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Impact of educated labor force on Economic growth of Pakistan: A human capital perspective

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Abstract

A considerable body of research has concentrated on the role of human capital investment in explaining the level and variation in production and growth and it has been shown that long-term sustainable growth and development across countries is driven to a large extent by productivity growth. Most of the studies in Pakistan measure human capital by using its proxy as enrollment rate of primary, secondary and tertiary level or expenditure on education. This widespread practice has coexisted with longstanding doubts about using school enrollments as a measure of human capital since there exists a gap between school attendance and entrance into the Labor Market. Further, public expenditure on education is not enough proxy in case of Pakistan because of the fact that there is a large private education sector in the country. Taking cognizance of it, instead of using the school enrollments and public expenditure on education as a measure of human capital, this research examines the role of human capital formation described by education levels of labor force in Pakistan which is more direct measure of human capital than school enrollments and public expenditure on education. Data of educated labor force at primary secondary, tertiary and higher level is collected from Pakistan. Time series data is used from the period 1973 to 2013. The data is taken from various issues of Pakistan Economic Survey, Pakistan Labor Force Survey, Federal bureau of statistics, State Bank of Pakistan Annual reports and 50 Years statistics of Pakistan. Johnson's Cointegration, Error Correction model (ECM) and vector error correction method (VECM) Granger Causality statistical tools are used to measure the impact of human capital on economic growth in the long run and short run. Finding shows that all proxy variables of human capital in this study have significant impact on economic growth in the long run; however, some variables are found insignificant in short run. This study concludes that education is a key determinant of Economic growth.

Keywords: Human capital, Economic growth, Education levels, time series, Labor force, Granger causality.

Introduction

Neo classical theorists believe that increase in physical capital can improve economic growth. The actual investment proved to be the major contributing factor towards economic development and technological progress were exogenously determined in the Neo classical growth models e.g. Solow (1956), Romer (1987) and Barro (1991).

But since mid-1980s a wave of new growth theories focus on increasing returns not only in physical but also in human capital and claim that the main engine of economic growth is the

accumulation of human capital and the main source of differences in living standards among nations are differences in education and level of skills (Amjad, 2005).

A considerable body of research has also concentrated on the role of human capital investment in explaining the level and variation in production and growth and it has been shown that long-term sustainable growth and development across countries is driven to a large extent by productivity growth (Easterly and Levine 2001). There is also increasing evidence to show that the education and skills of the workforce are significant determinants to economic growth and raising productivity. Romer (1990) and Lucas (1988) in their endogenous growth models gave a central role to education in the economic growth process. Renelt and Levine (1992) found that education appeared to exert a high positive impact on economic growth. So, during the past century, the focus of researchers remained on the impact of human capital on economic growth by increasing the facilities of education and health. A number of empirical studies have documented a strong and positive relationship between human capital (education and health) and economic Growth (Akram, et al. 2008,Kakar et.al.2011,Naeem et.al 2012).

A significant amount of literature is also available on the aforementioned topic in Pakistan. Most of the studies measure human capital by using its proxy as enrollment rate of primary, secondary and tertiary level (Akhtar, et al. 2011 and Afzal, et al. 2012). This widespread practice has coexisted with longstanding doubts about using school enrollments as a measure of human capital since there exists a gap between individual's education attainment and his/her entrance into the Labor market.

Some other studies have used public expenditure on education sector as measure of human capital like Awan et al. (2011) khan and Rehman (2012) Qadri and Waheed (2011) which is again not good enough proxy because of existence of large private education sector in the country .

Taking cognizance of it, instead of using the school enrollments and public expenditure on education as a measure of human capital, this research examines the role of human capital formation through education levels of employed labor force in explaining economic growth in Pakistan. The indicator of human capital, taken as education of employed labor force is more appropriate than conventional literacy rate, school enrollment or average no. of schooling years.

Human capital in Developing countries- Brief Literature Review

The focus of human capital as a driver of economic growth for developing nations has led to undue interest on school attainment. Third world countries have made considerable progress in ending the gap with developed countries in terms of school attainment, but studies have underscored the importance of cognitive skills for economic development. This result shifts interest to issues of school top quality and there developing nations have been much less successful in ending the gaps with western world. Without improving school quality, developing nations will find it difficult to improve their long run economic performance. (Hnushek, 2009).

In china, Whalley(2010) produces a human capital measure in the sense of Schultz (1960) and then reevaluates the participation of human capital to China's economic development. The outcomes indicate that investment in human capital performs a much more part in China's economic development than available literature work indicates, 38.1 of economic development over 1978-2008, and even higher for 1999-2008. In addition, because individual investment development multiplied following the major academic development improves after 1999 (college registration in Chinese suppliers increased nearly fivefold between 1997 and 2007) while development rates of GDP are little changed over the period after 1999. These outcomes emphasize the significance of efficient use of individual investment, as well as the number of individual investment development, in China's development strategy.

In Malaysia and Thailand, Jiminez(2012) examined that change of sustaining economic growth over the long term is one that only a few countries have been able to prevail Slowing momentum in countries like Malaysia and Thailand has led analysts and policy makers to consider what it would take to raise them out of middle-income status, where other countries have possibly become stuck. The study examines the role of human capital formation in the quest to sustain economic growth in these two countries It argues that a good education system is fundamental to supply workers with marketable skills .Malaysia and Thailand have successfully expanded access to schooling, but the quality of education remains an issue. Modern education systems should aim to provide quality education using the following policies: prioritize budgets to deliver quality and basic education before increasing higher levels of schooling; provide appropriate incentives and rewards to teachers; permit school autonomy and ensure accountability for results; invest in early childhood development; and consider implementing income-contingent loan financing schemes to expand higher education for human capital.

Particularly in Pakistan, Abbas (2003) explored the relationship between human capital and economic development in Pakistan with aggregate time series data, the study indicates an essential role of human capital in enhancing the economy's potential to process world technical improvement. Much higher profits, such as spillovers, to additional schooling in Pakistan than in OECD financial systems are reliable with very substantial knowledge under-investment in Pakistan. In the same way, extremely large profits to health spending evaluate very positively with included just under one-fifth of the increase in Pakistan's GDP per head. Since the 90's, the impact of lacking individual financial commitment guidelines is shown by the adverse contribution to economic development.

The main objective of another research in Pakistan is to investigate about the association between individual investment and economic growth in Pakistan. The research employed co-integration and Granger Causality to determine the connection and direction of causality between public expenditure (Proxy for human capital) and economic development. Results indicated that GDP is co incorporated with the explanatory variables (Public expenses on education, Community expenses on wellness, total fixed investment development & debt Service payment) for specified time frame which means that a long lasting connection exists between GDP and public spending in Pakistan. Therefore, it is suggested to increase people expenses on wellness and knowledge, which will raise efficiency and contribute towards maintainable economic development. Imran et. al. (2007).

Furthermore, it can be concluded that earlier studies have used education as a proxy for human capital and more recent studies lay emphasis on both health and education as a proxy for human capital. The existing literature on Pakistan economy shows that appropriate proxies of human capital are not used along with recent advances in dynamic modeling. There exists a gap in the literature regarding the role of human capital on economic growth in Pakistan. The present study is an attempt to bridge this gap by analyzing the causal relationship between human Capital and economic growth using recent advances in dynamic modeling and more appropriate proxies for human capital. The results of this study may be helpful for policy makers in designing appropriate policies giving priority to the development of human capital.

Measurement of human capital

Thereafter human capital measurement is an important source in terms of suggesting and implementing policies regarding human resources.

Kwon(2009) explained that the conventional standard to measure human capital stock is largely categorized into three parts output, cost and income based approach.

Output based approach

Human capital as a school enrollment

Several studies documented impact of human capital on economic growth using school enrollments, for example Mankiw et al. (1992) empirically examine the Solow growth model with and without human capital as a factor of production and find that the human capital augmented Solow model fits in explaining cross-country income variations. The study employs a data set of 121 countries from 1960 to 1985 and applies the method of OLS for estimation. The authors use Cobb-Douglas production function consisting of output as a dependent variable while labor, physical capital and human capital are explanatory variables. The study uses a variable "School" as a proxy for human capital. Similarly, Abbas (2000) explored the relationship between education levels and economic growth. He concluded that to increase the productivity, human capital is very important for the utilization of physical capital as increase in the stock of human capital in a country attracts investment in physical capital to accelerate the output.

Some other empirical studies have tried to examine the relation between investment in human capital and economic growth. Barro and Lee (1992) have used the census-survey data from the United Nations and other sources for more than 100 countries. These figures were combined with information about school-enrollment ratios to construct a panel data set on educational attainment at five-year intervals from 1960 to 1985.

However, the method includes the drawback that a student's effectiveness can be recognized after participating in production activities.

Human capital as average number of years of schooling

In most of the earlier literature on human capital measurements, Cohan and soto (2007) build the average number of years of schooling in a country by multiplying the population's shares of educational attainment by the appropriate length (in years) of each educational category (i.e. primary, secondary and higher education). The length may vary from country to country, which is taken into account in this research. But Hanushek and Kimko (2000) conducted extensive study on this issue and according to them, level of average educational attainment does not a complete proxy of human capital. It does not account for the quality of schooling. Quality of schooling may be affected by educational infrastructures, initial endowment of human capital and access to educational services to the people.But Martin, Doppelhofer, and Miller(2004), have also considered primary school enrolments as one reasonable measure of human capital. Similarly, the average years of schooling measures.

This method includes a drawback that an individual's year of schooling can be slightly related to his/her productivity.

Human capital as educational attainment

Nelson and Phelps (1966) pointed out that a country with more human capital would be more adept at the adaptation of technologies that were discovered elsewhere. Thus, the higher the stock of human capital for a follower country, the higher the rate of absorption of the leading technology and hence, the higher the follower country's growth rate. While some economists believe that in addition to its role of enhancing economic growth, education is a powerful tool in reducing poverty, empowering people, improving private earnings, promoting a flexible and healthy environment and creating competitive economy. It plays a vital role in shaping the way in which future generations learn to cope with the complexities of economic growth (Afzal 2010).

Nehrue, swanson and dueby(1993) attempted to measure the relationship between human capital and students' "accumulated years of schooling" in the employable age of educational attainment.

It is difficult to clearly demonstrate this relationship because education is a part of regular(school) education.

Cost based approach

Cost based approach is based on measuring the stock of human capital through Summing cost invested for one's human capital.

Human capital as a public expenditure on education

Many studies have used public expenditure on education sector as measure of human capital e.g. Qadri and waheed (2011) examined the regional comparison of public expenditures on education and health sectors as a percentage of GDP along with the other education and health indicators and concluded that both the health and education sectors should be given special attention in order to ensure long run economic growth. Meulmester (1995) has shown that education expenditure has positive effects on growth. However, he suggested that this relationship is not always direct. Similarly, Bashir et. al. (2012) state that Human Capital is an essential determinant of economic growth. They also explain that education expenditures are positively associated with growth.

Gyimah-Brempong (2004) also explored that investment (health expenditure) and stock (child mortality rate) of health human capital have a positive and significant relationship with growth of per capita income. However, the relationship is quadratic. Study concludes that investment in health in LDCs will boost the economic growth in the short run and increases the level of income in the long run because investment in health become a part of Stock of human capital.

But this approach is based on indirectly measuring the stock of human capital, so it is difficult to precisely classify boundary between investment and consumption in the perspective of cost.

Income based approach

This approach is based on the returns which an individual's obtains from a Labor market throughout education investment.

Mulligan and salai-Martin(1995) defines the aggregate human capital is sum of quality adjustment of each individuals labor force and present the stock of Human capital utilizing an individual's income.

But human un-related factors can more influence an individual's income. In this sense, this approach rarely present a complete measurement for human capital but comparatively this approach is better as compare to other approaches.

From the discussion given above, it is identified that there are following ways or proxies which most of the studies used to measure the human capital:

- Health expenditure as an indicator to measure the role of human capital.(Levine, 1992).
- People aged between 12 to 17 enrolled in the secondary school. (Mankiw,1992).
- Average number of years of schooling.(cohan and soto ,2007).
- School enrolment ratios. (Barro and lee,1992).
- Public expenditure on education .(Qadri and waheed,2011)
- Expenditure on education levels. (Abbas,2000)
- Primary school enrolments as measure of human capital. (Martin,2004)
- Life expectancy (as a proxy of human capital) and schooling. Bloom et. al. (2004).

Encapsulating the above literature, there is now increasing evidence to show that the education and skills of the workforce are significant determinants to economic growth and raising

productivity. Higher level of human capital leads to higher rate of economic growth and it is related with the knowledge and skills embodied in humans that are acquired through schooling, training and experience and are useful in the production of goods, services and further knowledge. While economists commonly use education as a proxy for human capital, this widespread practice has coexisted with longstanding doubts about using school enrolments as a measure of human capital since there exists a gap between enrolment in different education levels and entrance into the labor market. Taking cognizance of it, instead of using the school enrolments and public expenditure on education as a measure of human capital, this research examines the role of human capital formation described by education levels of employed labour force in explaining economic growth in Pakistan. The indicator of human capital, taken as education of employed labour force is more appropriate than conventional literacy rate or average no. of schooling years.

Objectives of the study

- To determine the relationship between education levels of labor force and economic growth in Pakistan.

Significance/ contribution of the study

- The study is an addition in the literature of human capital and economic growth by examining the role of human capital formation described by education levels of employed labor force. This is more direct measure of human capital than school enrollments and public expenditure on education.

Methodology

The Cobb Douglas production function is a particular functional form of the production function in economics aspects, commonly used to signify the relationship between the amount of two or more inputs, particularly physical investment and labor, and the amount of outcome that can be created by those inputs. The Cobb-Douglas type was designed and examined against mathematical proof by Charles Cobb and John Douglas during 1927–1947.

$Y = AL^{\beta} K^{\alpha}$

where:

- *Y* = total production (the actual value of all goods produced in a year)
- *L* = labor input (the total number of person-hours worked in a year)
- *K* = capital input (the real value of all machinery, equipment, and buildings)
- *A* = total factor productivity
- α and β are the output elasticity of capital and labor, respectively. These values are constants determined by available technology.

Several studies at national as well as at international level have been organized to capture the effect of human capital on economic growth by using the Cobb Douglas production function is a particular functional form of the production function. Roberts(2002),Becker and Murphy et al.(1994),Glomm and Ravikumar(1992).Black and Lynch(1996),Caballe and Santos (1993).

So, in this study also a standard Cobb-Douglas production is employed where real GDP growth is taken as proxy of economic growth as dependent variables. Physical capital stock is taken as capital input while data for labor force participation rate is used to incorporate the labor input. The input of the core variable human capital is captured through the education levels of employed labor force.

Y = AKLH…….....…… (I)

And the log converted form of this function is as follows.

Log Y= log A+ á log K+ â log L+ ã log H……(II)

Where log Y is the log of real GDP as a dependent variable, log A is the log of the constant term, log K is the log of physical capital, Log L is the log of labor input measured through labor force and log H is the log of the variable (H) which is human capital input in the production process.

Sample selection

In order to investigate the impact of human capital on economic growth, data of total employed educated and illiterate labor force is selected from Pakistan. The labor force can be defined as that part of the economically active population which can supply labor for production of goods and services in the country. Pakistan has a very large labor force due to its large population size. Data of total educated labor force is disaggregated into primary, secondary, tertiary and higher level of education. The annual time series data for the period 1973- to 2013 is used.

Data sources

In this study, the annual time series data for the period 1973- to 2013 is used. The data is taken from various issues of Pakistan Economic Survey, Pakistan Labor Force Survey, Federal bureau of statistics, State Bank of Pakistan Annual reports and 50 Years statistics of Pakistan.

Model description

Following Model has been used in this research as:

Human capital as educated labor force (education levels of labor force)

Education is the most important aspect which performs a major part in human resources growth. It encourages effective and informed population and makes possibilities for the socially and economically limited segments of community. Academic viewpoint pressures on a learning process through which knowledge, skills and experience are moved from one generation to the next generation through educating, training, research and growth that eventually duplicate the socioeconomic growth of the country. Productive employees play a big part in getting the potential economic growth through competition. Educated labor force increases efficiency and increase competition (Economic survey of Pakistan, 2012-2013).

In order to estimate the relationship between the human capital and economic growth, participation of educated labor force at different education levels is used as human capital in this study.

$$Y(RGDP) = \beta_\circ + \beta_1(LFPE_t) + \beta_2(LFSE_t) + \beta_3(LFTE_t) + \beta_4(LFHE_t) + \beta_5(PHYC_t) + \beta_6\,(ILLI.LF_t) + \epsilon_t$$

The model used is based on aggregate output function so; all the variables are transformed to logarithmic form.

$$\ln RGDP = \beta_\circ + \beta_1\ln(LFPE_t) + \beta_2\ln(LFSE_t) + \beta_3\ln(LFTE_t) + \beta_4\ln(LFHE_t) + \beta_5\ln(PHYC_t) + \beta_6\ln(ILLI.LF_t) + \epsilon_t$$

Where:

Ln = Natural Log arithm

Y(RGDP) = Real GDP as a proxy for economic growth

$LFPE_t$ =Educated labor force participation with primary education level.

$EDULF_{sec}$ = Educated labor force participation at secondary education level

$EDULF_{ter}$ = Educated labor force participation at tertiary education level

$EDULF_{higher}$= Educated labor force participation at higher education level

LFPR = Illiterate labor force

PHYC = physical capital stock

β1+β2+β3+β4+ β5+β6= Parameters to be estimated for each Independent variable.

U = time series residuals

- B1 is the elasticity of real GDP with respect to labor force with primary education as input, it measures the percentage change in GDP for 1% change in labor force with primary education input, holding the Other variables constant.
- B2 is the elasticity of real GDP with respect to labor force with secondary education as input, it measures the percentage change in GDP for 1% change n labor force with secondary education input, holding the Other variables constant.
- B3 is the elasticity of real GDP with respect to labor force with tertiary education as input; it measures the percentage change in GDP for 1% change in labor force with tertiary education input, holding the other variables constant.
- B4 is the elasticity of real GDP with respect to labor force with higher education as input, it measures the percentage change in GDP for 1% change in labor force with higher education input, holding the Other variables constant.
- B5 is the elasticity of GDP with respect to physical capital as input; it measures the percentage change in GDP for 1% change labor force with physical capital input, holding the other variables constant.
- B6 is the elasticity of GDP with respect to illiterate labor force as input; it measures the percentage change in GDP for 1% change in illiterate labor force input, holding the other variables constant.

The sum ($\beta1+\beta2+\beta3+\beta4+\beta5+\beta6$) gives information about the returns to scale, that is, if sum ($\beta1+\beta2+\beta3+\beta4+\beta5+\beta6$) =1 then there are constant return to scale, that is, doubling the inputs will double the output, tripling the inputs will triple the output, and so on.

If sum ($\beta1+\beta2+\beta3+\beta4+\beta5+\beta6$) >1 then there are increasing return to scale, that is, doubling the inputs will more than double the output.

If sum ($\beta1+\beta2+\beta3+\beta4+\beta5+\beta6$) <1 then there are decreasing return to scale, that is, doubling the inputs will less than double the output.

Aziz et.al(2008) used this technique and found increasing returns to scale by adding all GDP elasticities they come up with the value 7.09, which indicates that the function exhibits the property of increasing returns to scale doubling the inputs(higher education expenditure, employment rate, and enrolment in higher education) will result in increase in the output (GDP) more than doubled.

Hypothesis

H1: There is positive impact of human capital on Economic growth of pakistan.

H1.1: There is positive impact of educated labor force at primary level on Economic growth.

H1.2: There is positive impact of educated labor force at secondary level on Economic growth.

H1.3: There is positive impact of educated labor force at tertiary level on Economic growth

H1.4: There is positive impact of educated labor force at higher level on Economic growth

H1.5: There is no impact of illiterate labor force on Economic growth

H1.6: There is positive impact of physical capital on Economic growth

Description of variables

This section gives detail about the variables used for human capital and economic growth. Since the study is aimed to find out the impact of human capital on economic growth. So Real GDP is our dependent variable and education levels of labor force are our independent variables in Cobb-Douglas production function. Narrative picture of all variables is given below.

Dependent variables

There are mainly four dependent variables in different four models. Real GDP in million rupees is used as a proxy for economic growth in first model and gdp per capita in all other three models. Barro (1991) uses GDP as a control variable including such practices become standard in literature and now GDP is a scale variable that measures the greater variability in growth rates in different economies. Following researchers have used real gdp as natural logarithm of rgdp in their time series studies as dependent variable.

Independent variables

There are four independent variables, educated labor force at primary, secondary, tertiary and higher level in first model. Two variables are derived from Cobb-Douglas production function like, Variable K is used as Physical capital and L is used as illiterate labor force from Cobb-Douglas production function. This model focuses on the education levels of primary, secondary, tertiary and higher.

Result and Discussion

In order to estimate the relationship between the human capital and economic growth, participation of educated labor force at different education levels is used as human capital in this study.

$$\ln RGDP = \beta_{\circ} + \beta_1 \ln(LFPE_t) + \beta_2 \ln(LFSE_t) + \beta_3 \ln(LFTE_t) + \beta_4 \ln(LFHE_t) + \beta_5 \ln(PHYC_t) + \beta_6 \ln(ILLI.LF_t) + \epsilon_t$$

Unit root test

In order to find out the long run relationship between the dependent and independent variables, the first step is to determine whether time series is univariate or not. Unit root test is used to check the order of stationary. To test the unit root, most widely used test is Augmented Dickey Fuller (ADF) test. Result of table reveals that all the variables are non-stationary at level so the null hypothesis of unit root at level cannot be rejected. However, at first difference null hypothesis of unit root is rejected for all the variables and therefore, all variables are 1(1). When all variables are 1(1) therefore most appropriate technique for the analysis is cointegration.

Table 1.Result of ADF Test

	At Level			1st difference		
Variables	C	C&T	None	C	C&T	None
Real GDP	-1.030 (0.733)	-1.538 (0.798)	3.517 (0.999)	-2.476 (0.004)	-3.227 (0.005)	-4.794 (0.000)
Educated labor force with primary education level	-1.545 (0.489)	-1.831 (0.669)	0.273 (0.753)	-3.252 (0.025)	-4.098 (0.014)	-3.276 (0.002)
Educated labor force with secondary education level	-1.428 (0.559)	-1.887 (0.641)	0.406 (0.796)	-3.263 (0.024)	-4.045 (0.016)	-5.930 (0.000)
Educated labor force at tertiary education level	-1.475 (0.536)	-1.804 (0.684)	0.353 (0.782)	-4.190 (0.002)	-4.170 (0.012)	-4.207 (0.000)
Educated labor force at higher education level	-1.434 (0.555)	-2.072 (0.544)	0.427 (0.801)	-6.091 (0.000)	-6.037 (0.000)	-4.207 (0.000)
Illiterate labor force	-1.568 (0.519)	-1.819 (0.704)	0.040 (0.780)	-4.172 (0.002)	-6.379 (0.001)	-3.558 (0.003)
Physical capital	-1.632 (0.695)	-1.671 (0.738)	0.780 (0.878)	-7.922 (0.000)	-8.002 (0.000)	-6.860 (0.000)

Vector Auto Regressive (VAR)

The first step in Johansen's procedure is the selection of order of Vector Auto Regressive (VAR).All the variables are in log form in all models has been used for the VAR analysis. To determine the lag length VAR model is used and according to AIC criteria, we determine the lag length of two for the model.

Table 2. Vector Auto Regressive (VAR)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	146.8118	NA	1.23e-12	-7.557392	-7.252624	-7.449947
1	402.9383	401.4957	1.78e-17	-18.75342	-16.31528	-17.89386
2	533.4671	155.2234*	2.91e-19*	-23.16038*	-18.58886*	-21.54871*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Johansen co-integration

After deter mining the lag length of three of the model, by using the VAR technique, Next step deals with determining the number of co- integration vectors. In the trace statistics the null hypothesis that there is no co-integration vector, is rejected at 1 % and the other null hypotheses about the absence of more than one co integrating vectors are also rejected which implies that there is more than one co-integrating vector in the equation. Trace test indicates 6 co integration equations at the 0.05 level, furthermore the finding of more than one co-integrating vector is supported by the results of the maximum Eigen value test. Max-eigen values test also indicates 6 co integration equations at the 0.05 level. The result of both of the statistics is summarized in table 3.

Table 3. Johansen Cointegration test

Hypothesis	Trace statistics	Maximum eigen value
R=0	362.8486*	132.9941*
$R \leq 1$	229.8545*	64.26806*
$R \leq 2$	165.5864*	57.72726*
$R \leq 3$	107.8592*	41.57470*
$R \leq 4$	66.28445*	33.46771*
$R \leq 5$	32.81675*	24.39509*
$R \leq 6$	8.421659	8.421659

Long run regression analysis

Regression analysis technique is used to investigate how independent variables affect the dependent variables i.e. analyze the impact of human capital on economic growth. Six independent variables, educated labor force with primary, secondary, tertiary and higher level, physical capital and illiterate labor force and dependent variable real GDP is used in Cobb-Douglas production function. The regression result are presented in table 4.

$$\ln RGDP = \beta_{\circ} + \beta_1 \ln(LFPE_t) + \beta_2 \ln(LFSE_t) + \beta_3 \ln(LFTE_t) + \beta_4 \ln(LFHE_t) + \beta_5 \ln(PHYC_t) + \beta_6 \ln(ILLI.LF_t) + \epsilon_t$$

Table 4. Long Run Analysis

Dependent Variable = $\ln Y_t$			
Variable	Coefficient	Std. Error	T-Statistics
Constant	16.03297***	1.107217	14.48043
$\ln(\mathrm{LFPE_t})$	1.468100***	0.406965	3.607431
$\ln(\mathrm{LFSE_t})$	0.692779**	0.292956	2.0436
$\ln(\mathrm{LFTE_t})$	1.810846***	0.634698	2.853085
$\ln(\mathrm{LFHE_t})$	0.716198*	0.435625	1.644069
$\ln(\mathrm{ILLI.LF_t})$	-1.8223***	0.169128	-10.774
$\ln(\mathrm{PHYC_t})$	0.133626*	0.046280	2.887358
R^2	0.93322	Adjusted R-squared	0.91311
F-Statistics	199.9274	Prob. Value	0.0010
Durbin-Watson stat	1.652	S.D. dependent var	0.587731

Following empirical model is derived on the basis of empirical results obtained from table 4.

$$\ln\mathrm{RGDP} = 16.03 + 1.46(\mathrm{LFPE_t}) + 0.69(\mathrm{LFSE_t}) + 1.81(\mathrm{LFTE_t}) + 0.71(\mathrm{LFHE_t}) + 0.13(\mathrm{PHYC_t}) - 1.82(\mathrm{ILLI.LF_t}) + \epsilon_t$$

This table 4 shows the names of variables, values of coefficients, standard errors, t – statistic and probability values in 1st, 2nd, 3rd, and 4th columns respectively.

Values of R – square, adjusted R – squares, Probability of F – statistic and Durbin Watson statistics are given at the end of table. With regards to educated labor force with primary education that is used as a proxy to human capital, results illustrate positive relation with real gross domestic product of Pakistan. The result is theoretically logical and econometrically significant (significant at 1 percent level). It means that more investment in primary education of labor force will cause higher level of real GDP growth. Specifically, result implies that universal primary education of labor force may raise economic growth of the country by 1.46 percent on the average. Similarly, real gross domestic product increases by 0.69 units due to one unit increase in educated labor force with secondary education. This variable is statistically significant at 5 percent level. Effects of other education levels on economic growth are also positive as indicated by the signs of coefficients. For example, labor force with tertiary education shows significant effect on economic growth at 1 percent level, e.g. one percent increase in labor force with tertiary education leads to 1.81 percent increase in real GDP. The results of human capital accumulation continue exerting strong influence on economic growth in Pakistan. Another variable labor force with higher education is also statistically significant, though at 10 percent. The analysis describes that gross domestic product will increase 0.71 unit due to one unit increase in labor force with higher education. The results are analogues to economic theory which states that human capital leads to higher real gross domestic products of a country.

Other than human capital impact on economic growth, the physical capital is also statistically significant at 1 percent. The result exhibits that one unit increase in physical capital leads to 0.13 units increase in real GDP. Labor force is another important variable in growth

accounting frame work and therefore, used in econometric model as independent variable. The labor variable is defined as total labor force less educated labor force. The result postulates that illiterate labor force retard economic growth. Negative and significant sign of this coefficient indicates that increase in illiterate labor force, leads to slowing down economic growth. The existence of significant size of illiterate labor force in total work force in the country impedes higher economic growth of Pakistan. This research signifies that one percent increase in Illiterate labor force leads to decrease real gross domestic product by 1.82 percent. The lower part of table 4.4 describes that overall model is a good fit, For example, the value of F – statistics is 199.92 and probability of F-statistic is 0.001, the value of R – square is 0.93322.It means 93% dependent variable can be explained by independent variables.

Adding all GDP elasticities we come up with the value 2.98, which indicates that function exhibits the property of increasing returns to scale i.e. doubling the inputs (labour force with primary, secondary, tertiary, education, physical capital and illiterate labour force will result in increase in the output (GDP) more than doubled. Short run analysis (Error Correction model)

Error correction model indicates the speed of adjustment towards the long run equilibrium after a short run shock. In order to check error correction following equation is estimated.

$$\Delta RGDP = \beta_{\circ} + \beta_1\Delta(LFPE_t) + \beta_2\Delta(LFSE_t) + \beta_3\Delta(LFTE_t) + \beta_4\Delta(LFHE_t) + \beta_5\Delta(PHYC_t) + \beta_6\,\Delta(ILLI.LF_t) + ECM(-1) + \epsilon_t$$

Table 5. Short Run Analysis

Dependent Variable = $\ln Y_t$			
Variable	Coefficient	Std. Error	T-Statistics
Constant	0.060707***	0.005140	11.81169
$\Delta(LFPE_t)$	-0.114229	0.087178	-1.3102
$\Delta(LFSE_t)$	0.249879***	0.091001	2.7459
$\Delta(LFTE_t)$	-0.042729	0.091449	-0.4672
$\Delta(LFHE_t)$	-0.096657	0.081552	-1.1852
$\Delta(ILLI.LF_t)$	0.307174**	0.132748	2.313960
$\Delta(PHYC_t)$	0.012572**	0.006872	1.829325
ECM_{t-1}	-0.075**	0.034973	-2.1634
R^2	0.323973	Mean dependent var	0.050246
F-Statistics	2.053843	Prob. Value	0.080570
Durbin-Watson stat	1.565210	S.D. dependent var	0.018461

The results show that estimated lagged error correction term is negative and significant suggesting error correction is happening in the model. The value of Feedback coefficient (Error Correction term) is –0.075, suggesting approximately 7.5 percent of disequilibrium in previous year is corrected in the current year. Other estimated coefficients shows that in the short run only educated labor force with secondary education and physical capital have significant impact on GDP. Illiterate labor force is also found significant in short run which was insignificant in long run. It reveals that impact of educated labor force with primary. Tertiary and higher education is only a long run

Phenomenon and in the short run there exist no significant relationship with economic growth. However, labor force with secondary education and physical capital has significant impact on GDP in both short run and long run.

Direction of causality in long run and short run

Granger Causality test among the set of variables is applied to examine the direction of causality. For this we need to determine direction of causality in long run and short run. The results of granger causality test are arranged in table. Table reports the empirical findings of the VECM granger causality framework. On the basis of probability values, we can decide about the direction of causality. This outcome explains the bi – directional and Uni-directional causality among the variables. The long run and short run analysis just shows the impact of independent variables on dependent variables and ignores the cause and effect of the variables like direction of causal relationship between the variables. This is done by granger causality approach.

Table 6. Long run and short run Granger causality

Variables	Short Run Causality							Long Run Causality
	lnRGDP	$\ln(LFPE_t)$	$\ln(LFSE_t)$	$\ln(LFTE_t)$	$\ln(LFHE_t)$	$\ln(ILLI.LF_t)$	$\ln(PHYC_t)$	
LnRGDP	….	4.571** [0.040]	2.029 [0.164]	9.543*** [0.004]	0.308 [0.583]		5.813 [0.022]	-0.068*** [-2.020]
$\ln(LFPE_t)$	6.923** [0.013]	….	0.479 [0.494]	2.051 [0.162]	46.01*** [0.000]	2.523 [0.123]	0.030 [0.864]	…… ……
$\ln(LFSE_t)$	0.389 [0.537]	0.000 [0.987]	….	2.627 [0.115]	10.78*** [0.001]	1.695 [0.203]	0.374** [0.029]	…… ……
$\ln(LFTE_t)$	7.371** [0.011]	0.069 [0.795]	1.533 [0.225]	….	0.030 [0.864]	2.589 [0.118]	15.16*** [0.000]	…… …..
$\ln(LFHE_t)$	9.23*** [0.005]	2.753 [0.108]	0.527 [0.474]	0.308 [0.583]	….	0.004 [0.949]	2.237 [0.145]	-0.625*** [-3.896]
$\ln(ILLI.LF$	0.314 [0.579]	1.622 [0.213]	32.774*** [0.000]	14.863** [0.001]	0.518 [0.477]	….	5.747** [0.023]	-0.261** [-2.767]
$\ln(PHYC_t)$	0.939 [0.340]	3.140*** [0.087]	1.717 [0.200]	1.306 [0.262]	0.986 [0.329]	0.698 [0.410]	….	…… …

Long run Granger causality analysis

We find the impact of independent variables on dependent variable e.g. long run causality is found between all the independent variables and dependent variable as real GDP and in other equations all independent variables have not long run impact on dependent variable except labor force with higher education and illiterate labor force.

Short run Granger causality analysis

labor force with primary, tertiary education and illiterate labor force granger cause real GDP and real GDP also bi-directional granger cause labor force with primary and tertiary education and uni-directional causality found between real GDP and illiterate labor force. Labor force with primary education is bi-directional granger caused by real GDP and labor force with higher education. Labor force with secondary education is granger caused by physical capital and labor force with higher education. Labor force with tertiary education is bi-directional granger caused by real GDP and uni-directional by physical capital. Labor force with higher education is granger caused by real GDP. Illiterate labor force is granger caused by physical capital and labor force with secondary and tertiary education.

In a nut shell, combining the results from model no 1, there is positive impact of human capital on economic growth in the long run. Long run causality is also found between all the independent variables and dependent variable as real GDP. Adding all GDP elasticity we come up with the value 2.98, which indicates that function exhibits the property of increasing returns to scale i.e. doubling the inputs (labour force with primary, secondary, tertiary, education, physical capital and illiterate labour force will result in increase in the output (GDP) more than doubled. This property of the function recommends more Government investment on education of labour force.

Role of Human capital is measured by the educated labor force at primary, secondary, tertiary and higher level. Positive relationship between the educated labor force and economic growth is also found by the Griliche (1997). He contributed in the literature and considered the educated labor force very productive as employed by sectors like scientist, professionals and technicians in Israel.

Hanushek et.al also found a stable, strong and consistent relationship between labor force and economic growth. The increasing size of the global workforce is giving an opportunity to gain economic expansion and accelerate gross domestic product (GDP).

In this study Cobb-Douglas is implied, so, other variables physical capital has significant effect while illiterate labor force has negative impact on economic growth. Asghar et. al. (2011) also found insignificant effect of labor force on economic growth. The better part of the Bergheim's study contributed in literature is, an increase in female participation as a labor force participation is also observed in an economy through education. But along with education, experience is also considered very important in productivity growth because it decreases the chances of errors and increases the growth in a given period of time.

Aziz et.al, (2008) also found the negative sign of labor force participation rate as a variable of Cobb-Douglas production function. Illiterate labor force has positive and significant relationship with economic growth in short run. So it is strongly recommended that government should invest in education sector in order to have more productive human capital as well as labor force and it is likely to bring more benefits to the economy.

In china FCai et al, (2002) analyze China's regional disparity and suggested that China's 392 regional economic growth is affected by the labor market distortions and cause disparities. Removing obstacles to the development of 393 labor markets will increase growth in lagging regions and help narrow regional gaps. While measuring the impact of labor force on economic growth of developing countries, cheng et.al (2011) explored various factors which have contributed to China's rapid economic growth and analyzed the relationship between labor force and economic growth for a long time, China has already taken cheap labor resources as a comparative advantage but over-reliance on cheap labor advantage may lead to lose the ability to innovate, which will face a situation of unsustainable development. So, findings revealed that promoting the improvement of the labor quality and consumption capabilities, it will produce a stable growth solid foundation for China's economy for a long time.

Economy of a country depends upon labor productivity which relies on education. In the long-run, growth of educational opportunities and level of education attained by the individual leads to the economic growth rate and household income (Seebens and Wobst, 2003).

Jimenez (2014) investigated the relationship between an economically active population, human capital and technology in Mexico and found positive effect of technology on economic growth. Chatterj (1998) measured human capital by using its proxy as enrollment rate of primary, secondary and tertiary level .

In Pakistan, Iqbal and zahid(1998) have explored positive relationship between the primary school enrolment-labor force ratio (proxy of human capital) and Growth. Enrolment in primary

schools level, middle schools level, high schools level, and other educational institutions (i.e., secondary vocational, arts and science colleges, professional colleges, and universities) as a percentage of total employed labour force are also taken as proxies for human capital in Pakistan.Quantitative evidence shows that primary school enrolment-labor force ratio (proxy of human capital) has positive and significant relationship with real GDP growth. Results implies that primary education is an important precondition for accelerating growth. Therefore, primary education must be considered as the foundation-stone upon which the economic development in Pakistan can be erected. This finding is also supported by the idea of Barro (1991); Becker et al. (1990) and Barro and Becker (1989), who argued that primary school enrolment-labour force ratio measured as human capital leads to higher economic growth.Similarly, simulations of Birdsall et al, (1993), based on regression, revealed that Pakistan would have increased current per capita income by 25 percent if it had Indonesia's 1960 primary school enrolment rates. Primary education must be provided by the Government to all school-age children to improve the literacy rate within a minimum time-span. Average annual share of primary school enrolment in total enrolment has been observed about 70 percent during the period under consideration. Similarly, raising the stock of physical capital would also help to contribute to growth. But, the Government must make sure the provision of sufficient physical capital (including proper infrastructure), with effective private sector participation, in order to prolong economic growth. According to the economic survey of Pakistan 2012-2013, “National Education Policy (2009) is under implementation to address the issues of Access, Equity and Quality of Education at all levels. The salient features of NEP include: i) Free and universal primary education by 2015 and up to class 10 by 2025. (ii) The government is committed to allocate 7% of GDP to education by 2015”.

To set moral, social and economic standards of any nation, education plays a vital role. Education has a strong impact on thoughts, beliefs and planning of future policies of the nations. Due to the organized structure of education, developed nations are striving towards economic and political stability.

The Government of Pakistan is also fully devoted towards the attainment of the millennium development goals (MDGs) Goal 2 and Goal3 which focus towards development of education like Goal2 aims to achieve universal primary education (UPE) and Goal3 aims to eliminate gender disparity in primary and secondary education all levels of education by 2005.(Economic survey of Pakistan,2012-2013).

Conclusion

Human capital is generally considered as a positive contributor in the economic growth. This study is an addition in the literature of human capital and economic growth by examining the role of human capital formation described by education levels of employed labor force like labor force with primary, secondary, tertiary and higher education. This is more direct measure of human capital than school enrollments and public expenditure on education. Cobb-Douglas production function is implied and time series data is used from the period 1973 to 2013.Results revealed that there is positive impact of human capital (educated labor force) on economic growth in the long run. Illiterate labor force has significant impact only in short run. So, it is recommended that Government should invest more in education sector in order to have more productive labor force.

This research concludes that human capital is very important for the utilization of physical capital as increase in the stock of human capital in a country attracts investment in physical capital to accelerate the output .Results also provide evidence that if human capital inputs (H), physical capital, labor force are double, the national output will be more than double in the long run. So, this research implies that investment in men can accelerate productivity at macro level.

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