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Public Education Expenditure and Other Determinants of Private Investment in the Caribbean

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Abstract

This paper presents an analysis of the determinants of private investment in the Caribbean region, using data for the 1977-91 time period. Drawing on the endogenous growth literature, a model is developed to capture the impact of public education expenditure on private sector capital formation. The implications of this model are tested in the context of an econometric model assessing the impact of education and other variables on the share of private investment in GDP. The empirical results reveal that public education outlays, as well as economic growth, have a significant effect on private capital formation. Public investment has a negative effect on private investment, while real interest rates and external debt burdens are found to have no statistically significant impact on private investment.

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E22, H52, 054

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Summary

This paper analyzes the determinants of private investment in the Caribbean region, using data for 1977-91. Drawing on the endogenous growth literature, it develops a model to capture the impact of public education expenditures on private sector capital formation. The implications of this model are tested in the context of a simple econometric model that evaluates the impact of education expenditures and other variables on the ratio of private investment to GDP.

Confirming the implications of the theoretical model, the econometric results reveal that public education expenditures appear to have a significant effect on private investment. Ceteris paribus, a country that sustains a 1 percentage point increase in the ratio of public education expenditures to GDP would experience an increase of 1 percentage point in the private investment/GDP ratio. The econometric results also show that economic growth has a positive impact on the share of private investment in GDP, with a 1 percentage point increase in economic growth rates being associated with an increase of 1 1/2 percentage points in the private investment/GDP ratio. Public investment has an adverse effect on private sector capital formation, even when central government capital expenditure is used as a measure of public investment. Real interest rates and external debt burdens are found to have no statistically significant relationship with private investment rates. The insignificance of the external debt overhang may reflect the highly concessional nature of much of the foreign debt held by Caribbean countries.

Correlation analysis reveals that both private and total investment rates are high in countries that mobilize a large amount of national savings. High national savings, in turn, are associated with low budget deficits. Countries with the highest growth in the region tended to have high rates of national savings and private investment, relatively low budget deficits and external debt, and relatively high real interest rates.

I. Introduction

Economists have long recognized the importance of physical capital accumulation in the growth process of less developed countries (LDCs). The sharp downturn in economic growth in the 1980s and the accompanying fall of investment rates have sparked renewed interest in the determinants and effectiveness of investment in LDCs. The issue is of particular interest in the Caribbean, in view of the special encouragement provided under the Caribbean Basin Initiative for investment by U.S. firms in the region.

Despite the central role of capital accumulation in the development process, there has been only a modest amount of theoretical and empirical research on the subject. Furthermore, the theoretical debate has not led to agreement on the correct form of the investment function. As such, the emphasis in most works has been to assess, using econometric techniques, the impact of various macroeconomic and policy variables on private investment in LDCs (Tun-Wai and Wong, 1982; Blejer and Khan, 1984, 1985; Cardoso, 1990; Greene and Villanueva, 1991). A key issue in many of these studies has been the role of public investment in either promoting or deterring private investment. However, none of these studies incorporates the effect of government education expenditure on investment, despite the growing awareness of the role of education in fostering economic growth (Lucas, 1988; Romer, 1988; Barro, 1990, 1991).

Relatively little empirical work has been done on the factors determining investment in the Caribbean economies. One attempt was that of Blejer and Khan (1985), which analyzed the determinants of private investment in nine Caribbean Basin countries (Barbados, Costa Rica, the Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Panama, and Trinidad and Tobago). The Blejer and Khan study provides important insights for understanding the process of private investment in some of the larger economies of the Caribbean; nevertheless, the findings may be of less use in identifying the determinants of investment in the smaller island economies of the region that the study did not cover.

This paper presents an analysis of the determinants of private investment in the Caribbean region, using data for the period of 1977-91. 1/ The study covers both the larger Caribbean countries, including the Dominican Republic, Guyana, Haiti, Jamaica, and Trinidad and

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1/ In addition to econometric modelling, correlation analysis is used in section IV.3 of the paper to explore some observed patterns in the data. The paper utilizes data from the Government Finance Statistics (GFS) and World Economic Outlook (WEO) databases, as well as figures provided by national authorities, IMF staff estimates, and UNESCO's Statistical Yearbook.

Tobago, and the smaller countries of Barbados, Belize, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. 1/2/

An additional contribution of this paper is the presentation of a model that captures the effect of public education expenditure on private sector capital formation. The implications of the model are then tested in the context of an econometric model assessing the determinants of private investment in the Caribbean.

The paper is structured as follows. First, a macroeconomic overview of the Caribbean region is provided. In this section we also describe education and investment performance in the region. Second, previous research on the determinants of private investment is reviewed, along with the presentation of a model that attempts to capture the impact of public education expenditure on private sector capital formation. Third, an econometric model of the determinants of private investment rates in the Caribbean is presented, along with the statistical results from the model. Results from correlation analysis of investment, savings and economic growth are also provided in this section. A final section concludes the paper by reviewing the most salient results of the study.

II. Economic Performance in the Caribbean

1. Macroeconomic overview

In order to facilitate our discussion, the Caribbean economies are organized into two groups: the smaller countries (Barbados, Belize, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines), and the larger countries (the Dominican Republic, Guyana, Haiti, Jamaica, and Trinidad and Tobago).

As Table 1 indicates, the Caribbean countries exhibit considerable differences in population size, living standards, and recent economic performance. Of particular interest is the sharp divergence in economic performance in the period under review. For the most part, the smaller economies prospered in the 1980s, while the larger economies languished. On average, the typical smaller country grew at an annual rate of 4.6 percent, while the larger countries experienced either a decline in real GDP over the time period (Guyana, Trinidad and Tobago) or very low growth (Jamaica, Haiti). The sole exception to this poor growth performance of larger countries was the Dominican Republic. Along with low economic growth, the larger countries experienced higher inflation and larger budget deficits (Table 2). The external environment was also more difficult for the larger economies (excepting Trinidad and Tobago and the Dominican Republic), with

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1/ The division of countries into these two categories was based on 1990 population figures.

2/ Data for Belize are for the 1979-91 period; Dominica, 1978-91; Grenada, 1978-91; Guyana, 1977-89; St. Kitts and Nevis, 1980-91.

Table 1. Population Size and Economic Output in the Caribbean

	1990 Population (thousands)	1990 GDP/Capita (US$)	Real GDP Growth (annual avg. in percent) 1977-91 1/
Larger Caribbean Countries	3,626	1,404	0.2
The Dominican Republic	7,161	921	2.4
Guyana	754	312	-2.3
Haiti	6,522	332	0.4
Jamaica	2,478	1,430	1.1
Trinidad & Tobago	1,215	4,026	-0.8
Smaller Caribbean Countries	129	2,884	4.6
Barbados	250	6,997	2.1
Belize	189	1,822	5.5
Dominica	83	2,057	4.2
Grenada	95	2,153	4.4
St. Kitts & Nevis	46	3,195	5.2
St. Lucia	132	2,143	4.9
St. Vincent & the Grenadines	108	1,822	6.1

Source: National authorities; World Economic Outlook database; and IMF staff estimates.

1/ Data for Belize are for the 1979-91 period; Dominica, 1978-91; Grenada, 1978-91; Guyana, 1977-89; St. Kitts and Nevis, 1980-91.

worsening terms of trade for mineral exporters such as Jamaica and Guyana; in contrast, the terms of trade for most of the smaller countries (which rely heavily on tourism for their export earnings) improved. The larger economies also carried heavier external debt burdens. This systematic pattern across countries was also manifested in larger countries experiencing lower real interest rates (except Haiti). Private and foreign savings were higher, on average, in the smaller Caribbean countries, although there was consideration variation in these variables within each country group. 1/ In sum, economic performance varied considerably between the large and small economies of the region.

1/ Private savings are defined as national savings minus the central government's current fiscal balance (revenues and grants minus current expenditures). A difficulty in computing private savings with the data used in our study is the possible misclassification of grants as government financing.

Table 2. Macroeconomic Indicators in the Caribbean, 1977-91 1/

	Inflation 2/	FB/GDP 3/	CFB/GDP 4/
		(In percent)	
Larger Caribbean Countries	17.6	-10.2	-2.7
The Dominican Republic	23.7	-1.1	4.5
Guyana	24.6	-34.9	-24.8
Haiti	8.7	-3.6	2.1
Jamaica	19.6	-8.6	0.2
Trinidad & Tobago	11.4	-2.9	4.4
Smaller Caribbean Countries	6.5	-4.8	5.4
Barbados	7.6	-4.5	1.9
Belize	3.3	-3.4	6.5
Dominica	8.0	-4.8	9.0
Grenada	8.3	-8.7	11.2
St. Kitts & Nevis	4.9	-5.8	3.1
St. Lucia	6.3	-2.8	3.3
St. Vincent & the Grenadines	7.3	-3.4	3.0

	Terms of Trade 5/	Debt/ GDP 6/	Debt Service/ Exports 7/
Larger Caribbean Countries	0.4	91.2	20.0
The Dominican Republic	3.0	49.2	19.2
Guyana	-2.1	258.9	21.3
Haiti	0.2	32.2	14.1
Jamaica	-1.6	86.3	31.7
Trinidad & Tobago	2.3	29.5	13.9
Smaller Caribbean Countries	0.7	29.9	5.0
Barbados	0.6	25.5	7.8
Belize	2.2	42.5	6.1
Dominica	1.0	35.9	5.4
Grenada	1.4	35.7	5.5
St. Kitts & Nevis	1.9	23.0	4.0
St. Lucia	-2.4	21.7	2.1
St. Vincent & the Grenadines	0.3	25.0	4.4

1/ Unless otherwise noted, data for Belize are for the 1979-91 period; Dominica, 1978-91; Grenada, 1978-91; Guyana, 1977-89; St. Kitts and Nevis, 1980-91.

2/ Average annual change in the Consumer Price Index.

3/ Ratio of fiscal balance of the central government (FB) to GDP, with a negative sign indicating a deficit.

4/ Ratio of central government current fiscal balance (CFB) to GDP, calculated as revenues and grants minus current expenditure divided by GDP for 1980-1991, except for Guyana (1980-89).

5/ Average annual percentage change in the merchandise terms of trade.

6/ Average annual value of external debt as a percent of GDP.

7/ Average annual value of debt servicing (interest and principal) as a percent of exports.

Table 2 (continued) Macroeconomic Indicators in the Caribbean, 1977-91

	REALI 8/	PS/GDP 9/	FS/GDP 10/
Larger Caribbean Countries	-7.0	13.6	9.5
The Dominican Republic	-16.2	14.1	5.0
Guyana	-12.1	22.6	25.8
Haiti	2.5	4.0	8.3
Jamaica	-4.7	12.9	6.9
Trinidad & Tobago	-4.7	14.2	1.3
Smaller Caribbean Countries	-0.2	15.2	13.0
Barbados	-1.7	14.5	3.9
Belize	7.0	15.8	2.4
Dominica	-2.6	7.5	18.1
Grenada	-2.9	...	27.6
St. Kitts & Nevis	1.7	11.2	16.1
St. Lucia	-0.6	19.6	17.5
St. Vincent & the Grenadines	-2.3	22.8	5.3

Source: National authorities; World Economic Outlook database; and IMF staff estimates.

8/ Average annual value of real domestic short-term interest rates (REALI); defined as the nominal short term interest rate in deposits minus the rate of inflation indicated by the consumer price index.

9/ Average annual value of private savings (PS) to GDP; PS is defined as national savings minus government savings (as measured by the central government current total balance) for 1980-1991, except for Guyana (1980-89).

10/ Average annual value of foreign savings (FS) to GDP; foreign savings are measured by the current account deficit.

2. Education indicators

Caribbean countries benefit from a level of educational attainment which exceeds that found in other developing nations (Table 3), although the average number of years of schooling (averaging 5 years in the country sample) is relatively low compared to the level prevailing in the developed world (approximately 11 years). While educational levels in the Caribbean, as measured by the educational attainment index of the UN, show little variation from country to country (with the exception of Haiti), average years of schooling and expenditure on education show more variance. 1/

3. Investment performance

Various measures of investment as a proportion of GDP are presented in Table 4. The figures show that the smaller economies of the region were

1/ It should be noted that the UN's index of educational attainment places significant weight on literacy.

Table 3. Education Indicators in the Caribbean

	Education Attainment 1/ (1985)	Years of Schooling (1980)	EDUC/GDP 2/ (1977-91)
		(In percent)	
Larger Caribbean Countries	57.0	4.4	3.9
The Dominican Republic	55.0	4.3	1.9
Guyana	65.3	5.0	6.6
Haiti	32.4	1.5	1.2
Jamaica	67.0	5.1	5.8
Trinidad & Tobago	65.4	6.1	3.8
Smaller Caribbean Countries	62.0	5.0	5.1
Barbados	68.1	6.3	6.0
Belize	62.2	4.6	4.1
Dominica	64.2	4.7	4.7
Grenada	65.6	4.7	4.5
St. Kitts & Nevis	62.0	6.0	5.3
St. Lucia	56.0	3.9	5.1
St. Vincent & the Grenadines	56.0	4.6	5.8

Source: UNESCO, Statistical Yearbook, various issues, and Government Finance Statistics database.

1/ United Nations index of educational attainment. Index value for other countries: Japan, 69.5; Spain, 65.3; Malta, 65.3; Chile, 63.5; Philippines, 60.7; Peru, 56.6; El Salvador, 47.0; Senegal, 21.6; Nepal, 15.5.

2/ Ratio of central government expenditure on education to GDP for the period 1977 to 1991 (for the years reported) in the Government Finance Statistics database, except for Grenada and Jamaica, where the data indicate the ratio of current education expenditures to GNP, as reported in UNESCO's Statistical Yearbook.

able to sustain a higher level of investment as a proportion of GDP than their larger counterparts. In part this reflects the relatively low investment ratio of Haiti (14 percent) and Jamaica (20 percent) during the period under consideration. While all the larger countries (except for the Dominican Republic) suffered from low economic growth in 1977-91, not all of these economies were characterized by low total investment ratios.

Table 4: Investment Ratios in the Caribbean, 1977-91 1/

(In percent of GDP)

	I 2/	PI 3/	GI 4/	Net FDI 5/
Larger Caribbean Countries	21.5	9.7	11.8	0.9
The Dominican Republic	23.3	16.1	7.2	1.2
Guyana	27.2	5.7	21.5	0.3
Haiti	14.4	5.4	9.0	0.6
Jamaica	20.0	10.3	9.7	0.5
Trinidad & Tobago	22.6	10.8	11.8	2.1
Smaller Caribbean Countries	30.1	17.8	12.3	5.9
Barbados	20.1	13.7	6.4	0.6
Belize	25.2	12.7	12.6	3.0
Dominica	33.1	17.4	15.7	2.4
Grenada	31.1	12.8	18.3	3.6
St. Kitts & Nevis	30.4	19.2	11.2	13.4
St. Lucia	41.9	31.3	10.6	15.9
St. Vincent & the Grenadines	28.8	17.8	11.0	2.6

Source: National authorities; Balance of Payments Statistics database; and IMF staff estimates.

1/ Unless otherwise noted, data for Belize are for the 1979-91 period; Dominica, 1978-91; Grenada, 1978-91; Guyana, 1977-89; St. Kitts and Nevis, 1980-91.

2/ Average annual value of gross investment (I).

3/ Average annual value of private investment (PI).

4/ Average annual value of government investment (GI).

5/ Average annual value of net foreign direct investment (FDI) for the period 1977-91, except for Belize, which is for 1984-89, and Guyana, 1977-85.

The proportion of investment accounted for by the private sector differed widely between countries, from a low of 21 percent in Guyana to a high of 75 percent in St. Lucia. With the exception of Guyana, it appears that a high ratio of private investment to GDP is associated with a high

ratio of total investment to GDP. 1/ Likewise, the share of foreign direct investment (FDI) in the Caribbean economies varies widely. The smaller Caribbean nations, especially St. Kitts and Nevis and St. Lucia, have been quite successful in attracting foreign capital during the 1980s. The larger countries of the region, on the other hand, experienced much smaller net inflows of FDI. Much of the capital inflows into the smaller Caribbean countries are related to the booming tourism industry, rather than to the manufacturing sector.

III. Models of Private Investment

The previous sections have touched on various economic characteristics that might be useful to explain the different levels of investment in countries in the Caribbean. This section focuses specifically on private investment, with special attention given to previous econometric work. In addition, we present a model that captures the impact of education on investment, the implications of which we assess in the econometric tests conducted in section IV.

1. Previous econometric research

One line of research in studying the determinants of private investment in LDCs has been to apply the accelerator model of investment popularized by Jorgensen (1967). 2/ One of the early studies using the accelerator model is that of Tun-Wai and Wong (1982), who used a recursive model where private investment, in the reduced-form equation, was related to government investment, changes in domestic credit to the private sector, net foreign capital inflows, and the value of the capital stock in the previous year. Using annual data for Greece, Korea, Malaysia, Mexico, and Thailand, they obtained good-fitting equations for each country, but generally insignificant t-statistics for many of the variables in their model.

The study of Blejer and Khan (1984) likewise derives a reduced-equation accelerator model of private investment. In this model, private investment is related to lagged changes in output, domestic credit changes, and government infrastructure investment. In light of the limited data observations available for many LDCs, they relied on pooled time-series models. Their approach also incorporated depreciation and cyclical aspects

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1/ In this paper, investment made by public enterprises are considered government investment.

2/ The literature reviewed here involves mainly cross-sectional studies of the determinants of investment. For a review of empirical studies of investment in Latin American with a single country focus, see Cardoso (1990). Some of the studies that may be of particular interest from that review are Behrman (1972) for Chile; Billsborrow (1977) for Colombia; Dailami (1987) for Brazil; Musalem (1989) for Mexico; Ocampo (1990) for Colombia; and Solimano (1989) for Chile.

of investment. Pooled data for 24 countries for the period 1971-79, along with dummy variables to control for country-specific effects, were used. The econometric results reveal statistical significance for the variables capturing the impact of growth, changes in domestic credit, and changes in the level of infrastructure investment (with the last variable estimated by the trend-predicted value of government capital spending). The results of the Khan and Blejer study imply that government infrastructure spending has a positive effect on private capital formation, contrary to the view that public investment "crowds out" private investment. The same result is found in another study by Blejer and Khan (1985) that applied the model to nine Caribbean Basin countries: Barbados, Costa Rica, the Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Panama, and Trinidad and Tobago. Pooling data from 1970-79 and using a version of their earlier model, they obtained results similar to those derived from their larger sample. Once again, increases in the trend level of public sector investment (the proxy for infrastructure investment) were found to increase capital formation in the private sector.

The pooled time-series approach is also employed in a more recent study by Greene and Villanueva (1991). Unlike the studies already cited, the authors do not attempt to derive their econometric equations from a well-defined structural model. Instead, they seek to explore the relationship that might exist between variables pertaining to both policy performance and the external environment on the level of private investment. Their econometric model postulates that the share of private investment in GDP is a function of real interest rates, the lagged percentage change in real GDP per capita, the ratio of public investment to GDP, inflation, per capita income, the lagged ratio of external debt service payments divided by exports, the lagged value of external debt to GDP, and a dummy variable for each of the 23 countries in the sample. Using pooled data for 1974-87, they found a negative and statistically significant relationship between private investment and the level of real interest rates, inflation, and the external debt burden. A positive relationship is found between private capital formation, growth rates, public investment, and GDP per capita.

Cardoso (1990), in contrast to the above studies, uses a cross-sectional approach. This study pools together quadrennial panel data for the periods 1970-73, 1974-77, 1978-81, and 1982-85 for Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela. The regression equation, suggested by a model along the lines of Tobin's real cost of capital (Tobin, 1969) that incorporates a stock market, postulates that the share of private investment in GDP is a function of the growth rate, the share of public investment in GDP, the logarithm of the terms of trade, an index of economic instability, and the logarithm of the ratio of external debt to exports. The results indicate that private investment is positively related to growth and public investment, and negatively related to adverse changes in the terms of trade and increases in the debt burden. A major drawback to the econometric model Cardoso employs is that it is subject to simultaneous causality bias. That is, by making investment a function of growth in the

current time period, it ignores the possibility that higher investment itself may cause higher growth. 1/

The accelerator model is based on traditional growth theory, which underscores the role of physical capital accumulation in fostering economic development. A number of recent studies indicate that human capital development is also a key factor in stimulating economic growth. 2/ What has not yet been fully explored in the literature is the possible interaction between investment in human and physical capital. In the following section we attempt to shed some light on this issue by developing a model that explicitly addresses the impact of human capital development (measured by education expenditure) on private investment. The implications of the model are tested in section IV in the context of an econometric analysis of the determinants of private investment in the Caribbean.

2. A model of public education expenditure and private investment

We address the effects that expenditure on education and other forms of human capital development might have on private investment by using a model where the investment decisions of the private sector are endogenous. In such a model, the private sector comprises households that maximize their discounted utility when deciding how much to invest. Firms, owned by households, could be explicitly introduced into the model, but we need not distinguish firms' choices from those of households. This is due to the fact that we assume that there are enough markets (e.g., for capital, consumption goods, and for ownership of firms) such that households can, for example, rent capital and receive dividends. 3/

In the model presented in the Appendix, the typical household solves an infinite horizon optimization problem, taking the amount of government expenditure on education as given. We assume that the typical household knows the relationship between expenditure on education and increases in human capital. We also assume that the household knows that increases in human capital boost the productivity of firms for a given amount of physical capital, and that the private sector receives the profits from production, after paying taxes. At each moment investors consider alternative uses of their capital when deciding on the amount of private capital to invest. Formally, the household solves

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1/ This problem has been dealt with in the studies cited earlier by using lagged values of growth or economic activity. Another method for dealing with simultaneity bias is to use an instrumental variables technique.

2/ Lucas (1988), Becker and Murphy (1988), Romer (1989), Barro (1990, 1991), Mankiw et al. (1992).

3/ This is an approach similar to that in the endogenous growth literature. See Blanchard and Fisher (1989), Stokey, Lucas and Prescott (1989), and Barro (1990).

$$U = \int_0^{\infty} u(c)e^{-\theta t}dt \qquad (1)$$

where c is consumption per person and θ is the constant rate of time preference.

Under the assumptions of the model, private investment responds positively in the steady state to increases in public education expenditure (see equation 4 in the Appendix). That implies that countries which are able to support larger public education expenditure over a relatively long horizon should be those with higher private investment/GDP ratios. This result suggests that public education expenditure could have an important role, along with other macroeconomic variables that have been used in previous empirical work, in explaining the pattern of private investment across countries.

IV. Empirical Analysis

1. Methodology

The present study uses data from 1977-91 for a cross-section of countries that include the Dominican Republic, Guyana, Haiti, Jamaica, Trinidad and Tobago, Barbados, Belize, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. In order to increase the number of observations for our analysis, we divide the data into three different time periods (1977-81, 1982-86 and 1987-91) and pool the data together. In light of the limited data available on education expenditure, this yielded 33 observations. Data are computed as the average annual value for the time period under consideration. These time periods are considered sufficiently long to smooth out the effect of years of extraordinarily low or high investment rates. It is especially important to average out investment rates for the smaller Caribbean countries, where the investment rate can fluctuate drastically year to year because of the startup or completion of individual investment projects. Drawing from the discussion in the previous section, we test the following reduced form model:

$$PIGDP = f\ (EDUC,\ GDPGROW,\ GIGDP,\ DEBTGDP,\ REALI) \qquad (2)$$

where the function f is linear in the variables and

PIGDP = ratio of private investment to GDP;
EDUC = ratio of government expenditure on education to GDP;
GDPGROW = rate of growth of real GDP;
GIGDP = ratio of government (public sector) investment to GDP;
DEBTGDP = ratio of external debt to GDP;
REALI = real domestic interest rate.

The impact of expenditure on education, as discussed above, is expected to be positive. GDP growth is also expected to have a positive effect on private investment, as in Greene and Villanueva (1991) and Blejer and Khan (1984, 1985). However, as growth rates themselves are an endogenous variable, a simple regression (OLS) using contemporaneous observations would be inappropriate. We deal with the endogeneity of growth rates by using an instrumental variables technique.

The impact of public sector investment on private capital formation is ambiguous. Public investment can act as a complement to private capital formation, insomuch as it provides needed infrastructure (Blejer and Khan, 1984, 1985; Greene and Villanueva, 1991). On the other hand, public investment (including that of public enterprises) may crowd out private investment by using up the scarce credit available for investment financing and usurping investment opportunities that would otherwise be available to the private sector.

It is expected that higher debt burdens are associated with lower private sector investment. Given the irreversibility of many types of physical investment (Bernanke, 1983), investors may wait out a period of macroeconomic uncertainty associated with external imbalances and the financial requirements of debt servicing (Levy, 1991).

The impact of real interest rates on private investment is theoretically ambiguous. Following the Shaw-McKinnon line of reasoning, one would expect a positive correlation between changes in real interest rates and changes in investment (Shaw, 1973; McKinnon, 1973; both cited in Greene and Villanueva, 1991), since higher real interest rates encourage savings and therefore increase the supply of funds for investment. On the other hand, since higher real interest rates increase the cost of borrowing, it is not clear what the net impact of interest rates would be on private sector investment.

The source of data used to measure government education expenditures merits discussion. Whenever available, these data were drawn from the Government Finance Statistics (GFS) database. Most countries do not report these data for each year in the sample; hence, our variable measuring educational outlays over a five year span may not be based on data for all five years. This may not result in large measurement errors, given the low variance of these expenditures from year to year. 1/ In addition, data for some time periods was estimated by GFS figures from previous time periods and movements in the ratio of current educational expenditures to GNP, as reported in UNESCO's Statistical Yearbook. These should provide fairly

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1/ The relative stability of education expenditures as a share of GDP is revealed by the small value of the yearly standard deviation of expenditures to the mean for the entire 1977-91 period. For all the countries with GFS data, excepting St. Lucia, the ratio of the standard deviation to the mean was less than 0.2.

accurate estimates, given the high correlation between GFS and UNESCO data (r=.77). Where no GFS data are available for any of the years between 1977-91 (Grenada and Jamaica), these UNESCO data are used as a proxy for aggregate government expenditure on education. Given these caveats regarding the data, our results should be interpreted with due caution.

2. Empirical results

The results for equation 2, estimated with an instrumental variables technique, are presented in Table 5. A robust estimation procedure is used to ensure that the standard errors and associated t-statistics are heteroskedastic-consistent. The equation explains a significant share of the variation in private investment from country to country, as the adjusted coefficient of variation (adjusted R^2) for the model is 0.25, and the F-test allows one to reject with 95 percent of certitude the hypothesis that the variables are not relevant to explaining the levels of private investment. F-tests reveal no statistically significant differences in the estimated model across time periods, allowing the use of pooled data without any adjustments for specific time period effects.

Confirming the implications of the theoretical model developed in section III.2, the results reveal a positive and statistically significant relationship (at the 0.06 confidence level) between public education spending and private investment. The coefficient estimates suggest that each percentage point increase in the ratio of educational outlays to GDP will be matched by a similar rise in the ratio of private investment to GDP. 1/ 2/

1/ This value is consistent with a model incorporating a utility function with a coefficient of risk aversion of 1.5 and an intertemporal discount rate of 5 percent a year, an output (GDP) to education elasticity of 0.1 and an educational expenditure to GDP ratio of 4 percent--as can be checked by substituting these values into equation 4 in the Appendix.

2/ The precise effect of educational expenditures on private investment would depend on whether they are for current or capital expenditures. The effect of government capital expenditures on education on private investment would be somewhat less than indicated by the coefficient estimate in Table 5, since our results also indicate that public investment has an adverse effect on private sector capital formation.

Table 5. Determinants of Private Investment:
Instrumental Variables Estimates
(Dependent Variable: Share of Private Investment in GDP (PIGDP))

EDUC	GDPGROW	GIGDP	REALI	DEBTGDP	$\overline{R^2}$	N
1.01*	1.57**	-0.49**	-0.16	-0.52	0.25	33
(1.89)	(4.18)	(-3.29)	(-1.38)	(-0.47)		

Note: Coefficient estimates for the constant not shown; t-statistics in parentheses.

* statistically significant at the 0.10 confidence level.
** statistically significant at the 0.05 confidence level.

The estimate of the effect of economic growth on the levels of private investment is in general conformity with the estimates obtained in previous studies. Economic growth appears to have a positive effect on private investment, yielding a statistically significant coefficient at the 0.01 level. The positive coefficient is consistent with the predictions of the accelerator model, and is robust to the fact that private sector investment was relatively low for two high-growth countries in our sample (Belize and Grenada). Ceteris paribus, a country that sustains a percentage point increase it its rate of economic growth can expect to experience a 1.6 percentage point rise in the private investment/GDP ratio.

The results suggest that government investment has an adverse impact on private sector capital formation. Other things being equal, each one percentage point increase in the public investment to GDP ratio is associated with roughly a one-half percentage point drop in the private investment/GDP ratio. 1/ A similar result holds when central government capital expenditure, rather than our more comprehensive measure of public investment, is used for variable GIGDP. 2/

1/ Since private investment may only react to government capital expenditures with a long time lag, our results may not be capturing fully the effect of government investment on private sector capital formation. In addition, it should be noted that the effect of government capital expenditures on education would be somewhat different, given the positive relationship between education outlays and private capital formation.

2/ Due to limited data on central government capital outlays, these regressions were run for data covering 21 observations for the time periods 1982-86 and 1987-91.

The model results indicate that real interest rates are not a significant determinant of private investment. Caution should be used in interpreting this result, given that our measure of real interest rates is based on real rates of return for deposits, rather than lending rates. Finally, the amount of external debt, other things being equal, does not seem to significantly deter private investment. This may in part be explained by the concessionary nature of a large part of the foreign debt held by Caribbean countries, as well as the fact that the effects of foreign debt are already reflected in the rates of economic growth. 1/

3. Growth and private investment: insights from correlation analysis

The results for individual variables in Table 5 can be further evaluated through the analysis of the correlation between the determinants of private investment. The collinearity among variables is displayed in Table 6, where a correlation matrix is presented. The correlation coefficients confirm that private investment is positively correlated with growth. Low debt burdens are also associated with high private investment, even though the regression results from Table 5 reveal that debt has no independent effect per se on private sector capital formation. This strengthens the hypothesis that the effect of external debt on private investment (the debt overhang) might occur only through its effect on growth, but not independently. Beyond low debt burdens and high rates of private sector capital formation, Table 6 reveals that high growth countries in the region tended to have higher real interest rates.

An examination of the relationship between investment and financing (Tables 7 and 8) reveals the importance of mobilizing national savings to finance private investment. Table 8 indicates that high national savings are positively correlated with private investment. Foreign savings, on the other hand, are associated with high government and total investment, but not private investment. In a similar fashion, a high rate of external transfers is associated with high rates of government and aggregate investment, but not high private investment. These external transfers may help finance both consumption and investment, so one cannot argue that they are directly channeled into investment. However, there is little doubt that some of these transfers have helped finance government investment, as some official transfers were earmarked for public investment projects. 2/

1/ An alternative reason for the weak effect of external debt on private investment is that, when compared with other LDCs, the Caribbean countries have small amounts of debt; with the exception of Guyana, none had a debt to GDP ratio averaging above 100 percent during 1977-91.

2/ Loans on concessional terms can have the same effect in stimulating public investment.

Table 6. Correlation Matrix Among Variables From Equation One

	PIGDP 1/	GIGDP 2/	GDPGROW 3/	DEBTGDP 4/	REALI 5/
PIGDP	1.00				
GIGDP	-0.26	1.00			
GDPGROW	0.53**	-0.07	1.00		
DEBTGDP	-0.29*	0.44**	-0.41**	1.00	
REALI	0.07	-0.20	0.31*	-0.47**	1.00

* statistically significant at the .10 confidence level.
** statistically significant at the .05 confidence level.

1/ Ratio of private investment (PI) to GDP.
2/ Ratio of government (public sector) investment (GI) to GDP.
3/ Rate of growth of real GDP.
4/ Ratio of external debt to GDP.
5/ Real domestic short-term interest rate.

The correlation coefficients reported in Tables 6 and 8 indicate that the growth payoff for countries that relied on high rates of private sector capital formation and the mobilization of national savings were markedly higher than those dependent on government investment and foreign savings. While private investment and national savings are significantly correlated with economic growth, high rates of government investment are not associated with good growth performance. One key element in the mobilization of high rates of national savings has been good budgetary performance. Low budget deficits are correlated with a high level of national savings, high private investment, and high economic growth.

Table 7. Foreign Financing and Savings Indicators in the Caribbean, 1977-91 1/

(In percent of GDP)

	NS 2/	FB 3/	FS 4/
Larger Caribbean Countries	12.0	-10.2	9.5
The Dominican Republic	18.2	-1.1	5.0
Guyana	1.3	-34.9	25.8
Haiti	6.0	-3.6	8.3
Jamaica	13.1	-8.6	6.9
Trinidad & Tobago	21.2	-2.9	1.3
Smaller Caribbean Countries	17.1	-4.8	13.0
Barbados	16.2	-4.5	3.9
Belize	22.9	-3.4	2.4
Dominica	15.0	-4.8	18.1
Grenada	3.4	-8.7	27.6
St. Kitts & Nevis	14.3	-5.8	16.1
St. Lucia	24.4	-2.8	17.5
St. Vincent & the Grenadines	23.5	-3.4	5.3

	Total Transfers 5/	Official Transfers 6/
Larger Caribbean Countries	3.6	1.4
The Dominican Republic	4.6	0.8
Guyana	1.7	0.6
Haiti	7.6	4.6
Jamaica	5.0	1.5
Trinidad & Tobago	-1.0	-0.3
Smaller Caribbean Countries	15.4	5.8
Barbados	1.8	-0.4
Belize	11.1	4.2
Dominica	24.8	14.0
Grenada	21.5	11.0
St. Kitts & Nevis	15.1	4.0
St. Lucia	11.7	2.7
St. Vincent & the Grenadines	21.7	4.8

Source: National authorities; World Economic Outlook database; and IMF staff estimates.

1/ Data for Belize are for the 1979-91 period; Dominica, 1978-91; Grenada, 1978-91; Guyana, 1977-89; St. Kitts and Nevis, 1980-91.

2/ Average annual value of national savings (NS).

3/ Average annual value of the central government fiscal balance (FB); a negative sign reflects a deficit.

4/ Average annual value of foreign savings (FS); foreign savings are measured by the current account deficit.

5/ Average annual value of total (official plus private) transfers from abroad.

6/ Average annual value of official transfers.

Table 8. Correlations Between Investment and Financial Variables

	GDPGROW	PIGDP	FBGDP	GIGDP	I/GDP 7/
GDPGROW 1/	1.00				
PIGDP 2/	0.53**	1.00			
FBGDP 3/	0.52**	0.35**	1.00**	-0.56**	0.03
NSGDP 4/	0.47**	0.57**	0.65**	0.34**	0.37**
FSGDP 5/	0.01	0.22	-0.56**	0.58**	0.54**
TRANGDP 6/	0.56**	0.22	0.15	0.32**	0.39**

* significant at the 0.10 level.
** significant at the 0.05 level.

1/ Rate of growth of real GDP.
2/ Ratio of private investment (PI) to GDP.
3/ Fiscal balance (FB) to GDP ratio, with positive values reflecting a surplus.
4/ National savings (NS) to GDP ratio.
5/ Foreign savings (FS) to GDP ratio, defined as the current account deficit.
6/ External transfers to GDP ratio.
7/ Total investment (I) to GDP ratio.

V. Conclusions

This paper has provided some statistical analysis regarding economic performance and the determinants of investment in the Caribbean. In this section, the major results of the study are summarized.

In general, the smaller countries of the region fared much better than their larger counterparts. The smaller Caribbean nations sustained high investment and growth rates for the 1977-91 period. They were able to achieve high growth and low inflation while sustaining fairly large budget deficits (but smaller, on average, than those of the larger countries). They also tended to enjoy more favorable terms of trade movements and receive larger external transfers.

Econometric analysis of the determinants of private investment in the Caribbean reveals that economic growth has a significant impact on private capital accumulation. Our results also indicate that countries which devote a larger fraction of GDP to government expenditure on education benefit from higher private investment/GDP ratios. This confirms the predictions of the utility-maximizing model of endogenous growth presented in the paper, and suggests the importance of steady levels of public expenditure on education for fostering private investment.

High ratios of public investment to GDP appear to deter capital formation in the private sector. The effect of external debt and real interest rates on private investment was found to be insignificant when other factors are taken in account. Economic growth, however, is positively correlated with real interest rates, perhaps reflecting the severe macroeconomics imbalances and microeconomic distortions in countries experiencing highly negative real interest rates.

Correlation analysis reveals that high growth rates are associated with a high rate of private investment to GDP, high national savings rates, and low budget deficits. While private investment is associated with good growth performance, high rates of government investment were not associated with high growth rates.

APPENDIX

Expenditures on Public Education and Private Investment

1. Introduction

We present a simple model where the private sector (represented by infinitely-lived households) takes into account the average level of human capital in the economy when deciding on the amount to consume and to invest in physical capital. 1/ We present the solution at the steady state and show how steady state investment levels in physical capital change according to the level of public education expenditure.

2. The model

Assume a representative, infinitely-lived household in a closed economy which maximizes the following utility function:

$$U = \int_0^{\infty} u(c)e^{-\theta t}dt \qquad (1)$$

where c is consumption per person and θ is the constant rate of time preference. Assume

$$u(c) = \frac{c^{1-\sigma}-1}{1-\sigma},$$

where σ is a measure of risk aversion and is greater than zero.

Let the production function have the following form: 2/

$$y = \Phi(k,h) = k\phi(h/k)$$

where $\phi(0) = 0$, $\phi' > 0$, $\phi'(0) = \infty$ and $\phi'' < 0$, and h is expenditures on education, k is private physical capital and y is output net of capital depreciation--all in per capita terms.

We assume that government expenditures are a constant ratio τ of GDP and are financed by flat-rate income taxes:

1/ This model draws on Barro (1990).

2/ The effect of public investment on productivity can be accommodated in the model by adopting the following production function: $y = \Phi(k,G,h) = k\Gamma(G/k)\phi(h/k)$ where G is non-education public sector capital expenditures.

$$T = h + g = (\tau)y$$

where T is the total of taxes levied, h is public education expenditure and g is other government expenditure, which adjusts to changes in h. 1/

3. Solution

The first step is to solve the following Hamiltonian:

$$H = ue^{-\theta t} + \kappa(k\phi(h/k) - c - \tau y)$$

and obtain the usual conditions

$$H_c = 0 \tag{2}$$

$$\frac{d\kappa}{dt} = -H_k = -\kappa((1-\tau)(\phi(1 - \phi' h/y)) \tag{3}$$

Equation 2 implies

$$u' = \kappa e^{\theta t} = \lambda,$$

while substitution in equation 3 yields

$$\frac{d\lambda}{dt} = \lambda(\theta-(1-\tau)\phi(1 - \phi' h/y))$$

$$\frac{du'}{dt} = u'' \frac{dc}{dt}$$

$$= u(\theta-(1-\tau)\phi(1 - \phi' h/y))$$

Given our utility function, the relationship $\frac{u'' c}{u'} = -\sigma$ follows and we obtain the steady state condition

$$\gamma = \dot{c}/c = \frac{1}{\sigma}((1-\tau)\phi(1 - \phi' h/y) - \theta)$$

1/ An alternative would be to assume that the government finances education through consumption taxes.

APPENDIX

Let $i = I/y$ be the ratio of private investment to GDP. In the steady state, $i = \gamma/\phi$. Our interest is in seeing how the steady state investment level i varies with changes in the ratio $\epsilon = h/y$ (public education expenditure as a share of GDP), holding the marginal tax rate constant. Therefore we compute the marginal change in i as function of marginal changes in ϵ:

$$\frac{di}{d\epsilon} = \frac{1}{\phi}\frac{d\gamma}{d\epsilon} - \gamma\frac{\phi'}{\phi^2}\frac{d(h/k)}{d\epsilon}$$

Let the elasticity of output to education be defined by $\eta = \phi' h/y < 1$ and let us assume it is constant:

$$\eta = \bar{\eta}$$

In this case, after the appropriate substitutions, we obtain 1/

$$\frac{di}{d\epsilon} = \frac{\theta\ \phi'}{\sigma(1-\bar{\eta})\phi} > 0$$

If the Cobb-Douglas functional form ($\phi = A\ (h/k)^a$, $0 < a < 1$, $A > 0$) is postulated for the production function, it follows that $\phi'/\phi = y/h$, and $\eta = a$. Therefore, in this particular case

$$\frac{di}{d\epsilon} = \frac{\theta}{(1-a)\sigma\epsilon} > 0 \qquad (4)$$

This relationship could be estimated for a cross section of countries, using non-linear least squares. In the econometric model presented in the paper, the long-run relationship between investment in physical capital and public education expenditure is tested in a less formal way. We expect the correlation to be captured by linear least squares, in the context of an econometric model that captures the impact of other variables (including other government expenditure) on the share of private investment in GDP.

1/ The substitutions are simplified because $\frac{dh/k}{d\epsilon} = \frac{\phi(h/k)}{1-\bar{\eta}}$ where h and k are steady state values.

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