Human Capital and Economic Growth: The Quest for the Most Relevant Level of Education in Pakistan

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Human Capital and Economic Growth: The Quest for the Most Relevant Level of Education in Pakistan

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Abstract: *The study examines the role of human capital in the economic growth of Pakistan by using primary, secondary and higher education enrolments as proxies for human capital in three different specifications. The idea behind these models is to find out the most relevant level of education in terms of its contribution in economic growth. The order of integration of the variables is checked through Augmented Dickey Fuller and Phillips Perron test. In order to find out the evidences of the long run relationship, Engle-Granger two step procedure is used. The findings are re-examined through Johansen and Juselius method. The study found that human capital is positively related with the long run economic growth with primary education as the most relevant level of education. It is therefore recommended that special attention should be given to the primary level of education.*

Keywords: *Human Capital, Economic Growth, Education*

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Introduction

Human capital is considered as an important explanatory input in the growth process of exogenous and endogenous growth models. Does human capital really matter in explaining economic growth? This question was empirically illuminated in Mankiw et al. (1992), a seminal paper on the subject. The study found human capital as one of the key determinant of economic growth across nations. The area of economic growth in general and the relationship of human capital with the growth process in particular, has not been adequately explored yet. With the passage of time, the availability of reliable cross country data set has been increasing that motivates the scholars to empirically test the different dimensions of the growth theories. There are theoretically defined channels through which human capital directly or indirectly affect the growth process however when it comes to the empirics of growth,there are still questions and controversies to be addressed. Though intuition and theory postulates a positive role of human capital with economic growth however the same has been empirically found to be statistically insignificant and even negatively related with economic growth[1].

Despite the wide theoretical differences in the exogenous and endogenous growth theories, both implicitly agree that education is one of the most important elements of human capital. This is the reason, in most of the studies, different education indicators have been used as proxy for human capital. Now, the very next relevant issue for an individual economy is to find out the level of education which can serve the economy more in terms of growth and development. The present study is an attempt to address this issue in the perspective of Pakistan economy. The study would test the relationship of human capital with economic growth by using primary, secondary and higher education as human capital.

The paper is organized as follows. Section 2 is the brief review of selected studies on the subject, section 3 explains the methodology adopted in the study, section 4 presents the estimation results and section 5 concludes the discussion.

[1]See Pritchett (1996)

Review of Literature

Human capital enhances the productivity of a worker[2] which leads to an increase in the output. Moreover, increase in the productivity of labor leads an increase in the labor demand, employment and output. Growing stock of human capital attracts physical capital in the economy which also affects the output positively (Abbas, 2000 and 2001).

Barro (1991) is one of those studies which shed light on the role of human capital in the growth process from the empirical standpoint. The study analyzed the economic growth as a function of different explanatory factors including human capital. The functional relationship was tested through ordinary least square on the sample of 98 countries. It was found that the real per capita GDP is positively related with the initial level of human capital of a country.

Mankiw et al. (1992) focused on the role of human capital in the growth process. The human capital and output relationship was established by using Cobb-Douglas production function with labor and capital as inputs. The same relationship was again tested with the inclusion of human capital as a third input in the production function. The explanatory power of the model was enhanced remarkably after the inclusion of human capital. This was evident that human capital is in fact a very important determinant of economic growth.

Benhabib and Spigel (1994) evaluated the role of human capital from the exogenous as well as endogenous theory standpoint. The study employed a Cobb-Douglas production function and used the technique of ordinary least square. Initially, the role of human capital was tested from the exogenous theory point of view. In that case, the coefficient of human capital was found to be insignificant and the unexpected result remained consistent in six different specifications. The role of human capital was checked again with endogenous theory based specification and the coefficient of human capital was found to be positive and significant.

Abbas (2000) is a comparative time series study that analyzed the human capital-economic growth relationship between Pakistan and India on an annual data set from

[2]See Bergheim(2005)

1970 to 1994. The technique of ordinary least square was used in the study while primary, secondary and higher schooling enrolment rates were used as proxy for human capital. The study found the evidences of the human capital-economic growth relationship in both the countries though the results varied with different proxies. The secondary schooling was found to be significant and positively related with economic growth in both the countries however primary education was found to be positively related in case of India while the higher education was found to be positively related with growth in case of Pakistan.

Abbas (2001) is a time series study which compares the role of human capital in the economic growth of Pakistan and Sri-Lanka. A Cobb-Douglas production function with three variable inputs was employed to test the relationship with ordinary least square technique on an annual data set from 1970 to 1994. The study found the positive role of human capital in the economic growth of both the countries.

Abbas and Foreman-Peck (2007) studied the human capital and economic growth relationship by using an annual data set from 1961 to 2003. The study used the stock of human capital which was calculated by perpetual inventory method on the secondary enrollment data. The study also used health expenditures as a percentage of GDP as a proxy for human capital and found strong evidences of the positive role of human capital in the economic growth.

Modeling Framework

Traditionally, research studies on economic growth employ a standard Cobb-Douglas production function with two or three variable inputs. Gross Domestic Product, real Gross Domestic Product per worker or real Gross Domestic Product growth is taken as dependent variable in the production function. Capital generally proxied through Investment GDP ratio or gross fixed capital formation are used as a proxy for capital while labor input generally proxied by using total or employed labor force. In most of the studies, education or health indicators are used as a proxy for human capital. Following the convention, the current study also employs a Cobb-Douglas production function with labor, capital and human capital as input variables.

$$Y = AK^{\alpha}L^{\beta}H^{\gamma} \tag{1}$$

The function is converted in the log form and the new functional form is reported below.

$$LogY = logA + \alpha logK + \beta logL + \gamma log \tag{2}$$

In the equation 2, Y is the real Gross Domestic Product per working age population; K is the investment GDP ratio; L is the employed labor force while H represents the three proxies of human capital. The Equation 2 is further divided into three equations that capture the effect of human capital through enrollment in primary,secondary and higher education respectively.

$$LogY_t = logA_t + \alpha logK_t + \beta logL_t + \gamma logPe_t... \tag{3}$$

$$LogY_t = logA_t + \alpha logK_t + \beta logL_t + \gamma logSe_t... \tag{4}$$

$$LogY_t = logA_t + \alpha logK_t + \beta logL_t + \gamma logHe... \tag{5}$$

(6)

The equations 3, 4 and 5 can be used to estimate the relationship of human capital and economic growth. These three models would illuminate the contribution of primary, secondary and higher education on the economic growth of Pakistan in terms of the magnitude as well as statistical significance. The study would employ an annual data set from 1981 to 2007 and the data is taken from various issues of Pakistan Economic Survey, Labor Force Survey and other publications of Federal Bureau of Statistics.

Table-1: Stationarity assessment through ADF

	I (O)		**I (I)**	
Variables	C	C & T	C	C & T
Y	-0.94	-1.92	-5.71	-5.68
L	2.66	-0.4	-4.77	-5.57
K	-1.05	-2	-3.11	-3.03**
Pe	-0.58	-3.08	-4.96	-4.85
Se	0.66	-1.82	-3.87	-3.97
He	1.95	-1.25	-6.43	-7.17

Critical values on level with constant and constant with trend at 1 percent are -3.11 and -4.3 56 respectively. On 5 percent, the values are -2.981 and -3.595 respectively. The critical values on first difference with constant and constant with trend at 1 percent are -3.724 and - 4.374 respectively. On 5 percent, the values are - 2.986 and -3.603 respectively.

Table-2: Stationarity assessment through Phillips Perron

	I (O)		**I (I)**	
Variables	C	C & T	C	C & T
Y	-0.96	-1.84	-5.71	-5.68
L	2.66	-0.4	-4.77	-5.57
K	-1.05	-2	-3.11	-3.03**
Pe	-0.58	-3.08	-4.96	-4.85
Se	0.66	-1.82	-3.87	-3.97
He	1.74	-0.92	-6.43	-7.17

Critical values on level with constant and constant with trend at 1 percent are -3.11 and -4.3 56 respectively. On 5 percent, the values are -2.981 and -3.595 respectively. The critical values on first difference with constant and constant with trend at 1 percent are -3.724 and - 4.374 respectively. On 5 percent, the values are - 2.986 and -3.603 respectively.

Estimation Results

Initial step for assessment any relationship in the time series variables is to find out the order of integration of the individual series. The order of integration of the variables is initially checked through Augmented Dickey Fuller and the results are reported in the table 1 below.

The table shows that all variables are nonstationary at level however the same are found stationary at the first difference. The results indicate that all the variables included in the model are in fact integrated of the order one. The assessment regarding the order of integration is further checked through Phillips Perron test and the results are reported in the table 2.

The presented result confirms the assessment of Augmented Dickey Fuller test. All

variables are non stationary at level and stationary at the first difference. The result confirms that all the variables are integrated of the order one. The findings of table 1 and 2 permit us to proceed further and see whether there is any indication of the long run relationship between the variables in the equation 2. To test this possibility Engel-Granger two step procedure is used. The table 3 presents the results of the first step of the procedure.It would be pertinent to perform the second step of Engle-Granger procedure prior to interpret the different values of the table 3.

Table-3: Step One of Engle-Granger Two Step Procedure

	Model 1			Model 2			Model 3		
	Coeff.	t-Stats.	Prob.	Coeff.	t-Stats	Prob.	Coeff.	t-Stats	Prob.
Constant	5.437	14.8 13	0.000	7.280	36.327	0.000	8.469	20.609	0.000
Log(K)	0.340	3.217	0.004	0.042	0.479	0.637	-0.012	-0.073	0.943
Log(L)	0.097	0.584	0.565	-0.139	-0.900	0.378	-0.293	-0.736	0.469
Log(Pe)	0.648	7.8 14	0.000	-	-	-	-	-	-
Log(Se)	-	-	-	0.545	9.787	0.000	-	-	-
Log(He)	-	-	-	-	-	-	0.574	3.820	0.001
Adjusted R2		0.959			0.971			0.900	
D-W Statistics		1.161			1.461			0.708	
F- Statistics		178.662			255.665			75.662	
Prob(F- statistic)		0.000			0.000			0.000	

Dependent variable is the log of GDP per worker in all three models.
Source: Authors' estimation

The second step is performed and the result is reported in the table 4.

Table-4: Stationarity of residual series

	ADF Test Level	
Variables	C	C & T
RM1	-3.140	-3.558**
RM2	-4.044	-3.915
RM3	-2.460	-2.300

Critical values on level with constant and constant with trend at 1 percent are -3.711 and -3.557 and respectively. On 5 percent, the values are -2.981and -3.603 respectively.
Source: Authors' estimation.

In the table 4, RM1 is found to be stationary at level indicating the long run relationship between the variables in the model one. RM2 is also stationary at level indicating the long run relationship between the variables in the model 2. Similarly, RM3 is non stationary at level rejecting the possibility of the long run relationship.

Now, the coefficients of the model one and two can be taken as the long run equilibrium values of the variables as both have been found to be cointegrated. The coefficient of human capital is highly significant in the model one and two however the magnitude of human capital is greater in the model one. The coefficient of physical capital is highly significant in the model one and insignificant in the model two however the coefficient of labor is insignificant in both the models. This insignificance might be the outcome of the aggregation of the labor data. To reconfirm the existence of cointegration, the method of Johansen and Juselius (Johansen, 1988, 1991 and Johansen and Juselius, 1990) is used. The results of this method are reported in the table 5.

Table-5: Test for Co-integration through Johansen and Juselius method

Model 1	Trace Test			Max Eigen Value Test		
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r >0	r >1	r >2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	100.019	49.993	20.026	50.026	29.968	16.664
Critical Value on 5 percent	55.246	35.011	18.398	30.815	24.252	17.148
Probability	0.001	0.001	0.029	0.001	0.008	0.059
Model 2						
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r >0	r >1	r >2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	48.162	26.262	15.027	21.9	11.234	8.981
Critical Value on 5 percent	63.876	42.915	25.872	32.118	25.823	19.387
Probability	0.498	0.723	0.572	0.501	0.915	0.726
Model 3						
Null Hypothesis	r = 0	r = 1	r = 2	r = 0	r = 1	r = 2
Alternative Hypothesis	r >0	r >1	r >2	r = 1	r = 2	r = 3
Trace Statistics/Max Eigen Value Statistics	62.797	33.667	15.949	29.131	17.718	10.484
Critical Value on 5 percent	55.246	35.011	18.398	30.815	24.252	17.148
Probability	0.009	0.069	0.107	0.079	0.288	0.354

* Where r is the number of cointegrating vectors
Source: Authors' estimation

The results of Johansen and Juselius method differ from the findings of Engle-Granger two step procedures in case of model 2 and 3. The null hypothesis of no cointegrating vector and 1 cointegrating vector is rejected by the trace statistics as well as by the Eigen value statistics which confirms the existence of cointegration in the model one. None or the null hypotheses could be rejected in case of the model 2 implying there is no cointegregating vector in the model 2. The null hypothesis of no cointegrating vector is rejected through trace statistics in case of model three and none of the other hypothesis could be rejected implying that there is one cointegregating vector in the model 3 as per trace statistics. Thus the model one is found to be most

relevant and illuminating in case of studying the role of human capital in the economic growth of Pakistan.

Conclusion

Human capital is positively related with the long run economic growth at least as far as economic theory is concerned. Education is considered as one of the most important element of human capital however the importance of different levels of education varies country to country. The present study shows that the relationship of different levels of education with economic growth is not same. The results of Engle-Granger two step procedures and Johansen cointegration are contradictory in case of model 2 and model 3, however the model one that used enrolment in the primary education as a proxy for human capital is found to have long run relationship with economic growth through both of the tests. e most consistent. The results indicate that the primary education is the sector which is the most relevant to human capital and it is the sector which can ensure the economic growth in the long run.

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