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Poverty and trade liberalization: empirical evidence from 21 African countries

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ABSTRACT

The study investigated the possible nexus between trade liberalization and poverty in 21 African countries covering the period 2005–2014. The study deployed the following econometric tests: descriptive statistics; the correlation matrix and variance inflator; the panel unit root test; the pooled OLS technique; and the panel co-integration test (Johansen co-integration test). In order to confirm the robustness and validity of the regression model result, Ramsey RESET, cross dependence, autocorrelation and heteroscedasticity tests were conducted. The findings reveal that foreign direct investment and inflation rate had a positive relationship with the human development index while exchange rates and trade openness were negatively related to poverty level at the 5 percent level. The study recommended urgent policy measures aimed at revamping the poverty alleviation programmes. The study recommended that in a bid to diversify export market, developing countries should target other developing countries in the spirit of South–South cooperation. Such countries should also consider the joining or strengthening of regional economic integration. Incentives for production and human capacity building in the export-oriented sector should be emplaced. Social and economic policies are required to protect any country against the adverse effects of lowered trade barriers.

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poverty; trade liberalization; pooled OLS technique; panel co-integration test

JEL CODE

I32; C12

1. Introduction

African countries have been listed predominantly in the less developed category of countries as measured by the human development index (HDI) values based on the computation by UNESCO Institute of Statistics (2015). The HDI, not economic growth, was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country. Poverty in very broad terms is the inability to meet basic needs and encompasses general scarcity (World Bank, 1996). Indeed, the reduction of poverty levels has been at the heart of almost every agenda of the various African governments since their political independence.

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Economic liberalization involves the promotion of free trade, liberalization and deregulation of the economic units hitherto under the control of the government. These should lead to the elimination of subsidies, price controls and rationing systems, and the more efficient allocation of productive resources for the greater well-being of the people. Trade openness as defined by Quartey, Aidam and Obeng (2007) is the extent to which foreigners and the citizens of a nation can trade without artificial barriers, including governmentally imposed costs, which may arise through delays and uncertainty. Jhingan (2005) recommends the opening up of the economy to international trade in order to tackle the issue of poverty as more capital is therefrom injected. Indeed, the foundation of the neoclassical free-market assertion is that of the opening up of national markets drawing additional domestic and foreign investment which increases the rate of capital accumulation. This is in line with the position taken by Solow (1956) and Swan (1956). They equate the injection of capital to an increase in domestic savings rates, which raises the capital-labour ratio and enhances GDP growth, especially in the capital-challenged developing countries.

However, the findings in the literature as to the impact of trade liberalization on economic growth and consequently poverty levels are not settled. Empirical studies by Alan et al. (2004), Afaha and Njogo (2012), Christiaensen, Demery, and Paternostro (2003), Kis-Katos and Sparrow (2015) and Sakr (2012) among others provided evidence in support of a strong presumption that trade liberalization alleviates poverty in the long run.

On the other hand, Kanji and Barrientos (2002) are of the opinion that no direct linkage could be ascribed between the two variables given that exogenous political consideration is of greater influence on both. In the same vein, beyond trade openness, Santos-Paulino (2012) identified other poverty-inducing constraints to include a dearth of infrastructure and skills, incomplete markets and a non-inclusive policy. Other determinants of liberalization benefits include the terms of trade and the level of the full employment of resources. Stewart and Berry (2000) and Yusuf, Malarvizhi, and Khin (2013) counter-argued that the gain from trade may not be necessarily be equitably distributed.

Given these differing findings and opinions, this study seeks a better understanding of the linkage between trade liberalization and poverty in African countries. It also seeks to determine the possibility of a long run relationship among the variables.

This paper aims to contribute to the ongoing argument on the role of trade policy in fostering economic development and the reduction of poverty in developing countries.

The remainder of the paper is organized as follows: section two comprises a literature review. In section three, the methodological framework of the study is presented, while the empirical results are discussed in section four. Section five concludes the paper.

2. Literature review

This section is in two parts, a conceptual and theoretical review, and a review of related literature. These are discussed in turn.

2.1. Conceptual and theoretical reviews

The Central Bank of Nigeria (2010) views poverty as a situation where an individual is unable to cater adequately for his or her basic needs of food, clothing and shelter. This is in addition to his inability to meet social and economic obligations given the lack of gainful employment, skills, assets and self-esteem; and his limited access to social and economic infrastructure (education, health, portable water, sanitation).

Poverty is a noticeable a noticeable deficiency in well-being, comprising many dimensions, including low incomes, resulting in the inability to acquire the basic goods and services necessary for survival with dignity. This broader definition highlights both the relative and absolute definitions of poverty. It brings to the fore the fact that poverty is not just a lack of physical essentials but includes social needs as well.

A poor household is situated at the lowest rung of the Maslow hierarchy of needs. Deprived of access to basic food, clean water and the ability to pay for school fees, a poor household is open to the prevalence of diseases and infections leading to a low level of productivity which in turn leads to a low level of income. The consequential impact of this lack is a low level of self-esteem resulting in reinforced poverty.

Trade openness is the degree of business dealing of a country with the rest of the world. At its minimal, the country operating a closed economy is said to be an autarky. The openness ratio at its basic manner is the ratio of imports and exports as a fraction of the gross domestic product (GDP). The degree of openness is also measured by the Pitchet Index which is obtained by regressing the trade intensity (ratio of imports and exports) to a combination of total area, population, GDP, GDP per capita, GDP per capita squared. This is expressed in equation (1) by Bhatti, Aamir, Shah, Rahpoto, and Shaikh (2011):

$$TI = \alpha_0 + \alpha_1 POP + \alpha_2 AREA + \alpha_3 GDPPPC + \alpha_4 (GDPPC)^2 + \varepsilon \quad (1)$$

The residual from equation (1) is the measure the degree of trade openness.

Two types of trade openness measurement have been identified by Bhatti et al. (2011). These are the incidence-based measure of individual indicators and outcome-based measures which cover all the avenues of trade distortion. The former is predicated on tariff rate, quantitative restrictions, export taxes, and foreign exchange restrictions which are direct indicators of trade policy. The hitch with the incidence-based measure is that variations in one indicator are not easily weighted against the fluctuations in another. For example, an increase in average tariffs may coincide with, but not necessarily be due to, a reduction in export taxes.

The literature makes out that growth is an important channel through which the economy can grow (Helpman, 2004). The endogenous growth theory positions trade openness as a major source for managing higher and faster growth rates. The more open economies tend to congregate more quickly towards their steady state growth path in comparison with protected ones (Barro, 1989). The significance of trade openness as a means of opening the market was advanced by the neo-classicalist Adam Smith in 1776. The inference from this is the improvement of division of labour and the level of productivity with consequential reduction in the poverty level

of the host country. The benefit derived from trade openness is predicated upon the theory of comparative advantage that arise from differences in the factor endowments or technological progress of different countries. In seeming continuation of this strain of thought, is the *Ricardian* classical theory of comparative advantage in 1817 which explains the preferment of the country whose workers are more efficient at producing every single good than workers in other countries (Deardorff, 2005).

The new growth theory identifies the human desires and unlimited wants which foster ever-increasing productivity and economic growth. The contention of Cortright (2001) is that the motivation or environment provided by the government in lowering trade barriers promotes innovation and creative thinking which leads to the creation of diverse products and services, in turn leading to an increase in the welfare of the consumers.

Some possible deleterious effects may arise from opening up the economy to international trade. Imported inflation may creep into the economy as a result of greater exploitation of the environment which may lead to environmental degradation. In addition, the devaluation of the domestic currency may cause citizens to spend more on purchasing few goods from abroad, thereby further worsening the terms of trade. The conceptual model upon which this study is predicated is depicted in Figure 1.

The introduction of these trade liberalization policies in the economy results in beneficial and deleterious consequences.

The right hand side of the Figure 1 shows the benefits that arise from the implementation of these policies. The policies allow for more efficient factors which could be the proper allocated of raw materials between the initially protected sectors, leading to the expansion of these same protected and export-oriented sectors. For

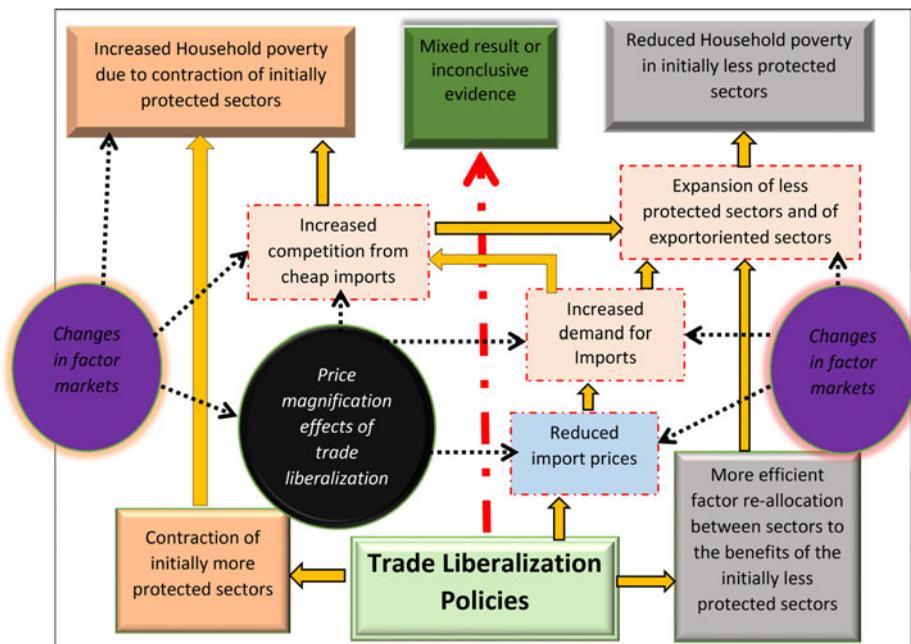


Figure 1. A synopsis of the effects of trade liberalization on poverty: a conceptual framework. Indirect link Direct link Source: Adapted from Aredo, Fekadu, & Kebede (2011).

example, the infant industries are able to produce and substitute. The expansion of these sectors does not just reduce the household poverty through the creation of jobs but also positively influences the factor markets through a reduction in price and an increase in workers' wages. This is consistent with the neo-classical growth model in which there is a theorized consequential impact on the reduction in the poverty level of the host country.

Furthermore, the reduction in prices of imported goods into the country will increase the demand for these goods by poor households which find these goods essential to promote their standard of living. On the other hand, the adverse side of the implementation of these policies gives way for the contraction of these initially protected sectors as a result of them competing with imported goods purchased cheaply from abroad. The contraction of these industries reduces the number of people employable and due to other changes in factor markets we can see household poverty increasing at an alarming rate which poses a negative threat to the development of the nation.

However, the theoretical underpinning of the direct linkage between trade openness and economic growth in the opinion of Santos-Paulino (2012) is vague. The connection between trade openness and poverty is also debatable. This is illustrated in the box stating mixed results (Figure 1). The inconclusive evidence is to propose that trade liberalization may not have significant short run impacts on poverty and inequality in economies characterized by weak initial conditions and structural rigidities. It can also be argued that trade openness may have differential impacts on different categories of households. Empirical evidence by Edwards (1998) shows no significant links between trade openness and the welfare of the poor beyond those associated with higher average per capita income growth. Indeed, Dollar and Kraay (2002a) provided evidence that economic growth, although necessary, is not a sufficient condition for significant and sustained reduction in poverty.

The summary of the findings appears to be the expressed by Khan (2005) who contends that the nexus between trade liberalization and economic growth is very important for the assessment of the impact of trade liberalization on poverty. The link is in two sequential parts: the impact on economic growth; and the impact on income and asset distribution. In effect, the link between trade liberalization and poverty can at best be an indirect one through the mediation of higher economic growth.

2.2. Empirical review

Trade openness in the findings of Cieřlik (2016) is multi-dimensional. The study examined the part played by the proximity-concentration trade-off in the choice between engaging in foreign direct investment and exporting within the context of the duopoly framework espoused by Smith (1987) and Motta (1992). It identified six possible types of equilibria: no entry equilibrium, monopoly FDI equilibrium, domestic monopoly equilibrium, a monopoly exporting equilibrium, a duopoly exporting equilibrium and a duopoly FDI equilibrium. Each of these equilibria is partly dependent on the first-mover investment decisions made by multinational enterprises. This has implications for local companies and domestic economies. Given the rapid

development of IT technologies, the importance of international trade in services was of interest to Stefaniak-Kopoboru and Kuczewska (2016) whose study was based on adjusted RCA index assumptions. They investigated how the export specialization of the Visegrad countries has been affected by their entry into the European Union. The result was mixed, with implications for the domestic economies and the service providers.

Mahdi Ghodsi and Michalek (2016) co-authored the research paper, 'Technical barriers to trade notifications and dispute settlement within the WTO' with the aim of verifying empirically whether the specific trade concerns (STCs) regarding technical barriers to trade (TBTs) notifications by WTO members could serve as an early warning system for past and future disputes (DS) covering allegedly trade restricting TBTs. In this paper it was noted that 45 requests for consultation to identify the possible violations of the technical barriers to trade agreement and the decision by the dispute body were critically discussed.

Trade liberalization was found to be positively related to welfare growth of urban households by Chidiebere Nwafor, Adenikinju and Ogujiuba (2007). The same research identified negative repercussions for rural households. The reason adduced was the greater dependence of the rural dwellers on land and labour income, which are less elastic, resulting in widening gap between the rural and urban sectors. In effect, whereas the urban poverty reduces in the short and long run, rural poverty increases in both periods.

In 2012, a comprehensive estimation of three models was conducted by Afaha and Njogo to determine the impact of trade openness on growth. These are the neo-classical supply-side model, the balance of payment constrained model (Hicks super multiplier model) and the virtuous circle model. The conclusion drawn was that economies grow faster when they are open to international competition. A similar conclusion was drawn in the findings of Christiaensen et al. (2003) which applied the computable general equilibrium approach, and considered both the macro and micro perspectives of growth and poverty in Africa.

The novel introduction of the Sachs-Warner-Wacziarg-Welch openness dummy (2008) by Billmeier and Nannicini (2009) sought to understand the impact that the lowering of trade barriers would have on economic growth, particularly the effect on the balance of payments position. The conclusion drawn was that multi-lateral liberalization changes the competitive position in world markets and promoted growth. The impact of this on poverty was not considered. However, Alan, McCulloch, and McKay (2004) support the notion that economic growth the key to sustained poverty alleviation.

The position taken by Yusuf et al. (2013) is that trade liberalization does not cause poverty reduction, so countries with a high propensity to import and poor commodity rises do not need to follow the one-size-fits-all trade liberalization policies. This is supported by the findings of Pradhan and Mahesh, (2014) on the impact of trade openness on poverty who have analysed a panel of 25 developing countries. The firm conclusion arrived at was that poverty however has a negative and significant relationship with total trade, imports, exports and merchandise trade. It concluded that an inward-oriented trade policy is neither good for growth nor for poverty.

The impact of liberalization was however found to increase income inequality within nations and the cause of inequality amongst nations by Stewart and Berry (2000) as a result of a number of institutional and policy factors. One of such factors identified by Li (2009) and Huang, Yang, Zhigang, Rozelle, and Ninghui (2007) was the expansion of international trade in China. They examined the trade and poverty levels in the country and based on the Solow and new growth theory concluded that expansion in foreign trade of agricultural producers reduces rural poverty especially the farmers in coastal areas more than the inter-land.

Haddad, Lim, Pancaro, and Saborowski (2013) also examined the subject matter of trade openness and reported reduced growth volatility, especially when trading partners are well diversified. This finding was obtained from an unbalanced panel of 77 developed and developing economies between 1976 and 2005. This appears to have been the confirmation of an earlier Egyptian case in 2012 when Sakr reported that poverty reduction was an outcome of rapid economic growth as a result of trade liberalization policies.

Globalization was a factor identified by Goldberg and Pavcnik (2004) who deployed the Heckscher-Ohlin (1991) model and concluded that there was a significant relationship between globalization and poverty. Dufrenot, Mignon, and Tsangarides (2010) discovered a heterogeneous trade and growth nexus in both the short and long term. The cut in tariffs and the implementation of uniform tariff schemes through the World Trade Organization agreements have in the findings of Aredo, Fekadu, and Kebede (2012) shown that further trade liberalization has little short run effect on the economy. Indeed, protected infant industries are badly affected by trade liberalization.

Pietrucha, Żelazny, Kozłowska, and Sojka (2018) examined the use of imports and foreign direct investments as transmission mechanisms for generating international total-factor productivity (TFP) spill-overs and externalities. The study deployed the dynamic spatial autoregression (SAR) technique, using data for 41 developed and upper mid-developed economies. The results show that investment and trade channels are essential for the transfer of technology. This is however dependent on the quality of the absorptive capacity of the social and economic institutions available in the countries. The import of these findings is that unless the economic institutions are strong, poverty levels in a country will be largely unaffected by trade liberalization. The oil and gas industry is a good example in Nigeria and Angola where the local communities are insulated from the wealth generated by the industry. The importance of institution is reinforced in the findings in the by Zahonogo (2016) who tested a dynamic growth model for sub-Saharan African economies using three measures of trade openness. The findings submitted that in the long run, trade openness may favorably affect economic growth but the effect is not linear. The growth effects ascribed to trade openness may indeed differ according to the level of trade liberalization. It recommended that trade openness must be accompanied by complementary fiscal and monetary policies targeted at the enhancement of the quality of institutions.

Indeed, Aigheyisi (2013) empirically investigated the effect of globalization on economic growth and human development in Nigeria in the new democratic era (1999–2011). He deployed the OLS method, examined three channels (trade

openness, financial openness and migration) through which globalization may impact human development and the growth of the economy. The result indicated that the globalization effect on economic growth was more significant than its effect on human development. The result also showed that financial and trade openness had significant but negative effects on both economic growth and human development.

In a bid to mitigate the deleterious impact of open trade, the International Monetary Fund (IMF) created a special lending program aimed at developing countries to solve their balance of payments (Limão and Olarreaga, 2006). According to Monisola (2014) the policy advice of bi-lateral and multi-lateral donors to developing countries in the past two decades has been centered on favoring greater market openness and better integration into the global economy. Three broad approaches to poverty reduction have been put forward by Adeoye (2008). These are the economic growth approach, rural development and basic needs approach. Briggs (2007) and Arogundade, Adebisi and Ogunro (2011) evaluated how these different policies brought about the National Economic and Empowerment and Development Strategy (NEEDS) programme in order to alleviate poverty. In addition, Akims (2014) with Nwafor and Adenikinju (2005) found several benefits (including poverty alleviation) from the participation of Nigeria in the Economic Country of West African States (ECOWAS) trade liberalization scheme.

The next presentation is on the methodology of the study

3. Methodology

This section deals with the method employed to obtain relevant information on trade liberation on poverty alleviation in 21 countries namely; Kenya, Ghana, Burundi, Guinea, Cameroon, Tanzania, Gambia, Uganda, Liberia, Nigeria, Angola, Mali, Mozambique, Malawi, South Africa, Namibia, Zambia, Togo, Botswana, Niger and Burkina Faso.

3.1. Data source and scope

The human development index was used to represent poverty alleviation. These data were sourced from UNESCO Institute of Statistics (2015). The data on trade openness, which is measured by imports (current currency) plus export (current currency) divided by gross domestic product (current local currency), were derived in the World Bank Development indicators (2014). Other data obtained from the same source are inflation rate, foreign direct investment and the official exchange rate. The research covers the period of ten years from 2005 to 2014.

3.2. Model specification

The model used in this research work was based upon the Solow theory production function framework, which was adapted from the work of Enu and Attah-Obeng (2013). The variables below were among the listed factors considered with the

application of trade liberalization according to the theory. The initial regression model is specified as equation (2):

$$HDI_{it} = a_0 + \sum_{i=1}^p b_{it} TRADEOP_{i(t-1)} + \sum_{i=1}^p c_{it} FDI_{i(t-1)} + \sum_{i=1}^p d_{it} EXRATE_{i(t-1)} + \sum_{i=1}^p e_{it} IFR_{i(t-1)} + \sum_{i=1}^p ECT_{i(t-1)} + \epsilon_t \quad (2)$$

Where:

GDP = gross domestic product;

HDI = human development index

TRADEOP = trade openness

FDI = foreign domestic investment;

EXRATE = exchange rate

IFR i Inflation rate;

ϵ_t = error term which denotes other variables that are not specified in the model.

t = time; P = optimal lagged time; a_0 = Intercept

ECT_{t-1} represents the error terms derived from the long term co-integration relationship.

b_{it} , c_{it} , d_{it} , e_{it} = slope of the linear equation

3.3. Model estimation procedure

The study employs three-phase procedural steps: pre-estimation, estimation and post-estimation. The first step in the pre-estimation phase is the use of descriptive statistics in order to understand the nature of the data. It also helps to know if the data are normally distributed through their averages and Jarque-Bera values (Gujarati & Dawn, 2009). The second step in this phase is the correlation matrix and variance inflation factor tests to check for the existence or otherwise of autocorrelation among the explanatory variables. The third step is the use of the panel unit root test to determine the stationarity of the series.

In the estimation phase, should the series be stationary at level, the ordinary least squares technique will be deployed. The Hausman test is applied to determine the appropriate estimator between fixed and random effect. In the event of non-stationarity at level for panel data, the OLS method can be utilised if the data are transformed into their logged form. In this case, the regression model will be specified as in equation (3):

$$\Delta HDI_{it} = \alpha_t + \alpha_t \Delta HDI_{it-1} + \sum_{i=0}^{m-1} b_t \Delta TRADEOP_{it-1} + \sum_{i=0}^{m-1} b_t \Delta EXRATE_{it-1} + \Delta \sum_{i=0}^{m-1} b_t \Delta IFR_{it-1} + \Theta_{,i} + \epsilon_{it} \quad (3)$$

Where Δ is the first difference operator, α_t and b_t , c_t , d_t and e_t are the coefficients estimated from equation (1).

In order to determine possibility of long run relationship among the variables, especially if the series are stationary at the first order difference (I(1)), the panel co-integration test (Johansen co-integration test) will be conducted. Prior to the Johansen co-integration test, the optimal lag length will have to be ascertained in order to prevent a misleading result. The Akaike information criterion (AIC) and Schwarz information criterion (SIC) are two of the methods to be utilised in deriving the optimal lag length. Koehler and Murphree (1988) advise that in the event that

AIC or SIC picks a different optimal lag length, the Schwarz Information Criterion should be selected.

In order to confirm the robustness and validity of regression model result some post-estimation tests are conducted in the third phase. These are the Ramsey RESET test to detect the possible omission of any significant variable which could affect or impair the dependent variable (hdi) of the model; cross dependence test; autocorrelation test and heteroscedasticity tests. They will explain the completeness of the model, variations in the residuals of the model and test the non-linear combinations of the fitted values between the variables.

In the event that results shows heteroscedasticity, cross-sectional dependence and/or autocorrelation, the OLS, fixed effect and random effect would not be appropriate estimator for the model. The more robust pooled OLS method will be applied in re-estimating the model.

The estimations are carried out with the aid of E-views version 8.0 and StataIC 11 software. Having described the estimation procedure, the next section reports the results and interpretations of the tests conducted.

4. Empirical findings and discussions

4.1. Preliminary analyses

The preliminary analyses are in three parts: descriptive statistics, series correlation test and stationarity test.

4.1.1. Descriptive statistics

The characteristics of the data and the summary of the descriptive statistics of the variables are presented in [Table 1](#).

There is evidence of significant variations in the trends of the variable over the period of consideration. The large difference between the minimum and maximum values of the series gave the result that there is a significant variation in the trends of the variable over the period of consideration.

Also the results based on the statistical distribution of the series show that the series are positively skewed. The values, human development index and exchange rate are platykurtic in nature since their values for kurtosis are 2.30 and 1.93 respectively and are less than 3, which therefore indicates a higher than normal distribution. The variables, inflation rate, foreign direct investment and trade openness have values of 5.88, 5.36 and 84.49 respectively, results which signify that they are leptokurtic in nature because they are greater than 3 indicating a flatter than normal distribution.

The Jacque-Bera statistic is a goodness-of-fit to check whether the sample data have the skewness and kurtosis matching a normal distribution. The P-value of the Jarque-Bera test reveals that all series are not normally distributed; this is expected in a panel data which is attributed to differences in the countries' features that constitute the panel, thus the testing of normality is not applicable due to the heterogeneity of the different countries contained in the panel. This also implies that there is no basis to test for correlation due to linearity of the variables. Therefore, any further test to correct the abnormality is not conducted (Gujarati & Dawn, 2009).

Table 1. Descriptive statistics.

Statistics	Human development index	LnForeign direct investment	LnExchange Rate	Trade openness	Inflation rate
Mean	0.47	19.76	4.62	1.28	7.82
Median	0.46	20.11	4.90	0.64	6.96
Maximum	0.70	23.55	8.86	40.66	34.70
Minimum	0.30	10.36	-0.10	0.27	-0.93
Std. Dev.	0.01	2.21	2.30	3.54	5.99
Skewness	0.39	-1.10	-0.17	8.52	1.40
Kurtosis	2.30	5.36	1.93	84.49	5.88
Jacque-Bera	9.74	91.41	10.97	60,640.49	140.6
Probability	0.01	0.00	0.00	0.00	0.00
Sum	98.70	4,148.68	970.03	269.05	1,642.31
Sum Sq. Dev.	2.08	1,021.65	1104.76	2,624.94	7,515.97
Observations	210	210	210	210	210

Source: Authors' computation using E-views 8.0 (2016).

The next preliminary test on the correlation of the series is presented discussed in the next section.

4.1.2. Series multi-collinearity test

In determining the multi-collinearity status of the series, the correlation matrix and variance inflation factor tests were deployed. The results can be seen in Tables 2 and 3.

The results of the correlation matrix in Table 2 reveal that the explanatory variables are weakly correlated. Except for the correlation between foreign direct investment and exchange rate which is moderate (-0.4165), the correlation coefficients among the other independent variables foreign direct investment, trade openness and inflation rate are weak.

As shown in Table 3, the variance inflation factor test result (with mean variance inflation factor (VIF) of 1.17 is less than the threshold of 2.78 (Gujarati & Dawn, 2009).

The VIF which shows how the variance of an estimator is inflated by the presence of multicollinearity amongst the independent variables (foreign direct investment, exchange rate, trade openness and inflation) is weak.

4.1.3. Auto-correlation test

The status of the variables with respect to autocorrelation is determined using the Durbin Watson method. The result is presented in Table 4.

This test was coined after James Durbin and Geoffrey Watson in the year 1950 (Chatterjee & Simonoff, 2013). The application of this test is beneficial to the measurement of autocorrelation in residuals from a regression analysis. Furthermore, the valuation of the Durbin Watson ranges from 0 to 4, where 2 is no autocorrelation, 0 to < 2 is positive autocorrelation and >2 to 4 is negative auto-correlation.

Finally, the hypothesis for this test is stated below as:

H_0 = first order auto-correlation absence

H_1 = first order auto-correlation presence

K = 5 N = 29

Table 2. Result of the correlation matrix test.

	<i>lnFDI</i>	<i>lnEXRATE</i>	<i>lnTRADEOP</i>	<i>lnIFR</i>
<i>lnFDI</i>	1.0000			
<i>lnEXRATE</i>	-0.4165	1.0000		
<i>lnTRADEOP</i>	0.2972	-0.2973	1.0000	
<i>lnIFR</i>	-0.0080	-0.0350	0.0881	1.0000

Source: Authors' computation, stataC 11, (2016).

Table 3. Result of the variance inflation factor test.

Variable	VIF	1/VIF
<i>lnFDI</i>	1.26	0.79
<i>lnEXRATE</i>	1.26	0.79
<i>lnTRADEOP</i>	1.15	0.87
<i>lnIFR</i>	1.01	0.99
Mean VIF	1.17	

Source: Authors' computation, stataC 11, (2016).

Table 4. Result of the Durbin Watson test.

D	D-UPPER	D-LOWER	DECISION CRITERIA
2.21	1.55	0.72	$d_U < d < 4 - d_U$

Source: Authors' computation using E-views8.0 (2018).

The test results reflect no statistical evidence that the error terms are either positively or negatively autocorrelated.

The stationarity test had to be conducted in order to confirm the stability of the variables. This is discussed in the next section.

4.1.4. Stationarity test results

The results of the panel unit root test summary comprising of Levin, Lin & Chu t^* , Im, Pesaran and Shin W -stat, Adf-Fisher Chi-square and PP-Fisher Chi-square are presented in Table 5.

The result in Table 5 shows that all the variables were stationary at first difference since their respective probability values were less than the 5% significance level. The results of the preliminary tests of normality, series correlation test and stationarity are satisfactory. The long run relationship between the variables will have to be determined next. In order to do this, a panel co-integration test is required to be conducted. The cointegration test entails both Pedroni (Engle-Granger based) and Kao (Engle-Granger based). This is deployed in the next section after determining the optimal lag length.

4.2. Estimation results

As mentioned in the previous section, the optimal lag length will have to be ascertained prior to the Johansen cointegration test in order to prevent misleading results. This is presented next.

4.2.1. Optimal lag length selection

The implication of the lag length selected explains the effect of the outcome of previous year on the current year (Johansen & Juselius, 1990). The selection of an optimal

Table 5. Panel unit root test results.

Series	Levin, Lin & Chu t^*	Im, Pesaran and Shin W -stat	Adf-Fisher Chi-square	PP – Fisher Chi-square	Equation specification	Order of integration
<i>LnFDI</i>	0.00	0.00	0.00	0.00	Intercept	I(1)
<i>lnXRATE</i>	0.00	0.00	0.00	0.00	Intercept	I(1)
<i>lnTRADEOP</i>	0.00	0.00	0.00	0.00	Intercept	I(1)
<i>IFR</i>	0.00	0.00	0.00	0.00	Intercept	I(1)
<i>HDI</i>	0.00	0.00	0.00	0.00	Intercept	I(1)

Source: Authors' computation using E-Views 8.0 (2016).

Table 6. Optimal lag length selection criteria.

Lag length	LogL	LR	FPE	AIC	SC	HQ
0	-1358.95	NA	7.75	16.24	16.33	16.27
1	-89.11	2448.96	2.84e - 06a	1.42a	1.98 ^a	1.64a
2	-65.76	43.65a	2.90e - 06	1.47	2.46	1.85

Source: Authors' computation using E-views 8.0 (2016).

AIC = Akaike information criterion; FPE = Final prediction error; HQ: -Hannan- Quinn information criterion; LR = sequential modified LR test statistic (each test at 5% level); SC = Schwarz information criterion.

^aIndicates lag order selected by the criterion.

lag length was essential before carrying out a panel cointegration test, the result of which is presented in Table 6.

The result in Table 6 portrays different lag length criterion (LR, FPE, AIC, SC and HQ). The Schwarz information criteria depicting lag order length of (1) for the model is selected. After establishing the lag order length, the co-integration, and long-run equation results are estimated and explained in the next section.

4.2.2. Long run panel cointegration test result

The types of tests considered under the panel cointegration test result were the Pedroni (Engle-Granger based) and Kao (Engle-Granger based) methods. The result of the panel cointegration is shown in Table 7.

Four different statistical results are presented in Table 7. These are the panel v -statistic, rho-statistics (both at panel and as group), PP-statistic (both at panel and as group) and ADF-statistic (both at panel and as group). Out of the four the results of Engle-Granger test, only the rho-statistic is insignificant while the remaining three are significant. The conclusion to be drawn is that trade openness, foreign direct investment, inflation rate and exchange rate have a long run relationship with human development index.

The Kao (Engle-Granger based) test was also performed as confirmatory test on Engle-Granger test results. This is to check the existence of long run association among the variables. The result is shown in Table 8.

The inference to be drawn from the result presented in Table 8 is that a long run relationship subsists between trade openness, foreign direct investment, inflation rate, exchange rate on the one hand and human development index on the other. This is because the probability value of 0.00 is less than the 0.05 level of significance.

The next result to be presented is the OLS estimation together with the fixed and random effects

4.2.3. Regression results OLS, Fixed and random effects

The comparative results of the OLS, fixed effect and random effect are shown in Table 9.

Table 7. Result of panel (Engle-Granger based) test on both intercept and trend.

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	3.75	0.00	2.46	0.01
Panel rho-Statistic	5.08	1.00	5.22	1.00
Panel PP-statistic	-1.57	0.06	-2.72	0.00
Panel ADF-Statistic	-1.17	0.12	-1.74	0.00
Group rho-Statistic	6.60	1.00		
Group PP-Statistic	-6.41	0.00		
Group ADF-Statistic	-2.87	0.00		

Source: Authors' computation using E-views 8.0(2016).

Table 8. Result of Kao residual cointegration test.

	T-Statistic	Prob.
ADF	-4.67	0.00
Residual variance	0.00	
HAC variance	0.00	

Source: Authors' computation using Eviews8.0 (2016).

Table 9. Regression results using OLS, fixed effect and random effect.

Method Variables	OLS				Fixed effect				Random effect			
	Coeff	Std. Error	t-stat	Prob	Coeff	Std. Error	t-stat	Prob	Coeff	Std. Error	t-stat	Prob
<i>lnFD</i>	0.021	0.005	4.09	0.000	0.025	0.003	7.51	0.000	0.030	0.004	8.12	0.000
<i>lnEXRATE</i>	-0.059	0.005	-12.21	0.000	0.140	0.020	6.91	0.000	0.011	0.013	0.86	0.390
<i>lnTRADEOP</i>	-0.119	0.016	-7.64	0.000	-0.022	0.013	-1.65	0.100	-0.018	0.014	-1.25	0.210
<i>lnIFR</i>	0.017	0.010	1.67	0.097	-0.009	0.005	-1.66	0.098	-0.008	0.006	-1.35	0.180
Constant	-0.972	0.114	-8.55	0.000	-1.900	0.104	-18.35	0.000	-1.415	0.101	-14.07	0.000
	Adj R-squared = 0.54				R-sq overall = 0.35				R-sq overall = 0.03			
	F(4, 200) = 60.36				F(4, 180) = 33.43				Wald chi2(4) = 70.57			
	Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			

Source: Authors' computation using StataC 11 (2016).

Based on the OLS result, the foreign direct investment (*FDI*) both positively and statistically significantly influence human development index (*HDI*). Inflation rate (*IFR*), although also positive, is not significantly related to *HDI*. However, exchange rate (*EXRATE*) and trade openness (*TRADEOP*) have significant negative influence on the *HDI*. The coefficient of determination is 0.54 which means that the regressors explain on the average, only 54 percent of *HDI*.

The fixed effect result reveals that *FDI* and *EXRATE* have significant positive effect on *HDI* while *TRADEOP* and *IFR* have negative but insignificant influence on the *HDI*. The explanatory power of *FDI*, *EXRATE*, *TRADEOP* and *IFR* combined on the *HDI* is 35%, this implies that the 35% changes in the *HDI* are caused by the combined influence of the explanatory variables.

From the result of the random effect *TRADEOP* and *IFR* have negative but insignificant influence on the *HDI* while *FDI* and *EXRATE* have positive effect on *HDI* but only the *FDI* is significant. The explanatory power of *FDI*, *EXRATE*, *TRADEOP* and *IFR* combined on the *HDI* is 3%, this implies that the only 3% changes in the *HDI* are due to the combined influence of the explanatory variables.

Having estimated the model using the ordinary least square (OLS) technique and testing for fixed effect and random effect, the next step is the selection of the more

Table 10. Hausman fixed random test.

Variables	Fixed (b)	Random (B)	Difference (b – B)	Sqrt (diag (V_b – V_B)) S.E
<i>lnFDI</i>	0.025	0.030	–0.005	–
<i>lnEXRATE</i>	0.140	0.011	0.129	0.015
<i>lnTRADEOP</i>	–0.022	–0.018	–0.004	–
<i>lnIFR</i>	–0.009	–0.008	–0.001	–
Chi ² (4) = 65.80				
Prob > chi ² = 0.0000				

Source: Authors' computation using StataIC 11 (2016).

appropriate model estimator. The Durbin-Wu-Hausman test also called Hausman specification test which result is presented in Table 10, comes in handy.

The result of the test reveals that the fixed effect model is the more appropriate estimator since the probability (P) value of 0.00 percent is less than the 5 percent level of significance chosen for the study.

It is still necessary to confirm the validity and robustness of the model. To achieve this, the study conducted post-estimation tests such as the modified Wald test for groupwise heteroscedasticity test, Pesaran's test of cross-sectional independence and Wooldridge test for autocorrelation. The results of the post-estimation tests for the confirmation of the estimation results are reported in the next sub-section.

4.3. Post estimation results

In order to confirm the robustness of the estimated model, some diagnostic tests were conducted. The results of the omitted variable, heteroscedasticity, cross-sectional dependence and autocorrelation test are presented in turns.

4.3.1. Omitted variable test

The study test for the possibility of having variables that may influence human development index aside foreign direct investment, exchange rate, trade openness and inflation rate; that is, variables which could have affected or impaired on the dependent variable (*HDI*) that are not captured in the model using Ramsey RESET test as shown in Table 11.

The P-value of the test at 0.00 (0%) reveals that there are some important independent variables aside from foreign direct investment, exchange rate, trade openness and inflation rate that can impair or impact on human capital development. However, the model is appropriate despite the existence of omitted variables within the scope of the study.

4.3.2. Heteroscedasticity tests, Cross-sectional dependence and autocorrelation tests

The results of the heteroscedasticity, cross-sectional dependence and auto correlation tests are presented in Table 12. The results reveal that the *resids* of the model are not constant over time, signifying the presence of cross-sectional dependence and serial correlation problem among the *resids* of the model.

Table 11. Ramsey RESET test result.

F(3, 202)	9.22
Prob	0.00

Source: Authors' computation Using StataC 11, (2016).

Table 12. Results of the Wald test, Pesaran test and Wooldridge test.

Wald test	Pesaran CD test	Wooldridge test
Chi ² (21) = 2874.19	Cross sectional = 17.674	F (1, 20) = 127.965
Prob > chi ² = 0.000	Pr = 0.000	Prob > F = 0.000

Source: Authors' computation using StataC 11 (2016).

4.3.3. Pooled OLS regression

Given these econometric errors as a result of series transformation, in the model, the OLS, fixed effect and random effect could not have been the appropriate estimator for the model. In order to correct to the errors (five missing observations out of the total 210 observations) arising from series transformation, in the model, the pooled OLS with Driscoll-Kraay standard errors comes in useful. The result of as the re-estimated model is presented in Table 13 and Equation (4).

$$HDI = -0.972 - 0.119TRADEOP + 0.021FDI - 0.059EXRATE + 0.017IFR \quad (4)$$

The results reveal that although changes in foreign direct investment (*FDI*) and inflation rate (*IFR*) have positive influence on the change in human development index (*HDI*), only the former is significant at 1 percent statistical level. Changes in exchange rate (*EXRATE*) and trade openness (*TRADEOP*) have significant negative influence on the change in *HDI*. The coefficient of determination of 0.55 implies that on the average, 55 percentage changes in the poverty (*HDI*) is explained by the combined influence of the changes in explanatory variables.

4.4. Discussion of findings

A critical analysis of the reviewed literature identifies contrasting schools of thoughts on the relationship between trade liberalization and poverty alleviation. Alan et al. (2004), together with Sakr (2012) fall in the school that finds positive association between the two variables. The opposing school of thought includes Aigheyisi (2013), Billmeier and Nannicini (2009), Yusuf et al. (2013) and contends that the balance of payment of a country will suffer due to the lowering of trade barriers of a country which in turn accentuates the poverty level through inflation. Yet another set of findings found no nexus between the two variables (Quartey, Aidam, & Obeng, 2007).

The finding of this research is that trade openness negatively and significantly influences change in poverty. The nexus between trade liberalization and poverty reduction is not direct. The link according to Khan (2005), between the two variables is in two sequential parts: the impact on economic growth, and the impact on income and asset distribution. The conclusions drawn are in sync with the traditional trade theory which posits that free trade through the reduction in import and export obstructions is the best strategy for growth due to increased efficiency and production

Table 13. Pooled OLS regression with Driscoll-Kraay standard errors.

Variables	Coeff	Drisc/Kraay Std. Error	t-stat	Prob
<i>lnTRADEOP</i>	-0.119	0.009	-13.79	0.000
<i>lnFDI</i>	0.021	0.006	3.25	0.010
<i>lnEXRATE</i>	-0.059	0.003	-19.23	0.000
<i>lnIFR</i>	0.017	0.011	1.52	0.163
Constant	-0.972	0.154	-6.32	0.000
F(4, 9) = 635.10		Prob > F = 0.000		R-Squared = 0.55

Source: Authors' computation using Stata11 (2016).

induced by national comparative advantage. Usually the benefits derivable from this static sort of trade exist only in the short term under perfect competition.

However, trade is dynamic trade and generates indirect, spill-over gains which increase growth rates in the medium and long term. The translation of growth to greater welfare of the people however requires that all the restrictive assumptions of the existence of perfect competition be relaxed. In essence, under the real world conditions of an imperfect competition and existence of externalities (spillovers), trade might be welfare-improving, especially in the developing countries of Africa (Pigka-Balanika, 2013).

The failure of African countries to harness the welfare-improving benefits from more open trade is due in part to inequitable distribution of such gains including the terms of trade and the level of the full employment of resources. This research particularly identified the negative impact of exchange rates on the human development index. All the African countries under review had at one time or the other conducted the devaluation of the domestic currencies which may cause citizens to spend more on purchasing few goods from abroad thereby further making worse the terms of trade.

Notwithstanding the potential trade openness in accelerating economic growth through greater integration into the world economy, the findings of this research of the negative impact of trade liberalization on poverty reduction can also be ascribed to the inability and failure of developing countries to diversify production and exports despite several trade diversification efforts (Santos-Paulino of United Nations Conference on Trade and Development –UNCTAD, 2012). Their efforts at structurally transforming their economies have also largely resulted in high level of employment, low economic growth and persistent poverty. These further exacerbate the income disparities and perpetuate poverty.

The negative coefficients of trade openness in both estimated results

$$HDI = -0.972 - 0.119TRADEOP + 0.021 FDI - 0.059EXRATE + 0.017IFR \quad (5)$$

connotes that trade openness deleteriously impacted both economic growth and poverty levels. This means that the countries are highly dependent on imports. The need for boosting domestic production of goods and services therefore becomes manifest. However, George (2010) counsels the careful and systematic opening of countries to open trade since an unbridled liberalization of agriculture, for example, could lead to an increasing dependence on food imports and a rise in poverty in developing countries.

Another significant result of this research is that a long run relationship exists between trade openness and the human development index – the proxy for poverty level. This finding is supported by the neoclassical models of trade policy which provide only a level effect on per capita income. Liberalization increases the per capita income in the long run but not its long-run rate of growth. The existence of spillovers in production, manufacturing and services sector is expected to give rise to long-run growth and therefore makes permanent growth possible. Indeed, based on Solow's (1956) theory, trade liberalization propelled by free market and comparative advantage fosters economic expansion through labour-intensive export activities, which results in employment generation. The added distribution of social benefit arising from the trickle-down effect and externalities, in the opinion of Maneschi (1998) will eventually benefit all members of society, including the poor. This is supported by Dollar and Kraay (2002b) postulate that as economic growth rises, poverty falls.

Most African countries have been politically independent for over 50 years. They have shouldered the responsibilities for their economic, including trade, policies. But poverty has been pervasive. Poverty has remained stubbornly high in Africa notwithstanding liberalization reforms. But this may have little to do with trade policy (or globalization), and more to do with unstable or failed political regimes, and wars and civil conflicts that have afflicted several countries in the region.

5. Conclusion

This research paper set out to carry empirical analysis on the relationship between trade liberalization and poverty alleviation in 21 African countries. The study employs three-phase procedural steps: pre-estimation, estimation and post-estimation. The first step in the pre-estimation phase is the use of descriptive statistics in order to understand the nature of the data. The correlation matrix and variance inflation factor tests were applied to check for the existence or otherwise of autocorrelation among the explanatory variables. The panel unit root test was also deployed to determine the stationarity of the series.

In the estimation phase, the ordinary least squares technique was deployed in addition to the Hausman test to determine the appropriate estimator between fixed and random effect. Since stationarity of panel data was not obtained at level, the data were transformed into their logged form. In order to determine possibility of a long run relationship among the variables, the panel co-integration test (Johansen co-integration test) was conducted after determining the optimal lag length. In order to confirm the robustness and validity of the regression model result some post-estimation tests are conducted. These are the Ramsey RESET test; the cross dependence test; and autocorrelation and heteroscedasticity tests. Since the results showed heteroscedasticity, cross-sectional dependence and/or autocorrelation, the more robust pooled OLS method will be applied in re-estimating the model.

The findings reveal that foreign direct investment and inflation rate had a positive relationship with human development index while exchange rate and trade openness was negatively related to poverty level.

The study recommends that in a bid to diversify the export market, developing countries should target other developing countries in the spirit of South–South cooperation. Such countries should also consider the joining or strengthening of regional economic integration bodies like the Economic Community of West African States – ECOWAS (Nwafor & Adenikinju, 2005). The diversification of exports also requires that beyond primary product exports, countries should encourage value adding manufacturing and technology-driven services in which they possess both absolute and/or comparative advantage and expanding the number of trade destinations.

Trade openness also involves financial openness which is attributable to the weakness of the nation's financial system, and calls for a conscious and deliberate effort to develop or strengthen the banking and all other non-banking financial institutions, including the nation's capital market in order to harness the gains of being integrated in the global financial system.

The economic benefits derivable from trade liberalization do not automatically cascade down to the poor. In fact, as this study has shown, supportive of the work of Nwafor, Adenikinju and Ogujiuba (2007), trade openness accentuates income disparities in the developing countries. Therefore, concerted and deliberate pro-poor inclusive programmes must be instituted. Incentives for production and human capacity building in the export oriented sector should be emplaced.

The jury in the literature is still out on the impact of trade openness on poverty. The evidence of the channel of transmission of trade liberalization to poverty reduction across the board is still being debated. This paper contributes to the debate.

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