Sustainable development of low income countries through investment in tertiary education

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Abstract

To counterbalance the challenges of globalization, raising the superiority of our tertiary education to global standard is very significant. Tertiary education is the essential enabler of the human capital of the twenty-first century that demands a set of new competencies. It draws lessons for developing countries where policy makers have set out procedure to build a tertiary education in which higher priorities and future strategies would form the center of the sustainable development strategy. In the case of low-income economies, which are keen to invest in tertiary levels of education but the government budget is constrained, this study recommends the formation of financing sources. In addition, it is necessary to develop an effective lifelong learning system to provide continuing higher education and skill upgrading to persons after they have left higher education in order to provide the changing skills necessary to be competitive in the new global economy. This paper analyses the importance of investment in tertiary education with low-income economies to ensure a gradual sustainable development over the years. It is apparent that Bangladesh will acquire potential gains from investment in tertiary education.

I. Introduction

Previous studies on low-income economies place heavy emphasis on investment in primary education, partly due to the primary sector orientation of these economies and high rates of returns associated with primary schooling. Gathak (1995), Papagergiou (2003) and Psacharopoulos (1985, 1994), emphasized primary education as a necessary and adequate ingredient for economic growth and development in developing countries, especially those with low income. This argument is based on the economic structure of these countries and the estimated high rates of return on investment in primary education. Lau, et al. (1991) and Psacharopoulos (1994), among others, argue that, based on the rate of returns, universal primary education is one of the most significant factors enhancing economic development in low-income economies. Their studies find that the rates of return on primary education are higher in poor countries, because wages earned by additional years of schooling exceed by far the initial cost of schooling.

Most low-income economies, however, are characterized by poverty, low state investment, limited numbers and quality of educational and legal institutions, inadequate financial resources and capital market imperfections. These factors combine to prevent adequate investment in human capital. Thus, the stock of skills and productive knowledge embodied in people remains low and consequently limits economic growth. Primary schooling is inadequate for the purpose

of adopting the sophisticated technology that characterizes a modern economy. Secondary and tertiary education is of greater significance for technological innovation, absorption and diffusion (Engelbrecht, 2002).

Human capital theory, however, postulates a positive relationship between the levels of education, the main way of acquiring human capital, and labor productivity. That means higher levels of education, ceteris paribus, contribute more to economic growth than lower levels of schooling. Human Development is a concept which considers both quantitative and qualitative aspects of sustaining life, aiming at increasing human welfare. Moving forward in a knowledge based economy, human capital becomes one of the major building blocks towards a sustainable growth path. Basic education should provide the foundation for learning, and tertiary education should develop core skills that encourage creative and critical thinking. As a consequence, tertiary education is essential, and tenacity of any nation to development, advancement, progress and sustainable growth and its effective returns contribute towards development and advancement of a nation, which will get benefit from generation to generation. Education provides a positive guidance to our future generation and helps to accelerate development of the nation.

II. Literature Review

UNESCO Director General Koichiro Matsuura mentioned of a 'veritable revolution' in Higher education with the dynamics of accelerating demand, diversification of provider's impact of information and communication technologies, and globalization (UNESCO World Conference on Higher Education, 2009). Investment in human capital, through investment in tertiary education, is a necessary ingredient to economic growth and development; although it is not sufficient (Cypher and Dietz, 1997). For a long time, the development of human capital was regarded as a requirement for the growth and development of any economy (Schultz, 1961).

Economic growth in future depends on the kind of educational investment made at present, therefore, defining a financing policy for education that promotes the country's human capital at higher levels, together with complementary policies to enhance their effective use in a way that can make the system sustainable, should address this problem in the long-run. Not only is education significant for economic growth, it also holds considerable private benefits for individuals. These benefits accrue either directly or indirectly. Economic development strategy should lay emphasis on investment in human capital, as human resources are the most significant resource of the country.

Jan. P. Voon (2004) says that the rate of return is the rate of interest that equates the PDV of the costs and benefits of acquiring a university degree. The general cost and benefit framework is expressed as:

$$PV = \sum_{t=1}^{n} \frac{B_t}{(1+r)t} - \sum_{t=n+1}^{m} \frac{C_t}{(1+r)t} = 0$$

$$\text{Or, } \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)t} = 0$$

where, C_t is the opportunity cost of university degree in year t; B_t is the benefit of university degree in year t; n is the length of education; $(m-n)$ is years in workforce or, individual earning life span assumed to terminate at the age of 65 when the same cohort of the graduates retires from the workforce; r is internal rate of return to the investment, in this expression for the rate of return it is assumed that all costs are incurred in years 1 to n, and benefits accrue between years n and m).

Cost includes any forgone earnings, sacrificed because the individual is in school and does not work. In addition to forgone earnings, households face direct costs in spending a child to school. These costs may include school or uniform fees, payments for books and other materials, transportation costs, or other "unofficial" fees to ensure a child get the attention of a teacher. Even though the dollar value of the private benefits of an education is likely to far exceed the dollar value of the private costs, a value for education can be found because future benefits are much more heavily discounted than costs incurred more immediately. Once the private rate of return to schooling is estimated, it can be compared to the internal rates of return to other household investments. Economists argue that one cannot simply add up the costs and compare them to the benefits because money received in the future is worth less than money that can be spent today. Such positive time preference is the result of both uncertainties about the future. Future benefits need to be discounted to compare them to current cost. One way of doing so is to compare the present value (PV) of all costs and benefits.

According to Psacharopoulos (1994), the elaborate method follows an algebraic definition of the rate of return which is the rate that equates a stream of benefit to a stream of costs for a given period. In this method of private rate of return calculation, the only cost of the education project under evaluation is the opportunity cost of staying on in school beyond the age of 18 instead of working in the labor market. The data requirement of this method is quite demanding and is usually not available for most developing countries. The basic earnings function is due to Mincer (1974) and involves the fitting of a semi-log ordinary least square regression using the natural logarithm of earnings as the dependent variable, and the years of schooling, potential years of labor market experience and its square as independent variables. In this semi-log earnings function specification, also used by Appleton et al (1999), the coefficient on years of schooling can be interpreted as the average private rate of return to one additional year of education regardless of the education level to which this year of schooling refers (see also Appendix).

This study estimated the effects of three forms of human capital on schooling, namely formal education, experience provided by employers, and its square pursued by employees. Human capital theory suggests that higher education raises the productivity of workers by imparting useful knowledge and skills, hence raising workers' future income by increasing their lifetime earnings (Becker, 1964). Becker (1964) and Mincer (1974) provide an explanation that links investment in higher education with workers' wages. Over the past thirty years or so, hundreds of studies have been conducted to estimate rates of return to education (RORE); most such studies show that higher schooling is a crucial factor in explaining variations of salary and wages in well developed countries (Cohn & Addison, 1998).

Comparative studies have been conducted in some less developed countries, focusing on investment in higher education (Psacharopoulos, 1985, 1994). At tertiary level, the graduates acquire skills to cope with logical and analytical reasoning tasks, as well as the technical

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knowledge required in the current era of globalization (Colclough, 1982). Endogenous growth models emphasize the importance of investment in human capital and the potential gains from the transfer of technology from countries with a more advanced study capacity to the low-income countries, because economic theory suggests that these levels of education help a country to make the transition from a low-income to a high-income economy. The study draws significant lessons for Bangladesh from the impressive investment in human capital and the economic growth achieved by the selected model countries.

This study explores interrelated issues in development economics. An objective of this study is to highlight the significant role of tertiary levels of education for sustainable development of future generation of low-income economies. More specific objectives of this study are to identify- the conditions under which the expansion of education at tertiary levels would be fruitful and sustainable for low-income economies, like Bangladesh. This study, following the questions, investigated:

i.   Why is the importance of tertiary education for long-run growth of low-income economies?
ii. What are the sources of investment in these tertiary levels of education for sustainable development of future generation to overcome the resource constraints in respect of financing education in low-income economies?

III. Data and Methodology

This study employs secondary data. It draws on a variety of sources, including books, theses, academic journals, institutional reports and the internet. The collection of data involves an extensive survey of the literature selected in accordance with the stated study questions and objectives. Existing literature on the contribution of education on long-term economic growth and sustainable development is generally reviewed. The study focuses on those studies that deal with the relationship between tertiary levels of education and sustainable development of future generation in selected low-income countries. Investment in schooling and other factors responsible for the significant impact of education on economic growth in these economies are analyzed.

It reviews theoretical methods of investment in tertiary education of low-income economies and assess is the effectiveness of investment in tertiary education levels. This study, based on endogenous growth theory and empirical evidence, argues that tertiary levels of education are essential in order to develop human capital capable of driving economic growth. Endogenous growth models emphasize the importance of investment in tertiary education of low-income economies and the potential gains from the transfer of human capital from low-income countries to the more advanced countries.

IV. Returns to Schooling Analysis
IV.1 Gross Enrollment Rates

Higher education influences economic well-being in three ways. First, the direct expenditures by the institutions, their employees, and their students impact the local economy. This spending multiplies through the local economy until the monies are used to purchase goods and services

from outside the local area. Second, higher education provides financial and non-financial benefits to the individual who pursues an advanced education and to society in general. Third, institutions of higher education are increasingly focused on knowledge creation. Thus, universities are sources of key study and development innovations that simultaneously can be beneficial to society and conducive to economic growth (OECD, 1998).

People with more years of schooling tend to earn more than people with fewer years. Useful thinking about education and investment and higher education produces human capital. The expectation is also that these investments will yield a positive return. By attending school, an individual hopes to acquire human capital, which makes that individual more productive, and therefore, better compensated.

Table-1: Changes in Schooling, Gross Enrollment Rates, by region, 1970-2000

Region	Primary		Secondary		Tertiary	
	1970	2000	1970	2000	1970	2000
East Asia/ Pacific	89.4	111.4	23.8	66.4	1.1	14.4
Europe/Central Asia	99.3[a]	99.5	86.2[a]	85.6	30.9[a]	46.0
Latin America/Caribbean	107.2	124.7	27.6	84.8	6.2	22.6
Middle East/North Africa	70.1	95.6	23.5	70.3	4.4	20.7[b]
South Asia	70.6	94.8	23.0	48.0	4.2	10.0
Sub-Saharan Africa	51.0	81.7	6.3	25.7[b]	0.8	3.6[b]
High Income	100.0	101.9	75.0	106.0	26.2	61.1

[a] Due to insufficient data for 1970, the values for Europe and Central Asia refer to 1980.
[b] Values refer to the late 1990s.
Source: World Bank, World Development Indicators online.

Worldwide, gross enrollment refer to the total number of children enrolled in a given school category divided by the number of children of the age group that officially corresponds to the levels of schooling, and net enrollment rates refer to enrollments of only those of the relevant age group, in any type of tertiary education amounting to about one out of every four members of the age group. In the high-income countries, the rate is close to 60 percent; in the middle-income nations, it falls to 22 percent; and in the low-income nations, it drops to 10 percent.
International evidence also shows that no country could become an economically advanced country, if the enrolment ratio in higher education is less than 20 per cent. In fact, we find no country in the group of the developed countries whose enrolment ratio in higher education is less than 20 per cent, and conversely we find very few countries with an enrolment ratio of above 20 per cent among the developing countries.

The importance of higher education further increases in the era of international competition and globalisation. International experience shows that it is only those countries that had built up high quality human capital stocks, through good higher education systems, could reap the benefits of globalisation (e.g., East Asian economies), and countries that do not have stocks of quality human capital suffered the most from the policies of globalisation and structural adjustment (e.g., countries in sub-Saharan Africa). Given all this, it is imperative that societies pay adequate attention to higher education. This is more significant, if societies would like to transform themselves into prosperous economic tigers.

IV.2 Returns to investment on Schooling

Tables 2 and 3 present estimates of annual private and social internal rates of return for schooling by income categories. The results are from a meta-analysis by World Bank economists, Psacharopoulos and Patrinos (2004). The authors compiled the results of internal rate-of-return calculations for over 75 nations. Some of these studies refer to outcomes as far back as the late 1950s, while others refer to the 1990s. At all levels of schooling, private rates of return may be higher in low-income economies than higher-income economies. This may seem surprising, given the much higher wages and salaries workers earn in high income nations. But rates of return measure something different than the levels of earnings. Take the case of graduates of tertiary education (table 2).

Table-2: Returns to investment in education by level, full method, latest year, averages (%)

Region	Private Rate of Return			"Social" Rate of Return		
	Primary	Secondary	Higher	Primary	Secondary	Higher
Asia *	20.0	15.8	18.2	16.2	11.1	11.0
Europe/Middle East/North Africa*	13.8	13.6	18.8	15.6	9.7	9.9
Latin America/Caribbean	26.6	17.0	19.5	17.4	12.9	12.3
OECD	13.4	11.3	11.6	8.5	9.4	8.5
Sub-Saharan Africa	37.6	24.6	27.8	25.4	18.4	11.3

Source: G. Psacharopoulos and H. Patrinos, "returns to Investment in Education: A Further Update", Education Economics 12, no. 2 (August 2004)
**Non-OECD.*

Table 3 also finds, as expected, that the returns to schooling tend to be greater the poorer is the country. This is especially evident when comparing low-income economies to the high-income economies. This may be due to much larger pay differentials between tertiary and primary school graduates. Or it may reflect opportunities tertiary school student have to earn some income while studying (so there is less cost from foregone earnings), including receipt of government stipends for attending a school, a common practice in many developing nations.

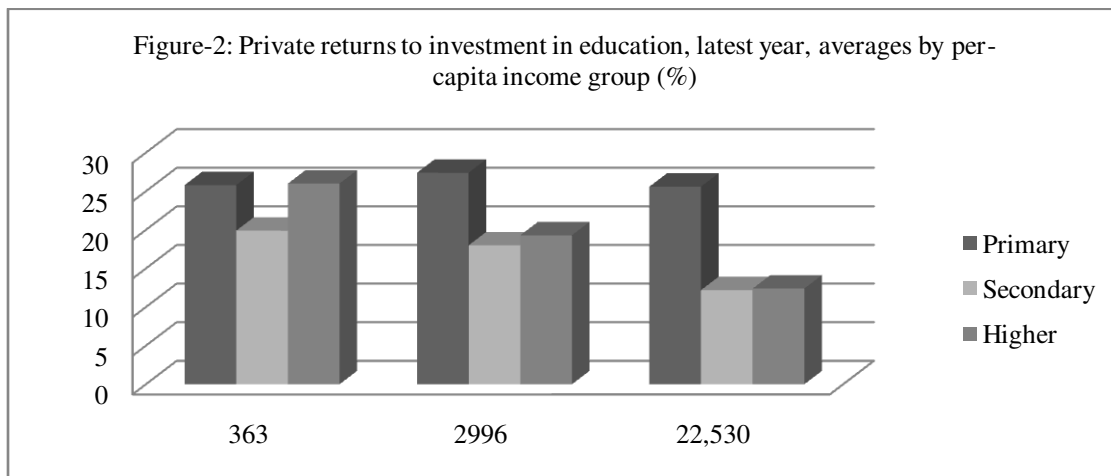Table-3: Returns to investment in education by level, latest year, averages income group (%)

Per-capita income group	Mean per capita(US$)	Private Rate of Return			"Social" Rate of Return		
		Primary	Secondary	Higher	Primary	Secondary	Higher
Low income ($755 or less)	363	25.8	19.9	26.0	21.3	15.7	11.2
Middle income (to $9265)	2996	27.4	18.0	19.3	18.8	12.9	11.3
High income ($9266 or more)	22,530	25.6	12.2	12.4	13.4	10.3	39.5

Source: G. Psacharopoulos and H. Patrinos, "returns to Investment in Education: A Further Update", Education Economics 12, no. 2 (August 2004).

The relative gap between private and social returns is especially large for tertiary schooling in low and middle–income nations. This reflects the relatively high per pupil cost and high degree of state subsidy for tertiary education, often including free tuition. The classic pattern of falling returns to education by level of economic development and level of education are maintained (see Tables 2-3 and Figures 1-2). Also, in the updated data set the private returns to higher education are increasing. These new results are based on six new observations and updated estimates for 23 countries since the last review (Psacharopoulos, 1994).

Figure-1: Returns to investment in education, latest year, averages by low-income group (%)
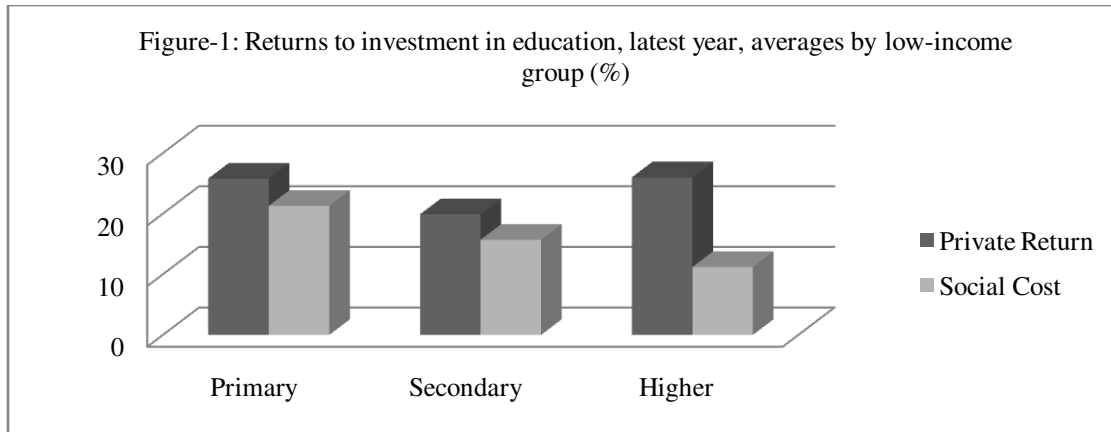
Private returns are higher than 'social' returns, where the latter is defined on the basis of private benefits but total (private plus external) costs (Figure 1). The average "social" rates of return to schooling account for only social cost, not social benefits, hence our use of quotation marks around the word *social*. By incorporating the full cost of schooling but not any positive externalities, "social" return for a given level of schooling must be less than the corresponding private return. This is because of the public subsidization of education and the fact that typical social rate of return estimates are not able to include social benefits. Nevertheless, the degree of public subsidization increases with the level of education, which has regressive income distribution implications. Overall, the average rate of return to another year of schooling is 10%.

Figure-2: Private returns to investment in education, latest year, averages by per-capita income group (%)

Returns to education by level of country income are presented in Table 3 and Figure 2 (Psacharopoulos, 1994). The highest returns are recorded for low-income and middle-income countries. This update includes new country estimates and updated estimates for 42 countries. Average returns to schooling are highest in Latin America and the Caribbean region and for the sub-Saharan Africa region (Table 4). Returns to schooling for Asia are at about the world average. The returns are lower in the high-income countries of the OECD.

IV.3 Coefficient on Years of Schooling
Tables 4 and 5 present estimates of annual private and social internal rates of return for schooling by income categories.

Table-4: The coefficient on years of schooling: rate of return
(Based on Mincer–Becker Chiswick): regional averages

Region	Mean per capita (US$)	Years of schooling	Coefficient (%)
Asia*	5182	8.4	9.9
Europe/Middle East/North Africa	6299	8.8	7.1
Latin America/Caribbean	3125	8.2	12.0
OECD	24,582	9.0	7.5
Sub-Saharan Africa	974	7.3	11.7

Source: G. Psacharopoulos and H. Patrinos, "returns to Investment in Education: A Further Update", Education Economics 12, no. 2 (August 2004).*Non-OECD

These results are from a meta-analysis by World Bank economists, Psacharopoulos and Patrinos (2004). In the high-income countries, the coefficient on years of schooling is 7.4 percent; in the middle-income nations, it increases to10.7 percent; and in the low-income nations, it rises to 10.9 percent (table 5).

Table 5: The coefficient on years of schooling: mean rate of return
(Based on Mincer–Becker Chiswick): Per-capita income group

Per-capita income group	Mean per capita (US$)	Years of schooling	Coefficient (%)
Low income ($755 or less)	375	7.6	10.9
Middle income (to $9265)	3025	8.2	10.7
High income ($9266 or more)	23,463	9.4	7.4

Source: G. Psacharopoulos and H. Patrinos, "returns to Investment in Education: A Further Update", Education Economics 12, no. 2 (August 2004).

Globally, the percentage of the age cohort enrolled in tertiary education has grown with the most dramatic gains in upper middle and upper income countries. In low-income countries tertiary-level participation has improved only marginally. Sub-Saharan Africa has the lowest participation rate in the world. In Latin America, enrolment is still less than half that of high income countries.

There is a general presumption that higher education is not necessary for economic growth and development. Without realizing the importance of higher education in development, many low-income countries tend to ignore higher education. Analyzing the contribution of higher education to economic well-being, the higher education has been given great social responsibilities, in harmony with the enormous needs and expectations of the society. Higher education is one aspect, which not only enhances knowledge but creates awareness in social and economic development. This education will ultimately lay out the economic and social well being of an individual.

The social return includes all costs entailed in the provision of schooling. These costs must be taken into consideration. On the benefit side, schooling benefits the individual through higher earnings but schooling may also produce a positive externality and potential positive externalities from schooling. More schooling, especially higher education, may also lead to technological progress that is not fully captured by private returns. More schooling has benefits which is why it is considered a merit good. Health clinics and tube wells for clean water improve health and fertility externalities, and educating women reduces child mortality, fertility, maternal mortality,

and spread of HIV/AIDS etc. By virtue of the respect, higher education can create awareness in social and economic development.

It is significant to remember that even in the 21st century there great is the importance of tertiary education for long-run growth. It is also necessary to improve the quality and efficiency in higher education, because they are an integral part of an ordered society. In addition, higher education is also a *public good* – at least a *quasi-public good*, benefits from which are not confined to the individuals that go to universities, but also the society at large and have profound positive effect on economic growth and development. Evidence can be cited from East Asia. According to The World Bank, 60% to 90% of growth achieved in Japan and other East Asian industrialized countries is the result of human capital development rather than natural resources and finance. While we must treat such findings with caution because economic factors cannot be separated from wider social and institutional factors, they underline the critical significance of tertiary education.

V. Financing Problem of Tertiary Education

In poorer nations, educated workers are relatively scarce, often making schooling, especially tertiary education, an investment with a higher rate of return than in advanced economies, where educated workers are far more abundant. Given the relative scarcity of students with a tertiary education in poorer nations, the pay premium to having such an education may be greater than the relative pay gap between university and high school graduates in richer nations. It is the relative scarcity of labor skills, a combination of the strength of labor demand and the extent of labor supply, which determine the attractiveness of schooling as an investment. The emergence of higher education was prompted by several factors: (1) Demand for tertiary education increased much faster than the primary and secondary could cope with; and (2) the government's inability to mobilize financial resources needed to establish and run an adequate number of higher education institutions with required enrolment capacities. The continuous widening of the gap between the supply of and demand for higher education opened up new opportunities; private entrepreneurs, philanthropists and social leaders stepped in to fill this gap. In addition, by this time globally and nationally, there was a general shift in ideology, with a preference toward privatization and market-based provision of higher education (Perkins et al., 2006).

In the current era of globalization, economic growth and development will be stunted in low-income economies unless they invest adequately in higher levels of education and define economic policies that enhance the effective use of advanced skills within the economy. Although investment in tertiary education remains poor low-income economies, more harm than good will result from expanding tertiary education, unless acceptable quality can be ensured. The 21st century focus should be on applying rigorously already established quality standards and consolidating and rationalizing existing universities, before investment is made on expansion in tertiary education. The problem of resource scarcity added further to the problem. But given the inter-dependence of one layer of education with the other, higher education becomes critically significant for developing and sustaining a good quality primary and secondary education. It is also a critical factor necessary for economic growth and development and also for its sustenance.

In the case of lower income economies, where there is a concentration on investment in tertiary levels of education but the government budget is constrained, this study recommends the creation

of Public Private Partnership (PPP) and students Bank loan (low-interest) by *internal* sources. This can partly be financed through borrowing at low interest rates from the International Development Association (IDA) of the World Bank Group by. Besides, scholarships and social support to students are becoming increasingly significant for attaining quality and efficiency in higher education.

Investment in tertiary levels of education has helped formerly low-income countries such as Taiwan and Singapore to attain vast increases in economic growth. Low-income countries, such as Bangladesh, should follow these success examples by investing in higher levels of education. This study suggests how Bangladesh can draw lessons from the success stories of Taiwan and Singapore of her investment in higher levels of education contributed to their economic growth. Further, it suggests an education-financing mechanism for Bangladesh and a framework that can be used to design meaningful education policies for sustainable growth and development of country.

The World Bank's policy approach to find mechanisms that can sustain higher education by proposing charging student fees and privatization has some definite merit (Samoff and Carrol, 2003). It is encouraging to note that in 2010 the Ministry of Education, Government of Bangladesh (GoB), with the assistance of the World Bank (IDA), has undertaken, through the University Grants Commission (UGC) of Bangladesh, a higher education quality enhancement project (HEQEP) to improve the quality of teaching, learning and study capabilities of higher education institutions of the country. Activities involving the promotion of academic innovation, the building of institutional capacity of the universities and the raising of connectivity capacity in the higher education sector are considered to be critical for universities in Bangladesh for initiating positive impacts on developments.

VI. Conclusion

The phenomenal growth of universities indicates the significant role they play in imparting higher education in a low-income economy like Bangladesh. These universities produce much needed highly skilled manpower. Many of their graduates are employable both locally and internationally. The number of students that go to foreign countries for undergraduate studies has decreased. This saves a huge amount of foreign exchange remittance earnings. The graduates of these universities contribute substantially to national and international development. The demand for higher education will increase further in future. Without investment, national demand for higher education cannot be met. Both government, public private partnership (PPP) and International Development Association (IDA) of the World Bank Group must supplement and complement each other. The main point drawn from this study is the importance of investment in education, particularly in the tertiary level. There is much evidence on the positive impact of education on productivity and development. Tertiary education should, therefore, be stressed particularly the present world of information technology and globalization. This is crucially important, the productivity growth being a key requirement to socio-economic development. The quality and relevance of such educational expansion to the economy and society in the low-income economies should also be taken into consideration.

This study indicates what lessons Bangladesh can learn to improve its strategy for economic growth and development. The lessons learnt would help the government to draw policy recommendations on measures of how to raise the level of human capital accumulation. Addressing the problem of investment in higher levels of education today through the suggested sustainable mechanism, will allow further accumulation, resulting in an increase in the economy's productivity, and its ability to adopt, adapt, or improve the technology update, and hence ensure sustainable economic growth.

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Appendix

Mincer (1974) show the basic earnings function is involves the fitting of a semi-log ordinary least square regression using the natural logarithm of earnings as the dependent variable, and the years of schooling, potential years of labor market experience and its square as independent variables. Data on these variables can be obtained from either household or firm surveys and used to estimate a human capital earnings function or wage equation like the following:

$$\ln E_i = \alpha + \beta_1 S_i + \beta_2 EXP_i + \beta_3 EXP_i^2 + \varepsilon_i \tag{1}$$

where, $\ln E_i$ is the natural logarithm of earnings of each individual, α is constant, S_i is individual's years of schooling completed, EXP_i is work experience, EXP_i^2 is work experience squared. $\alpha, \beta_1, \beta_2 and \beta_3$ parameters to be estimated, and ε_i is an error term.

The above function can be modified to include regional dummies, sex, or different levels of educational attainment. For the purpose of this study, different levels of education attainment are used. Since we intend to calculate the private rate of returns to different levels of education, the basic earnings equation becomes:

$$\ln E_i = \alpha + \beta_1 PRIM + \beta_2 SEC + \beta_3 UNIV + \beta_4 EXP_i + \beta_5 EXP_i^2 + \varepsilon_i \tag{2}$$

where, $PRIM, SEC, UNIV$ stand for primary, secondary and university levels of education, respectively, and EXP_i is work experience. From the above earnings function, one can calculate the rate of return of investment in education after acquiring an additional year of schooling. This is given as:

$$\beta_1 = \ln \frac{dE_i}{dS_i} \tag{3}$$

This is the estimate of the average percent additional earnings resulting from an extra year of schooling. It is an estimate of how wages in an economy vary by education for the year in which the data are obtained. The term β_1 is also interpreted as the average annual private rate of return to one additional year of schooling, regardless of the level of schooling already attained. Estimates of β_1 vary widely. The way to compute the returns to an extra level of education is taking the antilog and using the formula:

$$\mathrm{Re}\, turns = \{EXP_i(\ln E_i - \ln E) - 1\} \tag{4}$$

This rate can be divided by the numbers of years at each level to get annual returns. The estimates from equation 2 provide consistent estimates; but there may be correlations between education and unobservable variables such as family characteristics and background. This is taken care of by adjusting the model to account for the observables or that may not necessarily have a significant effect.