

**Privatization, Factor Productivities,
and Economic Growth in
Less Developed Countries**

Honors Thesis
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I hereby declare upon my word of honor that I have neither
given nor received any unauthorized help on the work.

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Introduction

Privatization has recently moved to the forefront of economic and political thinking as a plausible strategy for improving production and achieving growth in less developed countries. This paper examines the effects of privatization on factor productivities and output at the macroeconomic level. This analysis takes into account case studies of four countries which have experienced large-scale privatization initiatives: Chile, Bolivia, Mexico, and Jamaica. A discussion of the economic background of these four countries precedes the derivation of the economic model and research methodology. The results of the analysis examine the changes in output and factor productivities associated with privatization.

Worldwide, public sector production increased into the 1980's. In many developed countries this increase was largely a reflection of the growing public delivery of services. In less developed countries however, increased public spending reflects the growing number of state-owned enterprises (SOE's), firms operated by the government. The goal of public production is the delivery of a good or service, and not necessarily capturing real economic profits. These firms are protected from market forces, which reduces the need for efficient use of their resources. Governments established SOE's with hopes that they would provide a competitive edge by developing modern, efficient methods of production, but these enterprises have become inefficient fiscal and monetary burdens (Berg 1987, 24).

Many governments have attempted to get rid of these public burdens through privatization initiatives. Privatization redistributes production of goods and services from the public to the private sector (Hanke 1987, 4). There are three main forms of privatization: divestiture, contracting out, and load shedding. Divestiture is the transfer of SOE's to the private sector through targeting and selling to a private firm, or establishing and selling shares of the SOE. Contracting out is the leasing of public production to private companies. Prominent examples include the construction of goods

and equipment, and management services and waste collection. Load shedding involves a SOE simply shutting down to allow market forces to establish private firms that meet the public demand, if such demand exists. The goals of privatization are increased efficiency, reduction of the fiscal burden from the public sector, and an emphasis on the power of the market (Hanke 1987, 3-4).

Privatization has come to the mainstream largely through the experiences of less developed countries which have encountered much slower rates of economic growth than countries that rely on market forces (McPherson 1987, 18). By transferring production from the public to the private sector, a firm should theoretically achieve a higher level of efficiency. The goal of a private firm is profit maximization, which is achieved by increasing efficiency in order to reduce production costs. Efficiency gains include increased productivity of labor and capital. The presence of competition and market forces requires efficient production, which is necessary in order to profit.

In this analysis, data was collected for four countries that have undergone large-scale privatizations: Chile in 1985 (Maloney 1994, 137), Bolivia in 1985 (Gamarra 1990, 199), Mexico from 1982 to 1988 (Ramirez 1994, 27), and Jamaica in 1980 (Adam, Cavendish, and Mistry 1992, 116). These four countries used different approaches in privatizing and emphasized different industries in implementation. These countries were selected for this analysis because they underwent large, well-planned privatization programs. This study differs from many previous studies in that it attempts to isolate changes in productivity resulting from privatization at a macroeconomic level, rather than a microeconomic level. This study illustrates changes in labor and capital productivity between periods before privatization and periods during or after privatization. It also examines the relationship between privatization and growth in GDP.

Privatization in Chile was initially a policy associated with the military government between 1974 and 1982 (Maloney 1994 135). The objective of this government was to reprivatize many of the firms and banks that had been seized under the Allende

administration. The unorganized and corrupt methods of quickly selling the state firms led to the formation of *grupos*, groups of investors that collude to control a large portion of the total corporate stock. The small ownership base and bad financial planning led to the eventual collapse of the reform effort and the economy in 1982. This economic crisis brought about the government's reabsorption of many of the reprivatized firms (Maloney 1994, 135-7). The modest privatization program introduced in 1985 set out to establish and sell off only thirty percent of the shares of twenty-three renationalized firms (Maloney 1994, 137). As of 1994, Chile sold large portions of the shares of twenty-seven firms and completely privatized thirteen large firms, and stock ownership increased from 26,604 shareholders in 1985 to 169,733 shareholders in 1988 (Maloney 1994, 144, 153). In 1981, state production accounted for 24.1% of GDP, but by 1988, only three years following the introduction of the privatization plan, public production fell to 15.9% of GDP. (Hachette and Luders 1993, 4). Overall, more than 90.0% of the Chilean SOE's were privatized, a total of 500 firms (Thobani 1994).

In Bolivia, the election of Victor Paz Estenssoro in 1985, marked the beginning of the move towards privatization. In the midst of hyperinflation above 26,000 percent annually, President Paz Estenssoro enacted Decree 21060, an austerity program which deals with allowing market forces to operate freely (Gamarra 1990, 198-199). The primary goal of this policy was the reduction in the size of the state, and a major focus included the privatization of many SOE's. This new policy emphasized the importance of the private sector in the development process, rather than a dependence on the state.

Towards the end of 1992, Mexico faced an inflation rate of nearly 100%, rising unemployment, a fiscal deficit of 17.9% of GDP, and declining foreign currency reserves (Ramirez 1994, 22). Newly elected President De la Madrid, a former budget secretary quickly outlined his austerity program of returning the Mexican economy to market forces (Ramirez 1994, 23). Some of the larger goals of this plan included the reduction in government spending, a devaluation of the currency, trade liberalization, export

promotion of manufactured goods, encouragement of foreign investment, and a reduction of almost half of the SOE's (Ramirez 1994, 23). The number of SOE's decreased from 1,155 in 1982 to only 260 as of March 1991 (Ramirez 1994, 30). As of 1994, about 90% of the Mexican SOE's were privatized, bringing in over \$22 billion US dollars in revenue (Thobani 1994).

In Jamaica, the period 1972-1980 was marked by the establishment of price controls and restrictive trade policies. State ownership was increasing rapidly (Adam, Cavendish, and Mistry 1992, 108). The election of Edward Seaga, however, marked the declining role of the state and the emphasis of the free market in growth and development. The growing public disillusionment with the performance of SOE's and influence by the IMF supported Seaga's plan to privatize the SOE's (Adam, Cavendish, and Mistry 1992, 116). Public consumption as a percent of GDP fell from 20.3% in 1980 to 14.1% in 1989 (Adam, Cavendish, and Mistry 1992, 109). Investment increased from 15.7% of GDP in 1980 to 29.1% of GDP in 1989. Savings increased from 9.5% of GDP in 1980 to 17.4% of GDP in 1987 (Adam, Cavendish, and Mistry 1992, 109).

Survey of the Literature

Privatization increases efficiency by returning firms to market pressures that induce a firm to increase its productivity and lower its costs (Clark, Heilman, and Johnson 1995-6). The neoclassical view prescribes minimizing public enterprise to gain efficiency (Dinavo 1995). Baer and Villela (1994) discuss the economic efficiency gained through privatization by comparing the lower rates of return in government enterprises to private enterprises. Roth (1987) indicates that privatization of services increases general welfare, even when government expenditures continue. A brief discussion of benefits of privatization in several service industries supports this argument. Zank (1991) attributes sound planning as a requirement for any successful privatization plan, claiming that ill-planned implementations do nothing more than destroy a population's confidence in the open market.

Several studies have attempted to isolate the microeconomic gains of privatization by utilizing complex mathematical models. A study of efficiency gains in the UK through privatization (Hutchinson 1991) used regression analysis to determine that privatized firms increased profitability, yet decreased labor productivity. This study offers two explanations for this discrepancy: testing (sampling) error or increased capital productivity in privatized firms. A similar study of the UK divestiture (Parker and Hartley 1991) used a modified Cobb-Douglas production function and regression analysis to illustrate labor and factor productivity increases resulting from privatization. The sample took into account several firms in different industries.

Nellis claims that there is a strong direct relationship between firm ownership and performance. According to his study, efficiency is a result of “market and incentive structures” (1994). According to Nellis the three criteria for efficient production include: producing in a competitive market without barriers to entry or exit, responding to changes in demand, and rewarding management for good performance (1994). Nellis emphasizes efficiency gains from private production by citing empirical evidence from New Zealand’s corporatization efforts in the mid-1980’s (1994).

Newbery and Pollitt (1997) found that labor productivity of privatized U.K. utility companies more than doubled in the six years following the initiative. Their study utilized a cost-benefit analysis of the privatization implementations against optimistic and pessimistic counterfactuals of the firms had they not been privatized. This study found that there was a substantial net benefit to the economy in both of the scenarios. Newberry and Pollitt explain that the differences are indicative of lower labor and service costs that were brought about by privatization--changes that were inconceivable in the publicly owned firms.

Other analyses have examined case studies of different countries in order to observe changes resulting from privatization. Poole (1996) uses World Bank data to illustrate positive net welfare changes resulting from privatization implementations in several

industries from four countries. Cowan (1990) cites case studies from Ghana, Nigeria, and Malaysia to illustrate the growth in exports caused by privatization. The survey continues by noting the importance of privatization in developing financial and capital markets. A comprehensive collection of case studies from developing countries (Adam, Cavendish, and Mistry 1992) uses a model which regresses performance variables, such as profitability and marketability against ownership (public or private) with inconclusive results. While well-planned implementations that occurred slowly increased factor and labor productivity, implementations that occurred quickly, and often as a result of economic crises offered either no change in productivity or, on rare occasion, decreased productivity.

Theory and Methodology

Output is a function of labor, capital, and technology according to the Cobb- Douglas production function:

$$Q = A L^\alpha K^\beta$$

where Q is output; L is the amount of labor, and K is the capital stock. A is a value for technology that increased at a constant rate in the analysis. The parameters α and β represent the marginal productivities of labor and capital, respectively. The variable α indicates the percent change in total output for a 1% change in labor (the marginal productivity of labor). The variable β indicates the percent change in total output for a 1% change in capital (the marginal productivity of capital).

A regression analysis was performed on the Cobb-Douglas production function in the following log linear form:

$$\ln Q = \ln(A) + \alpha \ln(L) + \beta \ln(K).$$

Regression analysis uses data series to determine the relationship between a dependent variable (in this case $\ln Q$) and independent variables (in this case, the parameter technology, A, labor, L, and capital stock, K). In this analysis, a regression determines the coefficients for variables A, L, and K that best explain the behavior of variable $\ln Q$.

appears in the results as the coefficient for L, and α appears as the coefficient for K. Regression analysis was performed for a period of years both before and after privatization. The results yielded estimates for the α and β variables both before and after privatization, which illustrate changes in labor and capital productivity.

In running regressions before and after privatization, Q is measured as real GDP. L is an index for employment where 1987 is the base year. K is yearly amounts of capital stock calculated using the perpetual inventory method.

Results

The changes in productivity associated with privatization were tested using two approaches. In a structural stability test, regressions were performed in order to determine the values for the parameters α and β (the marginal productivities of labor and capital, respectively), both before and after privatization. A Chow breakpoint test, with the breakpoint equal to the year of privatization, determined if the changes in the coefficients were significant.

The second approach looked beyond the structural stability in order to determine whether or not privatization could be associated with a change in output. A regression was performed for the entire period 1972-1992 with an additional independent variable. The variable P, with a value of 0 in periods before privatization, and 1 both during and after privatization, was added as a dummy variable to represent privatization and to determine the relationship between privatization and output. A statistically significant positive value of the coefficient for P would indicate that privatization is associated with economic growth.

Twelve regressions were performed, three regressions for each country studied. One regression was performed for the period before privatization, and one regression was performed for the period during or after privatization to determine the changes in labor and capital productivity that are associated with privatization. A Chow test, next, confirmed whether or not these changes were statistically significant. A final regression

was performed for the entire period analyzed, adding the dummy variable to determine the effects of privatization on GDP.

Results: Chile

Table 1.1 illustrates factor productivities in Chile before and after the introduction of a privatization plan.

Table 1.1

Chile 1972 - 1985	Value	S Error	t-statistic	Prob.	R-Squared	0.258271
A Coefficient	0.218056	0.045603	**4.78167	0.0006	Adj. R-Squared	0.123411
K Coefficient	0.315711	0.181571	1.738777	0.1099	D-W Statistic	0.644024
L Coefficient	0.007776	0.388515	0.020014	0.9844	F-Statistic	1.915107
Chile 1985 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.954184
A Coefficient	0.291752	0.06753	**4.32032	0.0076	Adj. R-Squared	0.935857
K Coefficient	0.556843	0.136962	**4.06565	0.0097	D-W Statistic	1.65447
L Coefficient	-0.36814	0.294883	-1.24842	0.2671	F-Statistic	**52.0658

**significant at 0.95 level

According to Table 1.1, the marginal productivity of capital was not statistically significant from zero before privatization. After privatization, the marginal productivity of capital was positive and significant at the 0.95 level. Both before and after privatization, the marginal productivity of labor was not statistically significant. During both of the periods, technology had a statistically significant positive relationship with output.

The R-Squared value of 0.258 before privatization indicates that about 26% of the variation in output around its mean value was explained by the estimated equation. The

R-Squared value of 0.954 during the period after privatization indicates that about 95% of the variation in output around its mean was explained by the regression equation. In an F-test, the F-statistic is compared to a critical F value in order to test against the null hypothesis that all coefficients are not statistically significant from zero. In the period before privatization, the null hypothesis can not be rejected, yet after privatization, An F- test reveals with 0.95 certainty that not all coefficients are zero. The Durbin-Watson (D-W) statistic in the period before privatization indicates that there is no serial correlation. Serial correlation exists when there is a correlation between successive residuals (error terms) of the estimated equation. The D-W statistic for the period following privatization indicates that there may be some positive serial correlation. In this case, there may be a positive or direct relationship between the error terms of the estimated equation. Therefore, the R-Squared and F-tests indicate that the regression equation for the period following privatization was more accurate in explaining the data, yet the Durbin-Watson statistic may indicate some inflation of the t-scores in the estimation of the period following privatization.

Table 1.2 illustrates that results of a Chow Test, with the breakpoint set equal to 1985, the year its privatization initiative was introduced. The results of a Chow Breakpoint test confirm whether or not coefficients in regression equations are statistically significant from each other. In this case, the test will determine if the factor productivities are statistically significant from each other from the time before privatization to the period after privatization.

Table 1.2

Chile		F- statistic	2.601947
Breakpoint = 1985		Prob	0.090419

** significant at the 0.95 level

According to Table 1.2, the F-statistic is below a critical F-value of 3.18. Therefore, the breakpoint Chow test indicates that the change in the coefficients of the variables was not statistically significant at the 0.95 level. Therefore, the increase in capital productivity observed in Table 1.1 cannot be confirmed. According to Table 1.3, there was no significant change in any factor productivities in Chile between the period before privatization and the period after privatization.

Table 1.3 illustrates the results of the estimated equation for the entire period analyzed, and it includes the dummy variable P, which takes on values of zero before privatization and values of one for periods following privatization. This variable takes into account the relationship between privatization and total output.

Table 1.3

Chile 1972 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.829768
A Coefficient	0.237495	0.040522	**5.86082	0	Adj. R-Squared	0.799728
K Coefficient	0.124166	0.09734	1.275594	0.2193	D-W Statistic	0.549846
L Coefficient	0.417383	0.208716	1.999759	0.0618	F-Statistic	**27.6213
P Coefficient	0.125027	0.1086	1.151268	0.2656	Prob (F-stat)	0.000001

** significant at 0.95 level

According to Table 1.3, T-tests determine that only the coefficient for technology was statistically significant. The t-statistics for capital, labor, and privatization indicate that they are not statistically significant from zero. Therefore, no relationship was found to exist between privatization and output.

The R-Squared value of 0.829 indicates that about 89% of the variation in output around its mean was explained by the estimated equation. The Durbin-Watson statistic of 0.550 indicates some positive serial correlation, which indicates that a correlation exists

between the error terms of the estimated equation. This auto-correlation may account for some inflation of the t-statistics. Performing an F-test allows for the rejection of the null hypothesis that no coefficients are statistically significant from zero, with 0.95 confidence.

Results: Bolivia

Table 2.1 illustrates factor productivities in Bolivia before and after the introduction of a privatization plan.

Table 2.1

Bolivia 1972 - 1985	Value	S Error	t-statistic	Prob.	R-Squared	0.82803
A Coefficient	0.332309	0.03992	**8.32445	0	Adj. R-Squared	0.796762
K Coefficient	0.594583	0.050546	**11.7633	0	D-W Statistic	1.059958
L Coefficient	-0.02818	0.095691	-0.29454	0.7738	F-Statistic	**26.4822
						4
Bolivia 1985 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.740195
A Coefficient	-0.00835	0.0797	-0.10482	0.9206	Adj. R-Squared	0.636273
K Coefficient	-0.00558	0.216851	-0.02571	0.9805	D-W Statistic	2.591534
L Coefficient	0.986998	0.301146	**3.27747	0.022	F-Statistic	**7.12260
						3

**significant at the 0.95 level

According to Table 2.1, the marginal productivity of capital had a statistically significant positive value in the period before privatization. After privatization, however, capital productivity is not statistically significant from zero. In the period before privatization, the marginal productivity of labor was not statistically significant, yet after privatization, the labor productivity was positive and statistically significant. The

coefficient for technology was a statistically significant positive value before privatization, but after privatization, the coefficient was statistically insignificant. Therefore, in Bolivia, privatization can be associated with a decrease in the marginal productivity of capital and an increase in the marginal productivity of labor.

The R-Squared value of 0.828 in the period before privatization indicates that about 83% of the variation in output around its mean can be explained by the estimated equation. The Durbin-Watson statistic of 1.059 reflects that there is some positive serial correlation, which indicates that there is a correlation between successive residuals (error terms) in the regression equation. Positive serial correlation accounts for some inflation of the t-statistics. The F-statistic of 26.48 rejects the null hypothesis that all coefficients are equal to zero, with 0.95 confidence. The R-Squared value of 0.740 indicates that about 74% of the variation in output around its mean in the period following privatization can be explained by the regression equation. The Durbin-Watson statistic of 2.59 indicates that there may be some negative serial correlation in the residuals of the estimated equation, and it may account for some inflation of the t-statistics. In conducting an F-test, the F-statistic of 7.12 rejects the null hypothesis that all coefficients are zero.

Table 2.2 illustrates the results of a Chow test, with the breakpoint set equal to 1985. This test indicates if the coefficients of the independent variables before 1985 are different from the coefficients of the independent variables following 1985.

Table 2.2

Bolivia		F-statistic	**15.5499
			7
Breakpoint = 1985		Prob	0.000072

**significant at the 0.95 level

According to Table 2.2, the F-value is above a critical F of 3.18. The Chow Breakpoint test indicates that the factor productivities before privatization are statistically different from the factor productivities in the period following privatization, with 0.95 confidence. Therefore, according to Table 2.1, the decrease in capital productivity from a positive value to zero is statistically significant. Also, the increase in labor productivity from zero to a positive value is valid. Therefore, this Chow test indicates that decreases in capital productivity and increases in labor productivity are associated with the privatization initiative introduced in Bolivia in 1985.

Table 2.3 illustrates the factor productivities for the entire period analyzed, and it includes the dummy variable P, which is set equal to zero until 1985, and is equal to one following 1985. This variable indicates the relationship between privatization and output in Bolivia.

Table 2.3

Bolivia 1972 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.458208
A Coefficient	0.217921	0.06465	**3.37078	0.0036	Adj. R-Squared	0.362598
K Coefficient	0.41147	0.083729	**4.91436	0.0001	D-W Statistic	0.493442
L Coefficient	0.311494	0.158181	1.96923	0.0654	F-Statistic	**4.79245
P Coefficient	0.010056	0.08049	0.124934	0.902	Prob (F-stat)	0.013449

**significant at the 0.95 level

According to Table 2.3, the coefficient for technology was positive and statistically significant throughout the period analyzed. The marginal productivity of capital was also positive and statistically significant throughout the period. Labor productivity, however, was not statistically significant from zero. The coefficient for the dummy variable P was also statistically insignificant, indicating that there is no statistical relationship between

privatization and output. The R-Squared value of 0.458 indicates that about 46% of the variation in output during the period studied can be explained by the estimated equation. The Durbin-Watson statistic of 0.493 indicates that there is positive serial correlation, and there is a correlation between successive residuals of the regression equation. The F-statistic of 4.792 rejects the null hypothesis that all coefficients are equal to zero, with 0.95 confidence.

Results: Mexico

Table 3.1 illustrates factor productivities in Mexico before and after the introduction of a privatization plan.

Table 3.1

Mexico 1972 - 1982	Value	S Error	t-statistic	Prob.	R-Squared	0.998597
A Coefficient	-0.02715	0.011217	** -2.42058	0.0418	Adj. R-Squared	0.998246
K Coefficient	-0.53623	0.019941	** -26.8907	0	D-W Statistic	2.193676
L Coefficient	1.171515	0.043848	** 26.7173	0	F-Statistic	**2847.08
			4			5
Mexico 1982 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.80612
A Coefficient	0.044346	0.014532	** 3.05161	0.0158	Adj. R-Squared	0.757651
K Coefficient	-0.55581	0.17304	** -3.212	0.0124	D-W Statistic	0.933251
L Coefficient	1.196863	0.333142	** 3.59264	0.0071	F-Statistic	**16.6313
			7			6

**significant at the 0.95 level

According to Table 3.1, the coefficient for technology was positive and statistically significant in the period before privatization. After privatization, however, the coefficient was negative and statistically significant. The marginal productivity of capital was negative and statistically significant in the period before privatization, and after privatization, capital productivity decreased only slightly and remained statistically

significant. In the period before privatization, the marginal productivity of labor was positive and statistically significant, and after privatization, labor productivity increased only slightly and remained statistically significant. Overall, during the period analyzed, there was very little change in the coefficients representing capital and labor productivity. The coefficient for technology, however, experienced a dramatic change over the period studied.

The R-Squared value of 0.998 from the regression of the period before privatization indicates that almost 100% of the variation in output around its mean can be explained by the estimated equation. The Durbin-Watson statistic of 2.194 indicates there is no problem with serial correlation, and no correlation exists between successive residuals of the regression equation. An F-test of the regression for the period before privatization rejects the null hypothesis that all coefficients are equal to zero. The R-Squared value of 0.806 from the regression of the period following privatization indicates that about 81% of the variation in output around its mean can be explained by the regression equation. The Durbin-Watson statistic of 0.933 indicates that there is some positive serial correlation. Therefore, a correlation exists between error terms of the estimated equation. An F-test of the regression for the period following privatization rejects with 0.95 confidence the null hypothesis that all coefficients are zero.

Table 3.2 displays the results of a Chow test with a breakpoint at 1982, when privatization was implemented in Mexico.

Table 3.2

Mexico		F- statistic	**15.12927
Breakpoint = 1982		Prob	0.000083

**significant at the 0.95 level

According to Table 3.2, the F-value is above a critical F of 3.18. The Chow Breakpoint test proved that the change in the coefficients of the independent variables was significant at the 0.95 level between the period before privatization and the period after privatization. However, the marginal productivities of labor and capital changed very little between the two periods. The significant change of the coefficients in the estimated equations most likely reflects the coefficient for technology going from a significant positive value to a significant negative value.

Table 3.3 illustrates the results of the estimated equation for the entire period analyzed, and it includes the dummy variable P which takes into account the relationship between privatization and output.

Table 3.3

Mexico 1972 - 1992	Value	S Error	t-statistic	Prob.	R-Squared	0.981999
A Coefficient	0.054188	0.033703	1.60781	0.1263	Adj. R-Squared	0.978822
K Coefficient	-0.40041	0.064768	** -6.18226	0	D-W Statistic	0.756882
L Coefficient	0.869247	0.141325	** 6.15069	0	F-Statistic	**309.125
P Coefficient	0.063084	0.023012	** 2.74136	0.0139	Prob (F-stat)	0

**significant at the 0.95 level

According to Table 3.3, the coefficient for technology is not statistically significant from zero. The marginal productivity of capital has a value of -0.40, and is significant at the 0.95 level. The marginal productivity of labor is 6.15, and it is statistically significant. The coefficient for privatization is positive and statistically significant, which indicates that an increase in total output is associated with privatization. The R-Squared value of 0.982 indicates that about 98% of the variation in output around its mean throughout the period analyzed can be explained by the regression equation. The Durbin-Watson

statistic indicates that there is some positive serial correlation, and there is, therefore, a correlation between the residuals of the estimated equation. This serial correlation may account for some inflation of the t-statistics. The F-statistic rejects the null hypothesis that all of the coefficients are not statistically significant from zero.

Results: Jamaica

Table 4.1 examines the productivities of labor and capital both before and after a privatization plan was introduced in Jamaica.

Table 4.1

Jamaica 1972-1980	Value	S Error	t-statistic	Prob.	R-Squared	0.950441
A Coefficient	0.013762	0.01239	1.11071	0.3092	Adj. R-Squared	0.933922
K Coefficient	0.390567	0.052939	**7.37769	0.0003	D-W Statistic	2.099268
L Coefficient	0.049159	0.14949	0.328846	0.7534	F-Statistic	**57.5344
Jamaica 1980-1991	Value	S Error	t-statistic	Prob.	R-Squared	0.737655
A Coefficient	0.047211	0.032989	1.431102	0.1862	Adj. R-Squared	0.679357
K Coefficient	0.230908	0.035163	**6.56671	0.0001	D-W Statistic	0.771111
L Coefficient	0.500875	0.102275	**4.89733	0.0009	F-Statistic	**12.6530

**significant at the 0.95 level

According to Table 4.1, the coefficient for technology was not statistically significant from zero in either period of the analysis. The marginal productivity of capital decreased from a statistically significant value of 0.39 to statistically significant value of 0.23. Labor productivity increased from a statistically insignificant value to a significant value

of 4.90. Overall, in Jamaica, privatization was associated with a very small decrease in capital productivity, and a large increase in labor productivity.

The R-Squared value of 0.950 in the period before privatization indicates that about 95% of the variation in output around its mean can be explained by the estimated equation. The Durbin-Watson statistic of 0.757 indicates that there is some positive serial correlation, and this correlation of the residuals of the regression may account for some inflation of the t-statistics. An F-test rejects the null hypothesis with 0.95 confidence that all coefficients are equal to zero. The R-Squared value of 0.738 for the period following privatization indicates that about 74% of the variation in output around its mean can be explained by the estimated equation. The Durbin-Watson statistic indicates that there is some positive autocorrelation, and the correlation of the error terms of the regression may cause some inflation of the t-scores. An F-test rejects the null hypothesis that all coefficients are not statistically significant from zero with 0.95 confidence.

Table 4.2 displays the results of a Chow test with a breakpoint at 1980, when privatization was implemented in Jamaica.

Table 4.2

Jamaica		F-	**5.620605
		statistic	
Breakpoint = 1980		Prob	0.001241

**significant at the 0.95 level

According to Table 4.2, the F value was above a critical F of 3.18. This Chow test indicates that the change in the variables of the coefficients of the regression equation was significant at the 0.95 level. The coefficient for technology remained insignificant throughout the period analyzed, and the change in capital productivity was very small. There was, however, a rather large jump in the productivity of labor from an insignificant

value to a rather large statistically significant value. The Chow test indicates that there was a significant increase in the productivity of labor between the period before privatization and the period following privatization.

Table 4.3 examines the marginal productivities of labor and capital throughout the period analyzed, and it incorporates the variable P to detect a relationship between privatization and output.

Table 4.3

Jamaica 1972-1991	Value	S Error	t-statistic	Prob.	R-Squared	0.754556
A Coefficient	-0.01195	0.023142	-0.51656	0.6125	Adj. R-Squared	0.708535
K Coefficient	0.187537	0.019843	**9.4508	0	D-W Statistic	1.380673
L Coefficient	0.620765	0.05844	**10.6223	0	F-Statistic	**16.3959
P Coefficient	0.080341	0.032983	**2.43582	0.0269	Prob (F-stat)	0.000039

** significant at the 0.95 level

According to Table 4.3, the coefficient for technology was statistically insignificant throughout the period analyzed. The marginal productivity of capital had a statistically significant value of 0.188. Labor productivity had a statistically significant value of 0.621 throughout the period studied. Because the coefficient for privatization had a statistically significant positive value, a direct relationship was proven to exist between privatization and output. The R-Squared value of 0.755 indicates that about 76% of the variation in output around its mean can be explained by the estimation equation. The Durbin-Watson statistic of 1.38 indicates that there may be some positive serial correlation, and a correlation between the residuals of the regression may account for some inflation of the

t-statistics. An F-test rejects the null hypothesis that all coefficients are not statistically significant from zero with 0.95 confidence.

Conclusions

This analysis of productivity changes associated with privatization yielded mixed results. The case study of Chile found that the changes in the coefficients between the period before privatization and the period following privatization were not statistically significant at the 0.95 level according to a Chow test. Therefore, factor productivities in Chile were unaffected by privatization at the macroeconomic level. Also, privatization was found to have no statistical relationship with total output, such that privatization can not be associated with economic growth.

The case study of Bolivia found that the marginal productivity of capital decreased, while the marginal productivity of labor increased. A Chow test confirmed that the changes in the coefficients in the estimated equations were significant at the 0.95 level. Therefore, the decrease in capital productivity and the increase in labor productivity were statistically significant changes. Privatization in Bolivia was found to have no statistical relationship with total output, such that privatization can not be associated statistically with economic growth.

In Mexico capital and labor productivity changed only slightly, while the coefficient for technology changed from a statistically significant negative value to a significant positive value. The Chow test confirmed that the change in the coefficients was significant; however, this result is probably reflective of the large change in the technology coefficient, rather than the small changes in the factor productivities. In Mexico, a positive statistical relationship was found to exist between privatization and output, such that privatization is associated with economic growth.

In Jamaica the marginal productivity of capital decreased slightly between the period before privatization and the period following privatization. In both analyses, capital

productivity remained positive and statistically significant. The marginal productivity of labor, however, increased dramatically from a statistically insignificant value to a positive significant value. The Chow test confirmed that the change in the coefficients of the regression equation was significant between the period before privatization and the period following privatization. This result is most likely reflective of the dramatic increase in labor productivity. In Jamaica, a significant positive relationship was found to exist between privatization and output, such that privatization is associated with economic growth.

Privatization was only, therefore, associated with an increase in labor productivity in Bolivia and Jamaica, and a decrease in capital productivity in Bolivia. Privatization can be associated with economic growth, however, in Mexico and Jamaica. Of the four case studies, no country exhibited increases in both labor and capital productivity.

This analysis had three large obstacles to overcome: the omission of many other economic variables, lack of values for capital employment, and the difficulty of attempting to observe macroeconomic ramifications of a microeconomic phenomenon. This study does not take into account many significant economic factors which also have an effect on output. Variables such as the rate of inflation (or hyperinflation in many instances), the exchange rate, and the level of government spending certainly have an impact on a country's total output; however, by adhering to the Cobb-Douglas Production function, these variables were purposely omitted. This omission is particularly apparent in the case of Mexico, where privatization has a statistically significant positive relationship with output, yet there was no large change in factor productivities. These mixed results indicate that a variable other than labor or capital may be affecting output.

In this analysis, a significant decrease in the marginal productivity of capital was associated with privatization. One possible explanation for this significant decrease is the lack of data for capital employment. This analysis utilizes the variable L , which is an

index for labor employment. The variable K, however, indicates the amount of capital stock rather than the amount of capital employed. This problem would have also arisen if the variable L were represented by population rather than an employment index. Just as output is not necessarily a function of the population, it is not determined by the amount of available capital stock. This discrepancy can account for the observed decreases in capital productivity.

In all of the cases, this analysis attempts to isolate shifts in macroeconomic data that results from changes within individual firms. Theoretically, these individual firms should experience increases in factor productivities as they are privatized, yet the same notion does not necessarily hold true for the economy as a whole. In order for the increases in factor productivities to be observed at the macroeconomic level, the privatization initiative must encompass an extraordinarily large number of firms that account for a significant percentage of total output.

This analysis proves that changes in factor productivities and total output associated with privatization are not necessarily observable at the macroeconomic level; although, theoretically, productivity changes should be observed at the level of the individual firm. The goal of a private firm is profit maximization. In order to increase profits, a firm must lower total costs relative to total revenue. Raising the productivities of inputs increases marginal revenues relative to marginal costs, and thus increases efficiency. While this increase in efficiency would be easily observed within an individual firm, increased efficiency is not necessarily observed in the economy as a whole.

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