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The Role of Human Capital Formation in Poverty Mitigation: A Co-integration Analysis from Pakistan

¹Romaisa Arif, ²Muhammad Zahir Faridi, ³Fatima Farooq

¹M.Phil Scholar, School of Economics, Bahauddin Zakariya University, Multan Pakistan,

romaisa_pasha@yahoo.com

²Professor, Department of Economics, Bahauddin Zakariya University Multan, Pakistan,

zahirfaridi@bzu.edu.pk

³Assistant Professor, School of Economics, Bahauddin Zakariya University Multan, Pakistan,

fatimafarooq@bzu.edu.pk

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ABSTRACT

The present study tries to explore the dynamic relationship between human capital formation and poverty mitigation by adopting the course of investment in education and health substances. For this sake, study takes health expenditure and infant mortality rate as health indicators while status of education is captured with literacy rate and enrollment in higher education. Time series data is employed ranges from 1973-2013. The properties of time series data are inspected with the ADF test whilst PP test is employed for the robustness of unit root results. Mixed order of integration of data compels us to make use of ARDL technique for the estimation. Similarly, one unit change in health expenditures lead to reduce 0.251 units of poverty and one unit change in infant mortality cause to reduce poverty by 0.04 units. In last, one unit increase in literacy rate changes 1.03 units in poverty and one unit change in higher education results in 0.003 unit's change in poverty. The results of the study leave us with a clear finale for an optimal policy formulation that, Pakistan is in sturdy need of investment in health and education substances for a noteworthy accumulation of human capital for a right way poverty mitigation policy.

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Corresponding author's email address: romaisa_pasha@yahoo.com

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1. Introduction

The notion of human capital formation has attained a lot of entice in the recent years as it involves efficiency in the manufacturing mechanism that leads to high economic growth and turns into the outgrowth in term of boosting up the living standard of people. Among others, studies like Romer (1986) and Lucas (1988) provided the significance of investment in human capital as it is a key contributor to economic development and poverty mitigation, Schultz (1999); Sen(1999). On the same argument the New Millennium Development Goals (MDGs) focus on human capital accumulation as the majority of MDGs merely rely on the health and education substances. Different quantitative studies on economic growth in the west show that the growth of human capital plays a significant role in economic growth, Todaro (10th edition). Sturdy linkages are observed between economic growth and poverty mitigation when growth is channeled from investment in education and health as it goes for trickledown effect that remove inequality, Scheikman (2002).

Among the pioneers, Schultz (1993) was the first in defining the human capital who narrated that human capital formation includes; primary and high education; training and learning activities for the development of skills; and, investment in children education. The activities like education, training, health, wisdom, intelligence, attitude and tendencies may also be an indicator or criteria of human resources.

A strong causality is observed between the household income and their children's schooling and educational attainment. In particular, in the developing countries, parents with high income are more like to take children education as a normal commodity and increase its demand with every level of their income, Schultz (1993). While it is most common among poor that risk aversion or the credit constraint is the factor that compels parents to the under invest for children education, even when returns on investment are fairly good, Parish and Willis (1993). The impact human capital in eradicating poverty is also observed from the good health and nutrition conditions by narrowing the income divide—sourced from the improved education attainments, Eastwood and Lipton (1999); Girma and Kedir (2005).

With reference to Pakistan, present study is aimed to answer some fundamental question that are; does education attainment a starting place from where poverty is initiated to trim down? Does heath status a factual pathway through which poverty diminishes? The study uses ARDL technique to quantify the brief and deep impact of health and education substances in eliminating poverty through the course of human capital concentration.

One of the crux objectives of the study is to strive for providing an extensive review of the studies aimed at exploring the linkages between human capital formation and poverty elimination through the course of development process. The literature on the concerned issue is in surfeit. Yet Study makes a healthy endeavor to integrate worthy empirical findings that will leads to point out some important dimensions on that issue, Gundlach, (1996); Abbas (2000); khan (2005); Qadri et al. (2011); Oluwatoyin (2011); Hanushek (2013).The above narratives identify the importance of the human capital formation and poverty mitigation nexus for P akistan. The termination of segment draws a conclusion that for long term economic performance and social well being is strongly tied with the education and health status. For that reason, this study attempts to estimate deep and brief impact of human capital formation for Pakistan through dynamic analysis.

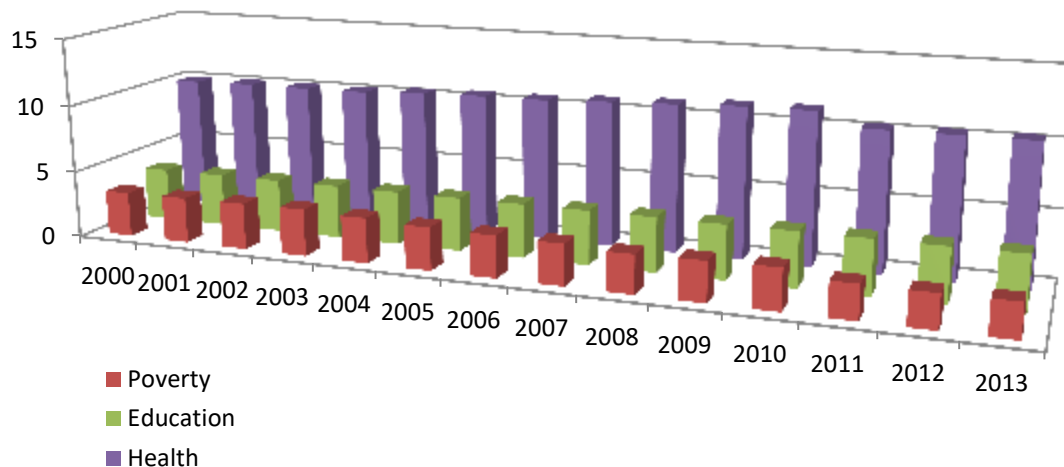
After the brief introduction, section two is consisted on the trends and patterns about how the human capital evolves over the period of time against poverty. Description of data and Methodology is given in

section three, while results and discussions are presented in section four. Six section is based on concludes and policy recommendations.

2. Human Capital and Poverty in Pakistan: Trends And Size

Trends are the most important part of all studies. The present segment has presented the human capital and poverty scenario in Pakistan. Therefore, literacy rate is used as a proxy of education and total health expenditures (million rupees) as a proxy of health. The head count ratio is used as a measurement of poverty (in percentage).

Figure 1: Human Capital and Poverty Trends in Pakistan



Source: Pakistan Economic survey (various issues)

Figure 1 shows the ten years trends of human capital and poverty in Pakistan. According to economic survey of Pakistan and Jamal (2006), in 2000, Pakistan has found 27.61 percent poverty rate and in 2005 it has declined to 23.9 percent. Pakistan has reached 20.7 percent poverty rate in 2010 and 12.45 percent in 2013. Now, the scenario of human capital proxies by literacy rate and total health expenditures in Pakistan is presented. According to economic survey of Pakistan, in 2000, Pakistan has found 49 percent literacy rate and it has increased to 54 percent in 2005. Subsequently, in 2010, the literacy rate reached at 57.68 percent in Pakistan and 60 percent in 2013. In Pakistan the total health expenditures are 21475.47 million rupees in 2000 and it has increased to 38000 million rupees in 2005. The total health expenditures have increased day by day— in 2010, these were 79000 million rupees and, in 2013, reached to 32000 million rupees in Pakistan according to the information of economic survey of Pakistan.

3. Data and Methodology

This section is based on data source and methodology. At first, we briefly explained the description of variables and present statistical analysis. Further, we have used ADF and PP for unit root results, and ARDL approach for the estimation of the results and the Wald test (F-stat) is used for bound of co-integration.

a) Data

In this article, we have used annual time series data from 1973 to 2013. The data is collected from different sources, economic survey of Pakistan (various issues), World Development Indicator, handbook of statistics, Jamal (2006) and some data has not available that's why we interpolating by econometrics software, Eviews 9.

In the analysis, poverty has estimated in percentage with head count ratio. Independent variables included per capita GDP is measured in terms of million rupees, inflation rate is taken in percentage. While health expenditures are measured in million rupees and infant mortality rate is measured in term of per 1000 population. However, trade openness is calculated as the ratio of imports and exports to GDP in terms of percentage; literacy rate is measuring in 10 year and above population (percentage), in last, the enrollment in higher education is measured in numbers.

Table: Description of Variables

	Description of variables	Measuring units	Sources of Data
POV	Poverty, head count ratio	Percentage	Jamal, H., (2006), The PDR 45(3), pp. 439–459 and Economic Survey of Pakistan 2014
GDP	Gross domestic product per capita	Million rupees	Economic survey of Pakistan (various issues)
INF	Inflation rate	Percentage	Economic survey of Pakistan (various issues)
HEX	Total health expenditures	Million rupees	Handbook of statistics
MOR	Infant mortality rate	Per 1000 population	Economics survey of Pakistan
TOP	Trade openness	Imports + exports / GDP	Economic survey of Pakistan
LITR	Literacy rate	Percentage	Economic survey of Pakistan
HED	Enrollment in higher education	Numbers	Economic survey of Pakistan

b) Properties of Time Series Data

We examines the properties of time series data by using ADF (1979) as well as PP (1988) unit root test to analyze the stationarity of data. Now the following specification of ADF test where the optimal lag length is based on Schwarz information criteria (SIC);

$$\Delta D_t = c + \phi X_{t-1} + \sum_{j=1}^{k-1} \nu D_{t-j} + \alpha L + \mu_t$$

Where, D_t is representing all time series variables i.e., POV, GDP, INF, HEX, MOR, TOP, LITR, HED and L represents the time trend. In short, Δ shows the first difference operator and μ is the disturbance term. The null hypothesis ($\phi = 0$) means that the unit root exist in equation and alternative hypothesis ($\phi \neq 0$) means that the stationary exist in our model. The following equation is ADF test statistics for non parametric adjustment.

$$D_t = c + L \left\{ t - \frac{c}{2} \right\} + \varphi D_{t-1} + \mu_t$$

Where, D_t is representing all the time series variables i.e., POV, GDP, INF, HEX, MOR, TOP, LITR, HED and c is the sample size while $\{t-c/2\}$ is the time trend and μ is the disturbance term.

c) Econometric Methodology

The ARDL co-integration approach is diverged from the other Engle and Granger (1987) and Johansen (1990) co integration approaches. The ARDL co-integration model is newly developed but it's popular in recent years, Jayaraman and Choong (2009). There are many positive edge of ARDL co integration approach. Firstly, ARDL approach has used in small sample size of time series variables, Ghatak and Siddiki (2001). However, Johansen co integration mechanism has used in large sample size. Secondly, ARDL approach has examined the diverge order of integration i.e., $I(0)$ and $I(1)$ but Johansen co integration examined the same order of integration i.e., $I(1)$, it means that all variables have integrated in first difference stationarity, Pesaran et al. (2001). Thirdly, the ARDL approach has different optimal lags of all time series variables, Ozturk and Acaravci (2011).

According to these properties of ARDL model, we prepared the specified equations of ARDL bound testing approach as follow;

$$\begin{aligned} \Delta(POV)_t = & \alpha_0 + \sum_{i=1}^a \alpha_{1i} \Delta(POV)_{t-i} + \sum_{i=0}^b \alpha_{2i} \Delta(GDP)_{t-i} + \sum_{i=0}^c \alpha_{3i} \Delta(INF)_{t-i} + \\ & \sum_{i=0}^d \alpha_{4i} \Delta(HEX)_{t-i} + \sum_{i=0}^e \alpha_{5i} \Delta(MOR)_{t-i} + \sum_{i=0}^f \alpha_{6i} \Delta(TOP)_{t-i} + \sum_{i=0}^g \alpha_{7i} \Delta(LITR)_{t-i} + \\ & \sum_{i=0}^h \alpha_{8i} \Delta(HED)_{t-i} + \alpha_9(POV)_{t-1} + \alpha_{10}(GDP)_{t-1} + \alpha_{11}(INF)_{t-1} + \alpha_{12}(HEX)_{t-1} + \alpha_{13}(MOR)_{t-1} + \\ & \alpha_{14}(TOP)_{t-1} + \alpha_{15}(LITR)_{t-1} + \alpha_{16}(HED)_{t-1} + \mu_t \end{aligned}$$

Where, Δ is showed the short time period and α_9 to α_{16} showed the long time period while μ_t is the disturbance term in ARDL equation. We have selected the different lags length based on Schwarz Bayesian criterion (SBC). The next step is to check the co integration exist in our variables through Wald test for bound statistics, if co integration exist in our analysis so we are distinguished the short run and long run equations of ARDL modeling as follow;

$$\begin{aligned} (POV)_t = & \beta_0 + \sum_{i=1}^{g^1} \beta_{1i} (POV)_{t-i} + \sum_{i=0}^{g^2} \beta_{2i} (GDP)_{t-i} + \sum_{i=0}^{g^3} \beta_{3i} (INF)_{t-i} + \\ & \sum_{i=0}^{g^4} \beta_{4i} (HEX)_{t-i} + \sum_{i=0}^{g^5} \beta_{5i} \Delta(MOR)_{t-i} + \sum_{i=0}^{g^6} \beta_{6i} \Delta(TOP)_{t-i} + \sum_{i=0}^{g^7} \beta_{7i} \Delta(LITR)_{t-i} + \\ & \sum_{i=0}^{g^8} \beta_{8i} \Delta(HED)_{t-i} + \alpha_9(POV)_{t-1} + \mu_t \end{aligned}$$

And

$$\Delta(POV)_t = \gamma_0 + \sum_{i=1}^{m1} \gamma_{1i} \Delta(POV)_{t-i} + \sum_{i=0}^{m2} \gamma_{2i} \Delta(GDP)_{t-i} + \sum_{i=0}^{m3} \gamma_{3i} \Delta(INF)_{t-i} + \sum_{i=0}^{m4} \gamma_{4i} \Delta(HEX)_{t-i} + \sum_{i=0}^{m5} \gamma_{5i} \Delta(MOR)_{t-i} + \sum_{i=0}^{m6} \gamma_{6i} \Delta(TOP)_{t-i} + \sum_{i=0}^{m7} \gamma_{7i} \Delta(LITR)_{t-i} + \sum_{i=0}^{m8} \gamma_{8i} \Delta(HED)_{t-i} + \lambda(ECM)_{t-1} + \mu_t$$

The term λ shows the error correction model. ECM represents the speed of convergence from disequilibrium to equilibrium, and it is always negative, and highly significant, Pesaran et al. (2001); Narayan (2005); Halicioğlu and Anno (2009); Arif et al. (2013).

4. Results and Discussions

5.

The results of the study are based on ARDL co-integration. First, we have discussed the descriptive analysis, and then we have discussed the ADF (1979) as well as PP (1988). Furthermore we have estimated the deep and brief nexus between human capital and poverty.

Table: Descriptive Statistics

Variables	Mean	St. Dev.	Observations	Probability
POV	25.54	7.61	41	0.14
GDP	512.26	314.49	41	0.01
INF	9.57	5.35	41	0.00
HEX	17977.6	20004.2	41	0.00
MOR	92.11	16.69	41	0.32
TOP	33.59	2.90	41	0.64
LITR	38.92	13.60	41	0.14
HED	1331.37	759.10	41	0.16

Source: Authors Calculation (Eviews 9)

In this analysis, there are 41 observations and have based on average value of mean and standard deviation, to find out the direct effect of human capital on poverty in Pakistan. We have calculated the human capital through education and health. However, literacy rate and enlistment in higher education are used as a proxy of education and health expenditures and infant mortality rate are used as a proxy of health, both health and education are representing the human capital.

Table: Tests for Stationarity

Variables	At Level		At 1st Difference		ADF	PP	Inter. trend	Inter. trend	Order Of Integration
	ADF	PP	ADF	PP					
	Inter.	Inter. & trend	Inter.	Inter. & trend					
POV	-2.24	-2.11	-2.16	-2.22	-4.80	-	-4.87	-	I(1)
GDP	2.75	0.84	2.75	0.73	-4.55	-	-4.61	-	I(1)
INF	-3.20	-	-3.37	-	-	-	-	-	I(0)
HEX	2.89	0.55	-1.43	-2.65	-5.01	-	-5.98	-	I(1)
MOR	-0.73	-3.26	-0.66	-2.36	-6.27	-	-6.28	-	I(1)

TOP	-3.31	-	-3.31	-	-	-	-	-	I(0)
LITR	0.38	-1.99	0.33	-2.08	-5.96	-	-5.97	-	I(1)
HED	1.69	-1.54	1.69	-1.54	-4.67	-	-4.67	-	I(1)

Source: Authors Calculations (Eviews 9)

According to this table, some variables are integrated at level and some time series variables are integrated at first difference. However, inflation (INF) and trade openness (TOP) have integrated at level and all other variables such as poverty (POV), GDP per capita (GDP), total health expenditures (HEX), infant mortality rate (MOR), literacy rate (LITR) and enrollment of higher education (HED) have integrated at first difference. No one variable has integrated at second difference that's why we can apply the Autoregressive distributed lag techniques (ARDL) of co integration.

Table: Bound Testing for Co integration

Equation	F-Statistic	Upper Bound Critical Value	Conclusion
POV/GDP, INF, HEX, MOR, TOP, LITR, HED	13.73 [0.00]	5.96 (1%)	Integration exists

Source: Authors Calculations. Note: f-statistic: 13.73 (Significant at 1% marginal values).

Critical Values at $k = 8 - 1 = 7$ is cited from Narayan (2005), Case v: unrestricted intercept and unrestricted trend. The numbers in parenthesis shows the probabilities of F-statistic. We checked the existence of co integration in this analysis through Wald bound testing. The value of F-statistic is greater than the upper bound critical value; it's mean to show that the co integration exists. We follows the Narayan (2005) to compare the critical value of co integration exists. Finally the long run relationships exist in this analysis.

Table: The Effect of Human Capital on Poverty Samples 1973-2013

Variables	Coefficient	t-statistics
ARDL estimate intercept	45.438	4.768
GDP	-.017	-2.795
INF	.563	4.062
HEX	-.251	-.592
MOR	-.040	-.619
TOP	-.932	-3.839
LITR	1.030	2.972
HED	-.003	-.665
Error correction coefficient		
ECMt-1	-0.596	-6.115
Diagnostic test (p-values)		
X2sc	.567	NA
X2ff	.487	NA
X2nor	.985	NA
X2het	.554	NA

Source: Authors calculations using Microfit 4.1.

Table shows the effect of human capital on poverty in Pakistan, the time period is 1973 to 2013. We have estimated the human capital through education and health while literacy rate and enlistment in higher education is used as a proxy of education, health expenditures and infant mortality rate is used as

a proxy of health. However, GDP per capita, inflation rate and trade openness are controlled time series variables.

The statistically significant variable GDP per capita is negative shows that economic growth increasing edge to decline poverty in Pakistan, Amjad & Kemal (1997); Forgha (2006); Ahmad & Riaz (2010). In addition, the inflation coefficient (0.563) shows the positive relationship between inflation and poverty, it is highly statistically significant at 1%. This implies that increase in inflation leads to increases poverty in Pakistan because the value of money declines that's why poverty increases, Amjad & Kemal (1997); Forgha (2006). Now we have interpreted the results of education and health— proxies for human capital. One unit change in health expenditures lead to reduces 0.251 units of poverty but it is statistically insignificant. It's mean that people have a good health and high will power to compete the economic problems that's why total health expenditures reduce poverty. Similarly, the one unit change in infant mortality cause to reduce poverty by to 0.04 and it is insignificant.

Furthermore we have discussed about trade openness and poverty relationship. The one unit change in trade openness leads to 0.93 units reduce in poverty and it is statistically significant at 1% level. Trade openness may stimulate poverty in the presence of high imbalance in income distribution. It is evident that mostly rich people are the major investor in Pakistan; big businesses are in the hands of few people who are involved in export business. Any increase in the level of business activity at open economy level benefits high investing business community leaving major portion of poor people i.e. workers at their marginalized condition. Now we have explained the relationship between literacy rate and poverty; one unit increase in literacy rate changes 1.03 units in poverty. Literacy rate means that people are just read or write, if people have low educated and have a low level of working knowledge that's why poverty rises. In last, the one unit change in higher education results in 0.003 unit's change in poverty. Reason is that the poverty is reduced with higher education increase and higher education is negatively related to poverty, it is insignificant.

The coefficient of ECM is 0.59 and has a statistically significant with negative sign. It implies that, the 59% of the short run disequilibrium in poverty to the long run equilibrium in present year.

The diagnostic test results are presented in the lower part of table. The evidence shows that there is no serial correlation, functional form specification, normality or heteroscedasticity. In last step of ARDL model is to analyze the stability of data and this graph is here in appendix. The graph of CUSUM is within the boundaries but the graph of CUSUMSQ is little bit without the boundaries. Many studies have unstable data means CUSUM and CUSUMSQ are without the boundaries, Dritsakis (2010); Ahmad and Riaz (2010); Ozturk and Acaravci (2011).

5. Conclusions

The study has presented strong connections of human capital accumulation with poverty mitigation policies in Pakistan. We measured the human capital through education and health; while, education is measured through literacy rate and enrolment in higher education and, health is measured with health expenditures and infant mortality rate. The connections between human capital and poverty have checked through ARDL co integration approach by employing data ranges from 1973 to 2013. Study also uses many other supporting variables such as per capita GDP, inflation rate, and trade openness.

The results show that per capita GDP is negatively and significantly related to poverty while inflation rate is positively and highly significantly associated to poverty. When growth increases in Pakistan, the poverty starts to decline. Likewise, health expenditures, infant mortality rate, trade openness and enlistment in higher education are negatively associated to poverty while the literacy rate is positively

associated to poverty. The results of the study leave us with a clear finale for an optimal policy formulation that is— Pakistan is in sturdy need of investment in health and education substances for a noteworthy accumulation of human capital as a right way poverty mitigation policy.

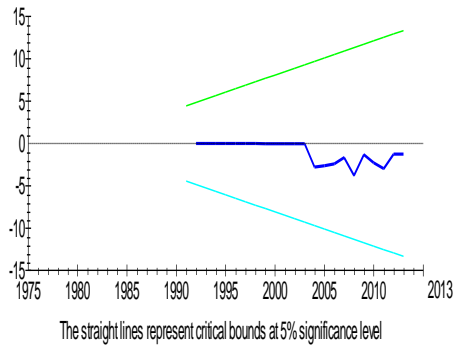
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Appendix

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals

