Setting Priorities across Levels of Education in Developing Countries

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Abstract

Education is a key to the economic development of nations. This research investigates the effects of education on economic development using cross-national statistical analyses of developing nations. It focuses on the impacts on economic growth of differences in levels of education (primary, secondary and higher). The statistical analysis showed that length of schooling has a significant impact on economic growth. Several patterns of the relationship are observed in the analysis. Generally, while the regression coefficient of higher education is greater than those of lower levels of education, the statistical significance shows the opposite.

1. Rate of Return Analysis

Rate of return analysis has been one of the most popular methods for the investigation of the contribution of education to economic development. In using this simple indicator to determine investment priority in development projects, policy makers have found several patterns. First, the social rate of return to education is lower than the private rate of return. Second, the rate of return is higher in developing countries than in developed countries. Third, the rate of return to investment in education is higher than the rate of return to investment in physical capital in developing countries. Fourth the social rate of return to primary education is higher than that to higher education across nations and regions all over the world (Psacharopoulos and Woodhall 1985, Psacharopoulos 1993).

Although rate of return analysis is a useful method for comparing different individual investment choices, it has several problems in reliability, especially as a social measurement to determine public investment. First, the social rate of return analysis is based on the assumption that income represents an individual's contribution to economic development. However, how much an individual makes may not necessarily reflect how much he or she contributes to the economic development of his or her society. Also, educational attainment can contribute to economic development but not necessarily through formal workplaces. For example, although they are not paid, housewives participate in the economic development of their nation by raising children and creating healthy environments for family members. The social rate of return analysis ignores the effect of this kind of informal workforce, which promotes development and informal economic activity. Also, a high rate of return to higher education in the poorest countries, for

example, does not necessarily mean a great contribution of university graduates to economic development. It may mean a large income gap exists between people without education and those with education.

The second problem of the social rate of return is its assumption that people with education are paid more (and presumably work more efficiently) because of their education. In fact, many other factors influence income and just correlate with educational level. Family background is one of the most obvious f actors that affect both income and education. An individual with a higher education may be paid more just because his or her parents may be relatively richer and can arrange a better job for their child. Another factor is that those with a higher education possibly have higher self and external (societal) esteem, more motivation, and greater natural ability.

Education may also function as a screening device of people. The content of education does not matter as much as the diploma because employers select applicants on the basis of how much education they have received. In other words, education may not contribute to economic development directly but may serve as a screening device of employees for the employers. This practice, called the "screening hypothesis" or "credentialism," tends to create excessive demand for higher education.

Third, it is difficult to argue worldwide trends and theory of education and development based' on the averaged rate of return to education of the available studies. It is very risky to make conclusions, as Psacharopoulos (1993) did, from just the averaged rate of return of a limited number of available studies. For example, Psacharopoulos presented the averaged rates of return for each level of men's and women's education, based on a collection of several results of rate of return analyses. His averaged figure of the rate of return to women's primary education was calculated based on only five studies two of which were on Great Britain in the 19th century. It is highly risky to generalize a world trend of the rate of return to primary education based on those two studies or on the other three studies on Puerto Rico in 1959, Taiwan in 1982, and Indonesia in 1982.

2. Cross-National Cross-Sectional Studies

The cross-national cross-sectional study method has been another popular device to identify the contribution of education. This study uses correlation and multiple regression to examine the effect of education (independent variable) on economic development (dependent variable). The first cross-national approach to education's effect on economic development was presented by Harbison and Myers (1964). They found a high correlation between several educational indicators, such as enrollment in each level of education and proportion of students in science and non science fields, and GNP per capita of about 80 countries. Using the same tests, with the nations divided according to income level, they found that lower levels of education are more important in less developed countries, while higher levels of education and science education are more important m more developed countries. However, their use of GNP per capita

as an indicator of economic development is problematic, because it represents level of development but not progress in the economic situation or economic growth.

Lee and Psacharopoulos (1979) included, in their correlation analysis, the average annual growth rate of the GNP, as well as per capita income, as economic performance indicators. They found that the correlations of educational enrollment and economic performance are very weak in advanced countries. Two indicators in particular -- enrollment in vocational schools and the number of doctorates per 1,000 population -- show very low correlation with national economic performance. On the other hand, two other indicators, enrollment in primary education and the literacy rate, are highly correlated with economic performance.

Meyer, Hannan, Rubinson, and Thomas (1979) used the multiple regression method to identify the effect of educational enrollment in 1950 on economic growth from 1950 to 1970. First, they found that enrollment in primary and secondary education has a significant positive impact on economic development, while enrollment in higher education has a non-significant negative impact. Second, the impact of secondary education is stronger than that of primary education. Third, after the countries are divided into richer and poorer groups, the two tendencies can still be observed in both groups.

McMathon (1987) was the first to relate educational investment (educational expenditure and income forgone) with economic growth. In his multiple regression analysis of 30 African countries, he found that investment in primary and secondary education (taken together) had a large positive impact on economic development, while investment in higher education had a negative impact.

Benavot (1989) found that primary education enrollment has a more significant impact on economic development than does secondary education enrollment and that higher education enrollment has a significantly negative impact. His main contribution was his analysis on the gender differences in educational enrollment on economic development, which had not been investigated before his work. He found that educational expansion among school-age girls at the primary level has a stronger effect on economic development than that among boys.

Baumol, Blackmann, and Wolff (1989), using the regression method, found that all levels of education have a positive impact on economic growth in the five periods they investigated. They also found that "higher education does not confer as much benefit via its contribution to the catch-up process as does secondary education." Although they did not use any control variables or investigate different levels of development, the main virtue of their study is that they did not put the enrollment of the three levels in one equation, which many other multiple regression studies did. This is a better model to prevent the multicollinearity problem. Surely, the enrollment rates of the three levels are highly correlated with each other, and biased estimates are likely to result if they are put together in one equation.

For example, Barro (1991) neglected the multicollinearity problem in his analysis. He put the educational enrollment of primary and secondary education in one model and also, in some equations, put educational enrollment in 1950 and 1960 together (they are surely highly correlated) in order to analyze the relationship between the growth rate of real per capita GDP

from 1960 to 1985 and initial human capital of 98 countries. However, the virtue of his analysis is his introduction of control variables. For instance, he included an indicator of political instability, which has a significant impact on economic development. He found not only a positive impact of education on economic growth but also its positive relationship with the investment rate and negative relationship with the fertility rate.

The World Bank's publication "East Asian Miracle" (1993) suggested that one of the reasons for the successful economic development in that region is the high human capital formation and that the quantity of basic education is considerably higher in those economies then in other economies with a similar income level. With the cross-national regression analysis, the bank found that primary education enrollment is the largest contributor to economic growth, followed by average investment rate in physical capital, secondary education enrollment, and population growth. The study concluded that the prioritized allocation of public resources to primary and secondary education was the determiner in the success of educational strategies in this region.

Thus, a number of attempts have been made to identify the effect of education on economic growth with a cross-national statistical analysis. All of them suggest a greater impact of primary and secondary levels of education on economic development than higher education. However, there are several problems in the previous studies. First, the proxy they used for human capital was only school enrollment rates, which can be considered flow of education, but not years of schooling, which is the indicator of stock of education and a better indicator for human capital. Although a change in educational enrollment affects the level of human capital in a long run, educational enrollment does not represent the educational attainment of workers directly but only the percentage of enrolled students in the same age cohort. Second, with a few exceptions, many of the previous studies took all the countries together and did not analyze the impacts of education on development at different development stages.

3. Hypotheses

The previous studies lead to several hypotheses, to be tested in this research on the contribution of education to economic development, focusing on levels of education.

Hypothesis (1)

Lower level education has more impact on economic development than higher level.

This tendency was found in many previous rate of return studies. The worldwide average social rate of return to primary education is 20.0%, while that to secondary education is 13.5% and that to higher education is 10.7% (Table 1). Many cross-national studies have also found a larger impact of primary education and secondary education and a smaller or sometimes negative impact of higher education. However the difference in importance between primary and secondary education is not clear in many of the studies. More studies than not suggested that it is

natural to assume that the impact of primary education is stronger than that of secondary education (e.g. Benavot 1989, World Bank 1993). Only one study asserted the opposite (Meyer and Hannan 1979). Some of the studies took primary and secondary education together to compare with higher education (e.g., McMathon 1987, Barro 1991) or did not examine the relative impacts between primary and secondary education

Table 1 Returns to Education by Level

Educational Level	Social	Private
Primary	20	30.7
Secondary	13.5	17.7
Higher	10.7	19

Source - Psacharopoulos (1993)

Hypothesis (2)

Lower level education contributes to economic development more strongly in less developed countries than in more developed ones. In less developed economies, where universal primary education is often not complete and agriculture dominates the economy, an increase in primary education possibly has more impact than the same amount of increase in primary education has in more developed economies. The social rate of return analysis shows this tendency clearly. The social rate of return to primary education in low-income countries is 23.4% while that in lower middle-income countries is 18.2%, and that in upper middle-income countries is 14.3% (Table 2). (The social rate of return in high-income countries is not available.)

Only a few of the previous cross-national studies examined the impacts of levels of education on economic growth in different income groups. Using the correlation analysis method, Lee and Psacharopoulos (1979) found that, in low-income countries the educational enrollment at the primary level in 1960 was significantly correlated with economic growth in the 1900s while they were not in middle-income countries and high-income countries. In the Meyer, Hannan, Rubinson, and Thomas study (1979), the researchers found no impact of primary education and a significantly positive impact of secondary education on economic growth in both "richer countries" and "poorer countries."

Table 2

Returns to Investment in Education by Level (%), Latest Year

Averages by Per Capita Income Group

Region	**Mean Per Capita ($)**	**Social**			**Private**		
		Prim.	**Sec.**	**Higher**	**Prim.**	**Sec.**	**Higher**
Low Income ($610 or less)	299	23.4	15.2	10.6	35.2	19.3	23.5
Lower Middle Income (to $2,449)	1,402	18.2	13.4	11.4	29.9	18.7	18.9
Upper Middle Income (to $7,619)	4,184	14.3	10.6	9.5	21.3	12.7	14.8

High Income ($7,620 or more)	13,100	n.a.	10.3	8.2	n.a.	12.8	7.7
World	2,020	20	13.5	10.7	30.7	17.7	19

Source: "Returns to Investment in Education: A Global Update," 1993, by George Psacharopoulos

Hypothesis (3)

Higher level education contributes to economic development more strongly in more developed countries than in less developed ones. In more developed economies, where universal primary education is usually almost complete and the production system requires the acquisition and development of sophisticated technology and highly educated manpower, an increase in higher education possibly has more impact than the same amount of increase in higher education has in less developed countries. The social rate of return analysis, however, does not strongly support this argument. The social rate of return to higher education in low-income countries is 10.6%, while that in lower middle-income countries is 11.4%, that in upper developed countries is 9.596, and that in high-income countries is 8.2% (Table 2). Although there is no clear direction of the social rate of return across income levels, the difference from tendency of primary education is clear. While primary education has a lower social rate of return at the higher development stage, social rates of return to higher education are approximately the same across development stages. Lee and Psacharopoulos (1979) found that enrollment in higher education in 1960 was positively correlated with economic growth in the 1960s in low-income countries, and negatively correlated in middle- and high-income countries. However, all of these correlations are not statistically significant. Meyer, Hannan, Rubinson, and Thomas (1979) found a negative impact of higher education in both "richer countries" and "poorer countries."

Although the previous rate of return analysis or cross-national studies do not support this hypothesis, it is presented based on the assumption that a higher level of industrialization requires a highly educated labor in industrialized economies.

4. Research Method

(1) Data Source

This study utilizes the "Data Set for a Panel of 138 Countries," prepared by Barro and Lee (1994). The data set contains national-level statistics on national accounts, education, population, government expenditures, price levels, the political situation and trade policy at five-year intervals from 1960 to 1985 or 1990. This study also uses the data set from the "World Table 1994," published by the World Bank, for a control variable that is not contained in the Barro and Lee data set.

In most of the previous literature, school enrollment rates were used as possible proxies for human capital. However, Barro and Lee data set allows this study to use average years of schooling in the population. It is expected that years of schooling represent human capital in a

country better than enrollment rate, because this variable represents the "stock" of human capital, while the enrollment rate represents only "flow." Barro and Lee created the data set based on population censuses which are available in a limited number of countries. The census information fills 40% of the cells and then the adult literacy rates and school enrollment rates, which are available from UNESCO, are used to estimate the numbers in the other cells. Although this attempt to create educational stock indicators is a great contribution to the advancement of cross-national analysis of human capital, it should be noted that 60% of the educational data is an estimation based on enrollment data and may not reflect educational stock perfectly.

(2) Regression Model

As seen in the literature review, a number of cross-national studies have been done on education and economic development. Some have used a correlation analysis (e.g. Harbison and Myers l~4, Lee and Psacharopoulos 1979). However, most have used a regression analysis to examine the degree to which a change in the dependent variable economic growth, is associated with the independent variable, education.

There are two possible models for regression to identify the contribution of education to economic growth. One is a panel design. In this model, a time gap is put between the dependent variable and the independent variables. Because the time of the dependent variable t and the time of the independent variable t-1 are set, the dependent variable t-1 must be put as an independent variable to control the already existing effect of the dependent variable t-1. For example, where Yt is GDP per capita in 1985, Yt-1 is GDP per capita in 1970 and Xt-1 is educational attainment in 1970, the panel design model is as follows:

$$Yt = b0 + bl*Yt-1 + b2*Xt-1 + e$$

The other possibility is to take the growth rate of the independent variable from t-1 to t. For example, where Y (t-1, t) is the growth rate of GDP per capita from 1970 to 1985, Xt-1 is educational attainment in 1970, this model is as follows:

$$Y(t-1, t) = b0+ b1*Xt-1 + e$$

Both ways are used by the cross-national studies that have been reviewed. A few studies used the first approach, the panel design (e.g., Benavot 1989), and more used the second approach. Although the first approach provides the regression coefficient for Yt-1, which is certainly the merit of this method, there are two main problems. First, because the dependent variable and one of the independent variables are time lagged, the correlations of those variables are generally very high and the R square is also very high. Therefore, if the first model is used, the analysis of the R square is meaningless. Many of the previous studies that used this method recognized the problem and did not analyze the R square. Second, when the first method is used to examine the impact on economic growth and the dependent variable is national income, the normality of the dependent

variable is unlikely to be obtained. On the other hand, the growth rate of national income is likely to be normally distributed. Considering the merits and demerits of both approaches, this research uses the second approach.

(3) Grouping of Countries

The regression is run with all countries first and then with countries of each level of development to examine the different impacts of education on economic development in different development stages. There are a number of ways to classify countries by development stages. Some may look at literacy rate, industrial structure, life expectancy, etc. Because this analysis focuses on economic growth, countries are classified by economic level. To allow each development stage to have a statistically appropriate number of countries, countries are divided into three groups: low-income, middle-income, and high-income countries. Low-income countries are defined as countries with a GDP per capita of less than US$1,500 in 1970; middle-income countries have a GDP per capita between US$1,500 and US$5,000; and high-income countries have more than US$5,000 GDP per capita in 1970.

(4) Time Period

This study investigates the impact of education on economic growth from 1970 to 1985. This period is chosen to maximize the number of cases. In the Barro and Lee data set, relatively less data is available in 1960 and 1965 and in 1990

(5) Dependent Variable--Economic Development Indicator

The concept of "economic development" is broader than "economic growth." "Economic growth" represents merely the increase in wealth, while economic development means the increase and improvement "in productivity and efficiency of social settings. There is much overlap between the two notions and the most used proxy for economic development is economic growth rate. Acknowledging the limitation, this study uses economic growth rate as a dependent variable. The indicators of national economic wealth are also many: gross national product, net national product, gross domestic product, national income and domestic income. They are all defined and calculated in different ways. The most available and frequently used indicators are gross national product (GNP) and gross domestic product (GDP). The difference in these indicators is that GNP includes net income transfer from foreign countries, but GDP does not. Considering that this study focuses on the progress of domestic productivity, in which education plays an important role, the use of GDP better fits the purpose of this study. In fact, almost all the recent cross-national studies of economic growth have used GDP (e.g., Barro 1989, World Bank 1992) although some relatively old studies used GNP when the cross-national data on GDP was available only for a limited number of countries (e.g., Harbison and Myers loe4, Lee and Psacharopoulos 1979).

The simple growth rate of GDP may reflect only the growth of population. Because population growth rates vary from country to country, economic growth is better captured by

looking at the growth of GDP per capita rather than the growth of GDP. The growth rate of GDP per capita, as a dependent variable, takes a logarithm transformation to make the distribution more normal. The data on GDP per capita in Barro and Lee data set is originally from "The Penn World Table" (Summers and Heston 1991) and is already adjusted for the 1985 international price.

Here the measure used is
Yt = Growth rate of GDP per capita from 1970 to 1985 = Log (GDP per capita m 1985 / GDP per capita in 1970)

(6) Independent Variable-Education Indicator

This study uses years of schooling because this indicator presumably is the best proxy for human capital at different levels of education. Average years of schooling, the sum of the three levels of education, are included to examine the impact of overall education on economic growth.

The specific measures for these education variables are:
HUMAN70 = Average schooling years in the total population over age 25 in 1970
PYR70 = Average years of primary schooling in the total population over age 25 in 1970
SYR70 = Average years of secondary schooling in the total population over age 25 in 1970
HYR70 = Average years of higher schooling in the total population over age 25 in 1970

These educational stock variables are highly correlated. If they are put in one regression, multicollinearity makes it difficult to estimate regression coefficients for education variables and increase the standard error and possibility of obtaining nonsignificant coefficients. Consequently, in this study, each education indicator is put in each regression model, then the results of the regression are compared across models to avoid the multicollinearity problem. This treatment of educational variables in a cross-national study is found in several previous studies (e.g., Benavot 1989, Baumol Blackmann and Wolff 1989). There are some studies in which highly correlated educational variables are put in one regression model (e.g., MacMahon 1987, Barro 1991).

To test hypothesis (1) "Lower level education contributes to economic development more effectively than higher level," the regression coefficients, T-values and their significance, and R squares are compared across the three levels. It should be noted that the regression coefficients of these education level indicators represent the impact of a certain amount of increase in educational stock on a dependent variable, such as the impact of a one-year increase in years of schooling. Consequently, the regression coefficients do not represent the impact of the increase in unit cost of education because, as reviewed, the per capita cost of each level of education differs significantly from the other levels. Because complete cross-national data on the per capita cost of different levels of education is not available, the educational indicators cannot be controlled by the unit cost. This limitation should be reflected in the comparison of regression

coefficients across levels of education. Many of the previous studies do not discuss this problem. For example, Baumol, Blackmann, and Wolff (1989) suggested that educational enrollment in lower levels has a larger impact on economic growth, looking at only the higher significance level of the lower levels of education compared with the higher levels and ignoring the fact that the higher education has higher coefficients.

The same attention should be paid when the regression coefficients, T values, and R squares of education indicators are compared across development stages of countries to test hypothesis (2),"lower level education contributes to economic development more strongly in less developed countries than in more developed ones," and hypothesis (3),"higher level education contributes to economic development more strongly in more developed countries than in less developed countries."

(7) Independent Variables--Control Variables

Although some previous cross-national studies did not use control variables (e.g. Lee and Psacharopoulos 1979, Baumol, Blackmann, and Wolff 1989) it is important to include them in the model because economic growth is an outcome of complex social and natural settings of countries. The following three control variables are selected based on their theoretical significance.

(a) Fuel Export

FUELEI = (fuel export in 1970 -fuel import in 1970) / GDP in 1970

This indicator is expected to represent the contribution of fuel export to economic growth. Given the rapid increase in fuel prices in the 1970s, whether a country had fuel to export or had to import must have affected its economic growth from 1970 to 1985. Without this control variable, the model would have specification errors. This variable is expected to positively affect economic growth. Fry (1984) and Benavot (1989) introduced this factor as a control variable in their cross-national study of the impact of education on economic growth. However, they used only the dummy variable of whether a country is oil-producing. In this research, the fuel factor is calculated using the formula above to reflect the situation of fuel exporting countries as well as fuel importing countries. Because this data was not included in Barro and Lee data set, it is obtained from the "World Table 1994," published by the World Bank

(b) Political Instability

PlNST345 = (Average number of assassinations per million population per year from 1970 to 1985 = average number of coups per year from 1970 to 1985 = average number of revolutions per year from 1970 to 1985) / 3

This variable represents political instability, which is expected to have a negative impact on economic growth. Fry (1984) used the number of coups as the indicator of an unstable political environment as a control variable in his study on the impact of foreign study on development and found a significantly negative effect on economic growth. Barro (1989) included the number of

revolutions and coups per year and the number per population of political assassinations per year in his model and found that they have significantly negative impacts on economic growth. He argues that political instability worsens property rights and then lower workers' effectiveness and eventually slows economic growth. Because the coups, revolutions, and assassinations all represent political instability and are correlated highly with each other, this study uses the combined number of the three indicators as the measure of political instability. These variables are included in Barro and Lee data set but are originally from the "Cross-national Time Series Data Archive."

(c) Degree of Export Orientation

EX345 = (Average ratio of export to GDP from 1970 to 1985 in current international prices). This variable represents the degree to which an economy is export oriented, which is suggested by several studies as one of the characteristics of a rapid growing economy in East Asia. The World Bank (1992) included these factors with the human capital factor in its cross-national regression model and found that both factors had significantly positive impacts on per capita economic growth. The bank explained that exporting promotes the "productivity-based catching up" process of less developed countries, helping to overcome the imperfections of knowledge and its acquisition. Compared with an import-substituting economy, an export-oriented economy is more likely to earn the foreign exchange for importing new machines, attract export-oriented direct foreign investment, obtain technical knowledge from foreign firms and information from consumers, and establish domestic research and development functions. This variable is included in Barro and Lee data set, but originally came from "The Penn World Table (Mark 5)" (Summers and Heston, 1991).

5. Statistical Results

(1) Educational Variables

Table 3 is the summary of means and standard deviations of average years of schooling in 1970 (HUMAN70, PYR70, SYR70, and HYR70). As can be easily predicted, all the educational indicators are smallest in low-income countries and largest in high-income countries. For example, in 1970, the average years of schooling (HUMAN70) in low-income countries were only I .8 years, while they were 7.1 years in high-income countries. The F values of the ANOVA tests show that all the indicators are significantly different across income levels of countries.

The average years of schooling are the greatest in primary education and smallest in higher education in all the income levels. For example, the average length of primary schooling (PYR70) of all countries was 2.9 years, while the average length of higher education (HYR70) was only 0.1 year. Thus, the indicators in primary education are much larger than those in higher education in all the country types. The significant F-values (56.14, 35.20, 25.78) indicate the significant difference of the effects of educational levels in each country group.

Table 3 Means and Standard Deviations of Educational Stock by Levels and by Country Type and F Value of ANOVA Mean

[Standard Deviation]

	All Countries N	Low-Income N Countries	Middle Income N Countries	High-Income N Countries	ANOVA F value
HUMAN70	3.81467 102 [2.63464]	1.81276 38 [1.42312]	3.89324 42 [1.94122]	7.1225 23 [1.93180]	63.24***
PYR70	2.93997 102 [1.96113]	1.43521 38 [1.10482]	3.08031 42 [1.50924]	5.27118 23 [1.43867]	56.14***
SYR70	0.73468 109 [0.77294]	0.30345 44 [0.38614]	0.71884 43 [0.60802]	1.62809 23 [0.86725]	35.20***
HYR70	0.09505 110 [0.11945]	0.039 45 [0.03797]	0.08807 43 [0.03342]	0.22336 23 [0.19181]	25.78***

***p<0.01 **p<0.05 *p<0.1

(2) Control Variables

Table 4 provides the summary statistics of the control variables. The indicator of political instability (PlNST345) is lowest in the high-income countries, while the indicators are almost the same in low-income and middle-income countries. The F Value of the ANOVA tests shows that political instability differs significantly across country types. The indicator for export orientation (EX345) is highest in the high-income countries and lowest in the low-income countries. The F value also shows the significant difference of the degree of export orientation across country types. The indicator of fuel export (FUELEXIM) is highest in middle-income countries, while the indicators for low income and high-income countries are lower and similar. The F value of an ANOVA test does not obtain statistical significance.

Table 4 Means and Standard Deviations of Control Variables by Country Type and F Value of ANOVA test Mean

[Standard Deviation]

	All Countries N	Low-Income N Countries	Middle Income N Countries	High-Income N Countries	ANOVA F value
PINST345	0.08044 117 [0.10519]	0.0972 53 [0.09716]	0.09583 41 [0.12696]	0.01438 24 [0.03226]	6.15***
EX345	0.2003 112 [0.17414]	0.15017 52 [1.16305]	0.18952 37 [0.13109]	0.33095 23 [0.19815]	10.13***
FUELEXIM	-1.18266 87 [9.10849]	-1.78728 35 [0.03797]	-0.04214 32 [10.86621]	-1.94941 21 [9.91625]	0.39

***P<0.01 **p<0.05 *p<0.1

(3) Regression Analysis across Levels of Education for All Countries

Table 5 provides the results of simple regressions (no control variables). It presents the

effect of educational indicators at all levels on the economic growth of all countries. First, the average length of total schooling (HUMAN70) has high statistical significance. Second, the lower levels of education have lower regression coefficients and higher T-values than higher levels of education. The regression coefficient for higher education (HYR70) is approximately ten times greater than that for primary education (PYR70). While primary (PYR70) and secondary education (SYR70) have statistical significance higher education (HYR70) does not. The R squares are very small at all levels of education. The same tendency is also found in the multiple regressions (with control variables) in Table 6. Lower levels of education have lower regression coefficients and higher T-values than higher levels of education. While primary education (PYR70) has statistical significance, secondary (SYR70) and higher education (HYR70) do not.

Table 5 Effect of Education at Each Level on Economic Growth
(Simple Regression, All Countries)

	HUMAN70	PYR70	SYR70	HYR70
Regression Coefficient	0.036244	0.4772	0.97013	0.441548
T Value	[2.838]***	[2.761]***	[2.313]**	[1.629]
R-square	0.0789	0.075	0.0503	0.0253
N	95	95	102	103

*** p<0.01 ** p<0.05 * p<0.1
T-value of coefficient estimates appears in parentheses

Greater coefficients of higher levels of education suggest that a certain amount of increase in educational stock (e.g., a one-year increase in schooling) at higher levels has more impact on economic growth than the same amount of increase in educational stock at lower levels. Consequently, hypothesis (1), "lower level education has more impact on economic development than higher level," is rejected by this finding. However, there is a large difference in cost among the three levels of education. For example, a one-year increase in the averaged years of primary education is much less costly than a one-year increase in higher education. Consequently, greater regression coefficients at higher levels of education do not mean greater cost-effectiveness of higher education, compared with lower levels of education. Also, the significance of the association between education and economic growth is larger at lower levels of education than at higher levels of education.

Table 6 Effect of Education at Each Level on Economic Growth
(Multiple Regression, All Countries)

	[1]	[2]	[3]	[4]
Intercept	0.188334	0.185014	0.241999	0.261249
	[2.146]	[2.068]	[2.960]	[3.180]
	HUMAN70	PYR70	SYR70	HYR70
Education	0.031802	0.042586	0.068777	0.276444
	[2.135]**	[2.049]**	[1.542]	[1.063]
PINST345	-0.521242	-0.537947	-0.554233	-0.610362
	[-1.499]	[-1.547]	[-1.585]	[-1.740]
FUELEXIM	0.004995	0.005241	0.003953	0.003652
	[0.953]	[0.992]	[0.752]	[0.689]
EX345	-0.333718	-0.317781	-0.190379	-0.09903
	[-0.944]	[-0.899]	[-0.551]	[-0.299]
Rsquare	0.1215	0.1168	0.0906	0.0746
F Value	2.178	2.082	1.62	1.331
N	67	67	69	70

*** p<0.01 ** p<0.05 * p<0.1
T-value of coefficient estimates appears in parentheses

(4) Regression Analysis across Levels of Education and across Country Types

Table 7 provides the results of simple regressions (no control variable) in the different country types. In low-income countries, the regression coefficient is about five times higher for higher education (HYR70) than for primary education (PYR70). Only primary education (PYR70) has statistical significance. In middle-income countries, both the regression coefficient and T value are higher for higher education than for the lower levels of education. Only higher education (HYR70) has statistical significance. On the other hand, in high-income countries, both the regression coefficient and T value is lower for higher education (HYR70) than for the other levels of education (PYR70 SYR70). None of the educational levels has statistical significance. Across the three levels of education, the R squares are generally low.

Tables 8, 9, and 10 are the results of multiple regressions (with control variables) in the three country types. Almost the same tendency is observed in the low- and middle-income countries, although the education variables do not obtain statistical significance after the control variables are introduced in the models. In high-income countries, almost no impact of education on economic growth was found after the regression was controlled by the other factors. In both the simple and multiple regression models primary and secondary education (PYR70, SYR70) have the highest regression coefficients for low-income countries and the lowest coefficients for high-income countries. Higher education (HYR70) has the highest coefficients for middle-income countries and the lowest for high-income countries.

Table 7 Effect at Education of Each Level on Economic Growth by Country Type
(Simple Regression)
Low-Income Countries

	HUMAN70	PYR70	SYR70	HYR70
Regression Coefficient	0.106764	0.13566	0.237724	0.686627
T Value	[1.800]*	[1.777]*	[1.221]	[0.582]
R-square	0.0975	0.0952	0.0398	0.0091
N	31	31	37	38

Middle-Income Countries

	HUMAN70	PYR70	SYR70	HYR70
Regression Coefficient	0.044156	0.046935	0.12913	1.9652
T Value	[1.612]	[1.319]	[1.553]	[2.137]
R-square	0.0061	0.0417	0.0325	0.1002
N	41	41	42	42

High-Income Countries

	HUMAN70	PYR70	SYR70	HYR70
Regression Coefficient	0.020056	0.027998	0.021551	0.018616
T Value	[1.106]	[1.152]	[0.521]	[0.099]
R-square	0.0576	0.0623	0.0134	0.0005
N	21	21	21	21

***p<0.01 **p<0.05 *p<0.1
T-value of coefficient estimates appears in parentheses

Hypothesis (2) "lower level education contributes to economic development more strongly in less developed countries than in more developed countries" is supported by these findings. Hypothesis (3) "higher level education contributes to economic development more strongly in more developed countries than in less developed ones" is rejected because higher education (HYR70) has the lowest, and sometimes negative regression coefficients and small R squares in both simple and multiple regressions in high-income countries.

Table 8 Effect of Education at Each Level on Economic Growth
(Multiple Regression, Low-Income Countries)

	[5]	[6]	[7]	[8]
Intercept	0.124328	0.138376	0.229393	0.315426
	[0.646]	[0.696]	[1.343]	[1.917]
	HUMAN70	PYR70	SYR70	HYR70
Education	0.0846	0.097329	0.264926	1.302862
	[1.489]	[1.282]	[1.437]	[1.044]
PINST345	0.830469	-0.633176	-1.232664	-1.481292
	[-0.869]	[-0.666]	[-1.226]	[-1.277]
FUELEXIM	0.055275	0.056302	0.049309	0.050867
	[2.470]**	[2.647]**	[2.162]**	[2.167]**
EX345	0.168187	0.095435	0.061831	-0.067019
	[0.159]	[0.071]	[0.058]	[-0.060]
Rsquare	0.4483	0.4303	0.4239	0.3868
F Value	3.251	3.022	3.127	2.839
N	20	20	21	22

*** p<0.01 ** p<0.05 * p<0.1
T-value of coefficient estimates appears in parentheses

Table 9 Effect of Education at Each Level on Economic Growth
(Multiple Regression, Middle-Income Countries)

	[9]	[10]	[11]	[12]
Intercept	0.306241	0.3274	0.325356	0.209023
	[1.684]	[1.596]	[2.367]	[1.264]
	HUMAN70	PYR70	SYR70	HYR70
Education	0.015719	0.00976	0.041065	1.485609
	[0.390]	[0.166]	[0.437]	[1.269]
PINST345	-0.656047	-0.669572	-0.647049	-0.618171
	[-1.476]	[-1.499]	[-1.489]	[-1.466]
FUELEXIM	0.015897	0.015147	0.015952	0.017901
	[1.550]	[1.430]	[1.691]	[1.935]*
EX345	-0.107754	-0.046173	0.005743	0.170238
	[-0.147]	[-0.065]	[0.008]	[0.229]
Rsquare	0.1791	0.1744	0.0395	0.229
F Value	1.2	1.162	1.277	1.708
N	26	26	27	27

*** p<0.01 ** p<0.05 * p<0.1
T-value of coefficient estimates appears in parentheses

Table 10 Effect of Education at Each Level on Economic Growth
(Multiple Regression, High-Income Countries)

	[13]	[14]	[15]	[16]
Intercept	0.282346	0.312348	0.226365	0.254821
	[1.758]	[2.135]	[1.988]	[2.363]
	HUMAN70	PYR70	SYR70	HYR70
Education	-0.003899	-0.011647	0.011846	-0.006588
	[-0.218]	[-0.493]	[0.320]	[-0.038]
PINST345	0.216206	0.26049	0.399076	0.255684
	[0.226]	[0.283]	[0.397]	[0.254]
FUELEXIM	-0.011213	-0.011731	-0.010487	-0.010812
	[-2.976]***	[-3.154]***	[-3.158]***	[-3.260]***
EX345	0.014167	0.019964	0.03955	0.019164
	[0.055]	[0.079]	[0.152]	[0.070]
Rsquare	0.4635	0.4704	0.4655	0.4619
F Value	3.24	3.331	3.265	3.219
N	19	19	19	19

*** p<0.01 ** p<0 05 * p<0.1
T-value of coefficient estimates appears in parentheses

6. Discussion

(1) Educational Stock

A finding about the effect of total educational stock (averaged total years of schooling of the population) on economic growth is as follows

(a)Educational stock variables do not have statistical significance in the models with the countries of different income groups after the control variables are introduced.

Rate of return studies have found that investment in education has higher private and social rates of return than investments in infrastructure (Psacharopoulos and Woodhall 1985). The growth accounting method also identified that significant parts of economic growth can be attributed to education (e.g., Denison 1962, Kendrick 1977). All the previous cross-national studies confirmed the significant contribution of education to economic growth (e.g., Meyer, Hannan, Rubinson, and Thomas 1979, Benavot 1989). Therefore, the results of this study are different from the previous studies in the significance of education for economic development. This is likely due to differences in the sample size, the quality of proxies for human capital and the use of control variables.

A reason for the smaller statistical significance of the income levels models, compared with that of the all-countries model, is apparently the smaller number of cases in the

income-levels model. Many of previous cross-national studies used only the all-countries model. However, it is also true that the statistical significance and R square of this study, which used years of schooling as the proxy for human capital, is relatively smaller than the previous cross-national studies which used educational enrollment rates.

As discussed, the averaged years of schooling is theoretically a better proxy for human capital because it represents stock of education while educational enrollment rate represents flow of education, which is merely the ratio of pupils who go to school in the same age cohort in a certain year. However, if it is true that educational enrollment compared to years of schooling, relate more with economic growth, this indicator may have some advantages in representing the human capital of societies. One possible explanation is that educational enrollment better represents the recent education of the young generation, while the averaged years of schooling include an education that took place many years ago. Consequently, the enrollment rates may reflect people's acquisition of new knowledge better than the educational stock indicator, which includes both recent education and old education and reflects people's acquisition of both new and old knowledge.

Another possible explanation is that rapidly growing economies tend to have a rapidly growing educational enrollment. Consequently, greater educational enrollment might be a result, not a cause, of rapid economic growth. Educational stock (years of schooling) can be also influenced by economic growth in the long run, but very slowly compared with educational enrollment. In this study, the average years of schooling in 1970 were used as a proxy for human capital for economic growth from 1970 to 1985. It is unrealistic to assume that the economic growth of these 15 years affects the years of schooling in 1970, which has accumulated for many years prior to 1970. On the other hand, it is possible that the economic growth in the period of 1970 to 1985 affected enrollment in this term. Theoretically, the economic growth during that term cannot affect the enrollment in 1970. However, a fast-growing economy from 1970 to 1985 likely also grew at a fast pace before 1970 and resulted in higher educational enrollment in 1970. If this idea explains partly why educational enrollment correlates with economic growth more strongly than years of schooling do, the use of years of schooling as a proxy for human capital is more strongly justified than previously argued.

Then, does not education contribute to economic development as much as human capital theory and modernization theory suggest? Dependency theorists see education as reinforcing the dependency condition of developing countries, while other two theories regard education as an important factor for economic development and modernization. Therefore, dependency theory may explain a part of the reason why education does not contribute to economic development as expected. However, in this analysis, education is found to have positive impacts on economic development, whether small or large, especially in developing countries. Dependency theory cannot explain the finding that education does not contribute to economic growth in developed countries but does in developing countries. They might predict the opposite tendency. To dependency theorists, because education is reinforcing the dependency of poor countries education should discourage the development of developing countries and encourage the

development of developed countries.

Although the finding of this research suggests that the significance of education may have been overestimated, it also at least indicates the positive impacts of education on economic development, especially in developing countries, and supports modernization and the human capital view on education and development. Because the relative significance of total educational stock in economic development is not a thesis of this study, further investigation is left for future research. Rather, this study concentrates on a comparison of the effects of education for each level on economic development.

(2) Levels of Education

The findings of the statistical analysis on levels of education can be summarized as follows:

(a) In general, an increase of educational stock at higher levels promotes more rapid economic growth than the same amount of increase of educational stock at lower levels does.

(b) The statistical significance of the association between education and economic growth is greater at lower levels of education than at higher levels.

(c) In low-income countries, an increase of educational stock at higher levels promotes more rapid economic growth than the same amount of increase of educational stock at lower levels does. However, the statistical significance of the association between education and economic growth is greater at lower levels of education than at higher levels.

(d) In middle-income countries, an increase of educational stock at higher levels promotes more rapid economic growth than the same amount of increase of educational stock at lower levels does. Also, the statistical significance of the association between education and economic growth is greater at higher levels of education than at lower levels.

(e) In high-income countries, an increase of educational stock at any level does not have a significant impact on economic growth.

As mentioned earlier, the first finding does not mean a higher cost-effectiveness of higher education, because the unit cost of higher education is greater than that of the lower levels. Because the educational stock at higher education level is generally more scarce than at lower levels, the same amount of increase of educational stock (e.g. an additional one-year to averaged years of schooling) in higher education can contribute more to economic growth than the same increase at lower levels. Because this study does not include the cost factor, all the statistical

results show are the higher regression coefficient of higher levels of education and the greater statistical significance of the relationship between lower levels of education and economic growth. This finding differs from the findings of other previous cross-national studies, which concluded that lower level education has a greater impact on economic growth than higher level. It may imply that the relative benefit of higher education for economic development has been underestimated. On the other hand, the second finding implies that lower level education promotes economic development more certainly than higher level. The probability of primary education contributing to economic development is hi her than that of higher education.

These two implications of the statistical results have not been discussed in the previous cross-national studies. Because Harbison and Myers (l~4) and Lee and Psacharopoulos (1979) used a correlation analysis, they ignored the elasticity of educational input in economic development. Baumol, Blackmann, and Wolff (1989) found that a higher regression coefficient lowers the statistical significance for educational enrollment at the higher level, which is consistent with this analysis of years of schooling. However, they did not discuss the regression coefficients and simply concluded that primary education is more important than higher levels for economic development. Weal (1992) criticized their ignorance of regression coefficients in his review of cross-national studies of education and economic growth. Consequently, the greater regression coefficient of higher education was never discussed, while the greater statistical significance and greater R square of lower level education have been found in previous studies.

What can the findings of this study tell policy makers? Because this analysis unfortunately could not include cost factors and because the coefficient for higher education is not statistically significant, the first finding is not a sufficient challenge to the current trend of educational finance, which puts a higher priority on lower levels of education. Moreover, the second finding confirms the rationale for the trend to invest in lower levels of education for development. Although the effectiveness of investments in primary and higher education cannot be compared, it is now apparent that investing in primary education drives economic development, at least with a higher probability, than investing in higher education does. This study supports the conclusion justifying investment in lower levels of education.

However, policy makers should realize that less costly higher education has the potential to promote economic development more strongly than lower levels of education. Consequently, policy makers should be aware of the difference in the unit cost of the three levels of education. If the disparity in unit cost between primary and higher education is inappropriately large, policy makers should try to reduce the disparity. At the same time, knowing that an increase in the stock of higher education has a greater impact on development than that of primary education does, it is crucial to maintain and promote enrollment in higher education. For example, many developing countries are now privatizing their higher educational institutions to reduce the public cost for this sector under the strong guidance of the World Bank (Ranson, Khoo and Selvaratnam 1993). Although this may be a reasonable policy option for establishing cost effectiveness in higher education, if this policy discourages the enrollment significantly, it may damage potential economic growth in these economies.

The findings also imply that there are distinct differences in priorities in levels of education for economic development across income groups of countries. In particular, the importance of higher education in middle-income countries is astonishing, compared with the other two income groups. The relatively greater importance of lower levels of education is confirmed in low-income countries. There are several possible reasons why providing primary education is more important in low-income countries than it is in middle-income countries. First, in low-income countries, primary education is still not universal. Presumably, there is a diminishing marginal effect of years of schooling on economic development. In other words, providing the first year of schooling to people, who have not had any education before, has a greater impact on development than providing the tenth year of schooling to people who have already had nine years of schooling, especially where a significant proportion of the population does not have the opportunity to receive the first year of schooling. Consequently, primary education becomes especially important in low-income countries where the enrollment in primary education is relatively low. Second, lower level education contributes to the improvement of social circumstances of poverty, which are the main constraints for economic development in low-income countries. Education at lower levels in low-income countries provides students with basic knowledge for improvement of their and their family's life in key areas, such as health and agriculture. Third, graduates from primary and secondary education can contribute to the progress of agricultural activity, which is still a significant part of the economies of low-income countries. On the other hand, graduates from higher education tend to enter the industrial and public sector, which is limited in those countries. Therefore, higher education cannot contribute to economic development as much as can in low-income countries.

In middle-income countries, primary education is almost universal. Therefore, a further increase in lower level education is not as important as in low-income countries. On the other hand, higher education promotes economic development through nurturing human resources for industrialization, and transferring and developing the technical knowledge necessary for middle-income countries to develop more. Graduates from higher education contribute to economic development by entering the relatively larger, formal economic sectors of middle-income countries.

In high-income countries, no significant relationships between education and economic growth were observed. Because high-income countries have already attained a certain level of educational stock, there is almost no effect from additional educational input on economic growth. Also, educational policy in developed countries tends to target not economic growth directly but other purposes of education, such as individual fulfillment and sociocultural development. In less developed countries, the effect is greater because the educational stock is small enough for additional input to make a substantial difference and the educational policies tend to target economic growth more directly.

This finding, confirming a difference across country groups, presents a challenge to the findings of the rate of return analysis and previous cross-national studies. Although the rate of return analysis suggests that both private and public rates of return to education tend to be lower

in more developed countries, it also indicates that the investment priority among levels of education is the same all over the world (Psacharopoubs 1993). Most of the previous cross-national studies did not analyze the difference across development stages of countries but treated all the countries together. Educational policy makers, especially those who work at the international level, should recognize the different impacts and needs for levels of education in each development stage of a country and set appropriate investment priorities in levels of education.

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