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Nexus Among Human Capital, Public Expenses and Economic Growth: Empirical Evidence from Developing World

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Abstract
Public spending and human capital are always focused on appropriate economic growth via a variety of short and long term methods. In this study, government spending, human capital, and economic growth in 31 developing countries are examined from 1986 to 2017. The long-term connections between public spending, human capital, and economic growth are examined in this study. To do this, the research estimates an empirical model that considers human capital, public investment, and the combined impact of these variables on economic growth. For the unit root, econometric procedures such as the ADF test were employed. Comparably, co-integration has been measured using the Pedroni, Johansen Fisher, and Kao tests. For long-run analysis, the FMOLS and DOLS estimators are employed. In the empirical models, labor force, capital formation, public spending, and human capital are independent variables. Long-run results indicate that labor force, capital formation, public spending, and human capital positively affects economic growth. Significant empirical connection among economic growth, public spending, and human capital is quantified in this study. The results of this evaluation, which took place in 31 developing nations between 1986 and 2017, have a big impact on human capital accumulation and fiscal policy. Regardless of whether the model is estimated using weighted or pooled DOLS estimators or weighted or pooled FMOLS estimators, this relationship is robust from the estimation approach.
Keywords: Economic Growth, Public Expenses, Human Capital, FMOLS, DOLS

1. Introduction

The economic growth of a nation is used to estimate its level of advancement. The economic development of a nation also affects how it is classified. Every nation creates a strategy to achieve economic growth while accounting for its unique conditions and geographic features (Acemoglu, 2012; Denison, 2010). The classical school of thinking represents economic progress based on output and investment (Eltis, 2000). In order to improve a nation's economic growth, human capital is especially important in the production phenomena .A wide range of investments in people make to the concept of human capital. It was first believed to be human-acquired knowledge and skills (Schultz, 1961). Over time, the concept took on more dimensions and acquired traction in many ways. Investments in health and education, job training, migration, and skill development are all considered forms of human capital. Furthermore, its scope has expanded to encompass personal talents, innate abilities, and unique attributes that support the development of economic and social well-being (Becker, 1992). Examining the connections between financial stability and human capital competencies is important. Keynesians believe that government spending has a major impact on the volume of economic production. There are several ways that this could occur. Higher government spending boosts economic production, according to the fiscal multiplier idea. Government spending on social programs like health and education is considered to increase worker productivity, which in turn increases output. This kind of public spending is referred to as "investment in human capital". The speed at which these kinds of investments are made is also important, according to the classical school of thought.

Similar to this, government expenditure on energy supply, road construction and maintenance, and communication networks lowers production costs and encourages private investment, increasing the output of the country. The phrase "infrastructure development" describes this type of expenditure. In summary, higher government expenditure stimulates the economy by creating jobs, enhancing infrastructure, and providing better public services. A rise in the people's purchasing power causes aggregate demand to rise, which in turn boosts economic output. For this reason, government spending promotes economic growth. (Olurankinse & Alimi, 2014; Abdullah, Habibullah, & Baharumshah, 2009; Cooray, 2009; Adu, Joseph, & Ackah, 2014).It is important to consider how other macroeconomic factors must be modified in order to fully benefit from such government investment.

Conversely, numerous research studies have discovered that government expenditure has an adverse effect on economic expansion in cases where related factors are overlooked or if an odd rent-seeking behavior is at play. Growth thus may be pro-poor or anti-poor. The main reasons why government expenditure has a detrimental effect on economic production are threefold: borrowing, taxes, and excessive political engagement. Individuals will be discouraged from working long hours to avoid paying more outstanding taxes at higher income levels if the income tax rate is raised. Similarly, taxing firms raises manufacturing costs and diminishes profit margins, deterring the economy from expanding output. Government borrowing reduces the availability of financing for the private sector. It discourages private-sector investment. Government borrowing eventually pushes out private investment. Certain unproductive enterprises are formed for political goals as a result of political pressure, putting the economy under strain. In a nutshell, taxation on individuals and businesses, the prevalence of non-productive public expenditure due to political intervention, and the reduction in credit accessible to the private sector due to

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government borrowing all have a negative impact on productivity. (Barro, 1991; Iheanacho, 2016; Majeed, Iftikhar, & Atiq, 2019). The underpinnings of such anomalies need to be identified for addressing the issue in a better way. This calls for finding out a rational association of public spending and human capital with economic growth by exploring explicit and implicit causes.

2. Review of Literature

Initial studies on the topic were limited to the use of cross-sectional data. Barro (1991) established that, between 1960 and 1985, the growth of 98 nations was inversely correlated with per capita GNP and positively correlated with human capital as determined by the school enrollment ratio. According to Barro and Lee (1993), education had a favourable correlation with GNP and a considerable impact on growth. By including more recent data and better indicators of human capital, Barro (2001) updated his findings. Most of the time, the outcomes support his earlier conclusions. It is crucial to investigate the ways in which different educational attainment levels influence the economic development of developing nations.

Petrakis and Stamatakis (2002) explored at how human capital affected economic growth in three different countries: OECD, Developed, and LDCs. Empirical study was conducted using cross-country data. Based on data from multiple countries, the results indicated that varying degrees of economic development contributed to variations in the link between education and economic growth. It was discovered that the importance of elementary and secondary education was greater in developed and least developed nations. The demands of higher education are as significant and require investigation from the standpoint of developing nations.

Alper and Demiral (2016) conducted a study on the impact of government social spending on economic development in 18 OECD nations during 2002-2013. The study employed micro panel data methodologies to estimate the models. The study used the FGLS for estimation and found a positive impact of government social expenditure on economic growth. Similarly, a positive impact of education expenditures was found in the selected OECD countries.

Kimaro, Keong, and Sea (2017) conducted a comprehensive study on the role of public expenses. The study utilized data from 25 sub-Saharan African nations between 2002 and 2015. They considered several variables e.g., inflation, physical capital, and government expenditure. Co-integration was assessed using the Pedroni test, and estimates were obtained using the GMM approach. The study found a positive effect of public expenses on GDP per capita in all countries.

Shah and Bhusal (2017) evaluated how government expenditure affected Nepal's economic expansion between 1975 and 2016. Regression modelling was used in the study, and the results showed that public spending positively impacted GDP growth overall. These findings are consistent with Keynesian theory. Furthermore, the authors showed that interest rates had little bearing on GDP. Despite defying common belief, this was a rather intriguing finding.

Piabuo and Tieguhong (2017) explored the effect of health spending in African economies. The countries were divided into two categories based on health expenditure, those with more than 15% and those with less than 15% of GDP spent on healthcare. Long run estimates were obtained using FMOLS, DOLS, and Panel OLS techniques. The study revealed that all three estimation methods indicated a positive relationship in both categories of countries.

Using unbalanced panel data from 2000 to 2016, Majeed et al. (2019) investigated this association. GDP was the dependent variable and government spending, inflation, and openness were the independent factors. The results showed that, for all the nations examined, government spending had an adverse impact on economic growth, whereas other variables had a beneficial effect.

Gumus and Mammadov (2019) investigated nexus of public spending with economic growth during 1990- 2016 in Georgia Azerbaijan, and Armenia. The findings showed that public spending had a positive impact which supported Keynesian hypothesis. Furthermore, study also supported Wagner hypothesis as a two-way causality was observed for economic growth and public spending in the countries.

3. Materials and Methods

This study discusses some of theoretical models in two sections. First part is on human capital and economic growth while the second one covers public spending and economic growth.

3.1. Human capital and Economic Growth

Human capital as an input for economic growth was not given significant weight in neoclassical growth models. Endogenous growth models explain why human capital investments matter for economic growth. Based on the stock of native human capital, a country's ability to acquire and deploy new technology from elsewhere (Aghion & Howitt, 1992). These models suggest three fundamental sources of growth; human capital accumulation by educational investments (Lucas, 1988), technological progress because of investment in research and development (Romer, 1990) and technological progress due to learning-by-doing externalities (Romer, 1986). The endogenous growth hypothesis is not a rebuttal to either neoclassical or traditional growth theories. Rather, it is a development of traditional growth theory that elucidates the origins of economic growth in greater depth. The rate of technical change or population expansion is considered endogenous in the endogenous growth theory. Endogeniety play a pivotal role in developing and understanding of the relationships and causality between two variables. To consider an endogenous technology, production function used in Solow (1957) model is modified as follows[5]

$Y_t = F(K_t, L_t, A_t)$ ………………… (1)

[5]The specification of Solow (1957) model is $Y_t = A(t)F(K_t, L_t)$, when technological progress is unaffected (favoring neither capital nor labor). The relative marginal productivities of labor and capital are considered to be unaffected by technological progress in this specification.

where Y represents aggregate production and K and L are capital and labor inputs, respectively. This specification demonstrates that aggregate output is also influenced by technology (A), which is one of the endogenous inputs to the production function. The degree of technology is not anticipated to rise exogenously in this paradigm. They augmented Solow model assume following production function[6]

$Y(t) = K(t)^{\alpha}(A(t)L(t))^{1-\alpha}$ $0 < \alpha < 1$ ………………… (2)

where Y is output, K is capital, L is labor and A is level of technology. Labor and level of technology are exogenous and grow at n and g. The growth rate of $A(t)L(t)$ (i.e., effective labor) is $n + g$.

In order to determine the causes of economic growth, Solow (1957) also established the growth accounting paradigm. He hypothesized that the production function would have the following shape for growth accounting.

$Y_t = A_t L_t^{\propto}, K_t^{1-\propto})$ ………………… (3)

According to this production function, the amount of output in the economy is determined by three factors of production. These are capital (K), labor (L) and level of technology (A) or productivity. From the above production function (2.3) the following relationship is derived

$g_Y = g_A + (\propto)g_L + (1-\propto)g_K$ …………………… (4)

Where,

g_Y is growth rate of output
g_A is growth rate of technology
g_L is growth rate of labor
g_K is growth rate of capital
$\propto$ is output elasticity of labor
$1-\propto$ is output elasticity of capital

Mankiw et al. (1992) extended the production function of Solow by adding human capital as an extra input in production function. Mankiw et al. (1992) production function is as follows

$Y(t) = K(t)^{\alpha}H(t)^{\beta}(A(t)L(t))^{1-\alpha-\beta}$ ………………… (5)

where stock of human capital is H while K is capital, L is labor and A is level of technology. α and β are shares of output or income of physical capital and human capital, respectively.

The model assumes that q_k and q_h are the fractions of the economy's output invested in physical capital and human capital, in that order.

Defining

$y(t) = Y/AL$ as level of output per effective unit of labor,
$k(t) = K/AL$ as the stock of physical capital per effective unit of labor and
$h(t) = H/AL$ as the stock of human capital per effective unit of labor.

Evolution of $k(t)$ and $h(t)$ is determined as

$dk/dt = q_k y(t) - (n + g + \delta)\, k(t)$ ……………………… (6a)

$dh/dt = q_h y(t) - (n + g + \delta)\, h(t)$ ……………………… (6b)

where n and g are exogenous rate of growth of labor and level of technological, respectively. is the rate of depreciation? Equations (3.6) implicitly takes that human and physical capital depreciates with the similar proportion.

If α + β < 1, it suggests that returns to human capital and physical capital are decreasing[7]. Equations (3.6) indicates as economy meets a steady state path, k and h meet the following steady state paths:

$$k* = \left(\frac{q_k^{1-\beta} q_h^{\beta}}{n+g+\delta}\right)^{1/(1-\alpha-\beta)} \qquad h* = \left(\frac{q_k^{\alpha} q_h^{1-\alpha}}{n+g+\delta}\right)^{1/(1-\alpha-\beta)} \text{…………… (7)}$$

Substituting (3.7) into (3.5) and taking logarithms provide steady state income per capita:

$$\ln\left[\frac{Y(t)}{L(t)}\right]^* = \ln A(0) + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta}\ln(q_k) + \frac{\beta}{1-\alpha-\beta}\ln(q_h) \text{ ……………. 8)}$$

This indicates that how the portion of income spent in the physical capital (q_k), human capital (q_h) and population growth determine income per capita. Moreover, the equation (8) predicts that the existence of human capital accumulation surges effect of physical capital accumulation.

Alternatively, we can show the role of human capital in determination of output per capita in this model. If we combine (8) with equation for $h*$ given in (7), it provides a function in which income per capita depends on g (the rate of population growth), q_k (rate of investment in physical capital) and $h*$ (the level of human capital):

$$\ln\left[\frac{Y(t)}{L(t)}\right]^* = \ln A(0) + gt + \frac{\alpha}{1-\alpha}\ln(q_k) - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) + \frac{\beta}{1-\alpha}\ln(h*) \text{… (9)}$$

Note that in both equations (8) and (9), it is the level of income that is being explained, not its growth rate. Mankiw et al. (1992) estimated cross-country regressions for three subsamples of countries. The results showed that schooling variable was statistically significant.; that is augmented Solow model having human capital improves its performance.

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[6]This discussion is heavily borrowed from Mankiw et al. (1992).
[7]The model presented in (3.5) become an endogenous growth model if α + β ≥ 1, as it shows non decreasing returns to human and physical capital.

An alternative growth model, introduced by Benhabib and Spiegel (1994), postulates that aggregate factor productivity can be directly impacted by human capital levels via two distinct routes. They postulate that a country's ability to develop new technologies appropriate for domestic production can be directly influenced by its human capital. They presume that a country's ability to acquire and apply new technologies from other countries is proportional to its own human capital stock.
They assume the following production function

$$Y_t = A_t L_t^{\alpha}, K_t^{\beta} H_t^{\gamma} \varepsilon_t$$

Where *Y* is per capita income, stock of human capitalis *H* while *K* is physical capital, *L* is labor and *A* is level of technology. Long term economic growth is derived by taking log differences of both sides of production function i.e.

$$logY_t - logY_0 = (logA_t - logA_0) + \alpha(logL_t - logL_0) + \beta(logK_t - logK_0) + \gamma(logH_t - logH_0) + (log\varepsilon_t - log\varepsilon_0) \quad (10)$$

They called it an aggregate production function which represents standard growth accounting framework.
They also presented an alternative model for growth accounting that is as under

$$logY_t - logY_0 = (logA_t - logA_0) + \alpha(logL_t - logL_0) + \beta(logK_t - logK_0) + \gamma\left(\frac{1}{T}\sum_0^T logH_t\right) + (log\varepsilon_t - log\varepsilon_0) \quad (11)$$

where ${}^{1}/{}_{T}\sum_0^T logH_t$ is average level of the log of human capital
This model differs from the above model only in that the term $logH_t - logH_0$ is replaced with ${}^{1}/{}_{T}\sum_0^T logH_t$. This alternative model incorporates two sources by which human capital can affect $logY_t - logY_0$ i.e. per capita income growth. These sources are known as the endogenous growth component and the catch-up component of level of human capital stock.
In addition to above alternative model, Benhabib and Spiegel (1994) proposed a structural model which is based on following Cobb-Douglas production function

$$Y_t = A_t(H_t) L_t^{\alpha}, K_t^{\beta}$$

And model of long-term economic growth from time 0 to T time is

$$logY_T - logY_0 = (logA_T(H_t) - logA_0(H_t)) + \alpha(logL_T - logL_0) + \beta(logK_T - logK_0) + (log\varepsilon_T - log\varepsilon_0) \quad (12)$$

Where $(logA_T(H_t) - logA_0(H_t))$ is growth of total factor productivity, It is dependent upon the human capital level, as well as an interactive measure of that level and the degree to which a nation lags behind the leader in technology. The influence of domestic endogenous innovation is captured by the level of human capital, while the effect of catch-up is captured by the interaction term.
The above structural model for any representative country *i* is presented by defining growth of total factor productivity of country *i* as follows

$$(logA_T(H_t) - logA_0(H_t))_i = a + gH_i + mH_i[(Y_{max} - Y_i)/Y_i] \ldots\ldots\ldots\ldots\ldots \quad (13)$$

Where
a is predetermined technological progress,
gH_i is endogenous technological progress related to the ability to innovate domestically country *i*
$mH_i[(Y_{max} - Y_i)/Y_i]$ is the diffusion of technology from outside of country *i*
Equation (3.13) can be simplified as

$$(logA_T(H_t) - logA_0(H_t))_i = a + gH_i + mH_i[(Y_{max} - Y_i)/Y_i]$$
$$= a + gH_i + mH_i[(Y_{max}/Y_i - Y_i/Y_i)]$$
$$= a + gH_i + mH_i[(Y_{max}/Y_i - 1)]$$
$$= a + gH_i + mH_i - mH_i[(Y_{max}/Y_i)]$$

$$(logA_T(H_t) - logA_0(H_t))_i = a + (g - m)H_i + mH_i[Y_{max}/Y_i] \ldots\ldots\ldots \quad (14)$$

Putting (14) into 12) gives

$$logY_T - logY_0 = a + (g - m)H_i + mH_i[Y_{max}/Y_i] + \alpha(logL_T - logL_0) + \beta(logK_T - logK_0) + (log\varepsilon_T - log\varepsilon_0) \quad (15)$$

3.2. Public Expense and Economic Growth

Barro (1990) built a growth model which incorporates government expenditures using augmented version of following production function
$y = f(k) \ldots\ldots\ldots\ldots\ldots\ldots$ (16)
Where
y = *Y/L* i.e., output per worker
k= *K/L* i.e., capital per worker
each worker works for a fixed time; thus, no leisure-labor choice is assumed and capital includes human and nonhuman capital and constant returns to capital is assumed, therefore
$y = Ak \ldots\ldots\ldots\ldots\ldots\ldots$ (17)
A > 0 and it presents net marginal product of capital which is constant. In production, human and nonhuman capital is not necessarily perfect substitutes. To include the government expenditures (g) in production process production function is written as
$y = \emptyset(k, g) = k.\varphi(g/k) \ldots\ldots\ldots\ldots\ldots\ldots$ (18)
k and g are not close substitutes. Since characterizes quantity of capital of each producer so it corresponds per capita of aggregate capital. g is per capita government expenditure on good and services. The inclusion of g in production function as a separate input is based on the idea that private inputs are not close substitute of public inputs. If production shows constant returns to scale in k and g, so
$y/k = A(g/k)^{\alpha} \quad \ldots\ldots\ldots\ldots\ldots\ldots$ (19)

where $0 < \alpha < 1$
If government finances its expenditures contemporaneously by a flat-rate income tax then

$$g = T = \tau y = \tau . k . \varphi(g/k)$$

Where T are aggregate taxes collect at τ, and government runs a balanced budget.
Marginal product of capital from the production function in (18) is

$$\frac{\partial y}{\partial k} = \varphi\left(\frac{g}{k}\right).\left(1 - \acute{\varphi}.\frac{g}{k}\right) = \varphi\left(\frac{g}{k}\right).(1-\pi) \ldots\ldots\ldots\ldots\ldots (20)$$

Where, $0 < \pi < 1$, π is the elasticity of output per worker w.r.t. to g holding capital per worker (k).
Ligthart (2000) developed a conceptual framework assuming following production function

$$Y = AK^{\alpha}G^{\beta}L^{\gamma} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots 21)$$

Where
$\alpha, \beta, \gamma > 0$
Y is output of the economy
A is productivity of economy
K is private/physical capital
G is public capital/ government expenditure
L is labor or level of employment
In this setting
$Y_G = \partial Y/\partial G = \beta(Y/G) > 0$ i.e., G raise Y directly
and

$$Y_{KG} = \frac{\partial^2 Y}{\partial K \partial G} > 0$$

$$Y_{LG} = \frac{\partial^2 Y}{\partial L \partial G} > 0$$

These two cross partial derivatives show that G raise Y indirectly through changes in K and L.
Taking the log of both side of equation (21) gives

$$lnY = A + \alpha lnK + \beta lnG + \gamma lnL \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots (22)$$

Here α, β, γ are output elasticities of private/physical capital, public capital/ government expenditure and labor respectively.
Assuming constant returns to scale in all inputs i.e., $\alpha + \beta + \gamma = 1$ gives

$$lnY - lnK = A + \alpha lnK - lnK + \beta lnG + \gamma lnL$$

$$lnY - lnK = A + (\alpha - 1)lnK + \beta lnG + \gamma lnL$$

$$lnY - lnK = A + (-\beta - \gamma)lnK + \beta lnG + \gamma lnL \because \alpha - 1 = -\beta - \gamma$$

$$lnY - lnK = A + \beta lnG - \beta lnK + \gamma lnL - \gamma lnK$$

$$lnY - lnK = A + \beta(lnG - lnK) + \gamma(lnL - lnK) \ \ (23)$$

Equation (3.23) shows decreasing returns to K and L (private inputs) as $\alpha + \gamma < 1$.
Alternatively, if constant returns to scale in K and L (private inputs) is assumed i.e., $\alpha + \gamma = 1$, then it gives,

$$lnY - lnK = A + \alpha lnK - lnK + \beta lnG + \gamma lnL$$

$$lnY - lnK = A + (\alpha - 1)lnK + \beta lnG + \gamma lnL$$

$$lnY - lnK = A + (-\gamma)lnK + \beta lnG + \gamma lnL \because \alpha - 1 = -\gamma$$

$$lnY - lnK = A + \beta lnG + \gamma lnL - \gamma lnK$$

$$lnY - lnK = A + \beta lnG + \gamma(lnL - lnK) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots (24)$$

Now, equation (3.24) shows increasing returns to all inputs which endogenous growth model employed regularly.
Two estimators are used to estimate the empirical models: (i) the Fully Modified OLS (FMOLS) estimator, created by Phillips and Moon in (1999) and (ii) the Dynamic OLS (DOLS) estimator, presented by Kao and Chiang in (2000)These are very common estimates that are regarded as reliable.
Data sources include World Development Indicators (WDI) and Penn World Tables (PWT). The data so obtained is consistent to a great extent.

3.3. Empirical Model

The objective of the current study is to estimate the empirical model in order to determine how public investment and human capital affect economic growth.
Following the
Empirical Model

$$GDP_{it} = \alpha_{0i} + \alpha_1 L_{it} + \alpha_2 K_{it} + \alpha_3 H_{it} + \alpha_3 G_{it} + u_{it}$$

$i = 1, \ldots\ldots\ldots\ldots, N, t = 1, \ldots\ldots\ldots\ldots, T$
Where i, t, uit and εit represent the countries, time period and individual errors respectively. GDP stands for GDP per capita, L is labor force, K is physical capital, H is human capital, and G is government investment. All the variables are in their log form.
In general, the empirical research uses a coherent understanding of economic growth. GDP per capita used as proxy for economic growth. The labor force is one key factor influencing economic expansion. Although there might be other proxies, developing countries do not view them from a totally valid perspective.

4. Results

4.1. Unit Root for Stationarity Check

Under the null hypothesis, the unit root of the panel data is suggested by the LLC, Harris and Tzavalis, IPS, and Fisher tests. Under the null hypothesis, the Hadri-test supposes that all panels are non-stationarity. The unit root assumptions common unit root process hypothesis is put out by the LLC t-stat and (Breitung, 2001) t-stat. Unit root is assumed to assume individual unit root process, according to the ADF-test, IPS W-stat, and PP chi-square test. ADF was used in the study's unit root.

Table 1: ADF- Unit Root Test

Variables	Levels		1st Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
GDP	24.86	65.44	422.56*	353.21*
L	43.98	93.61*	373.16*	456.84*
K	44.87	134.06*	100.24*	84.28*
H	29.14	64.62	39.15	36.32
G	171.94*	415.39*	431.78*	726.13*

The unit root above displays the results of the ADF test, which is applied. In the ADF test, the series is stationary under the alternative hypothesis and non-stationary under the null hypothesis. Except human capital (H), the ADF-test results show integration order I(1) for all variables.

According to the ADF test, I(0) and I(1) represent the mixed integration order. Panel co-integration is needed in order to estimate the study's empirical model. This technique is more powerful as compared to other tools to achieve the given objectives of the study.

4.2. Panel Cointegration

Panel cointegration analysis is required for the study in order to evaluate the long-run relationship of the variable in an empirical model. The approach for long-run estimation is chosen purely based on the integration order of the variables. To determine cointegration among variables, the Pedroni test, the Johansen Fisher test, and the Kao-test are employed.

In this model, study used GDP per capita (dependent variable), labor (L), human capital (H), capital formation (K) and government spending (G) as study variables.

$$LRGDPE_{it}=f(L, K, H, G) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (25)$$

4.3. Results of co-integration tests

Three cointegration tests are applied (Pedroni, Kao and Johansen fisher). Null hypothesis is " no cointegration" in all three tests. Table 13 presents the estimates of three cointegration tests (Pedroni, Kao and Johansen).

Pedroni, Johansen fisher test and Kao test confirm the presence of long run relationships in the variables of model. All the three tests confirm co integration.

4.4. DOLS Estimates

The study applied DOLS approach for long run estimates of model. This estimation approach has two estimation ways/procedures i.e., pooled estimation and weighted estimation.

Table 3 presents DOLS estimates where under pooled estimation show that, all variables of study have positive and significant impact on output. So, one percent rise in labor (L), Human capital (H), capital formation(K) and govt. spending (G) brings about 0.26 percent, 0.29 percent, 0.45 percent and 0.56 percent increase in output respectively.

Similarly, under weighted estimation approach, one percent rise in labor (L), Human capital (H) and capital formation(K) and govt. spending (G) brings about 0.26 percent, 0.31 percent, 0.45 percent and 0.52 percent increase in output respectively.

4.5. FMOLS Estimates

FMOLS estimator is used to estimate long run relationship. This estimator provides unbiased estimates of parameters. Table 4.15 presents long run estimates among the study variables by using FMOLS approach under two estimation procedures (pooled estimation and weighted estimation).

The results under pooled estimation show that, one percent increase in labor (L), Human capital(H), capital formation(K) and govt. spending(G) brings about 0.24 percent, 0.39 percent, 0.44 percent and 0.56 percent rise in output respectively.

Almost similar results are found under weighted estimation approach. One percent rise in labor (L), Human capital (H), capital formation (K) and government spending (G) brings about 0.27 percent, 0.29 percent, 0.44 percent and 0.56 percent rise in output respectively. However, effect of government spending (G) is not statistically significant.

Table 2: Three Panel Cointegration Tests

Pedroni (Within-Dimension)				
	t- statistic	Probability	Weighted t-statistic	Probability
Panel v-Statistic	-2.248	0.988	-2.752	0.997
Panel rho-Statistic	4.317	1.000	2.585	0.995
Panel PP-Statistic	1.031	0.849	-4.052*	0.000
Panel ADF-Statistic	0.613	0.730	-7.116*	0.000

Between-dimension				
	t-statistic	Probability		
Group rho-Statistic	5.030	1.000		
Group PP-Statistic	-3.914*	0.003		
Group ADF-Statistic	-6.163*	0.000		
Johansen co-integration test				
Hypothesis	Trace Statistics	Probability	Max Eigen Value Statistics	Probability
None	795.5*	0.000	439.7*	0.000
At most 1	455.7*	0.000	251.0*	0.000
At most 2	258.5*	0.000	157.8*	0.000
At most 3	162.3*	0.000	117.9*	0.000
At most 4	144.7*	0.000	144.7*	0.000
Kao Co-Integration Test				
Kao Test			t- statistics	Probability
			-7.212*	(0.000)

Table 3: Long Run Estimates

DOLS						
	Pooled Estimation			Weighted Estimation		
Regressors	Coefficient	t-stat	Prob.	Coefficient	t-stat	Prob.
L	0.259**	2.154	0.032	0.264*	5.128	0.000
K	0.457*	14.461	0.000	0.450*	24.610	0.000
H	0.296***	1.947	0.052	0.312*	4.157	0.000
G	0.565***	2.166	0.030	0.526**	3.825	0.000
R^2 =0.98				R^2 =0.98		

Table 4: Long Run Estimates

FMOLS						
	Pooled Estimation			Weighted Estimation		
Regressors	Coefficient	t-stat	Prob.	Coefficient	t-stat	Prob.
L	0.245**	2.003	0.045	0.272*	143.606	0.000
K	0.442*	13.874	0.000	0.449*	192.205	0.000
H	0.393*	2.570	0.010	0.291*	335.827	0.000
G	0.568**	2.058	0.039	0.568	314.768	0.000
R^2 =0.98				R^2 =0.98		

The findings of two approaches indicate that labor, capital formation, human capital and government spending show significant and positive impact on output. Public spending and investment in human capital both are the key factor for any economy. Public spending provides better infrastructure and opportunities in the society whereas investment in human capital enhances working ability in labor force.

Government expenditures promote economic growth by investing in human capital. Education and training are critical factors in increasing productivity and innovation. By investing in education and training, governments produce more productive worker that leads to higher economic growth. Furthermore, public spending can also encourage growth by providing social welfare programs. By providing social welfare programs, governments can help reduce poverty and inequality, which can lead to increased economic growth.

Governments can provide support for research and development, and create a favorable business environment that encourages innovation and entrepreneurship. However, policy interventions aimed at promoting human capital may face challenges such as limited resources and political constraints. Some developing countries may lack the financial resources to invest in education and training, while others may face political constraints such as resistance to educational reforms.

5. Conclusion

Over a thirty-two-year period from 1986 to 2017 the study investigated the relationship among human capital, government spending and economic growth in 31 developing countries. The main objective of the study is to investigate the long-term links among human capital, government spending, and economic growth in developing nations using a balanced panel dataset. The model computes the effects of public investment and human capital on economic growth simultaneously. The mixed integration order, or I(0) and I(1), is validated by the LLC (2002), IPS (2002), ADF, and PP tests, which are used to test the

unit root. The long-term associations between the variables in the empirical model of the research are also validated by the Pedroni, Johansen Fisher and Kao tests, the results of which are employed for cointegration.
The DOLS and FMOLS estimators are extensively used. The independent variables in the model include labour force, capital formation, human capital and public investment. The long-term outcome shows a direct link among economic growth and the labor force, capital formation, human capital, and public investment.

References

Abdullah, H., Habibullah, M. S., & Baharumshah, A. Z. (2009). The effect of fiscal variables on economic growth in Asian economies: A dynamic panel data analysis. *International Journal of Business and Management, 4*(1), 56-69.

Acemoglu, D. (2012). Introduction to economic growth. *Journal of economic theory, 147*(2), 545-550.

Adu, F., Joseph, O.-M., & Ackah, I. (2014). Government Expenditures and Economic Growth dynamics in Ghana. *International Journal of Economics and Empirical Research (IJEER), 2*(5), 180-190.

Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60, 323-351.

Alper, F. O., & Demiral, M. (2016). Public social expenditures and economic growth: Evidence from selected OECD countries. *Research in World Economy, 7*(2), 44-51.

Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106, 407–443.

Barro, R. J. (2001). Human capital and growth. *American Economic Review*, 91, 12-17.

Barro, R. J., & Lee, J. W. (1993). International data on educational attainment: Updates and implications. *Oxford Economic Papers*, 3, 541-563.

Barro, R., & Sala-i-Martin, X. (2004). *Economic Growth*. USA: MIT Press.

Bassanini, A., & Scarpetta, S. (2001). Does human capital matter for growth in OECD countries? Evidences from pooled mean-group estimates. Working Papers, No. 282, Economics Department OECD.

Becker, G., Murphy, K., & Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of Political Economy*, 98, 12-37.

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development. *Journal of Monetary Economics*, 34, 143-174.

Breitung, J. (2001). The local power of some unit root tests for panel data *Nonstationary Panels, Panel Cointegration, and Dynamic Panels* (pp. 161-177): Emerald Group Publishing Limited.

Cooray, A. (2009). Government expenditure, governance and economic growth. *Comparative Economic Studies, 51*(3), 401-418.

Denison, E. F. (2010). *Accounting for slower economic growth: the United States in the 1970's*: Brookings Institution Press.

Eltis, W. (2000). The Classical Theory of Economic Growth. London: Palgrave Macmillan.

Fisher, I. (1906). The Nature of Capital and Income. Macmillan Company.

Gumus, E., & Mammadov, R. (2019). Real Government Expenditure and Economic Growth in the Southern Caucasus Countries: A Panel Data Analysis.

Hussain, I. H., Khan, Z., & Rafiq, M. (2017). An empirical analysis of the impact of compositional changes in public expenditure on economic growth: Time series evidence from Pakistan. *Business & Economic Review, 9*(1), 1-20.

Iheanacho, E. (2016). The contribution of government expenditure on economic growth of Nigeria disaggregated approach. International Journal of Economics and Management Sciences, 5(5), 1-8.

Kimaro, E. L., Keong, C. C., & Sea, L. L. (2017). Government expenditure, efficiency and economic growth: a panel analysis of Sub Saharan African low income countries. *African Journal of Economic Review, 5*(2), 34-54.

Majeed, S., Iftikhar, S. F., & Atiq, Z. (2019). Credit Activity and Growth Performance: Evidence from Panel Data. *Pakistan Journal of Applied Economics, 29*(1), 107-129.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107, 407-437.

Olurankinse, F., & Alimi, R. (2014). Government Spending and National Income: A Time Series and Panel Analysis for Nigeria, Ghana and South Africa. *Research Journal of Finance and Accounting, 5*(14), 54-61.

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and statistics, 61*(S1), 653-670.

Piabuo, S. M., & Tieguhong, J. C. (2017). Health expenditure and economic growth-a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries. *Health Economics Review, 7*(1), 23.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94, 1002-1037.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98, 71-102.

Schultz, T. W. (1961). Investment in human capital. *American Economic Review*, 51, 1-17.

Shah, R. K., & Bhusal, T. P. (2017). Nexus between public expenditure and economic growth in Nepal. *Economic Journal of Nepal*, *40*(1-4), 28-43.

Solow, R. M. (1957). Technical change and the aggregate production function. *Review of Economics and Statistics*, 39, 312-320.