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Abstract

There is widely accepted concept in economic theory that human capital plays positive role in determining national income. Formation or accumulation of human capital and economic development for human welfare are the major targets of economic policy of each country. This study investigates the casual relationship between economic development and formation of human capital in Pakistan. Based on endogenous growth theory, this study empirically test the standard growth model consisting of Gross Domestic Product (GDP) per capita as a dependent variable and human capital formation, investment in physical capital and labor force as independent variables. Auto Regressive Distributive Lag (ARDL) bound testing approach to co-integration is used to check the long run equilibrium relationship between the variables included in the model. For checking the causal relationship between economic development and human capital formation, Pair-wise Granger Causality test is utilized using the time series data ranging from 1972 to 2009. The results of the co-integration show that the variables are co-integrated. They have long run stable equilibrium relationship. The results of the causality test show that there is bidirectional causal relationship between economic development and human capital formation.

Keywords: Human capital formation, physical capital, welfare, education, health, labour force.

1. Introduction

There is widely accepted concept in economic theory that human capital plays positive role in determining national income. Formation or accumulation of human capital and economic development for human welfare are the major targets of economic policy of each country. Education and health play vital role in formation of human capital. Human capital is considered as important for economic growth and development as all other factors of production like land, labor and physical capital. The development of an economy is dependent upon the economic factors of production along with management and accumulation of its human resources. Every country has separate population, history, natural resources, and international trade methods, and political institutions, regional and religious factors. There is no ambiguity that formation of human capital fundamental for each country but the degree of accumulation of human capital is varying from country to country and culture to culture. The rich and developed countries heavily invest in education rather than poor and developing countries. Because the developed countries have more financial resources to invest in accumulation of human capital in order to capture more gains from world level (Heyneman, 1999; Elu, 2000 and Oketch 2000, 2002).

The decision to invest in human like the physical capital depends on the future needs and projects. There are two main reasons for investing in human resource formation, it increases the productivity of the labor force in the country and it also increases the employment opportunities. Another advantage of investing in human capital is it exploits the appropriateness of individuals for their skill development as uneducated individuals' potential for skill development remained under-exploited. So, it can be said that investment in human capital is very necessary for an individual as well as a country for getting economic development (Chani et al., 2011). Ferroni and Kanbur (1990) developed a simultaneous equation model for investigating the interaction between rise in public expenditure on basic needs and income raising forces. This model highlights the importance of investing in physical as well in human capital.

Physical capital, natural resources and human resources are the three important components of resource endowment of an economy. It is an open reality that education affects attitudes, motivation level, skills and knowledge of individuals in an economy and positively contributes to its development (Romer 1990). The formation of human capital is an ongoing procedure. The country's education system is influenced by its socio-economic and political environment. Investment in human capital proves productive when educated labor force is wisely utilized to contribute and to accelerate the economic activities through public policy. The education is considered as a major component of human capital and most of the developing countries including Pakistan spend a large share of their human resource development spending on education. Human capital and physical capital investments are essential if a developing country like Pakistan wants to attain an industrial level development and per capita growth through labor productivity.

This study concentrates on testing the casual relationship between human capital formation through education and economic development in Pakistan. Keeping in view the endogenous growth theory, the study also tests direction of causality, either human capital formation cause economic development or economic development causes human capital or both of them are causing and supporting each other.

2. Literature Review

For the development of a country investment in human capital and investment in physical capital is key elements. There is a number of studies are available in economic literature which highlights the importance of economic development on the behalf of human capital formation and stock of physical capital. Lindsay (1971) discusses, it takes long time to get benefits from investing in human capital. The idea of human capital can be raised in a few years, but for the development of human capital it takes 10 to 15 years. In a case of an investor it selects a particular investment pattern for getting profits. Same case is true for a nation for investing in human capital. Nations can invest for long period for getting benefits for humans and increases their economic development.

Mankiw, Romer and Weil (1992) study the effects of human capital stock on the level of output for economic development. Following the Solow model which includes accumulation of human capital as well as physical capital on economic development, the empirical findings of the study shows that change in GDP bring a change in human capital accumulation. It means schooling increase the development of a country giving the example of LDCs and OECD. When the education is increased on various levels development level of a country is also changed.

Judson (1998) investigates that investment in education help the economic development of the country. He also finds the relationship between investment in education and it allocation. For that he develops a model for measuring the individual ability before and after getting the education. For his analysis of panel countries he takes data from UNESCO on educational enrollments and spending to estimate the efficiency of existing educational allocations. The results of regression of the decomposition growth of cross-country reveals that the correlational relationship is not significant between accumulation of human capital and GDP growth among those countries where the allocations of resources are poor but it show significant and positive relationship among those countries where allocations of resources are in reasonable position.

Hall and Jones (1999) using across countries data they find the relationship between per worker output. They found that the investment in physical capital and human capital will increase the output per worker. According to them the difference in capital accumulation, productivity and then output per worker depend upon social infrastructure (institutions and government policies).

For his analysis of panel countries he takes data from UNESCO on educational enrollments and spending to estimate the efficiency of existing educational allocations. The results of regression of the decomposition growth of cross-country reveals that the correlational relationship is not significant between accumulation of human capital and GDP growth among those countries where the allocations of resources are poor but it show significant and positive relationship among those countries where allocations of resources are in reasonable position.

Mogues and Carter (2005) find the relationship between social capital and economic development. They conclude that those parts of the world have higher social capital; they must achieve the higher levels of growth relative to those countries with low investment on social capital. Thus social capital focus on economic growth for the economy as whole and individual level, Social capital is working like the wheel of economic development and economic prosperity.

Silles (2009) investigates the impact of Minimum School-Living Age on economic development. This study finds the impact of education on heath is positive finds that the coefficient that measures the impact of education on all health indicators is positive and significant. The more education gives more opportunities for employment and it further increases the more spending on health and education. The study concludes that for getting the optimal level of economic development it necessary for an economy to invest on physical as well as human capital.

Zhang and Zhuang (2011) examine the effects of economic development by the composition of human capital in China. They use the data from different provinces of china form 1997 to 2006 by applying GMM they find endigenity and possibility of dynamic. According to their results they get three divisions in provinces between education and economic development. The results highlighted that those areas where education is high economical highly developed rather than others so we can say human development plays a significant role in economic development of a country. The underdeveloped provinces relay on primary as well as secondary education, while more developed parts of China get benefits with tertiary education.

3. Methods and Material

Following the endogenous growth model proposed by Romer (1990) the following independent regression models are used to study the causal relationship between human capital formation and economic development in Pakistan.

$$EDEV_t = \alpha_1 + \beta_1 IPC_t + \beta_2 HCF_t + \beta_3 LBF_t + \varepsilon_{1t} \quad (1)$$

$$HCF_t = \alpha_2 + \gamma_1 IPC_t + \gamma_2 EDEV_t + \gamma_3 LBF_t + \varepsilon_{2t} \quad (2)$$

Where,

$EDEV_t$ = level of economic development of the country at time t.

IPC_t = Investment in Physical Capital in time t.

HCF = Human Capital formation in time t.

LBF_t = Labor Force at time t.

$\varepsilon =$ Error Term

3.1 Data Sources

The annual time series data collected from various sources is used for econometric analysis in this study. The data on growth rate of per capita GDP and investment in physical capital proxied by gross fixed capital formation is taken from World Development Indicators (WDI) by World Bank (2011). Data for labour force and high school enrollment as a measure of human capital formation is used from The Pakistan Economic Survey 2010-11 issued by Government of Pakistan (2011). Keeping in view the diversity of units in which variables are measured, the natural logarithmic form of all the variables is used in this study.

3.2. Econometric Methodology

3.2.1. Augmented Dickey-Fuller (ADF) Test

For finding the unit root problem the Dickey and Fuller (1981) proposed the Augmented Dickey-Fuller (ADF). The general forms of the ADF can be written as:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \phi_i \Delta X_{t-i} + e_{1t} \quad (3)$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \phi_i \Delta X_{t-i} + e_{2t} \quad (4)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^{q} \phi_i \Delta X_{t-i} + e_{3t} \tag{5}$$

H_0 : $\delta = 0$ Time series data is non-stationary; there is problem of unit root.

H_A : $\delta < 0$ Time series data is stationary

Apply OLS and calculate τ statistic of the estimated co-efficient of X_{t-1} and compare with the Dickey Fuller (1979) if critical τ values reject the H_0, in this case the time series data is stationary. On the other hand if we do not reject the H_0, in this case the time series is non-stationary.

3.2.2. Autoregressive Distributed Lag (ARDL) Model of Co-integration

A number of techniques are available for testing the existence of long run relationship among the variables related to time series data. The co-integration methodology utilized by Engle Granger (1987) for testing the long run relationship, fully modified OLS procedure of Phillips and Hansen's (1990), maximum likelihood based Johansen-Juselius (1990). This methodology is utilized when variables of the model have same order of integration and this method is further extended by Pesaran I(1). The above method is not fit for small size of data so researchers cannot get good results. Therefore in this state of condition the ARDL methodology by Pesaran and Shin (1990) and further extended by Pesaran et al. (2001). This method is used mixed order of integration. Firstly, this method is simpler than other methods of co-integration as like Johansen and Juselius (1990). For ARDL methodology the dependent variable or regressor to be I(1) is advantageous because the explanatory variables or regressands can either be purely I(1) or I(0) or a mix of both. Secondly, in this method there is no need for pre-testing of the variables of the model for unit roots distinct other methods as like the Johansen approach. Thirdly, this method is more suitable for small size of data than the others methods. But this procedure is lost it validity when any variable is integrated on I(2). Following Pesaran *et al* (2001) as summarized in Choong *et al* (2005), our bounds test procedure for the long-run as:

$$\Delta EDOV_t = \beta_1 + \beta_2 t + \beta_3 EDOV_{t-1} + \beta_4 IPC_{t-1} + \beta_5 HCF_{t-1} + \beta_6 LBF_{t-1}$$

$$+\sum_{h1=1}^{p} \beta_h \Delta EDOV_{t-h1} + \sum_{j1=0}^{p} \gamma_{j1} \Delta IPC_{t-j1} + \sum_{k1=0}^{p} \phi_{k1} \Delta HCF_{t-k1} + \sum_{l1=0}^{p} \phi_{l1} \Delta LBF_{t-l1} + u_t \quad (6)$$

$$\Delta HCF_t = \alpha_1 + \alpha_2 t + \alpha_3 EDOV_{t-1} + \alpha_4 IPC_{t-1} + \alpha_5 HCF_{t-1} + \alpha_6 LBF_{t-1}$$

$$+\sum_{h2=1}^{p} \beta_{h2} \Delta EDOV_{t-h2} + \sum_{j2=0}^{p} \gamma_{j2} \Delta IPC_{t-j2} + \sum_{k2=0}^{p} \phi_{k2} \Delta HCF_{t-k2} + \sum_{l2=0}^{p} \phi_{l2} \Delta LBF_{t-l2} + e_t$$

(7)

For equation (6)

$H_0 : \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ (there is no co-integration)

$H_a : \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$ (there is co-integration)

For equation (7)

$H_0 : \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$ (there is no co-integration)

$H_b : \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$ (there is co-integration)

When co-integration among the variables of the model is found we apply Vector Error Correction Model (VECM). The VECM is explained as under**:**

$$\Delta EDOV_t = \beta_1 + \beta_2 t + \sum_{h1=1}^{p} \beta_h \Delta EDOV_{t-h1} + \sum_{j1=0}^{p} \gamma_{j1} \Delta IPC_{t-j1} + \sum_{k1=0}^{p} \phi_{k1} \Delta HCF_{t-k1} + \sum_{l1=0}^{p} \phi_{l1} \Delta LBF_{t-l1} + \Psi ECT1_{t-1} + u_t \quad (8)$$

$$\Delta HCF_t = \beta_1 + \beta_2 t + \sum_{h1=1}^{p} \beta_h \Delta EDOV_{t-h1} + \sum_{j1=0}^{p} \gamma_{j1} \Delta IPC_{t-j1} + \sum_{k1=0}^{p} \phi_{k1} \Delta HCF_{t-k1} + \sum_{l1=0}^{p} \phi_{l1} \Delta LBF_{t-l1} + \omega ECT2_{t-1} + u_t \quad (9)$$

All of the variables are explained above expect ECTs which are one time period lagged error correction terms. The error correction model results indicate the speed of adjustment back to the long run equilibrium after a short run shock.

3.2.3. Granger Causality and the Vector Autoregressive Model

The Granger Causality test [Engle and Granger (1987) and Granger (1988)] is estimated by using the following methodology:

$$EDOV_t = \alpha_1 + \sum_{i=1}^{q} \beta_i EDOV_{t-i} + \sum_{j=1}^{q} \gamma_j HCF_{t-j} + \varepsilon_t \qquad (10)$$

$$HCF_t = \alpha_1 + \sum_{i=1}^{q} \theta_i EDOV_{t-i} + \sum_{j=1}^{q} \delta_j HCF_{t-j} + v_t \qquad (11)$$

For finding the optimal lag length Schwarz Information Criteria (SIC) or Akaike's Final Prediction Error (FPE) are used.

For checking the equation (1) EDOV Granger Causes HCF if $H_0 : \gamma_j = o$ is rejected there is no causal relation but $H_A :$ at least one $\gamma_j \neq o$ then we accept the alternative hypothesis and there is causal relation and for equation (2) HCF Granger Causes EDOV if $H_0 : \delta_j = o$ is rejected there is no causal relation but $H_A :$ at least one $\delta_j \neq o$ then we accept the alternative hypothesis there is causal relation between variables.

4. Empirical Results and Discussion

The results presented in Table: 1 show only the variable of Investment in Physical Capital is stationary at level but the variables like economic development of Pakistan (per capita real GDP is used as proxy of economic development of Pakistan), Investment in Human Capital and Labor Force are stationary at first difference. So there is mix order of integration. Hence this situation is suitable for applying ARDL so for finding the co-integrational relationship among variables of our model we apply ARDL model of co-integration.

Table 1: Augmented Dickey-Fuller (ADF) Test for Unit Root

Augmented Dickey-Fuller (ADF) Test at Level			LINEAR TREND	
Variables	**t –Statistic**	**p- Value**	**t -Statistic**	**p- Value**
EDOV	-1.256644	0.6391	-1.231565	0.8885
IPC	-5.079686	0.0002	-4.719251	0.0029
HCF	-0.101373	0.9419	-2.409388	0.3688
LBF	-1.260563	0.6374	-2.920356	0.1680
Augmented Dickey-Fuller (ADF) Test at 1st Difference				
Variables	**t –Statistic**	**p- Value**	**t -Statistic**	**p- Value**
Δ EDOV	-4.603042	0.0007	-4.624370	0.0037
Δ IPC	-3.846173	0.0057	-3.935322	0.0206
Δ HCF	-3.970175	0.0041	-3.913637	0.0216
Δ LBF	-5.182106	0.0001	-5.186852	0.0009

For lag selection keep the number of observation in view, the number of variables of the study and the lags requirement of the co-integration test. The maximum three lags are allowed to select the optimum lag length in Vector Auto-Regressive (VAR) process. Following Akaike Information Criterion (AIC) 2 is selected as optimal lag length.

For the investigation of long run relationship among the variables economic development of Pakistan, Investment in Human Capital, Investment in Physical Capital and Labor Force in Pakistan ARDL bound testing approach to co-integration has been utilized.

ARDL co-integration test results which based on equation (6) are declared in table 2. For testing the null hypothesis of no co-integration ($\beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$) among the variables Wald statistics is used to test. The Wald statistics is 5.9346, which is greater than Pesaran et al (2001) upper bound value of 5.7792 at 5% level of significance. Hence we are able to reject the null hypothesis of no co-integration ($\beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$) and accept the alternative hypothesis

($H_a : \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$) which describes that there is co-integrational relationship among the variables used in the model. Thus the analysis of data proves the existence of long run relationship among economic development of Pakistan, Investment in Human Capital, Investment in Physical Capital and Labor Force in Pakistan.

Table 2: Bound Testing Approach to Cointegration

ARDL(1,2,2,0)

F-Statistic (Wald-Test) = 5.9346		
Level of Significance	Pesaran et al. (2001) Critical values	
	Lower Bound Value	Upper Bound Value
5%	4.5068	5.7792
10%	3.7692	4.8721

*Critical values bounds computed by Pesaran et al. (2001) with unrestricted intercept and unrestricted trend.

When co-integration existed among the variables used for analysis, the results for long run are reliable. These results represent long run responsiveness of economic development of Pakistan, Investment in Human Capital, Investment in Physical Capital and Labor Force in Pakistan. The long run results are reported in table 3.

Table 3: Long Run Relationships

ARDL (1, 2, 2, 0)

Dependent Variable: EDOV			
Variable	Coefficient	t-Statistic	p-Value
IPC	0.144299	2.290301	0.0285
HCF	0.181457	3.170142	0.0033
LBF	0.564702	4.075400	0.0003

Constant	6.452768	48.56091	0.0000

The results reported in the table 3 show that economic development of Paksitan, Investment in Human Capital, and Investment in Physical Capital and Labor Force in Pakistan. The impact of Investment in Physical Capital on economic development in Pakistan is positive and significant for the long period of time as the co-efficient (0.1443) of Investment in Physical Capital shows. The coefficient (0.1815) of human capital formation shows that economic development of Pakistan is positively and significantly impacted by Investment in Human Capital. And the long run co-efficient (0.5647) of Labor Force shows that between Labor Force and economic development of Pakistan positive and significant relationship exists.

After the validity of the long run relationship among the variables of our and assessing the significance of their relationships, testing the nature of casual relationship and direction of causality will provide the important information regarding policy measures to invest in Human Capital for the development of Pakistan.

Table 4: Pair-wise Granger Causality Test

Null Hypothesis:	F-Statistic	p-Value
HCF does not Granger Cause EDOV	3.55329	0.0199
EDOV does not Granger Cause HCF	2.79183	0.0481

For this purpose Pair-wise Granger Causality Test (1969) is used and the results of the causality test are presented in table 4. The results of Model indicate that there exists a bi-directional causality between economic development of Pakistan and Investment in Human Capital in the country. The improvement in the degree of economic development leads to invest more on formation of human capital through spending more on health and education sectors. These spendings on health and education of the people produce healthy and skilled labor force which has higher efficiency in producing goods and services. This improvement in the efficiency of labor through skill development in turn leads to higher economic growth as well as economic development in Pakistan. The test of causality also tells from where we should start. The results indicate that both (economic development and investment in human capital) variables cause each other. Weather we start from focusing on economic development or stressing on investment in formation of human capital, we can achieve the both objectives. It means government of Pakistan has flexible policy options to reach the dual goal of accumulation of human capital and economic development as both of them reinforce each other.

5. Conclusion and Recommendations

The study investigates the responsiveness of economic development by investment in human capital, investment in physical capital and labor force in case of Pakistan. For analysis the data is used from 1972-2009. In investigating the unit problem in data ADF test is utilized in the study. For finding the long run relationship among the variable autoregressive distributive (ARDL) lag approach is used. The results of the ARDL model show investment in Physical capital positively and significant effect the economic development of Pakistan. The co-efficient of investment in human capital highlights that between investment in human capital and economic development positive and significant relation exists. And the results of the labor force points out that there is positive and significant relationship between labor force and economic development in Pakistan. For checking the causal relationship between economic development and investment in human capital Pair-wise Granger Causality test is utilized. The results of the Pair-wise Granger causality show that there is causal relationship between economic development and human capital formation in Pakistan. The results also explain that when the government of a country wants to get and specific level of output it has to investment in the education and health of its people. When government invests in the training and development of human in the long run these individuals increase the output level and in this way a country can get the fruit of economic development. There is bidirectional relation between investment in human capital and economic development. So getting the industrial development Pakistan should start either from economic development or from investment in human capital the results will be favorable for the economy of Pakistan.

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