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Determinants of Long-Term Growth Performance in Developing Countries

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Abstract

This paper provides empirical evidence on the determinants of long-term growth performance in a sample of 55 developing countries grouped by income levels. The evidence indicates that a model incorporating the savings rate, export performance, expenditures on human capital development, the growth of population, and the real interest rate on external debt, explains the growth performance of these countries remarkably well. The model also suggests policies that would lead to higher long-run rates of growth.

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I. Introduction

The growth performance of developing countries over the past two decades has been rather disappointing. Broadly speaking, the average annual growth rate of per capita real income declined significantly in this period, compared with the record achieved in the post-war period up to the 1970s, and this deterioration worsened progressively in the first half of the 1980s. 1/ The poor growth performance was accompanied by a marked decline in the investment ratio in most countries, except some oil producing nations. Despite this decline, expenditures on investment exceeded domestic saving substantially, causing rapid increases in foreign borrowing and external debt, and external payment positions became unsustainable in many developing countries.

In the event, many developing countries attempted to compress aggregate demand, further weakening investment in both physical and human capital. The adverse implications of the compressed investment activity have triggered alarming signals, echoed by many quarters in economic and business professions, national authorities, and international organizations, 2/ and the need for growth-oriented adjustment programs has been stressed with the added call for a clarification of the saving-investment-growth nexus.

A recent paper by Otani and Villanueva (1988) presented a theoretical growth model that is capable of assessing the growth performance characterized by these events and the impact of macroeconomic policies on the long-term performance of a developing economy. That model emphasized the role of structural parameters of the macroeconomic relationships, including the saving-investment-growth linkage, the role of expenditures to improve human capital and the dynamics of external debt. The model also yielded empirically testable hypotheses for the relative importance of various determinants of long-term growth performance. The main purpose of the present paper is to follow up on the theoretical analysis by undertaking an empirical examination of the long-term growth experiences in developing countries.

Such an examination would be extremely important for several reasons. First, in order to ascertain the relevance of the theoretical growth model in understanding the growth experiences of developing countries, it is necessary to determine the extent to which the model's predictions on long-term growth stand up against the observed economic performance of developing countries at different stages of economic development. Second, the empirical investigation should help policymakers in designing appropriate growth-oriented adjustment programs and in setting priorities in their implementation. Third, such an empirical examination should point to several areas requiring additional research efforts aimed at the further development of growth models.

1/ See Fischer (1987) and Cornia, Jolly, and Stewart (1987) for summary statistics.

2/ See, for example, G-24 (1987).

The rest of the paper is organized as follows: Section II presents an overview of the theoretical growth model that forms the basis for the empirical work. Section III discusses the regression results. Section IV contains a summary of the findings and policy implications. Data sources and definitions of variables are contained in Appendix I, and the list of countries covered by the study appears in Appendix II.

II. An Overview of the Theoretical Growth Model 1/

In the model the economy is open and consists of four sectors: household, corporate, government, and banking sectors. Broadly speaking, the corporate sector 2/ produces a composite non-capital good, with imported physical capital and labor as inputs. The production technology allows substitution between capital and labor, subject to positive but diminishing marginal products of the two inputs. Receipts from the sale of output are exhausted to cover the various costs associated with production, including the wage bill, the rents on capital, debt service payments, taxes and transfers of one kind or another. The remainder is saved for new investment. When internal saving is insufficient to cover the cost of new investment, the corporate sector resorts to domestic and foreign borrowing. The household sector provides labor services and uses its wage income to pay taxes, purchase consumption goods, and saves the remainder in the form of money balances. 3/ The government collects taxes and transfer payments, including dividends, from the corporate sector and taxes from the household sector, and spends on both consumption and investment activities. The budget deficit is financed by borrowing from the domestic banking sector and the foreign sector. The debt obligations of the corporate and government sectors are serviced continuously. The banking sector acts as a financial intermediary, receiving deposits from the household sector and loaning them out to the corporate and government sectors. 4/ Prices are assumed to adjust to clear the goods and money markets, while the exchange rate is assumed to be given exogenously.

Because of the insufficiency of domestic savings, a typical developing country is assumed to be a net borrower from the international capital market. However, as in Hernández-Cáta (1988), foreign borrowing is undertaken only as long as the net marginal product of capital is at

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1/ See Otani and Villanueva (1988) for a detailed discussion of the theoretical model.

2/ State-owned firms are included in this sector.

3/ It is assumed that there are no domestic bond markets. The household sector may, however, lend directly to the corporate sector through the unofficial money market (UMM). When UMM assets are allowed, the effect of changes in the deposit interest rates on the availability of funds to finance investment depends on the degree of substitutability among currency, deposits, and UMM assets in the portfolio of the household sector.

4/ Banks also borrow abroad and compete with traders in the UMM.

least as high as the marginal cost of capital. The possibility of a rising cost of capital is permitted. The cost of capital is given by the foreign interest rate plus a risk premium that depends positively on the ratio of net external debt to exports. 1/

In the labor market, the demand for labor is assumed to be always met by supply at a given level of real wages. Nominal wage adjustments are institutionally determined, and real wages are assumed to be equal to the marginal product of labor. Variations in the domestic price of output reflect the difference between nominal wage adjustments and changes in the marginal productivity of labor. The labor supply, measured in efficiency units, is defined as a product of the labor force and its productivity. The former is assumed to grow exogenously at a constant rate. The productivity, or skill-argumentation factor, is assumed to increase endogenously. Increases in this productivity factor are assumed to depend on expenditures to improve human capital, as represented by the proportion of per capita government revenue spent on education. 2/

Short-run macroeconomic equilibrium obtains when aggregate domestic investment is equal to the ex ante internal savings of the corporate and government sectors plus domestic bank borrowing and foreign financing. Long-run (steady-state) equilibrium is defined as the solution to two basic differential equations in the capital-labor ratio and the external debt-capital ratio, to which the system of equations describing the above macroeconomic framework could be reduced. 3/ The balanced growth path in the steady-state is derived as the growth rate of output and income such that the warranted rate of growth (of the capital stock) equals the natural rate of growth (of the labor force). In the steady-state, the growth of external debt is also equal to the growth rate of output and exports. Since all the structural policy and other parameters (such as the domestic saving rate, export growth rate, cost of capital, etc.) enter the capital and labor growth equations, the steady-state growth rate of output per capita is also a function of all such parameters.

III. Empirical Results for Growth Performance

Table 1 shows how the equilibrium or the steady-state capital-labor ratio, the external debt-capital ratio, and the growth rate of per capita output respond to changes in the structural policy and other parameters of the growth model. This section examines the empirical results only for the growth performance in developing countries, since, as is often the

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1/ Khan and Zahler (1983) also include a risk premium in the equation determining foreign borrowing.

2/ Total public and private spending on education is perhaps the more appropriate variable. However, in most developing countries, the government bears the major responsibility for educational expenditures, particularly at the primary and second levels.

3/ For a detailed exposition, see Otani and Villanueva (1988).

Table 1. Effects of Structural Parameters on Capital Intensity, External Debt-Capital Ratio, and Per Capita Output Growth in Steady-State

	Effects on		
	Capital to Labor Ratio	External Debt to Capital Ratio	Per Capita Growth
Corporate income tax rate	Indeterminate 1/	Indeterminate 1/	Indeterminate 1/
Personal income tax	Indeterminate 1/	Indeterminate 1/	Indeterminate 1/
Government consumption rate	Negative	Negative	Negative
Corporate saving rate	Positive	Positive	Positive
Household saving rate	Positive	Positive	Positive
Aggregate domestic saving rate	Positive	Positive	Positive
Budget share of expenditure on human capital	Negative	Positive	Positive
Interest rate on external debt	Negative	Negative	Negative
Growth rate of export volume	Positive	Positive	Positive
Population growth rate	Negative	Positive	Negative
Depreciation rate	Negative	Negative	Negative
Exogenous rate of labor-augmenting technical change	Negative	Positive	Positive

Source: Otani and Villanueva (1988), Table 2.

1/ Depending on the relative magnitudes of the corporate and household saving rates in relation to the expenditure shares in the budget. For details, see Otani and Villanueva (1988).

case in these countries, data for the stock of capital and the external debt of the private sector are almost nonexistent. Furthermore, the availability of data for some of the variables presented in Table 1 is incomplete and the quality is less than ideal.

In addition, there is a strong correlation, a priori, among some of the explanatory variables. For example, the aggregate domestic saving ratio is closely related to the various tax ratios, the share of government current expenditure, as well as the saving ratios of the household and corporate sectors. For this reason, these variables are represented by only the aggregate domestic saving ratio. Moreover, since it is extremely difficult to identify the impact of possible export restrictions on the saving ratio and the growth of exports, both these variables are included in the equation below. 1/ Thus, the reduced-form equation to be estimated for the empirical analysis has been simplified to the following:

$$g^* - n = f(s,\ h_g,\ r,\ \tilde{x},\ n)$$
$$\qquad\qquad +\quad +\quad -\quad +\quad -$$

where $(g^* - n)$ denotes the growth rate of per capita real output; s the domestic saving ratio; h_g the budgetary share of expenditures on human capital; r the cost of external borrowing in real terms; 2/ $\tilde{x}$ the growth rate of exports in real terms; and n the growth rate of population. 3/ Since no meaningful information is available for the rate of depreciation of the capital stock and the exogenous component of labor-augmenting technological progress, these variables are excluded from the reduced-form growth equation.

1/ When the entire exports are subject to restrictions, the warranted rate of growth is determined by the given export-capital ratio. Therefore, any changes in government, household, or corporate saving rates will have no effect on the economy. An increase in the exogenously given growth rate of exports, however, will lead to a higher equilibrium level of capital intensity, external debt ratio, and per capita growth. It is conceivable that some countries were subject to export restrictions for all or some subperiods of the entire sample period, while others were not. However, the delineation of the country experiences with export restrictions in terms of both the extent and the duration of the restrictions would pose formidable practical problems.

2/ Nominal interest rate adjusted for changes in export prices.

3/ See Appendix I for the data sources and the definitions of variables.

The expected signs of the partial derivatives of ($g^* - n$) with respect to the explanatory variables are indicated below the arguments in the equation. With respect to the coefficients of the saving ratio and the export growth, four results are theoretically possible: (1) the coefficient of the saving ratio is statistically significant and that of the export growth is not; (2) the former is not significant and the latter is; (3) both coefficients are significant; and (4) neither coefficient is significant. The first possibility implies that no significant restrictions on exports were in place during the sample period; the second implies the presence of binding restrictions on exports; the third means that restrictions were present in some years and absent in others; and the fourth result invalidates our growth model.

The values of the variables included in the reduced-form equation were calculated as annual averages for the period 1970-85, whenever requisite data were available; otherwise, somewhat shorter periods were used. The choice of countries was determined essentially by the availability of data. The number of sample countries was 55, with 13 developing countries from Africa; 12 from Asia; 6 from Europe; 6 from the Middle East; and 18 from the Western Hemisphere. 1/

Before empirically examining the growth performance of developing countries, it is worth noting several important limitations and caveats associated with the approach taken in the analysis. First, while each of the regression coefficients is indicative of the magnitude of the impact of a change in the explanatory variable on the growth rate of per capita output for an "average country," it would not always be valid for a particular individual country in the sample, unless that country closely resembles the average country with regard to the economic structure summarized by the values of the explanatory variables. Second, the sample period of 16 years may not be long enough to allow the annual averages of the variables included in the reduced-form equation to represent the steady-state or long-run equilibrium. Third, during the 16-year period, major shocks were experienced, causing structural changes--two episodes of large increases in oil prices and the commodity boom and bust in the 1970s, as well as large swings in real exchange rates. It is conceivable that these shocks might have changed the nature of the steady-state over time. Finally, while the number of factors accounting for the growth rate of per capita output had been reduced to a small number of key variables, these variables are themselves likely to be influenced by the growth rate, and thus there may be simultaneous equation biases in the estimated coefficients. 2/ Despite these shortcomings, the empirical results are informative.

1/ See Appendix II for the list of countries in the sample.

2/ For a theoretical and empirical analysis of the dependence of the saving ratio on growth, see Lahiri (1988).

1. Performance by the entire sample

Table 2 reports regression results obtained by the ordinary least squares method, using data for the entire 55 sample countries. The moststriking finding is a high degree of the explanatory power of the reduced-form equation and its variant. An R^2 of about 0.7 is exceptionally high for cross-country analysis. 1/ The estimated coefficients have the right signs for all the variables.

The estimated coefficient of the domestic saving ratio is highly significant, and the size of the coefficient suggests that a 10 percentage point increase in the domestic saving ratio (i.e., the ratio of domestic saving to GNP) increases the long-term growth rate of per capita output by 1 percentage point for an average economy. 2/ 3/ This suggests that for an average economy the domestic saving ratio would have to increase from the actual 19 percent to about 29 percent in order to raise the steady-state per capita output growth by 1 percentage point a year--not an easy task by any standard.

The importance of export performance for the growth process is also noteworthy, and is even more powerful and systematic than the saving ratio, as indicated by the beta coefficients--0.65 for the growth of exports and 0.40 for the saving ratio. 4/ The estimated regression coefficient indicates that, if export volume increases by 10 percent annually, the steady-state growth rate of real per capita output will rise by 4 to 5 percentage points a year. For an average economy, where the share of exports in GNP is estimated to be about 30 percent, such export and output performance would increase the export/GNP ratio by 2 percentage points to about 32 percent. These considerations suggest that, ceteris paribus, the export-led growth strategy appears to have had a much more direct impact on growth. 5/

1/ Ramanathan (1982) notes that typical values of R^2 for equations estimating the growth performance in developing countries using cross-country data fall in the range 0.3 - 0.4.

2/ The statistical significance of the estimated coefficients is based on a one-tailed test since the expected signs of these coefficients have been determined by the theoretical model as noted earlier.

3/ As will be discussed below, the statistical significance and the magnitude of the estimated coefficients may be different for nonaverage countries.

4/ Feder (1983) also presents empirical evidence supporting the important role played by the export sector in the growth process. In his study, however, the export sector's contribution to growth comes from its "higher factor productivity" in relation to the productivity of the non-export sector.

5/ This should not be interpreted, however, that domestic savings are unimportant. These savings are, indeed, crucial for financing investment in the export sector.

Table 2. Cross-Country Regression Results: Entire Sample 1/

(Growth of Per Capita Real GNP as Dependent Variable)

(55 Developing Countries)

Constant Term	Domestic Savings Ratio (s)	Budgetary Share of Expenditure on Human Capital (h_g)	Real Interest Rate on External Debt (r)	Growth of Exports ($\tilde{x}$)	Growth of Population (n)	R^2 ($\bar{R}^2$)
-1.18	0.12	0.04	-0.04	0.38	-0.85	0.68
(0.98)	(3.42)	(1.29)	(0.93)	(7.57)	(2.81)	(0.64)
	[0.40]	[0.11]	[-0.02]	[0.65]	[-0.24]	
-1.58	0.14	0.04		0.38	-0.70	0.67
(1.42)	(4.22)	(1.17)		(7.62)	(2.72)	(0.64)
	[0.40]	[0.11]		[0.65]	[-0.23]	

1/ Figures in parentheses below the estimated coefficients represent t-ratios, while those in brackets below the t-ratios represent beta coefficients.

The estimated coefficient of the variable representing expenditures on the improvement of human resources is marginally significant and is rather small in magnitude. 1/ However, this finding does not necessarily imply that the role of human capital is unimportant for four reasons. First, the lack of statistical significance could be due primarily to the heterogeneity of the sample in terms of the level of economic development of the countries. Second, this variable is expressed in terms of government expenditures on human capital as percent of current revenue, so that this explanatory variable assumes a large numerical value (about 16 percent), thus reducing the size of the estimated coefficient accordingly. 2/ Third, public enterprises as well as private corporations also devote considerable resources to improve human capital, but data on these expenditures are not readily available. Finally, data on expenditures for health services, which should be theoretically included, are neither complete nor reliable across countries and, therefore, were excluded.

The growth rate of population was highly significant, with the estimated coefficient having the negative sign, as expected. The size of the coefficient, which is far from zero and less than unity (in absolute terms), suggests that an increase in the population growth would only partially reduce the steady-state growth rate of per capita real output for an average developing country. This, in turn, would imply that production in such an economy must have been taking place at a point such as A in Figure 1, where k is the capital-labor ratio and y is real GNP per unit of labor, measured in efficiency units. An increase in population growth and a resultant decline in the capital-labor ratio leads to a substantial reduction in output per unit of labor, i.e., the marginal product of capital is high.

The estimated coefficient of the real interest rate on external debt, though having the right sign, is found to be statistically insignificant. This result could be for at least two reasons. First, the coverage of external debt was limited to public or publicly-guaranteed external debt. Therefore, it may not adequately reflect the true cost of external borrowing by the economy. Second, for debtor countries which have experienced large fluctuations in real exchange rates, the world market interest rate on external debt may not capture the true cost of borrowing as these countries usually had to assume exchange risks in real terms. In general, it is difficult to obtain a good proxy to represent the true cost of borrowing from external sources.

1/ Landau (1983), in his "structuralist" approach to growth accounting, finds that the level of school enrollment is statistically significant in explaining the growth of per capita GDP in a sample of 96 countries during 1961-76.

2/ If the ratio of government expenditures on human capital to GNP were used, its numerical value would, on average, be about one-fifth of the ratio to current revenue and the estimated coefficient would increase by a factor of 5 to a value somewhat larger than that for the domestic savings ratio. However, the associated beta coefficient remains unchanged.

2. Performance by income group

It has been pointed out frequently in the literature that the stage of economic development has important implications for the growth process. 1/ In order to gain insights on this issue, the entire sample is divided into three stages of economic development, proxied by the level of per capita income. We have chosen the following income groups; (i) the "low-income" group, which includes countries with an average per capita nominal GNP of US$560 or below over the sample period; (ii) the "middle-income" group, which includes countries with an average per capita nominal GNP of more than US$560 but less than US$1,100; and (iii) the "high-income" group, with an average per capita income of US$1,100 or above. 2/

The results of the regression for the reduced-form equation and its variant for each group are summarized in Table 3. One of the most significant findings was that the coefficient of determination, R^2, is high for each group, with that for the middle-income group being 0.9. This result suggests that the specification of the reduced-form equation captures the essential characteristics of the growth process rather well, regardless of the stage of development. By extension, available empirical evidence lends remarkable support to the thrust of the model developed in Otani and Villanueva (1988).

As already suggested earlier, the importance of a particular variable in explaining the growth performance varies from one income group to another. For example, the beta coefficients indicate that the saving ratio was found to be a more significant contributing factor for the middle- and high-income groups than for the low-income group. While the reasons for this difference are not entirely clear, it may be that, in low-income countries, the development of the financial system is still at a rudimentary stage, so that the saving-investment-growth nexus is not well-established. Another possible explanation for the difference may be found in the role of external financing of capital accumulation. Many middle- and high-income countries have much easier and greater access to foreign sources of financing investment than do low-income countries, so that some of the real output produced by the capital stock financed by foreign borrowing may have been attributed to that part of the capital stock financed by domestic savings.

The impact of the saving ratio on the growth of per capita income is estimated to be two to three times as great for middle-income countries as for high-income countries. One possible explanation for this is that middle-income countries may have reached the so-called "take-off" stage

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1/ A well-known argument is found in Rostow (1960).

2/ The selection of the cut-off income levels is somewhat arbitrary, necessitated by the desire to have some balance in the number of sample countries in each group so that a reasonable number of degrees of freedom is obtained for regression analysis. See Appendix II for the list of countries by income level.

Figure 1. Stages of Economic Growth

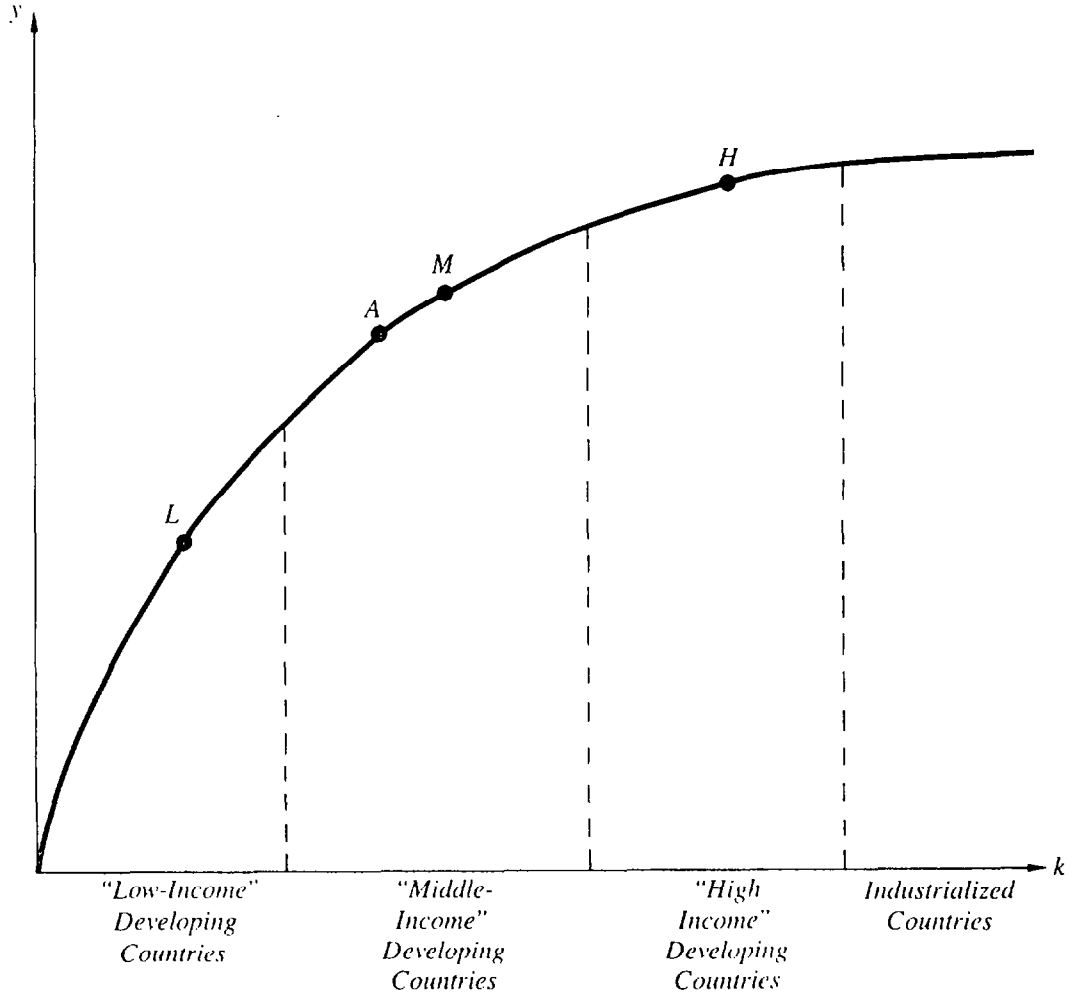

Table 3. Cross-Country Regression Results: Income Groups 1/

(Growth of Per Capita Real GNP as Dependent Variable)

	Constant Term	Domestic Savings Ratio (s)	Budgetary Share of Expenditure on Human Capital (h_g)	Real Interest Rate on External Debt (r)	Growth of Exports ($\dot{x}$)	Growth of Population (n)	R^2 ($\bar{R}^2$)
			(By Income Levels)				
"Low-income" Group	0.77	0.003	0.12	-0.12	0.40	-1.13	0.73
(17 Countries)	(0.30)	(0.01)	(1.32)	(0.57)	(3.28)	(1.62)	(0.61)
		[0.00]	[0.35]	[-0.16]	[0.89]	[0.27]	
	1.34	0.003	0.08		0.34	-1.21	0.72
	(0.59)	(0.07)	(1.42)		(4.61)	(1.69)	(0.63)
		[-0.01]	[0.24]		[0.77]	[-0.28]	
"Mid-income" Group	-5.68	0.47	0.11	-0.11	0.10	-1.32	0.89
(15 Countries)	(1.28)	(2.83)	(2.08)	(0.69)	(0.80)	(1.78)	(0.82)
		[0.73]	[0.32]	[0.09]	[0.19]	[-0.23]	
	-3.98	0.41	0.10		0.14	-1.34	0.88
	(1.11)	(3.03)	(2.02)		(1.39)	(1.86)	(0.83)
		[0.64]	[0.29]		[0.27]	[-0.24]	
"High-income" Group	-2.48	0.16	0.02	0.03	0.43	-0.66	0.55
(23 Countries)	(0.59)	(1.65)	(0.27)	(0.18)	(3.37)	(0.74)	(0.42)
		[0.56]	[0.06]	[0.04]	[0.68]	[-0.29]	
	-1.86	0.15	0.02		0.42	-0.64	0.55
	(0.68)	(1.85)	(0.25)		(3.64)	(1.18)	(0.45)
		[0.53]	[0.06]		[0.67]	[-0.28]	

1/ Figures in parentheses below the estimated coefficients represent t-ratios, while those in brackets below t-ratios represent beta coefficients.

of economic development, while high-income countries have passed that stage. As a result, the productivity of capital in middle-income countries may be much higher than in high-income countries. This in turn implies that the contribution of domestic saving to the growth of per capita income is expected to be higher for middle-income countries than for high-income countries.

As regards the contribution of export performance to the growth of per capita real output, two points are noteworthy. First, the statistical significance of the estimated coefficient is much greater for low- and high-income countries than for middle-income countries. This finding may be attributable to the characteristics associated with the growth process. In the early stage of development, the engine of growth is dependent largely on the expansion of primary commodity exports, as is often experienced by low-income countries. As these countries enter the take-off stage, the pattern of production shifts away from primary products toward consumer goods and import-substituting products, the growth of oveall economic activity tends to be dependent on the expansion of the domestic market for commodities, and the dependence on exports lessens. However, as the economy nears the end of the take-off stage, the domestic market becomes increasingly saturated and is unable to accommodate a further expansion in the absorption of these products at home. Consequently, producers increasingly have to find outlets for their products abroad. Thus, economic growth becomes, once again, dependent on export performance.

Second, the interrelationships among exports, saving, and investment appear to change over the stages of economic development. In the early stage, when the stock of capital is relatively low, the ratio of exports to the capital stock is high and rising. As a result, the ratio of domestic saving to the capital stock is likely to rise, enabling imports of capital goods to increase, which in turn leads to faster growth in the capital stock and in output. Thus, the linkage between the growth rates of exports and of output would be strong. In the second stage, export growth is likely to slow, while the growth of capital accelerates, as reviewed above, implying that the growth of domestic saving also tends to slow. Under these circumstances, the share of capital goods in total imports increases. This trend would be reversed in the third stage, when the export sector once again becomes the engine of growth.

Unlike the results obtained for the entire sample, the estimated coefficient of the variable representing expenditures on the improvement of human capital for low-income and middle-income countries is statistically significant, while the coefficient of determination is noticeably higher. 1/ In any event, it appears that the role of human capital as a source of economic growth hinges crucially on the level of economic

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1/ When the ratio to GNP is used, the size of the estimated coefficient is similar to that of the domestic saving ratio.

development and that the returns on human capital are likely to be highest when the economy reaches the take-off stage.

The estimate of the population growth is significantly greater than unity in absolute terms for the low- and middle-income groups, suggesting that production must be taking place at very low capital intensity and high marginal product of capital, so that an increase in population (and thus in the labor force) and a resultant decline in capital intensity would lead to a substantial loss in output per unit of labor. 1/ Production in the low- and middle-income groups can be represented by points L and M, respectively, in Figure 1. By extension, the coefficient of the population growth for the high-income group, being less than unity in absolute terms, suggests that production in this group could be represented by point H, where the marginal product of capital is lowest and the capital intensity highest among the three income groups.

IV. Concluding Remarks

The objective of this paper has been to provide empirical tests of simplified versions of a reduced-form growth equation derived from the theoretical model proposed by Otani and Villanueva (1988). Using a cross-section sample of 55 developing countries, the tests showed that the reduced-form equation explained the growth performance of these countries quite well and helped to identify some of the key contributing factors. These factors included the domestic saving ratio, budgetary allocations to improve human capital, and the export performance. The results lend

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1/ The equilibrium growth rate of per capita output is $g^* - n = h_g s_3 f(k^*)+\lambda$, where $g^* - n$ is the growth rate of per capita real GNP, $f(k^*)$ is the production function written in intensive form, k^* is the capital-labor ratio and h_g, s_3, and λ are parameters representing human resource development, saving propensities, and labor-augmenting technological progress, respectively, as defined in Otani and Villanueva (1988). The effect of an increase in population growth (n) on per capita output growth is $\partial(g^* - n)/\partial n = h_g s_3(\partial f/\partial k^*)(\partial k^*/\partial n) < 0$ since h_g, s_3, and $\partial f/\partial k^*$ are all positive and $\partial k^*/\partial n$ is negative. Given h_g, s_3, and $\partial k*/\partial n$, it is possible that $|\partial(g^* - n)/\partial n| \lesseqgtr 1$ because the marginal product of capital ($\partial f/\partial k*$) can take on a small or a large value, depending on the stage of development. In Figure 1, in the early stage of development when the capital intensity is low and thus the marginal product of capital is relatively high, a reduction in the capital-labor ratio brought about by an increase in population growth results in a substantially greater reduction in output compared with a later stage when capital intensity is high and the marginal productivity of capital is relatively low. Consequently, the negative effect on per capita output growth of an increase in population growth exceeds unity in countries in the early stage of development (i.e., low-income countries), but is less than unity in those in the later stage development (i.e., high-income countries).

empirical support to the propositions and policy implications of the theoretical growth model.

The development of human resources plays an important role in economic growth. The estimated coefficient of the ratio to current revenue of government expenditure on education indicates that its impact on growth might be somewhat smaller than the domestic saving ratio. However, the impact of the human capital variable on growth is likely to be underestimated because of the exclusion of (unavailable) data on similar expenditures by public and private enterprises and by households, and of incomplete or unreliable data on expenditures for health services. When proper account of these data is made, the development of human resources is expected to have a strong impact on growth in developing countries, particularly those saddled with an excessive external debt burden. Improved quality of labor enhances the profit opportunities of the producing sector and raises domestic saving, export and investment. This could have a salutary effect of reducing the reliance on foreign borrowing to the level dictated by the improved marginal productivity of capital.

A sustained increase in the aggregate domestic saving rate is crucial to growth-oriented adjustment efforts. Empirical estimates suggest that an increase in the domestic saving rate of 10 percentage points over time would raise the long-term steady-state growth rate of per capita output by 1 or 2 percentage points annually in many of the high-income countries which have passed through the take-off stage of economic development, and by as much as 3 to 4 percentage points in many countries which are still in the take-off stage. Thus, it seems safe to conclude that the mobilization of domestic savings over the years would greatly facilitate the achievement of growth potentials in many developing countries. There are many ways to raise the rate of domestic savings. In countries where government consumption expenditures nearly exhaust current revenues, it is wise to combine tax reforms aimed at raising the revenue-income ratio with measures to reduce the budgetary share of consumption spending. In other countries, financial deepening through an integration of unofficial financial markets would allow households to hold their savings in financial assets.

A steady expansion of the export sector appears to have even more powerful effects on growth. A steady growth of 10 percent in the volume of export, or to put it alternatively, an increase in the export/GNP ratio by 2 percentage points would likely raise steady-state per capita output growth by 4 to 5 percentage points per year. The appropriate export promotion policies are country-specific. In some countries, adjustments may be required in the exchange rate and trading systems, while in others the monetary and fiscal incentive systems may have to be improved. In any case, such measures would have to be complemented by market-opening policies in industrial countries and in the developing countries themselves.

The effect of the growth rate of population on per capita income growth was highly significant and negative as predicted by the model. The size of the coefficient is less than unity in absolute value, suggesting that an increase in population growth would reduce per capita income growth only partially for an average developing country. This implies that production in such an average economy takes place at a point where a decline in the capital-labor ratio leads to a significant reduction in output per labor (measured in efficiency units), i.e., the marginal product of capital is relatively high.

Finally, as expected from the theoretical model, the estimated coefficient of the real interest rate on external debt, although statistically insignificant, had the correct sign. The lack of statistical significance may be due to difficulties encountered in obtaining a good proxy to represent the true cost of borrowing in the international capital markets. At any rate, general reductions in the world market interest rate and in the risk premium would naturally reduce the cost of external borrowing, help ease the burden of external debt, and contribute to the realization of growth potentials. In this context, both the international community and the developing countries themselves have active roles to play.

While the empirical analysis presented in this paper has contributed to a greater understanding of the growth process in developing countries and has suggested important implications for the design of structural policies at the macroeconomic level, some extensions would be desirable and useful. First, an endogenous treatment of inflation and inflationary expectations in the analysis would shed much light on the inflationary problems that many developing countreis are facing and on their implications for the appropriate growth strategy. While this would complicate the growth model, it would enable us to determine the inflationary impact of alternative domestic and external policies and developments. Second, the role of intermediate imports could be introduced formally in the production function, à la Bardhan and Lewis (1979). This would allow a more explicit consideration of the impact of import restrictions on the growth performance as well as on inflation. Extensions of these types are clearly necessary to fully understand the process of growth in developing countries, and what policy actions can be undertaken by governments to raise growth rates in these countries.

Data Sources and Definitions of Variables

Data Sources:

A. International Monetary Fund: Data Fund; BOP FILE
B. International Monetary Fund: Data Fund; GFS FILE
C. International Monetary Fund: Data Fund; IFS FILE
D. International Monetary Fund: World Economic Outlook
E. United Nations: Statistical Yearbook
F: UNESCO: Statistical Yearbook

In addition, various country sources and the Fund's reports, particularly Recent Economic Developments, are utilized.

Definitions of Variables:

Growth rate of real GNP (sources C and E).

Growth rate of population (source C).

Ratio of domestic saving to GNP, where domestic saving is defined as a sum of gross capital formation (source C) and external current account balance (sources A, C, and E).

Budgetary share in the government's total revenue (source B) of expenditure on human capital, where the expenditure is defined as a sum of current and capital spending on education (sources B and F).

Growth rate of the volume of exports (source C).

Nominal Interest rate on external debt (source D).

Export prices (source C).

List of Countries

By Income Level

High Income Group	Middle Income Group	Low Income Group
Algeria	Bolivia	Burma
Argentina	Colombia	Egypt
Barbados	Ecuador	Honduras
Brazil	El Salvador	India
Chile	Ghana	Indonesia
Costa Rica	Guatemala	Kenya
Cyprus	Cote D'Ivoire	Liberia
Fiji	Jordan	Madagascar
Greece	Mauritius	Morocco
Israel	Nicaragua	Pakistan
Jamaica	Nigeria	Philippines
Korea	Peru	Senegal
Kuwait	Syrian Arab Republic	Solomon Islands
Malaysia	Tunisia	Sri Lanka
Malta	Turkey	Tanzania
Mexico		Thailand
Portugal		Togo
Saudi Arabia		
Singapore		
Trinidad & Tobago		
Uruguay		
Venezuela		
Yugoslavia		

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