Chapter 5

Human Capital and Economic Growth: An Empirical Analysis

Section I

5.1 Introduction

Human capital stock determines the rate of economic growth, meaning that an economy with a higher human capital stock will evolve faster (Romer, 1986). Human capital is widely accepted as an important determinant of economic growth and the importance of human capital accumulation is unconditionally acknowledged in the existing exogenous and endogenous growth theories (Mankiw et al. 1992, and Howitt, 2005). Several studies explored the relationship between the accumulation of human capital and the economic output. Scholars identified a significant contribution of human capital to economic growth (Schultz 1961), (Bils and Klenow 2000).

Much of attention of economists has focused on long term issues, notably on the determinants (as human capital) of the long-term growth. The economic growth literature is extremely abundant in models and theories trying to clarify the link between different economic variables (inclusively human capital) and economic growth rate. These models and theories can be divided in several groups according to different criteria. Considering the time as criterion, there are 'statistical' (short run) and 'dynamic'(long run) models. As purpose, there are 'structure', 'forecasting' and 'decision' models (Neagu 2012).

The Keynesian and Harrod-Domar growth modesl takes into consideration three independent variables population growth, technological progress and labour productivity growth and economic growth rate and capital requirement for investment as dependent variables (Thirwal 2000). The model is based on the equation:

$$G=S/K \qquad (1)$$

where: *G* -economic growth rate, *S*-capital accumulation rate, *K*- capital coefficient.

Inspired by this model, Solow (1956) developed another model of long-run growth, considered by many economists as fundamental for the economic growth literature. The model shows how the savings rate, population growth rate and technological change influence the level of production and the economic growth in the long-run (Thirwal 2000). The starting point of the model is the aggregate production function with three factors of production:

$$Y = F(K,L,T) \qquad (2)$$

Where: *Y*-economic output (income), *K*-physical capital, *L*- labour, *T*-technology.

The basis of the model is the production function in per capita terms:

$$y = f(k) \qquad (3)$$

Where:

$k = K/L$ is the capital stock per inhabitant,

$y = Y/L$ is the output (income) per inhabitant.

The extension of the model was done when scholars take a standard Cobb-Douglas production function with labor, physical capital and human capital as input factors (Mankiw et 1992. Qadri 2001).

$$YL\,t = A_t\, K^a_t\, L^b_t\, EH^b_t \qquad (4)$$

Summarizing the above considerations, two concluding remarks arise. First, even the production function (Cobb-Douglas) was preferred by researchers to emphasize the role of education and health on the economic growth, a variety of regression models (cross-country) were frequently used. As dependent variables were used log GDP, log GDP per capita, GDP per capita, GDP. As independent variables, measuring the human capital, were used included school enrolment rates, literacy rate, average years of schooling, public and private spending on education (total, public and private, as % of GDP, costs per students, costs per student as % of GDP per capita, costs by education level), repetition rates, drop-out rates, tests scores, constructed data sets, public and private spending on health(total, as % of GDP) life expectancy, mortality rates, infant mortality, healthy life years (Neagu 2012).

Second, the two main components of human capital were incorporated only in the model of production never being introduced together in a regression model. Taking these things under consideration this study used simple models. The purpose of the chapter is twofold. One is to measure the impact of human capital on economic growth and second to know if there exists any causality relationship between Human capital investment and economic growth. For these two fold purposes two different models are framed which can be explained under research methodology.

5.2 Research Methodology

In order to measure the effect of the human capital on the growth of Jammu and Kashmir economy we used three regressions models and calculated correlation coefficients as well. Besides this we would like to know if there exists any causality relationship between two variables. For this granger causality test is used.

The first regression model is used to captures the relation of education human capital with the growth of Jammu and Kashmir Economy. Model second is used to measure the health human capital and economic growth. Finally model third is used to measure the human capital and growth. In the third model both education and health human capitals are used as independent variables.

The various proxy variables used to capture the effect of education human capital includes gross enrollment ratios at primary, secondary and at higher level. Similarly the various proxy variables to capture the effect of health human capital include life expectancy and primary health care availability. Per-capita income is used as a proxy variable for growth and dependent variable in our all the three models.

To know the causality of relationship between investment in human capital and economic growth the proxy variables used are expenditure on education and expenditure on health as independent variables and per-capita income as dependent variable. Both expenditure on education and health represents the actual planned expenditure in the state by government.

5.3 Econometric Methodology

5.3.1 Model one

Education Human capital and Economic growth estimation

First the education component of human capital is estimated. For education human capital the proxy variables to estimate are gross enrollment ratios at secondary level and gross enrollment ratios at higher level both represents more skills than primary. The proxy variable for economic growth used is per-capita GSDP in real terms. We expect the regression coefficients to be positive and OLS method is used for estimation. The respective equation for the education human capital as an explanatory variable and economic growth as explained variable is below.

$$y = \beta 0 + \beta 1\mathrm{X1} + \beta 2X2 + \varepsilon \qquad (1)$$

Here

Y *is per-capita GSDP in real times*

X_1 *represented the enrolment ratios at the higher level*

X2 represented the enrollment ratio at secondary level education

B_0 *represented the intercept*

B_1 *represents the regression coefficient associated with higher enrollment*

B_2 *represented the regression coefficient associated with secondary enrollment*

ε *Represented the error term*

5.3.2 Model 2

Health Human capital and Economic growth: estimation

In this study some constraint were faced in choosing which variables to include in this category. Infant mortality data was limited; availability of man power in health sector may not be a pure indicator to reflect the good results. Keeping these things under consideration that variables were included in the present chapter which fulfills two conditions. One the data uniformity and availability second which will reflect the access to health care as well. Another consideration was the linear association of the variables must be low. In technical terms the multi-colliniarity. For example, if life expectancy and expenditure are taken as independent variables to capture the effect one may found a strong correlation, If IMR and expenditure are taken association may arise. So in this model expenditure on health as percentage of GSDP and availability of primary health centers are used as independent variables.

The primary health care availability in terms of institutions has other benefits over other variables to include like availability of beds per head, man power availability etc. Firstly primary health centers are located more locally and every individual has easy access to hospitals and thus makes them productive. Second the location of primary health centers may reduce the other costs of rural as well as urban people because of easy access. Third its availability indirectly reflects the government involvement as well.

The separate estimation made is estimation of parameters of health human capital. The proxy variables used for health human capital are Expenditure on health as a percentage of GSDP and availability of primary health care. The proxy variable for economic growth is per-capita GSDP.

We expect the regression coefficients to be positive and OLS method is used for estimation. The model used is below.

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \varepsilon \qquad (2)$$

Here

Y is per-capita GSDP

X_1 represented the availability of primary health centers

X2 represented the expenditure on health as percentage share of GSDP

B_0 represented the intercept

B_1 represents the coefficient associated primary health centers

B_2 represented the regression coefficient associated with health expenditure as percentage share of GSDP

ε Represented the error term

5.3.4 Model 3

Human capital and Economic growth: estimation

In this model the effects of the human capital on the economic growth are measured by analyzing how the two components of the human capital: educational and health capital are influencing the economic output. Individually the proxy variables like expenditure and enrollment ratios or quality of life variables like life expectancy, Mortality rate, availability of institutions or manpower in the health sector represented either the effect of education or health variable.

It is assumed that the growth of GSDP per capita is result of the two forms of human capital (education and health) and we use the linear regression model:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \varepsilon \qquad (3)$$

Here

Y is per-capita GSDP

X_1 *represented the life expectancy*

X_2 *represented the primary gross enrollment ratio*

B_0 *represented the intercept*

B_1 *and* B_2 *represents the regression coefficient of life expectancy and primary gross enrollment.*

ε *Represented the error term*

5.3.5 Model 4 Granger Causality test

Time series approach is not free from problems though. One of them is stationary issue. The assumption of stationary in time series analysis is important because of the reason that correlation between unrelated non -stationary series can be positive and/or negative unity as the length of time series in question increases (Yule, 1926). Therefore, it is possible that the studies may end up with a relation who is because of non-stationary and hence spurious. The spurious relationship gives an impression of a worthy link between two or more variables that is invalid when objectively examined. Spurious regression is also an issue to take into account while dealing with time series data, as it mostly exhibits trend, if it is not taken care of gives absurd results. Simple technique of differencing will increase the problem of spurious autocorrelation (Gujrati, 2007).

Co-integration approach in this type of situations offers a solution by examining closely the variable properties through short and long run relationships by developing dynamic models. The basic idea underlying co-integration analysis is that if two or more variables are integrated of the same order (i.e., integrated of order one) then long run relationship using co-integration approach can be establish if the error term obtained is stationary or integrated of order lower than that of variables entering in the co-integration model. It means that variable can depart in the short run but move again to average in the long run therefore, the resulting empirical estimation is not spurious and we can apply simple ordinary least square estimation techniques to estimate the parameters (Gujrati, 2007).

There are number of ways one can apply co-integration methodology but in this part of chapter Engel-Granger (EG) co-integration test and Co-integration Regression Durbin –Watson (CRDW) Test. To know whether there exists any causality relationship between variables, granger causality test is used.

This model investigates the dynamics of relationship between human capital and economic growth of Jammu and Kashmir economy using the annual data for the period 1975-76 to 2011-12. The three variables considered for this are expenditure on education, expenditure on health as independent variables and per capita GSDP of Jammu and Kashmir as dependent variable. All the variables have been taken in natural logarithmic forms to avoid problem of heteroscedasticity.

In this model the Granger Causality methodology is used to determine the direction of causality between government expenditure on human capital measured by proxy variables of expenditure on education and expenditure on health and per-capita income; this econometric test is preceded with the stationary and co-integration test on the variables employed in the study.

Specification of model:

A simple functional model is presented thus:

$$Y = f\,(HE, EE) \text{ ------------------------------------- } (1)$$

In an econometric format:

$$Y_t = \beta_o + \beta_1 HE_t + \beta_2 EE_t + \mu_t \text{ --------------------- } (2)$$

Where:

Yt is per-capita income

HE is total expenditure on health.

EE is total expenditure on education.

b0 is the constant term, ‘t’ is the time trend, and ‘μ’ is the random error term.

Estimation Technique

Before conducting Granger causality tests, variable must be stationary individually or, if both variables are non-stationary, they must be co-integrated. This means that the test for stationary and the co-integration test must precede the Granger.

5.3.6 Unit root test

The very first step involved in this empirical analysis of time series data is to ascertain the nature of data (Stationary or non-stationary). For this, as a preliminary we take the graphic view of three series presented in the analysis section. To further verify this we make use of Augmented Dicky Fuller test (ADF).This test is based upon analysis of following three different forms of regression for three variables under consideration. The three forms are,

With drift

$$\Delta EE = \beta_1 + \beta_3 EE_{t-1} + \sum_{i=1}^{i=m} \alpha_i \Delta EE_{t-i} + \varepsilon_t \text{ --- (3)}$$

With constant and trend:

$$\Delta EE = \beta_1 + \beta_2 t + \beta_3 EE_{t-1} + \sum_{i=1}^{i=m} \alpha_i \Delta EE_{t-i} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (4)$$

Without drift and trend:

$$\Delta EE = \beta_3 EE_{t-1} + \sum_{i=1}^{i=m} \alpha_i \Delta EE_{t-i} + \varepsilon_t \text{ ----------- (5)}$$

Same three forms are followed in case of PS and HE variables

In all the three cases hypothesis is

Null; Ho: $\beta_3 = 0$ (Unit root is present or series is non-stationary)

Alternate; H1: $\beta_3 < 0$ (No unit root)

Decision rule:

If computed τ statistic is more negative than ADF critical values, reject Ho implying series is stationary.

If computed τ statistic is not more negative than ADF critical values accept Ho implying that series is non -stationary.

Having obtained these results same test is applied on first differences of two variables labeled as DEE, DHE and PCY. To check their stationarity the regressions equations to be estimated will be as

$$D^2EE = \beta_1 \ + \beta_2 t + \ \beta_3 DEE_{t-1} \ + \sum_{i=1}^{i=m} \alpha_i \ D^2EE_{t-i} + \ \varepsilon_t \qquad \ldots\ldots\ldots\ldots.. (6)$$

For other two variables equations will be formed accordingly.

5.3.7 Co-integration test

To examine the presence of long run equilibrium relationship between these variables we make use of Engel-Granger (EG) co-integration test and Co-integration Regression Durbin –Watson (CRDW) Test. For EG test we perform Unit root test on the residuals obtained from regressions.

$$PCY = \alpha + \beta(HE) + U1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (7)$$

$$PCY = \alpha + \beta(EE) + U2 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (8)$$

On applying the Engel Granger test upon U1 and U2 which involves the following two regressions

$$\Delta U1_{\mathrm{t}} = \rho U1_{t-1} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (9)$$

$$\Delta U2_{\mathrm{t}} = \rho U2_{\mathrm{t-1}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \ldots.. (10)$$

Results are obtained which are furnished in the analysis section of the chapter. We are working on residuals intercept and trend are ignored in above equations.

5.3.8 Bi-Variate Granger causality test

It would be interesting to know if there exists any causality relationship between two variables. For this granger causality test is used. The rough idea behind this test is that time does not move backward, i.e., if event A happens before event B then there is possibility that B is causing A. The econometrician Edward Leaner prefers the term Precedence to causality of this nature while Francis Diebold prefers to call it predictive causality.

5.3.9 Description of Variables for estimation.

The variable used for estimation is given in the table 5.01 below. The gross enrolment ratios were calculated by dividing the total enrollment with the population in the respective ages. The three categories of enrollment rate are gross enrollments at primary, gross enrollment ratios at secondary and gross enrolment ratios at higher. Life expectancy consists of average years of life expected. Per-capita income is in real terms.

Table 5.01 Variables for estimation of the models

year	GSDP	GER	GER	Health	life	Education	GER
1995-95	6732	16.3	1.89	2.098	60	411.02	86.32
1996-97	6978	18.9	2.01	1.86	61	503.96	79.33
1997-98	7128	17.29	2.1	2.21	62	372.19	80.3
1998-99	7296	24.9	2.54	3.08	64	317.42	87.12
1999-00	13816	29.52	3.89	2.08	64.5	363.45	93.11
2000-01	13859	34.35	3.27	2.36	66	443.95	92.5
2001-02	13784	42.24	3.17	2.67	67	497.50	89.85
2002-02	14341	33.38	4.95	2.61	68	257.92	84.39
2003-04	18654	32.6	5.3	2.65	70	231.83	71.52
2004-05	21734	35.38	6.2	1.99	68.5	285.77	83.72
2005-06	22406	35.74	7.2	2.09	69	236.58	100.49
2006-07	23375	27.47	7.9	2.44	70	141.99	103.01
2007-08	24470	41.14	8.4	2.77	71	176.51	100.46
2008-09	25641	45.1	10.36	2.59	70	167.67	103.2
2009-10	26519	44.11	18.2	3.21	70.5	75.44	117.25
2010-11	27666	53.2	16.8	3.18	72	99.54	119
2011-12	29067	52.8	23.7	3.13	73	71.02	115
2012-13	30237	51.9	24.1	2.88	74	74.56	89.2
2013-14	31285	47.11	25.2	3.15	76	59.32	84.3
2014-15	31977	51.12	26.2	2.87	75	67.96	85.3
2015-16	32098	49.21	26.39	3.44	75	54.08	88.3

Source: Hand book on Indian states, RBI, Various MHRD report (2014), Census Reports (2011)

Section II

5.4 An analysis of human capital as determinant of economic growth

In this section the results of the estimated models are presented. These results are presented under the four headings of education and economic growth, health and economic growth, human capital (both education and health component) and economic growth in Jammu and Kashmir and finally model four considers investment in Human Capital and Economic Growth in Jammu and Kashmir Using a Ganger Causality Approach.

5.4.1 Education component of Human capital and Economic Growth

The results of applying the regression model (Table 5.02 (a) (b) (c) shows that the model of human capital is statistically validated (the significance F is lower than 0.05- the significance level).

According to the results presented in the table 5.02, we could explain the evolution of GSDP per capita in proportion of 87% through the dynamic of the stock of human capital in the economy, considering all other factors as constant.

Regarding the composition of human capital, the people in higher education and at secondary level are both important for growth and both are statistically significant which can be get from the P-value which is lower than 0.05 (for a significance level of 5%) presented in the table 5.02 (c).

The estimated regression coefficients revealed that both are positive indicated that the stock of education human capital contributes to economic growth positively. A one unit increase in the X1 (expressing higher education enrollments) will increase the GSDP per-capita with 366.29 units and a one unit increase in the X2 (expressing secondary enrolment) will increase GSDP with 471.888 units. The more important fact is both the variables are statistically significant and hence confirms the results that education human capital had positive and a significant impact on the economic growth of Jammu and Kashmir economy. In order to increase the economic growth in Jammu and Kashmir the results confirmed that more thrust should be leaved on the education in Jammu and Kashmir as a policy recommendation.

$$y = 1597.5 + 366.29\mathrm{X1} + 471.888X2$$

Table 5.2 (a) Results Summary of Education Human capital

	coefficient	se	t
intercept	1597.5	3170.697	.504
X1	366.29	115.264	3.178 significant at five
X2	471.888	148.695	3.174 significant at five

Source: Authors estimation (Using SPSS)

Table 5.2 (b) Model Summary

Model summary	
R square	St. Error of estimates
.870	3396.4856

Source: Authors estimation (Using SPSS)

Table 5.2 (c) ANOVA

Summary output	df	SS	MS	F value
Regression	2	1.387E9	6.935E8	60.115 * Sig (05)
Residual	18	2.077E8	1.154E7	
Total	20	1.595E9		

Source: Authors estimation (Using SPSS)

5.4.2 Health component of human capital and Economic growth

The results of applying the regression model (Table 5.03 a,b and c) shows that the model of human capital is statistically validated (the significance F is lower than 0.05- the significance level).

According to the results presented in the table [5.03(a) (b) (c)], we could explain the evolution of GSDP per capita in proportion of 86% through the dynamic of the stock of health human capital in the economy, considering all other factors as constant.

Regarding the composition of health human capital, the availability of the primary health centers (X1) is statistically significant which can be get from the P-value is lower than 0.05 (for a significance level of 5%) presented in the table 5.0 3 (a). But the expenditure on health as a percentage share of GSDP X2 is not significant.

The estimated coefficients shows that both are positive indicated that the stock of health human capital contributes to economic growth positively. A one unit increase in the X1 (expressing primary health Centre availability) will increase the GSDP per-capita with 175.748 units and a one unit increase in the X2 (Expenditure on health as percentage of GSDP) will increase GSDP per-capita with 1854.418 units.

The more important fact is both the variables are not statistically significant. Primary health care is significant and expenditure variable is not significant. The possible reasons for the insignificant but positive coefficient may be that effect is longer over the long run the direction may run from growth to health expenditure which can be confirmed in next section of long run analysis. Here the possible explanation is that health may not affect directly the per-capita output as the health sector is not so modern in the state.

In order to understand the significant impact of the health expenditure another tool is employed to know the exact degree of association. In more detailed way life expectancy is correlated with the health expenditure. The simple rule is that if both expenditure on health and life expectancy are correlated we can then measure the impact of life expectancy on the per-capita GSDP.

The correlation between life expectancy with health expenditure for time period 2001 -2014 is to measure the degree of association. The correlation coefficient turned positive and (.78) which indicates highly correlation of the health expenditure and life expectancy.

Simple rule of thumb is that health expenditure is related to life expectancy more significantly. It means health expenditure affected the growth through different channels. Health expenditure leads to increase in life expectancy and life expectancy has significant impact on the per-capita growth. So it can now be more safely concluded in this model that health human capital effects the growth in a significant way and health expenditure increase productivity by increasing the life expectancy which in turn helps to be more productive for extra years.

Hence it confirms the results that health had positive and a significant impact on the economic growth of Jammu and Kashmir economy.

In order to increase the economic growth in Jammu and Kashmir the results confirmed that more thrust should be leaved on the health care system in Jammu and Kashmir as a policy recommendation. The estimated regression model is below

$$y = -49618.8 + 175.748\ \mathrm{X1} + 1854.418\ X2$$

Table 5.3 (a) Summary Results of health as human capital

	coefficient	se	t
Intercept	-49618.8	6503.182	-7.630
X1	175.748	22.111	7.948 ** Not significant at five
X2	1854.418	2099.732	.883 significant at five

Source: Authors estimation (Using SPSS)

Table 5.3 (b) Model Summary

Model summary	
R square	St. Error of estimates
.867	3429.34137

Source: Authors estimation (Using SPSS)

Table 5.3 (c) ANOVA

Summary output	df	SS	MS	F value
Regression	2	1.383E9	6.915E8	58.797 * Sig (05)
Residual	18	2.117E8	1.176E7	
Total	20	1.595E9		

Source: Authors estimation (Using SPSS)

5.4.3 Model 3: Human capital and Economic growth estimation

In order to analyze both effects (of education and of health) on economic growth, we put the statistical variables discussed above in the equation third

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + \varepsilon$$

where Y is the economic output (the dependent variable), expressed by GSDP per capita x_1 and x_2 are the two forms of human capital (independent variables) expressed by educational capital (Primary enrolment ratios) and, respectively, health capital, expressed by the life expectancy; ε -standard error.

The estimated results are provided in the table [5.04 (a) (b) and (c)] respectively. The major findings from the estimated variables revealed that a proportion of 95% of the GDP per capita dynamics can be explained by the variance of the two independent variables. The validity of the model is confirmed by the fact that the Significance F is lower than the significance level of 5%. Both independent variables have a significant influence on GSDP per capita. Due to the fact that the P-value is lower than 0.05 (the significance level). The estimated coefficient of the life expectancy denoted by X_1 indicates that an extra unit increase in the life expectancy would increase the GSDP per-capital by1759.629 units.

Another component of the education human capital represented by Gross enrollment ratios at primary level denoted with X_2, indicates when there is one unit change in the gross enrolment ratios GSDP per-capita increased at 106.271 units. The care must be taken here that the increment is not in percentage terms as the units doesn't represent equation in the logarithm form. The estimated regression is presented below.

$$y = -110659.9 + 1759.63\,X1 + 106.271\,X2$$

The results thus confirmed the literature evidence that human capital has a significant impact on the economic growth. The justification of the increasing impact is in the entire time period the most thrust of the state was on the primary education of the state. The life expectancy of the state has increased much faster than the other states of the country due to that fact the per-capita gross state domestic product in the entire time period has been significantly increased by human capital. The increasing thrust for future gains in terms of economic growth on human capital is strongly recommended as a policy implication of the study.

Table 5.4 (a) Human Capital and Growth Results Summary

	coefficient	se	t
Intercept	-110659.9	6974.449	15.866
X1	1759.63	104.410	16.853 significant at five
X2	106.271	37.871	2.806 significant at five

Source: Authors estimation (Using SPSS)

Table 5.4(b) Model Summary

Model summary	
R square	St. Error of estimates
.925	2066.86799

Source: Author's estimation (Using SPSS)

Table 5.4 (c) ANOVA

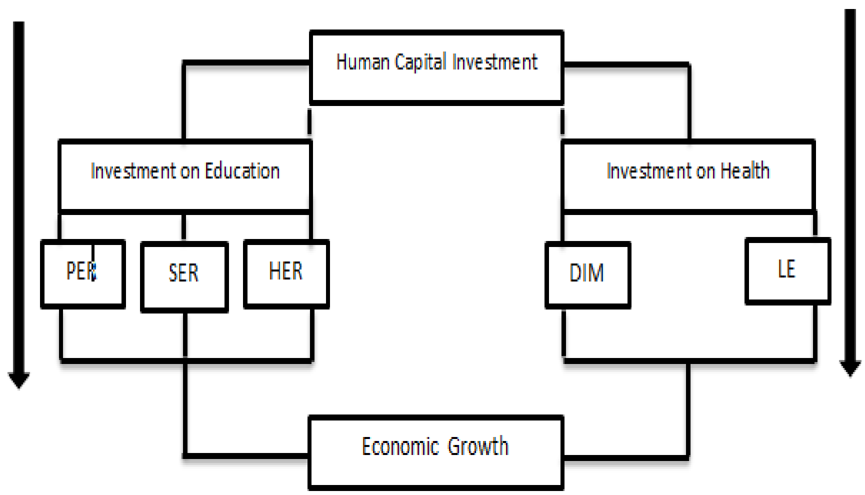
Summary output	df	SS	MS	F value
Regression	2	1.518E9	7.589E8	177.640
Residual	18	7.689E7	4271943.279	
Total	20	1.595E9		

Source: Author's estimation (Using E-views)

The conclusion is presented in the chart below. In the flow chart investment in human capital is represented as investment in education and health. Investment in education increases the enrollment ratios at primary level (PER), secondary gross enrollment ratios (GER) and enrollment ratios at higher level (ERH) which affects the economy in positive and in significant way by increasing economic growth.

Flow chart 5.1

Impact of human capital on economic growth of Jammu and Kashmir



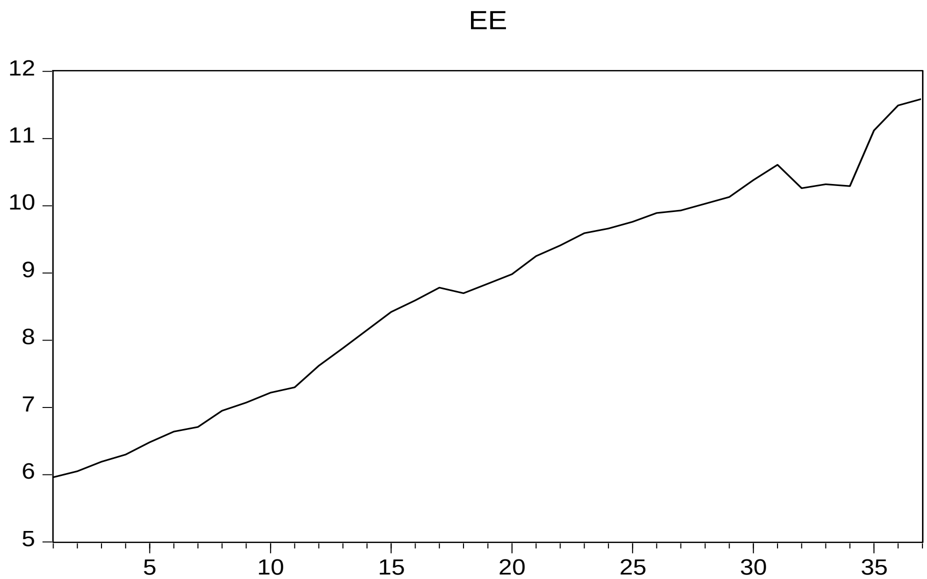
Similarly investment in health increase the life expectancy (LE) which also means decrease in infant mortality (DIM) and that contributes to economic growth in significant and positive way (Flow chart 5.01).

5.4.4 Model 4: Investment in Human Capital and Economic Growth in Jammu and Kashmir Using a Ganger Causality Approach

5.4.4.1 Unit root test

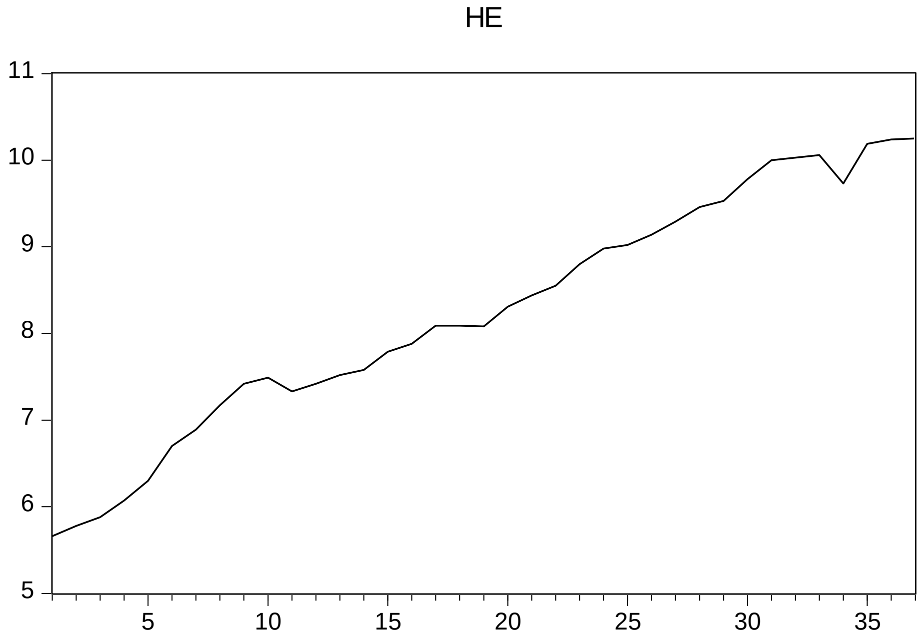
The very first step involved in this empirical analysis of time series data is to ascertain the nature of data (Stationary or non-stationary). For this, as a preliminary we take the graphic view of three series. From the graphs [fig.5.02., fig 5.03. and fig. 5.04] it is clear that three series ,at levels , are not maintaining a constant mean and seem to follow an upward trend. However, first differences of all the three series (figures 5.05, 5.06 and 5.07) fluctuate around non- zero mean.

Fig 5.2 Expenditure on Education At level



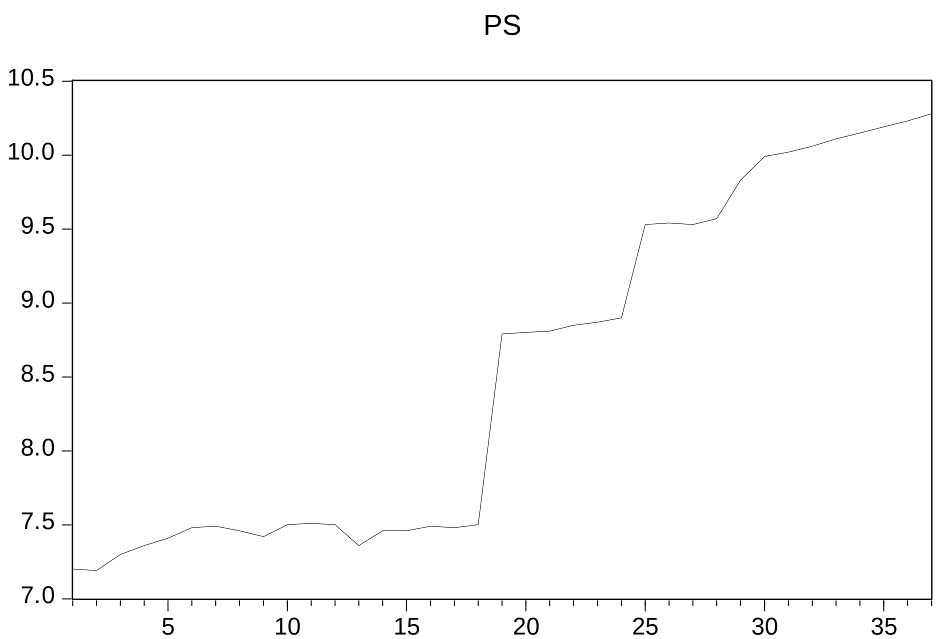
Source: Authors estimation (Using E-views)

Fig 5.3 HE: Expenditure on Health At level



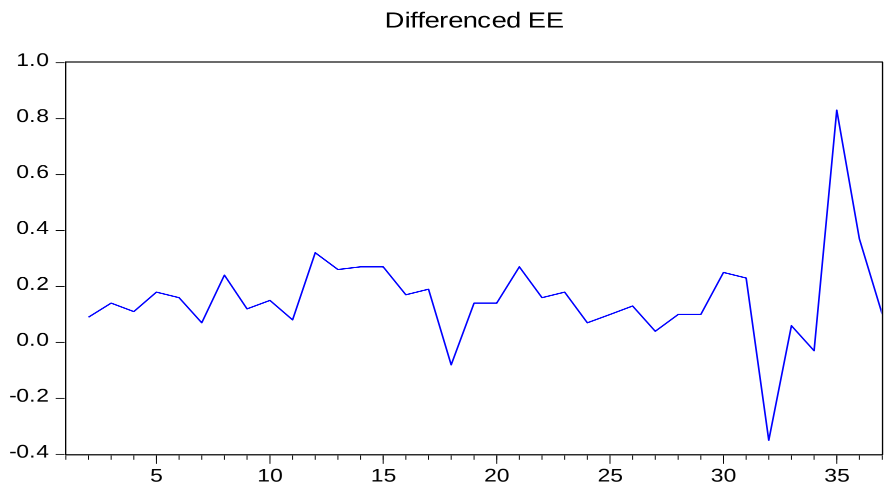
Source: Author's estimation (Using E-views)

Fig 5.4 per-capita GSDP At level



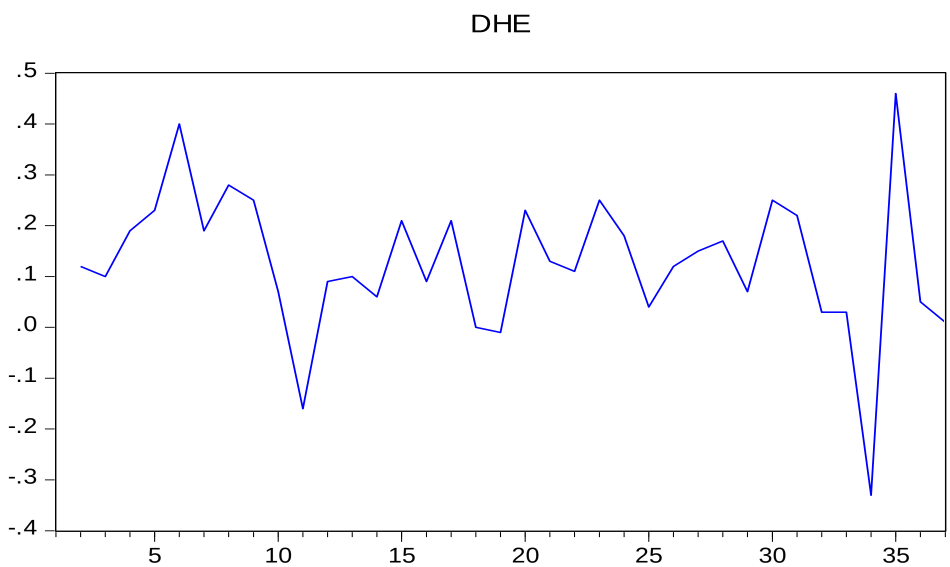
Source: Authors estimation (Using E-views)

Fig 5.5 EE: At Difference in Expenditure on Education



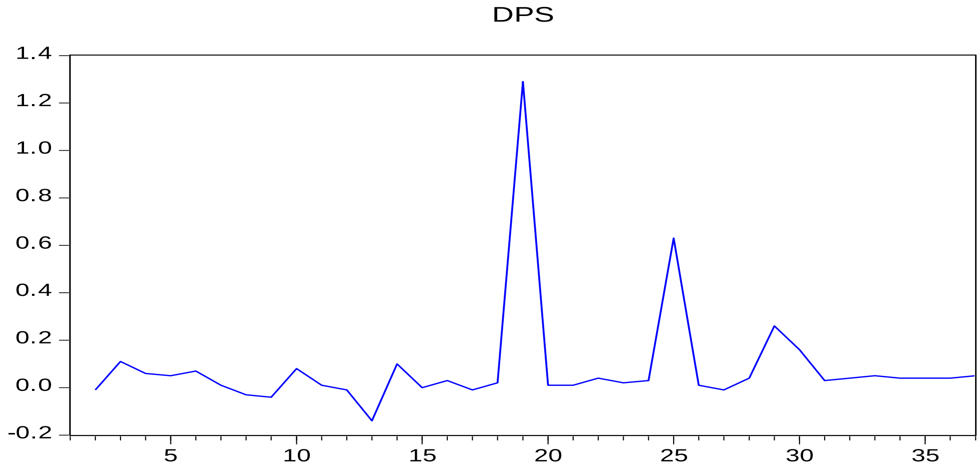
Source: Author's estimation (Using E-views)

Fig 5.6 At Difference in Health Expenditure



Source: Author's estimation (Using E-views)

Fig 5.7 DPS: At Difference Per-Capita GSDP



Source: Author's estimation (Using E-views)

Table 5.5: Augmented Dicky Fuller test

Variables		PS	HE	EE
Level	Intercept	-0.1969	-1.5245	-1.4729
	P Value	0.93	0.51	0.53
	Intercept and trend	-2.2028	-2.3180	-0.7954
	P Value	0.47	0.41	0.95
First Difference	Intercept	-6.1717	-6.0120	-6.0996
	P Value	0.00	0.00	0.00
	Intercept and trend	-6.1115	-6.2181	-6.3444
	P value	0.0001	0.0001	0.000
Order		I(1)	I(1)	I(1)

Source: Author's estimation (Using E-views)

To further verify this we make use of Augmented Dicky Fuller test (ADF). This test is based upon analysis of following three different forms of regression for three variables under consideration. Results of ADF test for all three variables at level and first difference are summarized in table 5.05.

From results it is clear that all the three variables in level form are non-stationary but they turn out to be stationary at first difference. All results are acceptable at 1% level of significance. Further these results hold in all forms of ADF test lag length was chosen as per AIC criteria.

5.4.4.2 Co-integration test

To examine the presence of long run equilibrium relationship between these variables we make use of Engel-Granger (EG) co-integration test and Co-integration Regression Durbin –Watson (CRDW) Test. We obtained results which are furnished in table 5.06 Since we are working on residuals intercept and trend are ignored in above equations.

Table 5.06: Co-integration stat

Null hypothesis: Residual is non -stationary			
Residual	T statistic	P value	Result
U1 U2	-2.3604 -1.9262	0.01 0.05	Stationary Stationary

Source: Author’s estimation (Using E-views)

Since residuals appear to be stationary in their level form there exists a long run equilibrium relationship between two variables as such the regressions involving these variables will have meaningful coefficient estimates.

5.4.4.3 Bivariate Granger causality test

Since co-integration analysis ascertained the existence of long run relationship between expenditures on education and health and per-capita GSDP, we would like to know if there exists any causality relationship between two variables. For this we use granger causality test.

The rough idea behind this test is that time does not move backward, i.e., if event A happens before event B then there is possibility that B is causing A. The econometrician Edward Leaner prefers the term Precedence to causality of this nature while Francis Diebold prefers to call it predictive causality. The results of Granger causality test are presented in table 5.07.

Table 5.7: Granger causality

	F Statistic	Probability
GSDP does not Granger cause HE	3.971	0.054
HE does not Granger cause GSDP	3.266	0.079
EE does not Granger cause GSDP	4.209	0.048
GSDP does not Granger cause EE	0.128	0.722

Source: Author's estimation (Using E-views)

From above results it is clear that in case of expenditure on health and GSDP there exists a bi-variate causality while in case of expenditure on education causality runs from EE to GSDP. In view of above results it can be inferred that increasing expenditures on health and education will improve the domestic product figures in the long run.

Section III

Summary and conclusions

The chapter was devoted to measure human capital as the determinant of economic growth in Jammu and Kashmir. The measurement of human capital as the determinant of economic growth was analyzed and measured under the headings of education, health, effect of both component of human capital and causality. Econometric methods were used to measure the effect of human capital on economic growth. The measurement was made with the three regression models and OLS method was used to estimate the coefficients. In the model first economic growth used as dependent variable and education human capital as independent variable. For economic growth the proxy variable used was per-capita GSDP and for education human capital gross enrollment ratios for secondary and higher level were taken as proxy variables. The second regression model was framed in which the independent variable was health component of human capital and economic growth as dependent variable. For economic growth per-capita GSDP was used proxy variable. Expenditure on health as percentage of GSDP and availability of primary health care centers were used as proxy variables for health component of human capital. In the same model correlation was carried out for life expectancy and expenditure on health as a percentage of GSDP to get clear picture of results. The third model was used to measure effect of overall human capital on economic growth. In the third model per-capita GSDP was used as proxy variable for growth while gross enrollment at primary and life expectancy were used as proxy variables for human capital. Finally in the model four test of causality was done on investment on human capital and economic growth

Major findings

As expected, it was found that a powerful effect of educational attainment on economic output. The evolution of GSDP per capita in proportion of 87% could be explained through the dynamics of the stock of education human capital in the economy, considering all other factors as constant.

The estimated coefficients both were positive which indicated that the stock of education human capital contributes to economic growth positively. The estimated coefficient revealed that a one unit increase in the gross enrollments of higher education will increase the GSDP per-capita with 366.29 units and a one unit increase in the secondary enrolment will increase GSDP with 471.888 units.

The results of applying the regression model show that the model of health is statistically validated. According to the results it can be explained that the evolution of GSDP per capita in proportion of 86% through the dynamic of the stock of health human capital in the economy, considering all other factors as constant.

The estimated regression coefficients revealed that one unit increase in the primary health Centre availability will increase the GSDP per-capita with 175.748 units and a one unit increase in the Expenditure on health as percentage of GSDP will increase GSDP per-capita with 1854.418 units. The model shows a positive relationship between health human capital and economic growth.

In order to see the significant validity of expenditure a correlation coefficient was calculated for life expectancy and expenditure on health and it was found that the correlation coefficient was .78 confirms the results that expenditure on health though showed a positive effect on economic growth can also increase life expectancy. Higher life expectancy then will result to increase the productivity and hence growth.

The human capital, in its two components, has a strong effect on the economic output. The major findings from the estimated coefficients revealed that the proportion of 95% of the GSDP per capita dynamics can be explained by the variance of the two independent variables. The validity of the model was confirmed by the fact that the Significance F is lower than the significance level of 5%.

Both independent variables have a significant influence on GSDP per capita. The estimated coefficient of the life expectancy indicates that an extra unit increase in the life expectancy would increase the GSDP per-capital by 1759.629 units. Another component, when there is one unit change in the gross enrolment ratios GSDP per-capita will increased by106.271 units. The results thus confirmed the literature evidence that human capital has a significant impact on the economic growth.

From the result of ganger causality test, in case of expenditure on health and per-capita domestic product their exists bivariate causality while in case of expenditure on education causality runs from expenditure on education to per-capita domestic product.

In view of above results it can be inferred that increasing expenditures on health and education will improve the domestic product figures in the long run. From the analysis its clear when income of population increases then there would be a definite desire to educate the children

Policy Recommendations

The Integrated education with links with the decentralized system must be followed to increase the gross enrollment at primary and secondary level. The dropout must be hence halted.

In order to stimulate the economic growth in Jammu and Kashmir it is important to support the development of the tertiary education and to invest in its quality. A stronger connection of tertiary education with research and development is needed to stimulate the component of scientific research of the academic activities.

Higher education must be integrated with the industrial sector to make it job oriented. Introduction of skill oriented courses at secondary and higher level must be the policy goal of education.

An increase in the investment in health care will lead to the raise of life expectancy and of the healthy years of the population. Moreover, policy measures are needed to carefully monitor the efficiency and the effectiveness of the public spending in health.

In order to increase the economic growth the advancement in health sector must be met in Jammu and Kashmir. The direct effect of health spending on income of the persons can be realized more quickly if the spending for health care is more in the form of increasing technologies and man power in health sector.

Direct links with other health institutes with the rest of the states of the country must be integrated to meet such technologies which the citizen feels a burden to afford.

The primary health care must be increased in the areas where it is missing because of increasing primary health care will lead to increase in the productivity of economy. Increasing primary sector must be making efficient as it will reduce the burden regarding day to day health problems by reducing the transaction costs.

Rural health care system must be integrated with the urban in more efficient way by increasing the infrastructure.

Finally a most important is to watch guard the imbalances between the rural and urban. A system is needed to minimize the rural and urban gaps in education and health.

Substantial amount of government budgetary allocation should be directed towards the educational and health sector.

Reference

Abbas, Q. (2000), The Role of Human capital in Economic Growth: A Comparative Study of Pakistan and India, Pakistan Development Review 39:4 part 2(winter 2000) pp.451-473.

Bils, M. and Klenow, P. J., (2000), Does Schooling Cause Growth, The American Economic Review, 90(5), pp. 1160-1183. http://klenow.com/BKHK.pdf

Howitt, P. (2005), Health, Human Capital and Economic Growth: A Schumpeterian perspective, Seminar paper for Pan American Health Organization www.brown.edu/Departments/**Economics**/Faculty/PeterHowitt

Mankiw, N.Gregory; David Romer, and David N. (1992), A Contribution to the Empirics of Economic Growth Quarterly Journal of Economics, 107, pp. 407-437.

Neagu, O. (2012), Measuring the Effects of Human Capital on Growth in the case of Romania, Annals of Dunarea de JosUniversity, Galati, Fascicle I Economics and Applied Informatics, No 1/2012, https://pdfs.semanticscholar.org/8b23/593603a437a349493bae68064f.pdf

Romer, Pual M. (1986), Increasing Returns and Long-run Growth, Journal of Political of Economy 94, 1002–37. http://links.jstor.org/sii?sici

Schultz, Theodore W. (1961), Investment in Human Capital, The American Economic Review, vol. 51(1), pp. 1-17.

Solow, Robert M. (1956), A Contribution to the Theory of Economic Growth, Quarterly Journal of Economics, Vol. 70 (1) 1956, 65-94.

Thirwall A. P. (2000), Growth and Development with Special Reference to Developing Economics, Macmillan London

Gujrati Damodar and Sangeeta (2007), Basic Econometrics, Tata MCGraw Hill Education Private Limited, New Delhi, Fourth edition

Yule, G. W. (1926), Why do we get some time nonsense correlations between time series? A study in sampling and the nature of the time series, Journal of Royal Statistical Society, Vol.89, pp.1-6