DOES HUMAN CAPITAL DEVELOPMENT MOTIVATE GROSS DOMESTIC PRODUCT IN ECOWAS SUB REGION? AN EMPIRICAL INVESTIGATION

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Abstract

Empirical answer towards the research question whether human capital development motivates Gross Domestic Product in countries located within ECOWAS sub region has been provided in this study after the data from fourteen countries between 1990 and 2020 have been subjected to the panel Dynamic Ordinary Least Squares and a panel Granger Causality Test. These are the major submissions that emerged from the study; human capital development positively impacted Gross Domestic Product in one hand and human capital development Granger caused Gross Domestic Product in ECOWAS countries on the other hand. Therefore, the results from both the DOLS regression and the Pairwise Granger Causality Test established that human capital development significantly motivated Gross Domestic Product in ECOWAS sub region. In the light of the above submission, this study recommends that whenever the ECOWAS sub region wants to pursue a rise in Gross Domestic Product, the policymakers in this economic bloc should embark on human capital development oriented policy and programs, this will in turn stimulate Gross Domestic Product.

Keywords: HDI; GDP; Labour Force; ECOWAS; Panel DOLS; Panel Granger Causality

JEL Classification: H51; H52

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1. Introduction

Some decades ago, the popularity of human capital in driving Gross Domestic Product in an economy was brought to the limelight in the empirical literature by the endogenous theorists (Lucas, 1988; Barro *et al.*, 1995). Since then, human capital has been given a special attention as one of the strategic variables in explaining the macroeconomic variable, such as GDP in the economy (Silva and Sumarto, 2014; Teixeira, 2014; Santos, 2009). Over the years, countries in ECOWAS sub region have made efforts to facilitate improvement in aggregate outputs through the mechanism to encourage development of human capital. In spite of this effort, macroeconomic variables such as poverty level, human development indicator and economic growth rate stability ECOWAS sub region are still performing below the global standard (Ozekhome, 2017; Ogunbadejo and Kanwanye, 2020).

However, since 2000, it has been observed that the GDP growth rate in ECOWAS sub region has fallen below 5 percent (World Bank, 2019). Further evidence indicated that the growth rate of average GDP per capita has been dwindling continuously in the past decades (World Bank, 2019). This is the reflection that the ECOWAS sub region has an abysmal performance of GDP. Meanwhile, Romer (1986), Lucas (1988) and Barro *et al.* (1995) have recognized human capital as the indispensable variable that motivates the growth of GDP of an economy. In view of the above, scholars in the recent times have made various efforts to investigate the nexus between human capital development and GDP in different countries. Meanwhile, carrying out this study in ECOWAS sub region during this time is very paramount on the following grounds; on the one hand, ECOWAS sub region possesses the lowest literacy rate in conjunction with the lowest human capital development in the world (UNDP, 2019; The Danish Institute for Human Rights, 2017). On the other hand, it has been observed the majority of the recent empirical studies such as Lawanson (2015), Roland and Joel (2020), Obialor (2017) and Ejemeyovwi *et al.* (2019) focus on the linkage between educational spending and aggregate productivity in ECOWAS sub region. These studies have failed to account for the impact of human capital development on GDP in this economic bloc. Similarly, recent studies in ECOWAS sub region like Deriouch (2020), Anowor *et al*. (2020), Ogunbadejo and Kanwanye (2020) and Musibau *et al.* (2019) that focus on the subject matter of this study did not utilize human development index to measure human capital development which has been adjudged to be the best measurement of human capital development (UNDP, 2019). Against this backdrop, to the best of our knowledge, this study will be the first to utilize HDI to proxy human capital development in a study regarding human capital development and GDP in ECOWAS sub region. Therefore, this study

would contribute to the literature by providing an empirical answer to the research question; what is the nexus between development of human capital and GDP in ECOWAS sub region?

In addition, the arrangement of this paper is done as follows. Section one introduces the subject matter of this study. Section two focuses on literature review while the latter part of this study contains the methodology, discussion of results and policy implication of the study.

2. Theoretical Literature

Beginning from the theoretical argument, it has been established that various factors directly and indirectly influence human capital and its aftermath effect on GDP. As a result of this, it is important for this section to recognize and present the underlying theory that links human capital and GDP which could provide a helpful information in assessing the relationship between GDP and human capital in ECOWAS sub region.

2.1 Human Capital Theory

Human capital theory could be associated with the revolutionary works of Becker (1975) and Schultz (1992). The basic argument underlining this theory is that investment in human capacity through education increases the cognitive skills and efficiency of workers which metamorphose into higher productivity in the firm. Investment in human capacity brings about a rise in the stock of human capabilities, and such investment includes the following education and educational oriented conferences, health, nutrition and on-the-job training. It is important to stress that, according to the theory, the stock of human capital could only rise in a period when the gross investment supersedes depreciation as time goes, with intense use or lack of use. Meanwhile, education in this context is regarded as a strategic investment in human resource in which human capital theorist considers as important as physical capital or even more worthwhile than the investment in physical capital. It has been established by human capital theorists that basic literacy catalyzes the productivity of workers engaging working in low skilled professions. Consequently, the marginal productivity of workers engaging in high skilled profession and positions increases in response to the demand for logical and analytical reasoning which requires technical and specialized information. Therefore, the submission of the theory is that: a society that makes room for greater provision of schooling, will eventually

witness the greater rise in GDP. Hence, the relevance of this theory to the subject matter of the study.

2.2 Literature Review

In this subsection, the review of relevant empirical studies focusing on the nexus between human capital development and productivity around the world is presented as follows;

In the work of Jameel and Naeem (2016), the relationship between human capital and aggregate productivity in eleven (11) economies between the period of 1992 and 2014 used a fixed effect OLS. It was established in the study that human capital contributed to aggregate productivity in the countries under investigation. Meanwhile, Khembo and Tchereni (2013) assessed how the formation of human capital motivated development of economies among 13 South African Development Community (SADC) within the period of 1990 and 2005. It was discovered in the study that there was a positive contribution of human capital to the economic development within this region. Having employed VAR and Granger causality approach to estimate the nexus between aggregate productivity and development of human capital from 1975 to 2010, evidence from advanced economies in the work of Hammani (2013) shows that in the long-run, aggregate productivity was positively motivated by health expenditures in the economies. Ejemeyovwi *et al.* (2018) estimated how investment in ICTs alongside development of human capital contributed to aggregate the productivity in the ECOWAS sub region between 2004 and 2015 applying GMM tool of estimation with this finding. Investment in ICTs had no significant connection with development of human capital. Whereas, development of human capital alongside ICTs could sponsor a rise in the level of aggregate productivity in ECOWAS sub region. In the outcome of the empirical study of human capital and aggregate productivity using OLS and Granger causality to analyse the country`s data between 1974 and 2012, evidence from North Africa in the work of Mekdad *et al*. (2014) proved that aggregate productivity in Algeria was significantly driven by the public investment in education. Boachie (2015) explored ARDL bounds test in investigating the influence of health growth on aggregate productivity in Ghanaian economy ranging from 1982 to 2012 within the application of econometrics technique. The study reported that, in the short run and in the long run as well, aggregate productivity was significantly facilitated by health in the country. In a similar study in developed countries, Sghari and Hammami (2013) investigated the contribution of investment in health on aggregate productivity

between 1975 and 2011. The reports from Granger causality and VECM proved that a rise in investment in health motivated a positive and stable contribution to aggregate productivity in the long run in the country.

Moreover, Obialor (2017) employed technique such as Co-integration alongside Vector Error Correction in examining the contribution of human capital investment by government facilitating aggregate productivity in three Sub-Sahara African (SSA) nations, namely Ghana, Nigeria and South Africa between 1980 and 2013. Evidence from the study shows that human capital variables like health and education caused a significant direct influence on aggregate productivity only in Nigeria, but literacy ratio was positive and insignificantly in all countries under investigation.

Olowookere *et al.* (2022) appraised interlink between the development of human capital and sustainable development using the Nigerian case across the period of 1981 and 2019. The authors analysed the study through the techniques of Fully Modified Least Squares and Granger causality respectively to conclude that human capital development components possessed the ability to eradicate poverty in Nigeria. Kanwanye *et al* (2021) examined the channel through which human capital affected aggregate output in ECOWAS sub region from 1980 to 2018 within ARDL in a panel form. It was reported that aggregate output was hindered by human capital in the period of short time and the long time as well. In a related study, Yaseen et al. (2020) explored nineteen (19) economies on the Asian continent by investigating the linkage among aggregate productivity, trade openness and human capital within the period of 1985 and 2017 using FMOLS and DOLS. The authors argued that in Western Asia and Southern Asia, aggregate productivity was significantly promoted by trade openness and human capital. Anowor et al. (2020) investigated the health aspect of human capital financing and aggregate productivity with data of 15 ECOWAS economies between 1985 and 2017. The results from the panel ARDL technique indicated that spending on healthcare from both private and public motived aggregate productivity significantly in the study. Using the Nigerian data, Ogunbadejo and Kanwanye (2020) assessed how human capital influenced aggregate output between 1970 and 2017. The authors used the reports from two-stage least squares (2SLS) technique to conclude that aggregate productivity was significantly enhanced by human capital components like physical capital, enrolment in tertiary institutions and life expectancy in the country.

In the same vein, Musibau *et al*. (2019) appraised the linkage among development of human capital, inflows of foreign capital and aggregate productivity using experience of ECOWAS sub region between 1980 and 2017 with the application of

technique of the PMG. It was concluded from the study that aggregate productivity was positively facilitated by human capital but the impact was not significant in ECOWAS sub region. Fadila and Olure-Bank (2019) explored the technique of Pedroni residual cointegration to appraise how development of human capital motivated aggregate productivity in ECOWAS sub region between 1980 and 2016. The study submitted that school enrolment, health and education spending caused a significant influence in driving aggregate output in the region.

3. Methodology

3.1 Theoretical Framework

Anchoring this study on the appropriate theoretical framework such as endogenous growth theory is very important. This theory emerged in response to the shortfalls of the Solow`s neoclassical (exogenous) growth model. As enunciated by Lucas (1988), human capital is a major driver of the production function in the endogenous growth model. As such, endogenizing technical progress motivates GDP in a sustainable manner. The growth of the economy is in connection to innovation that is driven by investment in the capacity building of human and technical improvement (Lucas, 1988). The argument of human capital theory is that health and education in an economy are so important that these factors are enhancing and promoting GDP (Wilson *et al.*, 2005). Therefore, the impact of human capital on aggregate productivity in ECOWAS can be analysed based on the augmented Solow model. It was Mankiw *et al.* (1992) that augmented the Solow model with human-capital-growth model as a better approach to the initial Solow growth model which failed explicitly to incorporate human capital. This modification facilitates the suitability and hence, the adaptation of this model for the ECOWAS context. The basic assumption in this approach is that, an increase in workers' quality through improved education, will improves the output. As such, Mankiw *et al*. (1992) explained the relationship in a Cobb-Douglas production function with constant returns to scale. The human capital augmented Cobb-Douglas production in its general form is illustrated below:

$$Yt=AKt^{a}Ht^{\beta}\ Lt^{1-a-\beta}\ a+\beta<1 \quad (1)$$

Econometrically, the model is specified as follows:

$$Yt=AKt^{a}Ht^{\beta}\ Lt^{1-a-\beta}\ Ua+\beta<1 \quad (2)$$

Where:Yt = output at time t. A = status of technology. Kt = physical form of capital at time t. Ht = human form of capital at time t. Lt = labour at time t. α = elasticity of

physical capital with respect to output. β = elasticity of human capital with respect to output. U = error term. When transformed into a log-linear form, it becomes:

$logYt=a_0+ alogKt+\beta logHt+\theta logLt+V$(3)

Where:θ=1- α-β; α_0 = logA and V = logU

3.2. Model Specification

3.2.1. Model 1: Regression Models

Steaming from the theoretical framework, this study will adopt the augmented Solow-human-capital-growth regression model. To suit the ECOWAS context which is our case study, some adjustments and modifications were made in equation three (3) as follows;

Following Babasanya *et al.* (2018) and Aderemi *et al*. (2021) the model for this study could be stated in functional form as

$GDP_{it} = f (HDI_{it})$(4)

Consequently, in order to accommodate other crucial control variables that would improve the robustness of the model, according to the extant literature such as, Olowookere *et al*. (2022), Oloke *et al*. (2022) and Akinbode *et al*. (2020), Gross Capital Formation (GCF), Trade Openness (TRO) and Labour Force (LF) have direct or indirect influence on both GDP and human capital development in an economy. Therefore, the new expanded model is put forward as this;

$GDP_{it} = f (GCF_{it}, HDI_{it}, TRO_{it}, LFP_{it})$(5)

Econometrically:

$GDP_{it} = \alpha_0 + \beta_1 GCF_{it} + \beta_2 HDI_{it} + \beta_3 TRO_{it} + \beta_4 LFP_{it} + \mu_{it}$(6)

Where: GDP = Gross domestic product.

HDI = Human development index

GCF = Gross Capital Formation

TRO = Trade Openness

LFP = Labour force participation rate

α is the intercept of the function.

β1, β2, β3 and β4 are the regression coefficients.

μ is the error term as proxies of other factors that affect GDP but weren't used.

Transforming the above equation into log form because we have to standardize the regressand and regressors in order to interpret the results in a better way, we now have the equation as this:

$$\log GDP_{it} = \alpha_0 + \beta_1 \log GCF_{it} + \beta_2 \log HDI_{it} + \beta_3 \log TRO_{it} + \beta_4 \log LFP_{it} + \mu_{it} \quad (7)$$

Where: log = natural logarithm

The dynamic panel model of the equation (7) is stated thus;

$$LGDP_{it} = \alpha_0 + \sum_{j=1}^{n} \beta_j \, LGCF_{it-j} + \sum_{k=1}^{n} \delta_k \, LHDI_{it-k} + \sum_{l=1}^{n} \gamma_l \, LTRO_{it-l} + \sum_{l=1}^{n} w_l \, LLFP_{it-m} + u_{1t} \quad (8)$$

Equation (8) will be the regression model to be used for this study.

3.2.2. Causality between Human Capital Development and GDP in ECOWAS Sub Region

A granger causality equation is specified below to verify the feedback information that exists among the key variables of interest in this study. It is expanded into Model 9-12 as follows;

$$LGDP_{it} = \alpha_0 + \sum_{i=1}^{n} \alpha_i \, LGDP_{2it-i} + \sum_{j=1}^{n} \beta_j \, LGCF_{it-j} + \sum_{k=1}^{n} \delta_k \, LHDI_{it-k} + \sum_{l=1}^{n} \gamma_l \, LTRO_{it-l} + \sum_{l=1}^{n} w_l \, LLFP_{it-m} + U_{it}$$

$$LGCF_{it} = Ƶ_0 + \sum_{p=1}^{n} Ƶ_p \, LGCF_{it-p} + \sum_{o=1}^{n} ¥_o \, LGDP_{it-o} + \sum_{r=1}^{n} €_r \, LHDI_{it-r} + \sum_{e=1}^{n} \chi_e \, LTRO_{i-e} + \sum_{l=1}^{n} w_l \, LLFP_{it-m} + U_{it} \quad (9)$$

$$LHDI_{it} = \psi_0 + \sum_{w=1}^{n} \psi_w \, LHDI_{it-1} + \sum_{q=1}^{n} \varpi_q \, LGDP_{it-q} + \sum_{z=1}^{n} ŧ_z \, LGCF_{it-z} + \sum_{x=1}^{n} \pi_x \, LTRO_{it-x} + \sum_{l=1}^{n} w_l \, LLFP_{it-m} + U_{it} \quad (10)$$

$$LTRO_t = ɓ_0 + \sum_{c=1}^{n} ɓ_c \, LTRO_{it-c} + \sum_{v=1}^{n} Ч_v \, LGDP_{it-v} + \sum_{b=1}^{n} И_b \, LGCF_{it-b} + \sum_{m=1}^{n} Þ_m \, LHDI_{it-m} + \sum_{l=1}^{n} w_l \, LLFP_{it-m} \, U_{it} \quad (11)$$

$$LLFP_{it} = Ƶ_0 + \sum_{p=1}^{n} Ƶ_p \, LLFP_{it-p} + \sum_{o=1}^{n} ¥_o \, LGDP_{it-o} + \sum_{r=1}^{n} €_r \, LGCF_{it-r} + \sum_{e=1}^{n} \chi_e \, LHDI_{i-e} + \sum_{l=1}^{n} w_l \, LTRO_{it-m} + U_{it} \quad (12)$$

3.3. Apriori Expectation

Apriori expectation refers to the expected signs of the independent variables in the study. It is expected that each of the explanatory variables would exhibit a positive relationship with the dependent variable. Table 3.1 shows a summary of the expected signs of the study variables.

Table 1. A priori expectations and Data Source

Variables	Label	Notations	Expected Value
Gross Capital Formation	GCF	β_1	Positive (+)
Human Development	HDI	β_2	Positive (+)
Trade Openness	TO	β_3	Positive (+)
Labour Force Participation Rate	LFP	β_4	Positive (+)

Source: Researchers' Compilation (2022)

3.4. Measurement of Variables

The rundown of the variables used in this study is given below:

Dependent Variable: The dependent variable is Gross Domestic Product (GDP).

Independent Variable: The independent variables are as follows:

Gross Capital Formation (GCF): Gross capital formation (% of GDP) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.

Human Capital Development (HDI): This is measured by the Human Development Index (scale of 0-1) which measures the level of education, health status and living standard of all and sundry respectively in each country (World Bank, 2022).

Trade Openness (TRO): Trade (% of GDP) is calculated as this, the addition of both exports and imports dividing it by GDP (World Bank, 2022).

Labour Force Participation Rate (LFP): This accounts for the proportion of the population within the age bracket of 15 and beyond who is economically viable. (World Bank, 2022).

3.5. Source of Data

This research investigated the relationship between human capital development and economic growth in ECOWAS using secondary data. Annual time series data was gathered from World Development Indicators (WDI) from 1990 to 2020 (31 years). Data from 14 ECOWAS countries were collated. The inclusion of these countries was based on data available on the variables of interest in this study. The countries selected are: Benin, Burkina Faso, Cabo Verde, Niger, Cote d'Ivoire, Sierra Leone, The Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Nigeria, Senegal, and Togo. Succinctly put, it is instructive to state that some missing data were observed in early 1990s regarding the Nigerian HDI, to this end, the study follows the approach of Benchani and Swiss (2019) in addressing the missing data points by employing the average of the last four most recent years in the dataset to replace the missing points. As such, the panel dataset is strongly balanced, and consequently motivates the balanced panel analysis in this study.

Table 2: The Breakdown of the Data Sources

Variable	Label	Description (Measure)	Source
Dependent Variable	GDP	Gross Domestic Product(aggregates based on constant 2015 prices, expressed in U.S. dollars)	World Development Indicators (2022)
Independent Varaibles	GCF	Gross capital formation (% of GDP)	World Development Indicators (2022)
	HDI	Human Development Index (scale 0-1)	World Development Indicators (2022)
	TRO	Trade Openness (% of GDP)	World Development Indicators (2022)
	LFP	Labour Force Participation Rate (15+ years based on ILO Modelled estimate)	World Development Indicators (2022)

Source: Researchers' Compilation (2022)

3.6. Estimation Techniques

This study will make use of the Fully Modified Ordinary Least Squares (FMOLS) and the Dynamic Ordinary Least Square method. These are co-integrating techniques used when there might be problems with serial correlation and endogeneity with datasets. They produce reliable parameter estimates in regression analysis and are superior to the Ordinary Least Square (OLS) method. The FMOLS is a non-parametric approach proposed by Phillips and Hansen (1990) to deal with serial correlation problems. It employs preliminary estimates of the symmetric and one-sided long-run covariance matrices of the residuals (Phillips & Hansen, 1990). The Dynamic OLS (DOLS), on the other hand, is an alternative (parametric) approach that was advocated by Saikkonen (1992). In this method, lags and leads are introduced to cope with the problem irrespectively of the order of integration and the existence or absence of cointegration. In other words, this method constructs an asymptotically efficient estimator that eliminates the feedback in the cointegrating system (Saikkonen, 1992).

However, before the aforementioned analyses are carried out, several post-estimation tests will be carried out. This includes the stationarity test and co-integration test. The Levin, Lin and Chu (LLC) test were used to test for the presence of stationarity (Priyankara and Li, 2018) while the Johansen Fisher Panel test will be used to test for co-integration in the datasets.

Finally, the Panel Granger causality test is applied to investigate the direction of causality between the variables. The Panel Granger causality test is a statistical hypothesis test used to determine a variable that may be used to predict another (Granger & Newbold, 1977). It looks at the effect of past values of one or more of the variables on the current value of the other.

4. Analysis and Results

The analysis of results starts with the presentation of descriptive statistics and then the trend analysis. This is followed by the presentation of the unit root test results using the Levin, Lin and Chu (LLC) test, and the co-integration test result using the Johansen Fisher Panel Cointegration Test. The analyses of the research hypothesis come next using the results from the FMOLS and DOLS regression results and the panel Granger causality test. Finally, the findings are discussed appropriately.

4.1. Pre-tests

Before the objectives of this study were holistically estimated, the authors subjected the data of this study to various pre-tests such as Descriptive Statistics, Multicollinearity Test, Unit Root Tests and Johansen Fisher Panel Cointegration Test which are presented systematically as follows;

4.2. Descriptive Statistics

Table 3. Descriptive Statistics

	LGDP	LGCF	LHDI	LTRO	LLFP
Mean	22.35866	2.898410	-0.872818	4.005321	4.165038
Median	22.17500	2.931140	-0.841647	4.003794	4.165075
Maximum	27.02712	3.972595	-0.406466	4.878896	4.429983
Minimum	19.14561	-1.228027	-1.546463	3.031221	3.790940
Std. Dev.	1.581183	0.517053	0.227448	0.325651	0.130503
Skewness	0.554090	-1.787650	-0.585431	0.075835	-0.344689
Kurtosis	3.395195	13.92105	3.207972	2.956378	2.761033
Jarque-Bera	25.03172	2387.944	25.57287	0.450400	9.626605
Probability	0.000004	0.000000	0.000003	0.798356	0.008121
Observations	434	434	434	434	434

Source: Researchers' Compilation (2022)

From Table 3, the mean values of the variables are within their minimum values and maximum values. By implications, no variables suffer from outliers. In addition, the standard deviation is another piece of information reported in the descriptive statistics and it accounts for the dispersal of the data regarding its mean, i.e., it describes the distribution in relation to the mean. A low standard deviation between 0 and 1 implies that data fall within the mean, and a high standard deviation above 1 signifies that data have dispersed out of their mean point. From Table 3 besides LGDP, all variables have a standard deviation below 1 which implies that the data are clustered around the mean but LGDP deviated from the mean.

The skewness values give information about the asymmetry or distortion of symmetric distribution. Values less than 0 indicate negative skewness while values greater than 0 indicate positive skewness. From Table 3, all the variables, LGDP and LTRO are positively skewed wilt LGCF, LHDI and LLFP are positively skewed.

Kurtosis measures the combined sizes of the two tails. That is, it measures the amount of probability in the tails. The value is often compared to the kurtosis of the normal distribution, which is equal to 3. From Table 3, LTRO and LLFP have a

kurtosis value of less than 3 implying that the variables have a smaller tail than the normal distribution.

The Jargue –Bera measures the normality of the distribution. The probability values of the Jarque-Bera coefficient show that except LTRO, all are lower than 5% implying that the variables obey the normal distribution assumption at a 5% level of significance.

5. **Results and Discussion**

5.1. Multicollinearity Test

It is important to ensure that multicollinearity is put to check in the model. This is because the presence of multicollinearity would bring about spurious results. A test for multicollinearity was conducted using the correlation matrix method. The result of the correlation matrix is shown in Table 4.2 below

Table 4. Correlation Matrix

	LGDP	LGCF	LHDI	LTRO	LLFP
LGDP	1.0000	0.2145	0.2616	-0.2096	-0.1690
LGCF	0.2145	1.0000	0.4130	0.3194	-0.1243
LHDI	0.2616	0.4130	1.0000	0.5083	-0.3997
LTRO	-0.2096	0.3194	0.5083	1.0000	-0.2447
LLFP	-0.1690	-0.1243	-0.3997	-0.2447	1.0000

Source: Researchers' Compilation (2022)

As seen in Table 4.2, none of the variables is equal to 1 or has a perfect positive or perfect negative correlation indicating that the variables used in this study are independent of each other and lacks multicollinearity issue.

5.2. Unit Root Tests

The stationarity test is examined using the Levin, Lin and Chu (LLC) test. The use of this stationarity statistic is to ensure that none of the variables is integrated at the second differencing level. The results of LLC unit root tests of the variables at levels and first difference are presented in Table 4.3.

Table 5. Stationarity Test using LLC Test

VARIABLES	LLC		LLC		Status
	LEVELS (0)		1ST DIFF (1)		
	LLC Test Stat	Probability	LLC Test Stat	Probability	
LGDP	-0.74888	0.2270	-13.5743	0.0000*	I(1)
LGCF	-1.47467	0.0702***	-11.9467	0.0000*	I(1)
LHDI	0.03270	0.5130	-4.96046	0.0000*	I(1)
LTRO	-2.95980	0.0015**	-10.6795	0.0000*	I(0)
LLFOP	-4.30700	0.0000*	-1.79404	0.0364**	I(0)

Hint :(*) (**) (***) indicate significance at 1%, 5% and 10% levels, respectively

Source: Researchers' Compilation (2022)

From the results in Table 4.3, the Levin, Lin and Chu (LLC) unit root test shows that LTRO and LLFP are stationary at levels [I(0)] while all other variables (LGDP, LGCF and LHDI) are stationary at first difference. Since some variables are only stationary at first difference. This implies that there might be a loss in the long-run characteristics of the data series. Nonetheless using the method of cointegration the long-run characteristics can be recovered. The data series were cointegrated and tested for a long-run relationship using the Johansen Fisher Panel Cointegration test.

5.3. Johansen Fisher Panel Cointegration Test

Since the unit root test results showed that not all variables were all stationary at Level, the Johansen Fisher Panel Cointegration Analysis was employed to determine the possibility of the existence of long-run relationships among the variables. The results are shown in Table 4.4:

Table 6. Fisher Co-Integrating Test Results

Hypothesized	Fisher Stat.*		Fisher Stat.*	
No. of CE(s)	(From trace test)	Prob.	(From max-eigen test)	Prob.
None	426.3	0.0000*	285.7	0.0000*
At most 1	193.5	0.0000*	110.8	0.0000*
At most 2	116.3	0.0000*	80.74	0.0000*
At most 3	65.07	0.0001*	51.61	0.0043**
At most 4	45.21	0.0810***	45.21	0.0810***

Hint: (*) (**) (***) indicate significance at 1%, 5% and 10% levels, respectively

Source: Researchers' Compilation (2022)

The Fisher statistic was used to test for co-integration in the model. The results presented in Table 4.4 shows that there are at most 4 co-integrating equations from the trace and max-eigen statistics. The performance of the co-integration test is necessary to establish if convergence is possible in the long-run among the studied variables. The cointegration ocured among the variables given the above result.

5.4. Analyses of Research Hypotheses

Hypothesis One

H_0: Human capital development does not exert a significant impact on GDP of ECOWAS countries.

H_1:Human capital development exerts a significant impact on GDP of ECOWAS countries.

Having done the stationarity test and co-integration test, all necessary conditions have been met to carry out a regression analysis using the DOLS method. The results presented in Table 4.5 and Table 4.6 will be used to analyse the above hypothesis

Table 7. Estimated Results of the Relationship between Human Capital Development and Aggregate Productivity in ECOWAS countries

Dependent Variable: LGDP				
Method: Panel Dynamic Least Squares (DOLS)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGCF	-0.316567*	0.082804	3.823092	0.0002
LHDI	4.054575*	0.306887	13.21194	0.0000
LTRO	-0.248015	0.169551	1.462778	0.1443
LLFP	-2.996367*	1.004910	2.981727	0.0030
R-squared	0.947511			

Hint: (*) (**) (***) indicate significance at 1%, 5% and 10% levels, respectively

Source: Researchers' Compilation (2022)

Table 7 presents the panel regression results, using DOLS technique. The adjusted r-squared and r-squared values in both Table 7 reveal that the endogenous variables explained more than 90% of the changes in GDP among the 14 ECOWAS countries examined. Therefore, the model estimated has strong predictive power. Based on the parameter estimates, it is revealed that Gross Capital Formation (LGCF)

negatively impacted GDP in ECOWAS countries from 1990 to 2020 and this relationship is significant at a 1% level of significance. The parameter estimates in the FMOLS result shows that human development index (LHDI) positively impacted GDP in ECOWAS countries from 1990 to 2020 and this relationship is significant at a 1% level of significance. The parameter estimates show that trade openness (LTRO) negatively impacted GDP in ECOWAS countries from 1990 to 2020 but this relationship is not significant.

Finally, the parameter estimates in the DOLS result shows that labour force participation (LLFP) negatively impacted GDP in ECOWAS countries from 1990 to 2020 and this relationship is significant at a 1% level of significance. In conclusion, the results of the DOLS regression analysis shows that besides LTRO, all other variables used to measure development of human capital have a significant effect on GDP.

By and large, development of human capital and GDP have a significant positive relationship in ECOWAS sub region. This finding is in tandem with the submissions of Anowor *et al*. (2020) in a related study in ECOWAS despite difference in methodology. The submissions of Yaseen *et al.* (2020), Khembo and Tchereni (2013), Jameel and Naeem (2016) and Ogunbadejo and Kanwanye (2020) in similar studies focusing on Asian,13 South African Development Community (SADC), other eleven (11) economies and Nigeria respectively. However, the finding of Kanwanye *et al.* (2021) in related study in ECOWAS sub region contradicts the finding of this current study. The reason for disparity could be probably attributed to difference in methodology and period of study`s coverage.

Table 8. Robustness Check using FMOLS Panel Regression Results

Dependent Variable: LGDP				
Method: Panel Dynamic Least Squares (DOLS)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGCF	-0.508818*	0.118504	4.293694	0.0000
LHDI	4.723912*	0.431637	10.94418	0.0000
LTRO	-0.367735	0.270255	1.360697	0.1751
LLFP	-2.505324***	1.379265	1.816420	0.0708
R-squared	0.979722			

Hint: (*) (**) (***) indicate significance at 1%, 5% and 10% levels respectively

Source: Researchers' Compilation (2022)

Table 8 shows the robustness check of the estimated model via panel FMOLS regression results. It is important to stress that this model corroborates the results in the panel DOLS regression results presented in Table 7.

Table 9. Pairwise Granger Causality Results of Human Capital Development and Aggregate Productivity in ECOWAS countries

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision
LGCF does not Granger Cause LGDP	406	3.03344	0.0493**	Unidirectional
LGDP does not Granger Cause LGCF		1.10829	0.3311	
LHDI does not Granger Cause LGDP	406	2.83887	0.0597**	Unidirectional
LGDP does not Granger Cause LHDI		0.51393	0.5985	No Causality
LTRO does not Granger Cause LGDP	406	13.9021	1.E-06	
LGDP does not Granger Cause LTRO		1.59321	0.2046	No Causality
LLFP does not Granger Cause LGDP	406	0.42538	0.6538	
LGDP does not Granger Cause LLFP		5.94481	0.0029*	Unidirectional
LHDI does not Granger Cause LGCF	406	4.68505	0.0097*	Unidirectional
LGCF does not Granger Cause LHDI		0.59234	0.5535	No Causality
LTRO does not Granger Cause LGCF	406	0.42885	0.6516	
LGCF does not Granger Cause LTRO		3.56557	0.0292**	Unidirectional
LLFP does not Granger Cause LGCF	406	0.18962	0.8273	No Causality
LGCF does not Granger Cause LLFP		2.68425	0.0695	
LTRO does not Granger Cause LHDI	406	0.83494	0.4347	No Causality
LHDI does not Granger Cause LTRO		1.33956	0.2631	
LLFP does not Granger Cause LHDI	406	1.33927	0.2632	No Causality
LHDI does not Granger Cause LLFP		2.52703	0.0812	
LLFP does not Granger Cause LTRO	406	0.01763	0.9825	No Causality
LTRO does not Granger Cause LLFP		0.31013	0.7335	

Hint: (*) (**) (***) indicate significance at 1%, 5% and 10% levels respectively Source: Researchers' Compilation (2022)

From Table 8 the pair-wise Granger causality tests attested that LGCF Granger caused LGDP but LGDP did not granger cause LGCF at a 5% level of significance. This implies that there is a unidirectional causal relationship running from gross capital formation to GDP in ECOWAS countries. Similarly, LHDI granger causes LGDP but LGDP does not granger cause LHDI at a 10% level of significance. This implies that a unidirectional causal relationship runs from human capital development to GDP in ECOWAS countries during the period covered in this study. This is an indication that human capital development is a strategic variable in driving GDP in ECOWAS sub region.

Furthermore, LTRO granger causes LGDP but LGDP does not granger cause LTRO at a 5% level of significance implying a unidirectional causal relationship running from trade openness to GDP in ECOWAS countries during the period covered in this study. In addition, LGDP granger causes LLPF. This indicates one way feedback relationship between labour force participation and GDP in ECOWAS countries during the period covered in this study.

Other significant causal relationships among the variables of this study include one way feedback causality running from LHDI to LGCF and one way feedback causality running from LGCF to LTRO.

In conclusion, the results of the Pairwise Granger Causality Test show the emergence of a unidirectional causal relationship in the variable used to measure human capital development and GDP. Given these results, the null hypothesis (H_0) that no causal relationship between development of human capital and GDP in ECOWAS countries is thus rejected and accept the alternative hypothesis that a causal relationship is accepted. Therefore, this submits that human capital development motivates GDP in ECOWAS sub region.

6. Conclusion and Recommendations

Empirical answer towards to the research question whether human capital development motivates GDP in countries located within ECOWAS sub region has been provided in this study after the data from fourteen countries between 1990 and 2020 have been subjected to the various econometrics techniques. These are the summary of the submissions that emerged from the study; gross capital formation caused a significant indirect influence on GDP in ECOWAS nations. Meanwhile,

human capital development positively impacted GDP but trade openness negatively impacted GDP, though, not significant. And labour force participation negatively and significantly impacted GDP in ECOWAS countries

Moreover, a unidirectional causal relationship runs from gross capital formation to GDP in ECOWAS countries. Similarly, a unidirectional causal relationship runs from human capital development to aggregate productivity in ECOWAS countries. Also, a unidirectional causal relationship runs from trade openness to GDP in ECOWAS countries. Labour force participation Granger causes GDP in ECOWAS countries. In conclusion, the results from both the DOLS regression and the Pairwise Granger Causality Test established that human capital development significantly motivates GDP in ECOWAS sub region. In view of the above submission, this study recommends that whenever the ECOWAS sub region wants to pursue a rise in Gross Domestic Product, the policymakers in this economic bloc should embark on human capital development-oriented policy and programs, this will in turn stimulate GDP growth.

7. References

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