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**PUBLIC CAPITAL FORMATION AND
PRIVATE SECTOR PERFORMANCE:
THE EXPERIENCE OF
SELECTED CARIBBEAN COUNTRIES**

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Experience of Selected Caribbean Countries

by

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The purpose of this paper is to empirically assess the impact of public capital investment on private sector performance. In keeping with the Aschauer (1989), and Munnell (1990a, 1990b) studies, this paper tests the hypothesis that as public capital investment increases private sector output expands. According to Aschauer, such an outcome is to be expected for at least two reasons. First, with the expansion in public investment expenditures, more intermediate services such as highways and roads, export facilities, electric power systems, water and sewer systems etc. become available to private sector firms which enables them to produce more output. Second, apart from this increase in the marginal product of public capital, it is also suggested that the marginal productivity of private capital would rise as public investment increases. To the extent that this occurs, it is expected that the rate of return to private capital would rise thereby stimulating private capital formation. As a result, it is anticipated that economic activity would be enhanced. To test the public capital hypothesis, pooled data for Barbados (BDS), Trinidad and Tobago (TT), and Jamaica (JA) for the period 1977-1990 are utilized. With the output to capital ratio in the private sector and the public capital to private capital ratio either remaining steady or trending downward in TT and JA, and with the ratios increasing in BDS, the experience of the three countries should be instructive in evaluating the public capital hypothesis.

The rest of the paper is organized as follows. Section 1 presents a simple model linking public capital expenditures to private sector performance. Section 2 then presents the empirical results derived from estimating the model in the previous

section. For that exercise, pooled data for BDS, TT and JA are utilized. Finally, Section 3 summarizes the main points of the study.

Section 1. Model

The theoretical underpinning for the analysis in this paper is provided by the aggregate production function,

$$(1) \quad Y_t = A_t * f(N_t, K_t, KG_t),$$

where Y_t = real output of goods and services in the private sector, N_t = the aggregate employment of labor, K_t = the private stock of capital, KG_t = the public stock of capital, and A_t = index of multifactor productivity or Hicks neutral technological change. By expressing equation (1) in logarithmic form and by assuming constant returns to scale for all inputs the following generalized Cobb-Douglas production function is derived:

$$(2) \quad y - k = a_0 + a_1 * (n_t - k_t) + a_2 * (kg_t - k_t)$$

where a_0 = a constant term, a_1 , and a_2 = the partial elasticity of the output to capital ratio in the private sector with respects to the labor-capital ratio and the ratio of public to private capital. The lower case variables represent the logarithmic values of the upper case variables.

In equation (1), the variable, KG_t , is included because the government is associated with the provision of a variety of capital goods and services. Based on public finance theory, the government is expected to provide capital goods as well as other services in instances where the private market system is either unwilling or unable to do so. One factor contributing to this state of affairs is the inability of

producers to withhold 'public goods' from those individuals who have not paid for the goods. Even in those instances where exclusion is possible, the government may nevertheless decide to provide the good as a means of curbing the monopoly power of private producers. Monopoly power can rise when there are substantial economies of scale associated with production.

Section 2. Empirical Analysis and Results.

To test the public capital hypothesis, pooled data for Barbados, Trinidad and Tobago, and Jamaica for the period 1977-1990 were used. The data were obtained from the International Monetary Fund, International Financial statistics; Inter-America Development Bank, Economic and Social Progress in Latin America; International Labour Organization, Yearbook of Labour Statistics; and the World Bank, Coping With Changes in the External Environment, Report No. 12821 LAC.

In an overview of the key macroeconomic variables for this study, the data reveal that the public capital to private capital ratio contracted in TT while it remained fairly steady in JA during the period 1977-1990. As shown in table 1, the decline in the public capital-private capital ratio has averaged about 37% annually in the case of TT. For this country, most of the decline in the ratio of public capital to private capital is linked to persistently sharp contractions in public capital expenditures. As a matter of fact, in 1980, public investment amounted to 19.7% of GDP. But by 1990, however, the share of public investment in GDP had fallen to 1.6% of GDP. For Jamaica, the growth rate for the public capital-private capital ratio is statically insignificant. This would suggest that the growth in public capital expenditures has

been matched quite closely by a similar rate of growth in private capital expenditures. In spite of this result, it is instructive to observe that Jamaica has also experienced severe budgetary problems over the period 1977-1990. As a result, the authorities have cut expenditures for investment purposes in order to reduce the size of the government's budget deficit. This decline in expenditures for investment purposes is reflected in the contraction of the share of public investment in GDP from 14.8% in 1981 to 6.7% in 1990. In contrast to the experiences of TT and JA, the public capital-private capital ratio in Barbados grew at an average annual rate of 10.1%. Although much of this growth is associated with the expansion of public capital expenditures, the consistency of fiscal policy over time has helped to keep the public investment to GDP ratio fairly stable. Throughout the 1980's public investment as a percent of GDP has ranged from a low of 6% to a high of 9.0%.

In all three countries, the performance of the private sector of the economy has mirrored the behavior of the public capital-private capital ratio. In TT and JA where the ratio of public to private capital has trended downward, the output to capital ratio in the private sector of the economy also fell. In BDS, however, given the increase in the public to private capital ratio, there was moderate growth in the private sector output to capital ratio. For the three countries individually a simple correlation coefficient was computed for the two variables $(y-k)$ and $(kg-k)$. According to the results reported in table 2, there is a significant direct relationship between the two variables.

When multiple regression analysis, that is ordinary least squares with dummy

variables, is applied to the pooled data for the three countries, results supporting the public capital hypothesis are similarly generated. As reported in table 3, there is a positive relationship between output per unit of capital in the private sector and the public capital-private capital ratio on the one hand and the private labor to capital ratio on the other hand. The analysis suggests that a 1% increase in the labor-capital ratio generates a 0.84% increase in output per unit of capital in the private sector. A 1% increase in the public to private capital ratio meanwhile raises the private output to capital ratio by 0.11%. Figures 1, 2, and 3 highlight the relationship between $(y-k)$ and $(kg-k)$.

With increases in public capital expenditures expected to increase productivity in the private sector, the model is further tested by regressing measures of total factor productivity on public capital expenditures adjusted by each of the other inputs in the production process weighted by the corresponding factor shares, that is:

$$(3) \quad p_t = b_0 + b_1 * (kg_t - i_t)$$

where p = total factor productivity = private sector output adjusted for the inputs of labor and private capital weighted by their corresponding factor share; i = the sum of the inputs of labor and private capital weighted by their corresponding factor share. As table 4 shows, there is a positive relationship between total factor productivity and the public capital to private inputs ratio. Based on these results one would expect a 1% increase in the public capital-private inputs ratio to increase productivity by 0.11%. Figures 4, 5, and 6 show the behavior of productivity in the three countries. The graph for BDS shows an overall upward trend in productivity. The graph for TT,

meanwhile, shows a steady decline in productivity over the period 1980-1989. In Jamaica the data suggest that between the period 1977-1981, productivity fell quite sharply. But starting from 1982, productivity has steadily improved.

Section 3. Summary

This study on the impact of public capital formation on private sector performance makes two points. First, it indicates that there is a direct relationship between the ratio of public capital to private capital and the output to capital ratio for the private sector in the economies of BDS, TT and JA. Second, it indicates that productivity is also positively affected by increases in the public capital to private inputs ratio. For the three countries examined in this study, the evidence suggests that productivity has grown quite steadily in BDS. For TT, the evidence suggests that productivity has declined consistently for most of the 1980's. While for JA, productivity after declining and reaching a low in 1981-82 has steadily increased since that time.

References

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**TABLE 1: ANNUAL AVERAGE GROWTH RATES FOR SOME SELECTED
MACROECONOMIC VARIABLES (FIGURES IN PERCENT)**

<u>VARIABLES</u>	<u>BDS</u>	<u>TT</u>	<u>JA</u>
(kg - k)	10.10 (3.12)	-37.36 (-4.75)	-2.38* -0.49
(y - k)	5.73 (3.19)	-15.45 (-1.80)	-6.47 (-2.78)
(n - k)	3.56 (2.37)	-12.15* (-1.35)	-6.59 (-2.08)
p	2.46 (4.59)	-3.86 (-6.07)	0.24* (0.23)

Note: Figures in parentheses are the t-statistics. The asterik indicates that the estimated coefficient as statistically insignificant.

TABLE 2: SIMPLE CORRELATION COEFFICIENTS
FOR THE VARIABLES (y-k) AND (kg-k)

<u>Country</u>	<u>Simple</u> <u>Correlation Coefficient</u>
Barbados	0.83 (5.15)
Trinidad and Tobago	0.85 (5.15)
Jamaica	0.80 (4.61)

The figures in parentheses below the correlation coefficient are the t-statistics. The asterisk indicates that the computed value for the correlation coefficient is statistically significant at the 1% level.

TABLE 3: ESTIMATED COEFFICIENTS FOR EQUATION (2).

<u>VARIABLES</u>	<u>GROWTH EQUATION (2)</u>
CONSTANT	4.18 (13.32)
(kg-k)	0.11 (4.08)
(n-k)	0.84 (21.37)
D1	0.06 (1.22)
D2	0.78 (13.34)
R ²	0.97
F-statistic	443.27
S. E. of Regression	0.13

Notes: The variables D1, D2, represent country dummy variables.
R² stands for the coefficient of determination. S. E. Stands
for standard error. The figures in parenthesis are the t-statistics.

TABLE 4: ESTIMATE COEFFICIENTS FOR EQUATION (3).

<u>VARIABLES</u>	<u>GROWTH IN PRODUCTIVITY EQUATION (3).</u>
CONSTANT	8.74 (43.37)
(kg-i)	0.11 (4.40)
D1	-0.26 (-5.16)
D2	0.67 (12.75)
R ²	0.93
F-statistic	187.42
S. E. of Regression	0.12

Notes: The variables D1, and D2 represent country dummy variables.
R² stands for the coefficient of determination. S. E stands for
standard error. The figures in parenthesis are the t-statistics.

FIGURE 1: BARBADOS' OUTPUT AND PUBLIC CAPITAL PER UNIT OF PRIVATE CAPITAL

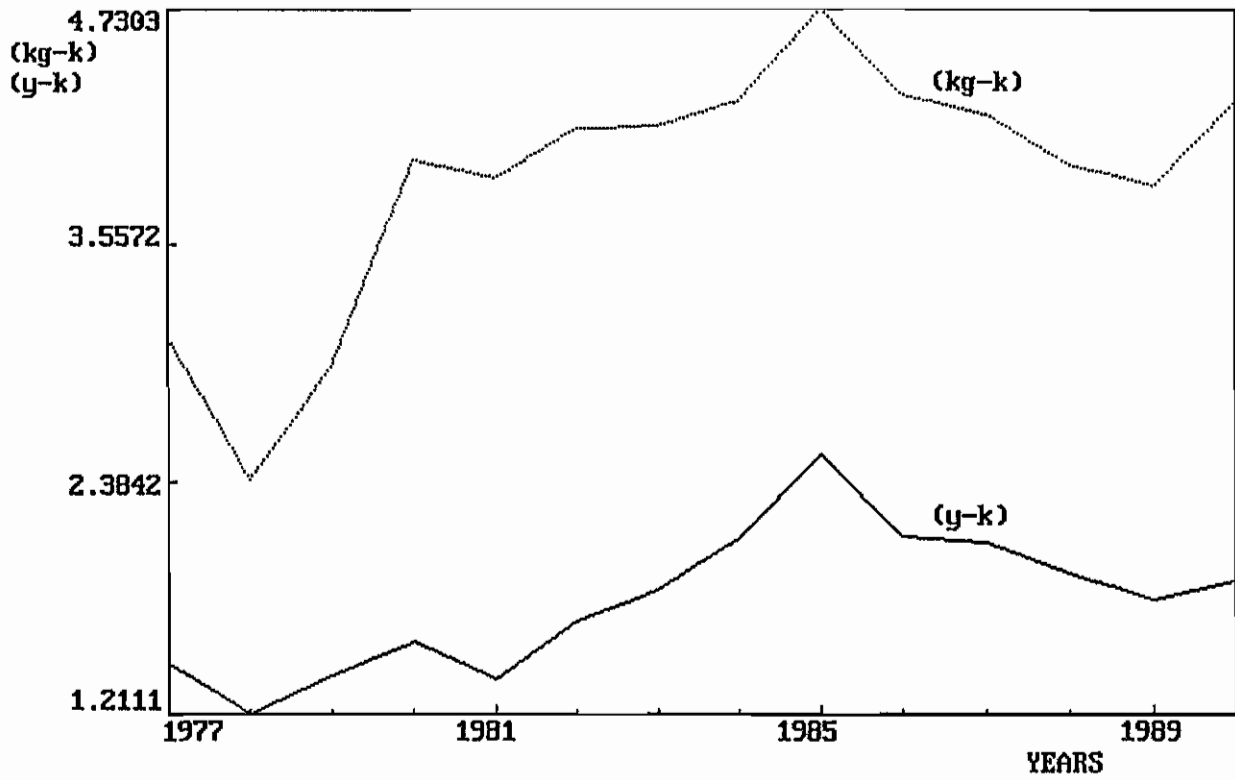


FIGURE 2: TRINIDAD AND TOBAGO'S OUTPUT AND PUBLIC CAPITAL PER UNIT OF PRIVATE CAPITAL

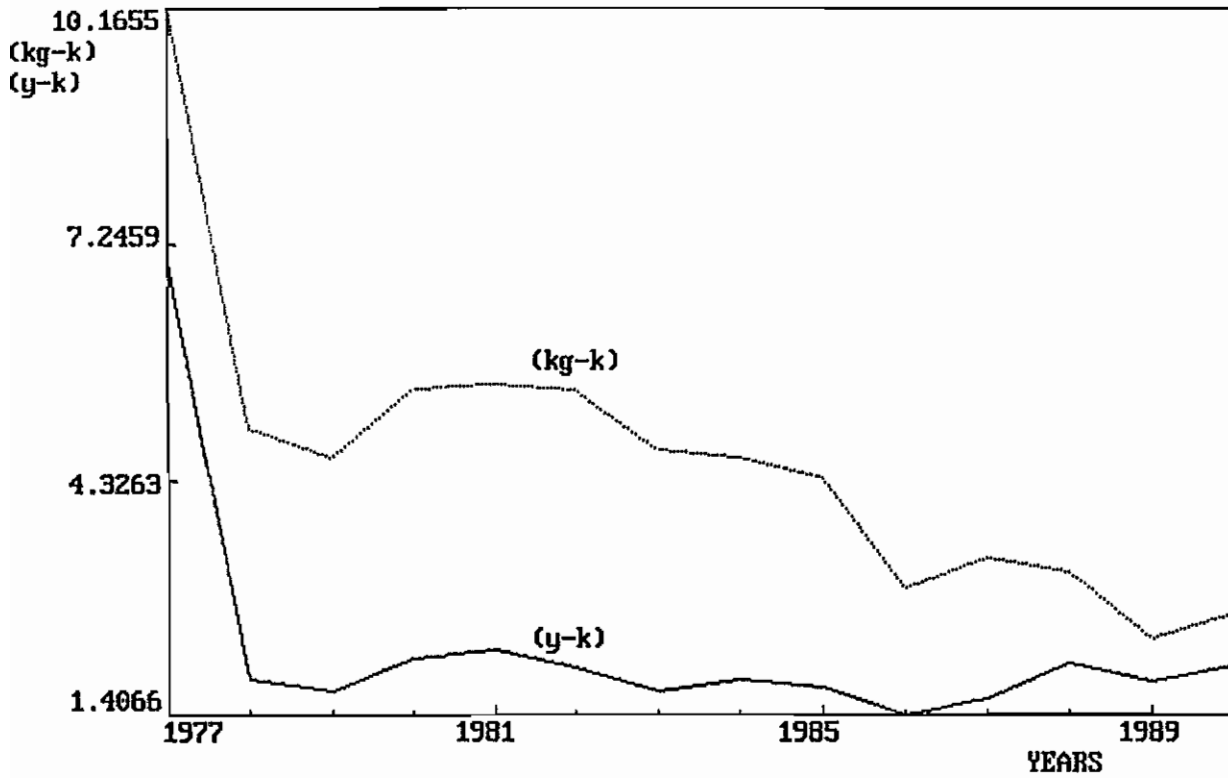


FIGURE 3: JAMAICA'S OUTPUT AND PUBLIC CAPITAL PER UNIT OF PRIVATE CAPITAL

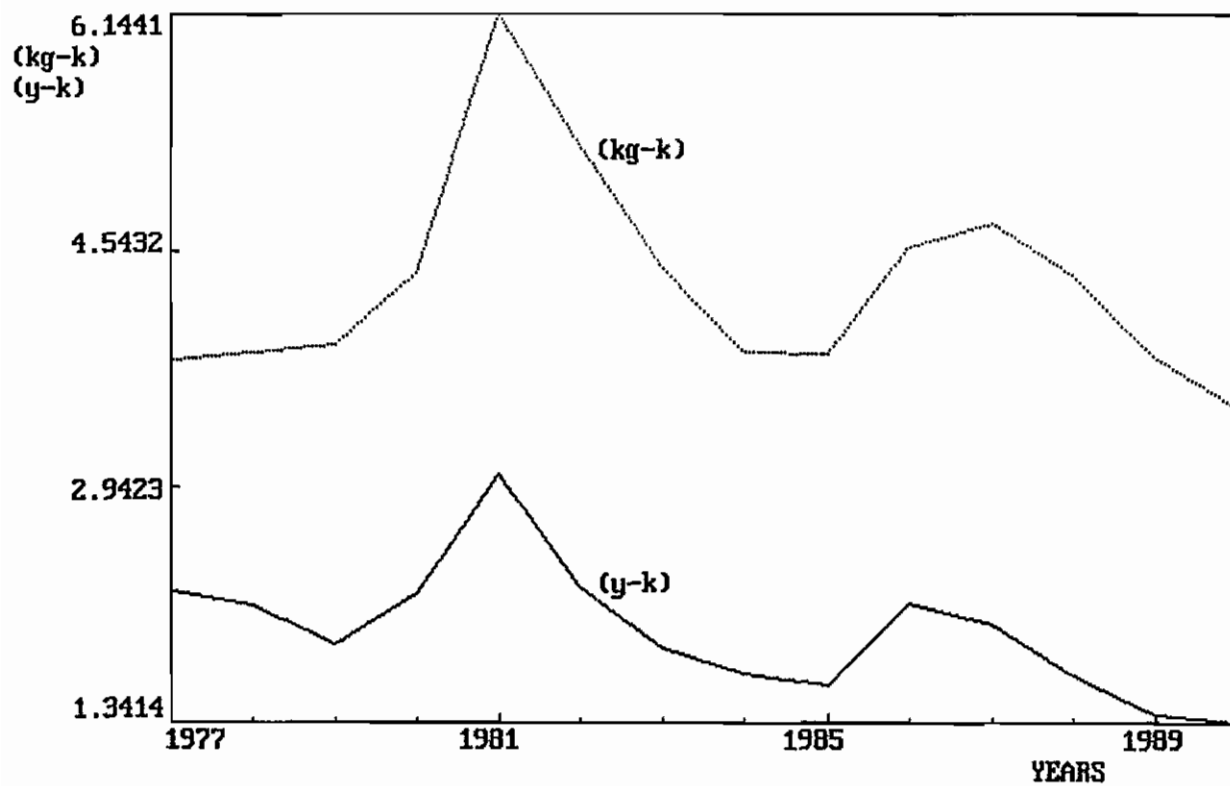


FIGURE 4: BARBADOS' PRODUCTIVITY INDEX



FIGURE 5: TRINIDAD AND TOBAGO'S PRODUCTIVITY INDEX

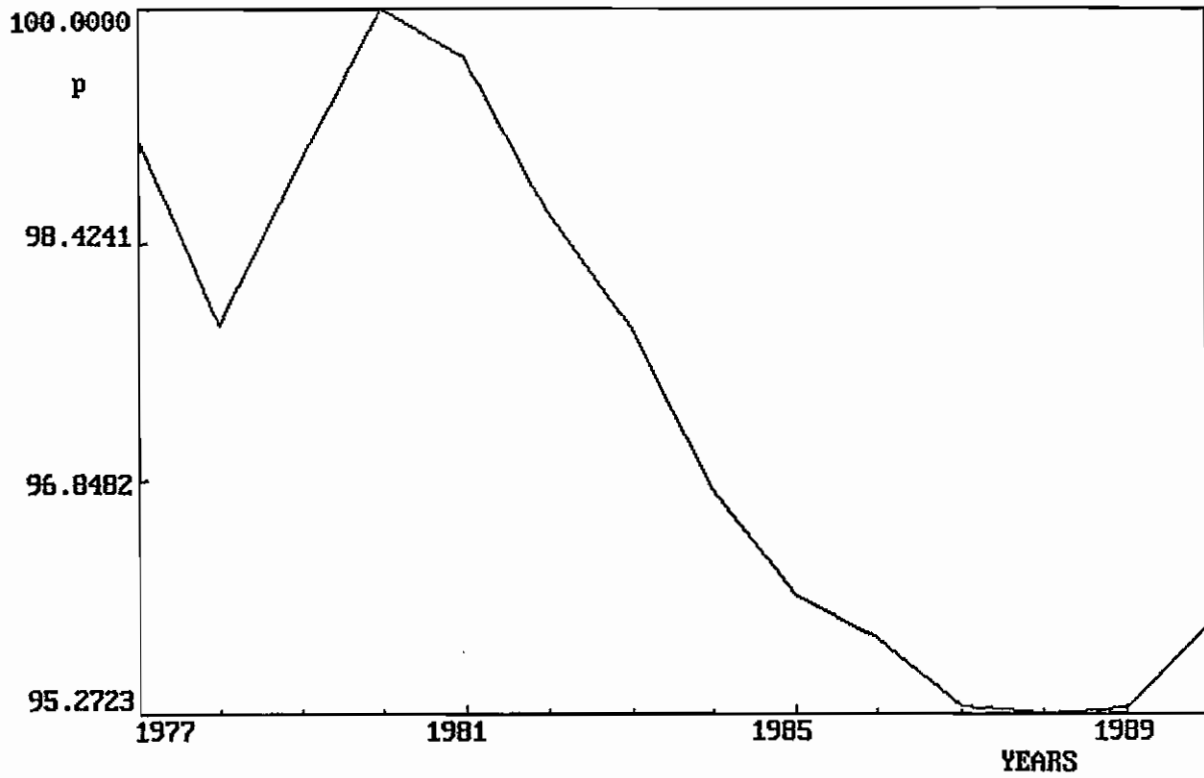


FIGURE 6: JAMAICA'S PRODUCTIVITY INDEX

