THE CONTRIBUTION OF EDUCATION TO ECONOMIC GROWTH: EVIDENCE FROM PAKISTAN

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Abstract

This paper concentrates on the contribution of education to economic growth of Pakistan during 1971-2008.The study uses Ordinary Least Squares (OLS) and Johansen Cointegration test as analytical techniques for this purpose. The results from OLS show that secondary education contributes significantly to the Real GDP Per Capita in Pakistan. The elementary education also positively affects economic growth but the result is statistically insignificant. The cointegration test results confirmed the existence of long run relationship in education and Real GDP Per Capita. It is therefore, suggested to keep education on top priority in public policies, make serious efforts for Universalization of Primary Education and discourage the drop-out rate at all levels of education to achieve sustained economic growth.

Key Words: Education, Economic Growth, Elementary Education, Secondary Education, Contribution, Ordinary Least Squares

1. INTRODUCTION

Realizing the importance of non-traditional factors in economic growth, human capital has been treated as the engine of economic growth in new growth theories[1]. Human capital is measured by skills of labour force, health, education level, experience, training and a number of other factors. Human capital is embodied in person and it enhances the productivity of labor. It positively affects economic growth (Lucas, 1988). Education is considered as the most important factor of stock of human capital[2]. Human capital in the form of school enrollment has positive association with real GDP per Capita (Barro, 1991). Human capital in form of education provides market as well as non-market benefits. It provides non-market benefits in form of parenting and leisure (Jorgenson and Fraumeni, 1992). Higher investment in children, leaves emotional, physical and cognitive effects on their lives and helps them in achieving higher economic capabilities as compared to those children, who get less investment (Romer, 1994).

The contribution of education varies with variation in the level of development. Some of the previous studies find that the effect of primary and secondary education on economic growth is higher in less developed countries than OECD countries[3]. Education has been addressed extensively in a number of studies due to its importance in economic growth. The cross-country difference in per capita incomes depends on the level of saving, education and population growth (Mankiw *et al,* 1992). Pritchett (1996) examined cross-sectional data on economic growth and found that an increase in education of labour force has no positive impact on growth rate of output per worker. The growth of human capital has large, negative and significant impact on total factor productivity.

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[1] See Barro (1991), Barro and Lee (1993), Benhabid and Spiegel (1995), and Echevarría and Amaia (2006)

[2] Goode (1959) and Schultz (1961) argued that education is the most important factor of human capital capital stock.

[3] For details see Petrakis and Stamatakis (2002) and Albatel (2004)

It is possible that schooling may not create human capital but it raises the private wage. Education has positive and significant effect on economic growth[4]. Abbas (2001) found negative impact of primary school enrollment on economic growth in Pakistan and Sri Lanka. When the human capital is proxied by secondary school enrollment the impact becomes positive in case of both countries. The overall results confirm the positive role of human capital in economic growth of Pakistan. Investment in education and health can generate highly productive labor force and can increase total factor productivity (Khan, 2005). Similarly, Akintoye and Adidu (2008) found negative relationship between human capital investment and per capita income growth

Pakistan is one among the human resource enriched countries. Its population is increasing at the rate of 2.05% per annum (Economic Survey of Pakistan (2009-10). Education is the most powerful weapon which can be used to utilize the huge pool of human resources in Pakistan. It improves not only productivity and create awareness among men but also adds to quality of life. Pakistan got a very low education profile in inheritance with literacy rate of only 16% in 1947, which is now 57%. It spends a meagre percentage of 2% on education (Economic Survey of Pakistan 2009-10). This paper is an attempt to find the contribution of education in economic growth of Pakistan during the period 1971-2008. It is expected that the paper will provide suggestions for optimal utilization of human resources in Pakistan.

2. MATERIALS AND METHODS

This study is based on time series data for the period 1971-2008. The data has been taken from Economic Survey of Pakistan, World Development Indicators, State Bank of Pakistan and Federal Bureau of Statistics, Pakistan. The stationarity of data has been checked by using Augmented Dickey Fuller test. We have derived the model for estimation from the following augmented form of Cobb Douglas Production Function.

$$Y = (A, K, L) \qquad\qquad (1)$$

If human capital is introduced in equation (1), it becomes

$$Y = (A, K, L, H) \qquad (2)$$

Where Y shows GDP Per Capita (Real), L shows labour while H shows human capital which is considered as engine of economic growth[5].The human capital in the present study has been measured by education, the empirical form of the model for estimation becomes

$$lnY = \alpha_0 + \alpha_1 lnK + \alpha_2 lnL + a_3 lnENR + U_i \qquad\qquad (3)$$

Where

ENR = School Enrollment

Economic growth has been measured by GDP per capita, Real GDP per capita, growth rate of GDP and GDP per capita in economic growth studies[6]. Real GDP Per Capita has been used as measure for economic growth in this study while Physical capital is measured by Gross Fixed Capital Formation (GFCF)[7]. Secondary and Elementary School Enrollments have been used as measures for education separately[8]. Labour is another important variable in current study. The present study has used Labour force participation rate for labour in the model.

The final equation of economic growth for estimation is given as below

$$lnY = \alpha_0 + \alpha_1 lnENRS + a_2 lnGFCF + a_3 lnL + U_i \qquad\qquad (4)$$

Two different levels of education, elementary and secondary education have been taken for analysis in the present study.

$$lnY = \alpha_0 + \alpha_1 lnGFCF + \alpha_2 lnL + a_3 lnENRE + U_i \qquad (5)$$

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[4] Harman et al (2003) and Khan (2005) found positive effects of schooling.
[5] Tallman and Wang (1994) , Steven (1999), Bedard (2001), Gokcekus (2001), Gungluch (2001) and Tamura (2001) declared human capital as the engine of economic growth.
[6] Asteriou and Agiomirgianakis (2001), Bloom et al (2000), Bhargava et al(2001), Barro (1991) and Borensztein (1998) used these different measures for economic growth.
[7] Lin(2004),
[8] See Asteriou and Agiomirgianakis (2001), Abbas (2001), Barro (1991), Canlas (2003), and McMahon (1998)

We have used the method of Ordinary Least Squares (OLS) and Johansen Cointegration test as econometric techniques for data analysis.

3.   RESULTS AD DISCUSSIONS

As discussed, the paper is an effort to unveil the contribution of education to economic growth of Pakistan. We have used school enrollment at elementary and secondary level separately as proxy for education in two different models. The results have been derived by using the method of Ordinary Least Squares (OLS). To strengthen our results, Johansen Cointegration has been used. The OLS results show that education at secondary level affects economic growth positively and the result is statistically significant at 5% level of significance. Labour force participation rate, an important variable of out model also showed positive significant impact on GDP per Capita during the study period. The physical capital as expected showed positive sign but it was statistically insignificant. The value of R-Sq remained 91.88% which shows validity of fit. The results are displayed in Table I.

Table I   Regression Results for Economic Growth Model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGFCF	0.0439	0.0481	0.9128	0.3678
LENRHM	0.3290	0.1173	2.8047	0.0083*
LLFPR	1.1544	0.4875	2.3683	0.0237**
C	-4.5976	1.9962	-2.3031	0.0275
R-Sq 0.9188 % R-Sq (Adj) 91.16 %				
F-Stat 128.253 Prob (F-Stat) 0.0000				
DW Stat 1.92				

*And ** shows 1% an level of significance.

The OLS results alter when secondary education is replaced by elementary education. Physical capital and Labour force participation rate contribute significantly to GDP per capita. Elementary education also showed positive relationship with the GDP per capita but the result was statistically insignificant. The results are displayed in Table II,

Table II   Regression Results for Secondary School Enrollment.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGFCF	0.1282	0.0343	3.7349	0.0007*
LLFPR	1.0709	0.5222	2.0510	0.0480**
LENRE	0.0859	0.0865	0.9924	0.3280
C	-2.9302	1.8913	-1.5493	0.1306
R-squared 90.55 % DW Stat 1.91				
F-statistic 108.6423 Prob (F-statistic) 0.0000				

*and ** shows 1% and 5% level of significance respectively

The study has used secondary data for analysis. Secondary data often have the problem of nonstationarity. Therefore, Augmented Dickey Fuller (ADF) test has been used to find the stationarity of data. The ADF test results show that all variables of study are nonstationary at level. They become stationary when first difference is taken. This is shown in Table III and Table IV. Table III shows that results with trend assumption of intercept but No Trend while Table IV shows shows the assumption with trend and intercept.

Table III   Results of ADF Test (With intercept but No Trend)

Variable	Level				First Difference			
	t-Stat	Critical value		P-value	t-Stat	Critical Value		P-Value
		1%	5%			1%	5%	
RGDP	-0.7820[0]	-3.6210	-2.9434	0.8125	-5.9552 [1]	-3.6329	-2.9484	0.0000*
GFCF	-1.1922 [1]	-3.6268	-2.9458	0.6672	-6.1723[0]	-3.6268	-2.9458	0.0000*
LF	0.7813[1]	-3.6268	-2.9458	0.9923	-7.7544 [0]	-3.6268	-2.9458	0.0000*
ENRE	-0.6678[0]	-3.6210	-2.9434	0.8425	-5.8975 [0]	-3.6267	-2.9458	0.0000*
ENRS	-0.5908 [0]	-3.6210	-2.9434	0.8607	-5.3518[0]	-3.6268	-2.9458	0.0001*
LFPR	-1.7086 [0]	-3.6210	-2.9434	0.4187	-8.0506[0]	-3.6268	-2.9458	0.0000*

Source: Author's Calculations based on data from Economic Survey of Pakistan(Various Issues), State Bank of Pakistan (2005), World Development Indicators(Various Issues), Lag Selection has been made by Using Minimum AIC Criteria. * stands for 1% level of Significance.All the variables have been taken in log form.

Table IV Results of ADF Test (With Trend and Intercept)

Variable	Level				First Difference			
	t-Statistic	Critical value		p-value	t-Statistic	Critical Value		P-Value
		1%	5%			1%	5%	
RGDPPC	-2.1706[2]	-4.2436	-3.5443	0.4904	-5.9868[1]	-4.2436	-3.5443	0.0001*
GFCF	-2.9618[1]	-4.2349	-3.5403	0.1565	-6.1951[0]	-4.2350	-3.5403	0.0001*
ENRE	-1.6896[0]	-4.2268	-3.5366	0.7358	-5.8570[0]	-4.2349	-3.5403	0.0001*
ERNHM	-1.5677[0]	-4.2268	-3.5366	0.7865	-5.2966[0]	-4.2305	-3.54032	0.0006*
LFPR	-2.2964[0]	-4.2268	-3.5367	0.4254	-8.3986[0]	-4.2349	-3.5403	0.0000*

Source: Author's Calculations based on dataset of Economic Survey of Pakistan (Various Issues), State Bank of Pakistan (2005), World Development Indicators(Various Issues). Lag Selection has been made by Using Minimum AIC Criteria. * Stands for 1% level of Significance.

As all variables are stationary at first difference, therefore Johansen cointegration becomes an appropriate tool for finding out the existence of any long run relationship. Johansen Cointegration test is first carried out for model with secondary education and then for model with elementary education. The cointegration test results for secondary education rejected the null hypothesis of no cointegration by showing the existence of at most one cointegrating equation. This means that education at secondary level affect Real GDP per capita in longrun in Pakistan. The test has been revised by replacing secondary education with elementary education. Results for elementary education equation also rejected null hypothesis of cointegration which shows the existence of long run relationship of education and economic growth. The results showed the existence of at most one cointegrating equation. This means that education contributes to Real GDP per Capita in long run in Pakistan. The long run relationship exists in form of elementary as well as secondary school enrollment. The results are displayed in Table V and Table VI.

Tabel V   Johansen Cointegration Test Results for Economic Growth Model

Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.577220	72.72603	54.07904	0.0005
At most 1 *	0.554043	41.73349	35.19275	0.0086
At most 2	0.260213	12.66229	20.26184	0.3914
At most 3	0.049091	1.812146	9.164546	0.8147

 Trace test indicates at most one cointegrating equation at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level

Tabel VI   Johansen Cointegration Test Results for Secondary Education

Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.672580	79.93939	54.07904	0.0001
At most 1 *	0.527410	39.74497	35.19275	0.0151
At most 2	0.253174	12.76197	20.26184	0.3831
At most 3	0.060659	2.252746	9.164546	0.7271

Trace test indicates at most 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

We have also used different tests to strengthen our results. These techniques include LM test, White Heteroscedasticity and Normality Test of Residual. The autocorrelation is checked mostly by Durban-Watson statistic but this method has few drawbacks. It becomes inappropriate when the results are inconclusive. Therefore, to avoid such problems LM test developed by Breusch (1978) and Godfrey (1978) has been used for detection of autocorrelation. The results of LM test are displayed in Table VII. The results show that irrespective of lag length the value of LM Statistic lies in acceptance region suggesting the acceptance of null hypothesis of no autocorrelation. This means that the estimates are reliable. The existence of heteroscedasticity is mostly checked with White Heteroscedasticity Test (WHT). The results of WHT accepted the null hypothesis suggesting no existence of heteroscedasticity in the model. The result is shown in Table VIII.

Table VI I   LM Test Results

Lags	Results for Elementary School Enrollment		Results for Secondary School Enrollment	
	LM-Stat	Prob	LM-Stat	Prob
1	16.63229	0.4098	12.08804	0.7379
2	16.26742	0.4345	17.54257	0.3514
3	14.78626	0.5403	12.47210	0.7109
Null Hypothesis: No Serial correlation Included Observations 38				

Table VIII   White Heteroscedasticity Test

Equation	Chi-sq	df	Prob.
Elementary /Secondary School Enrollment Joint Test	181.8378	160	0.1139

The normality tests are used to find whether a data set is well modeled by a normal distribution or no other words the normality tests tell us about the type of distribution of the residuals. In case of l regression model if the residuals are normally distributed then it may create many econometric prob and the derived results may not be valid.

The normality test in this paper is shown in Table IX and Table X. All the statistics, Kurtosis, Chi-S Jarque- Bera shows that the residuals are normally distributed in both equations
of economic growth i.e elementary and secondary education.

Table IX VAR Residual Normality Tests for Equation with Elementary School Enrollment

Component	Kurtosis	Chi-sq	df	Prob.
1	3.7609	1.9242	1	0.1654
2	3.5461	1.1329	1	0.2872
3	2.8146	0.0012	1	0.9722
4	1.8797	2.0729	1	0.1499
Joint	-	5.1313	4	0.2741
Component	Jarque-Bera		df	Prob.
1	5.8662		2	0.0532
2	7.1763		2	0.0276
3	0.0243		2	0.9879
4	2.1264		2	0.3453
Joint	45.4461		55	0.8173

Table X VAR Residual Normality Tests for Equation with Secondary School Enrollment

Component	Kurtosis	Chi-sq	df	Prob.
1	3.5284	1.0769	1	0.2994
2	3.4498	0.8458	1	0.3577
3	2.6453	0.0836	1	0.7724
4	1.3990	4.6746	1	0.0306
Joint		6.6811	4	0.1537
Component	Jarque-Bera		df	Prob.
1	4.8311		2	0.0893
2	6.8380		2	0.0327
3	0.4111		2	0.8142
4	4.9467		2	0.0843
Joint	63.3708		55	0.2050

4. *COCLUSION AD RECOMMENDATIONS*

The paper started with the aim of finding the contribution of education in economic growth of Pakistan. The results supported the view that education contributes to economic growth. The results from OLS education at elementary as well as secondary level affect economic growth. It is concluded on the basis of Johansen Cointegration test results that there exists a long run relationship between education and economic growth. This means that elementary as well secondary education contribute to Real GDP per Capita in Pakistan. It is recommended on the basis of the results of this paper to keep education on top priority in public policies. The government should leave no stone unturned for the Universalization of Primary Education (UPE) as primary education provides input for secondary education and UPE will accelerate the pace of school as well as college enrollment. The drop out at elementary and secondary level should be discouraged and sources of drop out should be explored.

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