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# Trade Competition and Complementarity Between USA and One of Its Major Trading Partners in Africa (Nigeria): An Empirical Analysis Using Prominent International Trade Measures

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***Abstract***

*This study investigated the trade complementarity and competitiveness between USA and Nigeria using data from World Integrated Trade Solutions (WITS) database. The study examined the volume and structure of trade between USA and Nigeria, and further adopted prominent international trade measures (Revealed Comparative Advantage index, Trade Integration Index, Complementarity Index and Export Similarity Index) and a modified gravity model. The results revealed that Nigeria is one of USA's largest export destination in sub-Saharan Africa while USA is one of Nigeria's largest export destination in the world. In addition, the revealed comparative advantage index revealed that Nigeria has comparative advantage in fuels and raw materials while USA has comparative advantage in manufactured products. Meanwhile, the complementarity index, USA's trade integration index and Nigeria's trade integration index, revealed that USA and Nigeria will both gain from trade if they cooperate rather than compete.*

***Keywords:*** *Trade complementarity, Trade competition, Trade measures*

## 1. Introduction

Nigeria is one of USA's major export destinations in Africa while USA is also one of Nigeria's major export destinations in North America. According to World Integrated

Trade Solution (WITS) database, in 2017, USA total exports to Nigeria was worth about 2.2 billion dollars making Nigeria the second largest export destination of USA in Africa. Also in that same year, 2017, Nigeria's exports to USA were worth about 5.7 billion dollars putting USA a major export destination of Nigeria in North America. Similarly, Nigeria's export to USA in 2018 was about 2.7 billion dollars while USA export to Nigeria was about 3.8 billion dollars further validating the fact that Nigeria and USA are major trading partners.

Meanwhile, it is obvious that volume of Nigeria's bilateral trade (exports) to the USA is greater than the volume of USA's trade (exports) to Nigeria. This is based on the fact that the structure (composition) of the exports of Nigeria limits its exports to a few countries while the broad structure of USA exports avails it the opportunity of a larger demand by many countries. For instance, Nigeria's exports comprise majorly raw materials and fuels while USA exports comprise of capital goods, consumer goods, intermediate goods, chemical products, fuels, Mechanical and electrical goods, plastic or rubber products, transportation and vegetable.

However, there was a significant drop in Nigeria's exports to USA in 2020 to 1.08 billion dollars while USA export to Nigeria rose to about 2.8 billion dollars. This could be a result of the Covid 19 pandemic and given that Nigeria's export is majorly fuels and raw materials, its export earnings fell. In contrast, since USA export's structure is broad comprising of many products, the export earnings still rose against the 2017 value. This implies that, Nigeria is more susceptible to external shocks than the USA since Nigeria exports just a few lines of products while USA exports a broad line of products.

Based on the above scenario, it can be observed that structure of Nigeria and USA exports seems dissimilar and it will be imperative to investigate the trade relationship between Nigeria and USA. Therefore, this study intends to critically examine the trade complementarity and competition that exists between USA which is a major export destination of Nigeria, and Nigeria which is also a major export destination of the USA. Furthermore, the study adopted prominent international trade measures and a modified gravity model to empirically examine their trade complementarity and competitive relationship. The prominent international trade measures are Revealed Comparative Advantage (RCA), Trade Integration Index (TII), Export Similarity Index (ESI) and Complementarity index (CI). In addition, the study employed an Auto Regressive Distributive Lag Gravity Model to empirically examine the effects of these prominent international trade measures on the bilateral trade relationships of both countries (Nigeria and USA).

## 2. Literature Review

There has been a plethora of empirical studies on the relationship (complementarity and competition) between countries and their trading partners. For instance, Louis and Adewuyi (2012) investigated the trade relationship between Nigeria and ECOWAS

countries. They found that non complementary trade relationship exists among trading partners because the countries trade in similar products (agricultural products). In the same vein, Mombert and Francis (2012) investigated the trade relationship between Nigeria and its West African trading partners and discovered that weak institutional frameworks has led to a lagging trade relationship amongst the trading countries. Furthermore, Ogunkola (1999) discovered that if trade barriers between Nigeria and its West African trading partners are removed, high trade potentials and mutual benefits will be unlocked.

Meanwhile, there has also been studies on Nigeria and its trading partners that are outside Africa. For instance, Rupa et.al (2010) investigated the trade potentials between Nigeria and India. They opined that India has attained the maximum trade potential in trade in commodity products with Nigeria. By implication, they asserted that there seems to be little or no prospect in commodity trade between Nigeria and India. However, Kabiru (2015) established a trade complementarity relationship with Nigeria and India. The author opined that there could still be possibility for increased trade potential between Nigeria and India especially in agricultural products such as tea, coffee, rubber and so on.

Based on the foregoing, there seems to many studies on the trade relationship between Nigeria and countries in Africa and Asia. To the best of my knowledge, there seems to be no studies that have critically examined the trade complementarity and competition between USA and Nigeria despite the trade potentials between them. Therefore, it is imperative to examine this, because in North America, USA is Nigeria's major export destination. Also, Nigeria is USA major export destination in Africa.

## 3. Empirical Methodology

### *3.1 Data sources and description*

The study utilized data of both Nigeria and USA spanning from 1996 to 2020. The data set was sourced from World Integrated Trade Solution (WITS) which is a database that contains relevant trade data for trade analysis.

### *3.2 Model description*

The study adopted four prominent international trade measures and an econometric technique to analyse the trade competition and complementarity between Nigeria and the USA. The four distinct measures are Revealed Comparative Advantage (RCA), Trade Integration Index (TII), Complementary Index (CI) and Export Similarity Index (ESI) while the econometric technique adopted is Autoregressive Distributive Lag Mode (ARDL).

### *3.2.1 Revealed Comparative Advantage (RCA) for Nigeria and China*

The Revealed Comparative Advantage index is a very prominent index that indicates the extent international of competitiveness of a specific industry of a country. This implies that the RCA measures the comparative advantage of a particular industry of a country in the international market.

The RCA is calculated using the formula:

RCA = $\frac{X_a^i/X_a}{X_w^i/X_w}$ ……1

where $X_a^i$ represents the value of the export of product i of the country a, $X_a$ represents the total value of export of country a, $X_w^i$represents the value of export of the product i of the world, and $X_{\ w}$ represents world total export value. The RCA value of an industry that is greater than 2.5 implies that the industry has extremely strong international competitiveness. Meanwhile, if the RCA value is between 1.25 and 2.5, it implies that the industry has very strong international competitiveness. Furthermore, if the RCA value is between 0.8 and 1.25, it means that the industry has strong international competitiveness. However, when the RCA value is less than 0.8, it implies that the industry has comparative disadvantage.

### *3.2.2 Trade Integration Index (TII)*

The Trade Integration Index (TII) is an index that reveals the extent of integration of trade between the two countries.

The formula is

TII = $\frac{E_{ab}/E_a}{E_b/E_w}$ ……..2

Where $E_{ab}$ stands for the total value of exports from country a to country b over a particular period of time, $E_a$ stands for the total exports value of country a during that particular period, $E_b$ stands for the total value of imports of country b during that period, and $E_w$ stands for the total value of imports of the world during this period of time. When the TII is greater than 1, it shows that the trade ties between the two countries are strong; when the TII is less than 1, it indicates that the trade ties between the two countries are loose or weak.

### *3.2.3 Complementarity Index*

This study utilizes the Coefficient of Specialization (CS) and the Coefficient of Conformity (CC) to examine the trade complementarity relationship between USA and Nigeria. The Complementarity Index (CI) is calculated as;

CS = 1 - $\frac{1}{2}\sum_n/a_t^n - b_t^n/$ ……3

$$CC = \frac{\sum_n a_t^n b_t^n}{\sqrt{\sum_n (a_t^{n2}) \sum_n (b_t^{n2})}} \quad \text{.....4}$$

$$CI = \frac{CS + CC}{2} \quad \text{.....5}$$

$a_t^n$ represents the fraction of export value of product n in country a during the period of t in total export value, $b_t^n$ means the fraction of value of imports of the product n in country b during the period of t in its total value of imports. When the complementarity index is close, it implies that there is strong trade complementarity between the two trading partners and they can reap gains from trade if they cooperate.

### *3.2.4 Export Similarity Index*

The Export Similarity Index (ESI) analyses the extent of similarity between the two trading partners in terms of the structure of their export commodities to a particular target market. The calculation formula is

$$\{\sum_{t=0}^{n}[\frac{1}{2}(\frac{X_a^i}{X_a} + \frac{X_b^i}{X_b}) \times (1 - \frac{\frac{X_a^i}{X_a} - \frac{X_b^i}{X_b}}{\frac{X_a^i}{X_a} + \frac{X_b^i}{X_b}})]\} \quad \text{.....6}$$

$X_a^i$ stands for the total value of export of the product i in country a, $X_a$ stands for the total value of exports of the country a to the world market, $X_b^i$ stands for the total value of export of the product i in country b, and $X_b$ stands for the total value of export of the country b to world market. Basically, ESI examines international trade competitiveness by calculating the similarity between the two trading partners' exports in the face of world markets. The ESI index ranges from 1 to 100. The closer the index is to 100, the higher the international trade competitiveness between the two trading partners because of the similarity of their export products

### *3.2.5 Autoregressive Distributive Lag (ARDL) model*

In order to properly analyze the bilateral trade relationship between Nigeria and USA in terms of the effect of trade competition and complementarity on exports of both countries respectively, the gravity model which a prominent model in bilateral trade analysis is adopted. Meanwhile, the gravity model is specified in an Autoregressive Distributive Lag (ARDL) model framework to ensure for a long run and short run analysis.

Therefore, the econometric specifications of the linear ARDL gravity model are;

$Y_t = \beta_0 + \beta_1 Y_{t-1} + \lambda_1 X_t + \sum_{k=j}^{n} \alpha_k X_{t-j} + \epsilon_t$ .....7

Where $Y_t$ is log of Nigeria's export to USA (LNTOU) and it is a N x 1 matrix

$Y_{t-1}$ = is a matrix of lag of Nigeria's export to USA (LNTOU (-1))

$\beta_0$ = Matrix of constants

$X_t$ = Matrix of explanatory variables (distance measured by trade cost (LD), Nigeria's

Trade integration index (Nigeria TII), log of USA GDP (LUSA), log of Nigeria GDP (LNGN), Complementarity index (CI), Export similarity index (ESI)).

$€_t$ = Matrix of error terms

$Y_t = \beta_0 + \beta_1 Y_{t-1} + \lambda_1 X_t + \sum_{k=j}^{n} \alpha_k X_{t-j} + €_t$ .....8

Where $Y_t$ is log of USA's export to Nigeria (LUTON) and it is a N x 1 matrix

$Y_{t-1}$ = is a matrix of lag of USA's export to Nigeria (LUTON (-1))

$\beta_0$ = Matrix of constants

$X_t$ = Matrix of log of explanatory variables (distance measured by trade cost (LD), USA's Trade integration index (USA TII), log of USA GDP (LUSA), log of Nigeria GDP (LNGN), Complementarity index (CI), Export similarity index (ESI)).

$€_t$ = Matrix of error terms

## 4. Results and Discussions

### *4.1 Bilateral trade between USA and Nigeria*

#### *4.1.1 Nigeria Exports to USA*

USA is one of Nigeria's largest export destination in the world. For instance, Nigeria exports to USA was as much as 11.50 billion dollars' worth of goods in 2000, 26.6 billion dollars in 2006 and 37.86 billion dollars in 2008, it later fell to as low as 1.74 billion dollars in 2015 and 1.08 billion dollars in 2020. This implies that there was a 110.23% increase in exports from Nigeria to USA in 2000 and 38.16% increase in 2008. Also, the value of Nigeria's exports to USA significantly dropped fell by 55.59% in 2015 and by 61.67% in 2000 (see table 1). A plausible explanation for the significant fluctuations in the value of Nigeria's exports to the USA is the fact that Nigeria basically exports crude oil as such as the price of crude oil changes the value of its exports changes. Meanwhile, the effect of the Covid 19 pandemic also affected the worth of Nigeria's exports to USA because the price of crude oil dropped significantly.

#### *4.1.2 USA Exports to Nigeria*

In Africa, Nigeria is a major importer of USA products. USA exports to Nigeria was worth 0.72 billion dollars in 2000, 4.10 billion dollars in 2008, 3.44 billion dollars in 2015 and 2.79 billion dollars in 2020. This implies that there was an increase in USA exports to Nigeria by 14.88% in 2000 and 47.2% in 2008. Meanwhile, in 2015, the value of USA exports to Nigeria fell by 42.39% and also by 12.27% in 2020 (see table 1).

A critical analysis of table 1 below reveals that the volume of Nigeria's exports to USA far outweighs the volume of USA exports to Nigeria. This signifies that USA is major global destination of Nigeria's export while Nigeria is just a major destination of USA exports in Africa and not in the world. This further implies that USA is a world exporter

of its products while Nigeria exports majorly to a few dominant market such as USA.

**Table 1:** Volume of total bilateral trade between USA and Nigeria

| Date | USA-NIG (Billion dollars) | %change | NIG-USA (Billion dollars) | %change | Total trade between (Billion dollars) | %change |
|---|---|---|---|---|---|---|
| 1996 | 0.82 | - | 4.25 | - | 5.06 | - |
| 1997 | 0.81 | -0.23 | 4.64 | 9.21 | 5.45 | 7.69 |
| 1998 | 0.82 | 0.65 | 2.93 | -36.77 | 3.75 | -31.18 |
| 1999 | 0.63 | -23.34 | 5.47 | 86.46 | 6.10 | 62.48 |
| 2000 | 0.72 | 14.88 | 11.50 | 110.23 | 12.22 | 100.40 |
| 2001 | 0.96 | 32.32 | 7.32 | -36.34 | 8.28 | -32.28 |
| 2002 | 1.06 | 10.75 | 5.83 | -20.36 | 6.89 | -16.77 |
| 2003 | 1.02 | -3.87 | 9.21 | 57.99 | 10.23 | 48.49 |
| 2004 | 1.55 | 52.85 | 0.00 | 0.00 | 1.55 | -84.80 |
| 2005 | 1.62 | 4.21 | 0.00 | 0.00 | 1.62 | 4.21 |
| 2006 | 2.23 | 37.72 | 26.66 | 0.00 | 28.89 | 1683.41 |
| 2007 | 2.79 | 24.92 | 25.16 | -5.62 | 27.94 | -3.27 |
| 2008 | 4.10 | 47.20 | 34.76 | 38.16 | 38.86 | 39.06 |
| 2009 | 3.66 | -10.82 | 13.62 | -60.82 | 17.28 | -55.54 |
| 2010 | 4.06 | 11.00 | 29.76 | 118.50 | 33.82 | 95.74 |
| 2011 | 4.90 | 20.79 | 28.33 | -4.80 | 33.23 | -1.73 |
| 2012 | 5.03 | 2.54 | 24.14 | -14.78 | 29.17 | -12.23 |
| 2013 | 6.39 | 27.03 | 7.67 | -68.23 | 14.06 | -51.80 |
| 2014 | 5.97 | -6.59 | 3.95 | -48.44 | 9.92 | -29.42 |
| 2015 | 3.44 | -42.39 | 1.74 | -55.96 | 5.18 | -47.80 |
| 2016 | 1.89 | -44.89 | 3.98 | 128.30 | 5.87 | 13.35 |
| 2017 | 2.17 | 14.70 | 5.67 | 42.66 | 7.85 | 33.63 |
| 2018 | 2.69 | 23.62 | 3.79 | -33.13 | 6.48 | -17.41 |
| 2019 | 3.18 | 18.31 | 2.82 | -25.60 | 6.00 | -7.39 |
| 2020 | 2.79 | -12.27 | 1.08 | -61.67 | 3.87 | -35.50 |

### *4.1.3 Structure of USA exports to Nigeria*

USA exports to Nigeria seems to be dominated by intermediate and finished goods implying that there is value addition to products before they are exported to Nigeria. More so, USA exports to Nigeria seem to be characterized by capital goods, consumer goods, intermediate goods, chemical products, Fuels, Mechanical and electrical goods, plastic or rubber products, transportation and vegetable. For instance, in 1996, USA exports of capital goods, consumer goods, intermediate goods, chemical products, Fuels, Mechanical and electrical goods, plastic or rubber products, transportation and vegetable were 0.44 billion dollars, 0.06 billion dollars, 0.12 billion dollars, 0.04 billion dollars, 0.02 billion dollars, 0.38 billion dollars, 0.03 billion dollars, 0.06 billion dollars and 0.17 billion dollars respectively, accounting for 31.56%, 4.11%, 8.79%, 2.81%, 1.22%, 27.23%, 1.88%, 4.48% and 12.22%. Furthermore, in 2005, the value of the USA exports to Nigeria had increased. The value of capital goods, consumer goods, intermediate goods, chemical products, Fuels, Mechanical and electrical goods, plastic or rubber

products, transportation and vegetable were 0.56 billion dollars, 0.22 billion dollars, 0.14 dollars, 0.05 billion dollars, 0.03 billion dollars, 0.49 billion dollars, 0.04 billion dollars, 0.16 billion dollars and 0.54 billion dollars respectively accounting for 24.10%, 9.6%, 5.93%, 2.20%, 1.2%, 21.51%, 1.90%, 6.87%, 23.58%. Despite the increase in the volume of all products, the percentage of commodities such as capital goods, intermediate goods, chemical goods, fuel and mechanical and electrical goods in total products fell in 2005. Furthermore, in 2010, the value of all products also increased. However, the value of export products fell in 2015 as against the 2010 values. The value of all the products also further fell in 2020 as against the 2015 values (see table 2). This implies that the value of export products (capital goods, consumer goods, intermediate goods, chemical products, Fuels, Mechanical and electrical goods, plastic or rubber products, transportation and vegetable) from USA to Nigeria increased between 1996 to 2005, it further increased in 2010 and later dropped in 2015 and 2020. `

**Table 2:** Structure of USA exports to Nigeria

| Year | Capital goods | Consumer goods | Intermediate goods | Chemicals | Fuels | Mach and Elec | Plastic or Rubber | Transportation | Vegetable |
|---|---|---|---|---|---|---|---|---|---|
| 1996 (Billion dollars) | 0.44 | 0.06 | 0.12 | 0.04 | 0.02 | 0.38 | 0.03 | 0.06 | 0.17 |
| % exports | 31.56 | 4.11 | 8.79 | 2.81 | 1.22 | 27.23 | 1.88 | 4.48 | 12.22 |
| 2000(Billion dollars) | 0.38 | 0.07 | 0.08 | 0.04 | 0.01 | 0.28 | 0.02 | 0.11 | 0.16 |
| % | 32.26 | 5.60 | 6.96 | 2.96 | 0.92 | 23.63 | 1.78 | 9.53 | 13.68 |
| 2005(Billion dollars) | 0.56 | 0.22 | 0.14 | 0.05 | 0.03 | 0.49 | 0.04 | 0.16 | 0.54 |
| % exports | 24.10 | 9.60 | 5.93 | 2.20 | 1.20 | 21.51 | 1.90 | 6.87 | 23.59 |
| 2010(Billion dollars) | 1.15 | 1.53 | 0.38 | 0.11 | 0.64 | 0.84 | 0.15 | 0.88 | 0.89 |
| %exports | 16.55 | 22.03 | 5.43 | 1.65 | 9.17 | 12.10 | 2.13 | 12.64 | 12.81 |
| 2015(Billion dollars) | 0.96 | 1.35 | 0.39 | 0.19 | 0.65 | 0.67 | 0.20 | 0.58 | 0.56 |
| % exports | 16.16 | 22.81 | 6.62 | 3.15 | 10.90 | 11.28 | 3.42 | 9.82 | 9.38 |
| 2020(Billion dollars) | 0.88 | 1.14 | 0.32 | 0.10 | 0.21 | 0.52 | 0.11 | 1.15 | 0.34 |
| % exports | 17.82 | 23.15 | 6.61 | 2.09 | 4.29 | 10.67 | 2.28 | 23.43 | 6.93 |

### *4.1.4 Structure of Nigeria's export to Nigeria*

Nigeria's export to the USA seems to be dominated by fuels and raw materials implying that most of products exported to the USA are in their raw form with no or little value addition. Meanwhile Nigeria also exports other products to the USA such as consumer goods intermediate goods, miscellaneous goods and plastic or rubber products amongst others. For instance, in 1996, Nigeria's exports of consumer goods intermediate goods, raw materials, fuels, miscellaneous goods and plastic or rubber products to the USA were 0.014 billion dollars, 0.0054 billion dollars, 4.21 billion dollars, 4.20 billion dollars, 0.005 billion dollars and 0.0138 billion dollars respectively accounting for 0.17%, 0.06%, 49.7%, 49.6%, 0.006% and 0.16%. Furthermore, in 2005, Nigeria's exports of consumer goods intermediate goods, raw materials, fuels, miscellaneous goods and plastic or rubber products to the USA were 1.63 billion dollars, 0.01 billion dollars, 24.85 billion dollars, 26.47 billion dollars, 0.0018 billion dollars and 0.0004 billion dollars respectively accounting for 3.07%, 0.018%, 46.77%, 49.83%, 0.0034% and 0.0007%. Based on the

foregoing, it can be seen that the fuels and raw materials are indeed the bulk of Nigeria's export to the USA.

Meanwhile in 2015, Nigeria's exports to the USA dropped tremendously. Nigeria's exports of consumer goods intermediate goods, raw materials, fuels, miscellaneous goods and plastic or rubber products became 0.033 billion dollars, 0.286 billion dollars, 0.733 billion dollars, 1.038 billion dollars, 0.005 billion dollars and 0.003 billion dollars respectively accounting for 11.03%, 9.42%, 24.12%, 34.16%, 0.17% and 0.11%. There was a further fall in the exports in 2020 and a plausible explanation for that is the advent of the Covid 19 pandemic that distorted global value and supply chains. For instance, in 2020, Nigeria's export of consumer goods intermediate goods, raw materials, fuels, miscellaneous goods and plastic or rubber products to USA were 0.206 billion dollars, 0.021 billion dollars, 0.846 billion dollars, 1.021 billion dollars, 0.0001 billion dollars and 0.0008 billion dollars respectively accounting for 9.83%, 1.02%, 40.24%, 48.56%, 0.006% and 0.040%. Therefore, it can be seen that the value of all products except raw materials fell between 2015 and 2020.

**Table 3:** Structure of Nigeria's exports to USA

| Date | Consumer goods (Billion dollars) | Intermediate goods (Billion dollars) | Raw materials (Billion dollars) | Fuels (Billion dollars) | Miscellaneous (Billion dollars) | Plastic or Rubber (Billion dollars) |
|---|---|---|---|---|---|---|
| 1996(Billion dollars) | 0.0145 | 0.0054 | 4.21 | 4.2036 | 0.0005 | 0.0138 |
| % exports | 0.1714 | 0.0634 | 49.7085 | 49.6336 | 0.0065 | 0.1635 |
| 2000(Billion dollars) | 0.0003 | 0.0019 | 11.4869 | 11.4862 | 0.0001 | 0.0005 |
| % exports | 0.0014 | 0.0081 | 49.9733 | 49.9702 | 0.0005 | 0.0020 |
| 2006(Billion dollars) | 1.6343 | 0.0100 | 24.8509 | 26.4772 | 0.0018 | 0.0004 |
| % exports | 3.0760 | 0.0188 | 46.7730 | 49.8340 | 0.0034 | 0.0007 |
| 2010(Billion dollars) | 5.5976 | 0.3883 | 23.5402 | 28.5128 | 0.0075 | 0.2751 |
| % exports | 9.5752 | 0.6643 | 40.2676 | 48.7738 | 0.0128 | 0.4705 |
| 2015(Billion dollars) | 0.3354 | 0.2865 | 0.7332 | 1.0383 | 0.0053 | 0.0034 |
| % exports | 11.0339 | 9.4250 | 24.1248 | 34.1620 | 0.1755 | 0.1110 |
| 2020(Billion dollars) | 0.2069 | 0.0216 | 0.8463 | 1.0211 | 0.0001 | 0.0008 |
| % exports | 9.8393 | 1.0252 | 40.2475 | 48.5602 | 0.0060 | 0.0401 |

### *4.2 Prominent International Trade Measures*

#### *4.2.1 Revealed Comparative Advantage (RCA)*

The results of the revealed comparative advantage in table 4 below shows that between 1996 and 1998, USA has a very strong international competitiveness in capital goods because USA RCA of capital goods ranges between 1.25 and 2.5. Furthermore, between 1999 and 2017, USA has strong international competitiveness in capital goods because the USA RCA between this period ranges from 0.8 to 1.25. Meanwhile, between 2018 and 2020, USA has a comparative disadvantage in capital goods because the USA RCA for capital goods within that period was below 0.8. With respect to plastic and rubber products, between 1999 and 2011, USA has a strong international competitiveness except in 1999, 2003 and 2011 where it had comparative disadvantage. In the same

vein, between 2015 and 2020, USA also had strong international competitiveness in plastic and rubber.

In the case of Consumer goods, between 1996 to 2008, USA had a comparative dis advantage, later had strong international competitiveness between 2009 to 2017 except in 2016 where it had comparative disadvantage. Meanwhile, between 2018 to 2020, the USA had very strong international competitiveness in consumer goods. Furthermore, the USA had strong international competitiveness in mechanical and electrical goods between 1996 to 2006 except in 1999, 2002 and 2006 where it had comparative dis advantage. Also, USA had strong international competitiveness between 2007 to 2010 and between 2016 and 2018 in mechanical and electrical goods. However, it had comparative disadvantage in the same product between 2019 to 2020.

More so, between 1996 to 2008, USA had extremely strong international competitiveness in export of vegetables except in 1997 and 2003 when it had very strong international competitiveness. Meanwhile, between 2010 to 2012, USA had very strong international competitiveness and also extremely strong international competitiveness between 2013 to 2017. However, with respect to chemical products, USA had comparative disadvantage.

In the case of fuels, interestingly USA was international competitive at some years and comparatively disadvantaged at other years. For instance, USA had very strong international competitiveness in 2001 and 2002, later had extremely strong international competitiveness in 2011. In the same vein, USA had extremely strong international competitiveness in transportation in certain years such as between 2014 to 2020 except in 2018 when it had very strong international

competitiveness. Conclusively, on the average, USA had comparative disadvantage in exports of intermediate goods over the period under investigation.

**Table 4:** USA Revealed Comparative Advantage

| USA RCA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Capital goods | Plastic and rubber | Consumer goods | Mach and elect | Vegetables | Chemical products | Fuels | Transportation | Intermediate goods |
| 1996 | 1.35 | 1.07 | 0.46 | 1.34 | 3.78 | 0.34 | 0.75 | 0.57 | 0.59 |
| 1997 | 1.67 | 1.04 | 0.34 | 0.86 | 2.14 | 0.31 | 0.49 | 2.41 | 0.5 |
| 1998 | 1.37 | 0.93 | 0.44 | 0.97 | 2.93 | 0.45 | 0.5 | 1.73 | 0.55 |
| 1999 | 0.8 | 0.6 | 0.32 | 0.5 | 4.58 | 0.34 | 0.85 | 0.86 | 0.33 |
| 2000 | 1.02 | 0.85 | 0.64 | 0.81 | 3.87 | 0.56 | 0.97 | 1.1 | 0.65 |
| 2001 | 0.94 | 1.17 | 0.73 | 0.92 | 3.63 | 0.69 | 2.17 | 0.46 | 0.76 |
| 2002 | 1.04 | 0.92 | 0.62 | 1.29 | 2.71 | 0.75 | 1.38 | 0.3 | 0.82 |
| 2003 | 1.48 | 0.74 | 0.63 | 1.36 | 1.72 | 0.65 | 0.06 | 1.35 | 0.68 |
| 2006 | 0.82 | 0.89 | 0.82 | 0.77 | 3.28 | 0.79 | 0.61 | 1.03 | 0.79 |
| 2007 | 0.83 | 0.81 | 0.78 | 0.85 | 3.26 | 0.52 | 1.02 | 0.98 | 0.74 |
| 2008 | 0.97 | 0.92 | 0.78 | 0.95 | 4.19 | 0.71 | 1.82 | 0.95 | 0.84 |
| 2009 | 1.13 | 0.82 | 1.05 | 1.06 | 0.96 | 0.95 | 0.13 | 1.53 | 0.71 |
| 2010 | 1.2 | 0.84 | 0.82 | 1.18 | 2.24 | 0.86 | 1.06 | 0.93 | 0.68 |
| 2011 | 0.63 | 0.72 | 1.32 | 0.51 | 2.16 | 0.49 | 3.09 | 1.42 | 0.35 |
| 2012 | 0.92 | 1 | 0.94 | 0.9 | 2.16 | 0.62 | 1.25 | 1.41 | 0.6 |
| 2013 | 1.01 | 0.59 | 0.93 | 0.94 | 4.23 | 0.66 | 0.6 | 1.86 | 0.62 |

| USA RCA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Capital goods | Plastic and rubber | Consumer goods | Mach and elect | Vegetables | Chemical products | Fuels | Transportation | Intermediate goods |
| 2014 | 0.92 | 0.79 | 1.09 | 0.77 | 2.65 | 0.44 | 0.67 | 2.49 | 0.55 |
| 2015 | 0.88 | 1.19 | 0.85 | 0.74 | 3.27 | 0.7 | 0.33 | 2.45 | 0.79 |
| 2016 | 1.12 | 1.12 | 0.78 | 0.93 | 2.79 | 0.49 | 0.38 | 3.63 | 0.88 |
| 2017 | 0.91 | 0.91 | 1 | 0.86 | 3.14 | 0.35 | 0.52 | 4.3 | 0.64 |
| 2018 | 0.61 | 1.07 | 1.31 | 0.86 | 2.12 | 0.4 | 0.78 | 1.83 | 0.8 |
| 2019 | 0.75 | 1.06 | 1.28 | 0.7 | 2.8 | 0.28 | 0.38 | 3.51 | 0.64 |
| 2020 | 0.62 | 1.21 | 1.54 | 0.66 | 1.75 | 0.23 | 0.35 | 3.75 | 0.61 |

Meanwhile, the table 5 below reveals that Nigeria has extremely strong international competitiveness in fuels and raw materials and comparative disadvantage in other products. This implies that Nigeria has international competitiveness in goods in their raw form and thus do not add value to products before they are exported. This is the major factor for the terms of trade deterioration being experienced in the balance of trade account of Nigeria.

**Table 5:** Nigeria Revealed Comparative Advantage Index

| Nigeria RCA | | | | | | |
|---|---|---|---|---|---|---|
| Year | Consumer goods | Intermediate goods | Plastic and rubber | Fuel | Raw materials | Miscellaneous |
| 1996 | 0 | 0.01 | 0.16 | 10.51 | 9.11 | 0.01 |
| 1997 | 0.01 | 0.01 | 0.07 | 10.81 | 9.27 | 0.01 |
| 1998 | 0.03 | 0.01 | 0 | 15.07 | 11.42 | 0.01 |
| 1999 | 0.03 | 0.01 | 0.01 | 13.27 | 10.55 | 0.02 |
| 2000 | 0.13 | 0 | 0 | 8.96 | 9.36 | 0 |
| 2001 | 0.19 | 0 | 0 | 9.32 | 9.76 | 0 |
| 2002 | 0.16 | 0.01 | 0 | 9.89 | 9.43 | 0 |
| 2003 | 0.18 | 0 | 0 | 8.03 | 8.25 | 0 |
| 2006 | 0.18 | 0 | 0.01 | 5.55 | 6.2 | 0 |
| 2007 | 0.16 | 0 | 0.01 | 5.4 | 6.05 | 0.01 |
| 2008 | 0.15 | 0.02 | 0.02 | 4.29 | 4.76 | 0.01 |
| 2009 | 0.11 | 0 | 0.02 | 5.71 | 6.02 | 0.01 |
| 2010 | 0.13 | 0.01 | 0.01 | 5.39 | 5.66 | 0 |
| 2011 | 0.17 | 0 | 0.03 | 4.87 | 5.06 | 0.01 |
| 2012 | 0.2 | 0 | 0.04 | 5.32 | 5.39 | 0.02 |
| 2013 | 0.39 | 0.01 | 0 | 5.92 | 5.56 | 0.02 |
| 2014 | 0.8 | 0.04 | 0.02 | 6.51 | 4.98 | 0.07 |
| 2015 | 0.74 | 0.04 | 0.02 | 10.96 | 7.42 | 0.18 |
| 2016 | 0.25 | 0.02 | 0.02 | 13.31 | 10.46 | 0.15 |
| 2017 | 0.24 | 0.03 | 0.03 | 11.53 | 9.54 | 0.05 |
| 2018 | 0.22 | 0.06 | 0.03 | 10.43 | 9.26 | 0 |
| 2019 | 0.09 | 0.04 | 0.02 | 11.72 | 10.79 | 0.14 |
| 2020 | 0.39 | 0.16 | 0.05 | 16.68 | 11.2 | 0.2 |

More so, the trade integration index reveals that USA is closely linked to the Nigeria because the USA TII is greater than one across all the periods under consideration. In contrast, the TII also reveals that Nigeria is loosely linked with the USA because the Nigeria TII is less than 1 across all the years investigated. Meanwhile, the

complementarity index was close to 1 across all the years and this implies that both countries trade complement each other and by implication they will both gain from trade if there is cooperation rather than competition. This is further reinforced by the export similarity index which reveals that both countries exports are dissimilar in nature because the value of the ESI is far less than 100% across all years. This is evident from the fact that Nigeria's export is dominated with fuels and raw materials while USA exports is dominated with finished products such as capital goods, consumer goods, mechanical and electrical goods and so on.

**Table 6:** Trade integration index (TII), Complementarity index (CI) and Export Similarity Index (ESI)

| Trade integration index (TII), Complementarity index (CI) and Export Similarity Index (ESI). | | | | | | |
|---|---|---|---|---|---|---|
| Year | USA-NIG TII | NIG-USA TII | CS | CC | CI = (CS +CC/2) | ESI (100%) |
| 1996 | 1.2 | 0.8 | 0.34 | 1.3 | 0.82 | 21.23 |
| 1997 | 1.02 | 0.73 | 0.55 | 1.1 | 0.825 | 28.21 |
| 1998 | 1.11 | 0.87 | 0.12 | 1.09 | 0.605 | 31.23 |
| 1999 | 1.09 | 0.56 | 0.88 | 1.08 | 0.98 | 26.32 |
| 2000 | 1.5 | 0.67 | 0.89 | 1.03 | 0.96 | 35.89 |
| 2001 | 1.03 | 0.77 | 0.89 | 1.04 | 0.965 | 29.78 |
| 2002 | 1.4 | 0.98 | 0.81 | 1.08 | 0.945 | 35.22 |
| 2003 | 1.6 | 0.55 | 0.67 | 1.09 | 0.88 | 36.55 |
| 2006 | 1.4 | 0.35 | 0.45 | 1.2 | 0.825 | 38.22 |
| 2007 | 1.14 | 0.24 | 0.54 | 1.01 | 0.775 | 21.32 |
| 2008 | 1.35 | 0.89 | 0.44 | 1.07 | 0.755 | 29.55 |
| 2009 | 1.9 | 0.78 | 0.66 | 1.1 | 0.88 | 25.45 |
| 2010 | 1.24 | 0.88 | 0.56 | 1.03 | 0.795 | 33.22 |
| 2011 | 2.1 | 0.56 | 0.57 | 1.4 | 0.985 | 35.66 |
| 2012 | 1.3 | 0.88 | 0.78 | 1.06 | 0.92 | 41.22 |
| 2013 | 1.5 | 0.91 | 0.55 | 1.02 | 0.785 | 23.12 |
| 2014 | 1.02 | 0.77 | 0.54 | 1.06 | 0.8 | 25.33 |
| 2015 | 1.09 | 0.67 | 0.35 | 1.13 | 0.74 | 27.11 |
| 2016 | 1.34 | 0.77 | 0.66 | 1.16 | 0.91 | 15.33 |
| 2017 | 1.23 | 0.91 | 0.45 | 1.17 | 0.81 | 19.44 |
| 2018 | 1.01 | 0.88 | 0.43 | 1.09 | 0.76 | 27.55 |
| 2019 | 1.11 | 0.77 | 0.55 | 1.11 | 0.83 | 26.33 |
| 2020 | 1.23 | 0.89 | 0.49 | 1.18 | 0.835 | 29.11 |

### *4.3 Effects of Trade Competition and Complementarity on both trading partners' exports*

The study further investigated the effects of trade competition and complementarity between Nigeria and the USA. In order to achieve this, the study examined the stationarity properties of the variables by performing the Augmented Dickey Fuller unit root tests. The results (see table below) showed that the Export similarity index, Nigeria's Export to USA, Nigeria's GDP and USA's GDP are not stationary level. However, after first differencing of the series, they become stationary implying that their order of integration is 1. Meanwhile, Complementarity index, USA's export to Nigeria, Distance,

Nigeria's Trade integration index and USA's Trade integration index are stationary at level, that is, their order of integration is I (0). Therefore, the result of the unit root test justifies the adoption of the ARDL model since the variables considered are a combination of I (0) and I (1).

**Table 7:** ADF Unit root tests

Null hypothesis: The series has a unit root.

| Variables | Probability value | Level of stationarity |
|---|---|---|
| ESI | 0.11 | I(1) |
| CI | 0.02 | I(0) |
| NTOU | 0.15 | I(1) |
| UTON | 0.02 | I(0) |
| Distance | 0.03 | I(0) |
| Nigeria TII | 0.01 | I(0) |
| USA TII | 0.03 | I(0) |
| NGN | 0.33 | I(1) |
| USA | 0.24 | I(1) |

Based on the results of the Unit root test above which reveals that the series are a combination of I (1) and I (0), the model estimated is linear Autoregressive Distributive Lag (ARDL) model. Furthermore, in order to properly analyze the bilateral trade relationship between USA and Nigeria, the gravity model which a prominent model in bilateral trade analysis is adopted.

### *4.3.1 Short run and long run Analysis of the Linear ARDL Model*

The results of the short run analysis are presented in Table 8 below. The results reveal that past exports of Nigeria to the USA positively and significantly influences its current value. Meanwhile, distance captured by trade cost negatively and significantly influences Nigeria's export to USA both in the short run and long run. In addition, the complementarity index and the USA GDP positively and significantly influences Nigeria's export to the USA in the long run.

In the same vein, past exports of the USA to Nigeria positively and significantly influences its current value. Furthermore, distance negatively and significantly influences USA exports to Nigeria while USA trade integration index and complementarity index, positively and significantly influences USA exports to Nigeria both in the short run and long run. Meanwhile, USA GDP influences USA exports to Nigeria positively and significantly in the long run alone. It is evident from the results that USA GDP positively influences both USA' export to Nigeria and this because most products USA exports undergo economic activities that generate value addition. In contrast, Nigeria GDP does not significantly influence Nigeria's export to USA. This is because most products Nigeria exports do not undergo economic activities that will produce value addition, implying that the products are exported in their raw form.

**Table 8:** Linear ARDL Gravity Model

| Dependent variable: NTOU | | Dependent variable: UTON | |
|---|---|---|---|
| Variables | Short run and long run coefficients | Variables | Short run and long run coefficients |
| LNTOU(-1)) | 0.456***<br>(0.002) | LUTON(-1) | 0.343**<br>(0.153) |
| L(USA) | 0.356***<br>(0.02) | L(USA) | 0.888***<br>(0.345) |
| L(NGN) | 0.123<br>(0.223) | L(NGN) | 0.212<br>(0.311) |
| L(NGN(-1)) | 0.234<br>(0.212) | L(NGN(-1)) | 0.321<br>(0.199) |
| L(DISTANCE) | -0.311***<br>(0.111) | L(DISTANCE) | -0.415***<br>(0.111) |
| L(DISTANCE(-1)) | -0.412***<br>(0.123) | L(DISTANCE(-1)) | -0.515***<br>(0.212) |
| NIGERIA_TII | 0.042<br>(0.341) | USA_TII | 0.345***<br>(0.111) |
| NIGERIA_TII(-1) | 0.211<br>(0.312) | USA_TII (-1) | 0.467**<br>(0.222) |
| ESI | 0.444<br>(0.234) | ESI | 0.454<br>(0.556) |
| CI | 0.551***<br>(0.111) | ESI (-1) | 0.616<br>(0.556) |
| C | 0.898***<br>(0.222) | CI | 0.543***<br>(0.212) |
| | | CI (-1) | 0.787***<br>(0.312) |
| | | C | 0.767**<br>(0.315) |

Note: The variables were transformed from annual series to quarterly series ***,**,* represent 1%, 5% and 10% level of significance respectively

Meanwhile, the study further investigated the level of co integration of the variables to determine whether the variables will be co integrated in the long run. The results in table 9 below reveals that when NTOU and UTON are dependent variables respectively, the F-statistics is lower than the lower bound I (0) of the bound test signifying that the variables do not exhibit a long run relationship. This necessitated the adoption of the linear ARDL model as against the Error Correction Model.

**Table 9:** Bound Test

Null hypothesis: No level relationship

| Dependent variable: Nigeria's export to China. (NTOU) | | | | |
|---|---|---|---|---|
| Test statistic | Value | Significance | I(0) | I(1) |
| F-statistic | 1.883 | 10% | 1.97 | 3.01 |
| K | 7 | 5% | 2.34 | 2.91 |
| | | 2.5% | 2.87 | 3.16 |
| | | 1% | 2.91 | 3.82 |
| Dependent variable: China's export to Nigeria. (UTON) | | | | |
| Test statistic | Value | Significance | I(0) | I(1) |
| F-statistic | 1.456 | 10% | 1.78 | 2.84 |
| K | 6 | 5% | 2.66 | 3.18 |
| | | 2.5% | 2.71 | 3.71 |
| | | 1% | 2.98 | 3.89 |

## 5. Conclusion

Based on the empirical findings of this study, it can be seen that Nigeria is indeed a major export destination of USA exports in Africa while USA is also one of Nigeria's major export destination in North America and even in the world. Furthermore, both Nigeria and USA have a dissimilar export structure. Nigeria's export structure comprises of Fuels and raw material while USA's export structure comprises of manufacture goods, capital goods, consumer goods, intermediate goods and mechanical and electrical goods. Meanwhile, the volume of Nigeria's export to USA is greater than the volume of USA's exports to Nigeria. This is because, Nigeria's major exports (fuels and raw materials) are demanded by the USA and a few other countries while USA's exports (manufacture goods, capital goods, consumer goods, intermediate goods and mechanical and electrical goods) are demanded by a large number of countries.

Meanwhile, the study also found that both countries can benefit from trade if they cooperate rather than compete. This is evident from the export similarity index that was far less than 100% and the complementarity index that was close to 1. In addition, the results of the gravity model reinforced the outcomes of the revealed comparative advantage, complementarity index, trade integration index and export similarity index. This is because, complementarity index positively and significantly influenced both Nigeria's export to USA and USA exports to Nigeria while the export similarity index was not significant. Succinctly, Nigeria and USA have large trade potential and will be better off if they both cooperate rather than compete.

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