




CAPITAL AND LABOUR PRODUCTIVITY: A COMPARATIVE STUDY OF NIGERIA AND SOUTH AFRICA



Favour O. Olarewaju¹
Oluwafadekemi S.
Areo²

 Adeyemi A.
Ogundipe³⁺

Toun Y. Ogunbiyi⁴

Abiola J. Asaleye⁵

^{1,2,3,4}Department of Economics and Development Studies, Covenant University, Nigeria.

³Email: ade.ogundipe@covenantuniversity.edu.ng

⁵Department of Economics, Landmark University, Omu-Aran Kwara, Nigeria.



(+ Corresponding author)

ABSTRACT

Article History

Received: 14 January 2020

Revised: 5 October 2020

Accepted: 23 November 2020

Published: 7 December 2020

Keywords

Human capital
Physical capital
Unemployment
Labour productivity.

JEL Classification:

E24; J24; D24; O4.

The emerging consensus in literature is that growth is dependent on the size and components of capital and labour force productivity. Using a comparative study between Nigeria and South Africa, this study aims to determine how human and physical capital affect labour productivity. The augmented Solow growth model was adapted and the resulting model was estimated using Johansen cointegration to establish the link between capital (labour) productivity and its determinants. This study found that both human and physical capital significantly affected labour productivity in both countries, though South African productivity was more responsive to changes in physical capital. Unemployment showed a positive link, but labour force showed an inverse relationship with labour productivity in South Africa. In Nigeria, school enrolment, capital stock and labour force had negative relationships with labour productivity, while unemployment had a positive relationship. Hence, this study recommends an increase in human and physical capital investment and entrepreneurial activities.

Contribution/Originality: The study is one of very few studies that has investigated the impact of human and physical capital on productivity of labour in Nigeria and South Africa. A comparison of the resulting evidence suggests that South African productivity was more responsive to changes in physical capital.

1. INTRODUCTION

Nigeria, with a population of over 190 million, is Africa's most populous country, is the seventh most populated nation globally, and has a life expectancy of 49 years (World Population, 2019). However, the country's large labour force has not contributed substantially to its productivity and living standards, as more than half of the population still live in poverty with high rates of unemployment and underemployment. The nation cannot claim to have well-developed human or physical endowment, and the educational facilities remain insufficient with less accessibility for females (Uku, 1992).

The 2005 United Nations Human Development Report classed Nigeria as a developing economy considering its social and economic indicators. Unlike the Nigerian economy, South Africa has better socio-economic indicators.

South Africa is comparatively more industrialized and larger as 6.6% of its populace yields 75.7% of manufactured exports and 45.5% of the subcontinent's GDP (McCarthy, 2005). Over time, there have been numerous disputes over which country has the largest economy in Africa. South Africa was at the peak until 2014 when Nigeria outpaced the former. Ever since then, there has been continuous conflict between the two giants (Oxfam, 2017). Oxfam (2017) further noted that the fundamental disparity between Nigeria and South Africa is their economic attributes. The latter is broadly diversified, while Nigeria is mainly a mono-product economy. Initially, South Africa grew around two main pillars: conducive agricultural terrain and abundant mineral reserves, and its economy expanded further to develop tertiary sectors of trade, communications, and tourism.

The capability of a nation to enhance the quality of its labour force is referred to as human capital development (HCD). Human capital (HC) comprises education (knowledge), training (skills), and health. It is expected that higher training engenders higher skill of labour force (Adejumo, Olomola, & Adejumo, 2013). Many industries in developing countries have performed poorly compared to those of developed countries (Benhabib & Spiegel, 1994; Guisan, 2005; Schumpeter, 1954). This could be as a result of lack of technical know-how as well as insufficient skills to boost technological production and utilization. The first step that most developing countries take to advance is to improve health and education. Grossman (1972) and Bloom, Canning, and Sevilla (2004) have proven that education and health are components of human capital as they directly influence people's wellbeing and increases individual capabilities.

Physical capital refers to man-made goods that facilitate production processes. Prominent economists such as Adam Smith, Robert Solow, Roy Harrod and Evsey Domar recognized that physical input plays a vital role in accelerating production processes (Ogundipe. & Olarewaju, 2020) and is therefore considered as one of the three major factors of production. After World War II, Asian nations including South Korea, China and Japan have been able to develop their physical capital and this has proven effective in eliminating poverty and attaining competitiveness. However, many less developed countries are yet to witness this type of industrial and economic evolution, partly due to poorly developed infrastructure and human capital (Oketch, 2006).

In this paper, we attempt to assess the contribution of human and physical capital to the Nigerian and South African economy. This comparative analysis highlights the rationale for the obvious developmental gaps in the two economies despite their relatively large and converging GDP.

2. LITERATURE REVIEW

2.1. Empirical Evidence from Nigeria

The study by Mba, Mba, Ogbuabor, and Ikpegbu (2013) used the ordinary least square (OLS) method and examined human capital (proxied using public expenditure on health and education, per capita real GDP, life expectancy, physical capital stock and primary school enrolment) and Nigeria's GDP growth. From results obtained, a strong positive relationship was observed between human capital development and economic growth. They recommended that government enact policies to increase national growth, and that expenses on education and health must be thoroughly utilized. This result corroborated that of Dauda (2010) who also found a positive effect of human capital formation on national development.

In the same manner, Adejumo et al. (2013) examined the effect of human capital on Nigeria's industrial development. The result confirmed that human capital impacts the additional value in Nigerian industries. A similar study by Enilolobo and Sodeinde (2019) examined the effect of socio-economic factors (using human capital variables and infrastructures) on industrial sector productivity from 1991 to 2014. They found positive and significant linkage between human capital development and industrial productivity; and the same relationship subsists between infrastructure and industrial development. The study submitted that more transparent governance and adequate execution of fiscal budget will enhance real sector productivity. Egbiremolen and Anaduaka (2014) using the augmented Solow growth model to analyze the influence of human capital development on Nigeria's

output. The study employed a quarterly time series spanning from 1990 to 2012 and found that human capital positively affects output level. The study concluded that human capital development is crucial to achieving sustainable progress nationally. It recommended that policy makers should make concerted efforts to build and develop human capacity by channeling more investment into quality education.

Olalekan (2014) assessed the human capital effect on Nigerian economic growth between 1980 and 2011 using the generalized method of moments (GMM) estimation technique. The study found a positive relationship and recommended swift investment in the sector in terms of budgetary allocation and adequate implementation of associated programs to gain higher returns. Meanwhile, Oladeji (2015) analyzed the connectivity between human capital (effective healthcare and educational services) and Nigeria's growth from 1980 to 2012. In line with previous studies, he found a functional connectivity between human capital and economic growth as well as the existence of a long-run relationship. Boman and Isiaka (2015) studied government healthcare financing and workforce productivity from 1980 to 2010 via the vector autoregressive (VAR) model. Findings revealed a negative effect of healthcare expenditure on workers' productivity and recurrent expenses had positive but weak impacts, thus, efforts should be directed at improving the quality of health amenities by boosting recurrent expenses to finance national health insurance schemes and raise personnel productivity. An alternative approach by Adeyemi and Ogunsola (2016) assessed the link between human capital development and economic growth from 1980 to 2013 using the autoregressive distributive lag (ARDL) approach. The study proxied human capital using government expenditure on life expectancy, education, and secondary school enrolment; it found a positive long-run relationship among all variables and suggested higher government budgetary commitment to education.

2.2. Empirical Evidence from South Africa

Labuschagne (2010) examined the constraints of human capital in South Africa and effects of these constraints on national firms. The study employed a regression analysis to evaluate what determines workers' productivity in the manufacturing sector. Aspects such as competition, regulations and compensation are all shown to influence workers' productivity. However, no evidence was found to indicate effects of human capital development initiatives, such as training, on productivity levels. Zelleke, Sraiheen, and Gupta (2013) examined the effect of physical capital, human capital, and unskilled labour on growth in 31 Sub-Saharan African (SSA) nations. The study found that physical capital constitutes 67% of real GDP growth, while human capital made up just 22%, and the remaining 11% was represented by raw labour. Regarding the productivity of workers, physical capital accounted for 90% of growth per employed worker, human capital per worker accounted for 46%, and the negative 36% was due to the rate of change of total factors of productivity (TFP). This negative result observed in the TFP could be as a result of corruption, civil wars, and poor governance. Furthermore, it was observed that human capital and labour have lower contributions in SSA countries than in economically advanced countries.

Makaula (2014) evaluated the impacts of human capital development in South Africa by employing the Johansen cointegration test and the Granger causality test to assess long run and causal links between the human development index and national growth from 1980-2011. It was observed that human capital positively influenced South Africa's growth. However, the period observed was before the advent of democracy. Policy reforms after democratic changes to macroeconomic operations and the proxy used to capture human capital development do not effectively represent the actual impacts. Ikechi and Anayochukwu (2014) used regression analysis to examine the effect of capital formation on growth in Nigeria, Ghana, and South Africa. No significant links existed on a short-term basis. However, in the long run, total export, gross fixed capital formation (GFCF) and lagged GDP were positively related to long-term growth. Their results further ascertained that negative connections persist among aggregate national savings, economic growth, and imports. A unidirectional causal relationship was observed between GDP, export, import, GFCF, and total national savings. Burger and Teal (2015) assessed the effect of schooling on workers' productivity in the South African industry panel. Their results showed high connectivity

between learning and individual earnings, but a non-substantial schooling effect on productivity levels. The methods are quite robust and allow for cross-sectional dependence, heterogeneous production technologies and measurement errors.

Dzeha, Abor, Turkson, and Agbloyor (2017) investigated how remittances affect labour productivity and capital accumulation using diverse mediums. They used a two-step GMM to evaluate panel data for 25 African nations between 1990 and 2013. While remittances positively impacted labour productivity, they adversely influenced capital accumulation, particularly in the midst of buoyant natural resources, unlike high quality human capital, which counteracts this unfavorable effect. Facilitating formalized channels of direct remittance flows to gainful investments will aid labour force productivity. Notably, their work lacked theoretical background for the model framework. Finally, Okoro, Chigozie, and Chika (2018) examined human capital in Africa and stated that countries that invest more in human capital development perform better than countries that do not. They employed a comparative analysis between South Africa and Nigeria and observed that South Africa had greater human capital development and economic outcomes in relation to Nigeria. The reasons for this were attributed to the fact that South Africa spends more than Nigeria on human capital development.

3. STYLIZED FACTS

The trend in Figure 1 clearly shows the labour productivity of Nigeria and South Africa. Although both countries have experienced increasing labour productivity over the years, South Africa's speed of growth is nearly twice that of Nigeria's and is comparatively more stable. Also, Nigeria's labour productivity was low and declining for nearly half of the total period and has been rising at a comparatively slow rate and declining in recent years. Conversely, South Africa has been increasing at a much faster rate. This partly explains the widening developmental gap between the two economies.

Low productivity can be attributed to non-augmentation of factor inputs, including physical capital, infrastructures, human capital, and technology innovation, which affect labour force quality. The labour productivity had an average growth rate of 6.53% between 2005 and 2010, and 6.68% between 2011 and 2014. However, between 2015 and 2016 it reduced to 2.8% and a negative 1.56%, respectively. This resulted in a further rise in unemployment, which increased from about 2.9% in 2005 to 29% in 2015, followed by a decline in 2016 to 14.2%. The period saw Nigeria's employment elasticity dip as low as 0.11 (Ajakaiye, Jerome, Nabena, & Alaba, 2015).

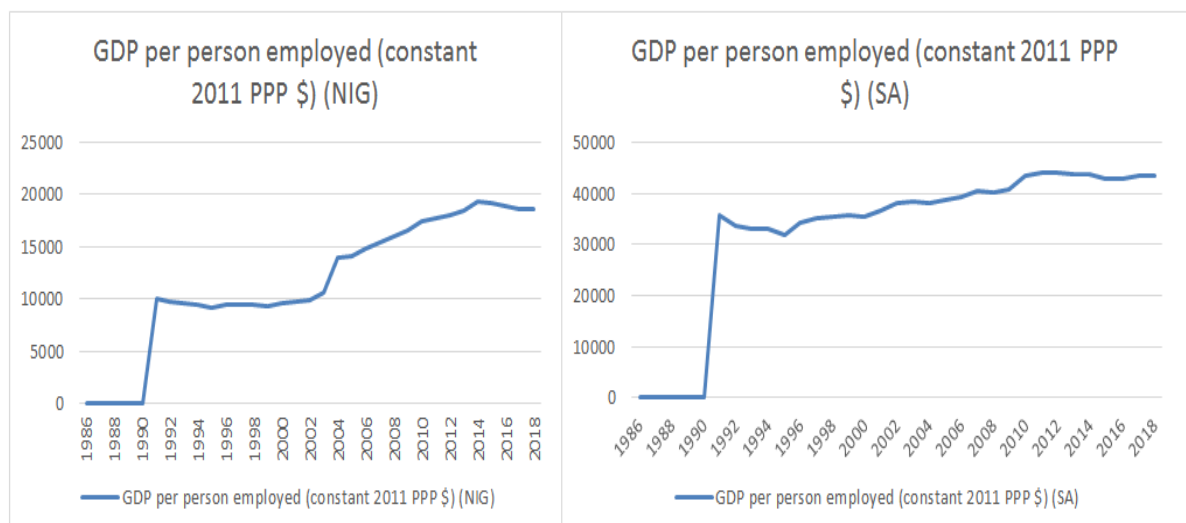


Figure 1. Graphical illustration of labour productivity in Nigeria and South Africa.

Source: World Bank (2019).

4. METHODOLOGY

4.1. Model Specification

The study adopted the augmented Solow growth model, which includes human capital investment in addition to the physical capital already present in the Solow model. The inclusion is based on emerging evidence supporting the relevance of human capital in the growth process of developing economies. The augmented Solow growth model posits that human capital investment is necessary to boost savings rates, higher saving rates, and skilled population, which results in higher incomes and return larger human capital investment. Moreover, correlation exists between human capital investment, savings rates and population growth (Ogundipe., Oye, Ogundipe, & Osabuohien, 2020). Therefore, omitting investment from the model will cause a bias. This paper implements the augmented Solow growth model as it is relevant in explaining the variation in income and growth while still retaining the assumption of decreasing return to scale of capital.

The model is written as follows:

$$Y(t) = K(t)^\alpha H(t)^\beta [A(t) L(t)^{1-\alpha-\beta}] \quad (1)$$

Y represents output, however, for the purpose of this research it will be used to represent labour productivity. K represents physical capital, H represents human capital stock, and A represents technology. We assumed that $\alpha + \beta < 1$, which reflects a decreasing return to scale of all capital. However, this model was adapted for this study and technology was excluded due to unavailable data.

The implicit form of the model is specified as follows:

$$LABP = F(SE, LE, GFCF, UNEMP, LABF) \quad (2)$$

Re-stating equation 1 in its explicit and econometric form, we have:

$$LABP = \beta_0 + \beta_1 SE + \beta_2 LE + \beta_3 GFCF + \beta_4 UNEMP + \beta_5 LABF + \mu \quad (3)$$

where LABP is labour productivity, SE is school enrolment rate, LE is life expectancy, GFCF is gross fixed capital formation, UNEMP is unemployment rate, LABF is labour force, and μ is the stochastic error term.

4.2. Estimation Technique

The study adopted the Johansen cointegration procedure. The choice of technique was based on the condition that all variables in the model were integrated (stationary) of order one. We began by examining the time series property of the data using the augmented Dickey–Fuller (ADF) and Phillips–Peron (PP) unit root test. Having obtained evidence of long run relationships in the model, the vector error correction model (VECM) was conducted to ascertain the extent of error correction in the model in the case of short run disequilibria or shocks in the model (Ogundipe, Akinyemi, & Ogundipe, 2016).

4.3. Data Sources and Measurements

The data used in the empirical estimation were obtained from the World Development Indicators (WDI). The variables and their descriptions are summarized in Table 1.

Table 1. Definitions, measurements, and sources of variables.

Variables	Definition and Measurement	Data Source
LABP	Labour productivity measured by GDP per person employed (constant 2011 PPP \$). This is GDP divided by total employment.	WDI (1986–2018)
SE	School enrollment, primary (% gross). This is the share of aggregate enrollment, irrespective of age, to population of age group that officially aligns with educational level.	WDI (1986–2018)
LE	Life expectancy at birth (years). This predicts how long newborn babies will survive given existing mortality trends.	WDI (1986–2018)
GFCF	Gross Fixed Capital Formation (constant 2010 US\$). This incorporates land enhancements (ditches, drains, fences, etc.), machines, equipment, plants, construction of offices, railways, roads, hospitals, and industrial and commercial buildings.	WDI (1986–2018)
UNEMP	Unemployment (% of total labour force) (modeled ILO estimate). This constitutes the share of the labour force that is currently unemployed, but searching and willing to work.	WDI (1986–2018)
LABF	Labour force total. This includes people aged 15 and above who provide labour for manufacturing commodities and services for a specific duration, those currently employed, the unemployed and first-time jobseekers, and excludes unpaid labourers, students and family workers.	WDI (1986–2018)

5. RESULT PRESENTATION AND DISCUSSION

5.1. Stationarity Test

The analysis began by examining the time series property of the variables using the unit root test. We tested whether the values assumed by the mean and variance of the series are independent of time, that is, the series reverts to its mean path following short-run disequilibrium. This is a property rarely found in most economic variables. To ensure the series are stationary (i.e. possess no unit root), differencing mechanisms using the augmented Dickey–Fuller (ADF) test was adopted and the resulting orders of integration are reported in Table 2.

Table 2. Unit root result (summary).

Variables	South Africa			Nigeria		
	T-stat	P-value	Order of integration	T-stat	P-value	Order of integration
LABP	-4.466717	.0013	I(1)	-4.057429	0.0037	I(1)
SE	-5.949390	.0000	I(1)	-4.426599	0.0014	I(1)
LE	-4.476100	.0013	I(1)	-4.575784	0.0010	I(1)
GFCF	-3.914134	.0053	I(1)	-5.006135	.0003	I(1)
UNEMP	-5.715290	.0000	I(1)	-4.912393	.0004	I(1)
LABF	-3.743885	.0082	I(1)	-4.496822	.0062	I(1)

Table 2 shows that all variables were not stationary, but became stationary at first differencing, that is, they are integrated of order 1. The decision is based on the significance of the probability value at a 5% significance level suggesting the rejection of the null hypothesis that the series possesses a unit root. The unique order of integration of one (I(1)) suggests that the Johansen cointegration approach is the most suitable estimation approach.

Table 3. Johansen cointegration test.

South Africa					Nigeria				
Unrestricted Cointegration Rank Test (Trace)									
Hypothesized No. of CE(s)	Eigenvalue	Trace/Max Eigen Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Eigenvalue	Trace/Max Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.802223	117.0956	95.75366	0.0008	None *	0.912510	175.8641	95.75366	0.0000
At most 1	0.614101	66.85649	69.81889	0.0842	At most 1 *	0.768114	102.7771	69.81889	0.0000
At most 2	0.440490	37.33890	47.85613	0.3317	At most 2 *	0.605160	58.93177	47.85613	0.0033
At most 3	0.319531	19.33738	29.79707	0.4689	At most 3 *	0.440962	31.05350	29.79707	0.0357
At most 4	0.181392	7.403235	15.49471	0.5312	At most 4	0.277562	13.60736	15.49471	0.0944
At most 5	0.037926	1.198578	3.841466	0.2736	At most 5 *	0.120546	3.853636	3.841466	0.0496
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level					Trace test indicates 4 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)									
None *	0.802223	50.23909	40.07757	0.0026	None *	0.912510	73.08705	40.07757	0.0000
At most 1	0.614101	29.51759	33.87687	0.1519	At most 1 *	0.768114	43.84531	33.87687	0.0024
At most 2	0.440490	18.00151	27.58434	0.4950	At most 2 *	0.605160	27.87827	27.58434	0.0459
At most 3	0.319531	11.93415	21.13162	0.5542	At most 3	0.440962	17.44614	21.13162	0.1520
At most 4	0.181392	6.204657	14.26460	0.5871	At most 4	0.277562	9.753720	14.26460	0.2286
At most 5	0.037926	1.198578	3.841466	0.2736	At most 5 *	0.120546	3.853636	3.841466	0.0496
Max-eigenvalue test indicates 1 cointegrating eqn(s) at 0.05 level					Max-eigenvalue test indicates 3 cointegrating eqn(s) at 0.05 level				
* Denotes rejection of the hypothesis at the 0.05 level									

Table-4. Normalized cointegrating coefficients.

Normalized cointegrating coefficients (standard error in parentheses)											
South Africa						Nigeria					
LABP	SE	LE	GFCF	UNEMP	LABF	LABP	SE	LE	GFCF	UNEMP	LABF
1.0000	-3.443	-1.710	-8.870	-3.123	0.0057	1.0000	2.52	-4.494.41	3.065	-1.542	0.00037
	(0.98)	(0.33)	(0.36)	(0.17)	(0.011)		(0.269)	(1.079)	(2.520)	(0.088)	(0.0001)

The trace and max-eigen statistics (see Table 3) are used in ascertaining long-run relationships between these variables. For both Nigeria and South Africa, the trace and max-eigen statistics indicated one cointegrating equation. This suggests that the model exhibits a long run relationship, hence, the null hypothesis of no cointegration is rejected at a 5% significance level.

Restating the cointegration equation for South Africa in explicit form:

$$LABP = 3.443SE + 1.71LE + 8.87GFCF + 3.12UNEMP - 0.005773LABF$$

$$T\text{-stat} \quad [-4.91288] \quad [-0.64878] \quad [-0.79097] \quad [-9.58985] \quad [5.73633]$$

The equation suggests that in the long run, a unit increase in school enrolment rate yields a 3.44 unit increase in labour productivity. In the same manner, a unit increase in life expectancy, gross fixed capital formation and unemployment lead to increases of 1.71 units, 8.9 units and 3.1 units in labour productivity, respectively. It is necessary to note that all variables were important determinants of labour productivity, except labour force, which is suggestive of the quality of labour in the economy.

Restating the cointegration equation for Nigeria in explicit form:

$$LABP = -2.52SE + 4.49.406LE - 3.06GFCF + 1.541UNEMP - 0.000374LABF$$

$$T\text{-stat} \quad [1.14111] \quad [-1.7283] \quad [1.7366] \quad [-8.97211] \quad [9.43901]$$

From the equation above, in the long run, an increase in school enrolment rate resulted in a decline of 2.5 units in labour productivity. A unit increase in life expectancy and unemployment raises labour productivity by 4.5 units and 1.5 units, respectively. On the other hand, an increase in capital stock and labour force lead to a decline in labour productivity by 3.6 units and 0.0004 units, respectively.

Table-5. Vector error correction estimates.

Error Correction:	D(LABP)	D(SE)	D(LE)	D(GFCF)	D(UNEMP)	D(LABF)
CointEq1 SA	-0.132518 (0.02631) [5.03637]	5.10E-06 (0.00026) [0.01970]	-9.91E-06 (5.7E-05) [-0.17283]	182520.0 (123043.) [1.48338]	0.000220 (7.5E-05) [2.93263]	-3.729480 (11.0854) [-0.33643]
CointEq1 Nig.	-0.101069 (0.08679) [-2.16454]	0.001388 (0.00063) [2.20950]	-0.000153 (5.1E-05) [-2.98711]	-3084108. (707265.) [-4.36061]	0.000127 (9.2E-05) [1.39154]	80.37428 (19.3959) [4.14389]

From the error correction test above, the error correction mechanism (ECM) shows a negative value of 0.1325 for South Africa, which suggests convergence of the model in the long run, though the level of error correction is small. Specifically, only about 13% of short-run errors will be corrected on the long-run equilibrium path. In the case of Nigeria, the ECM is appropriately signed (being negative); this implies model convergence in the long run. The evidence suggests that 10% of errors generated in each period will be rectified in subsequent periods. The results in Table 5 indicate that the models for Nigeria and South Africa exhibit a long-run convergence relationship, however, the extent of error correction in the models is low.

Table 6. VEC residual serial correlation tests.

Null hypothesis: no serial correlation at lag h													
South Africa							Nigeria						
Lag	LRE*stat	df	Prob.	Rao F	df	Prob.	Lag	LRE* stat	df	Prob.	Rao F	Df	Prob.
1	37.386	36	0.405	1.040	(36,55.5)	0.4398	1	48.150	36	0.0848	1.459	(36,51.1)	.1059
2	25.667	36	0.899	0.655	(36,55.5)	0.9106	2	41.997	36	0.2271	1.210	(36,51.1)	.2618
Null hypothesis: no serial correlation at lags 1 to h													
Lag	LRE* stat	df	Prob.	Rao F	df	Prob.	Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	37.386	36	0.405	1.040	(36,55.5)	0.4398	1	48.150	36	0.085	1.459	(36,51.1)	0.106
2	63.350	72	0.757	0.731	(72,38.4)	0.8745	2	98.111	72	0.022	1.482	(72,33.0)	0.107

*Edgeworth expansion corrected likelihood ratio statistic.

Table 6 shows the results of the diagnostic tests for auto correlation. The LM serial correlation test was adopted, and due to the insignificance of the probability value we failed to reject the null hypotheses of no serial

correction for the South Africa and Nigeria models. This suggests that successive values of the residuals are not linearly related. In the same manner, the variation of the residual from explanatory variables is constant over time (homoscedastic variation) (see Table 7).

Table 7. Heteroscedasticity test.

Joint test (South Africa)			Joint test (Nigeria)		
Chi-sq.	Df.	Prob.	Chi-sq	Df.	Prob.
320.9838	294	0.1340	289.2722	294	0.5669

Note: A heteroscedasticity test was also conducted, the probability values for South Africa and Nigeria surpassed .05, therefore, both models are not heteroskedastic.

5.2. Discussion of Findings

The study involved conducting a unit root test on the data obtained for Nigeria and South Africa. In both cases, all variables used were stationary at first difference. Therefore, the Johansen cointegration test was employed to examine this paper's objectives. For South Africa, the trace and max-eigen statistics (see Table 3) revealed one cointegrating equation that implied the presence of a long run relationship between the variables (SE, LE, GFCF, UNEMP and LABF). A positive link was observed between school enrolment and labour productivity, this conforms to a priori expectation and was further advocated in the work of Oluwatobi, Olurinola, Alege, and Ogundipe (2020), who confirmed that education is positively linked to economic growth as education aids the development of cognitive skills and this enhances labour productivity. The positive relationship between life expectancy and labour productivity also conforms to a priori expectation. Positive association between gross fixed capital formation and labour productivity is also plausible as it conforms to a priori expectation. However, unemployment did not align with the theory. Usually, a higher employment rate should increase labour productivity, but the result obtained showed a positive link between unemployment and labour productivity. According to Banda, Ngirande, and Hogwe (2016), the economic growth in South Africa has not been accompanied by job creation, so the growth can be described as a jobless growth. Rankin (2016) stated that South African workers are characterized by low skill and low productivity, however, the study further stated that rising productivity could occur as a result of low-skilled workers becoming more productive. A negative relationship was observed between labour force and labour productivity, this is because when workers are low-skilled their inputs will not contribute significantly to labour productivity.

For Nigeria, the cointegration test was also conducted using trace statistics and maximum Eigen statistics. However, unlike the result obtained for South Africa, the trace and max-Eigen values revealed different results. According to Ogundipe, Okwara, and Ogundipe (2020), a possibility exists whereby the trace and max-Eigen tests yield different result. The study suggested that for such scenarios, a trace stat is preferable since it is more robust than the maximum Eigen value test. In Table 4.2.1, while the trace test revealed four cointegrating equations, the max-Eigen value revealed three. From the trace test, a null hypothesis of no cointegration was not accepted. Hence, the study concludes that a stable and long-run connection exists between labour productivity and these explanatory variables. The VECM test in Table 5 shows that there is meaningful error correction taking place as about 11% of errors generated in the current period will be adjusted in subsequent periods, implying that about 89% of short-run errors will live perpetually in the system. Results further revealed that in the long run, school enrolment inversely impacts labour productivity. This result corresponds with findings by Ogunleye., Owolabi, Sanyaolu, and Lawal (2017), who showed that school enrolment inversely and insignificantly affects economic growth. This can be partially attributed to affordability and poor quality of schooling; people in some states attach a relatively low value to education. However, in contrast to the above results, Hadir and Lahrech (2015) and Yushi and Borojo (2019) found positive linkage between school enrolment and economic growth.

Linkages observed between life expectancy and labour productivity conform to a priori expectation. However, the negative relationship between gross fixed capital formation and labour productivity does not conform to theory,

which may be due to low capital formation in Nigeria's economy. This result conforms to findings by Oyedokun and Ajose (2018) and Kanu and Ozurumba (2014), who both found a negative relationship between economic growth capital formations in Nigeria. A negative relationship was also found between labour force and labour productivity, which could be as a result of unskilled labour in the Nigerian economy.

6. CONCLUSION AND RECOMMENDATION

This research compared the state of human and physical capital in two African countries (Nigeria and South Africa) and how this affects national productivity. The study found that both human and physical capital conform to a priori expectations with the exception of unemployment in South Africa. Whereas, for Nigeria, school enrolment, gross fixed capital formation and labour force did not conform to a priori expectations, although life expectancy and unemployment aligned with theory.

From this, we can see that one problem in South Africa is its high unemployment level, which is also evident in Nigeria. This is most likely due to low wages, which can be said to account for low skills and efficiency of labour force (Rodrik, 2008). Moreover, Burger and Teal (2015) found strong schooling effects are linked to individual earnings. Also, empirical evidence shows that South African physical capital remains the most essential resource accounting for its corporate achievements and efforts (Firer & Williams, 2003). Based on the results of the study, it is recommended that the Nigerian government should, first, raise expenditure of requisite educational amenities for comprehensive education delivery. Second, they must allocate an adequate portion of the budget for sufficient healthcare provisions to be made accessible to Nigerians. Third, they must be qualitative at all educational levels nationally, as adequate human capital is needed to boost productivity. Fourth, they should improve health care and schooling to make them accessible to more people, which will facilitate national progressions via human capital development. Finally, the South African government should continue to encourage innovative ideas to help increase entrepreneurial establishments and provide job opportunities for unskilled and skilled labourers.

Funding: Authors thank Covenant University for providing the resources needed to conduct this research, and for the financial support towards publishing this article.

Competing Interests: The authors declare that they have no competing interests.

Acknowledgement: All authors contributed equally to the conception and design of the study.

REFERENCES

- Adejumo, A. V., Olomola, P. A., & Adejumo, O. O. (2013). The role of human capital in industrial development: The Nigerian case (1980-2010). *Modern Economy*, 4, 639-651. Available at: <http://dx.doi.org/10.4236/me.2013.410069>.
- Adeyemi, P. A., & Ogunsola, A. J. (2016). The impact of human capital development on economic growth in Nigeria: ARDL Approach. *IOSR Journal of Humanities and Social Science*, 21(3), 1-7.
- Ajakaiye, D. O., Jerome, A. T., Nabena, D., & Alaba, O. A. (2015). Understanding the relationship between growth and employment in Nigeria. WIDER Working paper 2015/124, United Nations University – World Institute for Economic Research, Helsinki.
- Banda, H., Ngirande, H., & Hogwe, F. (2016). The impact of economic growth or unemployment in South Africa: 1994-2012. *Investment Management and Financial Innovations*, 13(2-1), 246-215.
- Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34(2), 143-173. Available at: [http://dx.doi.org/10.1016/0304-3932\(94\)90047-7](http://dx.doi.org/10.1016/0304-3932(94)90047-7).
- Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, 32(1), 1-13. Available at: <https://doi.org/10.1016/j.worlddev.2003.07.002>.
- Boman, C., & Isiaka, M. (2015). Government health care financing and workforce productivity: Empirical evidence from Nigeria. *African Journal of Applied Research (AJAR)*, 1(1), 549-562.

- Burger, R. P., & Teal, F. J. (2015). The effect of schooling on worker productivity: Evidence from a South African industry panel. *Journal of African Economies*, 24(5), 629-644. Available at: <https://doi.org/10.1093/jae/ejv014>.
- Dauda, R. O. S. (2010). Role of human capital in economic development: An empirical study of Nigerian case. *African Educational Research Journal*, 6(2), 80-87.
- Dzeha, G. C. O., Abor, J. Y., Turkson, F. E., & Agbloyor, E. K. (2017). Do remittances matter in accelerating labour productivity and capital accumulation? In *Development Finance* (pp. 251-283). Cham: Palgrave Macmillan.
- Eigbiremolen, G. O., & Anaduaka, U. S. (2014). Human capital development and economic growth: The Nigeria experience. *International Journal of Academic Research in Business and Social Sciences*, 4(4), 509-529.
- Enilolobo, O. S., & Sodeinde, O. (2019). Human capital development, infrastructural development and industrial sector productivity In Nigeria. *Archives of Business Research*, 7(1), 122-136. Available at: <https://doi.org/10.14738/abr.11.5917>.
- Firer, S., & Williams, S. M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital*, 4(3), 348-360.
- Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, 80(2), 223-255. Available at: <https://doi.org/10.1086/259880>.
- Guisan, M. C. (2005). Human capital, population growth and industrial development in Mexico and Turkey. Comparative analysis with other OECD Countries, 1964- 2004. Working Paper, No. 2.
- Hadir, M. A., & Lahrech, A. (2015). Human capital development and economic growth in Morocco. *International Journal of Education and Human Developments*, 1(1), 49.
- Ikechi, K. S., & Anayochukwu, O. B. (2014). Capital formation and economic growth in Nigeria. *Global Journal of Human Social Science*, 14(4), 1-17.
- Kanu, S. I., & Ozurumba, B. A. (2014). Capital formation and economic growth in Nigeria. *Global Journal of Human-Social Science: Economics*, 14(4), 43-58.
- Labuschagne, J. R. (2010). Human capital constraints in South Africa: A firm level analysis. *International Journal of Humanities & Social Studies*, 5(11), 1-15.
- Makaula. (2014). The impact of human capital development on economic growth in South Africa. *International Journal of Humanities & Social Studies*, 55(3), 120-140.
- Mba, I. C., Mba, E. I., Ogbuabor, J. E., & Ikpegbu, C. H. (2013). Human capital development and economic growth in Nigeria. *Journal of Economics and Sustainable Development*, 4(18), 48-52.
- McCarthy, C. (2005). Productivity performance in developing countries: Country case studies –South Africa. Retrieved from: <https://open.unido.org/api/documents/4851630/download/PRODUCTIVITY%20PERFORMANCE%20IN%20DEVELOPING%20COUNTRIES%20-%20Country%20case%20studies%20-%20South%20Africa>.
- Ogundipe, A. A., Akinyemi, O., & Ogundipe, O. M. (2016). Electricity consumption and economic development in Nigeria. *International Journal of Energy Economics and Policy*, 6(1), 134-143.
- Ogundipe, A. A., Okwara, C., & Ogundipe, O. M. (2020). CO2 emissions and environmental implication in Nigeria. *International Journal of Energy Economics and Policy*, 10(3), 317-324.
- Ogundipe., A. A., & Olarewaju, F. O. (2020). Manufacturing output and labour productivity: Evidence from ECOWAS. *Academic Journal of Interdisciplinary Studies*, 9(5), 102-102.
- Ogundipe., A. A., Oye, Q. E., Ogundipe, O. M., & Osabuohien, R. (2020). Does infrastructural absorptive capacity stimulate FDI-growth nexus in ECOWAS. *Cogent Economics & Finance*, 8(1), 1751487.
- Ogunleye., O. O., Owolabi, O. A., Sanyaolu, O. A., & Lawal, O. O. (2017). Human capital development and economic growth in Nigeria. *IJRDO-Journal of Business and Management*, 3(8), 17-37.
- Oketch, M. O. (2006). Determinants of human capital formation and economic growth of African countries. *Economics of Education Review*, 25(5), 554-564.

- Okoro, A., Chigozie, & Chika, O. (2018). Human as capital: An imperative for Africa. *The International Journal of Humanities and Social Studies*, 42(2), 123-130.
- Oladeji, A. O. (2015). Impact of human capital development on economic growth in Nigeria. *International Journal of Recent Research in Commerce Economics and Management*, 2(2), 151- 164.
- Olalekan, O. (2014). Human capital and economic growth in Nigeria. *International Journal of Innovation and Scientific Research*, 11 (2), 291–294.
- Oluwatobi, S., Olurinola, I., Alege, P., & Ogundipe, A. (2020). Knowledge-driven economic growth: The case of Sub-Saharan Africa. *Contemporary Social Science*, 15(1), 62-81.
- Oxfam. (2017). Report on Inequality in Nigeria: Exploring the Drivers. Retrieved from https://www-cdn.oxfam.org/s3fs-public/file_attachments/cr-inequality-in-nigeria-170517-en.pdf
- Oyedokun, G. E., & Ajose, K. (2018). Domestic investment and economy growth in Nigeria: An empirical Investigation. *International Journal of Business and Social Science*, 9(2), 130-138.
- Rankin, N. (2016). Labour productivity, factor intensity and labour costs in South Africa manufacturing. REDI3x3 Working Paper No. 21.
- Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, 2008(2), 365-412.
- Schumpeter, J. (1954). *The history of economic analysis*. Oxford: Oxford University Press.
- Uku, P. (1992). *Women and political parties*. In Chizea, Njoku (Eds.), *Nigeria women and the challenges of our time*. Lagos: Malthouse Press Limited.
- World Bank. (2019). The world development indicators. Retrieved from <https://databank.worldbank.org/source/world-development-indicators>.
- World Population. (2019). Report on 2020 World Population by country. Retrieved from @ world population.com.
- Yushi, J., & Borojo, D. G. (2019). The impacts of institutional quality and infrastructure on overall and intra-Africa trade. *Economics*, 13(2019-10), 1-34.
- Zelleke, G., Sraiheen, A., & Gupta, K. (2013). Human capital, productivity and economic growth in 31 sub-saharan African countries for the period 1975–2008. *International Journal of Economics and Finance*, 5(10), 1-17.

Views and opinions expressed in this article are the views and opinions of the author(s). Asian Economic and Financial Review shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.