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E-COMMERCE AND TRADE OPENNESS IN AFRICA: A PANEL DATA ANALYSIS

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ABSTRACT

This paper probes on the influence of e-commerce on the level of trade openness in Africa using country-level panel data from the period 1990 to 2013. Several additional variables were incorporated into the model to control for omitted variable biased. The estimation with fixed-effects techniques, both under the ordinary least squares (OLS) and generalized method of moments (GMM) estimators, points to evidence a significant positive relationship between e-commerce and trade openness in Africa. In addition, the study also produces insights that foreign direct investment (FDI) may or may not influence trade openness depending on which sectors enjoy FDI. Whereas Country size shows no relationship with trade Openness base on key assumption on policy relations. Given the numerous challenges affecting the improvement of e-commerce trade in Africa, this study suggests the need for further research focusing on how Africa could solve its many challenges.

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INTRODUCTION

Africa, a continent that has once consider being a dark continent, is gradually gaining momentum in the transmission of trade in the international Market. The past research trade data accumulated from the (World Trade Organization (WTO) show that the continent suffered a massive decreased in export and import from 1975 to 2003 in trade to the rest of the world, which can be clearly seen that, during that period most of the African countries experience an out-break of war which led to the destructions of many firms and businesses. Evidence from Angola 27-years of civil war, led to a massive destruction of the country infrastructure and severely damaged the nation's public administration and economic enterprises by which presently the government has made considerable efforts for stabilizing the economy especially on the trading sector. Also, the means of poor road network serve as a rigid factor to the decreasing of the trade during those period by which it affected the time it takes an exporter or importer to complete a series of procedure when moving their goods from the situated point of processing to the port for export or import vise-a-vise (see Freund and Rocha 2009). Due to this retrospection in Africa trade index both export and import later recover in 2013 (WTO, 2014) which in recent years, some countries on the continent are becoming rapidly independent with booming economic stability, which highlights a shift in trade dynamics

and increasing competition. In terms of its partners, Africa has been trading with series of partners, most of which have been prioritizing trade initiatives for Africa's involvement in the total transformation of its trade structure to sustain economic growth and development. Some of these partners include: China, India, Germany and United State. According to World Trade Organization (2014 WTO) import and export made by Africa with partners from 2010 to 2014 computed that Imports stood at 51.1% and export to partners had a percentage of 88.9% in total whereas, industrial export products (petroleum, oil excluding crude preparation, diamond, copper, Gold and Agglomerated iron) in 2014 were valued at \$153,188 million.¹ But from the huge dependence of African countries on revenues from export of primary commodities will lead to a shortfalls in export revenues and budget deficits which might likely create a serious instability for economic degradation in the volume of trade. With the emergence of e-commerce, there could be benefits for Africa's trade. In fact, the number of Internet users around the world has been steadily growing and this growth has provided market value for global and regional e-commerce trade. However through the Internet, different characteristics of the local environment, both the infrastructural and the socioeconomic have created a significant level of variation in the acceptance and growth of

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¹ Due to insufficient data this research has been limited to getting more information for analyzing the volume of trade on the industrial product and others trade data.

e-commerce in different regions of the world (Efendioglu *et al.*, 2004). During the last two decades, Africa's exposure to the Internet growth have become a major subject of scholarly debates. Interestingly, while Africa covers about 14.72% of the world's human population, it represents a proportion of 13.5% of global Internet users a continent forayed by marketing opportunist. Due to this high volatility ratio of Internet used in Africa, this had led to a new transitional method of trading on the continent, which is known as e-commerce. This newly transaction of trade has experienced a yielding structure in the business cycle and its transition from 2000 and 2001 has establish an impetus for series of opportunities especially for domestic firms in each countries market. Therefore, we define e-commerce as an immediate business connection carry out on the Internet between suppliers and buyers. According to Statistic Portal from 2012-2013 Africa e-commerce achieved a 22.6% growth, which is expected to further increase in 2016 and 2017. For instance in Nigeria online retailer, Jumia, which despite being founded only two years ago, is quickly gaining market share within the country which reiterates the region's potential. South Africa and Nigeria are the continent's leaders in online retail development. *Osagie (2015) deduce that* e-commerce trade in Nigeria and South Africa is increasing trade across the borders and opening more people to active trade in the two nations and beyond which help reduce business expenses thereby increasing marginal profits. According to DHL Africa released report the introduction of e-commerce trade pattern has created a surge for emerging markets in Africa which offers an enormous growth potential for online goods, despite the fact that online shopping is in its infancy in the region. Also Moodley (2003) find that, export market on international wood furniture buyers in South Africa are using the Internet via e-commerce to transform the way they do business and by which they collaborate with trading partners. In particular, many of them use the Internet to trade because it has helped develop close knowledge-based links with suppliers, that makes transactions convenient, lower prices and more choices are obtained from showcasing their products, which makes it much easier than traditional trade. According to World Bank e-commerce has been hailed by many as an opportunity for developing countries to gain a stronger foothold in the multilateral trading system. It plays an instrumental role in helping developing economies benefit more from trade. Meanwhile, several studies depicted that, a lack of insufficient Internet infrastructure and inadequate online payment systems remain the major hurdles to e-commerce trade in Africa, especially in countries where the formal banking sector has not reached much of the population.

The originality and scientific contribution of this paper adds value to the existing body of knowledge. First, from the review of studies (see section 2), it may be hypothesized that e-commerce has a positive impact on trade. Notwithstanding, the literature has explained the impact of e-commerce on trade internationally, paying no attention to measuring how e-commerce can influence trade openness. Therefore, our main focus is to research on the influence of e-commerce on the level of trade openness in Africa. Secondly, the past literature have not shown the used of panel data fixed-effects modeling techniques to investigate the impacts of e-commerce on trade openness before therefore this study used this study to give

evidence for a significant positive relationship between e-commerce and trade openness in Africa. Given the significance of the study and the need for more robust results to support policy making, it is necessary to draw insights from other robust methodologies. Thirdly, this study incorporates additional variables into the model in order to provide insights on the functional form for trade openness. It also uses the generalize method movement (GMM) to control for other variables that might be correlated. Finally, the literature survey is an important contribution to this research. The remainder of the paper is organized as follows: Section 2 reviews the relevant literature. Section 3 presents the research hypothesis and discusses the various mechanisms through which e-commerce may affect trade openness and discussion of its indicators and data used in the study are described. In section 4 we describe the methodology employed in the model and the empirical results discussions in the study. Section 5 draws the conclusions.

Review of the relevant literature

In recent years, it has been shown in the literature that e-commerce via the use of internet has become a determining factor in stimulating trade production which has become an interest and focus analysis of researchers in determining the relationship between trade and e-commerce. We group the literature into two broad categories namely; channels through which E-commerce affects trade and methods used to evaluate the impacts of E-commerce on trade.

Channels

The effect of e-commerce on cost and price of trade

Several recent studies have asked whether Internet use affects trade. The Internet offers seemingly limitless opportunities to the retail sector by enabling sellers to collect and process massive amounts of data to tailor prices and product characteristics to specific whims of consumers and ever-changing economic condition. Freunda and Weinhold (2003) and Yaday (2014) infer the Internet stimulates trade and that trade should expand because fixed costs associated with trade are reduced. He *et al.* (2011) finds that e-commerce impact international trade by affecting output prices. According to Xiaojing *et al.* (2014); Li and Yue (2012) and Haiyan (2007) they construe that the use of e-commerce for international trade can save cost and reduce the relative price of products. Lin (2014) found evidence that the Internet can reduce information cost for traders, which stimulates trade. In addition the Internet has improved information on the availability of manufacturing trade and reduces trade costs (Bojnec and Ferto, 2009). Clarke (2002) postulated that the Internet has dramatically lowered communication costs. Also, Gomez-Herrera *et al.* (2014) depicted that online trade introduces a new sources of trade costs such as parcel delivery and online payments systems that is, a 1% increase in the use of efficient and flexible cross-border payment systems on the internet could increase cross-border e-commerce by as much as 7%. Moreover Meltzer (2013) also highlighted that the Internet has helped to overcome some of the domestic impediments to reaching global markets, and has also enable business to overcome the transaction cost of selling goods and services oversea. Pondent (2015) explained that businesses that engaged in international trade by Internet help to manage

a better supply chain for their goods and services. Gregory *et al.* (2007) find that e-commerce enhances firm distribution efficiencies, facilitate greater distribution support, and improve price competitiveness for export ventures.

The effect of e-commerce enhances on profit

Internet sales have transformed the retail business. Today almost all products sold in the marketplace can be found online, and online retailers constantly engage in promotional activities. Jiang *et al.* (2014) suggested that online sale promotion and product recommendations should be jointly considered because e-trailers can motivate customers to purchase sales product on a non-discount bases that allow e-trailers to maximize their profit. According to Meltzer (2013), internet-based international trade has the potential to produce sizeable economic gains for developing countries. He *et al.* (2011) also construed that e-commerce positively affect firm profits both within country and foreign countries. The effect of e-commerce on market efficiency based on import and export. According to Salmani *et al.* (2015) and Changkyu (2009), Internet has had a positive and significant effect on service trade of developing countries, which has provided the chances for trade facilitation that enhances profit maximization competitiveness in the world.

The effect of e-commerce on market efficiency based on import and export

E-commerce can change international trade environment. The application of e-commerce technology accelerates goods, tax returns and sales, e.tc, and directly simplifies the process of international trade on import and export that provide the most economical and fastest ways for firm to enter the international market (Tang, 2007). The means by which trade is affected is through the influence of e-commerce via internet access by which the better performing countries with more internet access are more likely to be involved in exporting and importing. Therefore, as the number of firms with better information increases, the effect of distance on trade is actually likely to decrease George *et al.* (2004). Yadav (2014) find that the used of Internet in developing countries has a positive impact on the likelihood of both export and import. He *et al.* (2011) have shown that e-commerce impact international trade through the means of imports and exports of merchandise trade and total global merchandise trade. Clarke (2002) depicted that Internet access increase export performance by making it easier for firms to communicate with potential customers or distributor. In addition Lirong and Nath (2013) results indicated that Internet subscriptions and Internet hosts have significant positive effects on export as well as import shares in EMEs. According to Meyers (2013), Internet is a motivational instrument that impacts trade to which trade impact economic growth on export and import. Gregory *et al.* (2007) construed that the increase of product online and transferability of e-commerce assets include e-commerce infrastructure and demand for e-commerce encourages export market between countries. Therefore, as export market and e-commerce infrastructure becomes more developed, exporters make use of their experience in e-commerce to improve distribution efficiency.

The different effect of e-commerce in countries

Technological revolutions have always affected different sectors in different ways. The economic Commission for Africa, through its African Information Society Initiative (AISII), has identified e-commerce as one of the four key areas for Africa to exploit ICTs that would best advance social and economic development on trade. Esselaar *et al.* (2000) find that Internet trade in Africa is booming at a royal speed. From their result done on three African countries their ratings suggest that Rwanda, Namibia and South Africa are at very different stages in preparedness for the networked world. They also find series of common obstacles for e-trade readiness such like policy regimes, legal frameworks, financial environment, information infrastructure, transportation and delivery systems and human capacity. According to Gökmen (2011), e-commerce applications have also been increasing in Turkey at a great pace to cover foreign trade deficit but not significantly when compared to the total trade volume. Result being that there are more transactions done by financial channels instead by cards. This could mean that the Turkish consumers do not have trust. Shams and Mirmiran (2014) results show that the impact of e-commerce on Iran could be even stronger than that on the United States as a developed country because the scope for reducing inefficiencies and increasing productivity is much larger in Iran. According to YStatsproduct Brochure (2015), Tunisia also ranks high in Africa by Internet penetration and around seven hundred e-commerce websites are already active in Tunisia. Also according to Makame *et al.* (2014), technology infrastructure is an important factor in e-commerce adoption, and national policy initiatives are important in building online trust and improving technology infrastructure in Tanzania. Efendioglu *et al.* (2004) concluded that there are significant evidence which show that there are increasing number of Internet users in China, especially with access from home but there is an existence of diffusion on e-commerce in China which includes cultural issues like socializing effect of e-commerce transaction on land institutional trust and attitudes toward debt play a very major discouraging role on e-commerce trade in China. According to global e-commerce and retails logistic e-commerce (2013), Australia online retail was rated at 6.3% in 2013 while e-commerce sale growth from 2012-2017 amounted to 5.2% and ranked 18 for logistic performance. E-commerce in the UK is growing tremendously. In 2012 online-retail rated at 9.7% and it's growth from 2012-2017 mounted to 10.3% and ranked 10 in logistics performance. Also for the U.S e-commerce is the order of the day. It's growth rated 6.5% on retail sales from 2012-2017, 11.4% on growth and rank 9 in the world logistic performance. In India e-commerce is growing strongly on cash and delivery that has emerge as the preferred payment choice. Online retail in 2014 total at 0.4 and e-commerce sale growth from 2012-2014 had a percentage of 23.9 with a world rank at 46 in 2012.

Other studies focus on the broader concept of information and communication technologies (ICTs) on trade growth as a potential means of facilitating trade growth. Obviously, in itself the availability of the Internet cannot influence trade. Countries, organizations, and individuals have to adopt these technologies, utilize them to establish new trade channels, and/or reinforce existing ones (Vemuri, 2009).

According to Yush Kova(2013), there is a positive relationship between the deployment of ICT and trade in countries that extent their business by Internet. Demirkan *et al.* (2009) find that ICT has a more positive impact on bilateral trade flow between economies than it does for smaller economies. Also it appears to have more positive impact on trade than it does on countries that are nearer to one another. Moreover, Vijay and Siddiqi (2009) find that there is a strong, positive, and significant relationship between ICT infrastructure and the availability of Internet for commercial transactions and the international trade.

The influence of internet on international trade

Among several researchers, there are basic arguments of the possible influences of the Internet on international trade for developmental growth on both export and import flow. Terzi (2011) find that Internet will promote international trade much as lifting other trade barriers would. The countries open to import from high-income economies will benefit from knowledge spillover. But Meyers (2003) overall result insinuated that the use of Internet impacts international trade more in non- high -income countries than in high income Countries. George *et al.* (2004) supported that Internet penetration in developing countries is correlated with greater exports to developed countries. Moreover, YayushKova (2013) argue that the positive link of Internet create export flows between countries in which exports are generally stimulated by Internet. But according to Yadav (2014), Internet usage aids in the decision to export and import rather than in the volume of exports and imports. Clark (2002) finds that firm that are connected to the Internet export more than similar firm that are not connected, even after controlling for other factors that might affect Internet access and export performance.

Methods used in the literature

Meijers (2003) use simultaneous equations model to confirm the positive and significant role of Internet use to openness on trade growth. Estrella *et al* (2014) gravity model results show that online trade introduces new sources of trade costs such as parcel delivery and online payments systems. Yushkova (2013) use the theoretical gravity model to indicate that the Internet has a positive link with the export flow between countries. Terzi (2011) gravity model results also show that countries open to import from high-income economies will benefit from knowledge spillover. Freunda and Weinhold (2003) use theoretical model that showed that the impact of internet on international trade will expand because fixed cost associated with trade are reduced and that the number of firm with better information increases the effect of the distances on trade is actually likely to increase. Yong *et al* (2011) based their idea on economies of scale and trade theory raised by Paul Krugman and Helpman Elhanan. But mostly focus on Paul Krugman consideration that, the greatest impact on international trade theory is undoubtedly on introduction to "increasing returns to scale. From the review of studies presented above, one may notice that e-commerce may affect trade in different ways which differs from one country to the other,

For this reason, it is necessary to conduct studies which test the impact of e-commerce for different regions. Moreover, the review of studies show that panel data analysis hasn't been used before.

Research hypothesis and mechanisms through which E-commerce affects trade

From the Literature review afore-mention, one may see that there are many ways through which e-commerce influences trade. The purpose of this section is to discuss, in more details, the channels through which trade is affected by e-commerce. The section then closes by describing the testable hypotheses of the study.

Mechanisms through which E-commerce affects trade

We have already documented that e-commerce reduces the costs of trade, increases exports and imports, increases profit, saves time but with demonstrating how it increases trade openness. These channels are now discussed below:

Reduces trade costs and increases profits

Cost: can be divided into four mean parts, which is:

Advertisement: e-commerce lower advertisement cost by allowing firms ads a much wider global coverage of audience over geographical locations. Also it give a clearer picture regarding who view the company ads, who clicked, the number of leads generated and the amount of money that a firm have to spend so far for their internet advertising activities. Another main advantage of e-commerce reducing advertising cost or marketing is due to the affordable execution of speed on the Internet advertising methods, which provide more advantage over other traditional advertising methods when compared with the traditional advertising costs.

Transportation cost: Transportation serves as a main element of trade. If by purchasing goods cost a thousand miles to get what is needed, that discourages buyers not to go in for such goods because the higher input spend to purchase a good, the higher the selling price and the lower the demand will be for that particular product. Therefore, e-commerce makes it simple and easy by cutting down transportation cost constraint done by traditional purchasing.

Finance cost: e-commerce reduces transaction costs by minimizing search costs, as it bring a large number of buyers and sellers into one trading community. It also facilitates a more efficient processing of transactions by facilitating online auctions and online processing.

Manage cost: Putting things differently, people normally do business for profit. E-commerce allows Shops owners to manage their spending from paying workers salaries or paying rent. Therefore, the prices of their products are always different from physical interaction with consumers, which also accelerates profit for the suppliers when all charges from paying government tax, custom duties, insurance or any constraint experience during traditional process are eliminated. This allows dealers to receive their input spending with a higher returns and greater demand from customers.

Increases exports and imports: Mostly, as internet access is so common among manufacturing enterprises this boost the coverage of the firms which allow customers to make order at any hour work in line with the fast movement of shipment across borders. The fastest the connections the higher the proficiency used of Internet connections which will allow consumers purchase to increase, which enhances export and import base on lower trade barriers between countries.

Saves time: Basically, on the matter of time, e-commerce plays a major role. It helps decrease the time a buyer will have to take to get to a particular country or place to purchase an item or goods. For example by linking the processing of goods transactions directly to logistics functions. Liu *et al.* (2012) noted that when trading activities are conducted on computer networks in e-commerce mode, there are no time and space constraints as counterparties can make their transactions just at home. Also on the matter of delivery a number of products that traditionally have required physical delivery can be delivered to a customer via a network in digital for Examples media products, such as text, film and computer software According to Tang (2007), the internet can transcend time and space constraints and efficiently break the visible and invisible barriers between countries and region.

Increases trade openness by information: As trade openness is mostly measure by import plus export divided by GDP, we intend to extrapolate the index of telecommunications on trade by which it served as a main indicator of e-commerce. Telecommunication can simple be define as the exchange of information by electronic and electrical means over a significant distance. It plays a major role in trade by influencing communication between the buyer and sellers; thereby fostering and enabling better access to information (Skollegium, 2014). This study underscores that trade cannot happen without information being move from one location to another. Gregory *et al.* (2007) enclose that the internal e-commerce drivers (product online transferability and e-commerce assets) has directly increase a firm's degree of promotion adaptation and also enhance communication and distribution efficiencies that has facilitated greater distribution support, and improve price competitiveness for market ventures. Therefore with the efficient mandated used of the internet trade distribution and logistics that enables movement of information without the need for transport, insurance and other emerging factors will be to enable the line of openness on trade . These supply-chain efficiencies make it easier to sell products, such as clothing and health products, through e-commerce. As figure1 shows this index consists of four dimensions namely: fixed-telephone subscription, mobile cellular, household with computer and individuals using the Internet.

Diagram before hypotheses

Research hypothesis

From our review of the relevant literature and discussions on the mechanisms through which E-commerce affects trade, the following testable hypotheses are formulated:

a. **H₁:** E-commerce has a positive influence on the level of trade openness

b. **H₂:** E-commerce has no relationship on the level to trade openness.

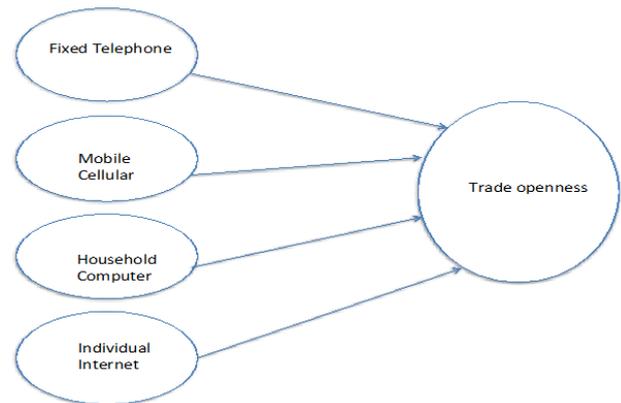


Figure 1. Dimensions of supply chain efficiency

Indicators of trade openness

Gross domestic product (GDP): This served as a major economic indicator that represents and supports a country's level of productivity. According to Riker (2014), Balanika (2003) Meijers (2013) trade openness has been measured in various ways in hundreds of studies investigating the issue. The most basic measure of openness is trade shares, which is exports plus imports divided by GDP. This has been used by a large number of studies that shows a positive and strong relationship with trade openness. Habibi (2015) explore the causal relationship between trade openness and economic growth and find out that there exist a long-run positive relationship between both sectors whereas, Gries and Redlin (2010) examine the dynamics between per capita GDP growth and openness for 158 countries over the period 1970-2009 using a panel co-integration tests and panel error-correction models (ECM) in combination with GMM estimation to explore the causal relationship between these two variables. They find that a long-run relationship exist between openness and economic growth .

Tariff: As it can be noted that tariff is the levied of tax impost both on export and import goods. David (2007) notes that, the issue of trade policy (or openness to trade) is important. Trade restrictions create price distortions that shift production between countries. The removal of these price distortions through the lowering of trade barriers leads to a more efficient allocation of resources, as making domestic markets more open to competition from foreign sources. Nevici and Pietrobelli (2007) mention in their studies that the theory of trade policy agrees with the view that trade barriers produces distortions that affect economies trade. Bekkers and Francois (2012) observed that the welfare effect of bilateral trade liberalization without free entry is unambiguously positive when tariff is negligible.

Government size: It is widely believed that governments of more open countries are forced to reduce taxes and public expenditure to attract foreign investment and human capital, or at least to prevent domestic firms from relocating abroad. Indeed, almost every economist would agree that there are circumstances in which lower levels of government spending

would enhance economic performance and other circumstances in which higher levels of government spending would be desirable. According to Gancia and Epifani (2009). They measure government size toward trade openness and argue that openness can increase the size of governments by which both have immensely effect on each other.² According to Ibrahim (2014), from the time series data from five countries covering the period 1970 to 2010 shows a positive causal link between trade openness and government size. Lin *et al.* (2014) finds that the increase in trade openness leads to an increase in government size vis-a-vis that 1 percent expansion in trade openness (trade GDP ratio) raises government consumption over GDP ratio by approximately 0.1–0.2 percentage points on average.

FDI: For the past few years foreign direct investment has seen a tremendous growth in both world output and world trade. Thus, foreign direct investment can exert a more profound influence on a country's growth, industrial structure, employments and trade patterns than other capital flows. Past researchers have analyzed the impact of FDI with special reference to trade openness. Min (2000) postulated that FDI directly affects the pattern of international trade of the host economy mainly via increases in the openness of trade between members of affiliates in different countries. Moreover, Leliset. Al (2014) emphasizes that, FDI is correlated with increased exports in the short run, but not in the long run that is, in the long run, the positive relationship between FDI and exports will only occur for export-oriented industries in which resource-seeking strategies are preponderant.

Industry structure: Industry structure plays a powerful role in determining success or failure in a country's growth to openness. Naudé and Szirmai (2012) reiterate that structural transformation of a traditional economy dominated by primary activities into a modern economy with high-productivity activities in manufacturing which assumed an important role for defining feature trade growth. According to Bekkers and Francois (2012), most industrial concentration emerges endogenously as a function of the degree of a firm heterogeneity through openness. As industry structure plays a powerful role in determining success or failure in a country developmental for firm growth Giovanni, Levchenko (2007) uses industry-level data to document several aspects of the relationship between openness and volatility and find out that higher trade in a sector is associated with higher volatility.

Exchange rate: Exchange rates are determined by basic supply and demand factors. It exerts a powerful impact on exports, imports and trade balance. An equal equilibrium market on foreign exchange rate influences trade openness within countries. According to Calegário *et al.* (2014) exchange rate (FX) is significantly and negatively correlated to imports, indicating that an increase in the exchange rate causes a reduction in imports, since exchange devaluation makes imports more expensive. So, an increase in the exchange rate

variable can also explain the decrease in imports that is the higher the exchange rate on currency values increases trade but the lesser the exchange rate value on international currency between countries reduces trade. Balanika (2003) also acknowledges that, exchange rate has a major factor toward trade openness in her studies.

GATT: The General Agreement on Tariffs and Trade (GATT) is an important institution. GATT reduced the discrimination in tariff and trade, which promote the reduction of other trade barriers. GATT protects the benefits of developing countries to a certain extent to international trade. Anderson (2014) econometric estimates infer that this institution (GATT/WTO) has contributed substantially to global economic welfare. Abu-Bader and Abu-Qarn (2007) test for structural changes in international trade patterns of 77 countries over the post-WWII period, to examine if they experienced a substantial increase in their trade ratios following major GATT rounds such as the Kennedy Round, they found that most countries experienced change in their trade patterns. The work of Nenci and Pietrobelli (2007) explained that, increasing import and export exchange appears to have developed together with an increasing in economic integration due to the reduction in trade barriers that started soon after the second world through the creation of the multilateral GATT/WTO trading system. According to Chowdhury *et al.* (2014) They find that the trade among WTO members tends to be more stable than the trade outside the WTO, and there is strong evidence to openness.

Country size: The theory of country size holds that, because countries with large land areas are more apt to have varied climates and natural resources, they are generally more nearly self-sufficient than smaller countries.³ Analyses drawn from Australia Reserve Bank in (2005) on openness of trade shows that openness is also correlated with the geographic size of countries. In particular, countries with larger land mass tend to be less open. Also Amin and Haidar (2013) included country size as a factor for measuring trade openness by (total population of the country (log values)). Their result shows that, trade facilitation does improve as country size becomes small that is, small countries perform better than large countries in terms of trade facilitation. Alesina *et al.* (2005) Used the log of population as a measure of size towards trade openness and concluded that size matters in which smaller countries have a greater stake in maintaining free trade.⁴ Behzad *et al.* (2015) Choi (2010) uses population, as dependent variables for

³Most of the very large countries such as Brazil, China, India, the United States, and the former Soviet Union import much less of their consumption and export much less of their production than small countries such as Iraq, the Netherlands, and Iceland

⁴From his prove shows that the richest country in the world in 2000, in terms of income per capita, was Luxembourg, with less than 500,000 inhabitants. Among the richest countries in the world, many have populations well below the world median, which were about 6 million people in 2000 and by considering growth of income per capita rather than income levels, again they find small countries among the top performers. For example Singapore, with 3 million inhabitants, experienced the highest growth rate of per capita income of any country between 1960 and 1990. These examples show that a country can be small and prosper, or, at the very least, that size alone is not enough to guarantee economic success. As international markets become more open, the benefits of size decline relative to the costs of heterogeneity, thus the optimal size of a country.

²According to Gancia and Epifani (2009) positive correlation between openness and government size holds strongly only for countries producing differentiated products. They argue that openness can increase the size of governments through two channels: (1) a terms-of-trade externality, whereby trade lowers the domestic cost of taxation, and (2) the demand for insurance, whereby trade raises risk and public transfers

controlling the effects of every country size by which population shows a positive and significant effect on trade.

The data

Even though the focus of this study is to examine the impact of e-commerce on trade openness, all of the above indicators are included in the model so as to be able to control for omitted variable biased. E-commerce index consists of three dimensions namely: on-line, telecommunication and computer. In order to comprehensively measure the effect of e-commerce on the level of trade openness so as to support our hypothesis, this study used telecommunication indicators such as fixed-telephone subscription, mobile cellular, household with computer, and individual using the internet. Diagram before hypotheses Research hypotheses Indicators of trade openness GD Relationship between these two variables. They find that a long-run relationship exist between openness and economic growth to measure e-commerce toward trade openness.

The data in this study are panel data form 10 most developing African countries over the period from 1990 to 2013 in order to know how well e-commerce stimulates trade openness in these selected African countries. In order to carry on this work, we measure the total sum of e-commerce index (Telecommunication indicators fixed telephone subscription, mobile cellular, telephone subscription, household computer and individual internet users) present within each country for a given year. All data was collected from the World Bank (World Development Indicators).

Methodology

Previous empirical work, find that e-commerce impact trade that makes it a very important determinant to trade flows (Freunda and weinhold2003 ,Yaday, 2014; Yong *et al.*,2011; Lin, 2014; Meltzer, 2005; Behzad *et al.*, 2013; and Choi, 2009). Also according to Clarke and Wallsten (2004) empirical studies they postulated that Internet use is correlated with openness to trade even after controlling for other factors that might correlate with both. Using these insights, we test whether e-commerce use influence trade openness with additional indicators of trade openness. The model we estimate is therefore given by:

$$TO_{it}=a+b(\beta_1\sum TC_{xit})+\beta_2GDP_{x2it}+\beta_3taff_{x3ijt}+\beta_4gov_{szx5it}+\beta_5FDI_{x5it}+\beta_6indus_{srx6it}+\beta_7exchange_{rx7it}+\beta_8\gamma_{x8it}+\beta_9GATT_{x9it}+\epsilon_{xit}(1)$$

Where,

i represents countries and t indicates the time period, $(\beta_1\sum TC_{xit})$ measure the sum of all e-commerce indicators , $a+b$ indicates the intercept of the regression, x_{it} represent each variables that have influence on trade openness in country i in the year t , β represents the parameters that measure the changes in trade openness that is explain by x_{it} , thus, in addition to the main independent variable (e-commerce), we also include several additional variables as a control variable for calculating openness. These include β_2 GDP measure the total gross domestic product within countries, β_3 *a ff* measure trade restrictiveness by calculating the country's tariff rate

Table 1. Descriptive statistics of the data

Statistics	TDOP	E-coms	GDP	Taff	FDI	GOVsz	INDUst	ExRT	Csz	GATT
Mean	54.07500	63.56958	34.22500	6.575000	11.02083	29.60833	48.25415	29.1416	31.68333	76.003167
Std. Dev	26.82273	127.8156	24.88768	55.92937	29.12180	26.99273	143.2317	85.78764	28.78749	31.51651
Skewness	0.078152	4.040990	2.116263	15.31872	4.445984	1.312501	5.171825	7.54783	1.349935	6.313379
Kurtosis	2.505734	22.10368	12.77054	236.4426	22.99850	4.661158	30.25811	65.19345	5.028485	45.49395
Jarque-Bara	2.687297	4302.691***	11333.778***	554340.9***	4790.072***	96.50082***	8499.954***	40954.78***	14.0405***	19651.7***
Sum	12978.000	5256.70	8214.000	1578.000	2645.000	7106.000	11581.00	6994.000	7604.00	1440.760
Observation	240	240	240	240	240	240	240	240	240	240

Trade Openness, E-Commerce (E-Coms), Gross Domestic Product (Gdp) , Tariff , Government Size (Govsz), Foreign Direct Investment (Fdi), Industrial Structure (Indus-Structure) , Exchange Rate(Exrate), Country Size(Contsz), Gatt/Wto

Descriptive statistics of the data

Table1 presents the descriptive statistics of all examined variables with 240 observations. It construe that all sample means are far from zero; ranging between 6 and 92.7. The sample standard deviations range between 24 and 147.5. The positive values of skewness of all variables, in the range of 0.07 and 6.3, suggest that the distributions of all series are slightly skewed to the right. The high Kurtosis values (this value is 3 for normal distribution) imply that, except for trade openness, all series have thicker tails than normal.

Similarly, the Jarque-Bera tests suggest that, except for trade openness, the null hypothesis of normal distributions of all variables cannot be accepted under the 10% level of significance. In order to substantiate these results and provide the basis for the right estimation technique, stationarity analysis us performed on all considered variable.

(applied weighted mean on all product corresponding to each partner country), β_5gov_{sz} government size measured by government consumption expenditure in country i at year t , β_6 FDI foreign direct investment (FDI) net flow in countries market, β_7indus_{sT} measure production shares of sectors in total manufacturing. $\beta_8\gamma$, measure the size of countries by population. The last variable takes the form of dummy variable, which takes the value of 1 if a country is a member of β_9GATT and 0 if they do not. In order to estimate the model, we first apply the OLS estimator. Notwithstanding, giving the high possibility that some of the explanatory variables might be correlated with the error term, it is necessary to draw insights from more robust econometric techniques. The presence of endogeneity issue should not be taken for granted for two major reasons. First, the large number of independent variables increases the likelihood that some of the explanatory variables would be correlated with the error term. Second, there somehow low value of the R-square

statistics (although not a problem in this study)⁵ makes it clear that several other factors which may influence trade openness have not been included in the model; and as such, raising the possibility that those un-observables might be correlated with other variables in the model. For these reasons, GMM estimates are also computed for comparison purposes.

Empirical results

This section reports various results obtained from the analysis in this study. Some of these include results of the unit roots analysis, fixed effects testing, parameter estimates of the statistical model as well as the model diagnostic and the GMM approach to control for endogeneity among the independent variables in explaining the dependent variable.

Table 2. Stationarity Properties of the data based on the ADF test

Variable	Level	First Difference
Trade Openness	-1.91***	-8.27***
E-Commerce	0.39	-7.45***
GDP	-2.55***	-7.45***
Tariff	-3.38***	-9.09***
FDI	-7.18***	-10.08***
Government Size	-3.13***	-8.11***
Industrial Structure	-4.43***	-10.02***
Exchange Rate	-1.86***	-6.98***
Country Size	-4.48***	-12.58***
GATT	-6.13***	-9.20***

Trade Openness, E-Commerce (E-Coms), Gross Domestic Product (Gdp), Tariff, Government Size (Govsz), Foreign Direct Investment (Fdi), Industrial Structure (Indus-Structure), Exchange Rate (Exrate), Country Size (Contsz), GATT/WTO.

Results from stationarity analysis

One of the basic assumptions of a standard regression analysis using ordinary least squares (OLS) estimation technique is that the variances of all variables in the model are constant. Therefore, in order to derive consistent and efficient estimates using OLS, it would be necessary to first show that the data satisfy the constant-variance assumption. In order to check for stationarity, this study applies the panel ADF tests for unit roots.

Evidence of a unit root in the series implies a break-down of the constant-variance or stationarity assumption. Hence, there might be a need to convert the variables into stationary series to be able to proceed with OLS estimation. Results from the stationary analysis are reported in Table 2. As may be observed, all variables are stationary at levels except e-commerce, which becomes stationary only after taking first difference of the series. This means that, for our OLS estimation, rather than using e-commerce at levels, it is the first difference that would be applied to the model.

Table 3. Hausman test for correlated random effects

Test summary	Chi-square statistic	d.f.	p-Value
Cross-Section Random	120.0	9	0.000

⁵ See Table

Results from random effects testing

A number of models exist for panel data analysis. However, the most popular in the literature are the fixed-effects and random-effects models. In order to determine the most appropriate model, be it fixed-effects or random-effects, we use the Hausman (1978) test, which follows a chi-square distribution. If the p-value from the test is less than 0.05, this means that the random-effects model and the fixed-effects model are very different from each other; and as such, the null hypothesis of orthogonality could be rejected (Wesseh and Lin, 2012). In other words, the fixed-effects model could be preferred over the random-effects model. Results from the Hausman test (cross-section random effects test comparisons are not presented to preserve space) are presented in Table 3. As may be observed, since the p-value of 0.000 is less than .005, fixed-effects modeling techniques appear to be more appropriate. For this reason, fixed-effects modeling techniques are adopted for estimation in this study.

Table 4. Fixed-effects Model estimates based on OLS Approach

Variables	Initial Model	Final Model
Constant	38.51***	41.48***
E-coms	0.048***	0.046***
GDP	0.154***	0.147***
Tariff	-0.049***	-0.049***
GOVsz	0.136***	0.134***
FDI	0.060	-
Indus-Structure	0.035***	0.034***
ExRate	0.140***	0.134***
Contsz	0.027	-
GATT/WTO	0.113***	0.112***

Trade Openness, E-Commerce (E-Coms), Gross Domestic Product (Gdp), Tariff, Government Size (Govsz), Foreign Direct Investment (Fdi), Industrial Structure (Indus-Structure), Exchange Rate (Exrate), Country Size (Contsz), Gatt/Wto

Results from fixed-effects model estimates

Results of the coefficient estimates using fixed-effects techniques are reported in Table 4. In the first column of Table 4, estimates are reported for the full model (or the model which includes all variables; denoted as initial model). It can be seen from column that trade openness for the panel of countries considered is mainly driven by e-commerce, real GDP, the level of tariff imposed, government size, industrial structure, exchange rate and countries' involvement in the world trade organization. This is demonstrated by the significance of the coefficients associated with these variables as indicated by the p-values. For our main coefficient of interest, that is e-commerce, the results show that a unit improvement in e-commerce will increase trade openness by a marginal 4.8%. This finding is consistent with a number of studies focusing exclusively on internet-use and trade (see for example Meijers, 2013). As we stated in the introduction, the limited amount of Internet services in most African countries can help explain why the effect of e-commerce is marginal. On another hand, while a number of empirical studies have demonstrated a significant relationship between trade openness, FDI and country size empirical evidence presented in this study shows that FDI and country size have not influenced the level of trade openness for the considered

countries. These results appear to be reasonable especially if one looks carefully into the sectors that enjoy most of the FDIs in these countries. For instance, for the vast majority of countries in our sample, the FDI is concentrated mainly in the commodity export sectors (like oil, diamond, gold, etc.). As was mentioned in the introduction, since these commodities are rather exported in their raw forms, as opposed to being processed through industries within countries, FDI does not generate sufficient economic activities to have an effect on the level of trade openness while, country size implies that, the smaller a country the higher the chances of not having any effect on openness to trade that is, a small nation is not capable of affecting international price interns of importation. If a government under such circumstance decides to protect its infant industries this reduces importations leading to a major increase in export then import, which give a clear explanation of the output result that country size only promote export then imports instead of encouraging both size which indicates openness to trade. This can as well help to explain why the variable country size seems to have no effect on trade openness.

Model diagnostics

In order to gauge the robustness of the parameter estimates in column one of table 4, fixed-effects estimates are also derived for only significant variables. In other words, the fixed-effects model is re-estimated, but this time, excluding FDI and country size from the model (which we depict as final model). These results, as shown in column two, mirror those in column one. That is, all coefficient estimates look similar in terms of their magnitudes and respective signs. For example, in the initial model, the output result estimated that for a unit increased in the variable e-commerce increases trade openness by 4.8% whereas, the final model shows a 4.6% increase in trade openness due to any unit improvement in the level of e-commerce. Hence, our final model, giving all coefficient estimates, can be depicted as:

$$TO_{it} = 0.046 TC_{x1t} + 0.147 GDP_{x2t} - 0.049 tariff_{x3t} + 0.139 gov_{x4t} + 0.034 indust_{x5t} + 0.134 FX_{x6t} + 0.112 GATT_{x7t} + \varepsilon_{xit} \quad (2)$$

Table 5. Model Diagnostics

Statistic	Value
Adjusted R-Square	0.5
Durbin-Watson Statistic	1.2
Jarque -Bera	96***

Note: *** Indicates significance at the 10% level

Model diagnostics

From the coefficient estimates reported in Table 4, it can be noticed that 7 out of the 9 estimated coefficients are statistically significant with the expected signs. Judging by the statistical significance of most of the coefficients and their conformity to the theory underlying the model, nothing seems to wrong with the estimation. Notwithstanding, further attempts have been made to check the estimated model. These results that are presented in Table 5 suggest that the estimated coefficients could be treated with some degree of reliability.

First, the adjusted R-square shows that up to 50% of the variation in the dependent variable has been explained by the independent variables, which, within the context of panel data, represents a very good fit. Second, the value of the Durbin-Watson statistic (this value should be close to 2 to ensure the absence of serial correlation) suggests that multi-collinearity is not a severe problem within the estimated model. Finally, although the Jarque-Bera test performed on the residuals rejects the null hypothesis of normality, in general, the model diagnostics seem to suggest that the data have been applied to the model correctly.

Table 6. Fixed-effects Model estimates based on GMM Approach

Variables	Initial Model	Final Model
Constant	38.51***	41.48***
E-coms	0.048***	0.046***
GDP	0.154***	0.147***
Tariff	-0.049***	-0.049***
GOVsz	0.136***	0.134***
FDI	0.060	-
Indus-Structure	0.035***	0.034***
ExRate	0.140***	0.134***
Contsz	0.027	-
GATT/WTO	0.113***	0.112***

Trade Openness, E-Commerce (E-Coms), Gross Domestic Product (Gdp), Tariff, Government Size (Govsz), Foreign Direct Investment (Fdi), Industrial Structure (Indus-Structure), Exchange Rate (Exrate), Country Size (Contsz), Gatt/WTO Interestingly, the fixed-effects estimates with GMM techniques, as reported in Table 6, mirror the results in Table 4. They show that the GMM estimator produces similar results as the OLS estimator. Hence, the results reported in this study are not affected by endogeneity problem.

Conclusions

From historical perspective, as Africa been label as a dark continent its trade boom has become a major concern of every researchers with the inclusion of how its responds to the acceptance of the internet or e-commerce can influence trade openness. This study attempts to investigate the influence of e-commerce on trade openness using country-level panel data form 10 progressing African countries over the period 1990 to 2013. In order to carry on this work, we measure the total sum of e-commerce index (Telecommunication with its indicators: fixed telephone subscription, mobile cellular, household computer and individual internet users) occurring within each country for a given year. All of these variables show a positive relationship toward trade openness by which we combined them into one series as e-commerce. Several additional variables were incorporated into the model to control for omitted variable biased.

From the result presented and discuss in Table 4 and Table 6, these tables provides a summary of the major findings and the policy implementations. The main findings of the study are enumerated below. Our estimation from the fixed-effects model techniques, both under OLS and GMM estimators, points to evidence of a significant positive relationship between e-commerce and trade openness including other variables. In term of the influence of e-commerce on trade openness in Africa the study found that Foreign Direct

Investment (FDI) and Country size may or may not influence trade openness depending on which sectors enjoy the FDI to generate sufficient economic activities to have an effect on the level of trade openness while, from other past literature country size have shown a positive relationship with trade openness in that the larger the size the lesser the trade and the smaller the size the greater the trade. But according to this research result country size has no link to enhancing trade openness, which implies that, the smaller a country the higher the chances of not having effect on trade openness. In addition, the study also produces insights that all data are collected from the World Bank (World Development Indicators). Given these findings, policies aimed at improving innovation in e-commerce in African countries would present opportunities. The implication of this is that international trade can be positively beneficial to a country especially if a country is an exporter of goods and services rather than being just an importer of goods and services. In addition, considering the numerous challenges affecting the improvement of e-commerce trade in Africa, this study suggests the need for further research focusing on how Africa could solve its many challenges.

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