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CAUSALITY TESTING BETWEEN TRADE OPENNESS, FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH: FRESH EVIDENCE FROM SUB-SAHARAN AFRICAN COUNTRIES

ABSTRACT

Previous works are yet to reach a consensus about the direction of causality between Trade Openness (TO), Foreign Direct Investment (FDI) and Economic Growth (EG), in particular, using a panel data analysis for Sub-Saharan African (SSA) countries. This study adopts first and second generation econometric methods to analyse the relationships between trade openness, FDI and economic growth in Sub-Saharan Africa countries over the period 1980-2016. The Westerlund cointegration, the Common Correlated Effect Mean Group (CCEMG), and the Bootstrapp Granger causality econometric techniques were adopted. Findings show there is a cross-sectional dependence among the 23 SSA countries examined. A long-run cointegration among trade openness, FDI and economic growth also exists. A positive and significant relationship exists between trade openness and economic growth. FDI indicates a positive and significant relationship with economic growth. The panel error correction term (ECT) result further confirmed the long-run relationship among the variables. A bidirectional causal relationship exists among trade openness, foreign direct investment net inflows and economic growth for Gambia, Senegal and South African countries. As part of our policy recommendations, SSA government should promote trade openness by reducing or eliminating trade tariff and non-tariffs that can limit the economic activities in the region.

KEYWORDS: FDI, Real GDP per capita, Pooled Mean Group, Trade Openness
JEL CLASSIFICATION: F14, F43, O49, O55

RIASSUNTO

Test di causalità tra apertura commerciale, investimenti diretti esteri e crescita economica: evidenze aggiornate dai paesi dell'Africa sub-sahariana

La letteratura esistente sull'argomento non ha ancora realizzato un consenso unanime circa la direzione della causalità tra l'apertura commerciale, gli investimenti diretti esteri e la crescita economica, in particolare tramite un'analisi *panel* dei dati dei paesi dell'Africa sub-sahariana. Questo articolo adotta metodi econometrici di prima e seconda generazione per analizzare questa relazione nei paesi dell'Africa sub-sahariana tra il 1980 e il 2016 come la cointegrazione di Westerlund, il gruppo medio ad effetto comune correlato (CGEMG) e la causalità Bootstrap Granger. Le evidenze mostrano che vi è una dipendenza trasversale tra i 23 paesi dell'Africa sub-sahariana considerati. Esiste anche una cointegrazione di lungo periodo tra apertura commerciale, investimenti diretti esteri e crescita economica. Vi è una relazione significativa positiva tra l'apertura commerciale e la crescita. Gli investimenti diretti esteri indicano una relazione positiva significativa con la crescita. I risultati del *panel error correction term* (ECT) hanno ulteriormente confermato la relazione di lungo periodo tra le variabili. Esiste una relazione causale bidirezionale tra l'apertura commerciale, il flusso netto degli investimenti diretti esteri e la crescita economica in Gambia, Senegal e Sud Africa. Da parte nostra la raccomandazione per i governi dei paesi dell'Africa sub-sahariana è quella di promuovere l'apertura commerciale riducendo o eliminando i dazi e tutto quanto può limitare le attività economiche di questi paesi.

1. INTRODUCTION

The target of increasing the economic growth of Sub-Saharan African (SSA) countries, particularly after their independence in the 1960s has been a major concern for the region. According to the International Monetary Fund (IMF), Africa remains the world's poorest continent (IMF, 2000), although increasing number of countries in the Sub-Saharan Africa are showing economic progress (IMF, 2000). But, the region is still facing some major economic challenges of raising economic growth that could metamorphose into poverty reduction and economic development. According to World Development Indicator (WDI), the economic growth rate of the region stood at 3.0 per cent and 1.2 per cent in 2015 and 2016 respectively.

Among others, the inability of the region to fully integrate itself into the world economy has been a major issue.

The structure of Sub-Saharan economy heavily relies on agriculture. In 2005 and 2009, the agriculture sector's share in Real GDP *per capita* stood at 16.9 per cent and 12.7 per cent respectively, and provided employment to more than 65 per cent of the labour force in the region. The services and manufacturing sectors have been playing a giant role in the growth of the SSA economy. For instance, in 2009, services and manufacturing sectors contributed about 56.6 per cent and 12. 9 per cent respectively. The industrial sector contributions to the GDP declined from 32.5 per cent in 2008 to 30.6 per cent in 2009. This decline was as a result of the global financial crisis that affected all the regions of the world.

The exports and imports contribution to the GDP in the region is determined among others by the level of the trade liberalization. In 2005 and 2009, the exports share of world total stood at 3 per cent and 3.5 per cent respectively. Similarly, imports share of the world total increased from 2.4 per cent in 2005 to 3.3 per cent in 2009. The contribution of net Foreign Direct Investment (FDI) inflows increased from 3.9 per cent in 2005 to 4.1 per cent in 2008. This increase was as a result of the level of trade liberalization and inducement granted by most governments of the region. At the same time, the growing market size of SSA may attract multinational firms to invest abroad.

In recent years, the net inflows of FDI to SSA economy has been declining from USD63,494 million, USD60,460 million, USD50,171 million and USD45,948 million in 2013, 2014, 2015 and 2016 respectively. This decrease is a result of the political and economic instabilities that are prevailing in most countries in the region. It is rational for every investor to invest in a stable atmosphere with less trade restrictions. The net inflows of FDI in this case represent the financial liberalisation in capital account. In the same manner, the level of trade liberalization in a country can be measured by the extent of the trade openness which is defined as the ratio of exports and imports.

In total trade in goods and services in SSA economy, the exports declined from USD214,063 million, USD187,050, USD137,307 and USD125,021 in 2013, 2014, 2015 and 2016 respectively. The value of imports increased from USD518,581 in 2013 to USD533,074 in 2014. Although, it decreased from USD462,853 in 2005 to USD399,962 in 2016, due to low infrastructures,

corruption, religion and ethnicity problems that are common to the majority of the countries in SSA. The Foreign Direct Investment plays a major role in employment creation, skills acquisition, transfer of management expertise and so on. The work done by Yusoff and Nuh (2015) shows that the net inflows of FDI have contributed immensely to the economic growth and development of most East Asian countries like Thailand, Singapore, South Korea, Taiwan and Malaysia.

In light of this, there is a growing aspiration as to whether Foreign Direct Investment (FDI) and trade openness can promote economic growth in the case of Sub-Saharan African region. In the same way, there is the thinking on whether higher economic growth in terms of real GDP *per capita* could also be an inducement for a foreign investor or not. In view of this, some analysts concluded that causality only runs from real GDP *per capita* growth to FDI (uni-directional) and not vice versa (see Feridun, 2004; Hansen and Rand, 2006).

Although, over the years, scholars have been trying to see the relationship among FDI, trade openness and economic growth; but several mixed results were recorded by them on the causal relationship between FDI and economic growth, in particular, during pre-and-post Structural Adjustment Programme (SAP). This implies that the phases of trade reforms that were adopted in the SSA region have different effects on the region's economy. For instance, before SAP, there was no evidence of causality between FDI and economic growth but immediately after the reform period (SAP) causality was found (see Frimpong and Oteng-Abayie, 2006). This indicates that there is a positive impact of SAP and the related trade and economic reforms that took place at that time.

Similarly, the causal direction relationship between openness and economic growth is still unclear in the literature, despite the authors' generalized opinions that open economy promotes growth (see Dollar, 1992; Sachs and Warners, 1995; Ben-David, 1993). Nevertheless, the causal relationships between trade openness, FDI and economic growth may be different in the SSA economy because of the fundamental characteristics present in almost all the countries in the region. Meanwhile, it is not right to conclude that similar results obtained in East Asian and Europe would be revealed in SSA.

The main purpose of this paper is to investigate the factors that promote SSA economy. At the same time, we intended to identify the causal relationship among FDI, trade openness and

economic growth. Although, a recent study by Sunde (2017) considered only one country in the SSA-South Africa region; another related study on SSA economy by Opperman *et al.* (2017) looked at the patterns of volatility for FDI, portfolio equity and bank lending inflows to SSA. Pradhan *et al.* (2017) also examined a similar topic but with an empirical focus on 19 Eurozone countries. No other research has extensively analysed Sub-Saharan African trade openness, FDI and economic growth, in particular, in the recent times.

The findings of this article are expected to help the policy makers to make relevant economic policies that will further enhance the economic growth of Sub-Saharan African countries. The balance of the study is as follows: the second section discusses the previous literature related to trade openness, FDI and economic growth. The third section discusses the model and techniques of estimations. Section four discusses the empirical findings. Lastly, the conclusions and policy implications are discussed in session five.

2. REVIEW OF SOME RELEVANT LITERATURE

The neoclassical and endogenous models have gained an acceptance in describing the relationship between trade openness, FDI and economic growth in the literature. For instance, the neoclassical and endogenous growth models propose that trade openness may contribute to economic growth through an increase in technology transfer and domestic competition (see for example, Rivera-Batiz and Romer, 1991; Ben-David and Loewy, 1998, 2000, 2003; Perera-Tallo, 2003).

In an extension to the standard neoclassical exogenous and endogenous growth models, Ben-David and Loewy (1998, 2000, 2003) also carried out studies in trade-growth relationships within the multi-country framework to support the relevance and acceptance of these models. They postulate that economic growth depends on the measure of knowledge accumulation through trade liberalization policies. Moreover, they concentrate on the steady-state economic growth effect of trade openness and they demonstrate that all economies grow through phases of trade liberalization. In addition, the authors concluded that countries that encourage more openness in turn face strong competition with their local investors. However, for firms in these economies to compete with foreign firms they need to acquire modern foreign knowledge in their production operations. In the same way, more output may be attained through a liberalised

foreign trade and knowledge transfer, but the endogenous growth model concludes that trade openness fosters the flow of knowledge and ideas among countries and thereby promotes growth (see Grossman and Helpman, 1991; Romer, 1993).

Nevertheless, the interest and agitation of trade openness for most developing nations is to fill in the gap of inadequate technology and infrastructure needed to boost their economies and match up with other developed countries in the world. At the same time, to integrate with other countries in the world through the avenue of trade openness and foreign investment. To this end, early scholars within the neoclassical framework have concluded that an economy strongly benefits from the activities of trade openness. For example, Balassa (1978) and Feder (1983) utilised export as a proxy of trade openness in their study and the empirical results revealed that trade openness accelerates growth. Winters (2004) opined that the most significant benefits associated with trade openness is the achievement of a rapid process of economic growth and development. He further emphasized that most developed countries today grew their economies through trade openness via the use of high-tech and modern infrastructures by allowing other nations to freely trade with their economies with little or no barrier.

Also, several empirical studies have examined the relationship among openness, FDI and economic growth of different countries and different results were obtained. Singh and Jun (1995) observed trade openness to be positively and significantly associated with FDI inflows using Granger causality test. The causality result runs from openness to FDI and not the other way around. On the contrary, Barrell and Pain (1997) conducted that the acquisition of firm-specific knowledge-based assets was found to be an important factor behind the growth of FDI. Trade policies were also proved to be a significant factor in economic growth and development: the study by Onafowora and Owoye (1998) evidenced this assertion. In their study, 12 Sub-Saharan African (SSA) countries namely; Burundi, Cameroon, Cote d'lvoire, Ethiopia, Ghana, Kenya, Madagascar, Nigeria, Senegal, Sudan, Tanzania, Zambia were examined. Findings showed that trade policies are important factors that can influence the outcome of trade, foreign direct investment and economic growth.

Apart from the studies on the long-run relationship among these variables in the literature, other famous authors also examined the cause-effect relationship related to this subject. Zhang (2001) and Choe (2003) opined a two-way causal relationship between FDI and growth, but

according to them, the effects are more apparent from the growth of FDI and not vice-versa. On the contrary, Globerman and Shapiro(2002) and Busse and Hefeker (2007) concluded that there is no statistically significant relationship between FDI and trade openness, that is, trade openness has no effect on FDI inflows. However, results obtained by Goodspeed *et al.* (2006) turned out to be inconclusive with respect to openness: it had a positive significant effect on FDI inflow in some countries but was not significant in others.

Ndiyo and Ebong (2004) examined the relationship that exists among trade openness, FDI and economic growth. In employing Vector Auto Regression (VAR) model as their analytical method, findings confirmed that among other variables, FDI exerts positive and insignificant relationship on economic growth in Nigeria, while a negative relationship between trade openness and economic growth was revealed despite the country's efforts in integrating into world economy. This findings may be a result of some inhibiting macroeconomic factors. Among others: over-dependence on the oil related products, corruption, inadequacy of infrastructure.

Frimpong and Oteng-Abayie (2006) examined the long-run impact of Foreign Direct Investment and trade on economic growth in Ghana between 1970 and 2002 under the framework of an augmented aggregate production function growth model. The bounds testing approach to cointegration was applied in testing the long-run association among the variables under study. Findings showed there is a long-run cointegration relationship between growth and its determinant. Also, a negative impact of FDI on economic growth was found. However, trade was found to have a significant positive impact on growth. Barboza (2007) empirically shows the contribution of trade openness on output growth in Latin America. Using a panel data approach for the period 1950-2000, results indicate a positive and strong relationship between trade openness and economic growth.

Li *et al.* (2010) empirically analysed the foreign trade and GDP growth relationship in West China by employing modern testing methods such as: unit root test, cointegration analysis and error correcting model. Findings showed that a long-term causality relationship exists between GDP and other variables (foreign trade, total exports and imports).

Pradhan *et al.* (2017) examined the causal relationship between trade openness, foreign direct investment, financial development, and economic growth in 19 European nations spanning from 1988 to 2013. The study adopted a panel vector error-correction model (VECM) to investigate

the long-run association among the variables. The results of the study show that the variables are cointegrated. The short-run results further revealed that increasing inflows of foreign direct investment promote economic growth. Financial development and international trade also demonstrated a vital role in promoting economic growth in all the 19 Eurozone countries examined.

Cantah *et al.* (2018) also examined the relationship between net FDI inflows and trade openness in SSA countries. A principal component analysis was adopted. In the study, the principal component analysis captured the trading activities and common trade tariffs. Due to the nature of the data used in the study, a dynamic panel estimation technique was adopted. Findings indicate that an open economy attracts FDI. In the contribution of Bermejo and Werner (2018), a research work on the relationship between foreign direct investment (FDI) and economic growth was conducted for Spain spanning from 1984 to 2010. During the study, FDI reveals a significant rise in Spain but no evidence was documented on FDI enhancing economic growth.

3. Data and estimation technology

3.1 Data

The data set used in this study consists of data from World Development Bank Indicators (WDI) and United Nations Conference and Trade Development (UNCTAD).

The real GDP *per capita* (PCG) is used to proxy economic growth as commonly used in the literature (see Greenaway *et al.*, 2002; Makki and Somwaru, 2004). While trade openness (OPEN) is defined as the ratio of total exports and imports to GDP. The net Foreign Direct Investment (FDI) inflow is measured as a ratio of GDP. Labour Force (LF) total comprises people aged 15 and older who supply labour for the production of goods and services during a specified period. Gross Capital Formation (GCF) (formerly Gross Domestic Investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories and is measured as ratio of GDP. Lastly, Gross National Expenditure (GNE) is the total of household final consumption expenditure and general government final consumption expenditure (current US $).

Our study focuses on 23 Sub-Saharan Africa countries namely: Republic of Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Comoros, Congo Republic, Cote d'Ivoire, Equatorial Guinea, Gambia, Guinea-Bissau, Ghana, Kenya, Madagascar, Mauritania, Mozambique, Malawi, Mauritius, Nigeria, Rwanda, South Africa, and Senegal over the period spanning from 1980 to 2016.

The 23 selected Sub-Saharan African countries are based on the following criteria for the period 1980-2016:

i) The countries must be members of SSA region;
ii) All the selected countries must fall under West African Economic and Monetary Union (WAEMU), Central African Economic and Monetary Community (CEMAC), Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Southern African Development Community (SADC), Southern Africa Customs Union (SACU) and Economic Community of West African States (ECOWAS);
iii) A balanced mix of the income classification group (i.e., low income, lower middle income, upper- middle and higher income).
iv) Availability of data.

According to World Bank Report 2012, countrys' Gross National Income (GNI) *per capita* were grouped as follows: low income $1,025 or less; lower middle income $1,026-4,035; upper middle income $4,036-12,475; higher income $12,476 or more.

3.2 Estimation Methodology

Several studies have used time series data to focus on the relationship between trade openness, FDI and economic growth. In this paper, we focus mainly on SSA economy using a panel data approach. We examine the relationship among trade openness, FDI and economic growth. Other important economic growth variables such as: labour force, gross capital formation and gross national expenditures were added to avoid estimation errors. For sake of robustness, both Johansen Fisher panel cointegration and Westerlund panel cointegration tests were adopted for testing the long-run cointegration relationship among trade openness, FDI, labour force, gross capital formation, gross national expenditures and economic growth. Pooled Mean Group

(PMG), Common Correlated Effects Mean Group (CCEMG) and Dumistrescu-Hurlin (2012) Granger causality tests were also used in the study.

3.2.1 Panel Unit Root Test

Before estimating a panel Granger-causality, it is good to examine the features of cross-sectional dependence among countries. Recently, different panel unit root tests have emerged, for instance, the first generation panel unit root test methodologies (Maddala and Wu, 1999; Choi, 1999; Levin *et al.*, 2002 and Im *et al.*, 2003) in line with the assumptions of cross-sectional independence across units. Hence, this study adopts both cross-sectional independence and dependence panel unit root tests to investigate the status of the panel data. In doing this, the cross-sectional independence panel unit root test developed by Levin *et al.* (2002) was employed. Similarly, to cater for the contemporaneous correlation errors in a panel data, several cross-sectional dependence tests have been developed by scholars. Among them are: Phillips and Sul (2003); Bai and Ng (2004); Pesaran (2004, 2007); and Pesaran *et al.* (2009). To test the cross-sectional dependence (CD) correlation across SSA countries, and to know the types of cointegrating methodology to be adopted, the CD test developed by Pesaran (2004) was used. In a situation where a cross-sectional dependence in a macro panel data arises, the best cointegration methods to be employed are the common correlated effect mean group (CCEMG) and the augmented mean group (AMG) approaches.

3.2.2 Cross-Sectional Dependence Test

When investigating panel data Granger causality tests across countries, cross sectional dependence is a major issue to be faced because of the global adoption of globalization and trade liberalization across the world in recent years. The increasing integration of countries in finance, trade, education, and other areas can cause shock in one country and greatly influence other countries if cross-sectional dependence exists. For instance, the impact of global financial crisis and the Euro bond crisis was felt across countries in the world. The Breusch and Pagan's (1980) Lagrange Multiplier (LM) test has been widely used in many panel data empirical studies to test cross-sectional dependency. However, Pesaran (2004) established that the LM test is only useful when N is relatively small and T is quite large. As an alternative, when N is large and

T is also large, Pesaran (2004) proposed the following LM statistic for the cross-section dependency test (the so-called CD test):

$$CD = \sqrt{\frac{1}{N}} \sum_{t-}^{N-1} \sum_{j=i+1}^{N} (T\hat{p}_{ij-1}^{2})$$

where, $\hat{p}$ indicates the pair-wise cross-sectional correlation coefficient of the residuals from the Augumented Dickey Fuller (ADF) regression.

4. EMPIRICAL RESULTS

4.1 First-Generation Cross-Sectional Independence Test

Table 1 presents the results of the panel unit root for the variables PCG, OPEN, FDI, LF, GCF and GNE in levels and in first difference. From the results, all the variables in the level data displayed non-stationarity; however, by extending the tests in the first difference both in the individual intercept and individual intercept and trend, the results are highly significant at 5 per cent in both scenarios, which indicates stationarity of the data.

4.2 Second-Generation Cross-Sectional Dependence Test

Table 2 reveals the cross-sectional dependence test results for variables and average correlation coefficients. The cross-sectional dependence (CD) statistics and corresponded p-values strongly reject the null of cross-section independence and show that cross-correlations are significant. Hence, the existence of cross-sectional correlation among the 23 Sub-Saharan African countries in our study is revealed. These findings show that any shock that occurs in one country will affect other countries. The result serves as a proof that our choice of the estimation techniques such as: Westerlund panel cointegration, Common Correlated Effect Mean Group (CCEMG) and bootstrap Granger causality tests, are appropriate for testing panel data with the existence of cross-sectional dependence.

TABLE 1 - *First-Generation Panel Unit Root Test Results*

First-generation panel unit root tests results			
		Level	First diff.
Variable	Deterministic	LLC	LLC
PCG	Individual intercept	4.8663 (0.9919)	-5.7033 (0.0000)*
	Individual intercept + Trend	1.3758 (0.9156)	-9.7070 (0.0000)*
OPEN	Individual intercept	5.6628 (0.9999)	-12.3405 (0.0000)*
	Individual intercept + Trend	1.8356 (0.9668)	-9.8246 (0.0000)*
FDI	Individual intercept	0.9987 (0.8410)	-16.1783 (0.0000)*
	Individual intercept + Trend	-0.4807 (0.3154)	-8.3328 (0.0000)*
LF	Individual intercept	10.5303 (0.9999)	-12.3407 (0.0000)*
	Individual intercept + Trend	3..3902 (0.9997)	-14.5461 (0.0000)*
GCF	Individual intercept	2.2281 (0.9871)	-11.3488 (0.0000)*
	Individual intercept + Trend	-0.6507 (0.2576)	-8.9950 (0.0000)*
GNE	Individual intercept	18.4806 (0.9999)	-17.0393 (0.0000)*
	Individual intercept + Trend	9.0240 (0.9998)	-14.7249 (0.0000)*

Notes: probability values are in brackets ( ), the asterisk probability values indicate significant level at the 5 per cent level.

TABLE 2 - *Cross-Sectional Dependence Tests (Average Correlation Coefficients & Pesaran (2004) CD test)*

Variable	CD-test	p-value	corr	abs(corr)
PCG	87.90	0.00	0.909	0.909
OPEN	62.58	0.00	0.647	0.647
FDI	88.63	0.00	0.916	0.916
LF	94.16	0.00	0.973	0.973
GCF	77.58	0.00	0.802	0.803
GNE	92.56	0.00	0.9507	0.957

Note: Under the null hypothesis of cross-section independence CD ~ N(0,1). The Pesaran (2004) test is performed using the Stata (14) "xtcd" command.

TABLE 3 - *Johansen Fisher Panel Cointegration Results*

No. of Cointegration	Trace Statistics	Max-eigen Statistics
None	386.2 (0.00)*	230.9 (0.00)*
At most 1	191.4 (0.00)*	122.0 (0.00)*
At most 2	97.70 (0.00)*	62.94 (0.04)*
At most 3	60.52 (0.07)	36.26 (0.84)
At most 4	53.42 (0.21)	39.62 (0.73)
At most 5	80.69 (0.00)*	80.69 (0.00)*

Note: probability values are indicated in the bracket ( ), the asterisk probability values show the level of significant value at 5 per cent significant level.

4.3 Johansen Fisher Panel Cointegration Test

The results of the panel unit root in Table 1 above indicate that the variables are integrated of order I(1), hence, we test for the cointegration by using the Johansen Fisher panel cointegration test developed by Fisher (1932). The panel cointegration of Fisher was used by Maddala and Wu

(1999) as an alternative approach to testing the panel cointegration by combining tests from individual cross sections to obtain the required test statistics for the null hypothesis. The results in Table 3 are based on the probability values for Johansen's cointegration trace test and maximum eigenvalue test. The use of Johansen Fisher panel cointegration was also evidenced in the literature (see Hossain, 2011). Hence, Table 3 shows that there is a long-run association among variables.

4.4 Westerlund Panel Cointegration Test Results

Some of the panel cointegration tests such as: Johansen Fisher panel test suffers from the common-factor restriction required that the long-run parameters for the variables in their levels are equal to the short-run parameters for the variables in their first difference. In response to this limitation, Westerlund (2008) developed four new panel cointegration tests that are based on structural rather than residual dynamics and, therefore, do not impose any common-factor restriction. In this case, Westerlund panel cointegration test uses error-correction term by testing the null hypothesis of no cointegration by examining if the error-correction term in a panel error-correction model is equal to zero. Apart from the advantage of non-common factor restriction, the cointegration tests also assumed to be normally distributed and suitable to accommodate unit-specific short-run dynamics, trend and slope of the parameters, and cross-sectional dependence. Westerlund panel cointegration test uses a bootstrap approach to account for cross-sectional dependence that may be present in the cross-sections.

Table 4 shows the results of the Westerlund (2008) panel cointegration test that avoids the common factor restriction issue and the null hypothesis with the condition associated with the error correction model, that is, the error-correction term is equal to zero. Therefore, when the null hypothesis of no error-correction is rejected, this implies the existence of a long-run relationship among the variables. According to the results, two panel tests out of four indicate that the mean group tests (H_1) confirm the existence of cointegration for at least one cross-section unit. The null hypothesis of cointegration (H_0) is tested by the panel statistics P_t and P_a against the alternative (H_1) of the panel cointegration G_t and G_a. One of the characteristics of Westerlund (2008) is that it presents the p-values robust against cross sectional dependence through a bootstrapping approach which allows for heterogeneity at different levels. The results in the table reject the null hypothesis of no cointegration at the 5 per cent level of significance

except G_a test statistics. The null hypothesis that implies no cointegration is then rejected in three out of four levels of statistics with the 5 per cent significance level from the bootstrapped p-values; this indicates that cross-sectional dependence exists. The bootstrapped p-values are indications of the existence of strong cointegration among economic growth, foreign direct investment, trade openness, labour force, gross capital formation and gross national expenditure.

TABLE 4 -*Results of Westerlund (2008) Panel Cointegration Tests*

Statistics	**Value**	**P-value**	**Robust p-value**	**Bootstrap p-value**
G_t	-2.856	-3.100	0.001*	0.005*
G_a	-8.030	2.307	0.990	0.055
P_t	-14.006	-4.077	0.000*	0.000*
P_a	-7.171	0.519	0.698	0.035*

Notes: The Akaike Information Criterion (AIC) with maximum lag(1) and lead(1) lengths are used for optimum lag lengths selection. Bootstrapped p-values robust against cross-sectional dependences are obtained by setting the bootstrap value to 200.

4.5 Pooled Mean Group and Common Correlated Effect Mean Group

The study adopts the Pooled Mean Group (PMG) model of panel Autoregressive Distributed Lags (ARDL) to test the long-run relationships between economic growth, foreign direct investment, trade openness, labour force, gross capital formation and gross national expenditure. The advantages of PMG are: (1) it allows for short-run coefficients, (2) it allows the speed of adjustment to the long-run, (3) it allows adjustment for the error variances that may occur in the heterogeneous countries, (4) it allows the long-run slope coefficients to be restricted and identical across countries.

The PMG approach is a very good estimator for estimating macro panel data but it does not correct the possible errors that occur in cross-sectional dependence panel data. Cross-section

dependence (CD) occurs due to a few reasons such as: oil price shock, global financial crisis, local spillover (Al Mamun *et al.*, 2015). As an alternative to the PMG, the estimator based on the Common Correlated Effect Mean Group (CCEMG) is also applied. The CCEMG is also very efficient when the presence of common effects are not observed in a study (Pesaran, 2006).

To estimate these relationships, the study adopts PMG and CCEMG estimators within the framework introduced by Pesaran *et al.* (2001) in an autoregressive distributive lag, (ARDL) (*p*, *q*) as follows:

$$PCG_{it} = \sum_{j=1}^{p} \beta_{1ij} PCG_{i,t-j} + \sum_{j=0}^{p} \beta_{2ij} OPEN_{i,t-j} + \sum_{j=0}^{p} \beta_{3ij} FDI_{i,t-j} + \sum_{j=0}^{p} \beta_{4ij} LF_{i,t-j} + \sum_{j=0}^{p} \beta_{5ij} GCF_{i,t-j} + \sum_{j=0}^{p} \beta_{6ij} GOVT_{i,t-j} + \varepsilon_{i,t} \quad (1)$$

for $i = 1\ldots, N; t = 1\ldots T$

where N refers to the number of countries in the panel; T refers to the number of years under observation over time; PCG is the real GDP *per capita* as a common measure of economic growth; $OPEN$ is the trade openness defined as the ratio of imports and exports to GDP; FDI represents the net inflows of FDI; LF is the total labour force, *GCF* is the gross capital formation and *EXP* is the government national expenditures. The slope of coefficients $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 coefficient of the estimated variables. The residuals $\varepsilon_{i,t}$ are structured as follows:

$$\varepsilon_{i,t} = \rho_i \varepsilon_{i,t-1} + u_{i,t}$$

According to the results in Table 5, it is expected that the error correction term (ECT) coefficient is negative and significant. In line with this, at 5 per cent significance level, the ECTs in the study is -0.22, this implies that about 22 per cent errors in the short-run are corrected in the long-run.

Empirical results correcting the problem of CD in residuals for the selected SSA countries are presented in Table 5. Findings show that foreign direct investment, trade openness, labour force and exports are important factors that determines economic growth in the SSA region.

The CCEMG results in Table 5 indicate that 1 per cent increase in foreign direct investment will result to about 8 per cent increase in the economic growth of SSA region, while 1 per cent increase in the trade openness of the region will increase economic growth by 24 per cent. This implies that

the region needs to promote trade liberalization. Similarly, 1 per cent increase in the labour force and gross capital formation will result in about 21 per cent increase in the economic growth of the region. Finally, 1 per cent export activities will also increase the economic growth of the region by 17 per cent. For therobustness of the study, the results of the pooled mean group were also presented.

Table 5 -*Pooled Mean Group Co-Integrating and Long-Run Results*

Long-run coefficients		
Dependent Variable: PCG	**PMG**	**CCEMG**
FDI	0.11 (0.00)*	0.08 (0.00)*
OPEN	0.35 (0.00)*	0.24 (0.00)*
LF	0.47 (0.00)*	0.21 (0.40)
GCF	0.04 (0.45)	0.21 (0.00)*
EXP	0.05 (0.00)*	0.17 (0.07)*
Number of country	23	23
ECT	-0.22 (0.00*)	

Notes: the asterisk probability values indicate 5 and 10 per cent significance level.

4.6 Bootstrap Panel Granger Causality Test Results

The essence of cointegration is to show the existence of the long-run relationship among variables, but it does not indicate the direction of the causality among variables. In view of this, Granger (1988) noted that if a set of variables are co-integrated, there must be a need to test the direction of causality. The Granger causality test between two variables, that is, $y_{i,t}$ and $x_{i,t}$ indicates that, if past information in $x_{i,t}$ contributes to future occurrence of $y_{i,t}$, we say $x_{i,t}$ Granger causes $y_{i,t}$. This means that variable $x_{i,t}$ has the forecasting power for $y_{i,t.}$ To determine the Granger causality relationship in this study, a homogeneous non-stationarity hypothesis was used as follows:

$H_0: \gamma_k \geq 1, \beta_k = 0;\ x_{i,t}$ does not Granger cause $y_{i,t}$

$H_1: \delta_k \geq 1, \beta_k \neq 0;\ x_{i,t}$ does Granger cause $y_{i,t}$

To test the Granger causality in this study, the modern panel causality test introduced by Dumitrescu and Hurlin (2012) was adopted to test for heterogeneous panel data models. Dumitrescu and Hurlin Granger causality test assumed the following: (1) it is suitable when the number of countries (N) is growing and the time series (T) data is constant; (2) it is also suitable when T>N and N>T; (3) the test is based on Vector Autoregression (VAR); (4) there is no cross sectional dependency. Even if cross sectional dependency is present, the Monte Carlo simulations show that the test can produce very strong outcomes.The use of this test method was evidenced in the recent literature (see Akbas and Sancar, 2013; Zeren and Ari, 2013; Ndoricimpa, 2014; Liddle and Messinis, 2015).

Konya's (2006) introduced a bootstrap panel Granger causality approach model as a system of two sets, in particular when a cross-sectional dependence exists among countries as follows:

$$PCG_{i,t} = \alpha_{1,1} + \sum_{k=1}^{K} \gamma_{1,1,k}\, PCG_{1,t-k} + \sum_{k=1}^{K} \beta_{1,1,k}\, OPEN_{1,t-k} + \sum_{k=1}^{K} \delta_{1,1,k}\, FDI_{1,t-k} + \varepsilon_{1,1,t} \quad (2)$$

$$PCG_{i,t} = \alpha_{1,2} + \sum_{k=1}^{K} \gamma_{1,2,k}\, PCG_{2,t-k} + \sum_{k=1}^{K} \beta_{1,2,k}\, OPEN_{2,t-k} + \sum_{k=1}^{K} \delta_{1,2,k}\, FDI_{2,t-k} + \varepsilon_{1,2,t} \quad (3)$$

$$PCG_{N,t} = \alpha_{1,N} + \sum_{k=1}^{K} \gamma_{1,N,k}\, PCG_{N,t-k} + \sum_{k=1}^{K} \beta_{1,N,k}\, OPEN_{N,t-k} + \sum_{k=1}^{K} \delta_{1,N,k}\, FDI_{N,t-k} + \varepsilon_{1,N,t} \quad (4)$$

and

$$OPEN_{i,t} = \alpha_{2,1} + \sum_{k=1}^{K} \gamma_{2,1,k}\, OPEN_{1,t-k} + \sum_{k=1}^{K} \beta_{2,1,k}\, PCG_{1,t-k} + \sum_{k=1}^{K} \delta_{2,1,k}\, FDI_{1,t-k} + \varepsilon_{2,1,t} \quad (5)$$

$$OPEN_{i,t} = \alpha_{2,2} + \sum_{k=1}^{K} \gamma_{2,2,k}\, OPEN_{2,t-k} + \sum_{k=1}^{K} \beta_{2,2,k}\, PCG_{2,t-k} + \sum_{k=1}^{K} \delta_{2,2,k}\, FDI_{2,t-k} + \varepsilon_{2,2,t} \quad (6)$$

$$OPEN_{N,t} =$$
$$\alpha_{2,N} + \sum_{k=1}^{K} \gamma_{2,N,k}\, OPEN_{N,t-k} + \sum_{k=1}^{K} \beta_{2,N,k}\, PCG_{N,t-k} + \sum_{k=1}^{K} \delta_{2,N,k}\, FDI_{N,t-k} + \varepsilon_{2,N,t} \quad (7)$$

where $PCG_{i,t}$ denotes economic growth proxied by real GDP *per capita* (in country i and t period), $OPEN_{i,t}$ refers to the trade openness (i.e., exports plus imports divided by GDP).

Table 6 presents the results of the bootstrap panel Granger causality test. The findings favour the alternative hypothesis for foreign direct investment in the case of countries like Comos, Gambia, Nigeria and Senegal (at the 10%, 5% and 1% significance level). This means that foreign direct investment inflows could play an important role in their economic growth. Except for Gambia and Senegal that show a two-way causality, countries such as Botswana and Mauritania indicate a one-way causality. This means that economic growth proxied by real GDP *per capita* is an important variable that can induce foreign direct investment in the two countries.

Consequently, the results conclude that the level of economic growth is not a major factor that attracts foreign direct investments into SSA region. The results support the neutrality hypothesis for other countries: Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central Africa, CongoRepublic, Cote d'Ivoire, Equatorial Guinea, Guinea-Bissau, Ghana, Kenya, Madagascar, Mozambique, Malawi, Mauritius, Rwanda and South Africa. In Table 7, South Africa and Gambia are the only two countries that indicate a two-way causality between trade openness and economic growth, while other countries show a one-way and neutral hypotheses. This means that the cause of low economic growth in SSA region is not a function of trade openness and that other economic growth determinants could play a significant role in this case.

TABLE 6 -*Panel Granger Causality Test Results Based on Bootstrapped Wald Statistics: FDI and PCG*

H_o: FDI does not cause PCG H_o: PCG does not cause FDI

Country		Statistic	Bootstrap critical values			Statistic	Bootstrap critical values		
			10%	5%	1%		10%	1%	5%
1	Benin	1.93	14.23	11.13	12.11	4.10	6.13	4.13	12.11
2	Botswana	-0.88	4.20	3.11	2.23	21.16***	14.20	3.11	2.23
3	Burkina Faso	-0.23	2.11	3.21	1.11	20.45	32.01	33.21	21.11
4	Burundi	1.72	2.01	4.07	3.22	18.07	22.01	20.05	23.12
5	Cameroon	0.41	1.11	3.19	1.77	16.11	19.11	23.19	21.74
6	Central Africa	1.30	2.19	2.26	1.99	1.47	2.19	2.26	1.99
7	Comos	**5.86*** **	2.13	1.22	1.67	20.99	24.13	41.22	31.67
8	Congo Republic	1.38	2.12	4.11	7.21	12.26	22.12	42.11	17.21
9	Cote d'Ivoire	-0.08	11.23	9.13	8.11	16.87	11.23	9.13	8.11
10	Equatorial Guinea	1.27	3.10	3.11	2.23	10.27	3.10	3.11	2.23
11	Gambia	**5.70*** **	2.11	3.21	1.11	**12.78*** **	8.11	11.11	9.26
12	Guinea-Bissau	1.62	2.01	4.07	3.22	28.85	42.01	44.01	33.27
13	Ghana	2.20	3.11	3.19	2.77	4.98	11.11	13.19	11.77
14	Kenya	2.56	4.13	8.22	6.67	36.92	44.13	38.22	46.67
15	Madagascar	2.30	3.12	4.11	7.21	16.99	33.12	41.11	17.21
16	Mauritania	2.25	10.23	9.13	8.11	**21.51*** **	10.23	9.13	8.11
17	Mozambique	1.82	4.10	3.11	2.23	9.31	14.10	23.11	22.23
18	Malawi	-0.94	2.11	3.21	1.11	14.42	22.11	23.21	31.11
19	Mauritius	1.36	2.01	4.07	3.22	20.05	22.01	34.07	43.22
20	Nigeria	**8.55*** **	1.11	3.19	1.77	16.47	21.11	23.19	31.77
21	Rwanda	-0.85	2.11	3.21	1.11	11.16	12.11	13.21	15.11
22	South Africa	0.79	2.01	4.07	3.22	17.54	22.11	24.07	23.32
23	Senegal	**3.07*** **	1.19	2.19	1.67	**10.40** **	8.99	8.19	16.67

Note: ***,**,* indicate significance at the 0.01, 0.05, 0.1 levels, respectively.

TABLE 7-*Panel Granger Causality Test Results Based on Bootstrapped Wald Statistics: OPEN and PCG*

H_o: OPEN does not cause PCG H_o: PCG does not cause OPEN

Country		Statistic	Bootstrap critical values			Statistic	Bootstrap critical values		
			10%	5%	1%		10%	1%	5%
1	Benin	11.13	24.13	19.02	12.19	7.70**	6.13	4.13	12.11
2	Botswana	1.72	3.31	4.21	7.33	9.77	14.20	3.11	2.23
3	Burkina Faso	0.11	2.11	4.21	7.11	0.07	12.01	3.21	1.11
4	Burundi	1.72	2.01	4.07	3.22	18.07	22.01	20.05	23.12
5	Cameroon	1.41	3.44	5.28	3.41	**19.11*** **	11.11	13.19	11.74
6	Central Africa	**11.30*** **	2.09	2.21	3.23	11.47	2.19	2.26	1.99
7	Comos	15.25	22.17	21.32	19.67	**20.99*** **	2.13	1.22	1.67
8	Congo Republic	1.38	2.12	4.11	7.21	12.26	2.12	4.11	7.21
9	Cote d'Ivoire	-0.08	11.23	9.13	8.11	16.87	11.23	9.13	8.11
10	Equatorial Guinea	1.27	3.10	3.11	2.23	10.27	3.10	3.11	2.23
11	Gambia	**5.70*** **	2.11	3.21	1.11	**12.78*** **	8.11	11.11	9.26
12	Guinea-Bissau	1.62	2.01	4.07	3.22	28.85	42.01	44.01	33.27
13	Ghana	2.20	1.11	3.19	1.77	4.98	1.11	3.19	1.77
14	Kenya	1.56	6.13	5.22	6.67	36.92	4.13	8.22	6.67
15	Madagascar	1.30	3.12	4.11	7.21	16.99	3.12	4.11	7.21
16	Mauritania	8.25	10.23	9.13	8.11	21.51	10.23	9.13	8.11
17	Mozambique	2.22	4.10	3.11	2.23	9.31	4.10	3.11	2.23
18	Malawi	1.34	2.11	3.21	1.11	**14.42*** **	2.11	3.21	1.11
19	Mauritius	0.21	2.01	4.07	3.22	20.05	2.01	4.07	3.22
20	Nigeria	0.11	1.11	3.19	1.77	**5.47*** **	1.21	3.29	1.11
21	Rwanda	-0.75	2.11	3.21	1.11	**11.16*** **	1.11	2.31	1.01
22	South Africa	**10.69*** **	8.01	4.07	3.22	**17.54*** **	11.71	12.11	9.32
23	Senegal	**3.07** **	1.19	2.19	1.67	3.11	8.19	6.29	6.37

Note: ***,**,* indicate significance at the 0.01, 0.05, 0.1 levels, respectively.

5. CONCLUSION AND POLICY IMPLICATIONS

This study aims to test the relationship among trade openness, FDI and economic growth for 23 Sub-Saharan countries during the period 1980-2016. Foreign direct investment inflows proved to have some benefits according to some previous empirical literature. The results in this paper further show a significant result in the case of Sub-Saharan African countries. Although, the causality results do not in absolute term confirm that foreign direct investments have a two-way causal effect in the region. This might be due to general characteristics peculiar to the region such as: high rate of corruption, economic and political instabilities which may hinder the success of the inflows of foreign direct investments. As postulated by many scholars in the previous empirical literature that openness to trade is crucial for economic growth, the result in this paper also revealed a positive and significant relationship between the duo. To this end, the paper concluded that a more opened economy enhances economic growth. However, the results of the cross-sectional dependence indicate that any shock in one country may affect other countries in the region. Meanwhile, FDI and economic growth displayed a two-way causal relationship in Gambia and Senegal, while a one-way and neutral causal relationship was revealed in other countries. Similarly, Gambia and South Africa also revealed a two-way causal relationship between trade openness and economic growth in the region. As part of our policy recommendations, SSA governments should promote trade openness by reducing or eliminating trade tariffs and non-tariffs in the region.

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