises through investment is economically and statistically significant (t = 2.2), but the indirect effect through education is not (t = 0.5). The visual impression conveyed by figures 1 and 3 is confirmed. Again, a broadly similar pattern is observed when initial rather than average values of the *SOE/Labor* variable are used: the total effect of an increase in state enterprise employment on growth is now –0.123 (t = 2.5).

So far, the size of the state enterprise sector has been measured by its share in total employment rather than by its share in GDP. This is because the inefficiency associated with state enterprises is often manifested in overstaffing. (Recall the case of Ghana, where the share of state enterprises in employment rose by half during 1978–91, while their share in GDP declined.) It is nevertheless interesting to explore whether there is a significant relationship between the share of state enterprises in GDP (*SOE/GDP*) and economic growth.

Regression 4a shows that an increase in the share of state enterprises in GDP has a significantly negative direct effect on economic growth, a result that also holds when initial rather than average values of *SOE/GDP* are used. There are no indirect effects, however, at least not through education (see regression 4c). True, the coefficient on *SOE/GDP* in investment regression 4b is marginally significant, but its sign is wrong in view of the model. Even entertaining the possibility that an increase in the share of state enterprises in GDP stimulates investment does not materially change the result: the total effect of *SOE/GDP* on growth is still significantly negative.

9. When *SOE/Labor* appears as an independent variable on its own in regression 3a, without interacting with investment, its direct effect on growth is still negative, but not significant (t = 1.1). In other respects, the results remain virtually unchanged.

Regression 5 includes the external debt of state enterprises as a proportion of GDP (*SOE/Debt*). This result also holds when initial rather than average values of *SOE/Debt* are used.

III. Conclusion

In the simple model developed here of endogenous growth in an economy with state enterprises as well as private firms, a large state sector tends to be associated with slow economic growth, all else remaining the same, if state enterprises are less efficient than private firms, invest less, employ less skilled labor, and are less eager to adopt new technology. The main empirical finding is that, across countries, investment and economic growth during 1978–92 were inversely related to the size of the state enterprise sector, measured by its share of total employment. Specifically, a one-standard-deviation increase in the state sector's share of total employment from one country to another reduces the ratio of investment to GDP by about four percentage points and reduces per capita growth by about one to two percentage points, all else remaining the same. Thus, too great a reliance on state enterprises may stand in the way of both static and dynamic efficiency—and consequently also investment and economic growth. Even so, the results need to be interpreted with caution in view of the limited data coverage across countries and over time.

Appendix. Country Abbreviations Used in Figures 1–3.

Code	Name	Code	Name
DZA	Algeria	MDG	Madagascar
ARG	Argentina	MWI	Malawi
BEN	Benin	MLI	Mali
BOL	Bolivia	MUS	Mauritius
BWA	Botswana	MEX	Mexico
BRA	Brazil	NAM	Namibia
BDI	Burundi	PER	Peru
CMR	Cameroon	PHL	Philippines
CHL	Chile	SEN	Senegal
COL	Colombia	SLE	Sierra Leone
COG	Congo	LKA	Sri Lanka
CIV	Côte d'lvoire	TAW	Taiwan
EGY	Egypt, Arab Rep.	TZA	Tanzania
GMB	Gambia, The	THA	Thailand
GHA	Ghana	TGO	Togo
GRD	Grenada	TTO	Trinidad and Tobago
GIN	Guinea	TUN	Tunisia
IND	India	TUR	Turkey
IDN	Indonesia	ZAR	Zaire
KEN	Kenya	ZMB	Zambia
KOR	Korea, Rep.		

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