IOSR Journal of Economics and Finance (IOSR-JEF)
e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 13, Issue 4 Ser. III (Jul. – Aug. 2022), PP 53-72
www.iosrjournals.org

An Investigation into the Effect of International Trade on the Economy Growth of Sub-Saharan Africa

MUGIMBA MWEHU YANNICK
Dissertation submitted for the requirements for the degree of
MASTER IN INTERNATIONAL TRADE AND ECONOMICS
in
FACULTY OF MANAGEMENT
(School of Economics and Management)
at the
ZHEJIANG SCI-TECH UNIVERSITY

ABSTRACT
Over the last few decades, Sub-Saharan African countries have implemented a number of trade reforms with the goal of increasing global openness and economic growth. Development economists and prominent multilateral institutions have recognized the positive contribution of international trade to economic growth in Sub-Saharan Africa, and their studies show that African countries have a strong potential for further economic growth and income development if invested in promoting international trade, despite their strong position to supply raw materials to major trading countries worldwide. However, their empirical studies continue to be questioned for at least three reasons:

- *There are still uncertainties about how trade openness is measured*

To determine the role of trade on growth among countries;

- *The estimation methodology and choice of regressors are still up*

For debate and not unanimously confirmed among researchers and policymaking groups; and

- *There are still uncertainties about how government policies*

Implemented effectively contribute to countries' economic growth.
The purpose of this study is to understand the contribution of trade openness to economic growth in Sub-Saharan African countries by using pooled regression of panel data econometrics from 1960 to 2015, and empirically testing the introduction of Human Capital and Corruption Indexes as new regressors to estimate the effects of trade openness on economic growth in Sub-Saharan Africa.
According to the study's findings, trade openness (as measured by the 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 a higher share of exports benefit more from trade openness than countries with a higher share of imports, as the latter significantly decrease the country's current account.
The effect of the import on the country's per capita income, however, was not statistically significant.
The study also discovered that the Human Capital Index has a strong and statistically significant positive impact on per capita income and trade openness in Sub-Saharan Africa, demonstrating how countries that have invested more in human capital development benefit more from trade openness than those that have invested less.
Nonetheless, the country's landlocked status has a statistically significant negative impact on per capita income. According to the research, landlocked Sub-Saharan African countries benefit less from trade openness than landlocked countries. Based on the findings of the study, this study recommends that governments throughout Sub-Saharan Africa increase their investments in human capital development through a variety of initiatives aimed at improving early learning and secondary education quality.
Sub-Saharan African countries should also increase their investments in export growth promotion initiatives by supporting export diversification policies, which will result in significant increases in country export volume. Export diversification in the agro-processing sector should be facilitated by focusing on organic food products, which are in high demand due to China's growing middle-income population. The latter would benefit from the majority of Africans, ensuring inclusive growth. Furthermore, governments in Sub-Saharan Africa should support intra-regional trade initiatives such as the recently signed African Continental Free Trade Agreement (AfCFTA) and ensure macroeconomic stability through comprehensive trade diversification policy reforms.

Date of Submission: 02-08-2022 Date of Acceptance: 15-08-2022

I. INTRODUCTION

1.1 Background

Sub-Saharan African countries, which have 54 governments, have implemented several international trade openness reforms to boost economic growth. These reforms are expected to improve trade openness, capital and goods mobility, and thus contribute to faster economic growth and development in Africa.

The empirical evidence from the literature on international trade and growth, remains mixed (Rodrik, 2001b); (Baliamoune, 2002); Yanikaya 2003). On the one hand, studies conclude that trade liberalization is not associated with economic growth and may actually slow countries' growth. For example, while (Sachs & Warner, 1997) argue that trade openness accelerates convergence, evidence from a study by (Baliamoune, 2002) suggests that increased trade openness has led to income divergence rather than convergence among African countries, and (Rodrik, 2001a) shows that the only systematic relationship between trade openness and growth is that as countries become richer, trade restrictions flatten.

However, multilateral institutions like the World Bank and the International Monetary Fund (IMF) have frequently made their support contingent on trade liberalization, especially among developing nations, the majority of which are located in Africa (Zahonogo & others, 2017).

The World Bank and the OECD have long recognized divergence in country behavior. Despite support for trade liberalization, industrialized economies have a tendency for trade protectionism; while developing countries have enjoyed special and preferential treatment in exporting and accessing markets in the rest of the world through the World Trade Organization's General Agreement on Tariffs and Trade (GATT), the share of African trade in global trade remains low.

According to WTO 2018 statistics, while the global export value was US$ 17.43 trillion, fifty two percent (52%) of the top ten merchandise traders account for more than half of global total exports, while forty-four (44%) of developing economies contributed only 44 percent of global 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.

Trade volume and GDP share have increased significantly across all regions. Between 2014 and 2017, the developed economy's export volume increased from 2.1 percent to 3.5 percent, while import volume decreased slightly from 3.4 percent to 3.1 percent. Over the last three years, the developing and emerging economies have seen an increase in export volume that has more than doubled from 2.7 percent to 5.7 percent. Unlike in developed economies, the volume of imports from developing and emerging markets increased dramatically between 2014 and 2017, rising from 2.7 percent to 7.2 percent.

When compared to other regions, which include the majority of Sub-Saharan African and Middle Eastern countries, the level of trade has improved significantly in terms of both exports and imports. The volume of exports as a share of GDP in Africa and the Middle East increased from less than 1% to 2.3 percent, while imports increased from 0.5 percent to 0.9 percent. Global merchandise volume has increased from 2.7 percent in 2014 to 4.7 percent in 2017. This has resulted in a slew of reforms implemented by various governments and economic blocs to ensure trade liberalization. However, African countries' share remains low, implying a number of improvements in trade policies and reforms.

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

The World Bank has made significant investments in recent years to promote trade openness among country members, particularly the least developed countries, with the expectation that once trade liberalization occurs, income will grow faster, reducing poverty. However, these World Bank assumptions have been called into question, raising concerns about the effects of trade reforms on poverty alleviation (Bussolo and Nicita,). Even though, African countries have recently implemented a number of policy measures aimed at trade promotion, such as encouraging exports, strategic imports, primarily electronics, and research and development.

In academic literature, there are still conflicting views on the role of trade liberalization in countries' income growth.

One trend of the literature on growth emphasizes the primacy of institutions in economic development (Rodrik, 2004); (Easterly & Levine, 2003); (Dollar & Kraay, 2003) and suggests that institutions are key for achieving economic reforms in developing countries(Addison & Baliamoune-Lutz, 2006); (Acemoglu, 2003); (Dollar & Kraay, 2003).

Whileotherauthorsconcludethatthereislimitedeffectoftradeliberationbecauseitonlyincreases incomeofcountrieswithflexiblepolicieswhichenablestrategicadjustments,(BussoroandNicita, n.d) and McCulloch, (Winters, 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.

Against this backdrop, this analysis would like to investigate the contribution of global trade to economic status in Sub-Saharan African countries.Against this backdrop, this analysis would like to investigate the contribution of global trade to economic status in Sub-Saharan African countries.

1.2 Problem statement

Despite the outward economic policies implemented by African countries in recent decades to boost economic growth, there are still open debates among policymakers and economists at various levels about the causalities between trade openness and growth.

International financial institutions such as the World Bank and the IMF recognize the positive effects of openness to international trade on a country's economic growth but fail to generalize their findings to all countries. According to the International Monetary Fund (1998), "international trade policies are among the factors that promote economic growth and convergence in developing countries," while the Organization for Economic Cooperation and Development (1998) reports that "economies characterized by more open and outward-oriented policy regimes consistently outperform economies that have adopted restrictive trade and foreign investment policies."

However, findings on the influence of foreign trade remain contentious among scholars, academics, and policymakers around the world. Some of the main reasons advanced in the preceding sections include, but are not limited to, I some doubts about how countries' openness to trade is measured, and (ii) the debate on the estimation methodology of the direction of income and trade openness itself, which includes the decision to make of estimators.

Freund and Bolaky (2008) used cross-country data from 126 countries to conduct a study on the impact of trade liberalization on income, and they discovered that (i) openness to trade has a positive and significant impact on per capita income, and (ii) trade could contribute to improved living standards if countries adopt flexible policies, while non-flexible (rigid) economic policies had no impact. Calderon et al. (2004) found that

trade liberalization has a positive impact on growth only in high-income countries; they found no per capita growth effects caused by trade openness in low-income countries.

1.3 Objective of the study

The goal of this research is to compare the contribution of trade liberalization to economic growth in Sub-Saharan African countries that have chosen increased trade liberalization versus those that have chosen neutral trade policies. The study also conduct a comprehensive review of the existing literature on trade openness and economic growth in order to reconcile the findings that will support the conclusion and policy recommendations that will guide policymakers and future researchers.

1.4 Research question

The following research questions guided this study:

- What role does trade openness play in the economic growth of Sub-Saharan African countries?

- Is there a link between per capita income and trade openness in Sub-Saharan African countries, or vice versa? Is there a link between the two?
- Is there any evidence that Sub-Saharan African countries should continue to invest in trade openness and liberalization?

1.5 Research hypotheses

The following two research hypotheses guided this study:

Ho Trade openness has no effect on growth in Sub-Saharan African countries.
H1: Trade openness has a significant impact on growth in Sub-Saharan African countries.
Ho: Per capita income has no effect on Sub-Saharan African countries' openness to international trade.
H1: Per capita income has a significant effect on Sub-Saharan African countries' openness to international trade.

1.6 Contribution of this study to science.

This study contributed to a better understanding of the effect of international trade on Sub-Saharan African economic growth. The study boosted the momentum of academics and analysts investigating the role of international trade in poverty reduction in Sub-Saharan African countries.

II. 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

Economic growth theories date back to the 15th century and even before that, all the way up to the present day. This section includes a discussion of selected literature. The thesis attempts to extrapolate the direct and indirect links between international trade and global economic growth.

2.1.1. Mercantilism andPhysiocrats

Since the 15th century, the concept of economic growth has been a topic of debate among various economists, policymakers, political elites, and, most importantly, research academics who have invested resources and time to investigate why some countries become rich while others become poor, and the ingredient behind economic growth that leads to sustainable development. The primary motivation for economic growth was and continues to be to hypothesize how economies can increase the quantity of goods and services they produce over time. Mercantilism was a concept that emerged in the 15th century and advocated primarily for the static nature of economic wealth.Pondered the role of international trade in increasing a country's income,

particularly the economy's ability to export more as a source of increased incomeand overall wealth.Among the most prominent mercantilist activists are Jean Bodin (1530-1596), Thomas Mun (1571-1641), and Giovanni Botero (1544-1617).

Physiocrats, in contrast to mercantilism, believed and advocated for land development through agriculture as the sole and immune source of wealth in the economy. The physiocrat theory emerged in France during the 18th century, during the Enlightenment era in their theories, they believed that agriculture produced should be expensive1. The physiocratic movement was primarily orchestrated by Anne-Robert-Jacques Turgot (1727-1781) and François Quesnay (1694-1774). This movement, however, was directly preceded by the first modern school of classical economics, which began in 1776 with the publication of Adam Smith's famous Wealth of Nations.

2.1.2. Classical Growththeory

The classical economists of the 18th and 19th centuries developed early theories on economic growth. 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), according to Barro and Sala Martin (2003), provided many of the basic elements that appear in modern theories of economic growth. The production function makes use of two key factors: capital (K) and labor (L). These, however, increase production efficiency (T). As a result, the production function is summarized below.

$Y = f(x)$ where $x \in R$ is a $p \times 1$ vector of production factors (the input) and $y \in R$ is a $q \times 1$ 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-Roegenproduction function $Y = f(k,x)$where $k \in R$ is a $m \times 1$ 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) claims that "three circumstances are responsible for this great increase in the quantity of work which, as a result of the division of labor, the same number of people are capable of performing: (i) the increase of dexterity in every particular workman; (ii) the saving of 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 labor, and enable one to Smith also sees advances in machinery and international trade as growth engines because they enabled further specialization.

Rostow (1992) added to Adam Smith's views on the source of wealth by arguing that economic growth engines affecting population growth (L), capital growth (K), the division of labor (technological progress) (T), and the institutional framework of the economy (T) are all important (competitive-free traded market economy). Sachs (2013) points out that Adam Smith does not develop a long run growth theory as such, but rather refers to the importance and effects of increasing labor productivity as well as saving.

2.1.3. Neoclassical growththeories

Various authors who developed sets of growth models spawned neoclassical economic growth. Many of them also mentioned aspects of international trade that support economic and income growth. The models discussed in this article include the Harrod Domar model, the endogenous growth model, and the Solow growth model. The model of neoclassical growth theory is used in this study to explain how openness to international trade affects income.

a. Harrod–Domar model

Roy F. Harrodin (1939) and Evsey Domar (1939) developed the Harrod-Domar model of economic growth (1946). The model is a forerunner to the exogenous growth model, and it was originally designed to aid in the analysis of the business cycle, but it was later modified to explain economic growth as well. The model's main assumption is that economic growth is determined by the amount of labor and capital supplied; thus, increased investment leads to capital accumulation, which generates economic growth. The model has implications for less economically developed countries, where labor is abundant but physical capital is scarce, slowing economic progress (Jones, 2002).

Poor countries are poor in this regard due to a lack of sufficient savings, which limits the accumulation of physical capital stock through investments. To put it another way, the Harrod-Domar model views investment as critical to economic growth by emphasizing the dual nature of investment, the Demand Effect and the Supply Effect of investment. The former generates income, whereas the latter increases the economy's productive capacity by increasing its capital stock.

b. Endogenousgrowth

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

Unsatisfied with the explanation provided by the Solow-Swan Growth model, economists such as Paul Romer and Robert Lucas, Jr. developed the Endogenous Growth Theory. This theory incorporates a new concept of human capital as well as a mathematical explanation of technological innovation (or the skills and knowledge that make workers productive). Unlike physical capital, human capital (education) has increasing rates of return, according to this theory. As a result, capital returns are constant, and economies never reach a steady state.According to Romer (1994), growth does not slow as capital accumulates, but the rate of growth is determined by the type of capital a country invests in.

2.1.4. Solow Swan growth model

Robert Solow (1956) and Trevor Winchester Swan are credited with developing the Solow Swan model (1956). According to (Acemoglu et al., 2009), this growth model has significantly influenced how we view not only economic growth but also the entire field of macroeconomics. The Solow Swan model assumes technological progress and investigates the effects of output division between consumption and investment on capital accumulation and growth.

In this section, we explain the neoclassical growth theory using David Romer's (2012) discussion of the Solow model.The Solow model is concerned with four variables: output (Y), capital (K), labor (L), and "knowledge" or "labor effectiveness" (A). The economy always has some amount of capital, labor, and knowledge, which are combined to produce output. $Y(t) = F(K(t), A(t)L(t))$ is the production function.

Where t stands for time It is worth noting that time enters the production function indirectly, via K, L, and A. That is, output changes only if the inputs to production change over time. The amount of output obtained from given amounts of capital and labor, in particular, rises over time—there is technological progress—only if the amount of knowledge increases. It's also worth noting that A and L appear in multiples.

AL is known as effective labor, and technological progress that enters in this manner is referred to as labor-augmenting or Harrod-neutral. Together with the other assumptions of the model, this way of specifying how A enters implies that the capital-to-output ratio, K/Y, eventually settles down. In practice, capital-output ratios do not exhibit a clear upward or downward trend over long periods of time. Furthermore, building the model so that the ratio eventually becomes constant simplifies the analysis. Assuming A multiplies L is thus very convenient. The Solow model's central assumptions 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

2.2.1Ricardianmodel

The Ricardian model is widely regarded as the most fundamental and straightforward general equilibrium model for explaining international trade. Despite being superseded by other more complex models, the Ricardian model remains the gold standard for the introduction of today's new ideas in trade.

The Ricardian model is a new concept that emerged many years after David Ricardo. According to(Ruffin, 2002), David Ricardo introduced only a portion of the model in 1816, but the Ricardian model first appeared in Mill (1844). Regardless, this model now bears Ricardo's name. This model was primarily concerned with the amount of labor required to produce traded goods, thus the concept of comparative advantage. According to Ruffin, this is the first appearance of the Ricardian model, was in Mill(1844).

The simple Ricardian model depicts a world with two countries, A and B, each producing two goods, X and Y, with a single factor of production, labor L. Technologies exhibit constant returns to scale, which means that a fixed amount of labor a_g^c is required to produce a unit of output of each good, g=X,Y, in each country, c=A,B, regardless of total output. All markets are perfectly competitive, so goods are priced at cost in the countries where they are produced, $p_g^c = w^c a_g^c$, where w^c is the competitive wage in country c.

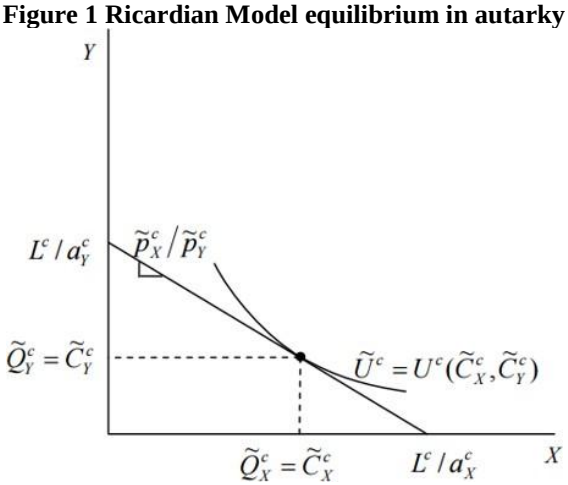
Labor is in fixed supply in each country, L^c; it is immobile between them but perfectly mobile within them.The Ricardian Model typically leaves demand for goods less fully specified than supply, though a modern formulation might specify a utility function, $U^c = U^c(C_x^c, C_y^c)$, for each country, which the representative consumer maximizes subject to a budget constraint. Utility functions may be assumed to be identical across countries, homothetic, or even Cobb-Douglas, though most properties of the model's solution do not require any of these assumptions.

The Ricardian model's most basic application compares autarkic equilibria to those of free and frictionless trade. Because both goods must be produced in each country, prices in autarky are determined immediately by the costs stated above, with further analysis required only to determine quantities produced and consumed.If this is

the case, linear technology implies a linear production possibility frontier (PPF), which also serves as the consumer budget line in autarky.

Figure 1 depicts the autarky equilibrium, where "p˜ " denotes autarky and Q denotes production. Comparison of the two countries in autarky is based primarily on their relative costs of producing the two goods, which define their comparative advantage in this model. As an example, suppose country A has a comparative advantage in good X:

Figure 1 Ricardian Model equilibrium in autarky



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

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

Little more can be said about autarky without making additional assumptions about preferences, but If preferences are identical and homothetic, with positive substitution elasticity, then that

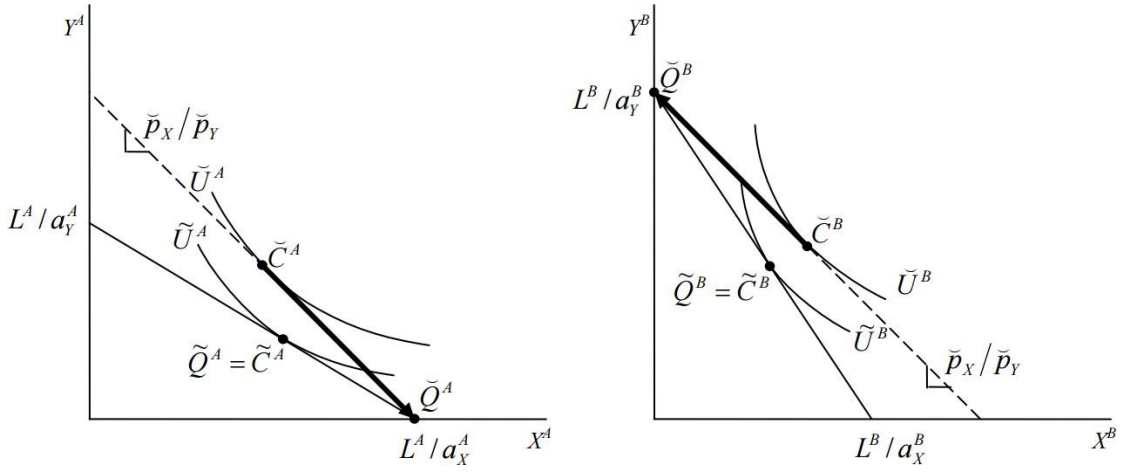
$$\tilde{Q}_X^A / \tilde{Q}_Y^A > \tilde{Q}_X^B / \tilde{Q}_Y^B$$

Prices in both countries must be the same in order for trade to be free and frictionless. Depending on the supply and demand for goods in the two countries, two types of equilibrium are possible. One type of equilibrium has global relative prices, denoted here by " ˇ ", which are strictly between the relative prices of the two countries in autarky:

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

In that case, each country must specialize in producing only the good whose relative cost is lower than the global relative price, i.e. the good in which it has a comparative advantage. Each must invariably export that good. With such complete specialization, goods outputs are determined by labor endowments and productivities, so global supply and demand equality must be achieved from the demand side. That is, world prices are set in such a way that the demands of the two countries equal the quantity produced in one of them. These demands are a result of each country's consumers' expanded budget constraints, and they reflect the value at world prices of the single good that the country produces.Consumers can now consume more of both goods than they could in autarky, unless they want to consume only that single good. Whether or not they do so is determined by the extent to which they substitute for the cheaper good now imported from abroad, but in any case, they reach a higher indifference curve and are better off. Figure 2 depicts all of this. For this to be an equilibrium, the amount of each good exported by one country must equal the amount imported by the other, so the heavy arrows representing net trade in each panel of the figure must be equal and opposite.

Figure 2 Trade equation for complex specialization



The study looked at the Ricardian model, which is the simplest model for explaining how differences between countries give rise to trade and trade gains. Labor is the only factor of production in this model, and countries differ only in labor productivity across industries. Countries will export goods that their labor produces relatively efficiently and import goods that their labor produces relatively inefficiently in the Ricardian model. In other words, comparative advantage determines a country's production pattern. We can demonstrate that trade benefits a country in one of two ways. To begin, we can consider trade to be an indirect method of production.

Rather than producing a good for its own consumption, a country can produce another good and trade it for the desired good. The simple model shows that whenever a good is imported, the indirect "production" must require less labor than direct production. Second, we can demonstrate that trade expands a country's consumption options, implying trade gains. The distribution of trade gains is determined by the relative prices of the goods produced by countries. To determine these relative prices, consider the relative global supply and demand for goods. A relative wage rate is implied by the relative price.

There is no requirement that a country be "competitive" or that trade be "fair" in order for trade to be beneficial. We can show that three commonly held beliefs about trade are incorrect. First, a country benefits from trade even if its productivity is lower than that of its trading partner across all industries.

Second, trade is advantageous even if foreign industries are competitive solely due to low wages. Third, trade benefits a country even if its exports contain more labor than its imports. Extending the one-factor, two-good model to a world of many commodities yields the same results.The only difference is that instead of working through relative demand for goods, it is necessary to focus directly on relative demand for labor to determine relative wages. A multi-commodity model can also be used to demonstrate the critical point that transportation costs can lead to a situation in which some goods are not traded. While some of the Ricardian model's predictions are obviously 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-Ohlinmodel

The Heckscher Ohlin model of international trade is based on the theory of comparative advantage and contends that countries can export goods and services that they can produce more efficiently and abundantly than other countries.

According to the Heckscher Ohlin model, comparative advantage is heavily influenced by the interface between a country's resources, such as I the relative abundance of factors of production and (ii) production technology, which greatly influences the relative intensity with which different factors of production are utilized in the production of various goods and services.To better understand the role of resources in trade, a model is developed in which two goods are produced using two factors of production.

The two goods differ in their factor intensity, which means that at any given wage-rental ratio, one of the goods will use a higher ratio of capital to labor than the other. As long as a country produces both goods, the relative prices of goods and the relative prices of factors used to produce the goods have a one-to-one relationship. A rise in the relative price of the labor-intensive good will strongly shift the income distribution in favor of labor: 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.

When the supply of one factor of production increases, the output of the good intensive in that factor rises while

the output of the other good falls. A country with a large supply of one resource in comparison to its supply of other resources has an abundance of that resource. A country will produce relatively more goods that make intensive use of its abundant resources. As a result, countries tend to export goods that are intensive in the factors with which they are abundantly supplied, according to the basic Heckscher-Ohlin theory of trade.Because changes in relative prices of goods have a large impact on the relative earnings of resources, and because trade changes relative prices, international trade has a significant impact on income distribution. Owners of a country's abundant factors benefit from trade, while owners of scarce factors suffer. However, in theory, there are still gains from trade, in the limited sense that the winners can compensate the losers, and everyone is better off. Increasing trade integration between developed and developing countries could potentially explain rising wage inequality in developed countries. However, there is little empirical evidence to support this direct link. Rather, empirical evidence suggests that technological advancements that reward worker skill have played a much larger role in driving wage inequality.

2.2.3Specific factorsmodel

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

As a result, the specific factors model is a useful model of income-distribution effects that distinguishes between general-purpose factors that can move across sectors and factors that are specific to specific uses. In the specific factors model, differences in a country's resources can cause that country to have different relative supply curves, resulting in international trade.

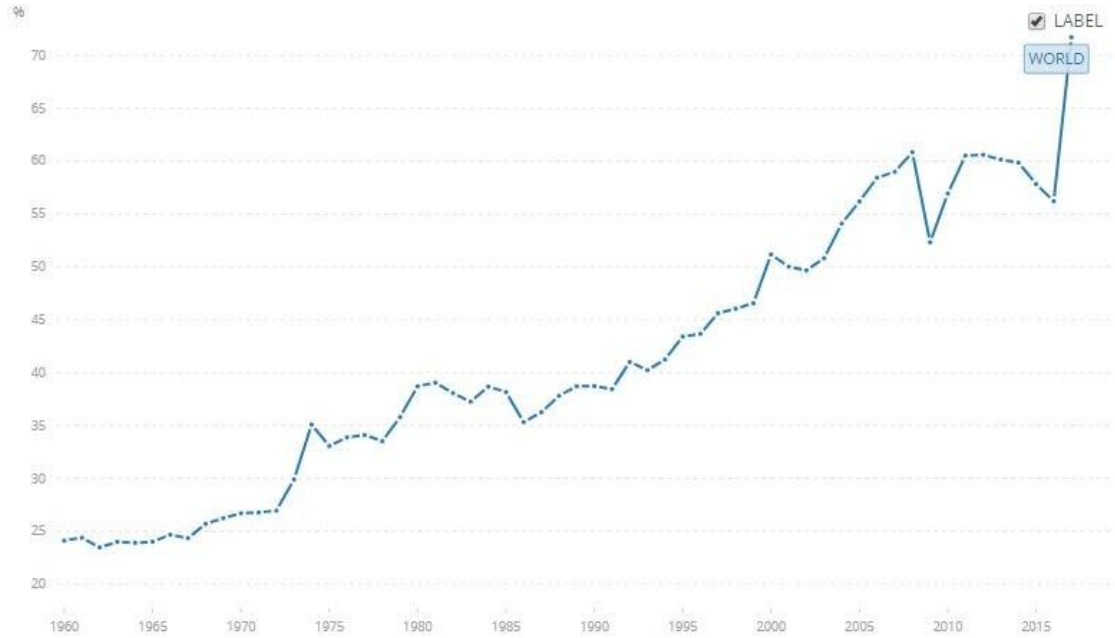
In this model, factors specific to import-competing sectors in each country suffer from international trade while factors specific to export-competing sectors benefit from international trade. Furthermore, mobile factors that can work in either sector (import or export) may gain or lose. However, international trade generates overall gains in the limited sense that those who benefit could theoretically compensate those who lose while still being better off than before. Despite this, most economists do not believe that the effects of trade on income distribution are a compelling reason to restrict international trade.This is because, in terms of distributional effects, international trade is no different from many other forms of economic change that are not typically regulated, and economists would typically prefer to address the issue of income distribution directly rather than by interfering with trade flows. Income distribution is critical in trade policy because people who lose from trade are usually a much more informed, cohesive, and organized group than those who gain.

2.2.4Standard trademodel

The Heckscher-Ohlin, Ricardian, and Specific Factors models are considered special cases of the standard trade model. The standard trade model is based 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 terms of trade—the price of a country's exports divided by the price of its imports—on a country's welfare.

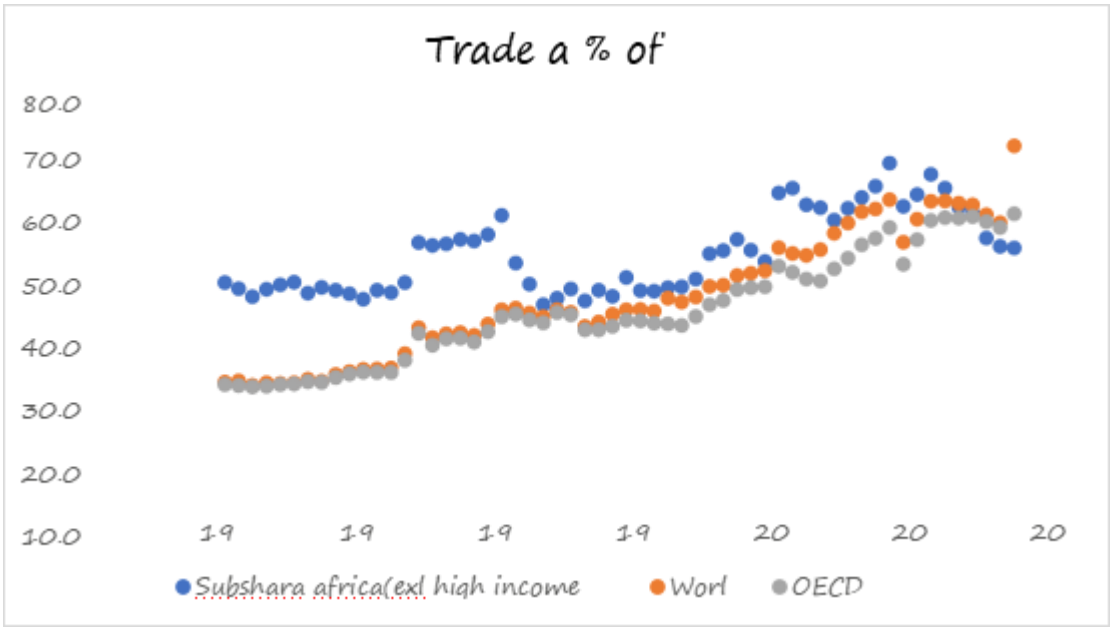
Countries all over the world have been working hard to understand the effects of international trade policies and lower trade barriers on boosting economic growth and increasing per capita income.(Sachs & Warner, 1995) developed binary indicators (SWWW); these indicators were revised and updated by Wacziarg and Welch (2003). The logic behind these indicators is that a country is considered closed to international trade in any given year if at least one of the following conditions is met: I the country's exports are consistently monopolized; (ii) the black market premium on the exchange rate exceeds 20%; (iii) non-tariff barriers cover more than 40% of its imports; and (iv) average tariffs exceed 40%; (v) it has a socialist economic system.If none of these conditions are met, a country is considered open to international trade. Based on the above binary indicator of openness—or economic liberalization, in the words of (Giavazzi & Tabellini, 2005), we can conclude that global trade openness has increased from the 1960s to 2015.

Figure 3 Global trade openness as percentage of GDP.



Source: World Bank development indicator

Figure 4 Openness growth: Sub-Sahara African, world and the OECD member countries



2.3 Empirical Studies on Trade Openness and Growth

Several studies use the approach of measuring trade volumes normalized by GDP and extended to instrumental variable framework analysis to investigate the relationship that exists between economic growth and trade openness (e.g., Frankel & Romer, 1999).

Several notable cross-country studies, including Edwards (1992, 1998), (Dollar, 1992), (Sachs & Warner, 1995), recognized a positive link between trade openness and growth, according to(Barro, 1991) study on growth regressions. In a study conducted in a historical context, (Vamvakidis, 2002) discovers that international trade is only associated with economic growth after 1970, but not before that year.

Furthermore, (Bhagwati, 2002) demonstrate that using cross-country regressions to investigate the effects of trade on growth is a poor approach. They also contend that the choice of sample, proxies, and period will result in numerous degrees of freedom.

Other economists, including Romer and Frankel (1999) and Tervio and Irwin (2002), use gravity models to find positive effects of international trade on growth by isolating geographical components of openness assumed to be independent of economic growth. Land area, borders, distances, and population are all presumably considered exogenous instruments. These instruments may have indirect effects on economic growth, skewing estimates of trade's effects on growth.

In the presence of imperfect competition or increasing returns, Devarajan and Rodrik (1989) use a general equilibrium model to show that trade liberalization can be either welfare-enhancing or welfare-reducing. Furthermore, Young (1991) demonstrates that a country's growth can be higher under autarky than under free trade, and(Rassekh, 2004) provides an overview of theoretical models demonstrating that trade openness can have either positive or negative effects on growth across countries.

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

III. RESEARCH METHODOLOGY

In addition to desk reviews of empirical and theoretical literature on trade and income growth around the world, the analysis of the impact of international trade on income in Africa has followed an unbalanced panel data analysis of all Sub-Saharan African countries, with 50 countries included in the data series. The data in the time series ranged from 1960 to 2015.

3.1. ModelSpecification

We use the time series regression model used by (Petkovski et al., 2014) in their analysis of Empirical Analysis of the Effects of Trade Openness on Economic Growth for South East European Countries to try to identify the relationship between international trade openness and per capita income levels in African countries.

3.1.1 Model one: Estimating the effects of trade openness ongrowth

The first model estimated the relationship between GDP and other macro-institutional covariates.

$lnGDPit = \beta o + \beta 1$ lnoptrit+ $\beta 2$ lncsh_xit+ $\beta 3$ lnimportit+ $\beta 4$ lndemocracyit+ $\beta 5$ landlkit+ $\beta 6$landemit+ $\beta 7$hci + ε *it*

Where $\boldsymbol{lnGDPit}$ is the natural logarithm of per-capita real income in country *i* at time *t*.

Explanatory variables are **lnoptrit** which is the natural logarithm of openness to trade (import + export as percentage of GDP), **lncsh_xit**, is the transformed level of export, **lnimportit** is the transformed level of import, **lndemocracyit**, which is the index of democracy(measuring the institutional quality), and$\boldsymbol{hcit}$**t**which is the human capital index, and **landlkit**refers to landlockedness of the country, **landemit**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 second model estimated the relationship between the instruments and trade openness.

$ln\ optrit = \pi o + \pi 1 ln\ area + \pi 2 ln\ pop + \pi 3 ln\ dist + \pi 4 landlk + ui$

Where are $\boldsymbol{ln\ optrit}$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 created with the idea that openness and GDP can have a bidirectional relationship, so the testing of two variables was critical. (Helpman, 1988), Colin Bradford, Jr., Naomi Chakwin, and Rodrik (1995) demonstrated that countries with high incomes for reasons other than trade may trade more. Furthermore,(Krugman, 1990) asserts that growth augments a country's income once growth inputs (capital, labor, education, and infrastructure) rise, implying 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, resulting in biased and inconsistent estimates of trade openness's effects on African income.

Furthermore, in our model, the explanatory variables of trade openness are likely to be equally correlated with the residuals. This is because, as(Frankel & Romer, 1999) argue, countries that pursue free-market trade policies are more likely to pursue free-market domestic policies as well as stable fiscal and monetary policies. Because these policies are likely to affect income, countries' trade policies are likely to be correlated with factors omitted from the income equation, potentially violating the orthogonality assumption. Furthermore,(Frankel & Romer, 1999)considered geographical variables as valid instruments for dealing with endogeneity when GDP and openness are discussed.More specifically, we use area and population, distance between countries, and a dummy for landlockedness as trade openness instruments because these variables are important determinants of within-country trade, which affects trade openness.

The intuition is that countries with larger areas and populations have lower trade openness than smaller ones, while landlockedness and distance also reduce a country's trade. As a result, the following trade openness model is estimated:

The first and foremost method of analysis used was pulled Ordinary Least Squares (OLS) methodology to estimate the effects, followed by Two stage least squares to identify economic problems such as endogeneity and heteroscedasticity, because we expected within and between difference of each variable's effect, fixed and random effects were tested. Furthermore, the analysis has expanded on summary statistics for each variable in the model.

IV. FINDINGS AND DISCUSION

The chapter presents findings on the impact of trade openness and income in Sub-Saharan African countries where data were available. The analysis goes on to investigate the impact 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 lncsh_x				
	0.127** (0.0490)	0.127** (0.0490)	0.334** 0.0419** (0.0199)	0.0436** (0.0203)
	0.334** (0.153)	(0.153)	-0.171*** (0.0632)	-0.160** (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*** (0.277)	8.541*** (0.277)	7.797*** (0.117)	7.708*** (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

The dependent variable, per capita GDP-, has been transformed into log values.

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

While landlockedness was significant, being a landlocked country contributed less to per capita income growth.

The analysis's impressive findings demonstrated that human capital and democracy are significant and potential contributors to per capita income growth. At 1% and 5%, respectively, the human capital coefficients were significant.The import level coefficient in a given country does not provide sufficient evidence to support the negative contribution to per capita income. These findings support the findings of(Petkovski et al., 2014) in their empirical study of the effects of trade openness on economic growth in South East European countries. See the detailed analysis procedures annex.

4.2. Estimating the effects of instruments on Trade openness

Table 4 The effects on instruments on tradeopenness

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*** (0.126)	-1.050*** (0.126)		-0.703** (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*** (0.569)	-10.19*** (0.569)	-4.297*** (1.325)	-7.076*** (1.096)
Observations	718	718	718	718
R-squared	0.300	0.300	0.048	
Number of panelid			31	31

Robust standard errors inparentheses
*** p<0.01, ** p<0.05, * p<0.1
Dependent variable is tradeopenness

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 levels of human capital may have a higher level of trade openness, and the coefficients were significant at 1% and 5% significant levels. Landlockedness, corruption, and population, on the other hand, have a negative impact on country openness. Landlockedness reduces trade openness by 4% for each unit/index of distance toward the sea level, and countries with a high corruption index tend to have very low trade openness.This study was surprising in 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 tested two hypotheses: whether trade openness affects growth in African countries regardless of income level. The findings revealed that openness has a significant impact on per capita income and that each unit increase in trade openness contributes to a 2.5 percent increase in per GDP. The study also investigated whether GDP has a relationship with trade openness; as a result, the study discovered that each unit of GDP increase contributes to approximately 9 units of increase in openness. However, these findings appear plausible, and more research should be conducted to produce more reliable linkages using block level analysis by country income classification

V. CONCLUSIONS AND POLICY RECOMMENDATIONS

The study on Investigation into the Effect of International Trade on the Economy Growth of Sub-Saharan African countries has thoroughly reviewed both recent and historical literature on the role of trade in country growth.

The literature was also reviewed to try to understand what the growth theories value or hypothesize about trade openness and countries' economic growth. According to the findings of the reviews of empirical and theoretical findings, the empirical evidence from the large and growing literature on trade and growth remains mixed. On the one hand, studies indicate that trade liberalization is not associated with growth and may actually slow countries' economic growth.For example, while (Sachs & Warner, 1997) argue that trade openness accelerates convergence,

evidence from a study by(Baliamoune, 2002)suggests that increased trade openness has led to income divergence rather than convergence in African countries, and(Rodrik, 2001a) claims that "the only systematic relationship between trade openness and growth is that countries dismantle trade restrictions as they become richer." The International Monetary Fund (IMF) and the World Bank, on the other hand, have frequently made their support conditional on trade liberalization, particularly among developing countries, the majority of which are in Africa(Zahonogo & others, 2017). There is mounting evidence that trade openness boosts export growth, which in turn boosts forex earnings, reducing or contributing to current account improvement.

While global international trade flows have improved dramatically in recent decades and continue to do so today, there has been a tendency for trade protectionism, despite support for trade liberalization. While developing countries have received special and preferential treatment in exporting and accessing markets throughout the world thanks to the World Trade Organization's General Agreement on Tariffs and Trade (GATT), African trade as a share of global trade remains low. For example, while global export value was US$ 17.43 trillion in 2018, 52 percent of the top ten merchandise traders account for just over half of the global total, while 44 percent of developing economies had a 44 percent share of world merchandise trade in 2017. (WTO, 2018).

When it comes to the benefits of international trade and the openness of countries, a variety of factors were considered, including institutions, democracy, human capital, and geographical location. Despite this, academic literature on the role of trade liberalization in countries' income growth remains divided. One school of thought in the growth literature has argued for the primacy of institutions in economic development(Easterly & Levine, 2003); (Dollar & Kraay, 2003); (Rodrik, 2004), emphasizing the importance of institutions in the success of economic reforms in developing countries(Acemoglu, 2003);(Dollar & Kraay, 2003); (Addison & Baliamoune-Lutz, 2006).While some scholars conclude that trade liberalization has a limited effect on income because it only increases income in countries with flexible policies that allow for strategic adjustments, others, such as(Winters, 2001), conclude that the effect of trade on poverty is largely country specific and is driven by various characteristics of poor households that do not provide enough evidence for generalization.

This analysis shed more light on a number of variables that could affect per capita income growth by combining all of the above information. Trade openness, corruption index, and human capital index, landlockedness of countries, import and export levels are among them.

These covariates were regressed against per capita income growth in sub-Saharan African countries using pooled regression, two stage least squares to test for endogeneity, and random and fixed effects.

According to the findings of this study, openness to international trade (as measured by the import and export ratio to GDP) is statistically significant and robust at the 5% significance level for inducing country per capita income growth in Sub-Saharan African countries. According to this study, countries with a higher share of exports are more likely to benefit from trade openness than countries with a higher share of imports, as the latter dampen the current count. However, in Sub-Saharan African countries, the effect of imports on per capita GDP was not statistically significant.

The study also found that countries with higher human capital indexes benefit more from trade openness, with the results being robust and significant at both 1% and 5%. Furthermore, findings indicate that landlocked Sub-Saharan African countries benefit less than non-landlocked countries.

The analysis concludes with the following recommendations:

- Given the low level, governments across African continents

Should strive to raise the human capital index by investing in early learning and improving educational quality. This could be accomplished through increased investments in the education sector as well as the development of integrated human health policies such as stunting, early vaccination, and ante-natal care.

- The study also recommends that the government increase its

Investments in export growth promotion initiatives by supporting export diversification policies in order to boost significant increases in the country's export volume. Because Africa is predominantly agrarian, countries should focus on agriculture sector reforms that transform agriculture into a business-led sector in order to produce beyond subsistence and small-scale agriculture. Agro-processing should be facilitated by focusing on organic food items, which are in high demand due to China's growing middle-income population.

- Oil and mineral exporting Sub-Saharan African countries must

Continue to invest in value addition and diversification of export destinations by embracing intra-Africa trade deals made through various economic blocks such as the Southern African Development Community, East African Community, Economic and Monetary Community of Central Africa, Economic Community of West African States, and the recently enacted African Free Trade Area (ACfTA).

- Finally, African governments should continue to invest in

Collective reforms aimed at removing all non-tariff barriers that continue to be major impediments to African trade openness. Reforms in local and regionally harmonized trade policies, competition policies, exchange and fiscal policies, as well as inflation control within different Sub-Saharan African economies, may be included.

References

[1]. Acemoglu, D. (2003). Root causes. Finance \& Development, 40(002).
[2]. Acemoglu, D., Johnson, S., Robinson, J. A., & Yared, P. (2009). Reevaluating the modernization hypothesis. Journal of Monetary Economics, 56(8), 1043–1058.
[3]. Addison, T., & Baliamoune-Lutz, M. (2006). Economic reform when institutional quality is weak: The case of the Maghreb. Journal of Policy Modeling, 28(9), 1029–1043.
[4]. Baliamoune, M. N. (2002). The new economy and developing countries: Assessing the role of ICT diffusion (Issue 2002/77). Wider discussion paper.
[5]. Barro, R. J. (1991). Economic Growth in a Cross Section of Countries*. The Quarterly Journal of Economics, 106(2), 407–443. https://doi.org/10.2307/2937943
[6]. Bhagwati, J. (2002). Free Trade Today, Princeton. Princeton Univ. Press.
[7]. Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. Economic Development and Cultural Change, 40(3), 523–544.
[8]. Dollar, D., & Kraay, A. (2003). Institutions, trade, and growth. Journal of Monetary Economics, 50(1), 133–162.
[9]. Easterly, W., & Levine, R. (2003). Tropics, germs, and crops: how endowments influence economic development. Journal of Monetary Economics, 50(1), 3–39.
[10]. Frankel, J. A., & Romer, D. (1999). Does Trade Cause Growth? 89 Amer. Econ. Rev, 379.
[11]. Giavazzi, F., & Tabellini, G. (2005). Economic and political liberalizations. Journal of Monetary Economics, 52(7), 1297–1330.
[12]. Helpman, E. (1988). Growth, technological progress, and trade. National Bureau of Economic Research Cambridge, Mass., USA.
[13]. Krugman, P. R. (1990). Rethinking International Trade, Cambridge MA and London. MIT Press.
[14]. Petkovski, M., Jordan, K., & others. (2014). An analysis of non-life insurance determinants for selected countries in central and South Eastern Europe: a co-integration approach. Romanian Journal of Economic Forecasting, 17(3), 160–178.
[15]. Rassekh, F. (2004). The interplay of international trade, economic growth and income convergence: a brief intellectual history of recent developments. The Journal of International Trade \& Economic Development, 13(4), 371–395.
[16]. Rodrik, D. (2001a). The global governance of trade: as if development really mattered (Vol. 58). UNDP New York.
[17]. Rodrik, D. (2001b). Trading in illusions. Foreign Policy, 55–62.
[18]. Rodrik, D. (2004). Institutions and economic performance-getting institutions right. CESIfo DICE Report, 2(2), 10–15.
[19]. Ruffin, R. (2002). David Ricardo's discovery of comparative advantage. History of Political Economy, 34(4), 727–748.
[20]. Sachs, J. D., & Warner, A. (1995). Natural resource abundance and economic growth. National bureau of economic research Cambridge, Mass., USA.
[21]. Sachs, J. D., & Warner, A. M. (1997). Sources of slow growth in African economies. Journal of African Economies, 6(3), 335–376.
[22]. Vamvakidis, A. (2002). How robust is the growth-openness connection? Historical evidence. Journal of Economic Growth, 7(1), 57–80.
[23]. Winters, L. A. (2001). Le souci de réduire la pauvreté devrait-il mettre un frein à la libéralisation des échanges? Revue d'économie Du Développement, 9(1), 245–259.
[24]. Zahonogo, P., & others. (2017). Financial development and poverty in developing countries: evidence from Sub-Saharan Africa. International Journal of Economics and Finance, 9(1), 211–220.

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 perperson, based on years ofschooling 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

Linearregression

Number ofobs=523
F7,515) =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 ln pcgdp 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 vari able: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 thatallu_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 vari able: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 landlkhci,

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

Linearregression Number ofobs=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 ln Optr lnPcGDP lnPop lnArea landlnarea aver_ci landlk hci,ro
Instrumental variables(2SLS)regression

Number ofobs= 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

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 vari able: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 thatallu_i=0: F(30,684)=12.88 Prob > F =0.0000

Random effect

. xtreg lnOptr lnPcGDP lnPop lnArea landlnarea aver_ci landlkhci,re

Random-effects GLS regression		Number	of obs	=	718
Group vari able: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)		