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Abstract

Health plays significant part in the growth of human capital and it is only in very current times that studies have started looking at health. This study attempts to estimate the relationship between health status and economic growth. Cobb-Douglas production function is implied and time series data on health expenditure as percentage of GDP, life expectancy, infant mortality rate, physical capital, labor force participation rate and economic growth is utilized for the span of 1972-73 to 2012-13 of Pakistan. Statistical tools like Johnson's Cointegration, Error Correction model (ECM), vector error correction method (VECM) and Granger Causality are used to measure the impact of human capital on economic growth in the long run and short run. "The result shows the positive impact of a strong human capital on economic growth despite the fact that Pakistan has been spending less of GDP in the proportion of health facilities for the development of human capital. The study concludes that in order to maximize the benefits of human capital, there is a need to formulate and implement effective economic policies related to the provision of health facilities to the people".

Keywords: Health, Economic Growth, Human Capital, time series, Cobb-Douglas Production Function

Introduction

Human capital plays a vital role in the modern theory of growth and in labor economics (Mincer, 1958).So the most important determinant of human capital is Education which affects the growth level through different ways. It is a direct source to enhance the knowledge and consequently increase the output level in the economy and it leads to an increased female labor force participation in the economy (Bergheim, 2005).

While some economists believe that in addition to its role of enhancing economic growth, education is a powerful tool in reducing poverty. " 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.

Brempong (2004) believes that investment (spending on health) and stock (mortality rate) of the health of human capital has a positive and significant relationship with per capita income growth.

Bhargava, et al. (2001) found a positive correlation between adult survival and economic growth rate. But the fertility rate variable has an inverse relationship with economic growth,high fertility rate reduces economic growth by placing an additional burden on scarce resources".

Taking note of it, rather than the study of school enrolment as a measure of human capital, this research address the role of human capital formation through the health indicators in the interpretation of economic growth in Pakistan. This study uses health expenditures as a percentage of GDP , average life expectancy , infant mortality, physical capital, the rate of participation in the labour force ,as the proxy of human capital and dependent variable is economic growth for the period from 1972-1973 to 2012-13 in the case of Pakistan

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.

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

1. Health expenditure as a indicator to measure the role of human capital(Levine 1992),

2. average number of years of schooling (cohan and soto,2007)

3. school enrolment ratios (barro and lee,1992)

4. as a public expenditure on education,(qadri and waheed,2011)

Methodology and Data analysis

Data sources

In this study, annual time series data for the period of 1973 to 2013 is used. The data is taken from economic survey of Pakistan, Pakistan Labour Force Survey, the Federal Bureau of Statistics and the annual reports of the State Bank of Pakistan and Pakistan 50 years statistics .

Model description

Following Model has been used in this research as:

$$RGDP = \beta_{\circ} + \beta_1(HEXP_t) + \beta_2(INFANT.MR_t) + \beta_3(LIFEXP_t) + \beta_4(PHYC_t) + \beta_5(LF_t) + \epsilon_t$$

$$lnRGDP = \beta_{\circ} + \beta_1 ln(HEXP_t) + \beta_2 ln(INFANT.MR_t) + \beta_3 ln(LIFEXP_t) + \beta_4 ln(PHYC_t) + \beta_5 ln$$

Following tests are used to analyse the time series data.

Unit root test

Table1. Unit root test

	Level			Ist 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)
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)
Labour force participation rate	-1.708 (0.419)	-1.959 (0.604)	0.010 (0.680)	-4.072 (0.003)	-6.079 (0.000)	-3.258 (0.002)

Health expenditure	0.299 (0.975)	-2.013 (0.576)	1.227 (0.941)	-3.039 (0.041)	-7.235 (0.000)	-6.027 (0.000)
Life expectancy	-1.167 (0.677)	-3.198 (0.111)	1.499 (0.964)	-3.987 (0.004)	-4.721 (0.003)	-3.377 (0.001)
Infant mortality rate	0.393 (0.980)	-1.448 (0.830)	-1.312 (0.172)	-4.291 (0.002)	-5.731 (0.000)	-5.245 (0.000)

Vector Auto Regressive (VAR).

Table 2. Vector Auto Regressive (VAR) Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	150.2588	295.312	3.66e-12	-9.307017	-9.029471	-9.216544
1	344.1480	300.2156	1.45e-16	-19.49342	-17.55060	-18.86011
2	446.1279	59.38698*	6.6717*	-21.4276*	-19.1542*	-19.7086*

Johansen co-integration

Table3. Johansen co-integration test

Hypothesis	Trace statistics	Maximum eigen value
R=0	163.9357*	52.08171*
$R \leq 1$	111.8540*	42.31877*
$R \leq 2$	69.53518**	28.49864
$R \leq 3$	41.03654	20.50267
$R \leq 4$	20.53387	15.50526
$R \leq 5$	5.028609	5.028609

Long run regression analysis (Long run determinants of Economic Growth)

$$\ln RGD = \beta_{\circ} + \beta_1 \ln(HEXP_t) + \beta_2 \ln(INFANT.MR_t) + \beta_3 \ln(LIFEXP_t) + \beta_4 \ln(PHYC_t) + \beta_5 \ln(LF_t) + \epsilon_t$$

Table4.Long Run Analysis

Dependent Variable = $\ln Y_t$			
Variable	Coefficient	Std. Error	T-Statistics
Constant	9.4043***	1.710414	5.498265
$\ln(HEXP_t)$	0.2258***	0.040568	5.567474
$\ln(INFANT.MR_t)$	0.060811	0.060488	1.005340
$\ln(LIFEXP_t)$	0.129742	0.428039	1.303107
$\ln(PHYC_t)$	0.0688***	0.021788	3.162175
$\ln(LF_t)$	0.7213***	0.194104	3.716251
R^2	0.9232	Adjusted R-squared	0.9101
F-Statistics	1067.759	Prob. Value	0.0000
Durbin-Watson stat	1.752	S.D. dependent var	0.5892

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

$$\ln RGDP = 9.40 + 0.225(HEXP_t) + 0.06(INFANT.MR_t) + 0.12(LIFEXP_t) + 0.068(PHYC_t) + 0.72(LF_t) + \epsilon_t$$

Health expenditure is used as a proxy of human capital, results described positive relation with real gross domestic product of Pakistan. Labour force is another important variable in growth accounting frame work and therefore, used in econometric model as independent variable. The labour variable is defined as total labour force and it shows highly significant effect on economic growth at 1 percent level, e.g. one percent increase in labour force leads to 72 percent increase in real GDP. "Other than human capital impact on economic growth, the physical capital is also

statistically significant at 1 percent. The result shows that one unit increase in physical capital leads to 0.13 units increase in real GDP. The lower part of table 4 describes that overall model is a good fit, For example, the value of F – statistics is 1067.75 and probability of F-statistic is 0.000, the value of R – square is 0.913.It means 91% dependent variable can be explained by independent variables".

Short run analysis (Error Correction model)

$$\Delta RGDP = \beta_{\circ} + \beta_1 \Delta(HEXP_t) + \beta_2 \Delta(INFANT.MR_t) + \beta_3 \Delta(LIFEXP_t) + \beta_4 \Delta(PHYC_t) + \beta_5 \Delta(LF_t) + ECM_{t-1} + \epsilon_t$$

Table-5 Short Run Analysis

Dependent Variable = $\ln Y_t$			
Variable	Coefficient	Std. Error	T-Statistics
Constant	0.0405***	0.005155	7.863895
$\Delta(HEXP_t)$	0.0543***	0.020941	2.594562
$\Delta(INFANT.MR_t)$	-0.011000	0.028173	-0.390447
$\Delta(LIFEXP_t)$	0.113923	0.133075	0.856079
$\Delta(PHYC_t)$	0.0154***	0.004697	3.292380
$\Delta(LF_t)$	0.015036	0.139405	0.107858
ECM	-0.246***	0.076957	-3.199232
R^2	0.375019		0.250
F-Statistics	3.00023	Prob. Value	0.020376
Durbin-Watson stat	1.630	S.D. dependent var	0.018346

Direction of causality in long run and short run

Table6.Long run and Short Run Granger causality analysis

Variables	Short Run Causality						Long Run Causality
	LnRGDP	$\ln(PHYC_t)$	$\ln(LIFEXP_t)$	$\ln(LF_t)$	$(INFANT.MR_t)$	$\ln(HEXP_t)$	
lnRGDP	….	1.271 [0.306]	2.384* [0.081]	1.322 [0.287]	1.318 [0.288]	3.474** [0.021]	-0.240*** [-2.979]
$\ln(PHYC_t)$	2.336* [0.080]	….	0.252 [0.905]	5.17*** [0.003]	1.349 [0.277]	1.691 [0.181]	…… …… …
$\ln(LIFEXP_t)$	1.173 [0.349]	1.688 [0.188]	….	0.827 [0.522]	0.830 [0.515]	0.879 [0.493]	-0.473** [-2.613]
$\ln(LF_t)$	0.180 [0.946]	0.621 [0.650]	0.083 [0.986]	….	1.911 [0.137]	1.338 [0.281]	…… …… ……
$\ln(INFANT.MR_t)$	3.471** [0.020]	4.798*** [0.004]	2.900** [0.040]	3.003** [0.03]	….	5.08*** [0.003]	…… …… ….
$\ln(HEXP_t)$	0.707 [0.593]	2.004 [0.122]	0.106 [0.979]	1.211 [0.32]	0.668 [0.619]	….	-0.488*** [-2.055]

Conclusion

The result clearly depicts that Pakistan can maintain the highest level of economic growth by increasing more financial resources to improve the quality of health services. This study found a positive relationship between the health of human capital and economic growth.Educated and healthy workforce always remain an invaluable asset for the country. The results of this research with previous research in all parts of the world are of the opinion that the development of human health brings a positive, tangible results in the field of social and economic development of the country. The second variable is used as an indicator of human capital in this research is the average life expectancy which directly contribute to the GDP. The average life expectancy enhances the incentive to invest in the acquisition of skills, average life expectancy variable has a positive impact on economic growth, which was very much expected". use of time-series data for the period 1973-2013 and the implication of production function Cobb-Douglas to assess the role of human capital in the economic growth of the country found health indicator of human capital to be a very important determinant of economic growth". However, the analysis depicts that the infant mortality variables and life expectancy have minimal impact on economic growth". "This research concludes that human capital is very important for the use of physical capital with an increase in the stock of human capital in a country that attracts investment in physical capital to accelerate production. The results also provide evidence that the human if the input (H), physical capital, and labor force are double, and national output will be more than doubled in the long term. Therefore, this research means that the investment in men can accelerate productivity at the macro level.

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