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An empirical analysis.

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ABSTRACT

IMPACT OF INTERNATIONAL TRADE ON INCOME IN AFRICA.

AN EMPIRICAL ANALYSIS.

By

Vincent NKUNDIMANA

Sub-Saharan African countries have implemented several trade reforms over the past decades, with the aim of boosting global openness and economic growth. Development economists and prominent multilateral institutions have recognized positive contribution of international trade on economic growth in Sub Saharan Africa and their studies show that African countries have strong potential for further economic growth and income development if invested in promoting international trade as its share to global trade remains small, unlike its strong position to supply raw materials to major trading countries around the world. However, their empirical studies do not cease to be questioned due to at least the following three reasons : (1) there are still doubts on how openness to trade is measured to ascertain the role of trade on growth among countries; (2) the estimation methodology and choice of regressors are still open for debate and not unanimously confirmed among researchers and policy making groups, and (3) there are still uncertainties on how policies implemented by the governments effectively contribute to countries' economic growth. This study aims at understanding the contribution of trade openness to economic growth among Sub Saharan African countries by using pooled regression of panel data econometrics around 50 countries from 1960 to 2015, and empirically testing the introduction of Human Capital and Corruption Indexes as a new regressors to estimate the effects of trade openness on income in sub Saharan Africa. The study findings show that openness to trade (which is measures as ratio of import and export to GDP) has a

statistically significant positive impact on per capita income growth across all selected sub-Saharan African countries incomes. Countries with larger share of export are more likely to benefit from trade openness that those with larger share of imports as the latter dampen the countries 'current account. However, the effect of the import on country's per capita was not statistically significant. The study has also found that Human Capital Index has a robust and statistically significant positive impact on per capita income and trade openness in Sub-Saharan African, which show the extent to which countries that have invested more in human capital development benefit more from trade openness than those that invested less. Nevertheless, there is a statistically significant negative impact of country's landlockedness on per capita income. The study suggests that landlocked Sub-Saharan African countries benefit less from trade openness than non-landlocked countries. Based on study findings, this study recommends that that Governments across in Sub-Saharan Africa should increase their investments in human capital development through several that are aimed at improving early learning and the quality of secondary education. Sub-Saharan African countries should also increase investments in export growth promotion initiatives by supporting export diversification policies to boost significant improvements in country export volume. Export diversification in Agro-processing sector should be facilitated by focusing on organic food stuff of which demand continues to increase amid china's middle-income population growth. The latter would benefit from majority of the African population hence ensuring inclusive growth. Furthermore, governments across Sub-Saharan Africa should embrace intra-regional trade initiatives such as the recently signed African Continental Free Trade Agreement (AfCFTA) and ensure macroeconomic stabilities by undertaking holistic trade diversification policy reforms.

Key Words: International trade, Trade Openness, income, growth, a meta-analysis

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CHAPTER I. INTRODUCTION

1.1. Background

Figure 1: Map of Africa

Home of 54 governments, African governments have implemented several international trade openness reforms to boost economic growth. It is believed that these reforms will contribute to trade openness improvement, capital and goods mobility, and thus contribute to faster economic growth and development in Africa. However, the empirical evidence from the literature on international trade and growth remains mixed (Rodriguez and Rodrik 2001; Baliamoune 2002; Yanikaya 2003). On one hand, studies conclude that trade liberalization is not associated with economic growth and could potentially retard countries economic growth. For example, while Sachs and Warner (1997) suggest that openness to trade increases the speed of convergence, the evidence from the study by Baliamoune (2002) suggests that increased trade openness has led to income divergence rather than convergence among African countries, and Rodrik (2001) show that, with regards to trade openness and growth, the only systematic relationship that exist is that as countries get richer they flatten trade restrictions. On the other hand, multilateral organizations such as the World Bank and the International Monetary

Fund (IMF), have often made their support conditional on trade liberalization particular among developing countries, which majority are based in Africa (Zahonogo, 2017).

The World Bank and OECD have long time ago realized divergence of countries behavior. Among the industrialized economies, there has be tendency for trade protectionism, despite endorsement of trade liberalization; while developing countries have enjoyed special and preferential treatment in exporting and access markets of the rest of the world though the World Trade Organization's General Agreement on Tariffs and Trade (GATT) though the share of African trade in global trade remains weak. For example, WTO 2018 statistics show that while the global export value amounted to US$ 17.43 trillion, fifty two percent (52%) of the top ten merchandise traders account for over a half of the world total exports, while forty-four (44%) of developing economies only contributed 44% of world merchandise trade in 2017 (WTO, 2018).

Table 1: Percentage change: Merchandize trade volume and real growth domestic product 2014-2018.

	2014	2015	2016	2017
Volume of world merchandise trade[a]	2.7	2.5	1.8	4.7
Exports				
Developed economies	2.1	2.3	1.1	3.5
Developing and emerging economies[b]	2.7	2.4	2.3	5.7
North America	4.6	0.8	0.6	4.2
South and Central America and the Caribbean	-2.1	1.8	1.9	2.9
Europe	1.6	2.9	1.1	3.5
Asia	4.5	1.5	2.3	6.7
Other regions[c]	-1.0	5.5	2.6	2.3
Imports				
Developed economies	3.4	4.3	2.0	3.1
Developing and emerging economies[b]	2.4	0.6	1.9	7.2
North America	4.3	5.4	0.1	4.0
South and Central America and the Caribbean	-2.7	-6.4	-6.8	4.0
Europe	3.0	3.7	3.1	2.5
Asia	3.7	4.0	3.5	9.6
Other regions [c]	0.5	-5.6	0.2	0.9
Real GDP at market exchange rates	2.7	2.7	2.3	3.0
Developed economies	2.0	2.3	1.6	2.3
Developing and emerging economies[b]	4.3	3.7	3.6	4.3
North America	2.6	2.7	1.5	2.4
South and Central America and the Caribbean	0.9	-0.9	-2.1	1.0
Europe	2.0	2.3	1.9	2.6
Asia	4.1	4.2	4.1	4.5
Other regions[c]	2.5	1.1	2.2	2.0

[a] Average of exports and imports.
[b] Includes the Commonwealth of Independent States (CIS), including associate and former member states.
[c] Other regions comprise Africa, Middle East and the CIS.
Sources: WTO estimates for trade, consensus estimates for GDP.

The trade volume and as share of GDP has recorded a significant increased all regions. Between 2014 and 2017, the developed economic trade volume of export increased from 2.1% to 3.5% while the import volume registered slight decline from 3.4% to 3.1%. The developing and emerging economies have realized a big increased in export volume which registered a more than

two folds increase from 2.7% to 5.7 over the past three years. Unlike the developed economies, the imports volume of developing and emerging markets has realized a big surge from 2.7% to 7.2% between 2014 and 2017. When looking at the other regions which include most of Sub-Saharan African and Middle East countries the level of trade changes has also improved significantly in terms of both exports and imports. The volume of export as share of GDP in Africa and middle east countries, increased from just less 1% to 2.3% while the import volume increased from just 0.5% to 0.9%. Globally the volume of global merchandize has increased from 2.7% in 2014 to 4.7% in 2017. This translate into many reforms that different governments and economic block have been conducting to ensure openness for trade liberalization. However, the share of African countries remains scant thus suggest a number of improvements in trade policies and reforms.

In his address Roberto Azevêdo, (2018), the Director General of WTO, confirms that "world trade continues to grow with impressive rate, and the ratio of trade growth to GDP growth returned to its historic average of 1.5, which is far above the 1.0 ratio recorded in the years following the 2008 global financial crisis". He emphasized that the current trend of trade development is a such a timely reminder of the crucial role that international trade can play in job creation and boosting economic growth, development around the world.

The World Bank has significantly invested in recent years to promote trade-openness among country members particularly the least developed countries with the view that once trade liberalization takes place in countries, income could grow faster, thus reduce poverty, However, these World Bank assumptions have been challenged, which led to doubts and uncertainties about the effects of trade reforms on poverty eradication (Bussolo and Nicita,). Nevertheless, African countries have recently embarked on several policy measures aimed at trade promotion either

through fostering exports, encouraging strategic imports mainly electronics and research and development.

There are still undecided mixed views in academic literature about the role of trade liberalization on countries' income growth. One trend of the literature on growth emphasizes the primacy of institutions in economic development (Rodrik et al. 2004; Easterly and Levine 2003; Dollar and Kraay 2003) and suggests that institutions are key for achieving economic reforms in developing countries (Addison and Baliamoune-Lutz 2006; Acemoglu et al. 2003; Dollar and Kraay 2003). While other authors conclude that there is limited effect of trade liberation because it only increases income of countries with flexible policies which enable strategic adjustments , (Bussoro and Nicita, n.d) and McCulloch, Winters, and Cicera (2001) suggest that effect of trade on poverty is largely country specific and is driven by various characteristics of poor households which do not provide enough evidence for generalization and non-universal one remedy on that matter. It is against the above background; this analysis would like to explore the contribution of international trade to the levels of income among \Sub- Saharan African countries.

1.2. Problem statement

Despite the outward economic policies adopted by African countries in the last decades with aim of boosting their economic growth, there are still open debates among policy makers and economists at different levels on causalities between trade openness and growth.

International Financial Institutions such as the World Bank and IMF recognize positive effects of openness to international trade on a country's economic growth but fail to generalize its effect to all countries. The IMF (1998) show that international trade policies are among the factors that promote economic growth and convergence in developing countries", while the Organization for

Economic Co-operation and Development (1998) reports state that “Economies characterized by more open and outward-oriented policy regimes consistently outperform economies that have adopted restrictive trade and foreign investment policy regimes.

However, findings on role of international trade continue to be debatable among scholars, academics and policy makers across the globe. Some the main reasons put forward as explained in the earlier sections include but not limited to (i) some doubts on how countries’ openness to trade is measured, and (ii) the debate on the estimation methodology of direction of income and trade openness its self, which include choice of estimators. Freund and Bolaky (2008) conducted a study on the impact of trade openness to income using cross-country data from 126 countries, and they found that (i) openness to trade has a positive and significant impact on per capita income, and (ii) trade could contributed to improved standards of living if countries adopt flexible policies while the assessment of non-flexible (rigid) economic policies there was no impact. Another piece of work by Calderon et al. (2004) shows that trade liberalization has positive impact on growth only in high income countries, they do not find per capita growth effects caused by openness to trade in low-income countries.

1.3. Objective of the study

The objective of this study is to investigate the contribution of trade liberalization to income growth among countries that opted for increased trade liberalization against those that have opted neutral trade policies. The study also extensively reviews the existing literature on trade liberation and income to reconcile the findings that will support conclusion and policy recommendations which shall guide policy makers and further researchers.

1.4. Research question

This study was guided by the following research questions:

- How does trade openness contribute to economic growth of sub Saharan African countries?
- Is there any relationship between per capita income and openness to trade among Sub-Saharan African countries or vice versa? Or is there a causal relationship?
- Is there any factual based convincing case for Sub-Saharan African countries to continue investing in trade openness and liberalization?

1.5. Research hypotheses

This study was guided by the following two research hypotheses:

H_o: Openness to trade has no impact on growth among Sub Saharan African countries.

H_1: Openness to trade has significant impact on growth among Sub Saharan African countries.

H_o: Per capita income has no impact on openness to international trade in Sub-Saharan African countries.

H_1: Per capita income has significant impact on openness to international trade in Sub-Saharan African countries.

1.6. Contribution of this study to science.

This study contributed to the improved the understanding of the impact of international trade on economic and per capita income growth Sub-Saharan African countries. The analysis strengthened the momentum of academics and analytics in investigating the role of international trade in supporting poverty reduction among Sub-Saharan African countries.

CHAPTER TWO: LITTERATURE REVIEW

2.1. A review of economic growth theories

Table 2: Chronology of Economic growth theories

Growth Concepts and Theories	Emerged
Mercantilism	15th century
Physiocracy	2nd half of 18th century
Classical Theories	1776
Innovative Growth Theory of Schumpeter	1911
Keynesian Theories	1930s
Post-Keynesian (Neo-Keynesian) Theories	1950s
Neoclassical Theories and Exogenous Theory of Robert Solow	1950s-1960s
Endogenous Growth Theories	1980s-1990s

The economic growth theories span for longer time as they span from 15th century and even before to the current 21st century. In this section, there is an elaboration on selected literature. The thesis endeavors to extrapolate the direct and indirect links between international trade and growth among world economies.

2.1.1. Mercantilism and Physiocrats

Since 15th century, the concept of economic growth has been a subject for discussion among different economists, policy makers, political elites and more importantly among research academics, who invested resources and time to investigate why some countries get rich while others get poor, and the ingredient behind economic growth, leading to sustainable development. The primary motive behind the economic growth was and still is to hypothesize how economies can increase the quantity of goods and services they produce in time horizon. Mercantilism concept emerged in 15th century and was advocating mainly the static nature of wealth of the economy but

reflected on the role of international trade for countries' income to grow particularly the economy's ability to export more as source of increased income and overall wealth. The mainly cited mercantilist activists include by not limited to Jean Bodin (1530–1596), Thomas Mun (1571–1641); Giovanni Botero (1544–1617).

Contrary to the mercantilism, the physiocrats, believed and advocated for land development through agriculture as sole and immune source of wealth of the economy. The physiocrat theory emerged from France during 18th century, this time was enlightenment era in their theories, they believed that agriculture produced should be high priced[1]. The movement of physiocrats was mainly orchestrated by Anne-Robert-Jacques Turgot (1727–1781) and François Quesnay (1694–1774). However, this movement was directly preceded by the first modern school of classical economics, which began with the publication of the famous Adam Smith's Wealth of Nations in 1776.

2.1.2. Classical Growth theory

Early theory on economic growth dates to the classical economists of the 18th and 19th centuries. According to Barro and Sala Martin (2003), classical economists, such as Adam Smith (1776), Thomas Malthus (1798), David Ricardo (1817) and, Allyn Young (1928), Frank Ramsey (1928), Joseph Schumpeter (1934) and Frank Knight (1944), provided many of the basic elements that appear in modern theories of economic growth. The production function capitalizes on two important factors Capital (K) and Labor (L). However, these add to production efficiency (T). Therefore, the production function is summarized follows

$$Y = f(x) \quad (1)$$

[1] https://en.oxforddictionaries.com/definition/physiocrat#physiocrat__5

where x ∈ R is a p × 1 vector of production factors (the input) and y ∈ R is a q×1 vector of products (the output). Both y and x are flows expressed in terms of physical magnitudes per unit time. Thus, they refer to both goods and services.

These variables should appear as arguments in eq. 1. This is done in the *Georgescu-Roegen* production function

$$Y = f(k,x \qquad (2)$$

where k ∈ R is a m×1 vector of capital endowments, measured in physical magnitudes. Without loss of generality we may assume that the first *mp* elements represent physical capital, the subsequent *mh* elements represent human capital and the last *mf* elements represent financial capital, wuth mp +mh +mf = m

Smith (1776) states that “three circumstances are responsible for this great increase of the quantity of work which, in consequence of the division of labour, the same number of people are capable of performing:(i) the increase of dexterity in every particular workman; (ii) the saving of the time which is commonly lost in passing from one species of work to another; and (iii) the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many.”. Smith also considers improvements in machinery and international trade as engines of growth as they facilitated further specialization.

Rostow (1992) complemented Adam Smit views on the source of wealth with the idea that economic growth engines affecting are population growth (L), capital growth (K), the division of labour (technological progress) (T) and institutional framework of the economy (competitive-free traded market economy). Sachs (2013) points out however, that Adam smith does not develop a

long run growth theory as such, conclusions on how growth may be deduced, as he refers to the importance and effects of increasing labor productivity as well as saving.

2.1.3. Neoclassical growth theories

Neoclassical economic growth mushroomed by different authors who developed sets of growth models. And many them noted aspects of international trade in support of economic growth and income growth. The models discussed herein include Harrod Domar model, endogenous growth model, Solow growth model. This study is grounded in neoclassical growth theory model to explain how openness to international trade affects income.

a. Harrod–Domar model

The Harrod–Domar model of economic growth was developed by Roy F. Harrodin (1939), and Evsey Domar (1946).The model is a precursor to the exogenous growth model and it was initially created to support the analysis of the business cycle, but it was later modified to also explain economic growth . The main assumption of the model is that economic growth depends on the quantity of labor and capital supplied; thus, more investment leads to capital accumulation, which generates economic growth. The model carries implications for less economically developed countries, where labour is in plentiful supply in these countries but physical capital is not, slowing down economic progress (Jones, 2002). In this respect, poor countries, are so because, of lack of enough savings, which limit the accumulation of physical capital stock through investments. To put it right, The Harrod-Domar model considers investment as being critical to economic growth and by putting emphasis on the dual character of investment, the Demand Effect and the Supply Effect of investment. The former creates income, whilst the latter augments the productive capacity of the economy by increasing its capital stock.

b. Endogenous growth

The endogenous growth literature, according to Charalambos &Mirestean (2009), emphasizes that openness to trade positively affects per capita income and growth through economies of scale and technological diffusion between countries.

Unsatisfied with Solow-Swan Growth model's explanation, economists such as Paul Romer and Robert Lucas, Jr. developed the Endogenous Growth Theory. This theory includes a mathematical explanation of technological innovation and also incorporates a new concept of human capital (or the skills and knowledge that make workers productive). This theory recognizes that unlike physical capital, human capital (education) has increasing rates of return. So, overall there are continual returns to capital, and economies never reach a steady state. Romer (1994) states that growth does not slow as capital accumulates, but the rate of growth depends on the types of capital a country invests in.

2.1.2.3. Solow Swan growth model

The Solow Swan model is credited to Robert Solow (1956) and Trevor Winchester Swan (1956). According to Acemaglou (2009), this growth model has greatly molded how we approach not only economic growth but also the entire macroeconomics field. The Solow Swan model takes technological progress as given and investigates the effects of the division of output between consumption and investment on capital accumulation and growth.

In this section, we use David Romer (2012) discussion of the Solow model to explain the neoclassical growth theory.

The Solow model focuses on four variables: output (Y), capital (K), labor (L), and "knowledge" or the "effectiveness of labor" (A). At any time, the economy has some amounts of capital, labor, and knowledge, and these are combined to produce output. The production function takes the form:

$$Y(t) = F\,(K(t), A(t)L(t)) \qquad (3)$$

where t denotes time. Notice that time does not enter the production function directly, but only through K, L, and A. That is, output changes over time only if the inputs to production change. In particular, the amount of output obtained from given quantities of capital and labor rises over time—there is technological progress—only if the amount of knowledge increases. Notice also that A and L enter multiplicatively. AL is referred to as effective labor, and technological progress that enters in this fashion is known as labor-augmenting or Harrod-neutral. This way of specifying how A enters, together with the other assumptions of the model, will imply that the ratio of capital to output, K/Y, eventually settles down. In practice, capital-output ratios do not show any clear upward or downward trend over extended periods. In addition, building the model so that the ratio is eventually constant makes the analysis much simpler. Assuming that A multiplies L is therefore very convenient. The central assumptions of the Solow model concern the properties of the production function and the evolution of the three inputs into production (capital, labor, and knowledge) over time.

2.2. International trade theory

2.2.1. Ricardian model

The Ricardian model is regarded as the most basic and simplest general equilibrium model that explain international trade. The Ricardian model provides the benchmark for the introduction of today's new ideas in trade despite of being superseded by other more complex models.

The Ricardian model itself, is a new idea that came many years after David Ricardo. According to Ruffin (2002), David Ricardo introduced in 1816 only a portion of the model, but the first appearance of the Ricardian model was in Mill (1844). Despite that, this model now bears Ricardo's name. This model was focusing primarily on the amounts of labor used to produce traded goods hence the concept of comparative advantage. The first appearance of the Ricardian model, according to Ruffin again, was in Mill (1844).

The simple Ricardian model describes a world of two countries, A and B, each using a single factor of production, labor L, to produce two goods, X and Y. Technologies display constant returns to scale, meaning that a fixed amount of labor a_g^c is needed to produce a unit of output of each good, g=X,Y, in each country, c=A,B, regardless of how much is produced in total. All markets are perfectly competitive, so that goods are priced at cost in countries that produce them, $p_g^c = w^c a_g^c$,where w^c is the competitive wage in country c.

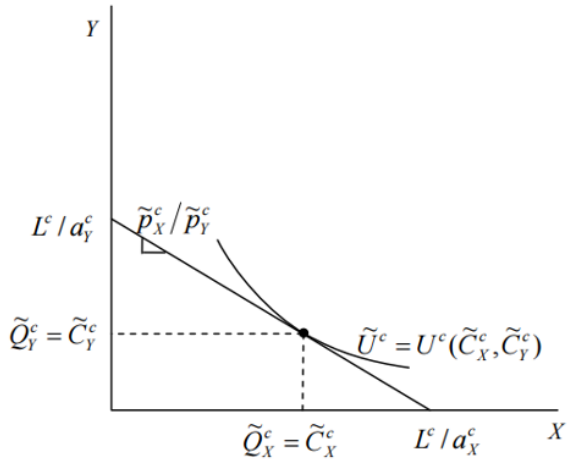
Labor is available in fixed supply in each country, L^c ; it is immobile between countries but perfectly mobile within each. The Ricardian Model typically leaves demands for goods much less fully specified than supplies, though a modern formulation might specify for each country a utility function, $U^c = U^c(C_x^c, C_y^c)$, which the representative consumer maximizes subject to a budget

constraint. Utility functions might, or might not, be assumed in addition to be identical across countries, homothetic, or even Cobb-Douglas, although most properties of the model's solution do not require any of these assumptions.

The most elementary use of the Ricardian model compares the autarkic equilibria with those of free and frictionless trade. In autarky, since both goods must be produced in each country, prices are given immediately by the costs stated above, and further analysis is needed only if one wants to know quantities produced and consumed. If so, the linear technology implies a linear production possibility frontier (PPF) that also serves as the budget line for consumers in autarky.

The autarky equilibrium is as shown in Figure 1, where " $\tilde{p}$ " indicates autarky and Q represents production. Comparison of the two countries in autarky depends primarily on their relative costs of producing the two goods, which in this model defines their comparative advantage. For concreteness, assume that country A has comparative advantage in good X:

Figure 2: Ricardian Model equilibrium in autarky



$a_X^A / a_Y^A < a_X^B / a_Y^B$, so that

$\tilde{p}_X^A / \tilde{p}_Y^A < \tilde{p}_X^B / \tilde{p}_Y^B$.

Without further assumptions about preferences, little more can be said about autarky, but if preferences are identical and homothetic, with positive elasticity of substitution, then one can infer that

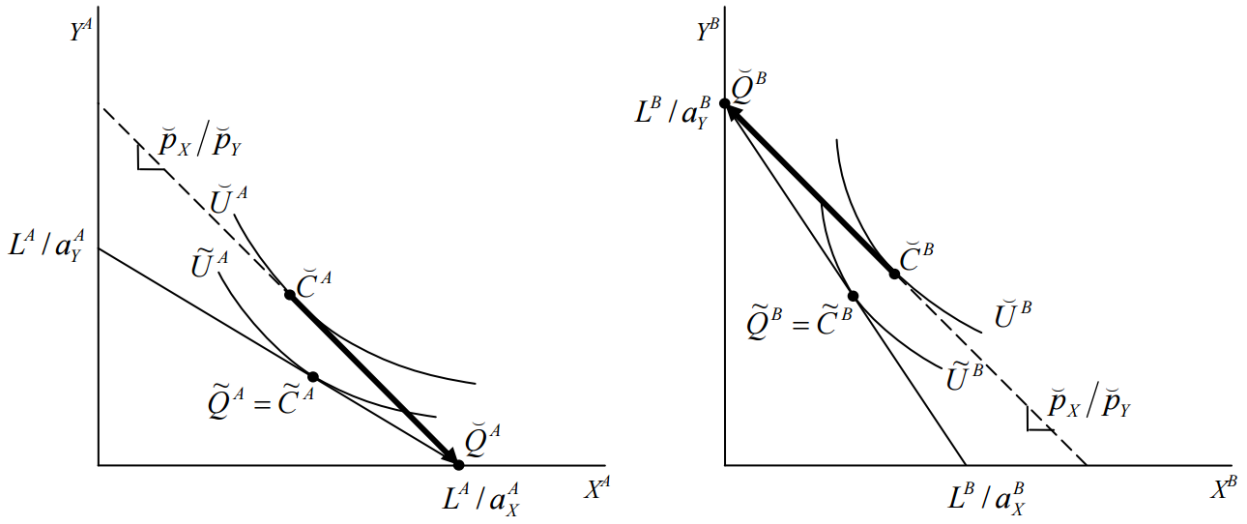
$$\tilde{Q}_X^A / \tilde{Q}_Y^A > \tilde{Q}_X^B / \tilde{Q}_Y^B \qquad (7)$$

With free and frictionless trade, prices must be the same in both countries. Two kinds of equilibrium are possible, depending on the supplies and demands for goods in the two countries. One kind of equilibrium has world relative prices, denoted here by " ˘ ", strictly between the relative prices of the two countries in autarky:

$$\tilde{p}_X^A / \tilde{p}_Y^A < \breve{p}_X^A / \breve{p}_Y^A < \tilde{p}_X^B / \tilde{p}_Y^B \qquad (8)$$

In that case, each country must specialize in producing only the good for which its relative cost is lower than the world relative price, thus the good in which it has comparative advantage. Each must necessarily export that good. With such complete specialization, outputs of the goods are determined by labor endowments and productivities, so equality of world supply and demand must be achieved from the demand side. That is, world prices are determined such that the two countries' demands sum to the quantity produced in one of them. These demands derive from the expanded budget constraints of each country's consumers, reflecting the value at world prices of the single good that the country produces. Consumers can now, unless they wish to consume only that single good, consume more of both goods than they did in autarky. Whether they choose to do so or not depends on the extent to which they substitute toward the cheaper good now imported from abroad, but in any case, they reach a higher indifference curve and are better off. All of this is shown in Figure 2. For this to be an equilibrium, the quantity of each good exported by one country must equal the quantity imported by the other, so the heavy arrows showing net trade in each panel of the figure must be equal and opposite.

Figure 3: Trade equation for complex specialization



The analysis examined the Ricardian model，the simplest model that shows how differences between countries give rise to trade and gains from trade. In this model labor is the only factor of production ，and countries differ only in the productivity of labor in different industries. In the Ricardian model ，countries will export goods that their labor produces relatively efficiently and will import goods that their labor produces relatively inefficiently. In other words ，a country’s production pattern is determined by comparative advantage. We can show that trade benefits a country in either of two ways. First ，we can think of trade as an indirect method of production. Instead of producing a good for itself ，a country can produce another good and trade it for the desired good. The simple model shows that whenever a good is imported ，it must be true that this indirect ″production" requires less labor than direct production. Second ，we can show that trade enlarges a country's consumption possibilities ，which implies gains from trade. The distribution of the gains from trade depends on the relative prices of the goods countries produce. To determine these relative prices, it is necessary to look at the relative world supply and demand for goods. The relative price implies a relative wage rate as well. The proposition that trade is beneficial is unqualified, there is no requirement that a country be ″competitive" or that the trade be ″fair." In particular, we can show that three commonly held beliefs about trade are wrong. First, a country gains from trade even if it has lower productivity than its trading partner in all industries.

Second, trade is beneficial even if foreign industries are competitive only because of low wages. Third, trade is beneficial even if a country′s exports embody more labor than its imports. Extending the one-factor, two-good model to a world of many commodities does not alter these conclusions. The only difference is that it becomes necessary to focus directly on the relative demand for labor to determine relative wages rather than to work via relative demand for goods. Also, a many-commodity model can be used to illustrate the important point that transportation costs can give rise to a situation in which some goods are non-traded. While some of the predictions of the Ricardian model are clearly unrealistic, its basic prediction-that countries will tend to export goods in which they have relatively high productivity has been confirmed by a number of studies.

2.2.2. Heckscher-Ohlin model

The Heckscher Ohlin model of international trade is built on the theory of comparative advantage and argues that countries can export the goods and services that they can most efficiently and plentifully produce compared to other countries.

Heckscher Ohlin model shows that comparative advantage is highly influenced by the interface between country's resources such as (i) the relative abundance of factors of production and (ii) the production technology which greatly influences the relative intensity with which different factors of production are utilized the production of different goods and services.

To understand the role of resources in trade， a model in which two goods are produced using two factors of production is developed. The two goods differ in their factor intensity, that is, at any given wage-rental ratio, production of one of the goods will use a higher ratio of capital to labor than production of the other. As long as a country produces both goods，there is a one-to-one

relationship between the relative prices of goods and the relative prices of factors used to produce the goods. A rise in the relative price of the labor-intensive good will shift the distribution of income in favor of labor and will do so very strongly: The real wage of labor will rise in terms of both goods，while the real income of capital owners will fall in terms of both goods. An increase in the supply of one factor of production expands production possibilities，but in a strongly biased way: At unchanged relative goods prices，the output of the good intensive in that factor rises while the output of the other good actually falls. A country with a large supply of one resource relative to its supply of other resources is abundant in that resource. A country will tend to produce relatively more of goods that use its abundant resources intensively. The result is the basic Heckscher-Ohlin theory of trade: Countries tend to export goods that are intensive in the factors with which they are abundantly supplied. Because changes in relative prices of goods have very strong effects on the relative earnings of resources，and because trade changes relative prices，international trade has strong income distribution effects. The owners of a country′s abundant factors gain from trade, but the owners of scarce factors lose. In theory，however，there are still gains from trade ，in the limited sense that the winners could compensate the losers, and everyone would be better off. Increasing trade integration between developed and developing countries could potentially explain rising wage inequality in developed countries. However，little empirical evidence supports this direct link. Rather，the empirical evidence suggests that

technological change rewarding worker skill has played a much greater role in driving wage inequality.

2.2.3. Specific factors model

Due to its strong effects on the distribution of income among countries, the international trade often produces losers and winners. These income distribution effects appear for two reasons: (i) factors of production cannot move instantly and without cost from one industry to another, and (ii) changes in an economy's output mix have differential effects on the demand for different factors of production.

So, the specific factors model is a useful model of income-distribution effects which allows for a distinction between general-purpose factors that can move between sectors, and factors that are specific to specific uses. In the specific factors model, differences in countries 'resources can cause those countries to have different relative supply curves, and therefore cause international trade to happen.

In this model, factors specific to import-competing sectors lose from international trade while factors specific to export-competing sectors in each country gain from international trade. Moreover, mobile factors that can work in either sector (import or export sector) may either gain or lose as well. However, international trade produces overall gains in the limited sense that those who gain could in principle compensate those who lose while still remaining better off than before. Despite that, most economists do not regard the effects of trade on income distribution as a better reason to limit this international trade. This is because international trade, in its distributional effects, is no different from many other forms of economic change, which are not usually regulated, and economists would typically prefer to address income distribution issue directly, rather than by interfering with trade flows. In the real politics of trade policy, income distribution is of crucial

importance because people who lose from trade are usually a much more informed, cohesive, and organized group than those who gain.

2.2.4. Standard trade model

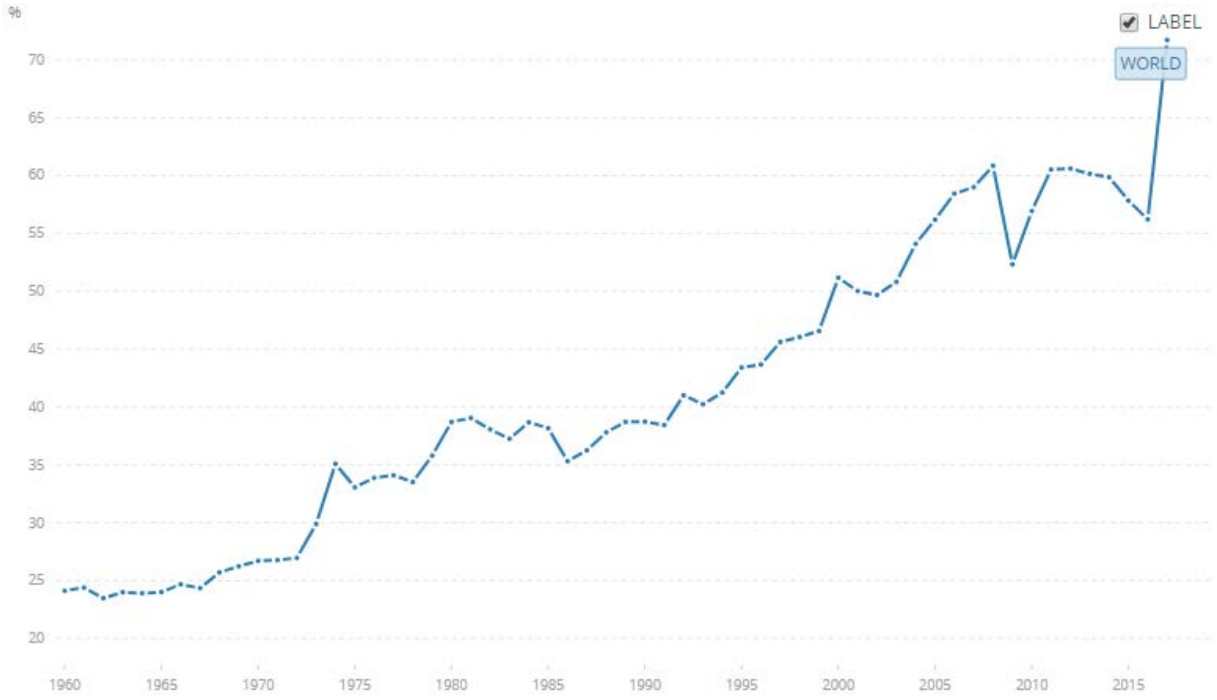
Standard trade model is regarded as a general model that contains Heckscher-Ohlin, Ricardian, and Specific Factors models as special cases. The standard trade model is built on four key relationships: (1) the relationship between the production possibility frontier and the relative supply curve; (2) the relationship between relative prices and relative demand; (3) the determination of world equilibrium by world relative supply and world relative demand; and (4) the effect of the terms of trade-the price of a country's exports divided by the price of its imports on a nation's welfare.

Across the globe countries have been making effort to understand the effects of international trade policies and lowered barriers to trade on boosting economic growth leading to an increased per capita income. Binary indicators (in short SWWW) have been constructed by Sachs and Warner (1995), these indicators were revised and updated Wacziarg and Welch (2003). The rationale behind these indicators is that , a given country is considered to be closed to international trade in any given year if the following conditions are at least fulfilled : (i) much of country's exports are stete controlled through monopoly ; (ii) the black market premium on the exchange rate exceeds 20 percent; (iii) non-tariff barriers cover more than 40 percent of its imports; (iv) average tariffs exceed 40 percent; (v) it has a socialist economic system.

A country is considered to be open to international trade if none of these conditions applies. Based on the above binary indicator of openness—or economic liberalization, and in the language of

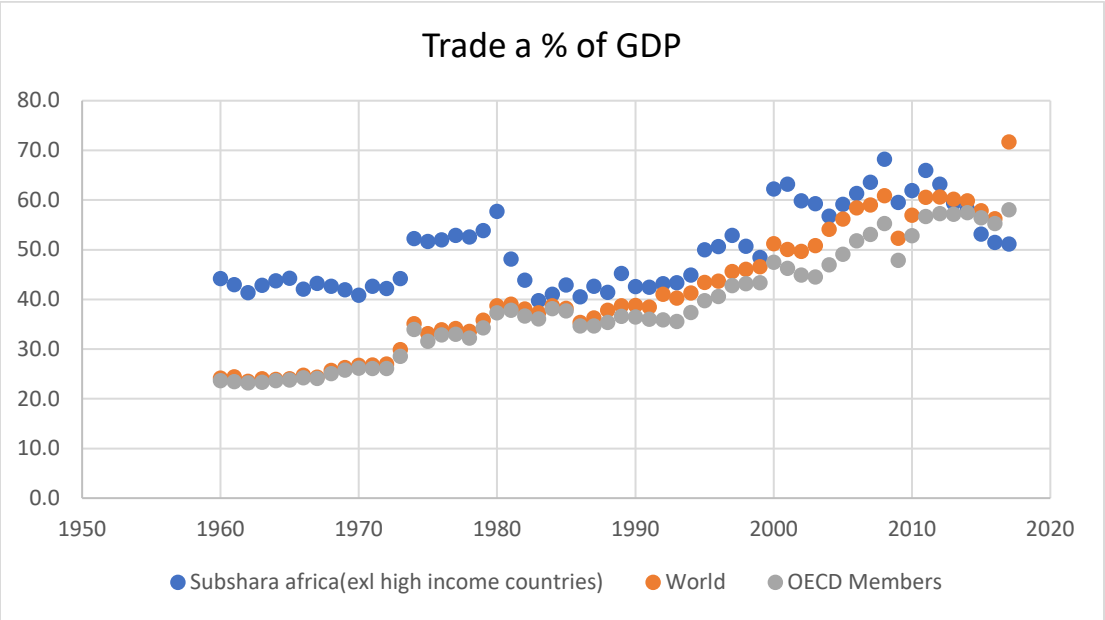
Giavazzi and Tabellini (2005), we can conclude an upward global trade openness has been observed from 1960s to 2015.

Figure 4: Global trade openness as percentage of GDP.



Source: World Bank development indicator

Figure 5: Openness growth: Sub-Sahara African, world and the OECD member countries



2.3. Empirical Studies on Trade Openness and Growth

A number of studies apply the approach of measuring trade volumes which are normalized by GDP and extended to instrumental variable framework analysis to investigate the relation that exist between the economic growth and openness to trade (e.g., Frankel & Romer, 1999).

According to Barro's (1991) study on growth regressions, several notable cross-country studies including Edwards (1992, 1998), Dollar (1992), Sachs and Warner (1995), recognized a positive link between trade openness and growth. Vamvakidis (2002), in a study that was conducted in a historical context, finds that international trade is only associated with economic growth after 1970 but it is not associated before that year. Moreover, Bhagwati and Srinivasan (2002) show that employing cross-country regressions is a poor approach to investigating the effects of trade on growth. They also argue that the selection of sample, proxies and period, will infer numerous degrees of freedom.

Other economists such as Romer and Frankel (1999) and Tervio and Irwin (2002) use gravity models and find positive effects of international trade to growth by isolating geographical components of openness that are assumed independent of economic growth. Those components that are presumably considered as exogenous instruments are land area, borders, distances and population. These instruments could have indirect effects on economic growth hence biasing the estimates of the effects of trade on growth.

Devarajan and Rodrik (1989) use a general equilibrium model to show that trade liberalization can be either welfare-augmenting or welfare-reducing in the presence of imperfect competition or increasing returns. Also, Young (1991) shows that growth can be higher for a country under autarky than under free trade, and Rassekh (2004) provides an overview of theoretical models showing that growth effects from trade openness can be either positive or negative across countries.

Trade may not be favorable to growth in the absence of good policies which are explained by institutional quality. For instance, North (1990), and Dollar & Kraay (2003) argue that political institutions (governance and policies), market institutions (bureaucracy and competition) and social institutions (social norms) define the extent to which trade openness contributes to growth.

CHAPTER III: RESEARCH METHODOLOGY

In addition to the desk reviews of literature both empirical and theoretical of trade and income growth around the globe, the analysis has of the impact of international trade on income in Africa has followed an unbalanced panel data analysis of all sub-Saharan African countries notably 50 countries are included in the data series. The time series consisted data from 1960 where available to 2015.

3.1. Model Specification

Trying to identify the relationship between of international trade openness on per capita income levels in African countries, we use the time series regression model followed by Vehapi, Sadikub and Petkovski (2014) in their analysis of Empirical Analysis of the Effects of trade openness on economic growth for South East European Countries.

3.1.1 Model one: Estimating the effects of trade openness on growth

The model one estimated the dependency relationship between the GDP and other macro-institutional covariates

$$ln\ GDPc_{it} = \beta_o + \beta_1\ \text{lnoptr}_{it} + \beta_2\ \text{lncsh\_x}_{it} + \beta_3\ \text{lnimport}_{it} + \beta_4\ \text{lndemocracy}_{it} + \beta_5\ \text{landlk}_{it} + \beta_6\text{landem}_{it} + \beta_7\text{hci} + \varepsilon_{it} \quad (10)$$

Where $\boldsymbol{ln\ GDPc_{it}}$ is the natural logarithm of per-capita real income in country *i* at time *t.* Explanatory variables are $\boldsymbol{ln\ optr_{it}}$ which is the natural logarithm of openness to trade (import + export as percentage of GDP), $\boldsymbol{ln\ csh\_X_{it}}$, is the transformed level of export, $\boldsymbol{ln\ import_{it}}$ is the transformed level of import, $\boldsymbol{ln\ democracy_{it}}$, which is the index of democracy(measuring the institutional quality), and $\boldsymbol{hci_{it}}$ which is the human capital index, and $\boldsymbol{ln\ landlk_{it}}$ refers to landlockedness of the country, $\boldsymbol{landem_{it}}$ which are indexes for landlockedness and democracy respectively, $\boldsymbol{\beta}$ is the parameter to be estimated and $\boldsymbol{\varepsilon}$ represents the error terms.

3.1.2 Model two: Estimating the effects of instruments on trade openness.

The model two estimated the dependency relationship between the instruments and trade openness

$$ln\ optr_{it} = \pi_o + \pi_1 ln\ area + \pi_2 ln\ pop\ +\ \pi_3 ln\ dist\ +\ \pi_4 landlk + u_i \quad (11)$$

Where are $\boldsymbol{ln\ optr_{it}}$ is the natural logarithm of openness to trade (import + export as percentage of GDP), $\boldsymbol{ln\ area}$ is the natural logarithm of the size of the country, $\boldsymbol{ln\ pop}$ is the natural logarithm of the population of the country, $\boldsymbol{ln\ dist}$ is the natural logarithm of the distance of the country with others, $\boldsymbol{landlk}$ is the dummy for landlockedness of the country, $\boldsymbol{\pi}$ is the parameter to be estimated and $\boldsymbol{u}$ represents the error terms.

The above model was designed with the view that openness and GDP can have bi-directional relationship, thus the test of two variables was sought very necessary. Helpman (1988), Colin Bradford, Jr. and Naomi Chakwin (1993), and Rodrik (1995), demonstrated that countries whose incomes are high for reasons other than trade may trade more. Moreover, Krugman (1990), state that the expansion of growth augments a country's income once the rise of growth inputs (capital, labor, education, and infrastructure) are taken into account, suggesting the possibility of various trade-growth relationships under different economic and social environments. As a result, the explanatory variables of trade openness may be endogenous, which may lead to biased and inconsistent estimates of the effects of trade openness on income in Africa.

Moreover, another major concern in our model is that the explanatory variables of trade openness are likely to be equally correlated with the residuals. This is because as argued by Jeffrey A. Frankel and David Romer (1999), countries that adopt free-market trade policies may also adopt free-market domestic policies and stable fiscal and monetary policies. Since these policies are also likely to affect income, countries' trade policies are likely to be correlated with factors that are omitted from the income equation which may violates the orthogonality assumption. In addition, Frankel and Romer (1999) have considered geographical variables as valid instruments that would best deal with endogeneity when GDP and openness are the subject matter. More specifically, we use area and population, distance between countries and dummy for landlockedness as the instruments for trade openness, as these variables are important determinants of the within country trade which eventually affects the trade openness.

The intuition is that the countries which have larger area and population inclined to have lower trade openness than the smaller ones, while landlockedness and distance also reduces the amounts of a country's trade. As a result, the following model of trade openness is estimated:

The first and foremost method of analysis used was pulled Ordinary Least Squares (OLS) methodology to estimates the effects, followed by Two stage least squared to identify economic problems among others endogeneity and heteroscedasticity, since we expected within and between difference of the effect of each variable, fixed and random effects were tested. In addition, the analysis has elaborated on summary statistics of each variable included in the model.

CHAPTER IV: FINDINGS AND DISCUSION

The chapter presents findings on the impact of trade openness and income in selected Sub-Saharan African countries where data was available. The analysis also goes further to investigate the contribution of GDP on trade openness.

4.1. Estimating the effects of trade openness on per capita income growth

Table 3: Model one: The effects of trade openness on per capita income growth

VARIABLES	(1) Pooled OLS	(2) 2SLS Regression	(3) Fixed effect	(4) Random Effect
lnoptr	0.127**	0.127**	0.0419**	0.0436**
	(0.0490)	(0.0490)	(0.0199)	(0.0203)
lncsh_x	0.334**	0.334**	-0.171***	-0.160**
	(0.153)	(0.153)	(0.0632)	(0.0646)
lnimport	-0.188	-0.188	0.0223	0.0173
	(0.123)	(0.123)	(0.0515)	(0.0526)
democracy	0.415***	0.415***		0.0940
	(0.0591)	(0.0591)		(0.191)
landlk	-0.611**	-0.611**		-0.589
	(0.247)	(0.247)		(1.497)
landem	0.729**	0.729**		0.760
	(0.350)	(0.350)		(2.102)
Hci	0.462***	0.462***	0.196***	0.205***
	(0.0944)	(0.0944)	(0.0466)	(0.0474)
Constant	8.541***	8.541***	7.797***	7.708***
	(0.277)	(0.277)	(0.117)	(0.220)
Observations	523	523	523	523
R-squared	0.536	0.536	0.056	
Number of panelid			20	20

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Dependent variable: per capita GDP- Transformed into log values

The coefficients of openness to trade which is measures as import and export ratio to GDP are statistically significant and robust a 5% significance level, similarly, exports which were transformed into log value they also showed significant and positive contribution to per capita income growth and they are also significant at 5% significance level.

While landlockedness showed a significant result but, being a landlocked country contributes less to per capita income growth.

The impressive findings from the analysis showed that human capital and democracy are great and potential contributors to the per capita income growth. The human capital coefficients were both significant at 1% and 5% percent. The coefficient of the import level in a given country do not provide enough evidence to support the negative contribution to per capita income. These findings affirm what Vehapia, Sadikub and Petkovskic (2014) have observed in the empirical analysis of the effects of trade openness on economic growth in South east European countries. See the annex of the detailed analysis procedures.

4.2. Estimating the effects of instruments on Trade openness

Table 4: The effects on instruments on trade openness

VARIABLES	(1) Pooled OLS	(2) 2SLS	(3) Fixed effect	(5) Random effect
lnPcGDP	0.710***	0.710***	0.0117	0.320**
	(0.0780)	(0.0780)	(0.164)	(0.135)
lnPop	-0.172***	-0.172***	1.096***	0.0536
	(0.0504)	(0.0504)	(0.225)	(0.123)
lnArea	-0.0312	-0.0312		-0.0371
	(0.0637)	(0.0637)		(0.129)
landlnarea	0.0359	0.0359		0.0482
	(0.0900)	(0.0900)		(0.210)
aver_ci	-1.050***	-1.050***		-0.703**
	(0.126)	(0.126)		(0.288)
landlk	-0.316	-0.316		-0.370
	(0.440)	(0.440)		(1.002)
hci	0.783***	0.783***	-0.756**	0.564**
	(0.154)	(0.154)	(0.323)	(0.222)
Constant	-10.19***	-10.19***	-4.297***	-7.076***
	(0.569)	(0.569)	(1.325)	(1.096)
Observations	718	718	718	718
R-squared	0.300	0.300	0.048	
Number of panelid			31	31

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Dependent variable is trade openness

GDP per capita has a very significant and positive effect on increasing trade openness and the coefficients are significant at 5%, similar to Human capital which data show that countries with higher human capital have could have higher level ratio of trade openness and the coefficients were significant at 1% and 5% significant levels. However, on the other hand, Landlockedness, corruption level and population affect negatively country openness. Data have shown that, landlockedness affect trade openness by 4% of each unit/index of distance toward the sea level, countries with high corruption index tend to have a very lower trade openness. It was surprising in this study to the direction of population and trade openness where, the study shows that there is a negative relationship suggesting that an increase in population correlates with lower trade openness, in this analysis, this remains a point of further discussion.

4.3. Hypothesis verification

This study evaluated two hypotheses, whether trade openness has an impact on growth among countries in African regardless of their income status. The findings showed a significant contribution of openness on per capita income and suggest that per each unit increase in trade openness contribute to 2.5% increase in per GDP. The study also tested whether the GDP has a correlation with Trade openness, as a result, the study found that, per each unit of GDP of increase contribute to around 9 units increase in openness. However, these findings look plausible thus further investigation should be conducted to come with more reliable linkages using block level analysis by country's income classification.

CHAPTER V: CONCLUSIONS AND POLICY RECOMMENDATIONS

The study on impact of international trade on income in Sub-Saharan African countries has extensively reviewed the recent and old-time literature about the contribution of trade on countries growth.

The literature also reviewed a number of growth theories to try understanding what the growth theories appreciate or hypothesize about the trade openness and countries' economic growth. As findings in the reviews of empirical and theoretical findings suggest, it was observed that (i) the empirical evidence from the large and growing literature on trade and growth remains mixed. On one hand studies suggest that trade liberalization is not associated with growth and could potentially retard countries economic growth. For example, while Sachs and Warner (1997) argue that trade openness increases the speed of convergence, the evidence from the study by Baliamoune (2002) suggests that increased openness to trade has led to income divergence rather than convergence in African countries and Rodrik (2001) argues that, regarding trade openness and growth, "the only systematic relationship is that countries dismantle trade restrictions as they get richer." On the other hand, the International Monetary Fund (IMF) and the World Bank, have often made their support conditional on trade liberalization particular among developing countries, which majority are based in Africa (Zahonogo, 2017). There is a growing evidence that trade openness contributes to export growth which significantly lead to forex exchange earnings hence reducing or contributing to current account improvement.

While the global international trade flow has realized tremendous improvements over the last decades and further situation continue to prevail even currently, there has been tendency for trade

protectionism, despite endorsement of trade liberalization. While developing countries have enjoyed special and preferential treatment in exporting and accessing markets of the rest of the world though the World Trade Organization ‘s General Agreement on Tariffs and Trade (GATT), African trade as share of global trade remains weak. For example, in 2018, while the global export value amounted to US$ 17.43 trillion, 52% the top ten merchandise traders account for just over half of the world total, while 44% of developing economies had a 44% share of world merchandise trade in 2017 (WTO, 2018).

When it comes to gains from international trade and countries openness, a number of factors were assessed which ranges from institutions, democracy, human capital and geographical location. Despite that, there are still undecided mixed views in academic literature about the role of trade liberalization on countries’ income growth. One strand of the literature on growth has argued for the primacy of institutions in economic development (Easterly and Levine 2003; Dollar and Kraay 2003; Rodrik et al. 2004) and emphasize that institutions are crucial for the success of economic reforms in developing countries (Acemoglu et al. 2003; Dollar and Kraay 2003; Addison and Baliamoune-Lutz 2006). While some scholars conclude that there is limited effect of trade liberation on income because trade liberation only increases income of countries with flexible policies which enable strategic adjustments, other scholars such as Bussoro and Nicita, McCulloch, Winters, and Cicera (2001) conclude that the effect of trade on poverty is largely country specific and is driven by various characteristics of poor households which do not provide enough evidence for generalization.

Combining all of above information, this analysis shed more light on a number of variables which could affect per capita income growth. Those include trade openness, corruption index, human capital index, land lockedness of countries, level of import and level of exports.

These covariates were regressed against per capita income growth in selected Sub Saharan African countries using pooled regression, two stage least squares to test endogeneity issues and also tested random and fixed effects.

This study concludes that openness to international trade (which is measured as import and export ratio to GDP) is statistically significant and robust at 5% significance level to inducing country per capita income growth in Sub-Saharan African countries. This study shows that countries with larger share of export are more likely to benefit from trade openness than those with larger share of imports as the latter dampen the current count. However, the effect of the import on country's per capita effect was not statistically significant in Sub-Saharan African countries. The study has also strongly found that countries with higher human capital index benefit more from trade openness as the results were robust and significant both at 1% and 5%. Moreover, findings suggests that landlocked Sub-Saharan African countries benefit less as compared to the non-landlocked countries.

The analysis concludes by recommending the following:

- Given the relatively lower level, Governments across African continents should aim to increase the human capital index through investing in early learning and improving the quality of education. This could be done through increased investments in education sector as well designing integrated policies which deal with human health such as stunting, early vaccination and ante-natal care.
- The study also suggests that Government should increase investments in export growth promotion initiatives by supporting export diversification policies to boost significant improvements in country export volume. Since African is mostly agrarian, countries should

aim at agriculture sector reforms which transform agriculture sector into business led sector, in order to produce beyond subsistence and small-scale type of agriculture. Agro-processing should be facilitated by focusing on organic food stuffs of which their demand continues to increase amid China's middle-income population growth.

- For oil and mineral exporting Sub Saharan African countries, there is need to continue investments in value addition and diversification of export destinations by embracing intra-African trade deals made through different economic blocks such Southern African Development Community, East African Community, Economic and Monetary Community of Central Africa, Economic Community of West African States and as well as the recently enacted African free Trade Area (ACfTA).
- Finally, African governments should continue to invest in collective reforms aiming at removing all non-tariff barriers which still constitute major impediments for trade openness across the African continent. This may include reforms in local, and h regionally harmonized trade policies, competition polices, exchange and fiscal policies as well control of inflation rates within different Sub-Saharan African economies.

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Annex 1: Variable Description and Data source

Variable	Description	Data Source
Trade	Trade openness which is (Import+export)/ GDP	Penn World Table 9.0, 2016
Pop	Population of the countries measured in thousands	Penn World Table 9.0, 2016
Log Pop	Logarithm of Population	Penn World Table 9.0, 2016
Area	Area of the countries measured in square kilometers	http://www.infoplease.com/ipa/A0004379.html.
Log Area	Logarithm of Area	http://www.infoplease.com/ipa/A0004379.html.
Landlock	Landlocked ness of the countries(1=Yes, 0=No)	World Atlas
CI	Corruption Index measured in 0-6 scale(0=Least, 6=Most)	IRIS center(University of Maryland),
Democracy	Measured in 0-10 scale(0=Least, 10=Most)	Center for International Development and Conflict Management.
Distance (DFE)	Absolute value of latitude of the country, scaled to take values between 0 and 1 where 0 is the equator	Distance is measured as the great-circle distance between countries' principal cities. CID geography data downloaded from http://www.cid.harvard.edu/ciddata/ciddata.html
Latitude	Latitude of the country scaled to take values between 0 and 1, where 0 is the equator	CID geography data downloaded from http://www.cid.harvard.edu/ciddata/ciddata.html
Human Capital Index	Index of human capital per person, based on years of schooling and returns to education	Penn World Table 9.0, 2016

Annex 2: Summary statistics and model (1) findings

Summary statistics

```
. su lnpcgdp lnoptr lncsh_x lnimport democracy landlk landem hci,
```

Variable	Obs	Mean	Std. Dev.	Min	Max
lnpcgdp	2695	7.690074	.8988929	5.085092	10.74914
lnoptr	791	-3.140629	1.636309	-12.17651	-.0727668
lncsh_x	2695	-2.322341	1.066836	-11.50298	.2392813
lnimport	2695	-1.947501	1.010577	-12.54575	.4565364
democracy	1464	-.7168815	.5648072	-1.955578	.2738281
landlk	2695	.2820037	.4500586	0	1
landem	1464	-.1029568	.3158641	-1.388337	.0264619
hci	2220	1.447292	.3722858	1.007038	2.809442

Pooled OLS Model

```
. regress lnpcgdp lnoptr lncsh_x lnimport democracy landlk landem hci, ro

Linear regression                               Number of obs =     523
                                                F(  7,   515) =  166.79
                                                Prob > F      =  0.0000
                                                R-squared     =  0.5361
                                                Root MSE      =  .63065
```

lnpcgdp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnoptr	.1267052	.0490249	2.58	0.010	.0303918	.2230185
lncsh_x	.3341159	.1528942	2.19	0.029	.0337428	.6344889
lnimport	-.1884756	.1226054	-1.54	0.125	-.4293439	.0523926
democracy	.4153827	.0591112	7.03	0.000	.2992539	.5315115
landlk	-.610825	.2474105	-2.47	0.014	-1.096883	-.1247671
landem	.7286776	.3497828	2.08	0.038	.0415009	1.415854
hci	.4620716	.0944332	4.89	0.000	.27655	.6475932
_cons	8.540706	.2774472	30.78	0.000	7.995639	9.085774

2SLS Regression Model

```
. ivreg lnpcgdp lnoptr lncsh_x lnimport democracy landlk landem hci, ro

Instrumental variables (2SLS) regression              Number of obs =     523
                                                      F(  7,   515) =  166.79
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.5361
                                                      Root MSE      =  .63065
```

lnpcgdp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnoptr	.1267052	.0490249	2.58	0.010	.0303918	.2230185
lncsh_x	.3341159	.1528942	2.19	0.029	.0337428	.6344889
lnimport	-.1884756	.1226054	-1.54	0.125	-.4293439	.0523926
democracy	.4153827	.0591112	7.03	0.000	.2992539	.5315115
landlk	-.610825	.2474105	-2.47	0.014	-1.096883	-.1247671
landem	.7286776	.3497828	2.08	0.038	.0415009	1.415854
hci	.4620716	.0944332	4.89	0.000	.27655	.6475932
_cons	8.540706	.2774472	30.78	0.000	7.995639	9.085774

(no endogenous regressors)

Fixed-effects (within) regression

```
. xtreg lnpcgdp lnoptr lncsh_x lnimport democracy landlk landem hci, fe
note: democracy omitted because of collinearity
note: landlk omitted because of collinearity
note: landem omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       523
Group variable: panelid                         Number of groups   =        20

R-sq:  within  = 0.0559                         Obs per group: min =         3
       between = 0.0092                                        avg =      26.1
       overall = 0.0257                                        max =        55

                                                F(4,499)           =      7.39
corr(u_i, Xb)  = -0.2637                        Prob > F           =    0.0000
```

lnpcgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnoptr	.0418652	.0198786	2.11	0.036	.0028091	.0809213
lncsh_x	-.1713869	.0632236	-2.71	0.007	-.2956042	-.0471696
lnimport	.0223186	.0515087	0.43	0.665	-.0788821	.1235194
democracy	0	(omitted)				
landlk	0	(omitted)				
landem	0	(omitted)				
hci	.19589	.0465861	4.20	0.000	.1043609	.287419
_cons	7.797293	.1172947	66.48	0.000	7.566841	8.027745
sigma_u	.79420206					
sigma_e	.25621666					
rho	.90573433	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(19, 499) =   186.38             Prob > F = 0.0000
```

Random-effects GLS Regression

```
. xtreg lnpcgdp lnoptr lncsh_x lnimport democracy landlk landem hci, re

Random-effects GLS regression                   Number of obs      =       523
Group variable: panelid                         Number of groups   =        20

R-sq:  within  = 0.0553                         Obs per group: min =         3
       between = 0.1817                                        avg =      26.1
       overall = 0.2574                                        max =        55

                                                Wald chi2(7)       =     36.48
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

lnpcgdp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnoptr	.0435537	.0203023	2.15	0.032	.0037619	.0833454
lncsh_x	-.1602191	.0645621	-2.48	0.013	-.2867584	-.0336798
lnimport	.0172768	.0525831	0.33	0.742	-.0857843	.1203378
democracy	.094003	.1914883	0.49	0.623	-.2813071	.4693132
landlk	-.5887754	1.496845	-0.39	0.694	-3.522537	2.344986
landem	.7598417	2.102208	0.36	0.718	-3.360411	4.880094
hci	.2045024	.0474011	4.31	0.000	.111598	.2974068
_cons	7.707865	.2195219	35.11	0.000	7.277609	8.13812
sigma_u	.48807292					
sigma_e	.25621666					
rho	.78395803	(fraction of variance due to u_i)				

Annex 3- **Summary statistics model 2**

Correlation coefficients

```
. pwcorr lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci
```

	lnOptr	lnPcGDP	lnPop	lnArea	landln~a	aver_ci	landlk
lnOptr	1.0000						
lnPcGDP	0.4779	1.0000					
lnPop	-0.0705	-0.1704	1.0000				
lnArea	0.0894	-0.0803	0.7700	1.0000			
landlnarea	-0.1951	-0.3506	0.1207	0.2586	1.0000		
aver_ci	-0.1410	0.3132	-0.2761	-0.2990	-0.0541	1.0000	
landlk	-0.2268	-0.3772	0.0712	0.1174	0.9274	-0.0070	1.0000
hci	0.2328	0.5219	0.0355	-0.0785	-0.0449	0.3316	-0.0138

	hci
hci	1.0000

Summary Statistics

```
. su lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,
```

Variable	Obs	Mean	Std. Dev.	Min	Max
lnOptr	791	-3.140629	1.636309	-12.17651	-.0727668
lnPcGDP	2695	7.690074	.8988929	5.085092	10.74914
lnPop	2695	1.511194	1.624513	-3.210892	5.178835
lnArea	2695	4.192893	2.076289	-1.737271	6.823928
landlnarea	2695	1.292034	2.223347	0	6.206076
aver_ci	2695	-.5815345	.5418042	-1.544314	.8858931
landlk	2695	.2820037	.4500586	0	1
hci	2220	1.447292	.3722858	1.007038	2.809442

Pooled OLS

```
. regress lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,robust

Linear regression                               Number of obs =     718
                                                F(  7,   710) =   69.64
                                                Prob > F      =  0.0000
                                                R-squared     =  0.3003
                                                Root MSE      =  1.3362
```

lnOptr	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnPcGDP	.7099482	.0779508	9.11	0.000	.5569066	.8629899
lnPop	-.171507	.0504114	-3.40	0.001	-.2704803	-.0725338
lnArea	-.0311952	.0637148	-0.49	0.625	-.1562872	.0938969
landlnarea	.0358688	.090027	0.40	0.690	-.1408821	.2126197
aver_ci	-1.05032	.1259408	-8.34	0.000	-1.297581	-.8030592
landlk	-.3160734	.4398856	-0.72	0.473	-1.179706	.5475588
hci	.7834937	.1541506	5.08	0.000	.4808482	1.086139
_cons	-10.19165	.5686031	-17.92	0.000	-11.308	-9.075306

2SLS

```
. ivreg lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,ro

Instrumental variables (2SLS) regression        Number of obs =     718
                                                F(  7,   710) =   69.64
                                                Prob > F      =  0.0000
                                                R-squared     =  0.3003
                                                Root MSE      =  1.3362
```

lnOptr	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnPcGDP	.7099482	.0779508	9.11	0.000	.5569066	.8629899
lnPop	-.171507	.0504114	-3.40	0.001	-.2704803	-.0725338
lnArea	-.0311952	.0637148	-0.49	0.625	-.1562872	.0938969
landlnarea	.0358688	.090027	0.40	0.690	-.1408821	.2126197
aver_ci	-1.05032	.1259408	-8.34	0.000	-1.297581	-.8030592
landlk	-.3160734	.4398856	-0.72	0.473	-1.179706	.5475588
hci	.7834937	.1541506	5.08	0.000	.4808482	1.086139
_cons	-10.19165	.5686031	-17.92	0.000	-11.308	-9.075306

```
(no endogenous regressors)
```

Fixed Effect

```
. tsset panelid yearcode, yearly
       panel variable:  panelid (unbalanced)
        time variable:  yearcode, 1960 to 2014
                delta:  1 year

. tsset panelid yearcode, yearly
       panel variable:  panelid (unbalanced)
        time variable:  yearcode, 1960 to 2014
                delta:  1 year

. xtreg lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,fe
note: lnArea omitted because of collinearity
note: landlnarea omitted because of collinearity
note: aver_ci omitted because of collinearity
note: landlk omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       718
Group variable: panelid                         Number of groups   =        31

R-sq:  within  = 0.0480                         Obs per group: min =         2
       between = 0.0155                                        avg =      23.2
       overall = 0.0185                                        max =        55

                                                F(3,684)           =     11.49
corr(u_i, Xb)  = -0.8426                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      lnOptr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnPcGDP |   .0116851   .1643497     0.07   0.943    -.3110054    .3343757
       lnPop |   1.096286   .2245559     4.88   0.000     .6553847    1.537188
      lnArea |          0  (omitted)
  landlnarea |          0  (omitted)
    aver_ci |          0  (omitted)
     landlk |          0  (omitted)
        hci |  -.7559084     .32328    -2.34   0.020    -1.390649    -.121168
      _cons |  -4.297121   1.325293    -3.24   0.001    -6.899251   -1.694991
-------------+----------------------------------------------------------------
     sigma_u |  1.9063547
     sigma_e |  1.1579621
         rho |  .73048064   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(30, 684) =    12.88             Prob > F = 0.0000
```

Random effect

```
. xtreg lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,re

Random-effects GLS regression                   Number of obs      =       718
Group variable: panelid                         Number of groups   =        31

R-sq:  within  = 0.0115                         Obs per group: min =         2
       between = 0.4312                                        avg =      23.2
       overall = 0.2338                                        max =        55

                                                Wald chi2(7)       =     27.79
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0002
```

lnOptr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPcGDP	.319864	.1345491	2.38	0.017	.0561526	.5835753
lnPop	.0535862	.1227636	0.44	0.662	-.1870261	.2941985
lnArea	-.0370535	.1290977	-0.29	0.774	-.2900803	.2159733
landlnarea	.0481799	.2104887	0.23	0.819	-.3643703	.4607302
aver_ci	-.702858	.2883589	-2.44	0.015	-1.268031	-.1376849
landlk	-.3696601	1.001614	-0.37	0.712	-2.332788	1.593468
hci	.5638011	.2224098	2.53	0.011	.127886	.9997163
_cons	-7.075548	1.095685	-6.46	0.000	-9.223051	-4.928045
sigma_u	.67207195					
sigma_e	1.1579621					
rho	.25197565	(fraction of variance due to u_i)				