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MACROECONOMIC RETURNS TO EDUCATION IN SOUTH ASIA

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The paper examines the relationship between human capital accumulation and macroeconomic growth to highlight that human capital is endogenous to economic growth and statistically significant as a determinant of growth in South Asia. Previous research [Barro (1991), Mankiw, Romer and Weil (1992) etc] has largely focused on developed countries or a large sample which lumps countries at different stages of development. However, research to-date has been inconclusive despite various model specifications, instruments of human capital and econometric methods. A plausible reason for this could be cross-country heterogeneity. Therefore, empirical analysis demands a more disaggregated regional focus as has been attempted in this study. Basically following the Barro Lee (1994) macro approach and using the empirical version of the augmented neo classical production function the study finds that an improvement in human capital, as measured by average years of schooling of adult population, to the level of South East Asian economies would increase the average growth rate of 2.8% to almost 5.1% in the South Asian economies.

1. INTRODUCTION

The paper examines the relationship between human capital accumulation and macroeconomic growth to highlight that human capital is endogenous to economic growth and statistically significant as a determinant of growth in South Asia. We estimate a macroeconomic rate of return to education, based on modified versions of the widely used 'macro-Mincer' regressions. We also examine the role of female educational attainment in the overall productive performance of South Asian economies.

Several theorists highlighted the importance of human capital in determination of economic performance[i]. Most notably, Becker (1964) theorized that the opportunity cost of investment in learning skills affects the level of technology and which in turn determines the output

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level. Lucas (1988), Romer (1986, 1990) also developed new growth models which incorporate human capital. It is now established that education not only provides a signal of better skilled labor, but also provides the structural basis of 'human capital' that is considered to be a primary input in production.

Empirical research on the effect of human capital, often proxied by educational attainment, is divided into two strands; "microeconomic returns to schooling" and "macroeconomic returns to schooling"[ii]. The former is primarily based on the wage regression functions developed by Mincer (1974), where the log of earning is regressed upon years of schooling and the quadratic form of a work experience variable. The latter is essentially empirical analysis of growth; typically applying the Barro-style regression framework or applying the Mincerian wage function in a macroeconomic setting- Heckman and Klenow (1977) have named these as 'macro-Mincer' regressions[iii]. Considering human capital as an input in the aggregate production function of an economy, this simple regression analysis allows us to estimate the contribution of human capital in the overall production process. An estimation of such contribution at the macro level can be validly compared with the measurement of returns to investment in education by individual economic agents. This comparison can then strongly facilitate policy making, particularly for policies regarding resource allocation amongst several alternatives. This understanding is especially important for the developing countries, more so for the South Asian countries, where there is a large population base with lower than global average education level. It must be noted that macroeconomic returns to education (which is the key proxy of human capital), can only be useful in conjunction with the understanding of private returns to education. However, the focus of this paper is solely estimation of the macroeconomic returns to education in South Asia. Following the pioneering empirical studies by Barro (1991), Mankiw, Romer and Weil (1992) and Barro-Lee (1994), numerous investigations were conducted to validate the effect of educational attainment on either the level or growth of per capita output. Researchers have experimented with various model specifications, instruments of human capital and econometric methods but could not find a globally significant effect of education on economic growth. Intuitively the level of educational attainment should have significant effects on the level of production. Most researches, on the contrary, have

found either insignificant or even negative role of educational attainment in explaining variations in output. Interestingly, with GDP growth rate as the dependent variable, the stock measure of human capital has been found to be significant. Given the asymmetry in technology and in the general level of skills, it may not be prudent to expect similar parametric values applicable for most countries in the world. A global cross-country analysis therefore suffers from the possibility of providing unexpected results due to heterogeneity. Therefore, empirical analysis demands a more dis-aggregated regional focus as has been attempted in this study.

South Asian economies share many common characteristics in terms of demography, social infrastructure and public spending on human development. Over the last three decades they have also experienced similar economic growth rates, and variations in per capita income, but their physical capital and educational attainment are much lower than global cross-country comparisons. Given the availability of sufficient number of observations, it is now possible to empirically examine the effect of human capital on economic growth in this region. Such a macroeconomic investigation on South Asia has not been done before, and therefore this paper contributes towards better understanding of the dynamics of growth, in this highly populated but impoverished region of 1.3 billion people.

For empirical analysis we assume validity of the augmented neo-classical production function. Our findings suggest that an improvement in human capital, as measured by average years of schooling of adult population, to the level of South East Asian economies would increase the average growth rate of 2.8% to almost 5.1% in the South Asian economies. Our findings also suggest the existence of a strong correlation between public expenditure and the level of human capital. In conclusion, it is recommended that in order to meet the millennium development goals of the United Nations, public expenditure on health and education would have to substantially increase. Moreover, further investigation on determinants of schooling and private returns to schooling is required for better policy making.

The structure of the paper is as follows: Section1 is the introduction. Section 2 shows some stylized facts on the state of human capital in South Asia. Section 3 presents a brief overview of the various estimation

specifications and results that have been found in the literature. Section 4 presents the specifications and methodology adopted in this study and section 5 discusses the results, while section 6 concludes.

2. STYLIZED FACTS ON EDUCATIONAL ATTAINMENT

This section briefly tabulates some stylized facts on indicators of educational attainment to assess the state of human capital and its accumulation in South Asia. These indicators include literacy, gross enrolment ratios, tertiary education and government expenditure on education. Against this background, one can then understand better the correlations (or lack of) between educational attainment and economic growth estimated in this paper. For a detailed survey of South Asian human development issues see Siddiqui (2007).

Literacy

Nearly 98% of the world's illiterate population lives in developing countries. Half of these people live in South Asia. The current (2001) adult literacy rate in South Asia (56%) has now slipped behind sub-Saharan Africa (62%) as well as that of Arab states (61%) and since 1970 literacy has increased at only half the rate of those regions. As of the year 2000, every second illiterate person in the world lives in India, which also has one of the highest female-male literacy gaps in the world surpassed only by 5 countries: Bhutan, Syria, Togo, Malawi and Mozambique. However, Sri Lanka is one of the success stories in South Asia. The total adult literacy rate in Sri Lanka is 90%, with a 94% literacy rate for men and an 87% literacy rate for women.

Gross Enrolment Ratios

Gross enrolment ratios are primary indicators of a country’s educational access and reflect the success of public and private sector efforts to increase educational access and literacy. The ratio is the estimated proportion of the relevant age group enrolled at different levels of education viz. primary, secondary or tertiary. In India, one-third of all children aged 6 to 14 do not attend school. This is equal to 23 million boys and 36 million girls which is almost double the entire population of Canada.

There has been a significant increase in the primary enrolment ratio within the South Asian region, with Pakistan lagging behind. Over the ten year period 1990-91 to 2001-02, the primary enrolment ratio in Bangladesh improved from 71% to 87%. Though informal observation of societal structure may give a very different impression, the statistics show a remarkable achievement. In Sri Lanka the primary enrolment ratio has historically been very high and continues at that level.

According to the Human Development Report 2004, overall the region has achieved 98% gross primary enrolment ratio in 2000 compared to 77% in 1990. This places South Asia at par with most other more developed regions. However, South Asia lags far behind other regions in secondary and tertiary level of education. The region had an average of 48% and 10% secondary and tertiary enrolment ratios respectively in 2000. Whereas, East Asia and Pacific and Latin America and the Caribbean had recorded 58% & 14% secondary enrollment ratios and 86% & 21% tertiary enrollment ratios in 2000. The high income countries have over 100% in secondary and 62% enrolment ratio in tertiary levels.

Tertiary Education

During the period 1994-97, in terms of tertiary enrollment both Sri Lanka and India are ahead of the pack in South Asia. It is apparent that at tertiary level, gender parity is highly skewed towards the male population. Also, at the tertiary level only 14-29% of the students are in science, math and engineering. The major tertiary education centers in South Asia are largely in India, where 25% of the tertiary education students are in science and related subjects, according to the Human Development Report 2004.

The report also states that at the tertiary level, the region is led by India, which has 10% enrolment ratio with a very large population base. The other countries within the region have less than 7% in tertiary enrollment. China with more than a billion people also has a 7% enrolment ratio. East Asia is slightly better at 14%. However enrollment ratios in South Korea are high at 78% and followed by Malaysia at 28%.

Government Expenditure on Education

It is interesting that as a percentage of the GDP, public expenditure on education in South Asia is amongst the highest in the world. This fact while correct can be very misleading. Unfortunately, given low per capita GDP, this expenditure may not be sufficient to ensure improvement in enrolment ratios, particularly at the secondary and the tertiary levels. Bangladesh, India, Nepal, and Pakistan spent 15.8%, 12.7%, 13.9% and 7.8% of total government expenditure on education in 1999-2001.

High income countries also spent a similar amount of 12% of annual government expenditure on education in 2000. However, as high income countries have per capita GDP which is almost fifty times higher than the per capita GDP of most South Asian countries, the above expenditure level can only mean that investment per capita in education in the South Asian countries is very low and not conducive to spurring economic growth and technological development. This is seen from South Asia's average annual expenditure on education which is only 1.9% of GNP. In contrast, military spending in the region is 3.8% of GNP and is as high as 7% in Pakistan which has many more soldiers than teachers. These educational indicators now need to be formally analyzed in terms of their effects on South Asia's economic growth. However we shall first glean from the growth literature of other countries whether education matters and then test the same for South Asia.

3. LITERATURE REVIEW

The earlier empirical research was inspired more by the need to determine the sources of economic growth, with some human capital proxy as an explanatory variable. Barro (1991) found that the initial level of enrollment in primary and secondary schooling was statistically significant in explaining the variations in economic growth rate for the period 1960-1985 for a cross section of countries. This spurred an influx of research in empirical analysis of the macroeconomic growth with some proxy for human capital. Barro-Lee[iv] (1994) then constructed a quinquennial time series of educational attainment of adult population for 135 countries. Using this data-set Barro-Lee (1994) estimated the

following specification applying Seemingly Unrelated Regression and Instrumental Variable techniques on a panel data of these countries:

$$\Delta \ln Y_j = \beta_0 + \beta_1 \ln Y_{j,t-1} + \beta_2 S_{j,t-1} + \beta_3 Z_{j,t-1} + \varepsilon_j$$

Where Y is income, S is a vector of human capital measure (male and female secondary school attainment) and Z is a vector of control variables that include investment to GDP ratio, government expenditure to GDP ratio etc. They found that male secondary school attainment positively affects the growth rate of output per capita (1% increase in male secondary schooling increases the growth rate by approximately 1.4% according to this estimate), whereas the female education variable is insignificant, a result that is not quite intuitive.

Benhabib and Spiegel (1994) estimate the following specification:

$$\log Y_T - \log Y_0 = (\log A_T - \log A_0) + \alpha(\log K_T - loK_0) + \beta(\log L_T - \log L_0)$$
$$+ \gamma(\log H_T - \log H_0) + (\log \varepsilon_T - \log \varepsilon_0)$$

The 'A' term denotes the level of technology and the difference in A is captured in the intercept term of the regression. The authors, however, found that the difference in human capital has an insignificant coefficient, or in other words growth rate in human capital does not affect the output growth rate. They modified the regression function to include the stock of human capital and found that this measure has positive effect on the GDP growth rate, thus supporting the prediction of the new growth theories of perpetual growth. After controlling for the initial level of income, the coefficient measure of log of human capital turned out be 0.128 and significant at 5% level. This is equivalent to saying that a 1% change in human capital increases the growth rate by approximately 13%. This is a very large effect and its veracity has been much disputed

Mankiw-Romer-Weil (1992) developed an augmented Solow model with human capital as a separate input in the neo-classical (Cobb-Douglas) production function and estimated a regression function based on the following equation, with the objective of validating convergence condition of the neo-classical growth model:

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha}\ln(s_k) - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) + \frac{\beta}{1-\alpha}\ln(h^*)$$

Where L denotes the working-age population, t is the time variable, s is savings of an economy, n is growth rate of population, g is growth rate of technology, δ is the depreciation rate (n+δ is assumed to be 0.05), and h* is the human capital measure (proxied by secondary school attainment of adult population). The coefficient of ln school) turned out to be 0.66 implying that a 1% increase in secondary school attainment by the working age population leads to 0.66% increase in output per working age population. This estimate was based on a regression of a cross section of countries.

Islam (1995) extended this model into a panel setting, and found that the coefficient on the human capital is not positive, rather negative. In fact, the regression for the subsets of developed OECD countries and countries with intermediate level development produced insignificant estimates of the coefficient on human capital.

Gemmell (1996) reconstructed the human capital measure based on not only the school enrollment figures but also the initial working age population. The author separately estimated the effect of primary, secondary and tertiary level educated work force by incorporating both the initial stock measure and the respective growth rates in these categories. The specification is as follows:

$$YG = b_0 + b_1 \ln GDP_{60} + b_2 \ln INV + b_3 \ln\{dL / L\}$$
$$+ \sum_i b_{i4}(dH_i / H_i) + \sum_i b_{i5} \ln H_{i,60} + b_6 \ln L_{60}$$

Where i denotes primary, secondary and tertiary level of education. He found that for the OECD countries both tertiary enrollment growth rate and initial stock of tertiary educated population are significant. But for the intermediate LDCs it is the secondary level enrollment and growth rate that are significant and for the poorest LDCs the primary level enrollment and growth rate are significant. This finding is contrary to the estimates of Benhabib and Spiegel (1994) who found the growth rate of human capital to be insignificant.

Hall and Jones (1999) attempted to clarify why the physical and the human capital explain only partially the total variation in output. According to the authors, a social infrastructure variable which is endogenously determined by a host of variables including government institutions, policy effectiveness, education, language etc provide a better picture of the output variations. The following equations form the basis of their estimation model:

$$\log Y / L = \alpha + \beta S + \varepsilon$$
$$S = \gamma + \delta \log Y / L + \theta X + \eta$$

Where, S denotes social infrastructure and X is a collection of other variables. Their estimates show social infrastructure to be a significant variable in the growth process.

Krueger and Lindahl (2001) provide a succinct summary of the macro returns estimation models and attempt to reconcile the studies done at the micro and the macro levels. They modify the Benhabib and Spiegel (1994) specification to include both stock and growth rate measures of human capital and show that the coefficients are significant. However, the authors themselves criticize this estimation procedure on the grounds that such a procedure is likely to provide unstable parameter estimates.

From the above, it is difficult to claim that human capital has always found to be a significant regressor in output regressions, be it for the level or for the growth rate of output.

Siansei and Van Reenen (2002) provide a detailed exposition on 'macroeconomic returns to education' and highlight the following key issues:

a) *Endogeneity Bias* – Higher level of education or human capital may lead to higher output. But we cannot rule out the possibility that higher output allows better allocation of resources in human capital development, and thus the estimates of human capital contribution may suffer from endogeneity bias.

b) *Parameter Heterogeneity* – One of the primary assumptions of cross-country regressions is that the production function contains constant parameters for the population. However, different countries are in varying stages of development. The parameter values for OECD countries may well not be the same as the parameter values for LDCs.

c) *Model Uncertainties* – Inclusion or exclusion of additional variables significantly modify the results.

d) *Non-Linearities* – Most regression functions are adapted to linear specifications, while the true process may be otherwise.

As far as microeconomic returns to schooling are concerned, most studies find significant effects of schooling on earnings of individuals for almost all countries. Psacharapoulos (1994) and other researchers estimate these returns for various countries.

Given the above it may be prudent to investigate the macro returns with a more regional focus, where economic background and development are more or less at a similar stage. In the following section, we present the specifications and results of such an investigation on South Asia.

4. MODEL SPECIFICATION

For this study we essentially follow the Barro-type regression framework. The general specification is:

$$Y_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 H_{it} + e$$

Where, Y is the log of per capita gross domestic product in constant US dollars; K is the log of gross per capita capital formation in constant US dollars; H is the log of average years of education amongst population of 25 and over; t is the time subscript and i is the country subscript.

The parameter β_2 captures the education elasticity of income, and is the parameter of interest. Since the above specification is merely a log transformation of the neo-classical production function, the expected signs of the parameters β_1, β_2 are positive. These parameters are not only the elasticity measures, but also provide a measure of the

contribution of physical and human capital respectively in the production process.

In addition to the above, several other specifications are estimated which include desegregated human capital variables by gender and government expenditure on education. These specifications will be presented in due course.

The countries in this study are the five larger economies of South Asia: Bangladesh, India, Nepal, Pakistan and Sri Lanka. Due to unavailability of data Maldives and Bhutan could not be included here. In some of the estimations, either Nepal or both Nepal and Bangladesh have been excluded to check whether the results vary for a more exclusive group within these countries.

Data and Sources

The data have been compiled from various sources. The per capita GDP in constant US dollars and the gross capital formation as a percentage of the GDP have been extracted from the World Development Indicators. The amount of gross per capita capital formation is calculated from the above data sources. The education variable is available in the education statistics division of the World Bank. This data is in fact the widely used Barro-Lee dataset. This dataset contains several statistics – educational attainment for total population over 25 and over 15 and the same information for female. Also available are the male-female population ratio, from which the male attainment figures have been calculated. For this paper, only 25+ populations are considered. The government expenditure figures have been collected from the UNESCO Institute of Statistics web site. However, this data is available for a shorter period of time.

Since the education variable is the key constraint, the time period for analysis is 1960 to 2000. The Barro-Lee dataset provides only quinquennial estimation of the education attainment statistics, and thus the estimation are based this 5 year time period gaps.

5. ESTIMATIONS

With the availability of panel data for five countries, pooled time series regression technique has been applied for estimation of the parameters.

The estimates have been calculated using Feasible Generalized Least Squares method. As the education variable is available for 9 time periods and there are 5 countries, which provide roughly 45 observations for estimation. The estimations have been in the following sequence. First we look at the result of regression in levels, i.e. log of output regressed on the log of physical capital and on log of education (Table 1). Second, we use the same variables in first difference (Table 2), essentially capturing the effect of growth rates of the inputs on the growth rate of the output. Third, following Benhabib and Spiegel (1994) we use the stock measure of human capital instead of growth rate (Table 3). Fourth, we use government expenditure as a proxy for human capital (Table 4).

The results of the regressions are generally in line with the earlier findings. The *level* of education does not turn out to be a significant explanatory variable for the *level* of output. In fact, in most specifications we get counter-intuitive estimates of the parameters. Also, variations in the growth rate of inputs do not capture the variation in growth rate of output. However, in this study, as was found by Benhabib and Spiegel (1994) the *level* of human capital significantly explains variation in *growth* rates of these countries.

Table I shows that the level of education is an insignificant explanatory variable when the dependent variable is output. Table 2 shows that the growth rate of physical capital has a positive coefficient significant at the 5% level, but the growth rates in education attainment do not have a significant coefficient. In Table 3, when the growth rate of output is regressed upon the growth rate of physical capital and the log of education attainment, the coefficient estimates are significant at 5% level. The estimate of coefficient of education varies from 0.487 to 0.703 depending on the countries pooled in the regression. The above results match the findings of Benhabib and Spiegel (1994) and Barro (1997), who also have found the stock measure to be significant but not the growth measure of human capital, when the dependent variable is growth of output per capita.

In Table 4, the regression estimates using various lags of government education expenditure on education as explanatory variables are presented. (Note: The education expenditure data are available for a shorter period of time). While the current government expenditure is

significant and positively affects output growth, the lagged values of education expenditure are insignificant.[v]

To trace the gender effect on GDP growth we first regressed output levels on levels of male and female educational attainment and found the wrong sign for male education (negative) but the correct sign for female education (Table 5). However, when the growth rate of output is regressed on growth rates of male and female educational attainment (Table 6), the model is quite robust and all the coefficients are found to be significant, even when the number of countries is changed. However, the male educational growth consistently affects the growth rate of output negatively, which is unintuitive and exactly the opposite of the finding of Barro-Lee (1994) who found that the female educational attainment shows a negative sign. Given that the female attainment is significantly lower compared to male educational attainment, the growth rate in female education attainment has been considerably higher relative to the male educational attainment. Therefore, there seems to be a downward bias in the male education coefficient.

Therefore, from the above estimates we can see that the specification that produces results coherent with the endogenous growth theories is the one that has growth rate of per capita output regressed on the growth rate of per capita physical capital and the level of human capital. The coefficient terms for both the production inputs are significant at a very high confidence level.

The measure of the coefficient of log of human capital is approximately 0.05. This gives us an education elasticity of growth measure of 2.5. This means that if the average educational attainment of adult population can be increased approximately equal to the the global average level (44%), the growth rate of output per capita will increase from current 2.8% to approximately 5% in the South Asian region.

Finally there is evidence of very strong correlation between educational attainment and various lags of government expenditure. The correlation matrix is presented in Table 7. Though this correlation measure hardly signifies any *causal* relationship between educational attainment and the government expenditure on education, it goes without saying that

effective public education management will increase the average education level among the population.
The above research findings on macro or social returns to schooling are suggestive of the correlations between economic growth and an educated working population. This research can be further corroborated by estimating the determinants of schooling and the micro level or private returns to education. Only then will a complete picture emerge to guide policy makers in their resource allocation decisions.

6. CONCLUSION

Initial empirical analyses of growth and of convergence prediction of neo-classical growth models produced mixed results on effect of human capital on macroeconomic productive performance. Theoretically the parameter of human capital proxy in Barro-type growth regression reflects the macroeconomic returns to education. Many researches in this field failed to provide conclusive results, which is puzzling given the robust findings in microeconomic returns to schooling estimates. Endogeneity, parameter heterogeneity and incorrect instrumentation may be the cause of ambiguity in empirical estimates. By focusing on a homogeneous set of countries of South Asia, this paper investigates validity of this widely used macroeconomic output-input regression.

Based on the estimates we can claim that the level of human capital significantly determines the growth rate of the South Asian economies. The result indicates that by reaching the global average level of educational attainment amongst the adult population, the growth rate can be significantly increased. This result in conjunction with microeconomic studies of returns to education may provide the policy makers with some basis in resource allocation for human development in this region.

Table 1: $Y_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 H_{it} + e$

	All Five Countries	*Excluding Nepal*	*Excluding Nepal and Bangladesh*
Log (capital)	0.550*	0.627*	0.775*
	(6.43)	(7.12)	(9.98)
Log (school)	-.009	-0.106	-0.106
	(-0.14)	(-1.12)	(-1.32)
Log likelihood	6.193	10.961	14.873
Wald Statistics	150.19	140.66	244.09
Prob > χ^2	0.0000	0.000	0.000

In each table * denotes significance at 5% level, ** denotes significance at 10% level. The values in parentheses under the coefficient estimates are the t-statistics values.

Table 2: $dY_{it} = \beta_0 + \beta_1 dK_{it} + \beta_2 dH_{it} + e$

	All Five Countries	*Excluding Nepal*	*Excluding Nepal and Bangladesh*
Growth Rate	0.326*	0.321*	0.345*
(capital)	(5.25)	(5.22)	(3.67)
Growth rate	-0.029	0.116	0.104
(school)	(-0.44)	(1.29)	(0.381)
Log likelihood	24.795	23.540	16.022
Wald Statistics	41.26	64.22	48.51
Prob > χ^2	0.000	0.000	0.000

Table 3: $dY_{it} = \beta_0 + \beta_1 dK_{it} + \beta_2 H_{it} + e$

	All Five Countries	*Excluding Nepal*	*Excluding Nepal and Bangladesh*
Growth Rate (capital)	0.299* (7.07)	0.331* (7.31)	0.369* (6.27)
log (school)	.049* (2.82)	0.070* (2.31)	.056 (1.42)
Log likelihood	33.057	28.86	19.548
Wald Statistics	58.28	73.03	53.25
Prob > χ^2	0.000	0.000	0.000

Table 4: $dY_{it} = \beta_0 + \beta_1 dK_{it} + \sum_j \delta_j X_j + e$

	Model 1	*Model 2*	*Model 3*
Growth Rate (capital)	0.113* (2.71)	0.152* (3.53)	0.079 (1.21)
log (expenditure)	0.075* (4.78)	0.102** (1.89)	0.128* (2.74)
log (expenditure)-lag1	-	0.008 (0.17)	-0.008 (-0.17)
log (expenditure)-lag2	-	-	-0.070 (-1.65)
Log likelihood	43.6197	37.625	29.676
Wald Statistics	33.64	63.13	23.5
Prob > χ^2	0.000	0.000	0.0001

(X denotes log of government expenditure, 'j' denotes various lags of X)

Table 5: $Y_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 HM_{it} + \beta_3 HF_{it} + e$

	All Five Countries	*Excluding Nepal*	*Excluding Nepal and Bangladesh*
Log (capital)	0.483*	0.626*	0.757*
	(5.43)	(7.79)	(10.52)
log (school – male)	-0.161	-0.67*	-0.447**
	(-1.26)	(-2.26)	(-1.79)
Log (school – female)	0.144	0.252**	0.151
	(1.63)	(1.74)	(1.28)
Log likelihood	7.7206	13.1709	15.9683
Wald Statistics	155.87	164.9	268.71
Prob > χ^2	0.000	0.000	0.000

Table 6: $dY_{it} = \beta_0 + \beta_1 dK_{it} + \beta_2 dHM_{it} + \beta_3 dHF_{it} + e$

	All Five Countries	*Excluding Nepal*	*Excluding Nepal and Bangladesh*
Growth Rate (capital)	0.321*	0.326*	0.413*
	(6.20)	(5.98)	(5.43)
Growth Rate (school –male)	-0.430*	-0.506*	-0.780*
	(-2.02)	(-2.17)	(-2.9)
Growth Rate (school – female)	0.289*	0.3421*	0.4475*
	(2.66)	(2.73)	(3.38)
Log likelihood	30.852	26.389	20.288
Wald Statistics	87.36	85.03	83.36
Prob > χ^2	0.000	0.000	0.000

Table 7: Correlation between log of education and various lags of log of education expenditure

	lnh	lnx	llnx	l2lnx	l3lnx	l4lnx
lnh	1.0000					
lnx	0.7904	1.0000				
llnx	0.7887	0.9834	1.0000			
l2lnx	0.7949	0.9804	0.9906	1.0000		
l3lnx	0.7359	0.9466	0.9541	0.9692	1.0000	
l4lnx	0.7380	0.9299	0.9514	0.9616	0.9910	1.0000

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Endnotes

[i] For details, see Barro-Sala-I-Martin (1995).

[ii] Extensive surveys on the literature on returns to education microeconomics and macroeconomics can be found in Hoosterbeek and Kim (2004) and Siansei and van Reenen (2004).

Krueger and Lindahl (2001) provide a succinct presentation of these regression ideas.

[iv] This dataset is now the most widely accepted measure of stock of human capital, and has been used in most studies of the World Bank and UNESCO. The dataset is available on the website http:\\devdata.worldbank.org.

[v] We also found that the growth rate of education expenditure does not explain the variation in growth rate of output. This is consistent with the earlier findings where the levels rather than growth rates of educational attainment proxies are more significant.