Analysis of Determinants of China-Africa Trade cooperation: The Application of the Gravity Model

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Abstract

The trade cooperation between China and Africa has received a greater interest in research in the recent decades as China's participation in development and economic activities including trade in Africa has significantly increased over the years. The study examined the determinants of trade cooperation between selected African countries and China using panel data with trade Gravity Model. The study estimated both the basic Trade Gravity model and the Extended Trade Gravity model using a panel data covering the period of 2000-2017. The Generalized methods of Moments (GMM) estimation techniques was utilized. Findings from the study suggest that, China's trade cooperation with the African countries harmoniously contributes to mutual benefits to the two trading partners in in terms of improving the welfare of the people, propelling economic growth of both economies. Again, GDP, Population and Relative factor endowment have positive impact on the China-Africa trade cooperation. However, geographical distance and inflation could have negative impact on trade flows between China and the African countries. Appropriate policies are need to stabilize the African economies to address inflation issues while the shipping and the freight systems and arrangements can be strengthened and improved for easy flow of trade from China to the African countries. Amore favorable terms of trade agreements are needed to be negotiated for increased gains from the trade cooperation between the two continents.

Key Words: China-Africa Trade cooperation, Gravity model, economic growth,

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1. Introduction

China has become attractive destination of global business and investment particularly after their ascension to World Trade organization and opening up to foreign trade and investment in 2002. Since then, Africa has been one of the continents that has benefitted significantly from the growing trade and investment inflows from China. Several studies such as (Adewuyi, Alarudeen, & Kareem, 2010; De Grauwe, Houssa, & Piccillo, 2012; Okoro & Oyewole, 2011) have maintained that, there has been an increased trade between china and Africa over the past decades. The trade cooperation between China and Africa has received a greater interest in research in the recent decades as China's participation in development and trade growth in Africa has significantly increased. Studies by (Adewuyi et al., 2010) suggest that, the Diplomatic ties between china and Africa could be traced as far back Ancient times through 1956 and to date.

The study recount the history between China and Africa trade relationship existing over centuries and both parties continue to have a mutual benefits. The author examines the cooperation policies of the two parties of Africa and China and particularly the purpose of the movement of China to Africa. It concludes that, China's arrival in Africa was informed by their search for a profitable trade market, energy security, investment in Africa and how to harness the untapped resources endowment in Africa.(Okoro & Oyewole, 2011) describe the policy principle of china in relation to their trade cooperation with Africa as a systematic effort for joint development and utilizing of resource potentials accompanied by their soft power policies. (Adewuyi et al., 2010) assert that, Many African countries in the recent times, have and a tremendous efforts to strengthen the relationship with the Chinese Government and have benefited fully which has translated into a more business friendly co-existing environment created coupled with the impressive progress to achieving both political and economic stability which was not existing. They have tried to revive their economic activities which has transformed their bureaucratic obstacles, investment policies, privatization measures and financial policies in their various economies.

Market product such clothes, machines, agricultural implements, food, transport equipment, footwear, stationaries and other manufactured products constitute the trade components exported from china to Africa. In the same vein, a lot of raw materials such as minerals, oils, cash crops are exported to China from Africa. Some previous studies believe that, smaller countries do not benefit from bilateral or multilateral trades, while others argue that, the smaller countries benefit most. Other have also compared developed and the developing countries in bilateral trade and found that developing countries benefit more that the developed economies in the Bilateral trade(Alshara, 2011; Babatunde, 2011; Portugal-Perez & Wilson, 2012).This study contributes to expanding the understanding of the extent to which trade cooperation between China and African explains the economic growth and development of both regions which has received least attention in previous studies. Several questions that have remained least addressed is the extent to which countries gain from bilateral trade cooperation such as the case of China-Africa.

This study is among the pioneering studies to consider relative factor endowment in the GM model with special application of a panel data extending the basic gravity model to enhance full understanding the factors contributing improve trade cooperation between China and

Africa. The study employs the Gravity Model innovatively to extend the comparative advantage, factor endowment and new trade theories to examine the determinants of the trade cooperation between China and Africa.

Previous studies lack the full ability to compare the specific factors that influence the trade cooperation in terms of imports, export and total trade which are necessary for proper economy policies, trade policies and improvement in trade gains in the cooperation. Since the factors that influence a countries import are not necessarily the same as the factors that influence their export or aggregate trade, hence the need to examine these trade components individually to expand full understanding of the predicting factors of the China-Africa trade. The direction of this study to empirically examine the factors the account for the imports, exports and total trade flows between China and Africa by employing the basic and extended gravity model using Panel data. Finally, the outcome of the study will fill the information gaps in literature which and will also serve as a spring ball for future researchers. The outcome from the study would also help policy makers in china and Africa to strengthen their institutions and trade regulations to achieve full benefits from the cooperation.

2.1Brief Literature

On the empirical front, studies on the issue of trade and economic growth have been examined by several authors. There are a large number of empirical studies on trade and economic growth and reported that trade has a positive impact on economic growth (Adewuyi et al., 2010; Babatunde, 2011; Bhattacharya & Das, 2014).(Babatunde, 2011)who studied relationship between Openness and Growth combined multiple policy criteria (namely Tariff and non-tariff measures, black market exchange rate premium, state export monopolies and the monopolization of exports) into a single dummy variable, classifying countries either as open or closed. Their results found out that the openness index was strongly and positively related to growth as variations in openness index accounted for up to 2% point's annual growth over 1970 – 1989. (Greenaway, Morgan, & Wright, 2002; Hallaert, 2006; Hoque & Yusop, 2010) used the same Sachs and Warner openness index as an indicator of openness and two other dummies aggregating various measures of trade protection in order to identify when liberalization occurred. Their study found out that, in the long run, liberalization increased growth by 2% and then open economies were about 50% richer in terms GDP per capita than closed economies. In the short run, however, the results suggested that liberalization negatively affects growth in the first year and then has a positive impact.

(Welch & Wacziarg, 2003) also replicated the same work of Sachs and Warner but through using an updated database. Their study first analyzed the within-country liberalization dynamics and found out that liberalization had strong and robust impact on growth. However, their study showed that despite the similar impact as seen in Sachs and Warner's study, yet the positive relationship seemed to break down in the 1990s. This was because of the changing nature of protectionist measures.

(owolabi Akeem) did a study on the topic "Performance evaluation of foreign trade and economic growth in Nigeria (1970 – 2005)". He found out that a 1% increase in export will cause economic growth to decrease by 19%. He suggested that conscious efforts should be

made by the government to fine-tune the various macroeconomic variables in order to provide an enabling environment to stimulate foreign trade. Key determinants of the increased inflows of trade into Africa and varied findings have been achieved. Some of these studies conclude that, the abundance of natural resources in Africa has been the major determinant of trade cooperation with the other parts of the world such as Africa –China relation. The United Nations Conference on Trade and Development opine that, the continents is determined by the resources endowment in the continent and that, countries with more resources are likely to increase trading partners(Martínez-Zarzoso & Nowak-Lehmann, 2003; Rahman, Shadat, & Das, 2006). Others study have supported these assertions while others have divergent findings being the determinants trade inflows in Africa. Again, the conducive business environment in Africa has been cited as one of the reasons for the trade with Africa (Babatunde, 2011; Biyase & Zwane, 2011a; Okoro & Oyewole, 2011). Providing stable business environment through regulations of so trade laws, tax exemptions and strong financial systems encourage the flow of investment and trade in Africa (Basu and Srinivasan, 2002). The continent is rich in the resources such as gold, bauxite, diamond, oil, timber, cocoa, cotton, sugar, among others. This has been the backbone of the development of the continent and has been used to attract several foreign partners and investor into the continent. More importantly, the author justifies the increase trade in Africa from all over the world as the results of the large markets potential of the continents. Africa has a very large market size which represents a good opportunity for investors and business world(Okoro & Oyewole, 2011). The existence of good infrastructure system and practice of efficient legal framework have also accounted for the growing interest of foreign investors and global partners to move to Africa for trade and investment.

According to (Babatunde, 2011; Naudé & Krugell, 2007; Okoro & Oyewole, 2011; Onyeiwu & Shrestha, 2004) the recent trade and investment liberalization in most African countries has been the reason behind the increased relationship between the continents and China among other parts of the world. This has created a link and deepen the confidence of foreign investors and trading partners to export to Africa and also import from without any rigorous restriction in terms of tariffs and diplomatic systems. The modern investment codes adopted by the African countries and the promising strong economic growth experienced in African also promotes the inflows of trade and FDI into Africa.

The findings from(Adjasi & Yartey, 2007; Kurihara, 2013) also support the opinion that high inflation affect the inflows of trade and FDI negatively. Again, the imbalances of some micro economic fundamentals in Africa has also been the determining factors and of course negatively affect the continents access to continuous inflow of trade and investment. The persistence increase inflation and exchange rate volatility in the continent affect the trade and investment (Jenkins & Thomas, 2002). The issue of corruption, and war could potentially influence FDI and trade which can influence the investment and trade in the African Countries

2.2 Trade Gravity Model

Gravity model (GM) was first developed by Isaac New a pioneer in Physics and has since be further developed by Tinbergen in 1962 and adopted to study bilateral international trade patterns. The original basic Gravity model was given as:

$$F = G\frac{M1M2}{R^2} \quad (1)$$

Where:

F- Force of attraction

G – Constant

M1- mass of object 1

M2 – mass of object 2

R- The distance between the two objects

This model has been used by several authors such as(Anderson & Van Wincoop, 2003; Carrere, 2006; LIU, 2018; Martínez-Zarzoso & Nowak-Lehmann, 2003; Rahman et al., 2006). Previous scholars attest that, this model is effective and produces efficient estimates and parameters which can explain a huge proportion of the variation in the bilateral trade. The gravity model has been continuously been developed over the years by merging the ideas from the international trade theories such as Hecsher-Ohlin theory of international trade. The adopted trade gravity model is also given as:

$$Trade_{ij} = A\frac{GDP_iGDP_J}{Dist^2} \quad (2)$$

From the model, $Trade_{ij}$ denotes the value of the trade between two countries such as China and Africa, i represents contry 1 and j represents country 2. The GDP_iGDP_j represent GDP for country 1 and 2 and tis expression represents determines the economic size of the two countries. The expression $Dist$ represents the distance between the two countries. This gravity model claims that higher income tends to support trade by leading to more production, higher exports and also higher demand for imports(Anderson & Van Wincoop, 2003; Carrere, 2006; LIU, 2018; Martínez-Zarzoso & Nowak-Lehmann, 2003). Gravity Model has been also applied to explain and examine several previous studies based on Ricardian trade theory, Hecksher–Ohlin trade model, the new trade theories, new trade theories in terms of economies of scale. It has also been used to examine the monopolistic competition market, and intra-industry and inter-industry trade (Anderson & Van Wincoop, 2003). (Carrere, 2006; Martínez-Zarzoso & Nowak-Lehmann, 2003)applied the GM and found that, geographical areas and distance has significant impact on trade cooperation between countries. The proximity of the trading countries determine the volume of trade flows between the countries both the exporting and the importing countries. Previous studies also reveal that, exchange rate has significantly mixed impact on trade flows between countries and among countries.

Exchange rate significantly influence both export trade volumes and import volumes. A rise in exchange rate improve export of goods and services since the exchange rate regime favour the exporting country(Balogun, 2007; Salim & Kabir, 2010). Nonetheless, exchange rate reduces import of goods and service. Since the rate of the domestic currency becomes cheaper than the foreign currency in that case, plenty money is exchanged for fewer foreign

currency. This does not favour imports. In this case, exchange rate is one of the key factors that influence international trade and bilateral trade between countries(Guo-bing, 2005; Kumar & Ahmed, 2015). The distance between the trading partners, the smaller has been identified in the basic mode of GM which has been used as proxy for the costs in the bilateral trade as determinant of trade. Several studies have examined the impact of distance on bilateral trade between countries. Distance has been used as a proxy for cost of production. Distance between locations of trade determines the extent to which trade flows. It has been found that, the longer the distance the lower the volume of trade between the countries.

Increasing distance reduces the trade volume between the countries. Furthermore, larger distances between countries are expected to decrease bilateral trade by leading to higher transportation costs and some other difficulties to trade (Kumar & Ahmed, 2015; LIU, 2018; Rahman et al., 2006). In china,(Guang-hua, 2008; Kumar & Ahmed, 2015; Martínez-Zarzoso & Nowak-Lehmann, 2003) and (LIU, 2018)extended the GM to examine the exportation products to trading partners and found that, the size of the economy of the trading countries defined by the economic growth determines the export flows of the bilateral trade performance. Other macroeconomic indicators such as exchange rate, inflation, per capita GDP, governance, language, and trade agreements also influence the trade cooperation among the countries engaged in the trade. Study by(Bhattacharya & Das, 2014; Kumar & Ahmed, 2015) who applied GM to examined access to trade among the South Asian countries revealed that, tariff has been one of the persistent barriers among other factors such as governance, productivity and factor endowment. Similarly (Bhattacharya & Das, 2014; Moinuddin, 2013; Rahman et al., 2006) employed panel data approach with GM to examine the determinants of trade cooperation, trade creation, trade diversion and accessibility to under the SAFTA regime. The study revealed that, GDP, distance, and population were key factors that determine bilateral trade patterns.

3.0 Methodology

3.1 Sources of Data

An annual panel data on China and 12 ECOWAS member countries were selected for the study. These ECOWAS members' countries comprise Group of West African Countries who have formed a community and established strong trade cooperation with china and are among the top countries who trade with China for many years. They included Nigeria, Ghana, Gambia, Cote D'Ivoir, Sierra Leone, Cape Verde, Guinea, Liberia, Mali, Senegal, Burkina Faso and Benin. These countries are among the top importing and exporting trade destinations from China. The period of the data used spanned from 2000-2017.

The data used for the analysis included Annual Inflation Rate (INFL) was estimated as Annual percentage (%) of inflation rate measured at consumer prices (World Bank Data, 2018), Distance (DIST), Distance between china and the African countries were measured in Kilometres Square (Km Sq.), China's Export from the African Countries (EXPORT) in US$ Millions (China's statistical Year Book, 2018), China's Import from the selected African countries (China's statistical Year Book, 2018), Gross Domestic Product (GDP), Per capita GDP (GDPpc), and Population(POP) (World Bank, 2018), Total Trade between China and selected African countries (TRADE) (China's statistical Year Book, 2018) and Relative

Factor Endowment (RFE) estimated as differences between natural logarithms of per capita GDP of china and the individual selected African countries(World Bank, 2018).

All the variables were then transformed to their natural logarithm except inflation which was in percentages. The transformation of the data to logarithmic values helped to linearize the data values to enhance easy computation in the Gravity model. There were obviously issues of some missing data in some countries while others recorded zero data points especially with regard to export, import and total trade. In order to easily transform them to their natural logarithms, all the missing values were assigned a value of 1 which was added to the export, import, and total trade values. In this case, the natural logarithm of 1 is zero instead on undefined which could have been the case of the mussing values or the zeros.

3.2 Basic Trade Gravity Model

Hence, the basic Trade gravity model using the panel data is then expressed as:

$$LNEXPORT_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_4 LNPOPR_{it} + \varepsilon_{it} \quad (3)$$

$$LIMPORT_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_4 LNPOPR_{it} + \varepsilon_{it} \quad (4)$$

$$LNTRADE_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_4 LNPOPR_{it} + \varepsilon_{it} \quad (5)$$

Where GDP is the Gross domestic product, TRADE denotes total trade between China and the selected African Countries, DIST also represents the geological distance between China and the selected African countries. Likewise, POP' denote population of the countries, LN is the natural logarithm, S' represents china whole R' denote the selected African countries. In the equation, ε represents the white noise of

According to the GM, the size of income of the economy is represented by GDP and it is estimated that, the larger the size of the income of the country, the greater the trade (export, import) and expected to have positive impact on trade(Kien, 2009; Kumar & Ahmed, 2015).

The geographical distance between the two countries China and the selected African countries is expected to have negative impact on trade as the farther the distance the lower the trading volumes. Population size represent the market size of the country and it is accepted to have positive impact on trade. In this study, the Basic trade Gravity Model has been extend and estimate.

3.3 Extended Trade Gravity Model

The extend GM has been estimated in this study where additional variables such as annual inflation rates of china and the trading partners, and Relative Factor Endowment. The Inflation (INFL) has been added to the extended GM to capture how economic stability and economic policy affect the trade cooperation between China and the selected African Countries. It is expected that Inflation has negative impact on trade between the paring countries. Again, the Relative Factor Endowment (RFE) has been added to the extended GM as proxy to capture differences in factor resources endowment to explain the comparative advantage Trade theory(Kumar & Ahmed, 2015). It was estimated as:

$$RFE = LNGDPpcS - LNGDPpcR \quad (6)$$

The extended trade Gravity Model estimated to examine the determinants of trade cooperation between China and African Countries were given as:

$$LNEXPORT_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_5 LNPOPR_{it} + \beta_6 INFLR_{it} + \beta_7 INFLS_{it} + \beta_8 LNRFE_{it} + \varepsilon_{it} \quad (7)$$

$$LIMPORT_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_5 LNPOPR_{it} + \beta_6 INFLR_{it} + \beta_7 INFLS_{it} + \beta_8 LNRFE_{it} + \varepsilon_{it} \quad (8)$$

$$LNTRADE_{it} = \beta_0 + \beta_1 LNGDPS_{it} + \beta_2 LNGDPR_{it} + \beta_3 LNDIST_{it} + \beta_4 LNPOPS_{it} + \beta_5 LNPOPR_{it} + \beta_6 INFLR_{it} + \beta_7 INFLS_{it} + \beta_8 LNRFE_{it} + \varepsilon_{it} \quad (9)$$

3.4 Techniques of Estimation of Coefficient

The Basic and the extended Trade Gravity Models in the equations (3-9) were estimated using the generalized methods of moments (GMM) estimation approach due its advantages over OLS, Fixed effect or random effect models especially due to its ability to handle the problem of endogeneity(Biyase & Zwane, 2011a, 2011b; Blundell & Bond, 2000). GMM technique is more appropriate when estimating growth models and also has a superior advantage to produce consistent estimates even in the presence of heteroscedasticity. With the GMM technique, the standard errors are efficient, consistent, and robust(Blundell & Bond, 2000). The coefficients and standard errors are not biased even when serial correlation and heteroscedasticity exist.

4.0 Results and Discussion

The main purpose of this study was to examine the determinants of trade cooperation between China and some selected African countries using the gravity model. The study also sought to investigate the extent to which the trade cooperation between china and the selected African countries contribute to the economic growth and development the trading partners, China and the African countries. The panel data was employed covering the period of 2000-2017.

4.1 Descriptive statistics

The table 2.0 below presents the descriptive statistics of the data used for the study. The results presents the transformed natural logarithmic values of the variable except inflation.

Table 2 Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
INFLR	6.079	4.459	34.695	-3.1	6.59	216
INFLS	2.194	1.907	5.843	-0.767	1.84	216
LNDIST	9.317	9.338	9.405	9.202	0.059	216
LNEXPORT	23.653	23.849	28.062	0	3.004	216
LNGDPR	22.813	22.763	26.864	20.297	1.563	216
LNGDPS	29.243	29.293	29.95	28.436	0.485	216
LNIMPORT	19.358	22.15	26.305	0	7.408	216
LNPOPR	15.968	16.106	19.067	12.967	1.368	216
LNPOPS	21.005	21.007	21.05	20.956	0.028	216
LNTRADE	23.889	24.133	28.222	0	3	216
RFE	1.443	1.486	2.753	-0.223	0.698	216

4.2China-Africa Export Flows perspectives

The study examined the predominate factors that determine China's import flows from Africa. Based on the panel data on the selected African countries, the basic Trade Gravity model as well as the extended Trade Gravity Model were estimated and the results presented in Table 3.0 below. From the gravity model, China's imports from the African countries constitute the African countries exports to China. The R-square of from the basic Model implies that, about 65.2 percent of the variation in the dependent variables (China's exports from the selected Countries) is explained by the model. Likewise for the extended Trade Gravity model, the R-square of 0.618 implies that, about 61.8% of the total variations in the dependent variable (China's exports from the selected African countries) are explained by the model. The Durbin Watson test value of 2.05 and 2.019 in the Basic model and the extended model respectively show that, serial correlation was not a problem in the data analysed.

Table 3.0 Trade Gravity Model Estimation (Panel Results from

Variables	Basic Model Coefficient	Std. Error	P-value	Extended Model Coefficient	Std. Error	P-value
LNGDPS	3.632023***	0.963474	0.0002	4.922476**	2.603344	0.0300
LNGDPR	1.170170**	0.461576	0.0120	6.028884*	3.083171	0.0519
LNPOPS	-2.696773***	0.203927	0.0000	-9.563979***	3.601776	0.0085
LNPOPR	0.249681	0.310471	0.4222	9.551361***	3.052464	0.0020
LNDIST	-1.436210*	1.927664	0.0571	-5.350525**	6.682076	0.0242
RFE				-2.236669	3.253881	0.4926
INFLS				0.393163*	0.155412	0.0122
INFLR				0.057510	0.042068	0.1731
R-SQUARED	0.652			0.6175		
Durbin Watson	2.053			2.019		

Note: Dependent variable: LNEXPORT, *,** and *** denote significant levels at 10%, 5% and 1% respectively.

The results from the Table 3.0 show that, China's GDPS (β=3.632, P< 0.01), have positive and significant impact on China's exports to the Selected African Countries at 1% level. This implies that, 1 percent increase in exporter's (China) national income, their exports to the African countries also increases by 3.632 percent. Conversely, exporter's (China's) population (β=-2.697, P< 0.01) interestingly has negative and statistically significant impact on their exports to the African countries. This implies that, 1 percent increase in the exporter's population reduces their export by 2.69 percent. This indicates that, the domestic market size and demand is larger to absorb the goods and services produced within the country hence it reduces the goods and service going outside the country as exports.

The findings also reveal that the GDPR (β=0.2496, P< 0.05) of the importers (selected African countries) contribute positively and significantly to the importation of goods and service from China. This means that, a 1 percent increase in the national income of the Importing countries increases their imports from China by 0.250 percent. Population of the importers (African countries) has positive impact on their import though it was not statistically significant in the basic model. However, the Basic model confirmed that, geographical distance has negative and significant impact on trade export to Africa (β=-1.436, P< 0.01). The results show that, a 1 percent increase in the distance between the importing and the exporting countries reduces the exports from china to the importers countries by 1.436%.

The results from the extended Trade Gravity Model revealed that, China's GDPS (β=4.922, P< 0.05), and china's Inflation (β=0.393, P< 0.01) have positive and significant impact on the country's exports to the African countries while China's Population (β=-9.564, P< 0.01) has negative impact on their exports to the African countries. The findings mean that a 1 percent increase in the exporter's national income Increases their exports by 4.9 percent while the exporter's (China) inflation level increases their export by 0.393% for any 1 percent increase in their inflation. This could be possibly attribute to the fact that, China has experienced significantly stabilized economy for many years such that, with that minimal inflation, it has a positive instead of negative impact on their trade.

The results also show that, Distance between China, exporting country and the African countries (β=-5.350, P< 0.05) and Relative Factor Endowment have negative impact on exports from form China however, only distance has significant impact on the export. A 1 per cent increase in the distance reduces the exports to the African countries by 5.35% from the extended gravity model. The relative factors endowment which refers to the differences in natural resources, capital resources, labour and other factors of production has negative impact on the export yet not statistically significant. (Alshara, 2011; Egger, 2002; Giovannetti & Sanfilippo, 2016; Kabir, Salim, & Al-Mawali, 2017) applied the GM and found that, geographical areas and distance has significant impact on trade cooperation between countries. The proximity of the trading countries determine the volume of trade flows between the countries both the exporting and the importing countries. Previous studies also reveal that, exchange rate has significantly mixed impact on trade flows between countries and among countries.

The extended trade Gravity model shows that, the importing African countries' GDPR (β=6.0289, P< 0.1), Population (β=9.551, P< 0.01) have positive and statistically significant

impact on the China's exports to the countries at 10% and 1% levels of significant respectively. The results indicate that, 1 percent increase in the national income of the importing countries (Selected African countries) increases their imports from China by 6.03% likewise as their population increase by 1 percent, their imports from China also increase by 9.55%. This implies that, as the market size and the income of the selected African countries increase, they imports more goods and services from China.

4.3 China-Africa Import Flows perspectives

The results from Table 4.0 present the extent to which national income, population, Relative factor endowment, geographical distance, and inflation determine the imports flow from Africa to China. The coefficient were estimated from both the Basic trade Gravity model and the extended trade Gravity model. The explanatory power of R-square from the basic Model implies that, about 61.57% of the variation in the dependent variables (China's Imports from the selected Countries) is explained by the model. Likewise for the extended Trade Gravity model, the R-square of 0.630 implies that, about 63% of the total variations in the dependent variable (China's imports from the selected African countries) are explained by the model. The Durbin Watson test value of 2.195 and 2.193 in the Basic model and the extended model respectively show that, serial correlation was not a serious problem in the data analysed.

Table 5.0 Trade Gravity Model Estimation (Panel Results from Basic and Extended Gravity Model)

Variables	**Basic Gravity Model**			**Extended Gravity Model**		
	Coefficient	**Std. Error**	**P-value**	**Coefficient**	**Std. Error**	**P-value**
LNGDPS	-5.96005***	0.872075	0.0000	-4.949516*	2.604106	0.0587
LNGDPR	3.934035***	0.629917	0.0000	6.022329*	3.083208	0.0521
LNPOPS	8.510708**	3.583567	0.0184	9.832151***	3.611397	0.0070
LNPOPR	-7.268189***	0.710147	0.0000	-9.527158***	3.052450	0.0021
LNDIST	-1.220084	7.332863	0.8680	-5.846688	6.683786	0.3827
RFE				2.227604	3.253953	0.4944
INFLS				0.393559**	0.155351	0.0120
INFLR				-0.056972	0.041941	0.1758
R-SQUARED	0.6157			0.630		
Durbin Watson statistics	2.195			2.193		

Note: Dependent variable: LNIMPORT, *,** and *** denote significant levels at 10%, 5% and 1% respectively.

Results from the Basic trade Gravity model in the Table 4.0 show that, China's national income, GDPS (β=-5.960, P< 0.01) has negative and statistically significant impact on the

import of goods services from the African countries. The results depicts that 1 percent increase in the national income of the importing country (China), reduces their imports from the Selected African countries by 5.96%. However, china's population (β=8.571, P< 0.01), has positive statistically significant impact on their import flows from the African countries. As the population of the importer increase by 1 percent, their imports from the African countries increases by 8.57%.

Again, from the Basic gravity model, the national incomes from the African countries, GDPR (β=3.934, P< 0.01) has positive and statistically significant impact on the China's imports from the African countries. The findings imply that, 1 percent increase in the GDP of the African countries increases their exports to China by 3.93% while 1 percent increase in their population also reduces their exports to China by 7.62%. The geographical distance (β=-1.220, P< 0.01) has negative impact on the import flows between China and the African countries though not statistically significant. As the distance increase by 1 percent, imports between the partners countries reduces by 1.23%

Findings from the extended trade Gravity Model indicate that, China's national income, LNGDPS (β=-4.949, P< 0.1) has negative and statistically significant impact on the import of goods a d services from the African countries. Yet, china's population (β=9.832, P< 0.01), has positive and statistically significant impact on their import flows from the African countries The economic stability in China represented by annual inflation showed a positive impact on the imports from the African countries even though it has no statistically significant impact on the imports flows between the partner countries.

From the extended trade Gravity model, the national incomes of the China's African trading partners, LNGDPR (β= 6.022, P< 0.1) and their Population (β=9.527, P< 0.01) have positive impact on the china's imports from the African countries and were statistically significant at 10% and 1% level respectively.

The relative factor endowment between china and the trading partners had positive impact on the china's imports but were not statistically significant. The study used relative factor endowment to extend the comparative advantage theory in the gravity model as applied in the China- Africa trade cooperation. The results agree with (Egger, 2002; Kabir et al., 2017; Kumar & Ahmed, 2015)who also found that, the relative factor endowment can have positive or negative on the bilateral trade cooperation. The results show that, RFE has a positive impact on trade cooperation. This is based on the absorptive capacity of the country including the natural resources, human capital, among others. These factors are essential for trade cooperation among countries as been inspired by the theory of comparative advantage for trade. Some countries are endowed with some specific resources while other do not have and this account for the basis of international trade cooperation particularly between china and Africa. As Africa is endowed with rich natural resources, the China's economy is also endowed with technology, and other natural resources which are lacking or inadequate for production in Africa.

4.4 China-Africa total trade Flows perspectives

The results from Table 5.0 present the extent to which national income, population, Relative factor endowment, geographical distance, and inflation determine the total trade

flows between Africa countries and China. The coefficients were estimated from both the Basic trade Gravity model and the extended trade Gravity model. The explanatory power of R-square from the basic Model implies that, about 68.23% of the variations in the dependent variable, total trade (LNTRADE) between China and the selected African Countries is explained by the model. Likewise for the extended Trade Gravity model, the R-square of 0.560 implies that, about 56% of the total variations in the dependent variable total trade (LNTRADE) between China and the selected African Countries is explained by the model. The Durbin Watson test value of 1.95 and 2.100 in the Basic model and the extended model respectively show that, the data did not suffer from a problem of Serial correlation. The estimated coefficients are presented in the Table 5.0 below.

Table 6.0 Trade Gravity Model Estimation (Panel Results from Basic and Extended Gravity Model)

Variables	**Basic Gravity Model**			**Extended Gravity Model**		
	Coefficient	**Std. Error**	**P-value**	**Coefficient**	**Std. Error**	**P-value**
LNGDPS	2.771521***	0.218473	0.0000	0.212943	0.645116	0.0417
LNGDPR	-0.377198	0.312545	0.2288	-4.470258***	0.613991	0.0000
LNPOPS	4.962670***	1.065928	0.0000	5.744279***	1.119347	0.0000
LNPOPR	1.235518**	0.477990	0.0104	5.394140***	0.779776	0.0000
LNDIST	-1.103953	2.151074	0.6083	-7.544301***	2.502363	0.0029
RFE				3.387214***	0.496060	0.0000
INFLS				0.148999**	0.070433	0.0356
INFLR				-0.024877**	0.010275	0.0163
R-SQUARED	0.6823			0.560		
Durbin Watson statistics	1.95			2.100		

Note: Dependent variable: LNTRADE, *,** and *** denote significant levels at 10%, 5% and 1% respectively.

Results from Table 5.0 show that, China's National Income measured as LNGDPS (β=2.771, P< 0.01) has a positive and statistically significant impact on total trade flows between china and the African countries. Similarly, China's population LNPOPS (β=4.962, P< 0.1) has a significant positive impact on total trade flows between China and the African countries. The results reveal that, 1 percent increase in China's GDP increase their trade flows with African trade partners by 2.77% while 1 percent increase in their population also increases their trade flows with the African countries by 4.96%. Moreover, the results reveal that, the national income measured by LNGDPR of the selected African countries has no significant impact on the total trade flows between China and the African countries. However, population of the African countries measured as LNPOPR (β=1.235, P< 0.05) has positive and statistically significant impact on the total trade flows between China and the African countries. This

implies that, as Africans population increase by 1 percent, their trade flows with China also increases by 1.24%. Increasing population tends to expand the market size hence more goods and demanded and supplied. The findings from the basic Trade Gravity model show that, the geographical distance between China and the trading partners in African has no significant impact on the total trade even though it has negative coefficient. The results from the extended trade Gravity Model show that, china's national income measured by (LNGDPS) has positive impact on total trade with the African countries which implies that, as their national income increases by 1 percent, their trading with the selected African countries also increase by 0.21 percent and this was significant at 5% level. Again, China's total population LNPOPS (β=5.744, P< 0.01), and their Inflation rates (β=0.1489., P< 0.05) have positive and significant impact on total trade between African countries and China at 1% and 5% levels of significance respectively. The results show that, 1 percent increase in their population increases their trade flows by 5.74%.

Table 5.0 shows that, the national income of the African countries, LNGDPR (β=-4.470, P< 0.01) has negative and statistically significant impact on total trade flows between China and the African countries. On the other hand, population, LNPOPR (β=5.394, P< 0.01) and inflation, INFL (β=0.0248, P< 0.05), have positive and statistically significant impact on total trade flows between China and the African countries.

The results also show that, geographical distance (β=-7.544, P< 0.01), between China and the African trading partners and Relative factor endowment (β= 3.387, P< 0.01) have positive and statistically significant impact on total trade between China and the African trading partners. The results show that, market size is one of the key factors that determine the trade cooperation between China and Africa. The study used population as proxy for market size of the trading countries. The results from this study reaffirmed the findings of previous scholars as(Babatunde, 2011; Karamuriro & Karukuza, 2015; Kumar & Ahmed, 2015)who also found that, very large market size which represents a good opportunity for traders, investors and business world and that GDP and population has a positive impact on bilateral trade relationships. The findings are also consistent with studies by scholars such as (Egger, 2002; Giovannetti & Sanfilippo, 2016; Kabir et al., 2017; Kahouli & Maktouf, 2014; Kien, 2009; Kumar & Ahmed, 2015; Kurihara, 2013; LIU, 2018) who employed the gravity model to study bilateral trade cooperation among countries. They found that, the size of the economy using GDP, and population conclude that, of the trading countries defined by the economic growth determines the export flows of the bilateral trade performance. The findings are also consistent with results from studies such as(Kurihara, 2013) who found that, inflation can have negative impact on bilateral trade flows. However, it can also have positive impact due to the rate and the level of the inflation. The level found that, China with much stabilized rate of inflation and very minimal tend to be positively associated to trade flows with other partners countries(Kurihara, 2013). Nonetheless, African countries with high rate of inflation, it tends to be negatively associated with trade with partners such as China. The findings from (Adjasi & Yartey, 2007; Hasen & Gianluigi, 2009; Kien, 2009) also support the opinion that high inflation affect the inflows of trade and FDI inflows between countries. Again, the imbalances of some micro economic fundamentals in Africa has also been the determining factors and of course negatively affect the continents access to continuous inflow of trade and

investment. The persistence increase inflation and exchange rate volatility in the continent affect the trade and investment (Dexter, Levi, & Nault, 2005). In Africa, one of the major factors that influence trade and economic growth is inflation and exchange rate volatility. This has made trading uncertain and increases the risk of trading with other countries. This has contributed negatively to the economic instability which undermines growth and development in the African countries. Corruption, and war could potentially influence trade as noted by which can influence the investment and trade in the African Countries.

5. Conclusion and Policy Implications

The study examined the determinants of trade cooperation between selected African countries and China using panel data with trade Gravity Model. The study estimated both the basic Trade Gravity model and the Extended Trade Gravity model in order to identify the key and predominant factors that determine the trade cooperation between China and the African countries. The Generalized methods of Moments (GMM) was used due to its ability to overcome endogeneity and heteroscedasticity problems in panel or data analysis. The study innovatively estimated the basic Trade gravity model and extend the basic trade gravity model to introduce new variables such as relative factor endowment. The study also used panel data which spans over a period of 2000-2017 as the most current data on the trade flows between China and each of the countries.

The results from the study reveal that, National income measured as GDP has a major positive impact on the import, export and total trade flows between China and the African countries. There efficient utilization of resources and factors of production to improve the national incomes would produce positive spill overs on expanding trade and enhancing the standard of living of the people especially the continent in which poverty is high. The findings suggest that, expanding the market size increases the trade flows, imports and exports from both trading partners. Therefore it appropriate policies and measures should be employed to expand the markets in order to increase the trade flows between China and the African countries so that their target of alleviating poverty through trade can be achieved.

Expanding trade flows between china and African has the potential to alleviate poverty in the continent as well as among the Chinese.

The results reveal that geographical distance has negative impact on trade flows between China and the African countries. The geographical distance constitute a major cost in transportation which reduces the imports or exports of goods and services. It is therefore imperative that, the appropriate transportation systems and arrangement are made between China and the African countries so that it can facilitate cost effective and efficient trade between the two partners since the trade cooperation has a positive impact on the economic growth and development of the African economy especially by alleviating the existing poverty in the continent. The shipping and the freight systems and arrangements can be strengthened and improved for easy trade within the two continents.

This study was only limited to the trade cooperation between selected African countries who are major trading partners with china and does not cover all the African countries in the continent. In the future studies, the African countries can be divide into major trading partners and minor trading partners and comparative analysis can be performed do identify

the causes of the differences in terms of trading with china. In the future studies, additional variables such as exchange rate, language, should be included in the extend gravity model to improve the discussion and extend the empirical understanding of the determinants of the trade cooperation between Africa and China.

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