THE SHARE OF PUBLIC EXPENDITURE ON EDUCATION ALLOCATED FOR HIGHER EDUCATION: CROSS COUNTRY ANALYSIS FOR THE PERIOD 1999 TO 2004

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CERTIFICATE

Certified that the dissertation entitled "THE SHARE OF PUBLIC EXPENDITURE ON EDUCATION ALLOCATED FOR HIGHER EDUCATION: CROSS COUNTRY ANALYSIS FOR THE PERIOD 1999 TO 2004" submitted by Somdatta Mandal in partial fulfillment for the award of the degree of Master of Philosophy (M.Phil) of this University, is her original work and may be placed before the examiners for evaluation. This dissertation has not been submitted for the award of any other degree of this University or of any other University.

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To
Maa and Baba

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Chapter 1. Introduction

The role of education as one of the major factors of economic growth has long been perceived by the political authorities of today's developed countries while pursuing their respective paths of economic development. Later, importance of education started being appreciated by developing countries, desirous of rapid economic progress.

The role of education in economic development can be seen in different ways. At the micro level the function of education can be seen as the creation of life-long stream of additional income for an educated individual compared with someone uneducated. By helping to get a job education also helps an individual to make use of his economic opportunities. In a discussion about the impacts of health and education on the freedom of a person, Sen and Dreze (1995) identified the different roles of education as follows:

(a)Instrumental personal roles: Being educated helps a person to gain in both monetary and non-monetary terms. According to Sen and Dreze (1995, pp.14):

> *(...) expansion in incomes and economic means can, in turn, add to a person's freedom to achieve functioning that he or she values.*

(b)Instrumental social roles: Education makes an individual aware of his or her economic and social rights and encourages collective demands; it also helps to improve public service facilities.

(c)Instrumental process roles: Education helps to sort out and solve many social problems like child labour which are strongly connected with the non-schooling of children and poor education levels of their parents. On the other hand education makes the young generation more open-minded and thus reduces social problems like gender discrimination etc.

(d)Empowerment and distributive roles: Education also has a redistributive effect as it increases the consciousness of disadvantaged groups in various social strata, among different social groups and within households, and thus increases people's ability to resist oppression, to organize and to fight for their rights.

According to Sen and Dreze there are also interpersonal effects of education beside the personal benefits obtained from it. These effects can be realized in various ways; in the political field when a handful of educated community members' consciousness facilitates the whole community or in the socio-economic field when the use of economic opportunities by one educated individual helps others to get those opportunities through different forward and backward linkage effects.

1.1. Human Capital and Growth

Though the roles of education have been well recognized from both the private and the social point of view, that which has received the most attention at a macro or national level in different countries, is the role played by human capital in the growth process of a nation. The concept of human capital was first given by Adam Smith (1776), who pointed out that education increased productive capacity of labourers, in exactly the same way as the purchase of new machinery, or other forms of physical capital increased the productive capacity of a factory. The concept was later developed by Theodore Schultz in the early 1960s when he analyzed educational expenditure as a form of investment. Soon in the real world the role of education in economic growth began to be recognized by the governments of various countries. The education-economy relationship became important and the concept of human capital flourished. In the subsequent period some growth theorists (Lucas, 1988; Romer, 1990) included human capital (Lucas) and knowledge (Romer) in their endogenous growth models.

1.1.1. Lucas' Growth Model (1988)

The first important endogenous growth model incorporating human capital was built by Lucas (1988). According to Lucas the traditional neoclassical model of Solow fails to explain the differences in the rates of growth between countries and thus remains

inadequate. Lucas tries to remove this inadequacy by adding the concept of human capital.

To relate human capital and economic activity Lucas divides the economy into two sectors: the education sector produces new human capital with the help of existing human capital (teachers), while the final goods sector uses both human capital and physical capital as inputs. The human capital in this model indicates general skill-level making one worker with human capital $h(t)$ equal to two workers with human capital $\frac{1}{2}.h(t)$.

According to human capital theory the decision about the allocation of time by an individual over participation in current production and accumulation of human capital affects his future productivity, that is, the values of $h(t)$ at future points in time.

In the basic neoclassical model output is used for consumption (consumption per worker being denoted by 'c') and capital accumulation. If $N(t)$ denotes the total number of workers at time 't' then total output in equilibrium at time t is equal to:

$N(t).c(t) + \dot{K}(t)$ where $\dot{K}(t)$ is the rate of change of the stock of capital. Production depends on capital, labour and the level of technology, $A(t)$; that is,

$$N(t).c(t) + \dot{K}(t) = A(t)\, K(t)^{a}\, N(t)^{1-a} \qquad \text{.....(1)}$$

(Where $0<a<1$ and $\dot{A}/A=\mu>0$).

Incorporating human capital Lucas assumes that $N(h)$ is the total number of workers with skill level h. Here h ranges from zero to infinity. Lucas assumes a worker with skill level h, allocates the fraction $u(h)$ of his/her non leisure time in current production and remaining fraction $(1- u(h))$in human capital accumulation. So, Lucas replaces $N(t)$ in (1) with the effective labour force:

$$N^{e} = \int_{0}^{\infty} [u(h).N(h).h]dh$$

According to Lucas the accumulation of human capital has both an internal effect (i.e. the effects of an individual's human capital on his/her own productivity) and an external effect (i.e. the effect of human capital on production, not perceived by an individual and so is not taken into account while deciding about allocation of time). According to Lucas the external effect of human capital is captured by the average level of human capital in the economy:

$$h_a = [\int_0^{\infty} h.N(h)dh / \int_0^{\infty} N(h)dh]$$

With these modifications (1) can be expressed as:

$$N(t).c(t) + \dot{K}(t) = A.K(t)^{a} (u(t)\, h(t)\, N(t))^{1-a}\, h_a(t)^{n}$$

Here $h_a(t)^n$ captures the external effect of human capital, A being constant here.

So, there are two kinds of capital in Lucas' model: physical capital and human capital. While physical capital is accumulated and utilized in production under a neo-classical production process, accumulation of human capital increases the productivity of both physical capital and human capital.

The productivity increase of human capital is explained by the fraction *(1-u(t))* of *h(t)*, which is devoted to human capital accumulation. This *(1-u(t))* must be linked to the rate of change of *h(t)*. Lucas postulates a technology relating the growth of human capital to the level already attained and the effort devoted to acquiring more:

$$\dot{h}(t) = h(t)^{\zeta} G(1-u(t)) \qquad \text{.....(2)}$$

Where G is increasing with $G(0)=0$. As for ζ Lucas assumes that $\zeta=1$. Lucas also assumes that right hand side of (2) is linear in $u(t)$; that is, G is linear.

Thus the assumption made here is:

$$\dot{h}(t) = h(t)\delta[1-u(t)]$$

If $u(t)=1$, that is, no effort is given to human capital accumulation then no human capital is accumulated. If $u(t)=0$, that is, all efforts are devoted to human capital accumulation,

then $h(t)$ grows at maximal rate δ. The crucial property of human capital is that constant level of effort produces a constant growth rate of the stock which does not depend on the level already attained.

Lucas expresses v as the rate of human capital growth. Assuming $v=\dot{h}(t)/h(t)$ on a balanced growth path, Lucas writes (6) as $v= \delta(1-u)$. Assuming v^* as the efficient rate of human capital growth, Lucas says the rates v and v^* must not exceed the maximum feasible rate δ. When v and v^* are equal $v = v^* = \delta$ and when these are not equal $v^*>v$.

In the efficient and competitive equilibrium growth rates of human capital along a balanced growth path increases with the effectiveness δ of investment in human capital.

1.1.2. Romer's Growth Model (1990)

Paul Romer (1990) constructed a growth model with endogenous technical change to explain the sustained growth of advanced countries. In Romer's model technical change takes place through research and development (R&D).

The argument behind the model is based on three premises. First, technological change is the key factor for economic growth as it provides incentives for further capital accumulation. Technological change and capital accumulation together are responsible for much of the increase in output per hour worked. Second, technological change is endogenous as it occurs through active actions by people. Markets play a crucial role by providing incentives. Third, instructions for working with raw materials created by knowledge are different in character than other economic goods. Once created, an instruction can be used repeatedly with no additional cost.

The basic inputs in Romer's model are capital, labour, human capital and an index of the level of the technology. The model deals with three sectors: (a) Research sector using human capital and existing stock of knowledge to produce new knowledge, designs for intermediate goods; (b) intermediate-goods sector using designs from research sector

and forgone output to produce a variety of producer durables; (c) final goods sector using labour, human capital and the set of producer durables to produce a final good which can be used for consumption and production of intermediate goods.

So the final output Y in this model can be expressed as a function of physical labour L, human capital devoted to final output H_y, and physical capital. The physical capital here is disaggregated into an infinite number of distinct type of producer durables (X) indexed by an integer i.

Thus, $X = \int_0^\infty X_i$

The production function in the final goods sector can be written as:

$$Y(H_y, L, X) = H_y^{a1} L^{a2} X^{1-a1-a2}$$

About labour and human capital the model makes some assumptions: (a) The population and the supply of labour are both constant; (b) the total stock of human capital in the population and the fraction of it supplied to the market are both fixed.

The accumulation equation for capital at time t is:

$$\dot{K}(t) = Y(t) - C(t)$$

So, K grows by the amount of forgone consumption.

Though the process of accumulation both for capital and labour in Romer's model are similar with the basic neoclassical model, the model differs in case of the accumulation of knowledge. The basic assumption about knowledge is that anyone engaged in research has free access to the entire stock of knowledge. If δ is the production parameter, then the output of researcher j who possesses an amount of human capital H_j is $\delta H_j A$. Here A is the stock of knowledge or the number of ideas that have been invented over the course of history. If sum is taken over all the people engaged in research, the rate of increase in the aggregate stock of knowledge is given by:

$$\dot{A} = \delta . H_a . A \qquad \ldots\ldots\ldots\ldots (3)$$

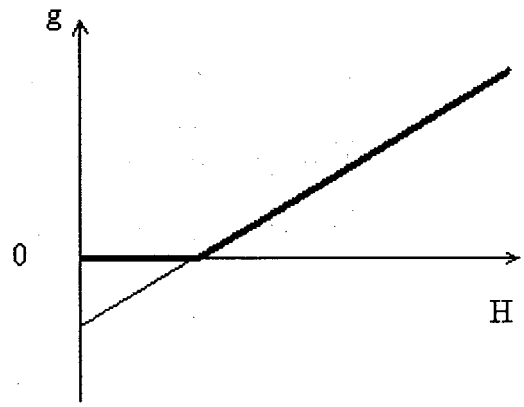
Where H_a is the total human capital employed in research.
The assumptions made here are: (a) If more human capital is devoted to research, higher amount of new designs will be produced; (b) productivity of human capital is higher the larger and more advanced is the total stock of designs and knowledge.

So in this model human capital is divided into two parts; one engaged in the production of final output H_y and another devoted to the production of more knowledge H_a. Together these constitute the total human capital, i.e. $H = H_y + H_a$.

The balanced growth equilibrium of this model occurs when the variables A, K and Y grow at a constant exponential rate. In this model along the balanced growth path, the ratio of K to A must be constant. As accumulation takes place for both K and A, the wage paid in the final good sector will grow in proportion to A. Again following equation (3), the productivity of human capital in research also grows in proportion to A. As the growth rates of productivity of human capital are same in both the sectors, H_y and H_a will be constant if the price for new designs is constant.

Now if the amount of total human capital is increased, then increase in the rate of growth takes place. This effect is depicted in Figure 1. Here rate of growth is expressed as a function of total human capital. An increase in the human capital implies an increase in the rate of growth as human capital is the input that is used most intensively in research.

Figure 1. Growth Rate as a Function of Human Capital



In a conclusion Romer (1990, pp.S99) remarked that:

> *In the absence of feasible policies that can remove the divergence between the social and private returns to research, a second-best policy would be to subsidize the accumulation of total human capital.*

1.1.3. Growth Model of Mankiw, Romer and Weil (1992)

Mankiw, Romer and Weil (1992) examined the validity of the Solow model on the basis of the data from Real National Accounts constructed by Summers and Heston (1988). According to them though the standard neoclassical production function with decreasing returns to capital correctly predicts the directions of the impacts of saving and population growth on income per capita (that is, the higher the rate of saving, the richer the country and the higher the rate of population growth, the poorer the country), it fails to predict the magnitude correctly. To eradicate this problem, Mankiw, Romer and Weil augmented the Solow model by including human capital accumulation beside physical capital accumulation. The reasons given are as follows: (a) For a given rate of human capital accumulation, higher saving and lower population growth increases the level of income and thus increases the level of human capital. So the impacts of saving or accumulation of physical capital and population growth is greater if the accumulation of human capital is considered; (b) if human capital accumulation is correlated with saving

rates and population growth rates then omitting it leads to biases in the estimated coefficients on saving and population growth.

The production function at time t in the augmented Solow model is:

$$Y(t)=K(t)^{a_1}H(t)^{a_2}(A(t)L(t))^{1-a_1-a_2}$$

Here Y is output, K is capital, H is human capital, L is labour, and A is the level of technology. The assumptions made here are: (a) Same production function applies to human capital, physical capital and consumption making costless transformation of one unit of consumption into one unit of physical capital or one unit of human capital possible; (b) human capital depreciates at the same rate as physical capital; (c) $a_1+a_2<1$, that is, there are decreasing returns to all capital.

In this model of Mankiw, Romer and Weil, human capital represents education and the proxy for the rate of human capital accumulation is the percentage of the working age population that is in secondary school. The model has some implications: (a) The accumulation of physical capital does not create substantial externalities; (b) even without externalities physical capital accumulation has a larger impact on the steady state level of income per capita than what is implied in the Solow model (In the augmented model higher saving create higher income in steady state and that leads to higher level of human capital and raises total factor productivity); (c) population growth also has a larger impact on the steady state level of per capita income than the Solow model indicates (In the augmented Solow model both the physical capital and human capital need to be spread more thinly with the growth in population implying a lower total factor productivity); (d) when the dynamics of the economy is considered the model predicts that countries with similar technologies, rates of accumulation and population growth will converge in income per capita, though this process of convergence occurs at a slower pace than the original Solow model predicts.

According to Mankiw, Romer and Weil the international differences in income per capita across countries, are best understood using an augmented Solow model instead of the original Solow model. While the original model can not predict the magnitude of the

change in income per capita correctly, the prediction of the augmented model is fairly similar to the actual situation.

1.2. Different Levels of Education and Their Relative Importance

Though up to this point the role of education was discussed without making any distinction between different levels of education, the development of different levels of education can have very different impacts on the economy and society. Generally education is divided among pre-primary, primary, secondary and tertiary levels. According to UNESCO (2007 World Development Indicators, pp.81):

> ***Pre-primary education*** *refers to the initial stage of organized instruction, designed primarily to introduce very young children to a school-type environment.* ***Primary education*** *provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.* ***Secondary education*** *completes the provision of basic education that began at the primary level and aims at laying the foundations for lifelong learning and human development by offering more subject-or skill-oriented instruction using more specialized teachers.* ***Tertiary education*** *refers to a wide range of post-secondary education institutions, including technical and vocational education, colleges, and universities, whether or not leading to an advanced research qualification, that normally requires as a minimum condition of admission the successful completion of education at the secondary level.* [1]

As far as basic or primary education is concerned unit costs are small relative to the extra lifetime income or productivity associated with literacy (Psacharopoulos, 1988). So it is of primary importance in increasing the income of the general population in a

[1] Throughout this paper the term 'higher education' is used alternatively to imply tertiary education.

resource poor developing country with low literacy levels and hence in bringing equity in the distribution of income. According to Psacharopoulos (1988, pp.103):

> *The equity impact is highest for basic education, since the low earnings of otherwise illiterate workers are raised nearer to the overall mean. But if university education is expanded (and especially postgraduate education), the equity effect may be negative, in the sense that a group of workers with earnings above the mean are raised even further away from it.*

1.2.1. Importance of Higher Education

This argument in favour of primary education is challenged by a report of the Task Force on Higher Education and Society (The International Bank for Reconstruction and Development and The World Bank, 2000). The report says the actual role of higher education is severely under-estimated by the traditional economic arguments which say that the rate of return to higher education is far less than the rate of return to primary education because while the latter has huge positive externalities on the economy, the former benefits only those who possess it through higher private earnings. But higher education has many other roles in the society. According to the report as educated people are well-positioned to be economic and social entrepreneurs, they have a far-reaching impact on the economic and social well-being of their communities. They are vital to create a better economic environment with good governance, strong institutions, and a developed infrastructure, all of which are important for further economic development. Another very important role which is generally over-looked in the rate of return analysis is research and development role of higher education. It plays a vital role for technological up-gradation and hence for growth of the economy.

The idea of a high social return to higher education was also advocated by Nancy Birdsall (1996). Citing the estimation done by Psacharopoulos et al. (1986) on education, Birdsall says that though the estimated rate of returns to higher education is supposed to

be lower than primary and secondary education, the rate is still higher than the rate of return to physical capital.

According to Birdsall beside the traditionally perceived role of increasing private earnings higher education has many other roles in the economy. Higher education creates professional, entrepreneurial, managerial and technical skills needed for the production process. Basic research, innovation, generation of knowledge in aggregate is another role. Higher education is also helpful from the national, political, social and cultural points of view. Highly educated individuals by carrying out various public and private services, creating awareness about various social duties and rights and with other activities play an important role in *nation-building*.

Meier and Rauch (2000) view the importance of higher education as follows: (a) If high skilled and low skilled labour are perfectly substitutable inputs in the production even then one unit of skilled labour equals more than one unit of unskilled labour; (b) in most of the cases unskilled or low-skilled labour and educated or high-skilled labour are not perfectly substitutable inputs in production and, when different production processes make more or less intensive use of high skilled or low skilled labour the presence of a greater number of educated workers may imply that a country can produce technologically more sophisticated goods; (c) skilled labour is also important for growth through its contribution to research, innovation, technological up-gradation etc. The entrepreneurial and professional skills achieved through higher education together helps a country to progress on the path of economic growth.

The argument for the importance of education, especially higher education is strengthened by World Bank studies. According to a World Bank report on Directions in Development (The International Bank for Reconstruction and Development and The World Bank, 2003), technology and economic growth are strongly related in the industrial countries. To support this argument the report says:

> *Computer hardware was linked strongly to output growth in the late 1990s, when it is estimated to have contributed as much as 2.5 per cent to increases in output.*(pp.4)

Psacharopoulos and Patrinos (2002) estimated that if the average year of schooling in a country increases one year, the per capita income of a country increases by 10 percent, and for very poor country income increases by 20 percent or more. However, according to the IBRD and the World Bank (2003), the returns to primary schooling have declined even in the poorest section of the lower-income countries while the returns to higher education are increasing.

Empirical Evidence: Barro

According to Barro (2001), for a given level of GDP, a higher initial stock of human capital implies a higher human to physical capital ratio which indicates a higher growth rate because of the following reasons:

> *First, more human capital facilitates the absorption of superior technologies from leading countries. This channel is likely to be especially important for schooling at the secondary and higher levels. Second, human capital tends to be more difficult to adjust than physical capital. Therefore, a country that starts with a high ratio of human to physical capital (such as the aftermath of a war that destroys primarily physical capital) tends to grow rapidly by adjusting upward the quantity of physical capital.* (Barro, 2001, pp.14)

The role of education in economic growth is analyzed in Barro's study in a panel of around 100 countries over the period 1965 to 1995. In the first set of empirical estimates, the quantity of education is considered. The result shows there is a positive relationship between growth and the average years of school attainment of adult males at the secondary and higher levels. Though the impact of primary education is not found to be

statistically significant, it is important as the base for higher levels of education. According to Barro the absence of a significant relation between growth and years of school attainment of females at the secondary and higher levels implies:

> *(...) discriminatory practices that prevent the efficient exploitation of well-educated females in the formal labour market* (Barro, 2001, pp.15).

However the study shows that an additional year of schooling of males at the secondary and higher levels increases the growth rate by 0.44 per cent per year. The second set of empirical estimates is related to the quality of schooling. For this standard test scores of internationally comparable examinations in science, mathematics and reading are taken to measure the quality of schooling. The results show that scores in science in particular, have strong correlation with growth. According to Barro for the given quality of education, represented by the test scores, the quantity of schooling, measured by average years of attainment of adult males at the secondary and higher levels, is significantly related to the growth rate of the economy of a country.

1.3. The Need for Government Intervention

So the development of a well-functioning higher education system is very important for the economic advancement of a country. For this reason the process of entrusting the development of higher education to private hands for many countries especially for resource-poor developing countries, may prove to be disastrous. In these countries a large part of the population are poor and private for-profit education system will make education inaccessible to them. The imperfect capital market will be a hindrance for the poor to get capital for funding education. So privatization on the one hand may barricade the poor from joining the mainstream of economic and social life; on the other hand it may restrict the potential growth mechanism of the country by blocking the path of human capital formation. For all these reasons government intervention in higher education is very important in developing and less developed countries.

In a comparison between public and private education systems, Glomm and Ravikumar (1992) have shown that in the public school regime, in which investment in the quality of schooling is made through majority voting, income inequality is reduced more quickly than in the private school regime, in which each household chooses its quality of education. On the other hand private education creates higher per capita income if the initial income inequality is not very large. But if the majority of agents have income below the average, the public education system will be chosen by majority voting.

1.3.1. Allocation of Public Resources: The Concept of Rate of Returns

To allocate government funding among different levels of education, a consideration of the rate of return at different levels is important. The rate of return to education can be of two types; social rate of return and private rate of return. The estimation of rate of return to education is done by cost-benefit analysis (Psacharopoulos, 1972). While the private benefit from education is determined by the earning of an individual with a certain level of education, the social benefit of education is measured by various social and economic betterments due to the spread of education. Private costs of education includes both direct costs of education, that is, the tuition fees, books and related expenses and the indirect costs, that is, the foregone earnings of a student. Social costs of education on the other hand include the full costs of providing education.

> *The costs and benefits (...) could be accounted for from two different points of view. First, from the point view of individual investor, and, second, from the point of view of society as a whole. In this investment decision the individual is likely to consider only the part of costs he actually earns and only the part of benefits he actually receives. Income tax is an example of benefit which the individual does not realize, although the society does by redistributing the proceeds among its members. Public subsidy to higher education is an example of a cost*

which the society bears but not the individual who counts only what goes out of his pocket and what he foregoes by not being in the labour force.

Therefore, one can have two different rates of return. First, a private rate of return where benefits are computed after tax and costs include only what the individual actually pays or foregoes. Second, a social rate of return, where benefits are gross of tax and costs include the full cost of higher education. (Psacharopoulos, 1972, pp.145)

According to Psacharopoulos (1981) the returns to primary education (both social and private) are the highest among all levels of education. Besides that, estimated private rates of return are observed to be higher than social rates of return for all education levels (Psacharopoulos, 1981). One of the reasons for high rates of return to primary education is the relatively low cost of providing it (Zymelman, 1976).

Other important observations (Psacharopoulos, 1972) regarding returns to higher education are as follows:

(a) The average level of the returns to higher education seems to be above the returns to investment in physical capital. The general policy implication of this finding is that priority should be given to investment in higher education versus other forms of investment that yield lower returns.

(b) The returns to higher education in less developed countries are higher than the returns to university education in more advanced countries. The policy implication of this finding is that the former group of countries has still unexploited opportunities for increases in national income via educational investment.

(c) Developing countries seem to subsidize their higher education systems more heavily than more advanced countries. The implicit distortion of the price system tends to generate intellectual unemployment in these countries. However, the dilemma for the policy-maker is whether he should reduce the public subsidy or spend more on a profitable investment opportunity.

(d) As economic growth takes place the returns to investment in higher education decrease. However, one should not yet worry about overinvestment in higher education as university graduates seem to be a complement to the high level of technology employed in more advanced countries. (Psacharopoulos, 1972, pp. 155)

According to Psacharopoulos (1972) if the relationship between per capita income and social returns to higher education is plotted in a graph then it shows a U-shaped pattern. At lower levels of per capita income the return to investment in education decreases as the level of per capita income increases due to the presence of diminishing marginal rate of returns, but after a certain stage of economic development the profitability of investment in higher education increases again with per capita income. This, according to Psacharopoulos, is due to the fact that human capital then becomes a complement to the more advanced technology used in developed countries and therefore a prime source of economic growth.

Assuming that the rate of returns to investment in education is a determinant of public expenditure per student in higher education, it is seen Psacharopoulos' analysis is consistent with today's scenario. Region-wise data (UNESCO, 2005) show that in developed regions like Europe public expenditure per student in case of tertiary education increases with an increase in national income. On the other hand the poorest regions like Sub-Saharan Africa and Southern Asia have exactly the opposite trend.

1.3.2. Trade in Higher Education

Again, because of the low public spending on domestic higher education, the relatively poorer regions of the world have to import education services from advanced countries on a large scale. In the recent era of globalization with the increase in the cross-border consumption of higher education, higher education has become a tradable service.

While some countries from the First World are the main exporters of this service, developing countries make up the major part of the importers.

Table 1. Students Studying Abroad by Sending Region 1999-2004

	1999 (thousands)	2004 (thousands)	% increase	% share in 2004
North America	60	90	50.0	4.1
Latin America and the Caribbean	100	150	50.0	6.8
EU15	100	110	10.0	5.0
Central and Eastern Europe	190	300	57.9	13.6
Arab States	120	190	58.3	8.6
Central Asia	60	70	16.7	3.2
South and West Asia	100	200	100.0	9.0
East Asia and the Pacific	440	720	63.6	32.6
Sub-Saharan Africa	90	160	77.8	7.2
Other	40	60	50.0	2.7
Not Specified	60	160	166.7	7.2
Total (excluding intra EU15)	1370	2210	61.3	100.0
Intra EU15 Students	270	240	-	
Total with Intra EU15 Students	1640	2450	49.4	

Source: Bashir (2007), pp. 14

Table 2.Students Studying Abroad by Host Region 1999-2004

	1999 (thousands)	2004 (thousands)	% increase	% share in 2004
North America	480	570	18.8	25.8
Latin America and the Caribbean	10	20	100.0	0.9
EU15	460	770	67.4	34.8
Central and Eastern Europe	130	170	30.8	7.7
Arab States	30	70	133.3	3.2
Central Asia	20	30	50.0	1.4
South and West Asia	Negl	Negl	-	-
East Asia and Pacific	200	510	155.0	23.1
Sub-Saharan Africa	Negl	Negl	-	-
Other	50	50	0.0	2.3
Not Specified	Negl	160	-	-
Total (excluding intra EU15)	1370	2210	61.3	100.0
Intra EU15 Students	270	240	-	
Total with Intra EU15 Students	1640	2450	49.4	

Source: Bashir (2007), pp.15

With the increase in demand for higher education services, higher education has become a serious business for most of the developed countries. Among the top eight providers of these services, while France, Germany and Japan do not 'export' education on a commercial basis, others, i.e. Australia, New Zealand, United Kingdom, United States and Canada do it. The value of the export services by the main exporter countries are given below. Though the data are not divided among different educational levels, except for Australia or New Zealand in some extent, in most of the cases it represents exports of higher education services (Bashir, 2007).

Table 3. Export of Education Services (Foreign Students) by Main Exporting Countries, 1999-2005 (US $ million)

	1999	2000	2001	2002	2003	2004	2005	Percentage increase 99-04/05
Australia	2038	2259	2528	2897	3925	4872	5563	173
New Zealand	273	257	343	632	925	998	1000	265
Canada	568	615	699	784	1014	1268	1573	177
United Kingdom	4101	3766	3921	3891	4709	5627	6064	48
United States	9620	10350	11480	12630	13310	13640	14120	47
Total 5 countries	16600	17247	18971	20834	23883	26405	28320	71

Source: Bashir (2007), pp. 19

The problem to estimate the level of import is that data is not available in the BOP statistics of main importer countries. When the data is available, it is seriously under-estimated in most of the developing countries, like in India. Even then the huge amount of spending on higher education imports is clearly evident from the following data.

Table 4. Estimated Imports of Higher Education from Five Main Exporters by Selected Developing Countries, 2004

	Estimated value of imports of higher education (US$ million)	Higher Education Imports as % of GDP	Domestic public expenditure on higher education as % of GDP
China	5080	0.26	0.44
India	3151	0.46	0.59
Malaysia	850 (813)	0.12	2.96
Hong Kong	805	0.49	1.50
Singapore	460	0.43	0.85
Indonesia	515	0.20	0.17
Turkey	405	0.13	1.04
Korea	1802 (1855)	0.27	0.69
Japan	1506	0.03	0.52

Source: Bashir (2007), pp.20.

Note: Figures in brackets for Malaysia and Korea indicate the value of imports as recorded in the BOP statistics (2004 for Malaysia and 2003 for Korea).

The lack of investment in domestic higher education has potential dangers:

1. There was a large amount of domestic resource transfer to purchase higher education services from the foreign countries as indicated in Table 5.
2. Generally it is seen that there is an inverse relationship between outward student mobility and domestic tertiary Gross Enrolment Ratio (GER) (Bashir, 2007).
3. Dependence on imports for higher education would also generally imply a worsening of equity in access to higher education (Bashir, 2007).

So from the above analysis it can be concluded that domestic spending, especially public spending on higher education is more important than before in this new era of globalization.

There are various factors determining the share of public expenditure on education allocated for higher education in a developing country. The objective of this study is to find out these factors and the nature of their influence, which will be done in the subsequent sections. Chapter 2 provides mainly evidence of the important role played by higher education in the growth process of today's developed countries and the role of respective governments in this process. Chapter 3 discusses the existing literature to find out the probable determinants of public resource allocation in higher education in developing countries. Chapter 4 analyzes the relevant data to find out the relative importance of the determinants. Chapter 5 will discuss the implications of these findings in greater detail.

Chapter 2. The Role of Education in Economic Development: Examples from the Developed Countries

The history of mankind provides numerous examples which show the importance of knowledge or education as one of the main factors behind economic growth. The development of education did not take place at the same time all over the world. Different continents, even different countries have their own different histories of educational development. Generally the introduction of a science-based, modern education system is dated back to the eighteenth century at the time of the Industrial Revolution in Western Europe. The process first started in the United Kingdom, before spreading out to other countries of the continent. Though France was another important economy in this region, the development of the French economy took place in a later period. The reasons were mainly the political instability and lack of large scale agricultural change which occurred in England (Jaoul-Grammare, 2008).

The role of knowledge in economic development was for long not recognized by economists. According to Jaoul-Grammare (2008, pp.28)

> *(...) during the first Industrial Revolution (1780-1880), the role of knowledge does not seem to have been a determining factor, inventions being the product of isolated and not educated activities. However, during the second Industrial Revolution (1880-1970) the role of knowledge had become vital.*

After the experience of Western Europe which became the most powerful region in the eighteenth and nineteenth centuries, the importance of modern education was perceived by the governments of various other countries. Many countries, particularly some Asian countries which already had their own traditions of knowledge-based societies, left their previous education systems and accepted the European system which is surviving till today as the standard.

Data relating to the period after World War II shows the difference in educational expenditures between developed countries and less-developed countries. This indicates the emphasis placed on education from the earlier period in economically advanced countries.

Table 5. Education Expenditure as a Percentage of GNP in More Advanced Countries

Year	UK	Ireland	USA	France	Netherlands
1950	3.1	2.8	3.0	-	2.9
1955	3.2	3.2	4.2	2.8	3.6
1960	5.1	3.7	4.9	3.3	4.7
1965	5.8	4.0	6.3	5.7	5.7

Source: Vaizey (1972), pp. 138

Table 6. Trend of Expenditure on Education as Percentage of GDP at Market Prices in LDCs

year	Colombia	Mexico	India	Uganda
1950	1.1	0.4	0.8	-
1954	1.2	0.8	2.0	3.4
1960	2.5	1.3	2.3	3.4
1965	2.2	1.9	2.6	2.7

Source: Vaizey (1972), pp. 139

At this juncture a brief review of the development of the education system in some economically and technologically advanced countries may help to understand the development of the modern education system and the role by the state in its development.

2.1. United Kingdom

Evidence exists that the tradition of schooling first started in England in the sixth century. From the twelfth century, Cathedral schools, and from the thirteenth century, universities started to develop (Haskins, 1976). Beside this traditional educational system other types of educational institutions started to emerge keeping pace with the needs of society, e.g. apprenticeship in crafts and trade. From the seventeenth and the eighteenth centuries the content and structure of education started to gain a comparatively modern form.

With the growing urbanization of society the need for a proper, modern education system was gradually felt, but the pace of development of a public education system was extremely slow. The picture started changing with the Industrial Revolution in England in the second half of the eighteenth century. With the agricultural revolution that took place during this period, a large number of agricultural workers were freed from their previous activities, making labourers available for the industrial sector. The new economic and political importance of Britain in the world scenario also helped it to acquire raw materials and other forms of industrial inputs from its colonies spread all over the world. It also created a large market for the goods produced in the country. The outcome was the new factory system designed for mass production of goods. It was at this time when the importance of specialization and division of labour in work was felt and the need of education for economic growth was perceived by both economists and politicians. Schools supported by cathedrals and monasteries, grammar schools and craft schools came into the picture. Beside this, higher education also developed. Universities like Oxford and Cambridge started achieving their modern day status. More universities and colleges were also established during this period (Sanderson, 1972).

Education became available for the general population with the Elementary Education Act (Forster Act) of 1870. The Act made universal education for all children aged 5-13 compulsory and also formed school boards to supervise education systems in

schools (Sanderson, 1999). This Act along with the Factory Acts of 1819, 1833, 1842, 1845 and 1874 which restricted and prohibited child labour to a large extent, made it possible for the children of the working classes to attend schools (Galbi, 1977). These new steps of the governments depict first serious government intervention in mass education.

But the spread of education and especially of higher education for the general population in UK was not satisfactory (Roach, 1986) given that public financed elementary schools were widely prevalent in USA and many other European countries. Many subjects of science and engineering which were previously looked down upon by the British system of gentlemen's education were proved to be important for technological development and so were prioritized in these countries while UK still lagged behind.

The danger of this situation was soon recognized and the desire to build a nation wide educated labour force took shape in the 1902 Education Act which gave emphasis on a common education system at all levels. The Act also established Local Education Authorities (LEAs) abolishing the previous school board system. The responsibilities of the LEAs were mainly supervising the functioning of the school system and providing grants to schools for maintenance and other purposes (Daun, 2002).

Table 7. Local Authorities Expenditure (£mn.) in the United Kingdom

Current expenditure	1913-14	1938-39
Education	36	118

Source: Pollard (1969), pp.32.

The next major step regarding education was the 1944 Education Act which was a part of the social reconstruction policies of Winston Churchill. There was an attempt to create a proper linkage between higher and lower levels of education system to help up-gradation of education from the grass root level (Jones, 2003).

In case of higher education, recommendation for technological education in colleges and universities was made by Percy Report (1945) and recommendation for more universities to teach science subjects was made by Barlow Report (1946). Accordingly in 1956 some technical colleges were upgraded to College of Advanced Technology status (Bocock, Baston, Scott and Smith, 2003).

The growing importance of higher education in public policy can be seen from the following data.

Table 8. Composition of Public Educational Expenditure by Sector: England and Wales, 1920-1967 (percentage)

	1920	1930	1940	1950	1955	1965
Primary	57.4	56.4	54.8	37.3	38.9	28.1
Secondary	20.0	19.4	19.1	27.4	28.3	32.2
Teacher Training	0.9	0.8	0.6	2.0	1.7	3.4
Further and Adult	5.0	4.9	4.9	7.5	7.9	12.2
Universities	5.2	5.9	6.7	8.0	8.2	9.9
Special Schools	2.3	2.5	2.7	1.5	1.9	2.0
Meals	0.4	0.5	1.1	7.2	6.2	5.9
Health Service	1.8	2.8	3.4	3.5	2.1	1.8
Administration and Inspection	7.1	7.0	6.8	5.7	4.9	4.5
	100	100	100	100	100	100

Source: Vaizey (1972), pp. 155

So, it is seen while the share of public expenditure on primary education, administration and inspection decreased over time, in other fields including secondary and university education it, in fact, increased.

However, not only was there a change in the sector-wise composition but aggregate public expenditure on education also increased during this period.

Table 9.Trends in Current Net Public Education Expenditure in the UK: 1920-1955

year	Current educational expenditure as percentage of NI
1920	1.2
1925	2.1
1930	2.3
1935	2.4
1940	2.0
1945	1.7
1950	2.7
1955	2.8
1965	4.1

Source: Vaizey (1972), pp.155

The progress of the government-supported education system came to a halt in the 1970s with the economic recession. Cutbacks in educational expenditure took place. The process accelerated after the Conservatives won the general elections in 1979. According to the Conservatives the alliance among LEAs, teacher unions and the Labour Party at the local level had become a hindrance to the development of the education system and thus was responsible for the low standard of the same. In 1983 to reduce the importance of LEAs, some of the decision making power was decentralized to schools and was centralized to Ministry of Education simultaneously. In the 1988 Education Act which was the most important Education Act since 1944, the power of the LEAs was further reduced, parents were allowed free choice of schools within any district and government

schools were given the permission to be 'grant-maintained' schools. In short privatization and 'marketization' crept into education system to a large extent. From the 1990s, LEAs were no longer independent institutions free to create their own policies (Daun, 2002). This tradition of privatization continued even after Labour Party returned to power in 1997.

From the history of educational development of England, it is seen that education played a very important role in the economic growth during the period of Industrial Revolution. The need for specialization and division of labour, which were required in the production process during this period, was fulfilled only by the existence of a proper, government supported education system. Since then education through its role of focusing innovation, and R&D remained one of the important factors behind economic growth in the United Kingdom.

2.2. Japan

Formal education in Japan began in the sixth century. By the ninth century Japan already had some institutions for higher learning beside some schools established by aristocrats and the imperial court. From the sixteenth century Japan came in contact with European culture through the regular visits of Jesuit Missionaries and European, especially Portuguese, traders. This flow of European culture stopped in the Edo period (1603-1867) as the country isolated itself from the outer world. But simultaneously it made amazing progress on the education front and there was a considerable improvement in the literacy rate during this period.

Though education was widespread during the earlier period, modern education following the western method and structure was introduced only after the Meiji Restoration. There were three major movements of modern educational reform in Japan: (a) The first was during the Meiji Restoration in the 1870s; (b) the second was after World War II under the leadership of General MacArthur and the Occupation; (c) the

third started in the late 1960s and was given further momentum during Nakasone Yasuhiro's tenure as prime minister (Doyen, 2001).

During the first education reform after 1868, the objective was mainly to make the country a strong, modern industrialized nation state. Compulsory primary education was introduced, Japanese government started employing Western academics and experts to develop the new Westernized education system and students and government officials were sent abroad to be familiar with western education. When these students and government officials returned to Japan, they eventually replaced the experts from west. (Yonezawa, 2007). In this period the main aim of the imperial government was to strengthen the country both economically and politically with the help of modern education system. According to El-Agraa and Ichii (1985, pp.1)

> *The Japanese modernization policy (...) in 1868 can be captured by two popular slogans: "Fukoku-Kyohei", which translates as the policy for enriching and strengthening a country and expanding the military, and "Syokusan-Kogyo", i.e., a policy of industrial development (...).*

The second major restructuring of modern education in Japan occurred after the defeat of the country in World War II under the supervision of the Allied powers and mainly following the American model. The Fundamental Law of Education (1947) was the basis of the new education reforms in the post-war period (Daun, 2002). The education system was decentralized, six-three-three grade structure (six years of elementary school, three years of lower secondary school and three years of upper secondary school) was introduced and in this structure six years of primary school education and three years of lower secondary schooling were made compulsory (Haiducek, 1991).

The education system was modified again after the achievement of national sovereignty in 1952.

> *(...) the ruling conservative Liberal Democratic Party began to regard the reform initiated by the Occupation powers as an imposition by foreign*

military authorities. A series of changes to centralize the educational system were implemented during this period (...) (Daun, 2002; pp.130).

The school operating system was changed. The Ministry of Education weakened local autonomy and took direct control of educational policy. School boards started being appointed rather than being selected locally (Schoppa, 1991). But the most notable changes came in case of higher education which got serious government attention during this period for its role in acceleration of growth and economic recovery.

In the rapid economic growth of 1960s, the business circles put pressure on the education system to be meritocratic. Diversification according to merit was the overall aim of educational changes from 1960s to the 1990s. From the end of World War II to the beginning of the 1990s, the Japanese economy had a continuous and strong growth rate. After the oil crises of 1973-1974 and 1979-1980, Japan's rate of economic growth slowed, but not as much as that of other countries. The state has been active in formulating strategies for the export industry. Japan was initially competitive in traditional industries and had a tremendous growth until mid-1990s. When the NICs (Newly Industrialized Countries) *started to expand on the world market, Japan entered into high technology industries and became competitive. The Japanese state then gave emphasis to high technology and supported such companies to develop and expand rapidly in these areas* (Daun, 2002; pp.130).

The Government began investing a large part of educational expenditure for the up-gradation and expansion of natural sciences and engineering programmes at the national universities. The number of private universities also increased rapidly to meet the increasing demand for trained industrial workers and employees in the service sector, though the private institutions were less prestigious than the national universities (Kaneko, 1997). The negligence of the government towards private universities manifested by irregular and limited financial support and deterioration of their quality due to this fact became one of the reasons of students' grievance towards government during the mid-1960s. As a result from 1970 government began assisting and providing funds for operational expenditure in the private higher learning institutions. The

government also introduced higher education plans at the same time to control student enrollment in various institutions and tried to get out of the earlier concentrated big–city education system by prohibiting starting of new education programmes in the big cities. This activity made the development of new campuses in the sub-urban areas possible though the attraction of elite institutions still remained as the degrees from these institutions still guaranteed a better position in the job market.

The picture changed with a decrease in the population and the deregulation of market forces in education. From 1980s financial assistance to public universities decreased. On the other hand elite private universities which had to be competitive in the market for higher education became popular (Yonezawa, 2007).

In 1984 when Prime Minister Nakasone came to power, the National Council of Educational Reform (NCER) was established. Some of the important themes of the NCER were liberalization and flexibility. The proposals which were launched included: Less restrictive rules for establishing private primary and lower secondary schools to increase competition; enlargement and abolition of school districts to provide more choice options; less regulation by the Ministry of Education and more decentralization (Daun, 2002).

Along with these liberalization policies of the government, public expenditure on education was also decreased and education system started suffering from continuous under-investment, a fact which is evident from the following data:

Table 10.Trends in the Share of R&D Expenditures and the Number of Researchers by Sector

		1970 (%)	1980 (%)	1990(%)
Universities	Expenditures	18.2	17.6	11.6
	Researchers	32.1	33.3	27.1
Private Companies	Expenditures	68.9	67.1	76.7
	Researchers	54.7	57.3	65.5
Others	Expenditures	12.9	15.3	11.7
	Researchers	13.2	9.5	7.3
Total	Expenditures	100.0	100.0	100.0
	Researchers	100.0	100.0	100.0

Source: Yamamoto (1995), pp.34.

Within the education sector itself private colleges and universities gradually outnumbered their public counter-parts.

Table 11. Number of Institutions of Higher Education in Japan 1955-1994

Year	Universities			Junior Colleges			Colleges of Technology		
	Public	Private	Total	Public	Private	Total	Public	Private	Total
1955	106	122	228	60	204	264	-	-	-
1960	105	140	245	66	214	280	-	-	-
1965	108	209	317	68	301	369	47	7	54
1970	108	274	382	65	414	479	53	7	60
1975	115	305	420	79	434	513	58	7	65
1980	127	319	446	85	432	517	58	4	62
1985	129	331	460	88	455	543	58	4	62
1990	135	372	507	95	498	593	58	4	62
1994	146	406	552	92	501	593	59	3	62
2004	167	542	709	57	451	508	60	3	63

Source: Teichler (1997), pp. 277 and Yonezawa (2007), pp.830.

But even then the public sector continues to play crucial role in case of colleges of technology which are vital for technological advancement and growth.

However, despite growing importance of private sector in education, Japan still manages to have a very centralized education system. The costs of education are also kept comparatively low.

From the Japanese experience regarding education it is seen from the beginning education was of prime importance in Japan's social and political life. It always got strong support and financial assistance from the political authorities.

2.3. United States

The first white population in the United States of America was formed by the Puritans who, dissatisfied with the Church of England, came to the country. The primitive form of education in America was apprenticeship or on-the-job training which was needed for the early development of the country.

> *(...) The schools and colleges in the early colonies were modeled, naturally enough, after the European, especially the English, patterns familiar to the settlers.* (Lee, 1963, pp.19).

In 1642 with the Massachusetts Act, the concept of compulsory education was introduced. According to Jernegan (1918) the original idea behind the Act was that it was the responsibility and duty of the states to make education available and free to all children at public expense. In 1852, the Compulsory Attendance Act enacted by the state of Massachusetts made the school attendance of children aged between eight to fourteen years mandatory. But as the law in general was ineffective there was little incentive to obey the law (Goldin, 1999). However with the Industrial Revolution around this period, the picture started changing. There was growing demand for cheap and skilled workers from the newly established factories. As a result public schools were established by the

initiative and funding of the industrial sector. However these schools were not meant for a full-fledged academic education, but only for producing a large number of industrial workers.

The first notable government intervention in education, particularly in higher education was made with the implementation of Morrill Act (Land College Grant Act) in 1862 when the government provided each state thousands of acres of land to support their respective colleges and universities (Reynolds, 1992). In this Act main emphasis was given on agriculture and mechanical knowledge (Evenson et al., 2006). The purpose of the First Morrill Act was further administered by the Second Morrill Act in 1890 (Redd, 1998). Besides supporting higher education, American public school system was standardized and institutionalized by the government with the 'Progressive Education Movement' in 1880s (Cremin, 1961). Starting from that period, there was fair amount of government intervention in the country's education system, mainly to solve different problems like socio-economic stratification, immigration etc. (Daun, 2002).

Though like in other fields of American economy, rationality of market is well accepted in education and the control of states is gradually decreasing, especially in the recent times, the public sector continues to play a vital role. One of the major indicators to analyze the importance of public sector is the percent of student enrollment in public and private institutions.

Table 12. Higher Education Enrollment in the USA

Year	Total Enrollment in thousands	Percent of Enrollment	
		Public Institutions	Private Institutions
1950	2,297	50	50
1955	2,679	56	44
1960	3,789	59	41
1965	5,921	67	33
1970	8,581	75	25
1975	11,185	79	21
1980	12,097	78	22
1985	12,247	77	23
1990	13,819	78	22
1995	14,262	78	22
2000*	14,889	78	22
2005*	15,516	78	22

Source: Trow (1988), p.14.

* Projected values.

Data shows that instead of showing a decreasing trend, the percent of enrollment in public sector increased during the period 1950-2005.

Like any other developed country education played an important role in the economic growth of USA. According to Jorgenson and Fraumeni (1992) who analyzed the impacts of different factors on US economic growth during 1948-86, besides nonhuman capital, investment in human capital accounts for a very large share of US economic growth during the post-war period.

> *(...) These investments should now become the main focus of economic policies to enlarge growth opportunities. Educational policies obviously deserve much higher priority in discussions of long term growth, which*

have been excessively preoccupied with policies that affect nonhuman investment (Jorgenson and Fraumeni, 1992, pp. S68).

Jorgenson and Fraumeni (1992, pp.S51) predicted that:

Educational investment will continue to predominate in the investment requirements for more rapid growth.

2.4. East Asia

Like the previously discussed countries which had long been known as parts of the developed world, some recently developed countries also have their own histories about the role of education in economic development. The most notable examples are the high performing East Asian economies (excluding Japan) which became important in the world economy from the early 1960s with their exceptionally high but steady growth rates and rapid industrialization. The pioneers were the four Asian Tigers: Hong Kong, Singapore, the Republic of Korea and Taiwan. In a later period Malaysia, Indonesia and Thailand also underwent rapid growth (Meier and Rauch, 2000).

The success of the Asian Tigers to a large extent depended on the abundant supply of cheap but skilled and productive workers which was the result of the education policies adopted in these countries. This is a phenomenon widely recognized by the international institutions like IMF, WTO and World Bank which attributed the success of their growth process to human capital development in these countries. While discussing the educational development of Taiwan Wu, Chen and Wu (1989, pp.125) remarked:

The success of Taiwan's economic policy is well known. A peaceful land reform, first enforced on the island in the spring of 1949, successfully led to prosperity in the rural regions. As advances were made in agriculture, the government focused efforts on the development of industry. (...) it was not until 1963 that Taiwan shifted from an agricultural economy to an economy with equal emphasis on agriculture and industry. (...) Education is closely related to Taiwan's widely reported economic growth.

Popularizing education at elementary and lower secondary level was an important government policy of the two decades after 1949. Since the early 1960's efforts have been made to expand education at the upper-secondary level, especially vocational and technical education, in order to meet the demands of economic development.

The gradual emphasis on higher education in Taiwan is evident from the following data:

Table 13. The Number of Tertiary Institutions in Taiwan

year	Colleges and universities	Junior colleges	total
1950	4	3	7
1960	15	12	27
1970	22	70	92
1980	26	77	103
1985	28	77	105
1990	46	75	121
1995	60	74	134
2000	127	23	139

Source: Wang (2003), pp. 266 and Wu, Chen and Wu (1989), pp.126.

This experience of substantial increase in the higher education system in Taiwan is also common for other high performing East Asian countries.

Table 14. Quantitative Expansion of Higher Education Institutions in South Korea

Year	Number of Institutions	Number of Students	Number of Professors
1945	19	7819	1490
1950	55	11358	1100
1955	74	84996	2626
1960	85	101041	3803
1965	114	141636	6801
1970	168	177996	9265
1972	173	195349	10368
1975	198	238719	11416
1980	236	601994	20900
1982	255	947334	27616
1988	260	1762154	37834
1991	273	n.a.	44936

Source: Kim and Ahn (1995), pp.105.

The Asian Tigers are characterized by high levels of government intervention in the education sector.

> *Higher education in Hong Kong is strictly controlled by the government. The sector has been mainly modeled on that of the United Kingdom, and private institutions have not been encouraged.* (Bray, 1991, pp.12)

However though government control was widely prevalent, the relative importance of public and private sectors in case of higher education is not uniform over the entire region. The education authorities of all these countries practiced from the beginning a strong central control over both the public and private institutions. The trend reversed in the recent years. In South Korea from 1987 educational institutions have been given greater autonomy and simultaneously governmental interference has also been substantially reduced (Kim and Ahn, 1995); a phenomenon which is also true for other tiger economies.

Education played a very important part in the growth process of these economies. There exist compulsory elementary and high school education and almost universal higher education system with special emphasis on natural sciences, engineering, management and other subjects which are needed to create appropriate skills for the industrial sector and the service sector and to increase the research capacity required for the sustenance of the growth process.

In spite of their vast differences the countries have adopted some common themes in their future education programmes: a) increasing the scope and quality of higher education for the sake of better research performance, especially in sciences, b) changing the rigid, instruction-based learning to a more flexible, more open, lifelong learning.

From the previous discussion about the education systems in some selected developed countries, some common features can be observed. First, in all these countries education played a very important role in the development process. While in UK and USA, the industrial revolutions of the late eighteenth and mid-nineteenth centuries were largely the products of new knowledge, in case of Japan and later for the Tiger Countries it became crucial for economic transition. Secondly, in all these countries, governments played a crucial role in educational development.

Chapter 3. Probable Determinants of the Share of Public Educational Expenditure Allocated for Higher Education

The objective of this chapter is to discuss in the context of the existing literature the probable determinants of the share of public educational expenditure allocated for higher education and the relative importance of these determinants. Public resource allocation across educational stages is an important public policy tool today for overall economic growth and social improvement.

3.1. Probable Determinants

Share of public educational expenditure allocated for higher education is represented in this study by the variable **current educational expenditure at tertiary level of education as a percentage of total current educational expenditure**. Several factors may be important to determine this variable. Some of them are discussed here.

3.1.1. Stage of Economic Development

The development phase of the economy can be one of the important factors to determine public educational expenditure allocated for higher education. The variation in the role played by different education stages in the path of economic development is discussed by Galor and Moav (2002). According to Galor and Moav at the early stage of economic development when physical capital is scarce, physical capital accumulation becomes the prime concern of the growth process. This phenomenon is the basis of Classical approach to economics which advocated the channeling of resources from individuals with low marginal propensity to save to individuals with high marginal propensity to save. Thus in this phase increase in inequality enhances the rate of growth.

The situation changes in the later stage of economic growth as endogenous replacement of physical capital accumulation by human capital accumulation occurs. According to Galor and Moav this phenomenon is observed during the transition of the currently advanced economies from the Industrial Revolution to the modern era of growth. Here Galor and Moav cite the example of England. In the earlier phase of the Industrial Revolution (1760-1830) in England, physical capital accumulation as a fraction of GNP increased significantly while human capital was neglected. Literacy rates did not improve during the period 1750-1830, workers were dependent on traditional on-the-job training, and child labour was very important. The picture changed in the second phase of Industrial Revolution. Whereas the pace of capital accumulation subsided, the level of human capital of workers increased considerably and skill became a crucial factor for production. The investment ratio in physical capital remained stagnant around 11% on average in the period 1856-1913. On the other hand, the average years of schooling of the male labour force in England tripled until the beginning of the twentieth century and school enrollment of 10-year olds increased from 40% in 1870 to 100% in 1900.

Galor and Moav argued that because of the complementary nature of capital and skill in an economy, physical capital accumulation in the earlier phase increases the productivity of human capital in the latter period. Accordingly Galor and Moav divided the economy into two fundamental regimes:

Regime I: In this phase the rate of return to human capital is lower than the rate of return to physical capital and growth takes place through physical capital accumulation. The wage rate is so low in this regime that the poor consume their entire wages. They have no incentive to invest in either physical capital or human capital. As a result they stay in a perpetual poverty. The rich on the other hand own the entire capital stock and as a result extract a very high income out of it. Thus the rich are able in this economy to accumulate and increase the physical capital stock. So in regime I inequality increases with the rich getting richer and the poor getting poorer.

Regime II: In this later phase the rate of return to human capital increases sufficiently and both human capital accumulation and physical capital accumulation contribute to economic development. In the first part of the regime II, though human capital accumulation starts taking place, it is generally confined within the richer section of the population. The wage rate of the poor is still low enough to discourage them from investing in human capital. In the second part of the regime II the wage rate permits everyone to make some investment in human capital. But compared to the rich, the poor still face credit constraints for this investment.

In the third part of regime II, however, the wage rate is high enough to remove all credit constraints. In contrast to regime I equality rather than inequality is the main driving force for economic growth.

This feature of an economy's development in regime II, according to Galor and Moav is explained by two complementary approaches. Recent capital market imperfection approach suggests that for sufficiently wealthy economies equality stimulates investment in human capital and thus enhances the growth process. The political economy approach on the other hand says that equality reduces socio-economic instability and hence encourages investment and creates economic growth. Galor and Moav attributed this fact to the asymmetric nature of human capital accumulation and physical capital accumulation. As human capital is embodied in humans, due to the physiological constraints on brain capacity its accumulation at the individual level creates diminishing returns. So the aggregate return to investment in human capital is maximized if the marginal returns are equalized across individuals; a fact which again suggests the accumulation of human capital by all individuals in the society.

So according to the Galor and Moav the stage of economic development determines the required policy. As physical capital is important for the earlier period of economic growth, inequality is important. In the later stage as human capital becomes important, equality enhances the growth process.

So **stage of economic development** may be considered as one of the factors determining public resource allocation in education. Though education is taken here as human capital in general without any division among different levels, the same policy prescription for aggregate level is applicable for higher education as well.

The stage of economic development of a country is represented by **real GDP per capita** in this study; as it is generally seen, a country with higher level of per capita GDP is the country having higher level of economic development.

3.1.2. Role of Secondary Education

However the role of education varies widely for different levels of education. The division of education among different levels and the role of different stages of education were discussed by Horowitz, Driskill and Méndez (2007). According to Horowitz, Driskill and Méndez the process of human capital accumulation is a hierarchical system where individuals proceed in a pre-determined way from primary to secondary level and from secondary to tertiary level and so on. The quality of human capital produced at each level of the hierarchy is distinct. So, more investment in primary education can not substitute the need for high-skilled labours. Beside that, in an N-level hierarchy the production of i level human capital requires i-1 level human capital as input.

According to the authors at a particular time a person can be employed only in one capacity. Again, as the transformation of human capital from level i to level $i+1$ is costly, in an optimal system an individual is always employed in a way such that the human capital confined to that individual can be used at its highest possible capacity.

Now in this hierarchical system two fundamental properties of human capital are 'qualitative distinctiveness' and 'intermediate productivity'. Qualitative distinctiveness means 'advanced' human capital cannot be substituted just by gathering enough 'basic' human capital. Each level of human capital has distinct characteristics. The basic human

capital of primary or pre-primary level creates advanced human capital when added with advanced technology for investment in human capital.

Intermediate productivity on the other hand implies the difference between human capital and physical capital. As human capital advances from one level to another level, at any point of time it can stop advancing and can enter the production function. Even then it achieves some characteristics of the level it was just going to reach but did not reach.

> *As the human putty traverses the hierarchy it may cease transformation at any stage and enter the production function. A "half-built" PhD (a secondary school graduate) is productive in a way that a half-built airplane is not.* (Horowitz, Driskill and Méndez, 2007, pp. 2)

Thus in the hierarchical system of human capital accumulation the investment in a particular hierarchical level creates a depletion effect on the next lower level.

From these features of human capital it is clear when a policy is deduced for higher education (tertiary education here) the quality and quantity of human capital of the previous level (secondary education) should be considered. So for public budget allocation in tertiary education vis-à-vis public budget allocation in other educational levels the **number of students completing secondary education** should be taken into account. This consideration is more necessary for the developing countries where the required resources are scarce.

Due to the non-availability of data regarding the factor, number of students completing secondary education, **Secondary Gross enrolment ratio (Male and Female)** is taken to represent the factor. It is assumed that drop-out rate during the entire period of secondary education is marginal.

3.1.3. Income Inequality

The political economic aspect of public budget allocation for different levels of education was elaborately discussed by Su (2006) in the context of a two-stage hierarchical educational system. Using 1996 cross-country data and summary statistics, published by UNESCO, Su showed that the developing countries spend excessively on higher education compared to the developed countries which follow a more balanced public budget allocation policy. According to Su this additional expenditure is totally irrelevant from the development point of view as education is hierarchically organized i.e. only after successfully completing the previous stage can one be admitted to the higher stages. In most of the LDCs, the average level of qualification, even the literacy level, is very low. Su (2004) shows that in an economy with low average qualification, funding basic education creates more benefit than funding higher education. So according to Su the prevalent bias in the public budget allocation for education in developing countries, that is, under-investment in basic education and over-investment in higher education is socially inefficient.

Su proceeds with some basic assumptions:

-In the hierarchical education model the initial qualification of an individual is determined by some basic factors like family background, wealth, income and parental human capital level.

-There is no private educational expenditure.

-There is no exclusion mechanism in higher education.

-Every student who attends school enjoys the same schooling quality.

Even under these more egalitarian condition with the apparent absence of inequality, Su showed that rich individuals may benefit more from public education than poor individuals, especially in the developing countries. According to Su this is because of the inequality in political power. The political power of an individual may depend on his economic power and that is generally common in LDCs where dominant economic power combined with less democracy gives rich individuals, the top class, dominant political

power. As a result the budget allocation policies of the governments are highly influenced by the preference of the top class.

Now like for any other private good, there is a congestion effect for public education as it is a publicly provided private good. When the budget allocation is fixed the quality of schooling measured as expenditure per pupil is inversely related to the enrollment at a given stage. In this situation the motive of the top class always remains to gain the highest possible benefit from government policy. The poor who never had enough means to reach the level up-to higher education are easily excluded from the higher education system. Then the major concern becomes the middle class. If the initial qualification of the middle class is low, as in case of most of the developing countries, the top class cut funding in higher education to disqualify the middle class and it gains more in this process.

> *On the other hand, in many developed countries where the initial qualification of the middle class is relatively high, the top class has less incentive and less means to exclude the middle class from higher education. So the actual policy, regardless of whether it is most preferred by the top class or some compromise outcome among the classes, is more balanced, and leads to expanded participation of the middle class in higher education.* (Su, 2006, pp. 450)

However, the situation changes when the assumption of 'no exclusion-mechanism' is dropped.

> *(....) admission to higher education may be based on entrance examination scores, which can be set above the technically-intrinsic threshold level. Another possible exclusion mechanism is through tuition, so that if credit constrained, qualified poor individuals may not be able to afford higher education. Yet another more subtle exclusion mechanism is through different academic tracks, so that only individuals on certain track can choose to attend higher education, while others are automatically excluded from the opportunity. Adding extra exclusion mechanism will*

give the top class more manipulative power to prevent the congestion effect in higher education. In this model, since there is non-monotonicity in the top class' most preferred policy, adding extra exclusion mechanism will also have non-monotonic effects. When the middle class is of relatively low qualification, the extra exclusion mechanism saves the top class from resorting to lower basic education quality to exclude the middle class, then the policy will favor higher education less. When the middle class is of relatively high qualification, the extra exclusion mechanism helps the top class to keep the middle class out, then the policy will favor higher education more. (Su, 2006, pp. 451)

So it can be said that the economic power which is manifested in the political power of the top class can be a determining factor of the share of public educational expenditure allocated for higher education. As the economic power of the top class is related to the income inequality of the classes in an economy, so we can take **income inequality** as a determinant.

Income inequality in this study is represented by two variables, **Gini index** and **percentage share of income or consumption of highest twenty percent**. Whereas Gini coefficient presents a pattern of income distribution of the whole population, the percentage share of income of highest twenty percent presents the comparative strength of the richer section of a society.

3.1.4. The Proportion of Labour with Higher Education in the Total Labour Force

However Su's argument of higher education being a luxury good needed only by higher and middle income groups was challenged in various papers. According to the report of the Task Force on Higher Education and Society (The International Bank for Reconstruction and Development and The World Bank, 2000) the demand for tertiary education in the recent decade increased significantly in many developing countries with

the increase in the secondary enrollment ratio. The growing impact of globalization on the economy increased the demand for skilled labour which in turn increased the demand for higher education. According to the Task Force report with demographic change, income growth, urbanization, and the growing economic importance of knowledge and skill higher, education became a necessary good even in the developing countries and it acquired a significant role in the development process.

The report also talks about the positive roles played by higher education in the economy through the creation of a highly educated socially conscious and economically active class and through the technological advancement brought about by research and innovation.

The positive externalities and the high social rate of return to higher education were further discussed by Birdsall (1996). Advocating higher education as an important factor of *nation building,* Birdsall challenges the argument of a lower rate of return to higher education. According to Birdsall the rate of return to higher education is much higher than the rate of return to physical capital.

While discussing the rate of returns to different levels of education Birdsall says:

> *(....) with higher internal efficiency and quality in public universities, the difference between social returns to higher vs. primary education would fall.* (Birdsall, 1996, pp. 413)

According to Birdsall the measured social returns to different levels of education reflect the differences in social costs which in a great part are represented by the opportunity cost of the time of trained teachers. As in most of the developing countries the number of highly educated teaching stuff for higher education is very few, the opportunity cost of employing them is very high. So, providing higher education to general population becomes very difficult and it is treated as a luxury good, accessible only to a small section of the population. When education is well spread, however these skills become less scarce and as a result the costs decrease. On the other hand data show that the social

returns to primary education decrease over time as the economy develops. According to Birdsall these facts weaken the argument of too much spending on higher education.

Birdsall's analysis also poses the need for creating high skilled human capital, even in developing countries. In that way it will be possible to reduce the scarcity of highly educated people in the society. Here the amount of already existing human capital has to be considered. **The proportion of labour with higher education in the total labour force** can therefore be a determinant of public resource allocation for higher education.

This argument is further strengthened by considering the need for a complementary approach towards education. According to Ramacharan (2004) complementarities exist among various types of human capital and it is manifested when different types of skill simultaneously play specific but complementary roles in the production process. Ramacharan cites the example of the Green Revolution in Asia. The success of this programme needed highly educated scientists, researchers and technicians for invention and innovation and farmers with minimum skill for using the results of these innovations. Considering the case of an economy with a limited number of secondary-educated labour force, Ramacharan (2004, pp.310) says:

> *The inability of the economy to adequately use technology within the skilled sector because of the limited supply of secondary-educated labor reduces the productivity of tertiary-educated workers and dampens the overall incentives for education investment.*

Thus the social marginal productivity of skilled labour depends on the complementary type of human capital. So if a sub-optimal amount of highly educated labourers exists it can affect the productivity of labourers with lower levels of skill. This again implies the need for simultaneous expansion of schooling at all levels. Thus governments in developing countries might attempt to achieve an optimal **ratio of skilled to unskilled labourers** in the economy. This ratio could therefore be a determinant of public resource allocation amongst different levels of education.

The variable, **average years of schooling**, is taken to represent this determinant as the data on proportion of population of a country having different levels of education is

not available. It is assumed that the average years of schooling is high in a country when the overall education level of the population is high, as well as the proportion of people with higher levels of education is high in total population.

3.1.5. FDI Flow

Beside all the above factors another factor which may influence public policy regarding investment in higher education especially in a period of globalization, is the possibility of attracting FDI flows. Lucas (1990) calculated the marginal productivity of capital in both developed and developing countries with the help of Anne Krueger's study of 1968 on the productivity level of workers in various countries based on the level of education, age and sector. According to Lucas even considering the fact that the productivity of workers is less for poorer countries, the marginal productivity of capital in poorer countries is still higher. But even then the flow of capital from richer countries to poorer countries is rare, while the opposite happens often. According to Lucas the reasons vary from skepticism about the market of developing countries to the restrictions on capital flow imposed by the borrowing countries. However this situation seems to be changing in the recent time.

Noorbakhsh, Paloni and Youssef (2001) showed that the share of global flows of FDI going to developing countries increased recently while within this group the importance of oil-producing countries as destinations for FDI declined. While in the early 1950s FDI flows were mainly in the primary sector and the resource-based manufacturing sector, from the 1960s the flow shifted towards the manufacturing sector in general and during the 1980s the service sector and the technology-intensive manufacturing sector became the most important host sectors for attracting FDI. In fact, according to Noorbakhsh et al. during the period 1980-90 the share of capital-intensive and technology-intensive industries in FDI flows rose faster in developing countries than in the developed countries. Therefore education, especially higher education, became an important factor determining a developing country's ability to attract FDI. Given this

background, a proper education policy which can increase the supply and raise the quality of human capital can greatly increase a country's importance from a global investment point of view.

Taking the number of accumulated years of secondary and tertiary education in the working age population as the main explanatory variables for changes in FDI flow and with the panel estimation based on three-year averages for the period 1980-90, the authors concluded that human capital is one of the important determinants of FDI inflows in the developing countries and its importance is increasing through time. In this situation, countries with relatively low levels of human capital find it difficult to attract appropriate level of FDI for high value-added industries and thus are subject to slower economic growth.

After seeing the importance of education on FDI flow the question arises whether the picture is true the other way round, that is, whether FDI flow has any role in improving the education system. As FDI flows are perceived to be more and more important for the development process of a country, especially in developing countries, the governments of these countries may put emphasis on the better standard and higher level of education.

To see the role of FDI inflow on educational development, it is assumed that the intensity with which the government desires to change FDI inflows depends on the actual FDI inflows in a country relative to what the government feels should be the FDI inflows into the country. The latter is referred as potential FDI inflows.

Following Goldar and Ishigami (1999) we obtain an estimate of potential FDI inflow for a country in a particular year by running a pooled regression of FDI inflows on the explanatory variables; exchange rate, degree of openness, GDP per capita, changes in GDP per year and investment share in real GDP.

The variable representing the importance placed by government of a country in a particular year on attracting FDI inflows is then taken to be the difference between the potential FDI and actual FDI of that country in that year.

3.2 Data

The data used in this study are all secondary data published by international organizations. The education data, that is, data on current educational expenditure at tertiary level of education as a percentage of total current educational expenditure and secondary gross enrolment ratio, have been taken from UNESCO data published by Global Education Database (GED). Data on real GDP per capita have been collected from Penn World Table. The data on Gini index have been collected from World Income Inequality Database (WIID) provided by United Nations University and World Institute for Development Economic Research (UNU-WIDER). The data on income share of highest twenty percent have been collected from World Development Indicators 2007. The average years of schooling data have been collected from Barro-Lee data set provided in *Education Attainment in the Adult Population* which is made available through web by EdStats (The World Bank). The FDI data have been collected from Global Development Finance (GDF) 2005 and GDF 2008, and the World Investment Report 2008. To calculate potential FDI in the absence of any role of human capital, data have been collected on exchange rate, openness and investment share in real GDP. These data are available from the Penn World Table.

3.2.1. Global Education Database

The Global Education Database (GED) is a repository of international education statistics compiled from the UNESCO Institute for Statistics and the Demographic and Health Surveys (DHS). UNESCO data, which are available in the GED are used in this study.

Variables Taken from GED

1) *Current educational expenditure as a percentage of total current educational expenditure (tertiary)*: This is current public expenditure on tertiary education expressed as a percentage of total current public expenditure on education. The Summation of percentages allocated to pre-primary/primary, secondary, and tertiary education will not add to 100% due to the unspecified category. The unspecified category is treated as a residual and includes expenditure on other types of education (for example, adult education) and all expenditure that could not be attributed to any of the three levels of formal education. Current education expenditures are non-capital expenditures for recurring costs necessary to maintain education systems operations including emoluments, administration, teaching materials and other operational expenses.

2) *Secondary gross enrollment ratio*: This is defined as the enrollment of secondary students of all ages expressed as a percentage of the secondary school-age population. The ratio describes the capacity of a school system in relation to the size of the official school-age population. For example, a ratio of 100 percent indicates that the number of children actually enrolled, including those outside the official age range, is equivalent to the size of the official secondary school-age population.

Limitations

The main limitation of the database is the scarcity of data. The problem faced in this study is the availability of very few observations for the dependent variable, current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure.

3.2.2. Penn World Table

The Penn World tables (PWT) displays a set of national accounts economic time series data covering many countries. Its expenditure entries are denominated in a common set of prices in a common currency so that real quantity comparisons can be made, both between countries and over time. It also provides information about relative prices within and between countries, as well as demographic data and capital stock estimates.

The original Penn World Table, PWT 5 was published by Robert Summers and Alan Heston in May 1991. It was an annex to the article *The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988*, written by Summers and Heston. Later PWT 6 was produced by The Center for International Comparisons at the University of California. The Table contained data on about 30 variables for about 167 countries over some or all the years 1950-98. After PWT 6, PWT 6.1 was published as an updated version. Currently available PWT 6.2 combines 2002 benchmark data for 30 OECD countries, updates for the 138 countries in PWT 6.1, and adds 20 additional countries.

Data Source

The national income accounting framework is the standard statistical device for describing countries' economic affairs. Entries in the usual System of National Accounts (SNA) are maintained by most members of the United Nations. The first systematic multilateral set of purchasing power comparisons was that of the International Comparison Programme (ICP) of the United Nations that was begun in 1968. The data provided by ICP is the basis of Penn World Table.

The Variables Taken from Penn World Table

1) Real GDP per capita (Constant Prices: Laspeyres): ***RGDPL***

RGDPL is obtained by adding up consumption, investment, government expenditures and exports, and subtracting imports in any given year.

2) Exchange rate: ***XRAT***

For the period under consideration exchange rates in the PWT are taken from UN and World Bank sources, and these are usually the same as the IMF annual rate.

3) Openness: ***OPENK***

Exports plus Imports divided by RGDPL. The export and import figure are in national currencies from the World Bank and United Nations data archives.

4) Investment Share of RGDPL: ***KI***

It is a component share of RGDPL.

3.2.3. UNU-WIDER (United Nations University- World Institute for Development Economics Research) World Income Inequality Database

In the UNU/WIDER World Income Inequality Database (WIID) information on income inequality for developed, developing, and transition countries is stored. WIID was initially compiled over 1997-1999 for the Project *Rising Income Inequality and Poverty Reduction: Are They Compatible?* of UNU/WIDER-UNDP. The current update, that is, WIID2 is part of the UNU/WIDER Project *Global Trends in Inequality and Poverty.*

The Basic Principles behind WIID2

As there is no agreed basis of definition for the construction of distribution data, dealing with this data is difficult. Sources and methods of collection might vary, both across and within countries. This may occur even if the data come from the same source.

According to UNU-WIDER in most industrialized countries inequality and poverty are assessed with reference to income, not consumption. This is also the case for Latin America. But by contrast most Asian and African countries collect data on consumption.

It is assumed distribution data based on both income and consumption construct comparable statistics.

Data Source for WIID2

The data of Deininger and Squire 2004 (D&S 2004), the unit record data of the Luxembourg Income Study (LIS), the Transmonne data UNICEF/ICDC, Central Statistical Offices and research studies are central sources of the WIID2 database.

Income Sharing Units

The following income sharing units are used in WIID2.

1) Household: There are variations in the definitions. A broader definition defines the household as covering people who share a dwelling; a more restrictive definition describes as those who share a dwelling and who share resources.
2) Family: Family is defined as a group of two or more persons residing together and related by birth, marriage, common-law or adoption.
3) Tax unit: The definition depends on the tax laws but is often close to nuclear family. Sometimes children of age eighteen or above, living with their parents are treated as separate tax units.
4) Persons: In this case data are collected on the individual level, generally by earnings surveys.

In our study we tried to collect the inequality data initially from the values given for the unit *Household*, and if this was not possible for a particular country then from the values given for the unit *Persons*. But as the numbers of observations available were still fairly small for certain countries we were forced to collect the values given for the unit *Family*.

Quality Rating

The following quality rating was done for the distribution data set.

1 for observations

a) Where the underlying concepts are known.

b) Where the quality of the income concept and the survey can be judged.

2 for observations where the quality of *either* the income concept *or* the survey is problematic or unknown or the estimates were not verified by the authors for the unavailability of the source.

3 for observations where both the income concept and the survey are problematic or unknown.

4 for observations classified as memorandum items; some of the observations originated from the older compilations of inequality data have been given this rating since the data lying behind the observations often are unreliable.

In the current study most of the data used had the quality rankings 1 or 2

In the study the *Gini* coefficient in percentage points as calculated by WIDER has been used as the determinant of income inequality factor.

Limitations of the Data

The main limitation of this database is limited number of entries for the inequality observations. In some cases even if the data are entered, they are done for different years for different countries; a fact which makes the cross country comparison of the observations very difficult. Besides this, different units of analysis have to be used for different countries and inequality measures based on income have to be used for some countries and those based on consumption have to be used for others. All of these further increase the difficulty of cross country comparison.

3.2.4. World Development Indicators 2007

The data on percentage share of income or consumption of the highest twenty percent of the population were collected from the database of World Development Indicators (2007).

About the Data

Inequality in the distribution of income is reflected in the percentage shares of income or consumption accruing to portions of the population ranked by income or consumption levels. The portions ranked lowest by personal income receive the smallest shares of total income. Data on the distribution of income or consumption come from nationally representative household surveys. Where the original data from the household survey were available, they have been used in the World Development Indicators to directly calculate the income or consumption shares by quintile. Otherwise, shares have been estimated from the best available grouped data.

The distribution data have been adjusted for household size, providing a more consistent measure of per capita income or consumption. Adjustment has not been made for spatial differences in cost of living within countries.

Data Sources

Data on distribution are compiled by the World Bank using primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are estimated from the Luxembourg Income Study database.

Limitations of the data

Because the underlying household surveys differ in method and type of data collected, the distribution data are not strictly comparable across countries. There are two main sources of non-comparability. First, the surveys can differ in many respects, including whether they use income or consumption expenditure as the living standard indicator. The distribution of income is more unequal than the distribution of consumption. In addition, the definitions of income used differ more often among surveys. Consumption is a better welfare indicator, particularly in developing countries. Second, households differ in size (number of members) and in the extent of income sharing among members. And individuals differ in age and consumption needs. Differences among countries in these respects may bias comparisons of distribution.

Besides this, data for any country is generally only available for one year during the study period. Even then the observation year for each country differs across countries. The number of observations available for the study period is also fairly small.

3.2.5. Barro-Lee Data Set on Education Attainment of the Adult Population

The Barro-Lee data set contains data on educational attainments for 142 countries and all regions in the world from 1955-2000. The data include average years of schooling of adult population by age for populations over age 15 and over age 25. The data refer to male and female attainment of the adult population at four levels: no schooling, primary, secondary, and higher. It also provides a rough breakdown into incomplete and complete attainment at the three levels of schooling.

Data Source

In the data set the data on school attainment are collected from census/survey information, as compiled by UNESCO and other sources. Data on enrollment rates are

taken from UNESCO and data on the structure of population by age are taken from United Nations. For the projections of educational attainment for 2000, Barro-Lee use the projections on the population structure for 2000 provided by the United Nations.

Average Years of Schooling

In the construction of average years of schooling Barro-Lee take account of changes of school duration over time within countries. The data set comprises at least one observation for 142 economies, of which 107 have complete information at five-year intervals from 1960 to 2000. According to Barro-Lee the percentage of the population who have successfully completed a given level of schooling, like secondary, tertiary, or post-primary schooling, is a straightforward way to show the population's attainment of skills and knowledge associated with a particular level of education. But each cycle of education has significant variation in duration across countries. So, the data showing average years of schooling is a better measurement of the educational attainment of the general population.

Problems of Using the Database

The main problem of using this data set, published in 2000, is the lack of data for more recent years. As the observations in this study ranges over the period 1999 to 2004, the only data which could be used is the data for the year 2000.

3.2.6. Global Development Finance (GDF - 2005 & 2008)

The GDF database publishes data on the external debt situation of the developing countries. The database is used in this study to collect the data on FDI inflow, which is presented as a part of long term Net Resource Flows.

About the Data

The World Bank is the sole repository for statistics on the external debt of developing countries on a loan-by-loan basis. The Debtor Reporting System (DRS), set up in 1951 to monitor these statistics, is maintained by the staff of the Financial Data Team (FIN). Using the DRS data, in combination with information obtained from creditors through debt data collection systems of other agencies such as the Bank for International Settlements (BIS) and the Organization for Economic Co-operation and Development (OECD), the Financial Data Team estimates the total external indebtedness of developing countries.

Data Source

The principle sources of information of the database are reports to the World Bank through the DRS from member countries that have received either IBRD loans or IDA credits. Additional information is collected from the African Development Bank, the Central Bank for Economic Integration, the Inter-American Development Bank, the IBRD and the IDA, and the IMF.

Reporting countries submit detailed (loan-by-loan) reports through the DRS on the annual status, transactions, and terms of the long-term external debt of public agencies and that of private ones guaranteed by a public agency in the debtor country. This information forms the basis of the GDF database.

FDI

It has already been mentioned that the FDI data are presented as a part of long-term Net Resource Flows (NRF). NRF are the sum of net resource flows on long-term debt (excluding IMF credit) plus net foreign direct investment, portfolio equity flows, and official grants (excluding technical co-operation).

Foreign Direct Investment (FDI) is defined in the database as investment that is made to acquire a lasting management interest (usually ten percent of voting stock) in an enterprise operating in a country other than that of the investor (defined according to residency), the investor's purpose being an effective voice in the management of the enterprise. It is the sum of equity capital, and short-term capital as shown in the balance of payment.

Problem with the Database

The data in this database are available only for developing countries. Data for developed countries have to be procured from some alternative source.

3.2.7. World Investment Report 2008

World Investment Report 2008 (WIR08) is the 18th in a series published by the United Nations Conference on Trade and Development (UNCTAD). The Report analyses the latest trends in foreign direct investment (FDI).

Data Source

UNCTAD regularly collects published and unpublished national official FDI flows directly from central banks, statistical offices and other national authorities on an aggregated and disaggregated basis for its FDI/TNC database. These data constitute the main source for the reported data on FDI. The data are further complemented from the data obtained from: (a) other international organizations such as the International Monetary Fund (IMF), the World Bank and the Organisation for Economic Co-operation and Development (OECD); (b) regional organizations such as the ASEAN Secretariat, European Bank for Reconstruction and Development (EBRD), Banque Centrale des Etats de I'Afrique de I'Ouest, Banque des Etats de I'Afrique Centrale and the Eastern Caribbean Central Bank; and (c) UNCTAD's own estimation.

FDI

In World Investment Report data on FDI are presented on a net basis (capital transactions' credits less debits between direct investors and their foreign affiliates). Net decreases in assets (outward FDI) or net increases in liabilities (inward FDI) are recorded as credits (recorded with a positive sign in the balance of payments), while net increases in assets or net decreases in liabilities are recorded as debits (recorded with an opposite sign in the balance of payments).

The data provided by World Investment Report on FDI is consistent with the data on FDI provided by Global Development Finance. This consistency can be seen from the data on FDI inflow for a particular (developing) country for a particular year when the data is present in both the sources.

3.3. Individual Relationships of Each Determinant with the Share of Public Educational Expenditure Allocated for Higher Education

In this section the individual relationships of each determinant with the dependent variable, public resource allocation for higher education, will be discussed with the help of scatter diagrams and single variable regression models. There are three scatter diagrams and correspondingly, three regression models for each determinant; one showing the relationship for developed countries, one showing the relationship for developing countries, and the third showing the relationship when the data for all countries are taken together.

3.3.1. Relationship between Stage of Economic Development and the Share of Public Educational Expenditure Allocated for Higher Education

As mentioned above the stage of economic development is measured by real GDP per capita and the share of public educational expenditure allocated for higher education is measured by current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure. Since the dependent variable is expressed as a ratio, the logarithm of real GDP per capita is taken as the independent variable, instead of real GDP per capita.

Figure 2. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Log of GDP per Capita (All Countries)

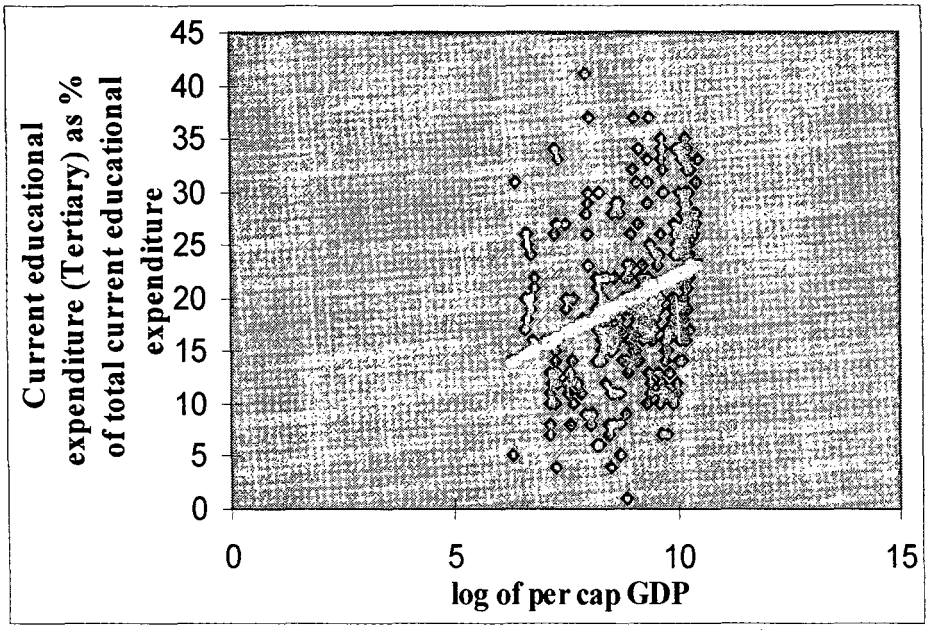


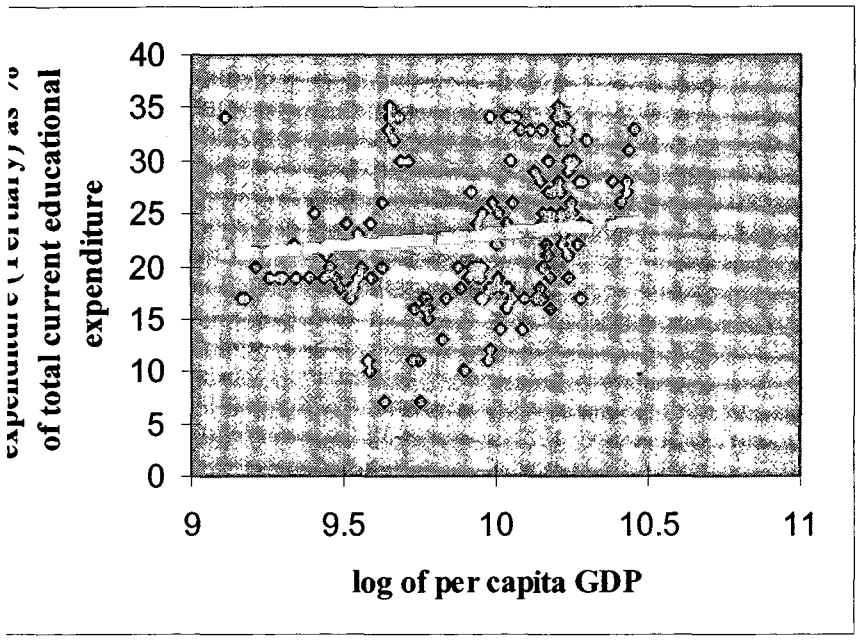
Table 15: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Log of GDP per Capita: Regression Result (All Countries)

Dependent Variable	*(1)*
Log per capita GDP	2.415716 (5.88)***
Cons	-1.915987 (-0.50)
Adjusted R^2	0.1119
Obs	329

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

ationship between Current Educational Expenditure at the Tertiary :ation as a Percentage of Total Current Educational Expenditure and Log of GDP per Capita (Developed Countries)



lationship between Current Educational Expenditure at the Tertiary :ation as a Percentage of Total Current Educational Expenditure and)f GDP per Capita: Regression Result (Developed Countries)

Dependent Variable	*(1)*
Log per capita GDP	7.191062 (4.32)***
Cons	-48.64531 (-2.94)***
Adjusted R^2	0.1080
Obs	147

in the parentheses give the *t* value. Results have been checked for heteroscedasticity, and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels

ılation

Figure 4. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Log of GDP per Capita (Developing Countries)

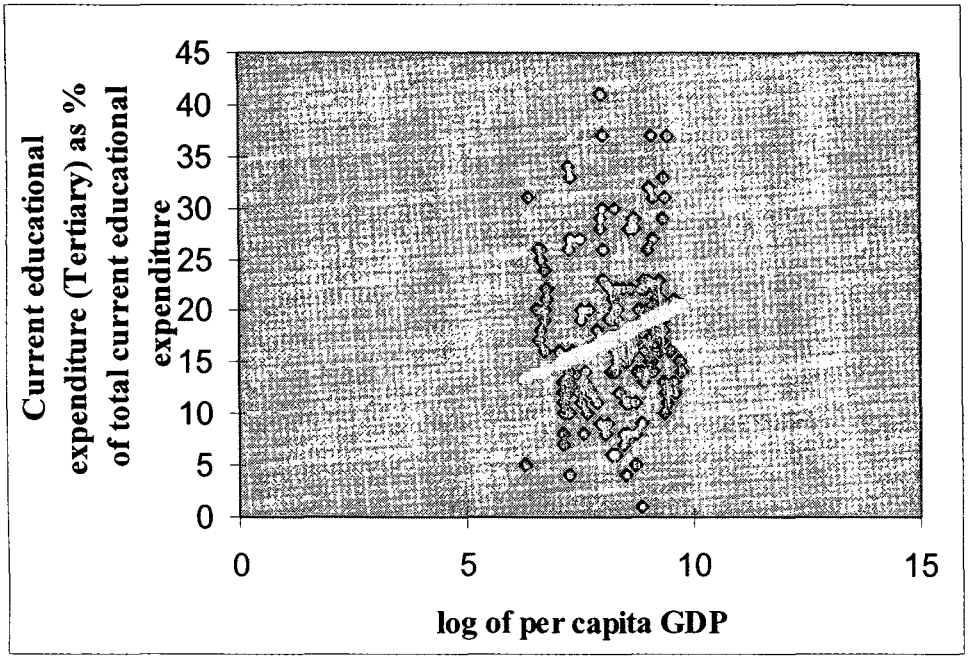


Table 17: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Log of GDP per Capita: Regression Result (Developing Countries)

Dependent Variable	*(1)*
Log per capita GDP	0.4254432 (0.66)
Cons	14.07302 (2.60)***
Adjusted R^2	-0.0031
Obs	182

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

In the diagrams, the black points represent the actual values of the dependent variable against the values of the independent variable; while the grey points represent the estimated values.

The scatter diagrams plotting the value of the dependent variable, current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure against the respective values of the independent variable, log of real GDP per capita, shows that there is always a positive relationship between these two factors. The corresponding regression equations confirm this observation. However, it is seen from the regression equations that though real GDP per capita remains a significant explanatory variable at all country level and for developed countries, it is not significant for developing countries.

3.3.2. Relationship between the Spread of Secondary Education and the Share of Public Educational Expenditure Allocated for Higher Education

The spread of secondary education is measured by secondary gross enrollment ratio, as was mentioned earlier and the share of public resource allocated for higher education is measured by current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure.

Figure 5. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio (All Countries)

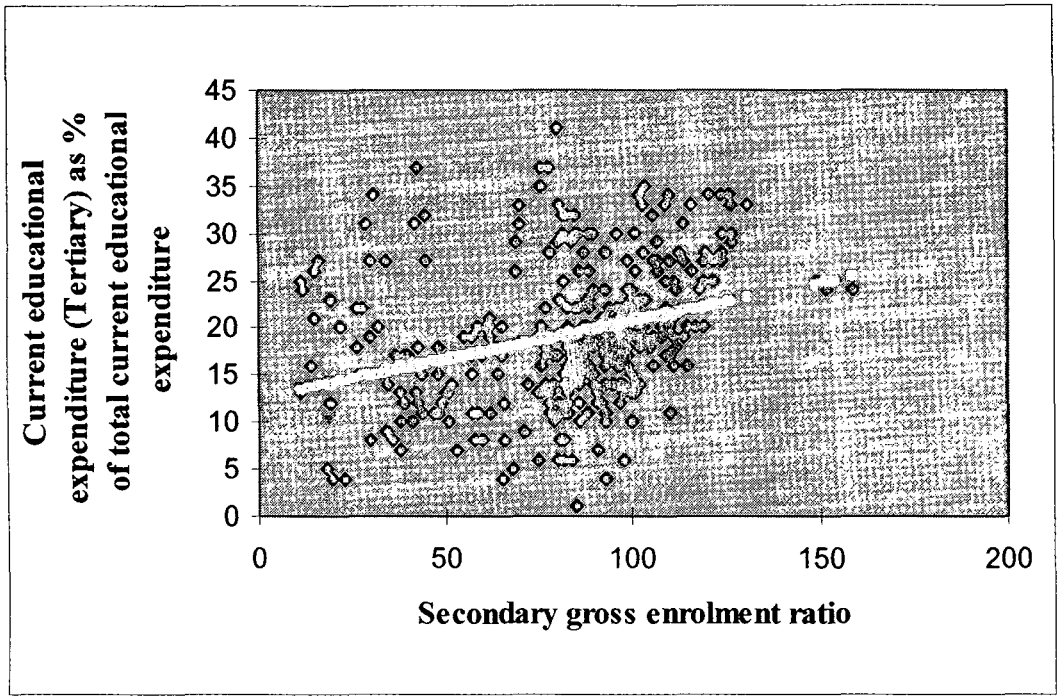


Table 18: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio: Regression Result (All Countries)

Dependent Variable	*(1)*
Secondary gross enrollment ratio	0.0801098 (5.63)***
Cons	12.61828 (9.49)***
Adjusted R^2	0.0934
Obs	347

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 6. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio (Developed Countries)

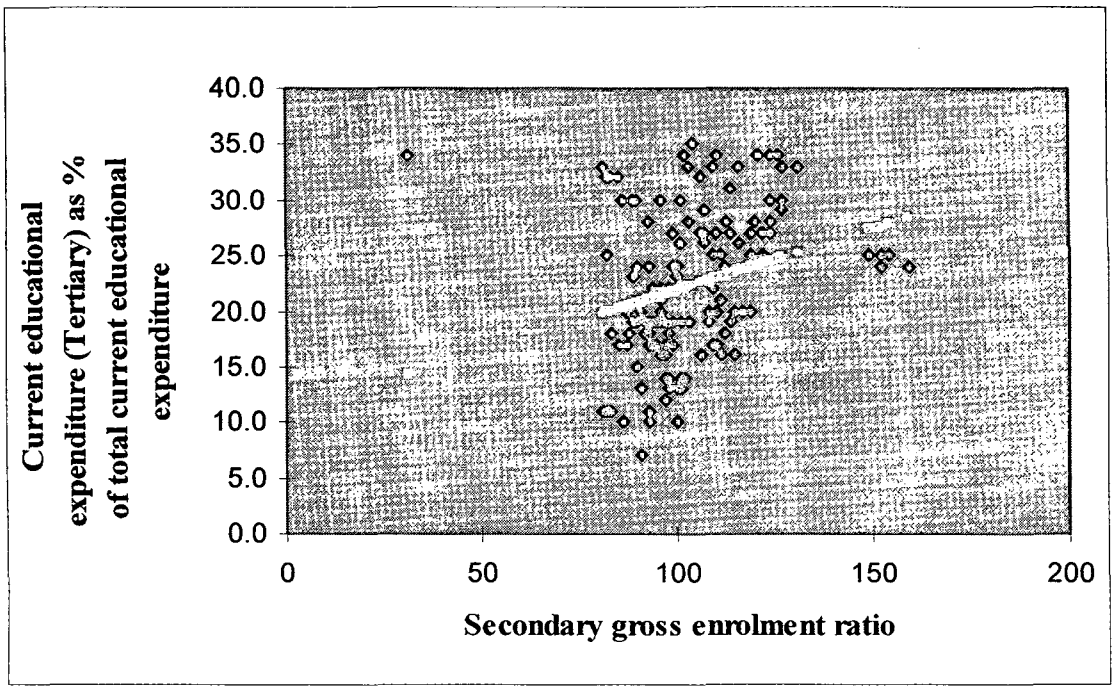


Table 19: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio: Regression Result (Developed Countries)

Dependent Variable	*(1)*
Secondary gross enrollment ratio	0.1100693 (2.47)**
Cons	10.83077 (2.24)**
Adjusted R^2	0.0771
Obs	148

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 7. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio (Developing Countries)

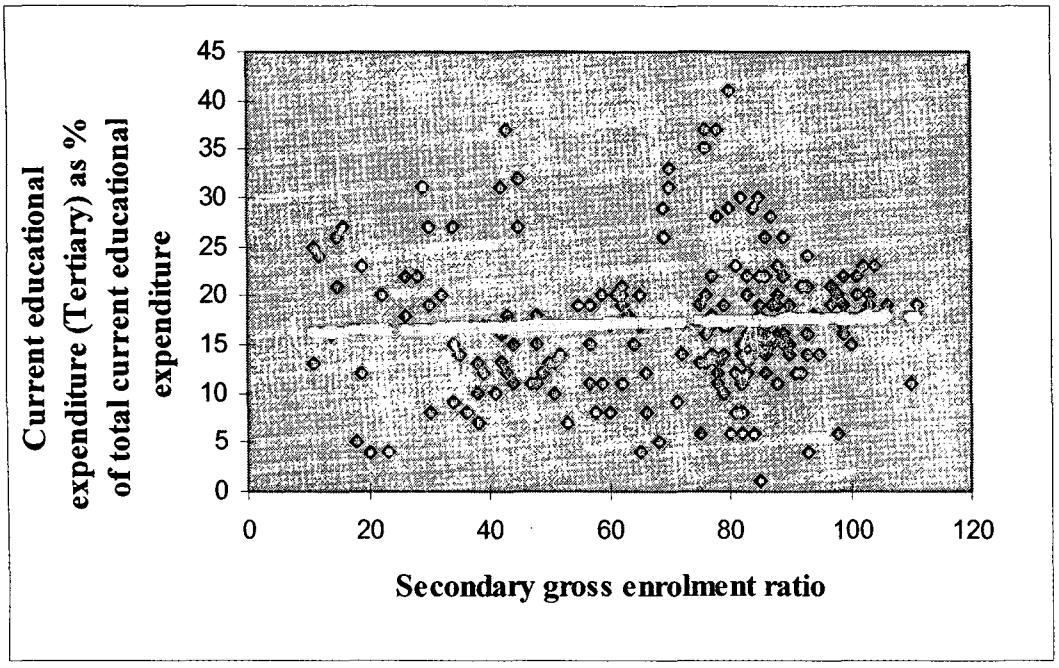


Table 20: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Secondary Gross Enrollment Ratio: Regression Result (Developing Countries)

Dependent Variable	*(1)*
Secondary gross enrollment ratio	0.0146932 (0.73)
Cons	16.12982 (10.96)***
Adjusted R^2	-0.0024
obs	199

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

In the scatter diagrams the black points again represent the actual values of the dependent variable against the values of the independent variable; the grey points represent the regressed values.

The relationship between the dependent variable, current educational expenditure as a percentage of total current educational expenditure (tertiary) and secondary gross enrollment shows a positive trend, implying again a positive relationship between the dependent variable and the explanatory variable. The scatter diagrams shows that the trend line for the developed country group is steeper than the trend line for the developing country group. The regression results show that while as an explanatory variable secondary gross enrollment ratio remains significant at 1% level for all-country group and at 5% level for developed country group, it is not a significant independent variable for the developing country group.

3.3.3. Relationship between Income Inequality and the Share of Public Educational Expenditure Allocated for higher education

In this study income inequality is represented by two variables; the Gini index and the income share of highest twenty percent in national income. While the Gini index gives the measure of overall income inequality of the society, the income share of the highest twenty percent gives a true measure of the economic power of the richest and hence, the economically most influential classes of the society.

Figure 8. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index (All Countries)

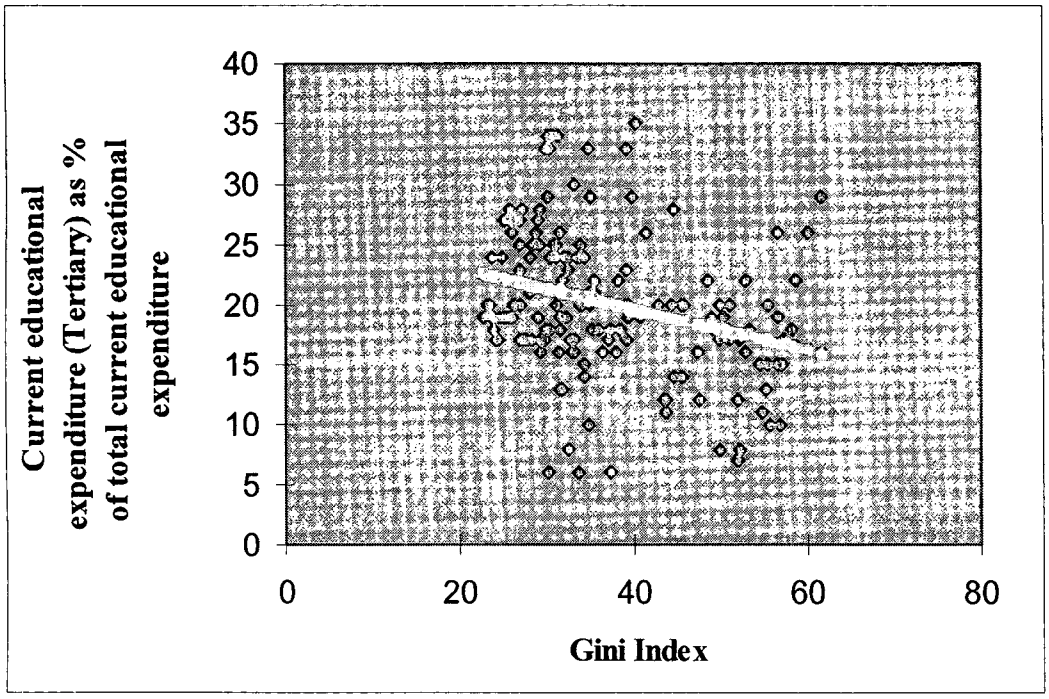


Table 21: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index: Regression Result (All Countries)

Dependent Variable	*(1)*
Gini index	-0.1711156 (-3.91)***
Cons	26.44953 (15.88)***
Adjusted R^2	0.0801
obs	165

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 9. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index (Developed Countries)

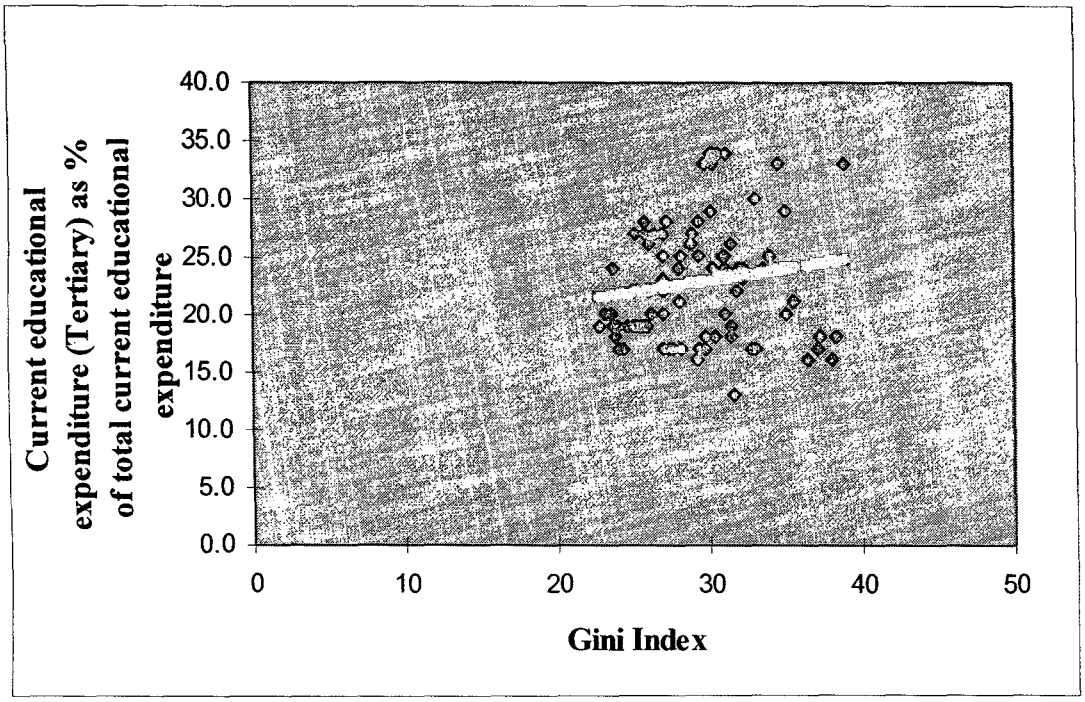


Table 22: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index: Regression Result (Developed Countries)

Dependent Variable	*(1)*
Gini index	0.0954822 (0.72)
Cons	19.83672 (5.23)***
Adjusted R^2	0.0067
obs	87

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 10. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index (Developing Countries)

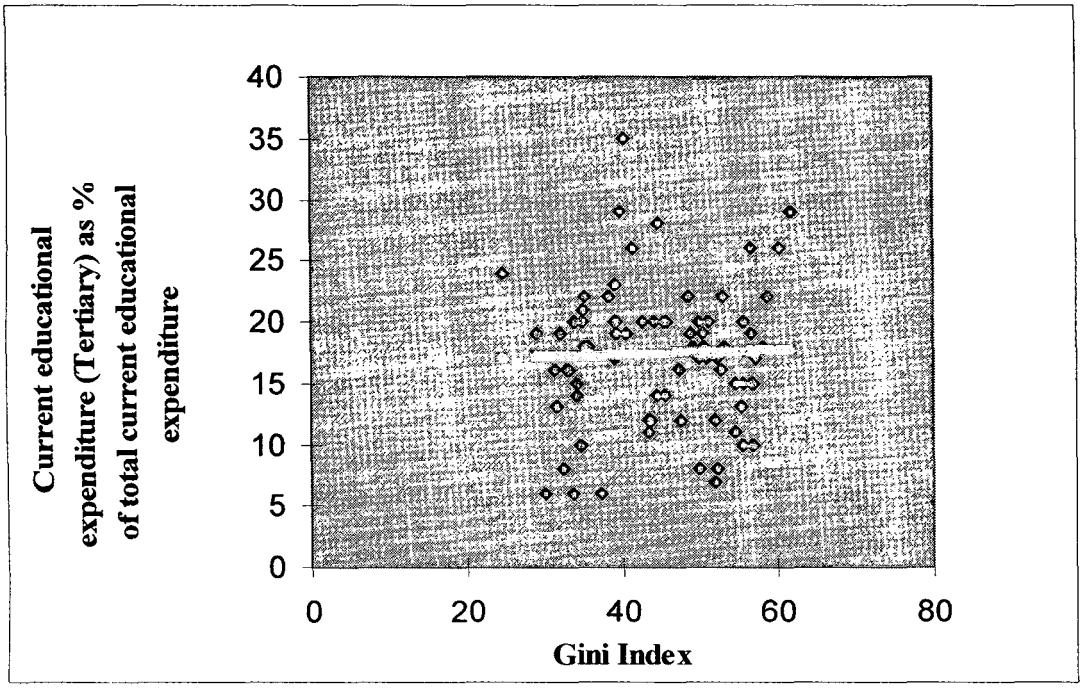


Table 23: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Gini Index: Regression Result (Developing Countries)

Dependent Variable	*(1)*
Gini index	0.0165902 (0.24)
Cons	16.61605 (5.16)***
Adjusted R^2	-0.0124
obs	78

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 11. Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20% (All Countries)

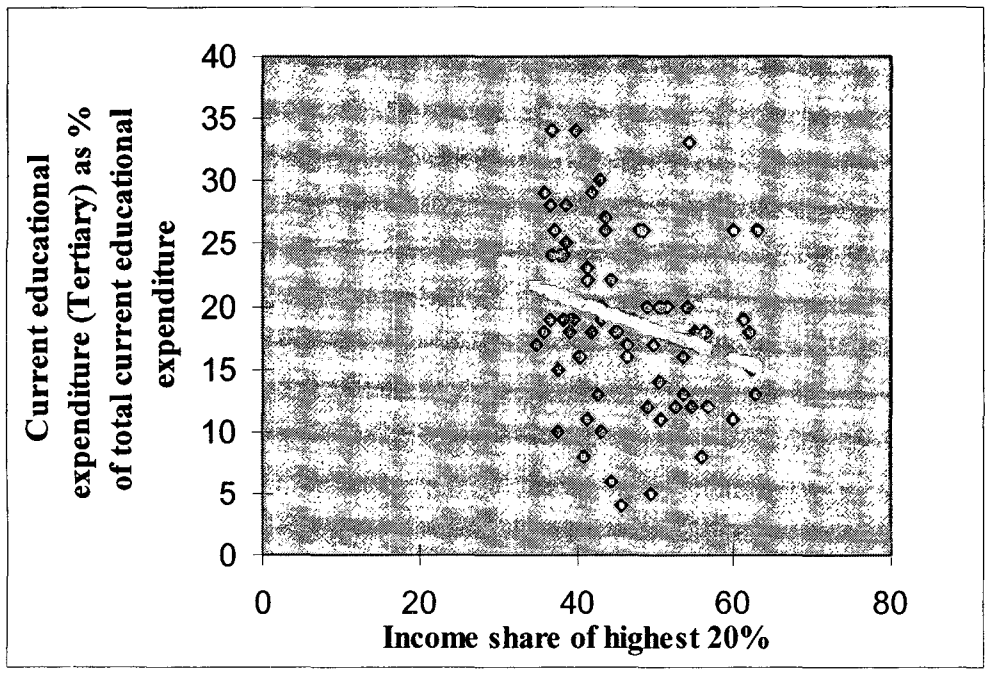


Table 24: Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20%: Regression Result (All Countries)

Dependent Variable	*(1)*
Income share of highest 20%	-0.2260003 (-2.34)**
Cons	29.37273 (6.47)***
Adjusted R^2	0.0570
obs	75

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 12. Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20% (Developed Countries)

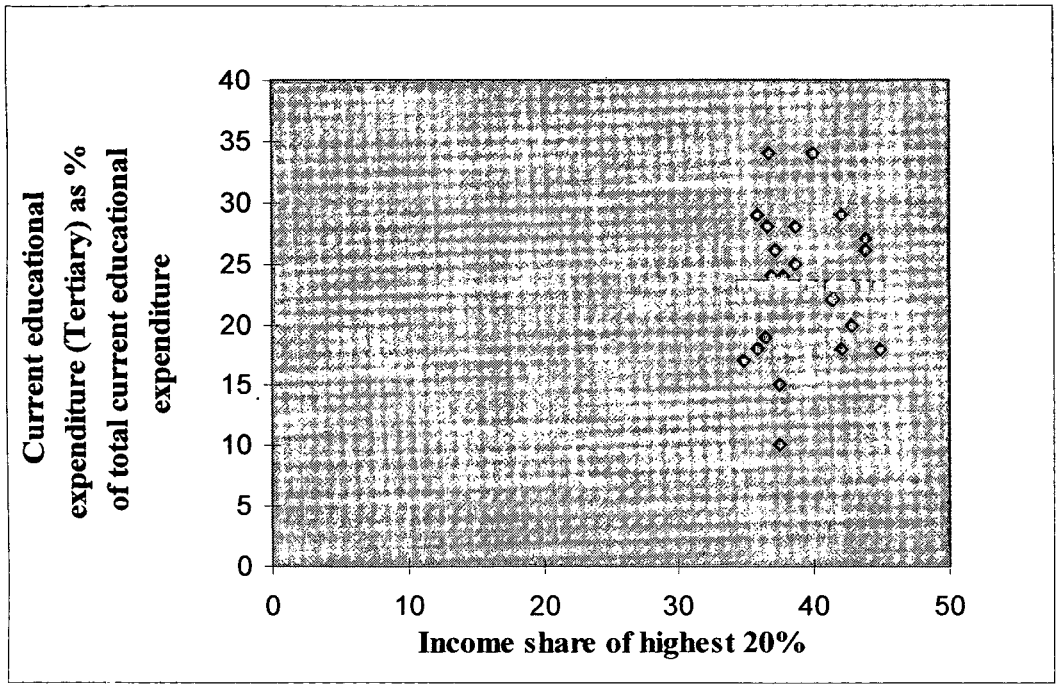


Table 25: Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20%: Regression Result (Developed Countries)

Dependent Variable	*(1)*
Income share of highest 20%	*-0.0618068 (-0.15)*
Cons	*25.67089 (1.54)*
Adjusted R^2	*-0.0489*
obs	*24*

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 13. Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20% (Developing Countries)

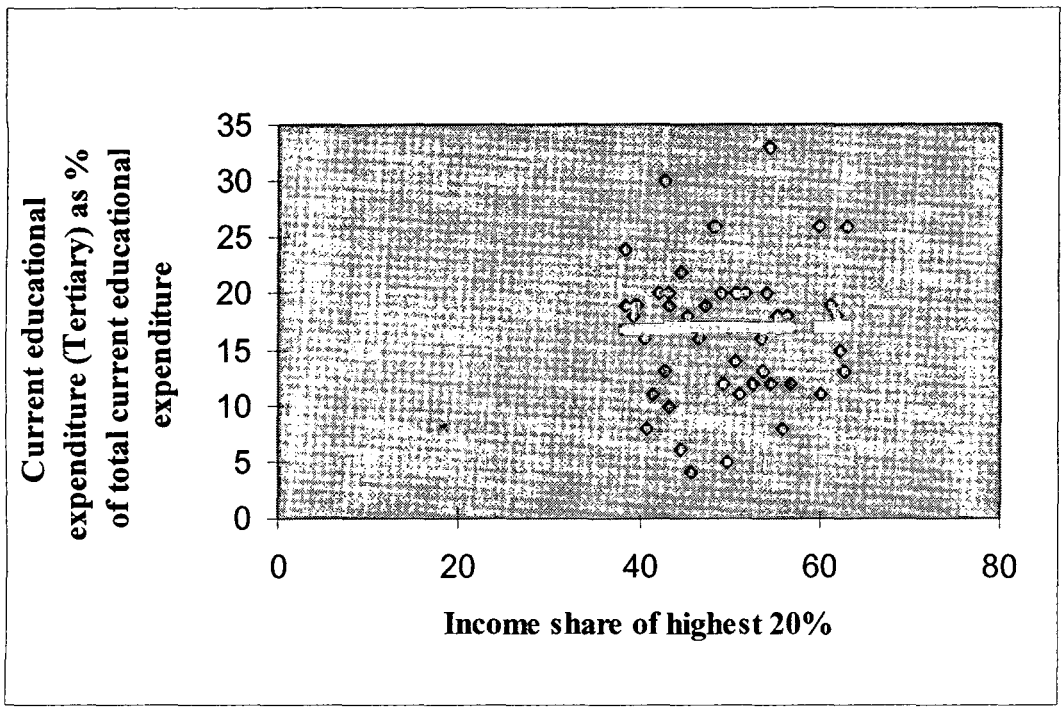


Table 26: Relationship between Current Educational Expenditure at the tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Income Share of Highest 20%: Regression Result (Developing Countries)

Dependent Variable	*(1)*
Income share of highest 20%	0.0097583 (0.08)
Cons	16.43716 (2.70)***
Adjusted R^2	-0.0203
obs	51

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Again in the scatter diagrams the actual values are represented by the black points and the estimated values, by grey points.

From the scatter diagrams it is seen, for each of the income inequality variables, there is negative relationship between the dependent variable and the independent variable at the all country level. However when the countries are divided into sub-groups, developed and developing countries, the picture changes to some extent. For Gini index, there is positive relationship between the dependent variable and the independent variable, in case of developed countries. But for developing countries the share of public educational expenditure allocated for higher education does not change much with the changes in the Gini index. On the other hand for income share of highest twenty percent, the trend lines fitted with the data for both developed and developing countries are nearly horizontal lines, that is, any specific positive or negative trend is absent.

From the regression analysis it is seen that for the all-country group the Gini index is significant at 1% level and the income share of highest twenty percent at 5% level. But for both the variables the regression results for the developed and the developing country groups show no significant relationship, confirming the observations from the scatter diagrams. This may be due to the fact that while between country groups income inequality factor changes the share of public educational expenditure on higher education, within country groups its effects are not significant. Almost all the developed countries continue to spend a greater amount on tertiary education irrespective of the differences in their income inequality levels. On the hand most of the developing countries continue to spend a lower amount on higher education, again irrespective of the differences in their income inequality levels.

3.3.4. Relationship between Proportion of Labour with Higher Education in the Total Labour Force and the Share of Public Educational Expenditure Allocated for higher education

The proportion of labour with higher education in the total labour force is represented by average years of schooling for population over age 25. Share of public educational expenditure allocated for higher education again is measured by current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure.

Figure 14. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling (All Countries)

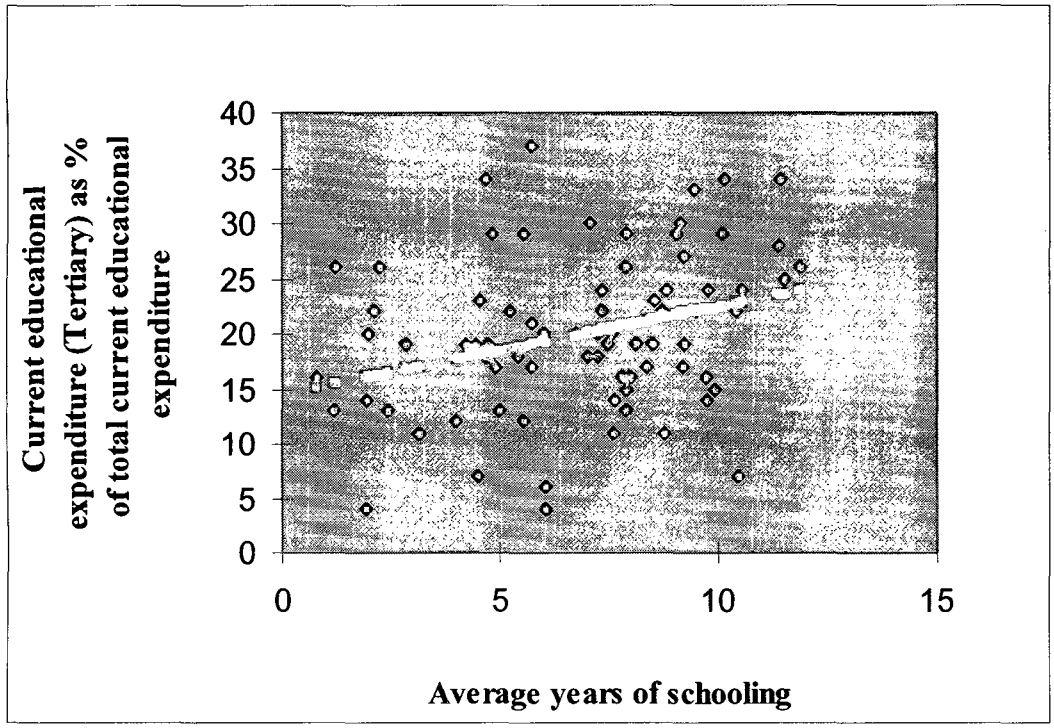


Table 27: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling: Regression Result (All Countries)

Dependent Variable	*(1)*
Average years of schooling	0.7868451 (2.80)***
Cons	14.56301 (7.10)***
Adjusted R^2	0.0817
obs	78

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 15. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling (Developed Countries)

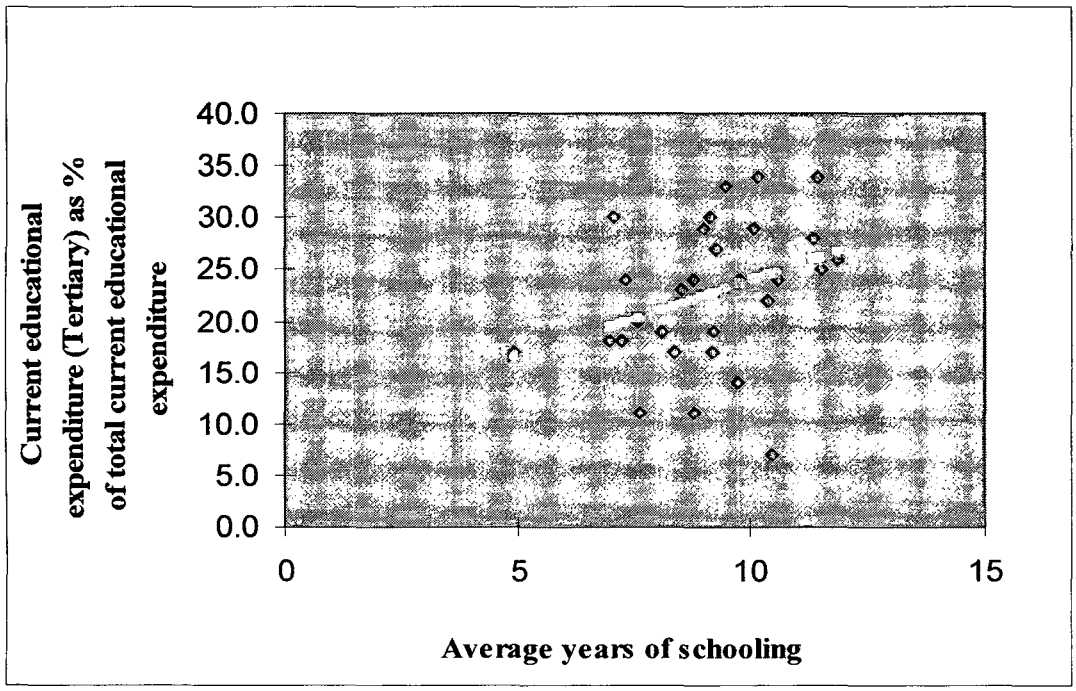


Table 28: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling: Regression Result (Developed Countries)

Dependent Variable	*(1)*
Average years of schooling	1.484165 (1.90)*
Cons	9.048207 (1.26)
Adjusted R^2	0.0827
obs	30

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 16. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling (Developing Countries)

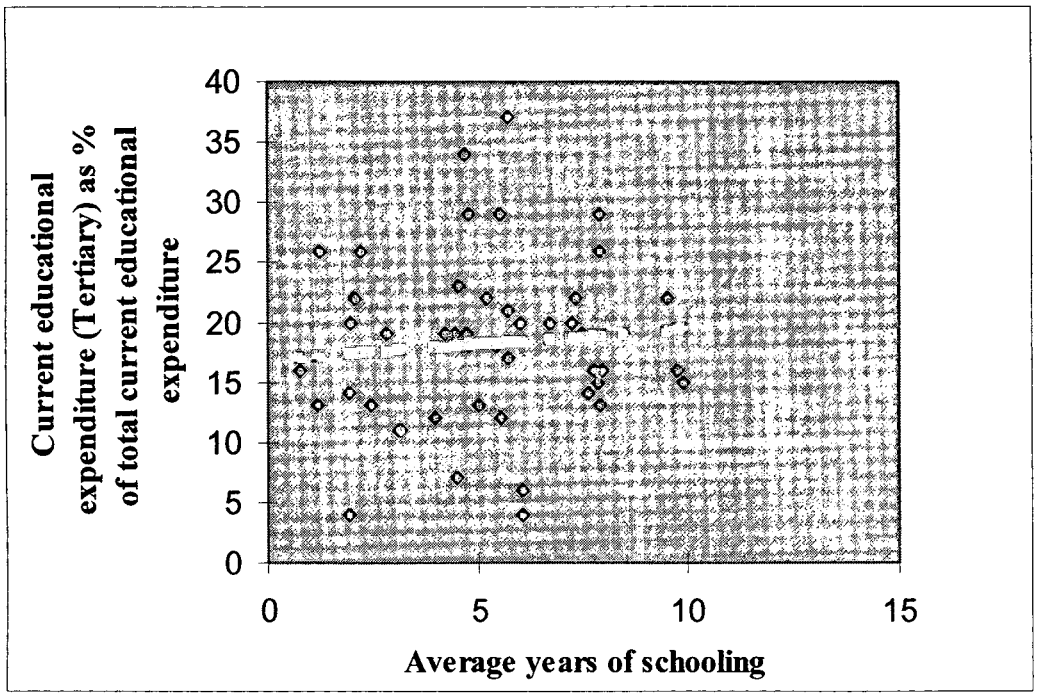


Table 29: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and Average Years of Schooling: Regression Result (Developing Countries)

Dependent Variable	*(1)*
Average years of schooling	0.2510808 (0.59)
Cons	16.88137 (6.81)***
Adjusted R^2	-0.0142
obs	48

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Again here in the scatter diagrams the black points show the actual values of the dependent variable against different values of the independent variable. The grey points depict the regressed values.

In the scatter diagrams the relationship between average years of schooling and the current educational expenditure at the tertiary level of education as a percentage share of total current educational expenditure show positive trends for all three country groups. A simple explanation of this trend is that a higher level of the average years of schooling is associated with a greater proportion of the population enrolled in tertiary education. As a result the proportion of educational expenditure spent on higher education will also be higher. The figures show this fact.

The regression results further show that while the independent variable is significant at 1% level for all-country group and at 10% for developed country group, it is not significant for the developing country group. So, it is seen there are significant changes in result between country groups.

The relationship between average years of schooling and the proportion of public educational expenditure spent at the tertiary level of education can be explained in a different way. As the proportion of skilled labour force in total labour force, represented by average years of schooling, increases, a country's economy gradually moves from producing basic goods to producing more sophisticated goods. As a result the demand for tertiary educated labour force increases, rather than showing a decreasing trend as can be inferred from Ramacharan's (2004) complementarity argument. The increase in the demand for a more highly educated labour force, on the other hand, explains the increase in the proportion of public educational expenditure spent at the tertiary level of education in a country.

3.3.5. Relationship between FDI Flows and the Share of Public Educational Expenditure Allocated for higher education

The impact of FDI flows on public resource allocation for higher education is measured in this study by the deviation of the potential FDI from the actual FDI.

Figure 17. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation (All Countries)

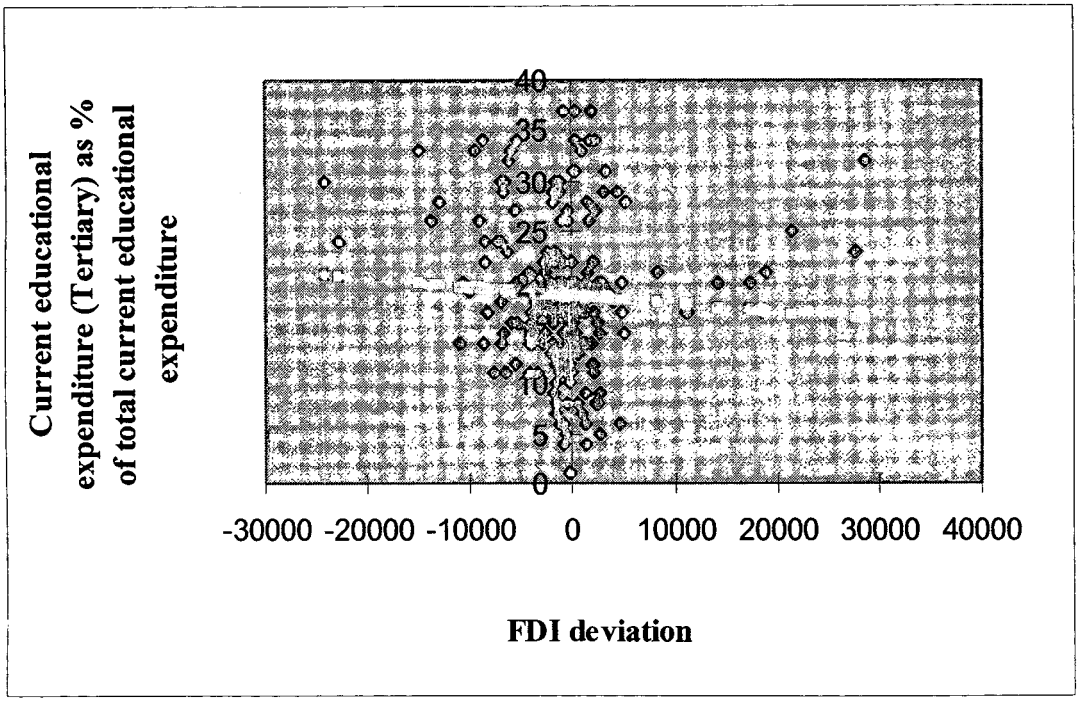


Table 30: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation: Regression Result (All Countries)

Dependent Variable	*(1)*
FDI deviation	-0.0000815 (-0.74)
Cons	18.66152 (23.22)***
Adjusted R^2	0.0046
Obs	205

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 18. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation (Developed Countries)

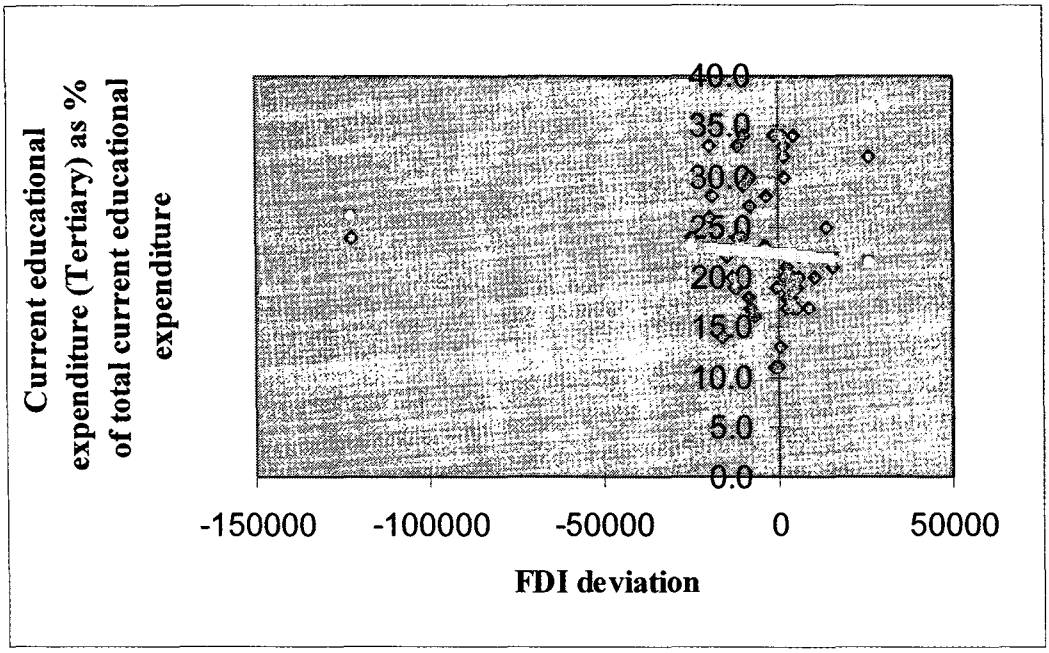


Table 31: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation: Regression Result (Developed Countries)

Dependent Variable	*(1)*
FDI deviation	-0.000863 (-0.75)
Cons	21.99949 (18.35)***
Adjusted R^2	0.0141
Obs	59

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Figure 19. Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation (Developing Countries)

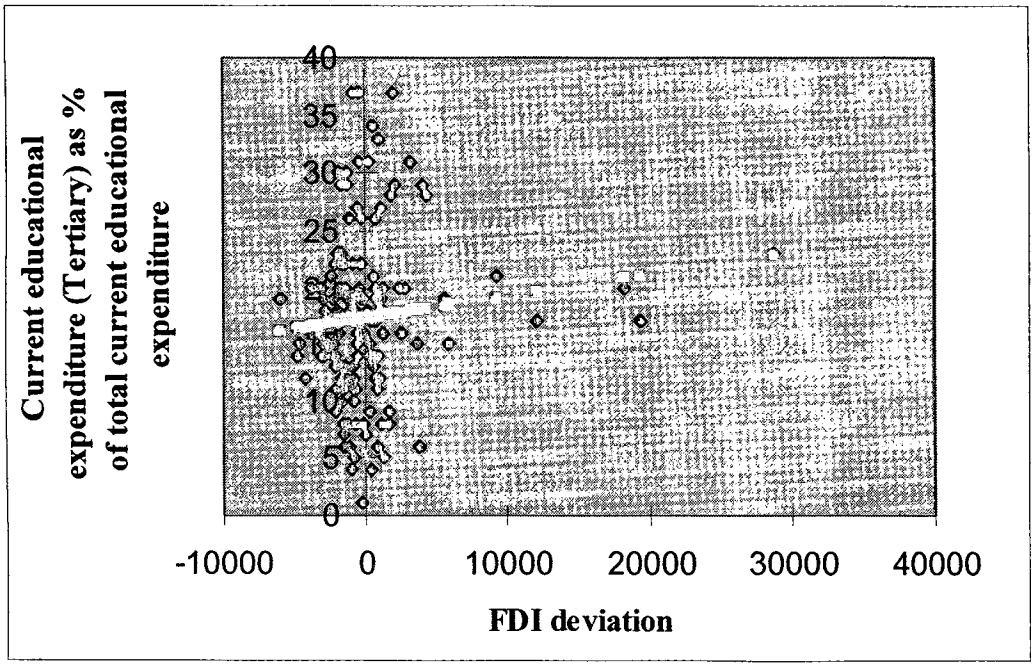


Table 32: Relationship between Current Educational Expenditure at the Tertiary Level of Education as a Percentage of Total Current Educational Expenditure and FDI Deviation: Regression Result (Developing Countries)

Dependent Variable	*(1)*
FDI deviation	0.0001592 (1.53)
Cons	17.28882 (18.31)***
Adjusted R^2	0.0084
Obs	146

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The black points in the scatter diagrams again show the actual values of the dependent variable against different values of the independent variable. The grey points depict the estimated values.

In the scatter diagrams the relationship between the dependent variable, that is current educational expenditure at the tertiary level of education as a percentage of total current educational expenditure and FDI deviation does not show any particular pattern. While there is a positive relationship for developing countries, the data on developed countries and all countries taken together show negative relationships. From the regression results, on the other hand, it is seen that FDI deviation is not significant for any country group.

According to the literature the stage of economic development, the spread of secondary education, the degree of income inequality and the proportion of labour with higher education in the total labour force may be the determinants of public resource allocation in higher education. It has also been conjectured that FDI inflows in a country may be another determinant. From the preliminary data analyses with the help of scatter diagrams and single variable regression equations, it is seen that log of per capita GDP which represents stage of development, secondary gross enrollment ratio which represents the spread of secondary education, and the variable, average years of schooling which represents proportion of labour with higher education in the total labour force, partially support the literature. The results for Gini index and income share of highest twenty percent, both representing the income inequality factor, show that these variables are not associated with the dependent variable exactly in the way the literature suggested. The results for FDI deviation, on the other hand, suggest that this variable is not associated with the dependent variable.

Chapter 4. Analysis of the Relative Importance of the Probable Determinants

In this chapter the relative importance of the determinants of the share of public educational expenditure allocated for higher education will be analysed with the help of factor wise regressions and regressions across factors.

4.1. Methodology

The method of regression by using least squares is used in this study. Data were collected for 195 countries over the time period 1999-2004. Due to the limited availability of data pooled regression instead of standard panel regression method was used in this study. As the available number of observations is very small for regression including all variables, single variable regressions and regressions using combinations of two or three variables have been estimated in this study. The statistical package STATA was used to run the regression models.

4.1.1. Variables Used in the Analysis

Dependent variable

The dependent variable of the regression models in this study representing public resource allocation in higher education is *current educational expenditure at tertiary level of education as a percentage share of total current educational expenditure*. It is denoted in the regression equations as ***y***.

Explanatory variables

1) Lagged dependent variable: Endogeneity problem may arise in the regression models of this study as some of the independent variables may be influenced by the dependent variable as well. For example, the level of FDI flow in a country may be determined by the spread and level of higher education and technological knowledge in a country. This on the other hand may be determined by the public resource allocation on higher education. To take account of this problem, one-period lagged value of the dependent variable is taken in the explanatory part. This lagged value is denoted by ***lagdep***.

2) GDP per capita: GDP per capita is used in this study to represent the stage of development of the economy of a country. As the dependent variable is a ratio, the logarithm of GDP per capita is used as the explanatory variable. In the regression equations this variable is denoted as ***pcgdp***.

3) Secondary gross enrolment ratio: One of the factors determining public resource allocation for higher education is the completion rate of secondary level education in a country. As data on this completion rate is unavailable, secondary gross enrolment ratio is taken to represent this factor. It is assumed that the drop-out ratio is negligible at the level of secondary education. This variable is denoted in the regression equations as ***sger***.

4) Gini index: Gini index is one of the variables used to represent the factor of income inequality in this study. The number of countries for which data is available for this variable is fairly small. So, whenever this variable is used in a regression model, the number of observations available in that model decreased significantly. Gini index is denoted in the regression equations of this study as ***gini***.

5) Income share of highest twenty percent: The income share of the highest twenty percent in a country is an alternative variable used to represent the extent of income inequality in a country. The variable income share of highest twenty percent is more appropriate than the Gini index as the income inequality variable in this study as it

estimates the economic power of the rich in a country which again determines the share of public resource allocated for higher education. It is assumed that if the income share of highest twenty percent increases, the income inequality in a country increases. However, the available data for this variable is so scanty, that the inclusion of this variable in the model reduces the number of available observations drastically. Hence, it is only used (along with the lagged dependent variable) for a single variable regression in this study. This variable is denoted as ***ysht.***

6) Average years of schooling: The average years of schooling in a country is taken to represent the proportion of the educated labour in the total labour force. In this study it is assumed that if the average years of schooling of a country increases, the proportion of educated labour will increase. However, due to unavailability of sufficient data for this variable, this variable is, like the income share of the highest twenty percent, used only (along with the lagged dependent variable) for a single variable regression model. The variable is denoted as ***ays.***

7) FDI deviation: The FDI deviation represents the difference between actual FDI and potential FDI, which is calculated without taking education level as an explanatory variable for FDI flow.

The regression model used in this study following Goldar and Ishigami (1999) to calculate potential FDI is:

$FDI_{it} = a_0 + a_1 GDP_{i(t-1)} + a_2 \Delta GDP_{it} + a_3 (I/GDP)_{i(t-1)} + a_4 XR_{it} + a_5 OP_{it}$

where

FDI_{it} = inflow of FDI to country i in year t;

$GDP_{i(t-1)}$ = the level of GDP of country i in year $t-1$;

ΔGDP_{it} = change in GDP of country i between year t and $t-1$;

$(I/GDP)_{i(t-1)}$ = the ratio of domestic investment to GDP in country i in year $t-1$;

XR_{it} = the exchange rate of country i in year t, defined as the ratio of the currency of country i to US dollar;

Op_{it} = degree of openness of country i in year t, measured as the ratio of exports plus imports to GDP.

The literature suggests that the variable FDI deviation should be positively related to the proportion of public expenditure on higher education in a country. In the regression model this variable is denoted as ***fdidev***.

4.1.2. Checks

Though OLS estimators are known as the best linear unbiased estimators, there are some potential problems for OLS method of estimation like heteroscedasticity, multicollinearity and autocorrelation, all of which can affect the accuracy of the regression results. To mitigate these problems necessary checks have been done. Brief discussions of these checks are stated here.

Heteroscedasticity

The OLS estimators give the minimum variance unbiased estimators, and hence, are known as best linear unbiased estimators (BLUE). Let a regression model be:

$$Y_i = \alpha + \beta X_i + u_i \qquad \text{, where } \alpha \text{ and } \beta \text{ are constants}$$

The assumptions made here is that:

$$Cov(u_i, u_j) = \sigma^2 \qquad \text{, when } i=j$$

$$= 0 \qquad \text{, when } i \neq j$$

Here u_i and u_j are the error terms for i^{th} and j^{th} observations and σ is some arbitrary constant. The implication here is that the variance of the error term is constant in the model, that is the model is homoscedastic.

The problem of heteroscedasticity occurs in an OLS model when the variance of the error terms is not a constant, that is, if $E(u_i^2) = \sigma_i^2$. The presence of heteroscedasticity hampers the accuracy of OLS estimation as the OLS standard errors of the estimates are incorrect and the OLS estimator is not BLUE. Therefore, it needs to be checked.

The statistical package STATA which is used in this study, by default uses Breusch-Pagan / Cook-Weisberg test for heteroscedasticity. The test procedure is briefly stated here:

Let there be a *k*-variable linear regression model

$$Y_i = \beta_1 + \beta_2 X_{2i} + \ldots\ldots\ldots + \beta_k X_{ki} + u_i$$

Here u_i is the stochastic error term. It is assumed that the error variance σ_i^2 is some function of nonstochastic variables Z's, that is,

$$\sigma_i^2 = f(\alpha_1 + \alpha_2 Z_{2i} + \ldots\ldots\ldots + \alpha_m Z_{mi})$$

Here some or all of the X's can serve as Z's. For specificity, it is assumed that,

$$\sigma_i^2 = \alpha_1 + \alpha_2 Z_{2i} + \ldots\ldots\ldots + \alpha_m Z_{mi}$$

Or, σ_i^2 is a linear combination of Z's.

The Breusch-Pagan / Cook-Weisberg test forms the null-hypothesis that the variance of the error terms is a constant. Now if $\alpha_2 = \alpha_3 = \ldots\ldots\ldots = \alpha_m = 0$, then $\sigma_i^2 = \alpha_1$, which is a constant. Therefore, to test the homoscedasticity, what is needed to test is whether the hypothesis $\alpha_2 = \alpha_3 = \ldots\ldots\ldots = \alpha_m = 0$ is true. This is the basic idea of the Breusch-Pagan / Cook-Weisberg test.

The actual test procedure is to estimate the regression by OLS and to obtain the residuals $\hat{u}_1, \hat{u}_2, \ldots\ldots, \hat{u}_n$. Then the maximum likelihood estimator of σ^2, $\tilde{\sigma}^2 = \sum u_i^2 / n$ should be obtained. The variables p_i need to be constructed then. The variables p_i are defined as $p_i = u_i^2 / \tilde{\sigma}^2$ which is simply each residual squared divided by $\tilde{\sigma}^2$. Now when p_i are regressed on Z's, the ESS (explained sum of squares) are obtained and the model defines $\Theta = 1/2$.(ESS). Assuming u_i are normally distributed, it can be showed that if there is homoscedasticity, and if the sample size n increases indefinitely, then Θ follows χ^2 distribution with $(m-1)$ degrees of freedom. Therefore, if the computed Θ exceeds the

critical χ^2 value at the chosen level of significance, then the hypothesis of homoscedasticity can be rejected.

To reduce the severity of the problem of heteroscedasticity which causes incorrect OLS standard errors, White's heteroscedasticity corrected standard error or robust standard error is used to estimate the regressions, whenever the presence of heteroscedasticity is detected in this study. For a two variable linear regression model:

$$Y_i = \beta_1 + \beta_2 X_i + u_i ; \qquad \text{var}(u_i) = \sigma_i^2$$

White suggests using u_i, the squared residual for each i in place of σ_i^2 to estimate the regression coefficient β_2 and shows that this estimation is consistent. This is the basic idea behind robust standard error.

Multicollinearity

Another problem which can be faced in the regression results of an OLS method, is the problem of multicollinearity. Multicollinearity implies the linear relationship among some or all explanatory variables in a regression model. If multicollinearity is high then OLS estimators develop large variances and covariances. Again because of it the confidence intervals tend to be much wider, leading to the acceptance of zero null hypothesis. High variances also cause the t ratio of one or more coefficients to be statistically insignificant. The presence of multicollinearity also makes the OLS estimators and their standard errors very sensitive to small changes in data.

In STATA the multicollinearity test is done by means of the variance-inflation factor (VIF). For example, let there be a three variable regression model,

$$y_i = \beta_2 x_{2i} + \beta_3 x_{3i} + u_i$$

The coefficient of correlation between X_2 and X_3 is r_{23} $(=\Sigma x_{2i} x_{3i} / \sqrt{\Sigma x_{2i}^2 \Sigma x_{3i}^2})$. When $r_{23}^2 = 1$, perfect collinearity exists between X_2 and X_3.

The variance-inflation factor (VIF) is defined as VIF = $1/(1- r_{23}^2)$. If collinearity increases in the regression model VIF also increases. If r_{23}^2 approaches *1* or to exact multicollinearity, VIF approaches infinity. On the other hand in the absence of multicollinearity, VIF is *1*.

Suppose b_2 and b_3 are the best linear unbiased estimators of β_2 and β_3. Now as var$(b_2) = \sigma^2/\Sigma x_2^2\ (1- r_{23}^2)$, it can be written as var$(b_2) = (\sigma^2/\Sigma x_2^2)$VIF. Similarly var$(b_3) = (\sigma^2/\Sigma x_3^2)$VIF. It shows that the variances are directly proportional to the VIF.

To generalize the result a *k*-variable linear regression model is taken:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \ldots\ldots + \beta_k X_{ki} + u_i,$$

Here the variance of the k^{th} coefficient can be written as:

$$\text{var}(b_j) = \sigma^2/\Sigma x_j^2\ (1- R_j^2) = (\sigma^2/\Sigma x_j^2).\text{VIF}$$

The inverse of VIF is called tolerance (TOL) and is defined as:

$$\text{TOL}_j = 1/\text{VIF}_j = (1- R_j^2)$$

Where, $R_j^2 = R^2$ or the coefficient of determination in the regression of X_j on the remaining *(k-2)* regressions.

Though a high VIF implies multicollinearity, there is no theoretical way to determine the threshold value, which can clearly point out the presence of multicollinearity. Generally *4* is taken as the threshold value of VIF. Taking this value, multicollinearity was not detected in any regression model of this study.

Autocorrelation

The third kind of check which has been done in this study is the test for autocorrelation. Autocorrelation is defined as correlation between members of series of observations ordered in time. According to the assumption of classical linear regression model, autocorrelation does not exist in the disturbances u_i, that is $E(u_i, u_j) = 0$ for $i \neq j$. So, if autocorrelation exists, the usual properties of classical model no longer hold. Serial

correlation in linear panel-data models biases the standard errors of the coefficients leading to larger *t*-statistics and incorrect decisions in hypothesis testing. So, serial correlation in the errors terms in a panel-data model needs to be identified.

In STATA the test for autocorrelation is performed using the Wooldridge test for autocorrelation in panel data. This test is designed to detect first order autocorrelation or AR*(1)* which can be expressed as:

$$u_t = \rho\, u_{t-1} + \varepsilon_t \qquad -1 < \rho < 1;\ \varepsilon_t \text{ is white noise.}$$

A brief outline of the test is given here.

Let there be a linear regression model:

$$y_{it} = \alpha + X_{it}\beta_1 + Z_i\beta_2 + u_{it} \qquad i \in \{1,2,.....N\},\ t \in \{1,2,.....T_i\}$$

Here y_{it} is the dependent variable; X_{it} is a $(1 \times K_1)$ vector of time-variant covariates; Z_i is a $(1 \times K_2)$ vector of time-invariant covariates; α, β_1, and β_2 are $1 + K_1 + K_1$ parameters; and u_{it} is the idiosyncratic error.

The model makes a null hypothesis that $E[u_{it}\, u_{is}] = 0$ for all $s \neq t$; that is, there is no serial correlation in the error terms, which could cause the standard errors to be biased.

The method uses the residuals from a regression in first difference. Taking the first differences in the given linear regression model removes the term based on the time-invariant covariates and the constant.

$$y_{it} - y_{it} = (X_{it} - X_{it-1})\beta_1 + u_{it} - u_{it-1}$$

$$\Delta y_{it} = \Delta X_{it}\beta_1 + \Delta u_{it}$$

Here Δ is the first-difference operator.

Wooldridge's test estimates the parameters β_1 by regressing Δy_{it} on ΔX_{it} and obtains the residuals $\hat{e}_{it}$. The basis of the Wooldridge's test is the observation that, if the u_{it} are not serially correlated, then $\text{Corr}(\Delta u_{it}, \Delta u_{i(t-1)}) = -0.5$. Given this observation, the method is to regress the residuals $\hat{e}_{it}$ from the regression with first-differenced variables on their lags and to test whether the coefficient on the lagged residuals is equal to -0.5.

To reduce the problem of autocorrelation, we used robust cluster estimator whenever the presence of autocorrelation is detected in the model.

4.2. Regression Analysis

The regression model of this study is:

$y_{it} = \beta_1 + \beta_2 pcgdp_{it} + \beta_3 sger_{it} + \beta_4 gini_{it} + \beta_5 ays_{it} + \beta_6 fdidev_{it} + \beta_7 y_{i(t-1)} + u_{it.}$

Or,

$y_{it} = \beta_1 + \beta_2 pcgdp_{it} + \beta_3 sger_{it} + \beta_4 ysht_t + \beta_5 ays_{it} + \beta_6 fdidev_{it} + \beta_7 y_{i(t-1)} + u_{it.}$

Here the subscript t denotes the time variable of the study.

$\beta_1, \beta_2, \ldots\ldots\ldots, \beta_8$ are the regression coefficients.

$u_{t.}$ is the error term at time t.

The original regression models included data for *195* countries over the period *1999* to *2004*. However, because of the scarcity of data the available numbers of observations for some variables are much less. Therefore, instead of a single regression including all variables, a number of regressions have been estimated using a single explanatory variable or combinations of two or three explanatory variables, so that the number of observations for any regression is never unacceptably small. In each of the regression equations the lagged dependent variable is included in the explanatory part.

Because of the very limited amount of data, available for the variables- income share of highest twenty percent and average years of schooling, these variables could only be used in single variable regressions along with the lagged dependent variable.

4.2.1. Factor Wise Linear Regression

In the factor wise regression models in this study regressions of the dependent variable, current educational expenditure at tertiary level of education as a percentage of

total current educational expenditure, are run on the independent variables per capita GDP, secondary gross enrollment, Gini index, income share of highest twenty percent, average years of schooling and FDI deviation, including the lagged dependent variable in the models.

1) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure *(y)* on log of GDP per capita *(pcgdp)*

Table 33: Linear Regression Result of *y* on *pcgdp*

Dependent Variable *y*	*(2)*
pcgdp	0.8539334 (4.18)***
lagdep	0.8669597 (24.13)***
Cons	-5.258875 (-3.37)***
Adjusted R^2	0.8541
obs	207

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The estimated regression equation shows that between the dependent variable and the log of per capita GDP, there is an expected positive relationship which is statistically significant at one percent level. The lagged dependent variable also has a positive coefficient and is statistically significant at one percent level.

2) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure *(y)* on secondary gross enrollment ratio *(sger)*

Table 34: Linear Regression Result of *y* on *sger*

Dependent Variable *y*	*(2)*
sger	0.019919 (2.39)**
lagdep	0.8808282 (24.27)***
Cons	0.5501957 (1.02)
Adjusted R^2	0.8516
obs	220

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The estimated regression equation shows that there is an expected positive relationship between the dependent variable and secondary gross enrollment ratio. The lagged dependent variable again has a positive coefficient and is statistically significant at one percent level. However, it was mentioned before that when the lagged dependent variable is not included in the model, the secondary gross enrollment ratio is significant at one percent level. But when the lagged dependent variable is included in the model, the variable, secondary gross enrollment ratio is no longer significant at one percent level, but even then it remains significant at five percent level.

3) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (*y*) on Gini index (*gini*)

Table 35: Linear Regression Result of *y* on *gini*

Dependent Variable *y*	*(2)*
gini	0.8312595 (10.67)***
lagdep	-0.0825973 (-2.35)**
Cons	6.322917 (2.47)**
Adjusted R^2	0.8012
obs	106

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The estimated regression equation shows high level of significance for Gini index. The sign of the regression coefficient is positive implying a positive relationship of this variable with the dependent variable. This is the opposite of what we have observed in scatter diagram and single variable regression without the lagged dependent variable. The lagged value of the dependent variable on the other hand quite interestingly, shows a negative relationship with the dependent variable.

4) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (*y*) on income share of highest twenty percent (*ysht*)

Table 36: Linear Regression Result of *y* on *ysht*

Dependent Variable *y*	*(2)*
ysht	-0.1285855 (-1.84)
lagdep	0.8229788 (6.94)***
Cons	9.412383 (1.90)
Adjusted R^2	0.7790
obs	53

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Though in the single variable regression model including the lagged dependent variable income share of the highest twenty percent shows a negative relationship with the dependent variable exactly like in the scatter diagram, it is not a significant independent variable in the model. The lagged dependent variable on the other hand has a positive coefficient and is statistically significant at one percent level.

5) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (*y*) on average years of schooling (*ays*)

Table 37: Linear Regression Result of *y* on *ays*

Dependent Variable *y*	*(2)*
ays	0.2218058 (1.50)
lagdep	0.8786001 (13.56)***
Cons	0.685216 (0.78)
Adjusted R^2	0.8637
obs	58

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The estimated regression equation shows that this variable has a positive relationship with the dependent variable as was expected. But the test statistic shows that this variable is not significant in the model as an explanatory variable. The lagged dependent variable again has a positive relationship with the dependent variable and significant at one percent level in the estimated regression equation.

6) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (*y*) on FDI deviation (*fdidev*)

Table 38: Linear Regression Result of *y* on *fdidev*

Dependent Variable y	*(2)*
fdidev	0.0000061 (0.25)
lagdep	0.8916971 (20.29)***
Cons	1.733716 (2.28)**
Adjusted R^2	0.8247
obs	144

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Table 19 shows though FDI deviation has positive coefficient in the regression equation as was expected, it does not show significant relationship with the dependent variable.

The level of government's desire to attract FDI may also depend on the national income of a country. A country with very low per capita GDP may not be able to attract a substantial amount of FDI. On the other hand a country with higher per capita GDP may have greater chance to attract FDI. So, to take the income level of a country into account, another regression was run taking the ratio of FDI deviation to GDP, rather than only the FDI deviation. But even then the variable does not become significant in the model.

4.2.2. Regressions across Factors

Regressions across factors were performed by taking all possible combinations of two independent variables and all possible combinations of three independent variables. In all the regression equations the lagged dependent variable is included.

1) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (y) on combinations of two independent variables

Table 39: Regression across Factors: Taking Two Independent Variables at a Time

Dependent Variable y	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
lagdep	0.8564884 (22.73)***	0.8569757 (18.68)***	0.7456939 (5.46)***	0.7452367 (7.13)***	0.8663556 (18.66)***	0.763054 (16.27)***
pcgdp	0.8274287 (2.26)**	0.8363933 (3.39)***	.	1.292918 (2.23)**	.	.
sger	0.0042464 (0.28)	.	.	.	0.0243452 (2.48)**	0.0452231 (2.89)***
gini	.	.	-.0693594 (-1.90)*	-0.0440737 (-1.62)**	.	-.0459901 (-1.61)
fdidev	.	0.0000199 (1.00)	.00000625 (0.23)	.	.00000777 (0.36)	.
Cons	-5.237235 (-2.15)**	-5.067258 (-2.66)***	7.032315 (2.11)**	-5.537727 (-1.29)	0.1854443 (0.34)	1.937803 (0.94)
Adjusted R^2	0.8463	0.8332	0.7307	0.7988	0.8218	0.8032
obs	201	144	73	103	142	105

Note: The values in the parentheses give the t value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

The multivariate regression equations which were formed taking any two independent variables at a time with the lagged dependent variable show a high level of significance for the lagged dependent variable in all the equations. In all the six possible equations the lagged dependent variable is significant in the equations at one percent level. The relationship between the lagged dependent variable and the dependent variable is always positive as was expected.

Apart from the lagged dependent variable real GDP per capita remained singularly the most influential independent variable in this study. In all the equations containing real GDP per capita as an independent variable, the coefficients of real GDP per capita remain positive implying a positive relationship with the dependent variable as was expected. The level of significance for the variable always remains high. Real GDP per capita remains significant at five percent level when it is taken with secondary gross enrollment ratio, at one percent level when it is taken with FDI deviation and at five percent level when it is taken with the Gini index.

The coefficients of secondary gross enrollment ratio show that this variable is always positively related with the dependent variable as was inferred from the literature. Secondary gross enrollment ratio remains significant at five percent level when it is taken with FDI deviation and at one percent level when it is taken with the Gini index. However, the variable is not significant in the model when it is taken with per capita GDP. This implies that the influence of the variable is probably not independent of the influence of per capita GDP.

The Gini index is significant only when it is taken with FDI deviation. But if real GDP per capita or secondary gross enrollment ratio remains present in the equations, then it no longer remains significant. The coefficients of Gini index in the equations show that this variable has a negative relationship with the dependent variable, contrary to the literature.

Thus it is seen that all the independent variables are significant in some of the regression equations. FDI deviation is the only exception as it is not significant in any of the estimated regressions. Though the variable is always positively related with the dependent variable as was expected, the results of the single variable regression equation and two variable regressions including the FDI deviation imply that this variable fails as an explanatory variable for the dependent variable. Using the ratio of FDI deviation to GDP, instead of using the FDI deviation only, does not give any significantly different result.

2) Regression of current educational expenditure at tertiary level of education as a percentage of total current educational expenditure (y) on combinations of three independent variables

Table 40: Regression across Factors: Taking Three Independent Variables at a Time

Dependent Variable y	*(1)*	*(2)*	*(3)*	*(4)*
lagdep	0.7062623 (6.22)***	0.8541004 (18.88)***	0.6913168 (4.45)***	0.6575337 (4.32)***
pcgdp	0.6845274 (0.98)	0.7078693 (1.43)	1.114347 (1.70)*	.
sger	0.0387591 (1.00)	0.0063858 (0.33)	.	0.0468378 (1.32)
gini	-0.0342814 (-1.33)	.	-0.0427798 (-1.55)	-0.0408953 (-1.27)
fdidev	.	.0000172 (0.81)	-0.00000239 (-0.09)	-0.0000333 (-0.87)
cons	-3.18759 (-0.63)	-4.420502 (-1.34)	-3.126612 (-0.76)	3.273378 (1.38)
Adjusted R^2	0.7986	0.8233	0.7479	0.7311
obs	102	142	74	73

Note: The values in the parentheses give the *t* value. Results have been checked for heteroscedasticity, multicollinearity and autocorrelation. ***, ** and * imply significance at 1%, 5% and 10% levels respectively.

Source: Own calculation

Like regression equations consisting of two independent variables and the lagged dependent variable, regression of the dependent variable on combinations of three independent variables and the lagged dependent variable, show that the lagged dependent variable is the most influential independent variable. As can be seen from Table 40, the lagged dependent variable always shows a high level of significance.

But unlike the regression on two independent variables, the regression on three independent variables does not show real GDP per capita as an important explanatory variable. From Table 40 it is seen that when the variable real GDP per capita is used with Gini index and FDI deviation, it is significant at ten percent level. But whenever it is used in any combination with secondary gross enrollment ratio, it loses its significance in the model. One of the reasons behind it may be the drastic fall in the number of observations in the three variable case. While the number of observations used in the two-explanatory variable regression including real GDP per capita and secondary gross enrollment ratio is 201, for the three explanatory variable regressions including real GDP per capita and secondary gross enrollment ratio the number of observations falls to 102 (with Gini index) and 142 (with FDI deviation).

However, except real GDP per capita none of the other independent variable is significant at the three variable regression equations.

The coefficients of real GDP per capita and secondary gross enrollment ratio again show that these variables are positively related with the dependent variable. Similarly again the coefficients of Gini index show that this variable is negatively related with the dependent variable. The coefficients of FDI deviation do not show any definite relationship of this variable with the independent variable.

Chapter 5. Conclusion

From the history of developed countries, it can be seen that education, especially higher education, played a very crucial role in the process of economic development. But the importance placed upon higher education changes across countries causing variations in the share of public educational expenditure allotted to higher education. The objective of this cross country analysis was to find out the factors affecting the proportion of public spending on education allocated for higher education.

Literature existing on the subject suggests that several factors may affect public education policies. The stage of economic development (Galor and Moav, 2002) is one of them. It is argued that for a country at a higher stage of economic development, the rate of return to human capital compared to the rate of return to physical capital increases sufficiently, stimulating higher level of government spending on human capital formation through further development and expansion of the higher education system.

According to the existing literature the total number of students completing secondary education is another determining factor of public spending in higher education, because, in the hierarchical education system (Horowitz, Driskill and Mendez, 2007), only those who successfully complete the secondary level of education can proceed to a higher level.

Income inequality is another factor which, as the literature suggests, can influence public expenditure on different levels of education. As education is a publicly provided private good, there exists an inverse relationship between the quality of schooling measured as expenditure per pupil and the enrollment at a given stage, under a fixed budget allocation policy. In this situation, the more powerful are the rich, which is determined by the level of income inequality of the economy, the more will they influence public budget allocation among different levels of education according to their own benefit levels (Su, 2006).

The literature also suggests that the proportion of labour with a higher education in the total labour force can be another determining factor. If the proportion increases, the cost of higher education will decrease as the opportunity cost of human resources required to provide higher education will decrease (Birdsall, 1996). This may again lead to the expansion of the higher education system and further increase in the educated labour force. This increase is very essential, especially in the developing countries where the proportion of educated labour force in the total labour force is very low. As complementarities exist in the production process among different levels of education and skill (Ramacharan, 2004), the number of skilled labourers needs to be increased with the increase in the unskilled labour force. So, relatively higher public budget allocation in higher education in one period can reduce the cost in the future period. This on the other hand may be an incentive for public budget allocation to higher education in the present period.

Beside all these factors the need to attract FDI inflow may be another factor affecting public budget allocation for different levels of education. According to the existing literature high education level which results in the creation of higher skills and the use of more sophisticated technology, have the potential to attract greater amount of FDI. This on the other hand may influence the government to spend more on higher education.

To see the relative influence of these factors on public budget allocation for higher or tertiary level of education, relevant variables were chosen for each of the factors. The stage of economic development was measured by the log of real GDP per capita; the secondary completion rate was measured by secondary gross enrollment ratio. The factor of income inequality was measured by two variables, Gini index and the income share of the highest twenty percent of the population. Data was collected on average years of schooling to represent proportion of labour with a higher education in the total labour force. The effects of the desire to attract FDI inflow is represented by the deviation of estimated potential FDI inflow of a country from its actual inflow.

Due to the scarcity of data for average years of schooling and income share of highest twenty percent, these variables were used in regressions in which the variables together with the lagged dependent variable are taken as the only regressors. For the Gini index the availability of data is comparatively better than that for the two above mentioned variables and the variable is therefore used in multivariate regressions in this study.

Regression results for all variables suggest that real GDP per capita, which has an expected positive relationship with the dependent variable, is the most influential variable among all the variables in this study. Factor wise regression and the regressions across factors while taking two explanatory variables at a time, show that the level of significance is very high for real GDP per capita. Single variable regression model also show that the variables, secondary gross enrollment ratio and Gini index are significant as the explanatory variables. But again when secondary gross enrollment ratio is used as a regressor along with the per capita GDP, it does not show any level of significance. This suggests that this variable may not have an independent influence on the allocation of public resources on higher education. However, while secondary gross enrollment ratio is positively related with the dependent variable like real GDP per capita, Gini coefficient has a negative relationship with the dependent variable as is clear from the estimation results of two variable and three variable regressions. The regression results for the variable FDI deviation imply that this variable is not significant in explaining public budget allocation in tertiary education. Even when the ratio of FDI deviation to GDP is taken, the variable does not become significant in the model.

Taking the literature and the regression analysis together it can be said that the stage of economic development appears to be a significant determining factor for public budget allocation in higher education. The regression results at the two variable level show that there may exist a positive relationship between real GDP per capita and the dependent variable implying that if real GDP per capita increases, public expenditure in higher education also increases. This is exactly what has been argued in the literature.

Data analysis also supports the literature stating secondary completion rate as one of the determinants of public budget allocation in higher education. Scatter diagrams and the results of single variable regression analysis show that this factor is significant as a determinant of the dependent variable and as the theory says, the variable representing this factor has a positive relationship with the dependent variable. However, the results of the two-variable regression equations suggest the influence of this variable on the dependent variable may not be independent of the influence of real per capita GDP.

The data analysis regarding income inequality factor does not support the literature like in the case of the previous two determinants. Due to the unavailability of data only factor wise regression has been performed for income share of highest twenty percent. The variable does not show any level of significance. On the other hand, for Gini index both the factor wise regression and regressions across factors show some levels of significance. Beside that, the literature suggests that if income inequality increases the share of public expenditure on education allocated for higher education should increase, that is, there should be a positive relationship between the income inequality factor and the dependent variable. But the outcome of scatter diagrams and the regression results do not show any such clearly defined positive relationship. On the other hand, the estimated regression equations for two variable and three variable cases always show a negative relationship between the dependent variable and the Gini index.

Due to the scarcity of data only factor wise regression was possible for average years of schooling. Single variable regressions along with the scatter diagrams show that while this variable is significant when it is not used with the lagged dependent variable, the variable loses its significance when it is taken along with the lagged dependent variable in a regression equation.

Another potential determinant of public resource allocation in higher education, according to the literature is the prospect of attracting FDI to a country. But the data analysis shows that this factor fails miserably as an explanatory variable. For the variable

FDI deviation, which is used to represent the potential of increasing net FDI inflow to a country, neither in the factor wise regressions nor in the regressions across factors is the variable significant. Even when the ratio of FDI deviation to GDP is taken rather than taking the FDI deviation only, the variable fails to become significant in the model. So, though the literature infers that the desire to attract FDI flow can affect public education policy, data analysis suggests that it does not have any real basis.

Beside the factors which were considered in this study, there may be some other possible determinants of public resource allocation for higher education. The growth rate of job market for the skilled labour may be one of these determinants as it on one hand provides the incentive to the masses to pursue higher education and on the other hand motivates the government to increase the proportion of skilled labour force in the economy through the spread of higher education. International trade in educational service may be another variable; while in the developed countries it provides incentive to the governments to attract a greater number of students with the development of the higher education system, in the developing countries it forces the government to develop that system to stop the outflow of domestic resources due to the import of higher education. Besides these factors, there may exist other factors determining public resource allocation in higher education. Further studies could be done to find out those factors.

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