Human Capital-Economic Growth Nexus: A Causality Analysis for Pakistan

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ABSTRACT

This paper concentrates on the role of human capital in economic growth of Pakistan during the period 1971-2012.Granger Causality test has been used as analytical technique for this purpose. The study used research and development (R&D), education and health as proxies for human capital. The results confirm the role of human capital in the economic growth of the study area. The resultsshow that human capital in form of research and development (R&D) Granger caused economic growth during the study period. Moreover, unidirectionalcausal relationships existamong different levels of education, physical capital, R&D and economic growth. Realizing the significance of human capital for sustained economic growth of the country, itis suggested to increase investment in R&D, health and education sector of Pakistan.

JEL Classification: E24,O47, H52,O32, J21
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INTRODUCTION

The role of human capital in economic growth has always been a topic of debate for growth economists across the world. The concept of human capital became popular in 1960s when augmented form of the pioneer models of Solow (1956) and Swan (1956) were used but it was formally introduced in New Growth Theories (Khan, 2011). Since then, it became an integral part of economic growth literature. The New Growth Theories (NGTs), also known as endogenous growth theories modified the contribution of Schultz (1961), Arrow (1962) and Uzawa (1965) which resulted in inclusion of few indicators in form of school enrollment, Research and Development (R&D), health and education expenditures, life expectancy, and labour into the theory of economic growth. Similarly, Formal education and on-the-job training also emerged as determinants of economic growth[4]. In 1993, G.S Becker called expenditure on education, training and health as investment in human capital.

The human capital and economic growth relationship remained a significant topic in literature. Different techniques have been used for this purpose round the world. Sankay*et al* (2011) found causal relationship between the human capital and economic growth in Nigeria. Similarly, Awel (2013) got bidirectional relationship between human capital and economic growth in Sweden. Asghar*et al* (2012) found unidirectional causality from economic growth to education in Pakistan and economic growth to health in Pakistan by using time series data for the period 1994-2009. Imran et al (2012) considered expenditure on education and health significant for economic growth as longrun relationship was found in his study. Eigbiremolen and Uchechi (2014) suggested human capital development as indispensible for sustainable economic growth in Nigeria which can be done through infrastructural development and huge allocations to education and health sectors. Similarly, Meulemeester and Denis (1995), In and Chris (1997), Chuang (2000), Mayer (2001), Narayan and Russel (2004),Guloglu and Tekin (2012), AKCY (2011) and Sadraoui*et al* (2014) mulled over human capital as an integral part of sustained economic growth both in developed and developing countries of the world.The investigations of Pegkas (2014) showed bidirectional causal relationship between secondary level of education and economic growth in Nigeria while primary education remained ineffective which provides a space for further research. Research and Development (R&D) is emerging as another important device for sustained economic growth in developing countries. Khan and Naeem (2013) quoted Aghion and Howitt (1992) who are of the view that R&D can result in innovation, which will improve the quality and quantity of output. The research firms enjoy the monopoly profits obtained after each innovation which are destroyed by next innovation.This paves way for the role of R&D in developing countries.

Realizing the importance of human capital, the developing countries are struggling hard to transform its huge unproductive human resources into skilled and professional labour force. They are doing so just because they have to improve the quality of human resources if they want to follow the rich countries (Barro, 1991). Pakistan, a country of 184.5 million people and 6th most populous country of the world, has huge pool of human resources. These resources can play an important role in economy if properly utilized. The investment in human capital is very low in Pakistan. It is mostly made in education and health sectors.The expenditure on education and health in Pakistan is much lower than the expenditure required for sustainable economic growth. Pakistan spent 0.78 % of its GDP on health in 1990s (State Bank of Pakistan, 2005). Health expenditure remained 0.56 % of GDP during the period 2000s. The life expectancy in Pakistan

[4] See Lucas (1988) for reference.

was 65 years as compared to 73 years in China in 2007. However, it increased to 66 years in 2012-13 (Economic Survey of Pakistan, 2012-13).

Investment in education is considered as investment in human capital. It gives not only market but also non-market benefits. It provides non-market benefits in form of parenting and leisure also. It was observed that the growth rate of US economy slowed down in 1970s. Investment in human capital as well non-human capital was suggested in order to bring back the economy on track of rapid economic growth (Jorgenson and Fraumeni, 1992). Education sector in Pakistan fortunately succeeded in getting more attention than the health sector. The expenditure on education was on the average 2.13 % of GDP during 2000s (Economic Survey of Pakistan, 2008-09). Unfortunately, Pakistan is still striving hard to achieve the required a higher literacy rate even after 67 years of its independence. The literacy rate in Pakistan is 58 % for both sexes (Economic Survey of Pakistan, 2012-13). The enrolment at all levels is increasing but the pace is very slow. Khan and Naeem (2013), Khattak and Khan (2012a) and Khattak and Khan (2012b) consider R&D, education and health as significant sources of economic growth in Pakistan .Azam and Ather (2015) found human capital and foreign direct investment critical for sustained economic growth. Ali *et al* (2012) found human capital not only as a source of economic growth for Pakistan but also highlighted its inner role for the development of society.

The economic growth performance of Pakistan remained very good during 1980s. The economic growth rate of Pakistan on average was 6.4 % in 1980s (State Bank of Pakistan, 2005). However, it fell to 4.8 % and 4.6 % during 1990s and 2000s (State Bank of Pakistan, 2005; Economic survey of Pakistan, 2008-09). The economic growth rate remained 3.6 % in 2012-13 (Economic Survey of Pakistan, 2012-13).

Fewer studies have been conducted to explore causal relationship between human capital and economic growth in Pakistan. Moreover, no study has so far studied the causal relationship between human capital with different proxies and economic growth in Pakistan which has created a gap in existing literature relevant to Pakistan. Most of studies have used school enrollment or years of education as proxy for human capital and investigated its relationship with economic growth. This paper fills the gap as it is an attempt to investigate the existence of any possible causal relationship between human capital and economic growth in Pakistan. The study has used different proxies for human capital. The significance of human capital on a number of other variables have also been discussed in this paper.

MATERIALS AND METHODS

This paper is based upon secondary data for the period 1971-2012. The data has been taken from State Bank of Pakistan,Economic Survey of Pakistan,World Development Indicators, United Nations Educational Scientific and Cultural Organization, Human Development Reports issued by UNDP,Social Indicators of Pakistan, Government of Pakistan and Pakistan Integrated Household Survey.

Model for estimation

If two variables 'X_i' and 'Y_i' are cointegrated, then there are four possibilities. First possibility is that 'X_i' may cause 'Y_i'. Secondly 'Y_i' may cause 'X_i'. Similarly it is possible that 'X_i' may cause 'Y_i' and 'Y_i' may cause 'X_i'. In first two cases the causality is unidirectional while in the third case the causality is bidirectional. The fourth case may be such that neither 'X_i' causes y nor 'Y_i' causes 'X_i' which shows the existence of no causal relationship.

The use of Granger-Causality tests is very common in economic growth empirical literature. In case of two variables X_t and Y_t, Y_t is said to granger cause X_t, if it is better predicted by using past values of Y_t as compared to the case when these values are not used.

GCT has been widely used in empirical growth literature. Ghali (1997), Chuang and Cesar (2000), Bader and Aamer (2003), Hsieh and Kon (1994), Vanhoudt (1998) used GCT for studying the impact of different factors on growth in different regions of the world. The use of GCT for human capital and economic growth nexus is also not very uncommon. Self and Richard (2004) used GCT for education and economic growth relationship in India for the period 1966-96, and found the direction of causality from primary and secondary education to economic growth. The causality from primary education to economic growth seemed stronger than the causality of secondary education to economic growth. Mayer (2001), Narayan and Russel (2004), Meulemeester and Denis (1995)[5] and a number of other studies used GCT for studying the causal relationship between human capital and economic growth in one form or other. These studies found significant causal relationships from human capital to economic growth and in some cases bidirectional relationships. However, Diebalt and Litago (1997) argued that the relationship between education and economic growth can neither be approved not disapproved by using single time series. (Chaung, 2000), found positive significant Granger causality from higher education to economic growth and bidirectional causality from exports to economic growth in Taiwan.

The present study intends to check the causal relationship between human capital and economic growth in Pakistan because rare studies have been conducted to check such relationship. In order to achieve the objectives of the study, the causal relationships Primary education-economic growth, Secondary education economic growth, health and economic growth and R&D- economic growth have been analyzed by using the GCT test procedure.

The general form of the model[6] is

$$y_i = \sum_{i=1}^{n} \beta_0 \, x_{t-i} + \sum_{i=1}^{n} \beta_1 \, y_{t-i} + u_i$$

$$x_i = \sum_{i=1}^{n} \gamma_0 \, y_{t-i} + \sum_{i=1}^{n} \gamma_1 \, x_{t-i} + u_i$$

Nelson and Charles (1982), and Hall (1978) analyzed the relationships of the time series variables and found that in most of cases, these variables track random walk. Granger and Newbold (1974), Granger (1986), Philips (1986) and Ohanian (1988) concluded that regression results from non-stationary time series can be spurious. It is therefore, better to conduct test for unit root before analyzing the time series for long run relationship. The mean and variance of stationary time series remain constant over time and the auto covariance also do not vary with over time[7]. Therefore, to get reliable results test for Unit Root has been conducted by using Augmented Dickey Fuller (ADF) technique.

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[5]Mayer(2001) used Granger Causality Test for the investigation of causal relationship between health and economic growth, Narayan and Russel (2004) found bidirectional causality in human capital and exports, Meulemeester and Denis(1995) found causal relationship in higher education and economic development in Sweden, United Kingdom,Japan and France but not in Italy or Australia.

[6] See Gujarati (2003)

[7] Enders, Walter. (2004). *Applied Econometric Time Series.* Second Edition, John Wiley & Sons, Inc., River Street,Hoboken, New Jersey.

RESULTS AND DISCUSSION

First of all the data was checked for the existence of unit root. The test was conducted for all variables in log form. The lag length was selected by Akaike Information Criteria (AIC)[8].
The ADF test 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 checked 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 test was repeated with assumption '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, Secondary School Enrollment, Elementary School Enrollment, Gross School Enrollment, High School Enrollment, Health, Research and Development are stationary when first difference is taken. The Results are shown in Table I.

The results of Granger Causality Test confirm the presence of 10 significant causal relationships. All causal relationships are unilateral. As all variables are non-stationary in log level form, therefore, all variables are taken in log differenced form. The causality between the GDP per capita (Real) and Gross School Enrollment (ENRG) is unidirectional. The direction of causality is from GDP per Capita to ENRG. This highlights the fact that with increase in the GDP per Capita, the incentives for education increases. The people with increased resources are in better position to send their children to school. The relationship is statistically significant at 5% level of significance. The second significant causal relationship is Gross School Enrollment (ENRG)-Elementary School Enrollment (ENRP) relationship. The relationship is unilateral and the direction of the causality is from ENRG to ENRP. This indicates the fact that enrollment at all level of school is expected to push up the elementary school enrollment. The results are displayed in Table III.

The human capital in form of education at elementary level is also found to have a causal relationship with Physical capital at 10% level of significance. The relationship means that human capital at elementary level increase the productivity of labour which through other channels leads to the accumulation of physical capital. The secondary education and higher education granger cause elementary education. The results are statistically significant at 1% level of significance. This highlights the facts that higher levels of education acts as incentives for lower level of education. A very important unilateral causal relationship is between higher education and R&D in Pakistan. The relationship is unidirectional and the direction of causality is from higher education to R&D. This means that higher education does play significant role in Research and Development in Pakistan.

The existence of causal relationship between R&D and GDP Per Capita is another significant relationship among the results of the GCT. The direction of the causality is from

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

R&D to GDPPC (Real). This is one of the most important relationship which shows the promotion of R&D in the economy leads to push up the GDPPC in the study area. This points out the significance of the development of R&D activities for economic growth. The R&D is also found in significant causal relationship with ENRG and ENRP. The Direction of causality is R&D →ENRG and R&D→ ENRHE. This means that the R&D is expected to promote the educational activities. This can be done by suggesting remedies to the educational problem or obstacles through promotion of R&D in the country.

The presence of causal relationship between the physical capital and economic growth is also a noteworthy. The direction in this case is from physical capital to economic growth. The means that being an important factor of production increase in physical capital leads to pushup the economic growth in Pakistan. The result is accordance with the conclusions drawn in economic growth literature. The primary education is found in causal relationship with labour force. The direction of the causality is from the primary education to labour force. This should be taken in senses that increase in the primary education increases the labour force participation.

The GCT results show no bilateral causal relationship among the selected set of variables. Although some independent type of the relationships are there like Enrollment at Secondary level (ENRS)- Real GDPPC, Enrollment at Secondary level (ENRS)- R&D, Health- GDPPC, Health- Enrollment at different school levels, R&D- Physical Capital, Physical Capital- R&D and Labour Force – GDPPC. All these relationships are statistically insignificant.

CONCLUSION AND SUGGESTIONS

This paper concentrated on the impact of human capital on economic growth of Pakistan using Granger Causality Test. Results show that causal relationship exists between human capital and economic growth in Pakistan. The results confirm presence of eleven significant causal relationships among the variables of the study. All causal relationships are unilateral. Human capital in form of Research and Development has causal relationship with Economic Growth and the direction of causality is from R&D to economic growth. This point out the significance of R&D for sustained economic growth of the country[9]. Similarly, Education in form of gross enrollment has causal relationship with economic growth[10] and the direction of causality is from economic growth to education. Health in form of life expectancy, school enrollment at secondary level and higher education cause elementary school enrollment which seems logical. Moreover, the study results confirm causal relationship in R&D and higher education. Similarly, Physical capital in Pakistan cause economic growth which is in line with theories of economic growth.

It is therefore suggested to leave no stone unturned for universalization of primary education. This will increase enrollment at other levels of education as well and through their mutual relationships as indicated by the causal relationships, it will play its role in achievement of economic growth. The expenditure on R&D in Pakistan needs to be accelerated, which will help in fetching sustained economic growth.

This paper is limited to single analytical technique, Granger Causality Test and data from 1971 to 2012. The future researchers can take the overall period since inception of Pakistan till now. The impact of human capital on economic growth can also be checked by using other

[9]This is the confirmation of the results obtained by Khan and Khattak (2013)
[10] The same result was derived by Khattak and Khan (2012a)

econometric techniques.This paper provides basis for future research in the study area at provincial and district level. Moreover, intercomparison of the impact of human capital on economic growth and other macroeconomic variables further provide space for perspective researchers in the field of economics.

Table: I ADF Test Results with the assumption "With intercept but No Trend"

Variable	Level			1st Difference		
	t-Statistic	Critical value (5% level of sig)	P-value	t-Statistic	Critical Value (5% level of sig)	P-Value
LRGDP	-0.7820[0]	-2.9434	0.8125	-5.9552 [1]	-2.9484	0.0000*
LGFCF	-1.1922 [1]	-2.9458	0.6672	-6.1723[0]	-2.9458	0.0000*
LLF	0.7813[1]	-2.9458	0.9923	-7.7544 [0]	-2.9458	0.0000*
LENRP	-0.6678[0]	-2.9434	0.8425	-5.8975 [0]	-2.9458	0.0000*
LENRG	-1.1900[0]	-2.9434	0.6685	-5.0206[0]	-2.9458	0.0002*
LENRS	-0.5908 [0]	-2.9434	0.8607	-5.3518[0]	-2.9458	0.0001*
LENRHE	-0.1939[0]	-2.9434	0.9305	-5.1899[0]	-2.9458	0.0001*
Lhealth	-0.6078[0]	-2.9434	0.8568	-6.3426[0]	-2.9458	0.0000*
LRD	-1.3174 [0]	-2.9434	0.6112	-5.1376[0]	-2.9458	0.0002*

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.

Table II ADF Test Results with trend assumption "With Trend And Intercept"

Variable	Level			1st Difference		
	t-Statistic	Critical value (5% level of sig)	p-value	t-Statistic	Critical Value 5%	P-Value
LRGDPPC	-2.1706[2]	-3.5443	0.4904	-5.9868[1]	-3.5443	0.0001*
ENRE	-1.6896[0]	-3.5366	0.7358	-5.8570[0]	-3.5403	0.0001*
LENRG	-0.7837[0]	-3.5366	0.9581	-5.0886[0]	-3.5403	0.0011*
LERNHM	-1.5677[0]	-3.5366	0.7865	-5.2966[0]	-3.54032	0.0006*
LENRHE	-2.0475[0]	-3.5366	0.5569	-5.1044[0]	-3.5403	0.0011*
LHealth	-2.8782[0]	-3.5366	0.1808	-6.2637[0]	-3.54032	0.0000*
LRD	-2.1337[0]	-3.5366	0.5109	-5.1302[0]	-3.54032	0.0010*

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.

Table III Results of Granger Causality Test

Dependent Variable	RGDPG	ENRG	ENRE	ENRS	ENRHE	Health	R&D	GFCF
RGDPG	-	3.26573 (0.0366)** →	0.7978 (0.5063)	1.24484 (0.3129)	0.6781 (0.1952)	0.13710 (0.9370)	1.25203 (0.3105)	1.13597 (0.3522)
ENRG	3.26573 (0.1692)	-	4.3183 (0.0134)** →	1.92577 (0.1492)	0.8739 (0.4668)	0.18575 (0.9052)	0.97453 (0.4192)	0.12101 (0.9469)
ENRE	1.7012 (0.1913)	0.2864 (0.8348)	-	0.1052 (0.9563)	0.3107 (0.8174)	0.2065 (.8910)	1.7059 (0.1903)	2.5392 (0.0784)*** →
ENRS	2.02543 (0.1340)	0.25675 (0.8558)	315.089 (0.0000)* →	-	0.1516 (0.9278)	0.18936 (0.9027)	2.15998 (0.1160)	0.60167 (0.6195)
ENRHE	1.6622 (0.1986)	0.09435 (0.9625)	100.176 (0.0000)* →	0.3049 (0.8216)	-	0.3285 (0.8047)	2.5900 (0.0735)*** →	1.5765 (0.2180)
Health	0.75537 (0.5289)	0.83592 (0.4860)	2.4176 (0.0890)*** →	0.85488 (0.4763)	1.3357 (0.2835)	-	0.94621 (0.4321)	0.45674 (0.7147)
R&D	12.3834 (0.0000)* →	3.81097 (0.0213)** →	0.6782 (0.5733)	1.96825 (0.1425)	3.3965 (0.0321)** →	1.61781 (0.2084)	-	1.23498 (0.3163)
GFCF	2.81077 (0.0584)** * →	0.85495 (0.9469)	0.5792 (0.6339)	0.41935 (0.7406)	0.3224 (0.8091)	0.73581 (0.5398)	0.03184 (0.9922)	-

*, ** and *** shows 1%, 5% and 10% level of Significance respectively. The arrows (→ & ←) shows the direction of causal relationship between the variables

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