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The Role of Human Capital in Economic Growth of Pakistan

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***Abstract*:** *The broad aim of this paper is to explore the human capital-economic growth relationship in Pakistan during the period 1971-2008. An augmented form of Cobb Douglas Production function has been used for this purpose. The study has used three different measures for human capital including education, health and R&D. Results from Johansen Cointegration test showed the existence of a long-run relationship in human capital and economic growth. Human capital in all forms education health and R&D affect economic growth while Real GDP per Capita and educational institutions affect school enrollment in the long run. The results further demonstrate that Real GDP, Education and health institutions influence health in the long run. Similarly, Real GDP per Capita, education, and Educational institutions appeared as the long-run determinants of R&D in Pakistan. The study recommended that education should be kept on top priority and resource allocation to education, health and R&D be increased.*

Keywords: Human Capital, Economic Growth, Education, health, Cointegration, Augmented , Dickey-Fuller

INTRODUCTION

Positive economic growth has always been considered as the core objective of economic policies in both developed and developing countries. Sustainability of economic growth is the main determinant that explains the huge gap in the standard of living in these countries. The emphasis on explaining the dynamics of economic growth increased after World War-II when former colonies emerged as independent states (Easterlin, 2001). Most of the developing countries especially, the newly independent countries tried to adopt such policies that would accelerate the pace of economic growth and bring them in line with developed economies. This led the economists and policy makers to work out the factors that maintain positive economic growth. Solow (1956) and Swan (1956) are considered the pioneers and their models provided a basis for most of the studies dealing with economic growth. This gave birth to new models, which covered obvious limitations of previous traditional models.

In the 1960s, a number of indicators like school enrollment, expenditures on education, Research and Development (R&D), health expenditures, life expectancy, and labour skills were alternatively used in a common term called "Human Capital". Human capital since then became an important component of economic growth literature. Becker (1993) termed expenditure on education, training and health as an investment in human capital. Investment in education enhances human capital accumulation in the form of skilled, semiskilled and professional labour force. Educated labour force can affect economic growth through factor accumulation as well as through an increase in Total Factor Productivity. Nakamura (1981) defined human capital as the skills embodied in labour and the physical attributes of labour like health and strength. Healthy workers are physically fit and considered more energetic and productive (Bloom *et al*, 2004). Health has a positive and sizeable impact on productivity (Schultz, 2003). The combined effect of education and health enhances Total Factor Productivity (TFP) and accelerates economic growth.

Research and Development (R&D) emerged as another important tool for economic growth. Its role in economic growth was also emphasized in New Growth Theories. R&D results in innovation, which improves the quality and quantity of production. The research firms enjoy the monopoly benefits which they get after each innovation but these benefits are destroyed by next innovation (Aghion and Howitt, 1992).

The role of institutions in determination of economic growth is worth-mentioning. Institutions are considered the primary determinant of long-run economic growth in recent growth literature. Institutions relating to labour and capital have a significant effect on investment (Durham, 2004).

In Pakistan, major investment in human capital is made in the form of expenditure on education, health and training. Unfortunately, the R&D sector has not been successful to get much attention of policy makers in Pakistan.

After discussing the importance of factors affecting economic growth, these are being taken up in the present study. Bottlenecks to the economic growth of Pakistan with special reference to human capital are addressed in this study. This study analyses as to what extent the education, health and research and development (R&D) have played their role in explaining the economic growth of Pakistan. In brief, this study will provide an in-depth analysis of the role of human capital in economic growth of Pakistan during the period 1971-2008. Similarly, the role of institutions in achieving efficient human capital and resultantly sustainable growth would be critically analyzed.

MATERIAL AND METHODS

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The present study has used secondary data covering the period 1971-2008 and taken from different national and international organizations including State Bank of Pakistan, Federal Bureau of Statistics, Pakistan, World Bank (World Development Statistics), and Economic Survey of Pakistan. The present study is using an augmented form of the Cobb Douglas Production Function for estimation as given below

$$Y = A\,K^{\alpha}\,L^{\beta}\,H^{\gamma} \quad (1)$$

By taking ln of equation (13), the model becomes

$$lnY = lnA + \alpha\, lnK + \beta\, lnL + \gamma\, lnH \quad (2)$$

In equation (2), Y = GDP Per Capita (Real), K= Physical capital, $L =$ Labour and $'H'$ stands for human capital. Human capital is considered as an engine of economic growth as concluded by Tallman and Wang (1994), Steven (1999), Bedard (2001), Gokcekus (2001), Gungluch (2001) and Tamura (2001). Most of the growth studies have used Education, Health, Research and Development, Training, or experience as measures for human capital. The present study is undertaking education, health and R&D as variables for human capital. Therefore, by including the variables for human capital, the functional form of the model becomes

$$Y = f(K, L, ENRS, He, RD) \quad (3)$$

where

ENRS = Education

$He =$ Health

RD = Research and Development

By introducing these variables in the model, the empirical form of the model for estimation becomes

$$lnY = \alpha_0 + \alpha_1 lnK + \alpha_2 lnL + a_3 lnENRS + a_4 lnHealth + a_5 lnRD + U_i \quad (4)$$

This is the major growth model, where 'ENRS' shows human capital in form of education, 'Health' shows human capital in form of health while 'RD' in form of Research and Development.

It is mandatory to introduce the variables used in the present study before proceeding to empirical estimation. Economic growth in most of the growth studies has been measured by Gross Domestic Product (GDP). It has been used in form GDP per capita, Real GDP per capita, the growth rate of GDP and GDP per capita in studies like by Asteriou and Agiomirgianakis (2001), Bloom et al (2000), Bhargava et al(2001), Barro (1991) and Borensztein (1998). The present study is using Per capita GDP in real terms as the measure for economic growth. The Physical capital has been measured by Gross Fixed Capital Formation (GFCF) following the economic growth literature[5].

Education is the most widely used measure for human capital in the literature concerning human capital-economic growth nexus. It has been used as average years of education, primary education, and secondary education and somewhere as gross enrollment. The present study has used secondary school enrollment as a proxy for human capital as used by Asteriou and Agiomirgianakis (2001), Abbas (2001), Barro (1991), Canlas (2003), and McMahon (1998)

"Health is wealth" is a widely used proverb, which shows the importance of health in life. Healthy people have a healthy mind and they are expected to be more efficient. It is expected to add to human efficiency and is treated as a good measure for human capital. Barro and Lee (1994), Barro and Sala-I-Martin(1995), Barro (1996), Caselli *et al* (1996), Bloom and Malanaey (1998), Bloom *et al* (2000), Sachs and Warner(1997), McDonald and Jennifer (2002) and Ozcan et al(2000) considered life expectancy as best measure for health so the present study is following their way and using life expectancy as measure for health.

Labour is another important variable in the current study. The labour force supply and composition of human resources in an economy settle on the labour force participation rate. The present study has used total labour force in the economy for labour in the model.

Research and Development (R&D) is another important variable inducted in growth determinants in New Growth Theories. Much struggle has been made to get data for R&D. Unfortunately, not much data is available on R&D in Pakistan. Only a few years' publication data was available. As most of the research is carried out in higher education institutions in Pakistan, so the expenditure on higher education was considered a proxy for it. This is also justified on the ground that high correlation was found between the Expenditure on higher education and publication per year from 1975-2008. This means that an increase in higher education expenditure led to increasing the research activities in Pakistan so this proxy is being used in the present study. The final equation of economic growth for estimation is given as below

$$lnY = \alpha_0 + \alpha_1 lnENRS + \alpha_2 lnHealth + a_3 lnGFCF + a_4 lnL + a_5 lnRD + U_i \quad (5)$$

[5] Lin(2004),

Education, health and R&D which are exogenous variables in the above economic growth equation can take the form of endogenous variables, which in turn can create the problem of simultaneity bias. This necessitates the use of a simultaneous equation model. Therefore, the interdependency of the variables has been treated by the use of a simultaneous equation model.

Human capital in the form of education can be affected by improvement in health conditions[6], development of educational institutions and GDP growth or increase in income[7]. This is explained in the following equation.

$$E = f\ (Y, Edins, Health) \quad (6)$$

Now the human capital in the form of education is affected not only by easy access to educational institutions but also by the quality of institutions[8]. The model for education after incorporating the quality of educational institutions can be written as

$$ENRS = f\ (Y, Edins, PTR, Health) \quad (7)$$

The model for estimation in log-linear form is expressed in the form of the following equation.

$$ln\ ENRS = \alpha_0\ lnRGDPPC + \alpha_1 lnEdins + \alpha_2 ln\ PTR + \alpha_3\ lnHealth + U_{1i} \quad (8)$$

In equation (24), 'Edins' and PTR shows the number and quality of educational institutions respectively.

Similarly, health which is the explanatory variable in major growth models can take the form of the dependent variable. One of the important determinants of health discussed in the literature is education[9]. The level of national income and, the number and quality of health institutions are believed to play their role in improving health status in the country. Therefore, by taking into account the various factors which can affect the health, the model for health can be expressed in the following form.

$$Health = f\ (RGDPPC, ENRS, DPR) \quad (9)$$

In order to estimate the health model, it is being written in log-linear form as

$$lnHealth = \beta_0 + \beta_1 lnRGDPPC + \beta_2 lnENRS + \beta_3\ ln\ DPR + U_{2i} \quad (10)$$

R&D is an important measure of human capital and widely used in the literature of human capital- economic growth relationship. The R&D in a country to a great extent depends on the level of income, the level of education and quality of educational institutions. The model for R&D can be written as

$$RD = f\ (RGDPPC, ENRS, Edins, LPTR) \quad (11)$$

$$lnRD = \gamma_0 + \gamma_1\ lnRGDPPC + \gamma_2 lnENRS + \gamma_3 lnEdins + \gamma_4\ lnPTR + U_i \quad (12)$$

Test for Unit Root

To get reliable estimates for time series data, it is indispensable to check the stationarity of data. It is crucial because, in stationary data, shocks are temporary and are eliminated over time, while in case of non-stationary data the shocks are everlasting.

Therefore, to get reliable results stationary test will be conducted by using the Augmented Dickey-Fuller (ADF) test.

Test for Cointegration

After testing the data for the existence of unit root, if the null hypothesis of having unit root is accepted, then the results derived from Ordinary Least Squares become unreliable. There is a possibility that the results may be spurious. In order to avoid the doubt of the spurious regression, the long-run relationship of the variable is checked. Cointegration is considered as an important tool for this purpose. In economics, two variables are said to be cointegrated if they have a long term relationship between them[10]. There are many techniques for testing Cointegration among the variables. The Engle-Granger technique (1987), Johenson Cointegration approach (1988, 1991, 1995) and the Autoregressive Distributive Lag Model (ARDL) are the widely used techniques for testing the Cointegration among the variables. The use of a particular technique depends on the properties and kind of data. The study in hand intends to employ the Johenson Cointegration technique. This approach is considered the most popular approach and most of the studies comparing different techniques for Cointegration have concluded in its favour[11]. This approach is used when all variables of the interest are integrated of order I(1). If the variables which are stationary at I(1) were found cointegrated, this will show long run relationship among these variables.

RESULTS AND DISCUSSION

The stationarity of variables in the present study has been checked by using Augmented Dickey Fuller (ADF) test. The variables which are not stationary at level are made stationary after taking 1st difference as they are expected to be stationary of

[6] Wolfe (1985) suggested health measures for children for better education

[7] Glewwe and Hanan (2004) found positive nexus in wealth and demand for education

[8] Behram and Nancy (1983), and Kingdon (1996) highlighted the benefits of educational institution's quality. Khan (2005) found significant impact of quality of institutions on economic growth of a cross-section of countries.

[9] Wesbrod (1962), Berger and Paul (1989), Hartog and Hassel (1998), and Giiskie and Ammi (1998) found effects of education on health.

[10] Gujarcati,D.N (2003), "Basic Econometrics", 4th ed, pp-822, Mc graw Hill, New york

[11] Ahking (2002) and Gonzolo (1994) concluded in favour of Johanson approach while comparing it to different techniques of Cointegration.

first order. But it is not necessary that all series for which null hypothesis of unit root is accepted may be integrated of first order. The stationarity of variables in log form was checked with intercept only and then with intercept and trend. The lag length was selected by Akaike Information Criteria (AIC)[12].

The results are derived by using Eviews6. The test is conducted at level with the assumption of intercept but no trend. The results showed that when the test is conducted with intercept but no trend, all variables in log form remain non-stationary at least at 1%, 5% and 10% level of significance. Therefore, in order to make the variables stationary, their first difference was taken and again analyzed for unit root. All variables of the study became stationary at first difference. The results are shown in Table I. The symbols I(0) and I(1) show results at level and first difference respectively.

The stationarity of the data is then checked with intercept and trend. Following the similar behavior, all variables of the study remain non-stationary at level with different lags and levels of significance. Therefore, they were converted to first difference and again tested for existence of unit root. The behaviour of variables in first difference was according to the expectations and all the variables became stationary at first difference. The results indicate that variables Gross Domestic Product Per Capita (LRGDPPC), Physical Capital (LGFCF), Labour (LLF), Secondary School Enrollment (LENRS), Elementary School Enrollment (LENRE), Health (LHealth), Research and Development (LRD), Educational Institutions (LEdins), Pupil- Teacher Ratio (LPTR), and Patient-Doctor Ratio (LDPR) are stationary when first difference is taken. The Results are shown in Table II.

Table I ADF Test Results (With intercept but No Trend)

Variable	I(0)					I(1)					Results
	t-Statistic	Critical value			P-value	t-Statistic	Critical Value			P-Value	
		1%	5%	10%			1%	5%	10%		
LRGDP	-0.7820[0]	-3.6210	-2.9434	-2.6103	0.8125	-5.9552 [1]	-3.6329	-2.9484	-2.6129	0.0000*	I(1)
LGFCF	-1.1922 [1]	-3.6268	-2.9458	-2.6115	0.6672	-6.1723[0]	-3.6268	-2.9458	-2.6115	0.0000*	I(1)
LLF	0.7813[1]	-3.6268	-2.9458	-2.6115	0.9923	-7.7544 [0]	-3.6268	-2.9458	-2.6115	0.0000*	I(1)
LENRE	-0.6678[0]	-3.6210	-2.9434	-2.6102	0.8425	-5.8975 [0]	-3.6267	-2.9458	2.6115	0.0000*	I(0)
LENRG	-1.1900[0]	-3.6210	-2.9434	-2.6103	0.6685	-5.0206[0]	-3.6268	-2.9458	-2.6115	0.0002*	I(1)
LENRS	-0.5908 [0]	-3.6210	-2.9434	-2.6103	0.8607	-5.3518[0]	-3.6268	-2.9458	-2.6115	0.0001*	I(1)
LENRHE	-0.1939[0]	-3.6210	-2.9434	-2.6103	0.9305	-5.1899[0]	-3.6268	-2.9458	-2.6115	0.0001*	I(0)
LHealth	-0.6078[0]	-3.6210	-2.9434	-2.6103	0.8568	-6.3426[0]	-3.6268	-2.9458	-2.6115	0.0000*	I(1)
LRD	-1.3174 [0]	-3.6210	-2.9434	-2.6102	0.6112	-5.1376[0]	-3.6268	-2.9458	-2.611531	0.0002*	I(1)
LLFPR	-1.7086 [0]	-3.6210	-2.9434	-2.6103	0.4187	-8.0506[0]	-3.6268	-2.9458	-2.6115	0.0000*	I(1)
LEdins	-1.2304 [0]	-3.6210	-2.9434	-2.6103	0.6508	-4.8765[0]	-3.6268	-2.9458	-2.6115	0.0003*	I(1)
LPTR	-1.1162[0]	-3.6210	-2.9434	-2.6103	0.6991	-5.0338[0]	-3.6268	-2.94584	-2.6115	0.0002*	
LDPR	0.251550[0]	-3.62102	-2.9434	-2.61026	0.9226	-5.830657	-3.62678	-2.94584	-2.61153	0.0000*	I(1)

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.

[12] The lag length with Minimum Akaike Information Criteria was selected

Table II ADF TEST RESULTS (WITH TREND AND INTERCEPT)

Variable	I(0)					I(1)					Results
	t-Statistic	Critical value			p-value	t-Statistic	Critical Value			P-Value	
		1%	5%	10%			1%	5%	10%		
LRGDPPC	-2.1706[2]	-4.2436	-3.5443	-3.2047	0.4904	-5.9868[1]	-4.2436	-3.5443	-3.2047	0.0001*	I(1)
LGFCF	-2.9618[1]	-4.2349	-3.5403	-3.2024	0.1565	-6.1951[0]	-4.2350	-3.54032	-3.2024	0.0001*	1(1)
LTLF	-2.5563[0]	-4.2268	-3.5366	-3.2003	0.3012	-7.7943[0]	-4.2350	-3.5403	-3.2024	0.0000*	I(1)
ENRE	-1.6896[0]	-4.2268	-3.5366	-3.2003	0.7358	-5.8570[0]	-4.2349	-3.5403	-3.2024	0.0001*	I(1)
LENRG	-0.7837[0]	-4.2268	-3.5366	-3.2003	0.9581	-5.0886[0]	-4.2350	-3.5403	-3.2024	0.0011*	I(1)
LERNHM	-1.5677[0]	-4.2268	-3.5366	-3.2003	0.7865	-5.2966[0]	-4.2305	-3.54032	-3.2024	0.0006*	I(1)
LENRHE	-2.0475[0]	-4.2268	-3.5366	-3.2003	0.5569	-5.1044[0]	-4.2350	-3.5403	-3.2024	0.0011*	I(0)
LHealth	-2.8782[0]	-4.2268	-3.5366	-3.2003	0.1808	-6.2637[0]	-4.2349	-3.54032	-3.2024	0.0000*	I(1)
LRD	-2.1337[0]	-4.2268	-3.5366	-3.2003	0.5109	-5.1302[0]	-4.2349	-3.54032	-3.2024	0.0010*	I(1)
LLFPR	-2.2964[0]	-4.2268	-3.5367	-3.2003	0.4254	-8.3986[0]	-4.2349	-3.5403	-3.2024	0.0000*	I(1)
LEdins	-0.6662[0]	-4.2268	-3.5366	-3.2003	0.9683	-4.8987[0]	-4.2349	-3.5403	-3.2024	0.0018*	I(1)
LPTR	-1.3646[0]	-4.2268	-3.5366	-3.2003	0.8549	-5.0523[0]	-4.2349	-3.54032	-3.2024	0.0012*	I(1)
LDPR	-2.4594 [0]	-4.2268	-3.5366	-3.2003	0.3451	-.7424[0]	-4.2350	-3.5403	-3.2024	0.0002*	I(1)

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 discussed, the major aim of present study is to find out the role of human capital in economic growth of Pakistan during the period 1971-2008. It was aimed whether human capital in form of education, health and R&D has affected the economic growth of Pakistan. The ADF test results accepted the hypothesis of existence of unit root at level pointing out that all variables are non-stationary at level but stationary at I(1). Therefore, the approach of Cointegration becomes indispensable in such cases. In order to find out the long run relationship and avoid the existence of spurious regression in particular, Johansen Likelihood Ratio Test has been used. This test is used when all variables are stationary at I(1).

First of all, the economic growth model has been analyzed for Cointegration. This model treats GDPPC in real form as dependent variable while Life expectancy (Health), Secondary School Enrollment (ENRS), Labour Force (LF), Physical Capital (GFCF) and R&D as explanatory variables. The results are exhibited in Table: 3.3.1. The Johansen Cointegration test results rejected the null hypothesis of no cointegration in the variables of the model. The results showed existence of two cointegrating equations at 5% level of significance. This means that the human capital affects economic growth in Pakistan in long run. Therefore, investments made in human capital can produce far-reaching outcome for the economy of Pakistan.

Education is one of the most important determinants of economic growth and keeping in view its significance, the factors which play a decisive role in its development needs to be explored. For this purpose, LEdins, LPTR, LRGDPPC, and LHealth have been used as explanatory variables in education model. Edins shows the number of educational institutions in Pakistan while Pupil-Teacher Ratio (PTR) measures the quality of institutions. The Johansen Cointegration results show that there are 2 cointegrating equations at 5% level of significance. This shows that all the explanatory variables in the model have significant long run relationship with the education. In other words the regression result derived from the non-stationary data is not spurious. The results are shown in Table 3.3.2.

Health is widely used as human capital in growth empirics. It is expected that health will affect economic growth in long run. Therefore, this becomes unavoidable to find its determinants. In equation for health, the log of life expectancy is treated as dependent variable while the log of Real GDP Per capita (LRGDPPC), Secondary School Enrollment (LENRS) and the quality of health institutions captured by Doctor Patient ratio (LDPR) are the explanatory variables. The results show the existence of 2 cointegrating equation rejecting the null hypothesis of no cointegration. All the results are significant at 5 % level of significance. This confirms the claim that the economic growth, education and R&D affect health in long run. The result is shown in Table 3.3.3.

Research and development is another important determinant of economic growth in New Growth Theory (NGT). The Gross Domestic Product (GDP), Education (Measured by School Enrollment) and Educational Institutions positively affect the R&D in a country. Along with the quantity of educational institutions, the quality of educational institutions is equally important. The quality of institutions is mostly measured by the Pupil-Teacher Ratio. The Johenson Cointegration test results reject the null hypothesis of no Cointegration in R&D and its determinants. The test confirms the presence of 3 cointegrating equations at 5% level of significance. The Johansen Cointegration test is conducted with intercept (no trend) in CE and test VAR. The trace Statistic is used for the results. The test results discard the claim that the R&D model regression of non-stationary data is spurious. The results of Johansen-Cointegration test for R&D Model are shown in Table 3.3.4.

Table: 3.3.1 Johansen Cointegration Test Result with intercept (no trend) in CE and no intercept in VAR.

The results are for economic growth model and the variables of the model are LRGDPPC LGFCF LENRS LHealth LLF LRD . The trend assumption is no deterministic trend. The lag interval is 1to 1.

Hypthesis No. of CE(s)	Eigen Value	Trace Statistic	Critical value (0.05)	Probability
None*	72	10	103.84	0.0142
At most 1*	0.594273	77.37206	76.97277	0.0466
At most 2	0.456995	44.89740	54.07904	0.2534
At most 3	0.298794	22.91445	35.19275	0.5341
At most 4	0.185094	10.13611	20.26184	0.6265
At most 5	0.073996	2.767555	9.164546	0.6250

* shows the rejection of null Hypothesis at 5% level of significance.

Table: 3.3.2. Johansen Cointegration Test Result with intercept (no trend) in CE and no intercept in VAR

The results are for education equation and the equation is
LENRS= f(LRGDPPC, LEdins, LPTR, LHealth)
Trend assumption: No deterministic trend
Lags interval (in first differences): 1 to 3

Hypthesis No. of CE(s)	Eigen Value	Trace Statistic	Critical value (0.05)	Probability
None*	0.730244	114.1798	76.97277	0.0000
At most 1*	0.667758	69.63175	54.07904	0.0011
At most 2	0.456677	32.16743	35.19275	0.1023
At most 3	0.244806	11.42568	20.26184	0.5016
At most 4	0.053769	1.879121	9.164546	0.8016

* shows the rejection of null Hypothesis at 5% level of significance.

Table: 3.3.3. Johansen Cointegration Test Result with intercept (no trend) in CE and test VAR

The results are for health equation and the equation is He= f (LRGDPPC, LENRS, LDPR)
Trend assumption: No deterministic trend
Lags interval (in first differences): 1 to 1

Hypthesis No. of CE(s)	Eigen Value	Trace Statistic	Critical value (0.05)	Probability
None*	0.536398	64.02248	54.07904	0.0051
At most 1*	0.439898	36.34822	35.19275	0.0374
At most 2	0.248469	15.48133	20.26184	0.2001
At most 3	0.134453	5.198190	9.164546	0.2624

* denotes rejection of the hypothesis at the 0.05 level

Table: 3.3.4. Johansen Cointegration Test Result with intercept (no trend) in CE and test VAR

The results are for R&D equation and the equation is
LRD= f(LRGDPPC, LENRS, LEdins, LPTR)
Trend assumption: No deterministic trend
Lags interval (in first differences): 1 to 2

Hypthesis No. of CE(s)	Eigen Value	Trace Statistic	Critical value (0.05)	Probability
None*	0.706770	114.8476	76.97277	0.0000
At most 1*	0.646700	71.90962	54.07904	0.0006
At most 2	0.462267	35.49427	35.19275	0.0464
At most 3	0.193070	13.78051	20.26184	0.3048
At most 4	0.164071	6.272387	9.164546	0.1707

* shows the rejection of null hypothesis at 5% level of significance.

CONCLUSION AND RECOMMENDATIONS

This paper started with the broad objective of exploring the role of human capital in economic growth of Pakistan during the period 1971-2008. The results showed the existence of human capital and economic growth. Human capital in all forms education health and R&D affect economic growth in Pakistan. The Real GDP per Capita and educational institutions affect school enrollment while Real GDP, Education and health institutions affect health in long run.Similarly, Real GDP per Capita, education, and Educational institutions are long run determinants of R&D in Pakistan.

The following recommendations are therefore, made on the basis of the results of the study.

1. Education is an important determinant of economic growth in Pakistan and it should be kept on top priority in economic policies. The resources allocated to education should be increased to ensure access to education for each and every individual in the country. As a first step measures should be taken for Universaliztion of Primary Education.
2. The education system in Pakistan needs to be linked with market. The trend of general education should be diverted to scientific, technical and vocational education in accordance with individual needs and resource potential of Pakistan.
3. Health in form of life expectancy appeared as statistically significant determinant of economic growth in Pakistan, which makes strong case for more investment in health. Health affects education and labour force participation rate. Therefore, it is strongly recommended that investment in health should be enhanced both on economic as well as humanitarian basis .
4. Research affects economic growth positively but the sector is neglected so far in Pakistan. The expenditures on R&D are lower than other developing countries of the region. Research in agriculture and industry is needed to increase productivity. The gap between university and industry should be bridged up to materialize the research in industrial output. It is therefore, recommended to increase investment in R&D to put the economy on path of sustained growth.

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