ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF GRADUATE STUDIES

EFFECTS OF TRADE OPENNESS ON ECONOMIC GROWTH IN AFRICA

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JUNE, 2021

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Development Economics

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JUNE, 2021

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DECLARATION

I, the undersigned, declare that this work titled “Effects of Trade openness on Economic growth in Arica” is a result of my own effort and study. I have produced it independently except with the guidance and suggestion of the advisor Zelalem G. Terfa (PhD). All sources of materials used for the research paper have been duly acknowledged. This has not been submitted either in part or full in this university or any other university for earning any degree. It is submitted here in partial fulfillment of the requirement for the Master of Science in Development Economics degree.

By: Samuel Demissie

Signature ----------

Confirmed by advisor: Zelalem G. Terfa (PhD)

Signature ----------

CERTIFICATION
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This is to certify that the thesis entitled, "Effects of Trade openness on Economic growth in Africa" is an original piece of work carried out by Samuel Demissie under the supervision of Zelalem G. Terfa (PhD), and is submitted in partial fulfillment of the requirements for the degree of Master of Science in Development Economics. It complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Signed by the Examining Committee:

Advisor: Zelalem G. Terfa (PhD) ---------- Signature _____Date_____

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External Examiner ----------Signature _____Date_____

Department Chair or Graduate Program Coordinator:

Signature _____Date_____

ACKNOWLEDGMENTS

First and foremost, I would like to give my thanks for the Almighty God and St. Virgin Marry for the gift of life, continued love and for being protectors through good and bad times of my life. Next my gratitude goes to my advisor Zelalem G. Terfa (PhD) for his constructive supervision and valuable comment. At last, I would like to mention my deepest gratitude to my family and friends who were by my side while I was conducting my thesis.

LIST OF ABBREVIATIONS AND ACRONYMS

AfCFTA	-	Africa Continental free Trade Agreement
ARDL	-	Autoregressive Distributed Lag
AR1	-	First order autocorrelation
AR2	-	Second order autocorrelation
CEE	-	Central and Eastern European
COMESA	-	Common market for Eastern and Southern Africa
ECOWAS	-	Economic Community of West African States
EPA	-	Economic Partnership Agreement
EU	-	European Union
FDI	-	Foreign Direct Investment
FEM	-	Fixed Effects Model
GDP	-	Gross Domestic Product
GFCF	-	Gross Fixed Capital Formation
GMM	-	Generalized Method of Moments
IMF	–	International Monetary Fund
LSDVC	-	Least squares dummy variable method
NTMs	-	Nontariff measures
OLS	-	Ordinary Least Squares
PMG	-`	Pool mean group estimator
PSCE	-	Panels corrected standard errors
PSTR	-	Panel Smooth Transition Regression
REM	-	Random Effects Model
SADC	-	Southern Africa Development Community
SSA	-	Sub Saharan Africa
TO	-	Trade Openness
UNCTAD	-	United Nations Conference on Trade and Development
UNECA	-	United Nation Economic Commission for Africa
WB	-	World Bank
WDI	-	World Development Indicators
$\mathbf{Y_{it-1}}$	-	Initial GDP per capita

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

Countries around the world are liberalizing their trade policies because trade openness is considered as one of the primary tools to increase economic growth. The paper empirically analyzes the effect of trade openness on the economic growth in Africa countries over the period 1996 to 2019. The empirical result shows that negative association between trade openness and economic growth in African countries, however; finding of the study approved a significant positive relationship between trade liberalization and economic growth of Africa countries is contingent on Initial Income per capita and other explanatory variables. Moreover, the study result also established that the impact of trade openness is more significant and beneficial to countries with higher level of initial per capita income, as well as, countries with higher Human capita and FDI. The paper recommends that efforts are required to ensure stable macroeconomic environment which will encourage other stakeholders to play their part in the growth process. Africa Countries should invest both in physical and human capital for the growing labour force. This could be done using domestic sources as well as encouraging foreign direct investment.

Keywords: Economic growth; trade openness; Africa countries; dynamic panel; system GMM

CHAPTER ONE

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The major initiative behind every economy is to achieve rising and sustained economic growth that could further promote the overall objectives of economic development. Governments of different countries around the world have been following various strategies suitable to their respective economies to attain this broad objective. Trade liberalization is among the many alternatives that countries implement toward facilitating the growth process. Countries have executed popular economic policies that allow reduction and removal of barriers to trade such as tariff, quotas, and import controls. Among many policies that most countries including Ethiopia have decided to choose is trade liberalization of economies (Herath, 2010).Trade liberalization of economies via the reduction or complete elimination of trade barriers has become the most popular economic policy of developed and developing countries today. Import and export tariffs, quotas, export subsidies, technical barriers are the popular trade barriers which have been used during the last few decades. However, with globalization of world economies almost all the counties in the world are actively involved with reducing trade barriers among their trading partners. Major intention of moving free trade is to achieve macroeconomic goals of their economies. Basically, developing economies are implementing free trade policies to achieve high economic growth during the last few decades. As a result of that trade openness has been widening up in these economies (Seid, 2012).

Trade openness refers to the extent to which countries eliminating potential barriers to free trade. Trade openness is normally associated with the reduction or complete elimination of taxes on goods and services (including tariffs and import duties), and other trade barriers such as subsidies and non-tariff barriers to trade (Quartey et al., 2013). Economic growth, on the other hand, is defined as sustained incremental in the total value of all goods and services which is produced by countries over period of time. It is usually known and measured by a rise in percentage rate of real Gross Domestic Product (IMF, 2012).In this study, real GDP growth used as a proxy for economic growth.

Economists have long been concerned in factors which cause different countries to grow at different rates and achieve different levels of wealth. As countries are striving hard to achieve high economic growth, it becomes more important to answer the question what actually determines their economic growth. Trade openness has recently been assumed as an important determinant of economic growth and it has been perceived during the past couple of decades that international trade openness has played a significant role in the growth process of both developed and developing countries (Dar & Amirkhalkhali, 2003). International organizations such as World trade organization, International Monetary Fund and World Bank is constantly counseling, especially developing countries, to speed up the process of trade liberalization to achieve high economic growth. High economic growth is the vital goal of all economic activities because it improves the standard of life of people which is desirable. The general view is that high trade openness leads to high economic growth (Tahir and Azid, 2015).

Trade liberalization is not without limitation and impact. Some criticizers suggest that the introduction of free trade leads to a scramble in social and environmental challenges, particularly in developing countries. Furthermore, regardless of the apparent benefits of the north-south cooperation, incomes of most of the Sub-Saharan African (SSA) countries either diminished or remained stagnant. A significant part of this low-level economic development was that these economies were dependent on high-cost western technology that did not match their primary production systems (Osabohien et al., 2021).

To promote trade and regional integration, the African Union has put together the African Continental Free Trade Area (AfCFTA).Recently, forty-four African leaders have signed the African Continental Free Trade Area (AfCFTA) but this 'bold' move impact on the growth of the economies could well be assessed when it has undertaken in full operation and reasonable time has passed. Countries are expected to remove tariffs of about ninety percent on the goods; the cost of the annual tax revenue to be forgone is expected to be recovered through time through more jobs, increased trade, larger market, and the free movement of labour and capital. But will the AfCFTA bring the much expected gains as Africa remains the "only" continent that trades the least among itself but has preferred trading more with Europe, US and more recently China?

From the above discussion it is clear that there is no clear point of view that whether trade openness boosts economic growth or not. However, studies are done on the issue of trade openness and economic growth, still there exist conflicts between trade openness nexus economic growth. Therefore, the purpose of this study is to examine the effect of trade openness on economic growth of Africa countries from 1996-2019. The study will be important by providing policy recommendations to the rest of countries that are looking to liberalize their economies by giving insight weather trade openness has significant and positive effect on economic growth or not.

1.2 STATEMENT OF THE PROBLEM

Trade liberalization has become pervasive over the past three decades, especially among developing and transition economies, due to the apparent failure of import substitution based development strategy and pressure of international financial institutions such as World Bank and international monetary fund, which have often made their support conditional on trade liberalization. The fundamental justification for this degree of commitment to a program of trade reform is the obvious belief that liberalization is a prerequisite to a transition from relatively closed to relatively open economies. Economists generally believe that open economies grow faster than closed economies. If openness is indeed positively affect growth, it then follows that liberalization is a requirement for growth. Despite their early promise, recent experience suggests that not all trade reforms have been as successful as expected (Singh, 2010).

The effect of trade openness on economic growth has been theoretically debatable. The conventional wisdom envisages a growth enhancing effect of trade. In contrast, the recent developments suggest that trade openness is not always a growth-enhancing effect to economic growth of countries. Even increased international trade can generate economic growth by facilitating the flow of knowledge and technology from foreign direct investment (FDI) or through direct import of high tech goods (Almeida & Fernandes, 2008). Trade accelerates integration with the sources of innovation and boosts gains from foreign direct investment. By increasing the size of the market, trade openness allows economies to expand production, increasing returns to scale and economies of specialization (Bond et al., 2005). Grossman and Helpman (1991) in their theoretical model, indicated that trade openness facilitating

technological progress and productivity improvement, enhancing transfers of new technologies, and that these benefits contingent on the degree of economic openness. This views rests on the assumption that trade generates economic incentives that increase productivity through two dimensions: trade openness reduces the misallocation of resources in the short run, whereas in the long run, it stimulate the diffusion of technological development. Hence, Trade liberalization policies in developing countries have therefore often been executed with the anticipation of growth stimulation in different phases of time.

However, endogenous growth models suggest that the contribution of trade to economic growth differs depending on whether the force of comparative advantage orientates the economy's resources toward activities that generate long-run growth or away from such activities. Moreover, theories suggest that, despite the benefits that may be realized from a trade, suffice it to say that there is skepticism that, the less developed countries are disadvantaged in the sense that they may not adopt the technologies from the developed countries due to technological and financial hurdles (Aghion, et al., 2005). Besides that, other constraints include; lack of human capital, R&D, the presence of bureaucracy, and ineffective national institutions, the level of development of a country may have an implication on the impact of trade to the growth of a particular country (Haltiwanger, 2011; McMillan & Verduzco, 2011). Therefore, despite its positive effect on growth, some theoretical studies claim that trade openness may impede economic growth.

The empirical analysis of trade openness impact on economic growth is still inconclusive and mixed Yanikkaya (2003); and Rodriguez and Rodrik (2001). From the empirical analysis perspective, there are two groups of studies. First, groups of studies have justified the significance of trade openness and its favorable impact on economic growth (Das & Paul, 2011; Lee et al., 2004). A study by Marelli and Signorelli (2011) identified that trade openness has a positive effect on economic growth. In contrast, Hye and Lau (2014) concluded that a positive impact of trade openness on economic growth in the short-run, but it affects in the long-run. On the other hand, the second group of studies has found that the impact of trade openness on economic growth is harmful (Gries et al., 2009; Hye et al., 2014; Zahonogo, 2016). Trade openness has a positive significant impact on economic growth across developed countries, and it harms developing countries (Kim et al., 2011; Vlastou, 2010). But at the same time, other sets

of evidence suggest that there is insignificant relationship between trade openness and economic growth (Eriș & Ulașan, 2013; Menyah et al., 2014; Ulașan, 2014). Manole and Spatareanu(2010) Using data from 131 developed and developing countries find that trade protection is associated with higher per capita income countries. Therefore, economic growth and trade openness nexus is still an open question in development studies and provide scope for further extensive empirical analysis. Hence, in this study, it is motivated to contribute to the existing gap in the literature and practice on international trade by examining the effect of trade liberalization on economic growth in Africa counties using Generalized Method of Moments (GMM) estimator on panel datasets given into consideration the spanning period of the study. Beside, in this paper, we take a close look at the most persuasive empirical studies on growth theory written by Solow (1956) and the augmented version used by Mankiw et al. (1992). Furthermore, the empirical analysis has been extended taking into account the trade openness index and following (Chang et al. 2009) measurement by connecting an interaction term between trade openness and initial income per capita that allows the growth effect of openness to vary with the level of income per capita of countries.

1.3 OBJECTIVE OF THR STUDY

The general objective of this paper is to examine the effect of trade openness on economic growth of Africa countries.

In accordance with this general objective, the study addresses the following specific objectives:

- To identify trade openness and economic growth nexus in the short run and long run;
- To determine whether external sector openness contributes to income differentials among African countries;
- To make suggestions on how the African continental free trade agreement may yield significant growth for the continent, in the concluding part.

1.4 RESEARCH HYPOTHESES

In line with the broad purpose statement the following hypothesis are formulated for investigation. Hypotheses of the study stands on the theories related to economic growth and trade openness that has been developed by researcher's and past empirical studies related to economic growth. Hence, based on the objective, the present study tested the following hypotheses:

Ho: There is no significant and positive relationship between import and economic growth.

Ho: There is no significant and negative relationship between export and economic growth

Ho: there is no significant and positive relationship between degree of openness and economic growth in Africa.

1.5 SIGNIFICANCE OF THE STUDY

This study contributes to knowledge in the broader area of trade openness – economic growth nexus literature in a number of ways. First, the current paper seeks to reexamine the linkage between trade and economic growth by empirical evidence to support the existing literature. The paper has important policy implication. Second, from academic point of view, this study presents additional evidence concerning the effect of trade openness on economic growth of developing economies with similar characteristics. Similarly, the findings of the study would provide policy-makers with relevant empirical evidence relating to the effect of trade openness on Africa's economic growth and development.

1.6 SCOPE AND LIMITATION OF THE STUDY

The study is limited to the effect of trade openness on economic growth of Selected African countries. The total sample size of the study is forty countries that have twenty three years of data from 1996 to 2019.Even if there are fifty four countries in the continent; only forty countries were selected as a sample, because the remaining counties lack adequate data availability for the study.

The study employs dynamic models of Two-step System Generalized Method of Moments (GMM) estimator. The study used the following variables- real GDP per capita growth as a proxy for Economic growth, Trade Openness, Foreign Direct Investment, Human Capital which

is proxyied by Secondary School Enrolment rate, Gross Fixed Capital Formation, Labour Force as a proxy for economically Active Population.

1.7 ORGANIZATION OF THE THESIS

The study is organized into five main chapters with each chapter further divided into sections and sub-sections. The first chapter is the introductory chapter. Chapter two reviews both the theoretical and empirical literature on trade openness and economic growth. Chapter three focuses on the specification of the empirical model and estimation technique employed in conducting the study. The results of the data collected for the study will be analyzed and discussed in the fourth chapter. The final chapter presents the summary, conclusions, and recommendations of the study.

CHAPTER TWO

2. LITERATURE REVIEW

The chapter presents a review of the literature related to the study. Past studies are important as they guide the researcher on other studies on the same topic. The literature review provides an explanation of theoretical rationale of the problem being studied as well as what research has already been done and how the findings relate to the problem at hand. This chapter discusses theoretical review and empirical review.

2.1 THEORETICAL LITERATURE REVIEW

In order to establish the theoretical part, the following related theories are reviewed in this study namely, classical theory of comparative advantage; neoclassical productivity model; endogenous model and Export-Led Growth Hypothesis.

2.2.1 THE CLASSICAL THEORY OF COMPARATIVE ADVANTAGE

David Ricardo developed the classical theory of comparative advantage in 1817 to demonstrate why countries engage in international trade. David Ricardo's central idea stressed on countries interdependence to enhance efficiency of labor and utilization of resources which will boost growth and development. According to the theory of comparative advantage, no country has the autonomy and potential to provide all the needed resources to stimulate economic development. Therefore, it is advantageous for the countries to focus on those commodities which have a strong a strong technical capacity to produce or those commodities can produce at a relatively cheaper cost. Similarly, imports goods that require a high cost of production of goods that has less ability to produce. That is he indicated that if two countries having the potential to produce two commodities participate in a free market, either countries can maximize their overall consumption by exploiting the goods for which it has a comparative advantage while import the other goods, given that there exist difference in labour productivity between the countries. It is assumed that moving this way give countries with the possibilities to earn higher income and growth (Alwell et al., 2017).

2.2.2 HECKSCHER-OHLIN MODEL OF RESOURCES AND TRADE

This theory was propounded by Eli Heckscher and Bertil Ohlin. The theory emphasized the need for trade between two countries based on the ground that there is a relative abundance of resources among the countries. Moreover, the Heckscher-Ohlin model encourages specialization between countries, that is, a country should focus on the production of those commodities it has abundant resources and imports those commodities it has limited resources to produce. For instance, a country with vast land should specialize in agriculture since it is territory-intensive. The Heckscher–Ohlin theory of trade reveals, on the other hand, that countries will have a comparative advantage in (and thus will export) products whose production uses their abundant factors intensively and comparative disadvantage in (and thus will import) products whose production uses their scarce factors intensively. Generally; Heckscher-Ohlin (H-O) theory advocated that trade between countries depends on relative factor abundance. There will be a great mutual beneficial trade if the trading countries have larger differences in technology and factor endowments. Little trade is expected between the countries with similar factor endowments (Tebekew, 2014).

2.2.3 NEOCLASSICAL PRODUCTIVITY MODEL

The neoclassical productivity model by Solow (1956) and Ramsay (1928) indicated that economic growth is the result of three factors- capital, labour and technology and an exogenous production factor is the result of continuing economic growth, that is, the passage of time. The theory demonstrate that the overall functioning of an economy significantly influenced by technological changes. According to this theory, labour force will increase at exogenous pace if novel technologies capable to raise productivity of labour and capital and in the same manner prevent decline in the rate of investment return. The portion of production increment which is not visible on production coefficient is mostly recognized as Solow residual or as gross productivity of used work force. Openness impact growth by affecting the extent of knowledge spillover from abroad. This feature effectively converts the traditional closed economy, exogenous growth model, in to multi country, open-economy endogenous growth model. In conclusion, one would claim that neoclassical productivity model argue that technological improvement and sustainable growth rate of export are totally exogenous.

2.2.4 ENDOGENOUS GROWTH MODEL

In the endogenous growth model endogenous development asserts that economic development is primary the results of internal force not external ones. In other words, it argues that investment on human capital, technology and innovation contributes significantly to economic growth by means of the development of new forms of technology and efficient and effective means of production. Moreover, endogenous theory suggests that economic policy measure taken by government is imperative to fuel persistent economic growth. For instance, to motivate innovation and generation of new idea, financing for research and Development is indispensible and as a result augmenting the rate of development. The point is that a knowledge based economy, the spillover effect from investment in technology and people continue generating returns. A model developed by Romer (1986) and Lucas (1988) maintain that technology incorporate both natural capital and human capital in such situation does not occur diminishing return to capital. Grossman and Helpman (1991) framed a model envisaging both international trade participation and technology in an endogenous manner. Also, Levine and Renelt (1992) indicated that trade an openness motivated direct foreign investment that leads to sustain economic growth for the long run. Unlike less developed countries advanced countries, improve and develop their efficiency by employing new development strategy. Besides, according to endogenous growth theory, an increase in trade openness promotes productivity and advances technology.

The recent endogenous growth theories give attention to the implications of trade openness on economic growth. The models of Rivera-Batiz and Romer (1991) and Grossman and Helpman (1991) provided a sound theoretical framework linking trade policy to economic growth. According to these models, trade openness offers four different opportunities that may lead to economic growth:

i) Communication effect: Trade openness provides opportunities for communicating with foreign counterparts, which in turn facilitate the diffusion of technologies.

ii) Duplication effect: In the absence of trade openness, some ideas and technologies are duplicated in multiple countries. Openness encourages local firms to invent new and distinct ideas and technologies and, consequently, prevent duplication of R&D efforts.

iii) Integration effect: International trade instantly increases the size of the market available each firm. Assuming intermediate goods as well as final goods are traded across countries, larger market size of the R&D sector raises R&D activity and, consequently, economic growth as this sector is subject to increasing returns to scale.

iv) Allocation effect: According to the theory of comparative advantage, trade openness allows countries to specialize in the production of goods and services in which they are relatively most efficient. In the other words, trade openness enables countries to maximize output from a given input of resources - which is a movement in the direction of environmental sustainability.

2.2.5 EXPORT LED GROWTH HYPOTHESIS

The Export led Growth hypothesis is an economic strategy and occurs when a country seeks economic development by engaging in international trade and postulates a relationship between the growth of exports and the economy such that export expansion become one of the main determinant of economic growth. This hypothesis holds that overall growth of different economies could be generated not by increasing the amounts of labor and capital, but also by expanding exports. The theoretical rationale for this hypothesis centers on a number of arguments which include the following: First, exports are likely to alleviate foreign exchange limitations and can thereby provide greater access to international markets. Second, export expansion will increase productivity by offering potential for scale economies, Helpman and Krugman (1985). Third, that the export sector may generate positive externalities on non-export sectors through more efficient management styles and improved production techniques, Feder (1983). These arguments have recently been extended and emphasizes the role of exports on long run growth via a high rate of technological innovation and dynamic learning from abroad by the literature on endogenous growth theory.

2.2.6 CONSTRUCTION OF THE TRADE OPENNESS MEASURES

Theoretically, one cannot disagree that trade openness has several benefits, the most important being knowledge and technological spillovers (Falvey et al., 2004). The resulting technological spillovers and knowledge may produce increasing returns and contribute to faster long-run growth (Squalli and Wilson, 2011). In contrast, trade openness may carry draining factors into an economy. More opened economies may be more vulnerable to imported inflation, negative

external shocks, boom-bust cycles of investment, volatile exchange rates, dumping, among others (Montalbano, 2011).From these definitions, two different measures of trade openness develop: one, outcome-oriented measure and the other is policy oriented measure. In the literature several policy oriented measure of trade openness has been developed (Lee et al., 2004). However, the major challenge in the use of policy oriented measure of trade openness is its subjectivity and differ considerably from author to author. Due to its constraint, majority of empirical studies have employed outcome oriented measure of trade openness (Dollar and Kraay, 2003; Yanikkaya, 2003; Alcalá and Ciccone, 2004; Awokuse, 2007; Cavallo and Frankel, 2008; Chang et al., 2009; Frankel, 2009). The major strength of the outcome-oriented measures is that they can be easily built using actual data compiled by recognized institutions such as the World Bank and the IMF.

2.2 EMPIRICAL LITERATURE REVIEW

The empirical findings of the relationship between trade openness and economic growth in the international economic literature is inconclusive and controversial. So as to identify the underlying linkage between trade openness and economic growth a vast number of research have been conducted in different countries.

Debel (2012) analyzed that trade liberalization seeks to reform a country's international commercial policies in order to improve economic welfare by achieving a better allocation of resources in the long- run. The results of the estimated model has confirmed undoubtedly that in the observed period, 1974-2009, trade liberalization has had a positive and significant impact on the export performance of the Ethiopian economy. This implies that policy makers should generate such policies for attracting exports from Ethiopia, which will focus on the utilization of the country's resource endowments in terms of developing new technologies, and improving national capabilities. As a result, openness has lead Ethiopia to economic growth. This suggests that when countries are more open, they are better able to exploit market opportunities through product diversification and differentiation. These results have important implications for national policies and strategies within the trading system of Ethiopia to open up its foreign trade policies in inter regional and global perspective.

Alemnesh (2012) examined the relationship between trade liberalization and economic growth by using time sires econometric analysis. She takes real GDP as a dependent variable and real private investment, real public investment, human capital and trade openness (proxy to determinant of trade liberalization) as independent variable in Ethiopian context. According to her finding trade liberalization have positive long run impact and significant effect on Ethiopian economic growth.

Seid Yimer (2012) empirically investigated the impacts of trade liberalization on economic growth and poverty reduction in Ethiopia using the Dynamic Computable General Equilibrum Simulation Model simulated alternative policies scenarious showing full and indiscriminating liberalization, gradual and rationalized liberalization, instantaneous tariff liberalization and found a positive relationship between trade liberalization and economic growth in the long run.

Alam and Sumon (2020) studied the impact of trade openness on economic growth on sixteen sample Asian countries over the period 1990 to 2017. In order to see the causal linkage on the variable of interest they employed panel cointegration and causality approaches. The result of panel vector error correction model and Granger causality depicted that opposite directional association between trade openness and economic growth.

Silajdzic and Mehic (2018) examined causal linkage between trade liberalization and economic growth in Central and Eastern European (CEE) countries using two econometrics estimation technique which is Prais-Winsten-correlated panels corrected standard errors (PSCE) method and dynamic least squares dummy variable method (LSDVC) over the period 1995 to 2015. From their analysis, the outcome of their studies indicated that positive relationship between trade openness and economic growth.

Guei & Roux (2019) investigated trade openness and GDP per capita nexus among member countries of Economic Community of Western African States (ECOWAS) based on two step econometrics model analyses from the period 1990 to 2016. In their preliminary examination they employed regression model in order to see a long run association between variable of interest. Subsequently, they used a model of Pooled Mean Group (PMG) models and the Autoregressive distributed lag (ARDL) model to explore the connection between trade openness and GDP per capita. The outcome of their studies indicated that, with the exception of Ghana,

Guinea-Bissau, Mali, Senegal and Togo, long run linkage between trade openness and GDP per capita. Besides, assessments showed that negative impact of trade openness on GDP per capita in the long run.

Bonga-Bonga and Kinfack (2019) studied the impact of trade openness on economic growth of 38 African countries using a Panel Smooth Transition Regression (PSTR) model which denotes endogenity and non-linearity on interrelated variables over the period 1970 to 2016. The outcome of the investigation indicated that African countries are not consistent essentially on trade openness and economic growth. Moreover, the result of the study showed that the association between trade openness and economic growth differ from country to country depending on their level of development. On the other hand, there is direct relationship between variables for relatively middle and high income countries.

Obadan and Okojie (2010) used annual time-series data covering the period 1980 to 2007 to examine the effects of trade on economic growth and development in Nigeria. Variables used included growth rate of GDP, openness, exchange rate, foreign direct investment, domestic investment and political stability. The finding indicated that trade openness had a positive impact on economic growth in Nigeria and a strong negative impact on growth due to political instability. It was concluded that Nigeria's export base which solely depend on petroleum should be diversified to include agricultural and solid minerals export.

A study by Ahmadi and Mohebbi (2012) studied the association between trade openness and economic growth in Iran using OLS method for estimation parameters from 1971 to 2008. Results indicated significant positive effect of trade openness on economic growth in Iran and concluded that oil revenue and investment growths have a significant positive effect on economic growth in Iran.

Herath (2010) studied effects of trade liberalization on economic growth of Sri Lanka. In analyzing the effect of trade liberalization on growth and trade balance, data were collected on a specific time interval before and after the trade liberalization between from 1960 to 2007. Finding of the study approved a significant positive relationship between trade liberalization and economic growth of Sri Lanka using regression analysis and Chow test to the variables. The

result of Chow test proved a clear change of economic growth before and after trade liberalization of the country.

Zeren& Ari, (2013) studied the G7 countries and they applied the Granger non-causality test in heterogeneous panels to reinvestigate the causality relationship between trade openness and economic growth for these countries between 1970 and 2011. Their empirical results expressed the bidirectional causality relationship between the variables. Meaning that, as the economies deepen the level of openness the more they experience positive growth and the more growth also leads to more openness trade. So from the review of the literature above, we note that there is the inconclusive link between the trade openness and economic growth.

Musila&Yiheyis, (2015) used the annual time series to study the relationship between trade openness on the level of investment and economic growth in Kenya. They found that aggregate trade openness is had a positive effect on the level of investment and the rate of economic growth, although the effect on the latter is statistically insignificant. On the other hand, they found trade-policy induced openness to have negatively and significantly affected investment and the rate of economic growth. They also studied the causality using the Granger causality and they realized that the change in trade openness influences the long-term rate of economic growth through the interaction with physical capital growth.

Gries and Redlin (2012) examined the underlying linkage between trade openness and per capita GDP growth among 158 countries employing econometric model of panel cointegration tests and panel error-correction models (ECM) which were assessed by GMM method of testing from the peried 1970 to 2009. The result of the study showed that a positive causality of the impact of trade openness on economic growth in the long run whereas, a negative association in the variable of interest in the short run.

Zeren and Ari (2013) studied trade openness and economic growth nexus in G7 counties to the causal effect using panel causality test over the period 1970 to 2011. The outcomes of empirical investigation showed that there is bidirectional linkage between trade liberalization and economic growth on G7 countries.

Muhammad and Jian (2016 conducted an empirical analysis to see long run association between trade openness and economic growth of sample muslin countries with different economic and

social characteristics employing econometric model which is random and fixed effect model as well as cointegration tests. the finding from econometric analysis concluded that trade openness has positive impact on economic growth of muslin countries

Mangir et al., (2017) examined trade openness effect on economic growth on ten African countries employing econometric estimation technique which is pool mean group estimator (PMG) and the panel Autoregressive Distributed Lag (ARDL) model over the period 1990 to 2015. The empirical finding revealed that positive significant impact in the long run in all countries included for the analysis.

Dritsaki (2015) explore the effect of trade liberalization and FDI on economic growth of three Baltic countries employing three econometric models which are pooled OLS, Fixed Effects Model and Random Effects Model over the peried 1993 to 2011. The coefficient of empirical analysis showed that there is positive relation between variable of interest and has significant impact on economic growth of Baltic countries.

Therefore, as described in the above theoretical and empirical reviews, there is no clear-cut conclusion on whether trade openness has a positive correlation with growth under all circumstances. The aim of this paper is to investigate empirically the relationship between trade openness and economic growth.

CHAPTER THREE

3. RESEARCH METHODOLOGY

This chapter presents the methodology employed in the study. It discusses the econometric model and variables used to empirically investigate the growth-openness nexus. Due to the nature of the dataset (panel data), the paper also discuss the challenges associated with estimating the relationship with various panel data estimation techniques. The section further explains the rational for the choice of estimation method used and ends with a discussion of the data used in the estimation.

3.1 RESEARCH DESIGN

The major aim of this study is to investigate the relationship of trade openness to economic growth of selected African countries. (Donald, 2013), argues that explanatory studies differ from descriptive statistics, attempt to discuss the reason of the phenomena and go further in observing and discussing the conditions. Explanatory research is dedicated to finding relationship among dependent and independent variables. Hypothesis could be basic (i.e., relationship exist) or could be directional (i.e. positive or negative). The quantitative data collecting method are useful when a study measures cause and effect nexus evident between variables. Therefore, the study uses the quantitative research approach to examine empirically the impact of trade openness on economic growth of African countries.

3.2 DATA TYPES AND DATA SOURCE

To investigate the association between trade openness and economic growth of Africa countries, the study relied essentially on secondary data. The sample consists of a balanced panel dataset that comprises Forty (40) African countries over the period 1996 to 2019. The choice of the time period and countries completely depends on the availability of data which are collected from the World Development Indicators (WDI), World Bank's Database. The dataset has been converted in to natural logarithms.

3.3 METHOD OF DATA ANALYSIS

In order to estimate the connection between trade openness and economic growth the paper utilized dynamic panel regression analysis for Africa countries. As is recognized in the empirical growth literature, the most widely used econometric method has been cross section estimation of Barro and sala-i-Martin (1995) style. This method uses a single regression and average-values of the variables and growth rates for each country for the entire period. It also supposes that the production function parameters and levels of technologies are the same across countries. Even if its easy operation is attractive, cross-section method fails to hold the dynamic aspects of growth. The many criticisms raised have brought many researchers to use dynamic panel techniques that account for country peculiar effects, and offer the possibility of obtaining consistent parameter estimates even in the existence of endogeneity of regressors and measurement errors. The approach of dynamic panel estimators has been recently extended to growth datasets. The empirical analysis of this study consists on System Generalized Method of Moments (GMM) estimator developed for dynamic models. Also, several models will be conducted such as: Pooled Ordinary Least Squares (OLS) and fixed effects exclusively for the comparison purpose of the empirical results. STATA software will be used for analysis in the study.

3.4 EMPIRICAL MODEL

3.4.1 THEORETICAL FRAMEWORK OF MODEL

The model adopted in this study is an augmented growth equation that relates trade openness to economic growth. This model is similar in spirit to that used by many analysts including Greenaway et al. (2002) and Dollar and Kraay (2003). Recent growth regression models normally attempt to identify additional determinants of growth beyond the usual of production – such as capital, technology, and labor. In this context and looking at underpinning theoretical considerations, trade openness is likely to affect per capita and overall economic growth, and should be included as a key explanatory variable in the regression:

$$Y_{i,t}-Y_{i,t-1} = \delta_0 Y_{i,t-1} + \delta'_1 X_{i,t} + \delta_2 OPEN_{i,t} + \lambda_i + \lambda_t + u_{i,t} \quad 1$$

Where subscript i indicates the countries included in the analysis (i=1, ..., 40), t denotes the years included in the analysis, y is the log of real GDP per capita, X it is a set of control variables expressed in logs, and OPEN is the log of real trade/GDP ratio, which is our measure of openness. Further, λ_i is the country-specific effect, such as unobserved factors. These include differences in an initial level of productivity that influence the countries growth rates. λ_t represents an unobserved period effect (i.e., the unobserved effects of each time period covered)and $\varepsilon_{i,t}$ is the disturbance (or error) term. As it is standard in the literature, the dependent variable is the rate of real GDP per capita growth. Since the model includes the lag of GDP level as an explanatory variable, it models growth in a dynamic setting.

On the right-hand side, there is a set of control variables X that considers their importance as proximate growth determinants and the possibility that they can influence the trade-growth relationship. Among them, we consider the investment rate (as a proxy for physical capital), a measure of human capital, and the economically active population. The first two variables should be interpreted as potential channels through which openness influences growth since technological progress is typically embodied in equipment while human capital measures the capability of the labour force to absorb the new technologies transferred by trade.

First, there exist unobserved country-specific effects. If the individual effects represent omitted variables, it is likely that these country-specific effects are correlated with the other repressors, as well as with both growth and trade openness. Second, some explanatory variables such as trade openness and other explanatory variables could be endogenous themselves. Many theoretical and empirical studies have shown that trade and growth are associated, and causation should go in both directions. Therefore, we need to have caution or control for jointly endogeneity and reverse causation. Third, the presence of the lagged dependent variable $Y_{i,t-1}$ makes a correlation between the error term and the lagged dependent variable. This would likely make estimating the classical static panel models such as Pooled OLS and within-group estimators biased or inconsistent.

Among the various econometric techniques at the hands of modelers proposed to overcome such problems is the difference generalized method of moments GMM(DIFF) estimator introduced by

Arellano and Bond (1991). This model has been applied to growth regressions by many researchers including Amable (2000), Bond et al. (2001), Dollar and Kraay (2003). One version of the GMM estimator is the canonical dynamic fixed-effect model that is specified as:

$$\mathbf{Y_{i,t} - Y_{i,t-1} = \delta_0 Y_{i,t-1} + \delta'_1 X_{i,t} + \varepsilon_{i,t}} \qquad 2$$

$$\varepsilon_{i,t} = \lambda_i + u_i$$

$$E[\lambda_i] = E[u_{i,t}] = E[\lambda_i u_{i,t}] = 0 \text{ for } i = 1,...,N \text{ and } t = 2,...,T$$

Equation (2) can be expressed equivalently as:

$$\mathbf{Y_{i,t} = \delta^*_0 Y_{i,t-1} + \delta'_1 X_{i,t} + \varepsilon_{i,t} \quad for\ i = 1,...,N\ and\ t = 2,...,T} \qquad 3$$

where $\delta^*_0 = \delta + 1$. As specified in equation (3), $Y_{i,t}$ is endogenous to the fixed effects in the error term. To avoid dynamic panel bias, it is desirable to transform the data to remove (i) the fixed effects, and (ii) their likely correlation with lagged income variables. Though the fixed effects have been removed, the lagged dependent variable remains endogenous since $Y_{i,t}$ is correlated with the error term $\varepsilon_{i,t-1}$. Similarly, any predetermined variable in X that is not strictly exogenous can become endogenous given the correlation with the lagged error term ($\varepsilon_{i,t-1}$). However, differently from mean-deviation transform deeper lags of the regressors are now available as instruments (Roodman, 2006). Equation (3) rewritten in first differences is:

$$\mathbf{Y_{i,t} - Y_{i,t-1} = \delta^*_0 (Y_{i,t-1} - Y_{t-2}) + \delta'_1 (X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t})}$$

$$\text{for } i = 1,\ldots,N \text{ and } t = 3,\ldots,T \qquad 4$$

By exploiting all the linear moment restrictions that derive from the assumption of no serial correlation in the errors, the GMM estimator gains efficiency and becomes a reliable estimator for growth regression. It is assumed that the following moment conditions hold:

$$E(\varepsilon_{i,t} - \varepsilon_{i,s}) = 0 \text{ for } S \neq t$$

$$E[Y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0$$

for $s \geq 2$; $t = 3,...,T$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0$$

for $s \geq 2$; $t = 3,...,T$

In particular, the GMM estimator uses all lagged values of the dependent variables as well as the lagged value of other regressors, going all the way through second-period lag, i.e., t – 2, as instruments for the equation in first differences. The GMM(DIF) approach of equation (4) may lead to a downward bias in the coefficients when data are persistent and when the time series data is too short with respect to the number of countries. The problem arises because lagged levels of the series provide only weak instruments for the differenced equations. In addition, the difference estimator can only be second best since the process of differencing to remove the country-specific effect eliminates information on the cross-country variation in levels. This weakness was underscored by Blundell and Bond (1998), among others.

An alternative was the system GMM proposed and implemented by Arellano and Bovier (1995), Blundell and Bond (1998), Bond et al. (2001) and Roodman (2009) as a more appropriate approach. Dollar & Kraay, (2004) stress that the system GMM estimator is the most appropriate way of solving modeling challenges related to growth analysis. The system GMM estimator uses moment conditions based on the level equations together with the usual Arellano and Bond (1998) type orthogonality conditions. The main advantage of this estimator is that it uses as instruments the lagged values and differences between two time periods of the endogenous explanatory variables which deals with the problem of correlation between the error term and the lagged dependent variable. It doesn't require any external instrument to deal with the endogeneity problem. Hence, this approach has widely been utilized in growth models to circumvent problems for empirical growth regression. We applied this approach in this study.

In summary, the reliability of the system GMM estimator hinges on the strength of the assumption that the error term does not display serial correlation and on the appropriateness of the instruments. This implies that the test for the null hypothesis of no first-order serial correlation should be rejected under the assumption that the error is not serially correlated. By

contrast, the test for the null hypothesis of no second-order serial correlation should not be rejected. To check for this, we use two diagnostics tests suggested by Arellano and Bover (1995) and Blundell and Bond (1998): the Sargan test of over-identifying restrictions, and whether the differenced residuals are second-order serially correlated. If the null hypothesis of both tests cannot be rejected, this implies that the model is correctly specified, and the instruments are appropriate. The test results from this estimation procedure are reported in Table 4.3 and 4.4.

3.4.2 MODEL SPECIFICATION

A growth equation introduced first by Solow (1956) and also the neoclassical augmented model developed by Mankiw et al. (1992) is utilized to estimate the effect of trade openness on economic growth of African countries. Economic growth (captured by the real GDP per capita) and the determinants of growth which vary across time and countries are denoted in the equation below:

$$\mathbf{lnY_{it} = \alpha_0 + \delta lnY_{it-1} + \beta' lnX_{it} + \lambda_i + \mu_t + \varepsilon_{it}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The dependent variable $\mathbf{Y_{it}}$ is the logarithm of real GDP per capita of country i at year t; the explanatory variables are $\mathbf{lnY_{it-1}}$ that is the initial per capita GDP; $\mathbf{X_{it}}$ is a set of control variables, determinants of economic growth, that vary across both countries and year, defined according to the augmented Solow growth model; the term $\boldsymbol{\lambda_i}$ refers the unobserved country specific effect such as institutions or geography that may be invariant factors of growth; $\boldsymbol{\mu_t}$ is the unobserved time specific effect which captures global shocks; and $\boldsymbol{\varepsilon_{it}}$ represent the error term. The subscript i and t denotes countries and time period respectively. The term **ln** is natural logarithm.

In Equation (1) are included determinants of growth normally used in growth regressions. The determinants of growth of Africa countries that vary across both countries and years are the following: the initial per capita income of African Countries, an indicator of Trade Openness, Gross Fixed Capital formation, the Human Capital stock, the growth of the work force (economically Active Population) and FDI. These variables are widely accepted in the empirical growth literature as determinant of growth. The initial per capita income is included to capture the convergence effect.

The econometric model that assesses the effects of trade openness on economic growth for Africa countries would be specified as in the following:

$$\mathbf{lnY_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 ln0penness_{it} + \beta_3 (ln0penness_{it} * InY_{it-1}) + \beta_4 InHC + \beta_5 InGFCF + \beta_6 InAP + \beta_7 InFDI + \lambda_i + \mu_t + \varepsilon_{it}}$$

where; Y, Y_{it-1},Openness, HC, GFCF, AP, FDI stands for Economic growth (GDP per capita), initial GDP per capita, Trade openness, Human Capital, Gross Fixed Capital Formation, Active Population and Foreign Direct Investment respectively. The coefficient of the variable is representing by β_i. The explanatory variable of interest is trade openness, $\mathbf{In}\boldsymbol{openness_{it}}$. This is the openness measure of each Africa countries included in the study for each year between 1996 and 2019. Measure of trade openness (Total Trade to GDP).To explore the possibility that the effect of openness on economic growth may depend on the level of income, most empirical studies on the openness-growth relationship have used models that seldom capture the effect of trade on economic growth given the initial level of growth in a country i.e, to include an interaction variable of a country's initial growth performance and its openness measured by trade ($\mathbf{In}\boldsymbol{openness_{it}} * \mathbf{InY_{it-1}}$). This helps us to determine whether or not the effect of openness on economic growth is contingent on the initial growth performance of an economy. Specifically, it helps determine if openness is more beneficial to relatively rich economies than poor economies. Hence it captures the accelerating or de-accelerating effect of trade openness on convergence. If the coefficient of the interaction variable is negative in sign and statistically significant, then trade openness has resulted in accelerating convergence among the countries in a given region. On the other hand, if the coefficient is positive in sign and statistically significant, then openness as measured by trade has reduced the rate at which countries were converging. With this interaction variable, we are able to assess if openness contributes to the income differences between countries within a particular region. If the gain from openness is greater for relatively rich countries than poor countries, then it must be that openness to trade contributes to widening the gap between rich and poor countries in the same region (Dollar and Kraay, 2004).

As the objective is to estimate the impact of trade openness on growth, the challenge is to include all determinants of growth potentially correlated with trade openness in order to avoid a biased estimation of the coefficient on the openness variable. Some omitted variables such as geography that drive both growth and trade do not change or change very little over time. They are

controlled by the Countries' fixed effects λ_i. The term λ_i represents all growth determinants specific to each Africa countries that do not change over time. Here, it captures invariant heterogeneity across Africa countries that have an impact on growth, such as Africa countries geographical characteristics, natural resources, to be landlocked or not etc.

The real challenge is to include all growth determinants that vary across countries and year and that could be correlated with Africa countries' trade openness. Human capital, public infrastructures have potentially an impact on trade performance of the Africa countries. Then, it was essential to include them in the growth regression. The term μ_t controls for unobserved time-specific effects and for shocks that are common to all Africa countries, such as the period of high inflation, economic crisis in different year.

3.5 DEFINITION, MEASUREMENT OF VARIABLES AND SIGN EXPECTATIONS

For the purpose of this study, the following measurement and operational definitions will be used for the variables being examined. The variables included in the study are real gross domestic product, trade openness, human capital, gross fixed capital formation, active population, Foreign Direct Investment (FDI). The choice of the variables was based on existing literature, economic theory, available data and their significance to the study. The basis for the signs of the respective coefficient of the variables is explained in the description of the variables below.

Economic Growth is defined as the sustained increase in a country's real output or real gross domestic product overtime (Demetriades & Hussein, 1996). Real GDP per capita growth ($Y_{it)}$ shows the level of economic performance with in each country. In this study real GDP per capita is used as a proxy for Economic growth.

The logarithm of **the initial GDP per capita (Y_{it-1})** is included to control for convergence. However, it can also be interpreted as a proxy for country's stock of Capital. Under this assumption, economic growth in the poorest countries is more rapid than the richest countries. The coefficient of lagged GDP per capita growth (β_1) is expected to be positive and less than one (Solow, 1956; Barro & Martin, 1995).

Trade openness corresponds by the ratio of the sum of exports plus imports to GDP. Various measures of openness have been proposed and tested, with no single 'best' measure emerging.

Frequently used measures include the ratio of total trade to GDP and changes in terms of trade. Openness promotes efficient allocation of resources through comparative advantages, allows dissimilation of knowledge and technological progress, and encourages competition in domestic and international market. Countries with greater ratio of export to GDP experience higher gain. A number of existing empirical literatures support a positive link between trade openness and growth; however, the sign of relationship between them is ambiguous as some studies find no robust evidence (e.g. Dollar and Kray, 2003).

In the model is included an **Interaction term ($\boldsymbol{0penness_{it}}$ * $\mathbf{InY_{it-1}}$)** between openness and country's initial income level to capture the effect of trade openness on economic growth given the level of development of the countries. It determines whether economic growth is conditioned by the initial income level of the economy due to trade openness and which countries benefit more from trade openness. The coefficient of the interaction variable ($\boldsymbol{\beta_3}$) cannot be determined a priori. If openness benefits rich countries more, the coefficient of the interaction variable is expected to be positive. However, if it benefits poor countries more, then the coefficient of the interaction variable is expected to be negative.

The **secondary school enrolment rate** is used as a proxy for human capital. Education captures the effect of human capital improvement on real GDP per capita growth. Then the coefficient of the Human Capital ($\boldsymbol{\beta_4}$) is expected to be positive.

Gross fixed capital formation formally gross domestic fixed investment includes plants, machinery and equipment. It also includes the construction of roads, railways, and others such as schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings and all these are necessary for economic growth. Physical capital accumulation is an important determinant of growth (Solow, 1956; Romer, 1986). Firms can accumulate know-how through capital accumulation, thus some investments can produce growing returns and promote economic growth. Physical capital accumulation in this analysis is proxied by the share of gross fixed capital formation (GFCF) in GDP. Based on the existing literature, the coefficient of this variable ($\boldsymbol{\beta_5}$) is predicted to be positive.

Labour Force P**articipation rate** or economically **Active Population** is another growth determinant that is used also in this analysis. Labour force (labour participation rate) is chosen instead of population growth because it denotes a proportion of the total population aged between fifteen (15) and sixty-four (64) years and is the active and productive population in the country. Solow (1956) advised that labour force should be included in the growth model because of its effect on the work force and this has been proven empirically in many researches that included labour force to be a good measure of economic growth. We expect a priori for this variable (β_6) to exert a negative effect on economic growth.

Foreign Direct Investment (FDI) is included in the model to capture the effect of external sources of investment on economic growth. Foreign direct investment serves as both a direct capital financing method and as a way to bring about positive externalities. It is therefore expected that an increase in foreign direct investment leads to an increase in total investment and hence increase in total output and its rate of growth. The coefficient of this variable (β_7) is predicted to be positive.

(Table 3.1) Summary of explanatory variables and their effect on dependent variables

Variable	Description	Expected effect
Economic Growth	Real GDP per capita growth	N/A
Initial stock of capital	GDP per capita of country i at the beginning of each period	+
Trade Openness	(Export + Import) to GDP	+/-
Human Capital	Secondary School Enrolment rate	+
Gross Fixed Capital Formation (GFCF)	Physical Capital Accumulation	+
Active Population	Labour Force	-
Foreign Direct Investment(FDI)	External source of Investment	+

CHAPTER FOUR

4. RESULT AND DISCUSSIONS

In the preceding chapter, it was specified and discussed the model to be used to empirically examine the openness-growth relationship. In this section, it is estimated and discussed the results of the standard growth model specified in equation (1), using panel data of countries within 40 African countries. As mentioned earlier, the openness-growth relationship is thus estimated for African Countries over the period 1996 to 2019. It is also checked the validity of the instruments ranks by Hansen test, Sargan and robustness by AR(2) test for serial correlation.

4.1. DESCRIPTIVE STATISTICS OF THE DATA

The descriptive statistics for the dependent and independent variables are presented below. The dependent variable is economic growth. The independent variables are initial GDP per capita, trade openness, human capital, gross fixed capital formation, active population, Foreign Direct Investment were used to see the effect of trade openness on economic growth. Table 4.1 bellow Present the descriptive statistics of the dependent and independent variables.

Table 4.1 Descriptive Statistics of Dependent and independent variables

Variables	Mean	Max	Min	SD
ln(GDP)	0.74489	3.356059	-6.350065	1.062561
ln(GDPit-1)	0.7500194	3.356059	-6.350065	1.071725
ln(openness)	2.656253	6.880989	-0.0708265	0.8933201
ln(HC)	3.632808	18.19637	1.016787	0.8126951
ln(GFCF)	2.958744	4.375276	-1.22803	0.479394
ln(AP)	4.175713	4.50358	3.7467	0.1952954
ln(FDI)	0.588072	3.834607	-6.28046	1.351565

Source: own computations using Stata.

The summary statistics contains different characteristics of data used in the analysis. As observed from table 4.1, the mean value of real GDP per capita and trade openness is 0.74 and 2.66 respectively. Real GDP per capita reached at its maximum of 3.36 and a minimum at -6.35, in the same way, trade openness was at its highest point at 6.88 and lowest point at -0.1.

4.2 CORRELATION RESULTS

Result for Pearson's correlation analysis, has been performed in order to determine and identify if there is any significant and strong relationship between the dependent and independent variables. The summary of Pearson's correlation matrix is presented in table below.

Table 4.2 Pearson Correlation Analysis

variables	**ln(GDP)**	**ln(GDP_{it-1})**	**ln(openness)**	**ln(HC)**	**ln(GFCF)**	**ln(AP)**	**ln(FDI)**
ln(GDP)	1						
ln(GD_{Pit-1})	0.3167	1					
ln(openness)	-0.4968	-0.2255	1				
ln(HC)	-0.0326	-0.0581	0.4345	1			
ln(GFCF)	0.1466	0.0959	0.1234	0.2894	1		
ln(AP)	0.1287	0.1545	-0.2825	-0.4988	-0.1258	1	
ln(FDI)	0.1921	0.1705	0.03442	0.1483	0.2775	0.027	1

Source: own computations using Stata.

Output of Pearson correlation analysis (table 4.2) is represented in matrix form. The correlation shows that GDP per capita growth correlated positively with initial GDP per capita, GFCF, AP and FDI whereas negatively correlated with trade openness and HC of the study. Correlation coefficient between GDP and initial GDP per capita is high compare to other variables correlation coefficients with GDP. Theoretically, the coefficient of the variable should be within 0.80–0.90 for avoiding multicollinearity from the series as guidelines of Kennedy (1998). However, the occurrence of multicollinearity in the series is not a problem for the GMM estimator; it can automatically remove multicollinearity from the series (Arellano & Bond, 1998).

4.3. ECONOMETRICS MODEL RESULTS

In this section, using econometric model specified in equation (1) we run different econometric estimation techniques for our empirical analysis, though the chosen estimator of the study is system GMM. Besides investigating the dynamic relationship between variable of interest, the study checked whether trade openness can be taken as a detrimental factor in affecting economic growth of African countries or not. as a yardstick, the study relied on the improved version of Solow and Mankiw et al. (1992) model that describes differences in per capita GDP growth across countries and time with the initial level of GDP per capita, Gross Fixed Capital

Formation, Human Capital, active population, FDI and Trade openness the focus of the present study is included in the analysis.

The study considered pooled OLS and fixed effects econometrics estimation techniques for baseline and robustness analysis but not our basis for discussion of research findings. The pooled OLS is used as a baseline model of the study, and the result shows significant effects of the factors of the study, except ln(Active population). Similarly, the study uses Fixed effects to show significant effects of the variables, except ln(FDI) and ln(Active population) is insignificant (see Table 4.3). If we compare between pooled OLS, Fixed effects and system GMM estimators, the pooled OLS and Fixed effect models strongly support the results of GMM estimator. However, the system GMM estimator has a lower bias and higher efficiency than the other estimators (Soto ,2009).

In (Table 4.3) here under indicated are the regression results of empirical analysis using different econometric specification technique such as pooled OLS, Fixed effects and two-step System GMM.

Table 4.3. Short run Regression results of different estimation techniques

Variables	Pooled OLS	Fixed effects	System GMM
lnGDPit-1	0.166*** (0.000)	0.102*** (0.002)	0.149** (0.015)
ln(Openness)	-0.713*** (0.000)	-1.019*** (0.000)	-0.860*** (0.000)
ln (HC)	0.313*** (0.000)	0.239** (0.034)	0.357** (0.021)
ln (GFCF)	0.326*** (0.001)	0.441*** (0.001)	0.340* (0.053)
ln (AP)	0.290 (0.136)	0.250 (0.816)	0.211 (0.311)
ln(FDI)	0.097*** (0.00)	0.022** (0.524)	0.070 * (0.057)
sargan Test			0.130
Hansen Test			0.284
AR(1) test, p-level			0.000
AR(2) test, p-level			0.212
number of observation			644
number of countries			40
number of instruments			29

Source: own computation using STATA

Notes: ***, **,* showed significance at 1%, 5% and 10% respectively. P-values are in parentheses

In the empirical result of system GMM of table 4.3, contrary to the expected negative coefficient according to Solow growth model, initial GDP per capita, lnY_{it-1}, carries a significant at the 5% level and positive coefficient, equal to 0.149 which is commonly interpreted in the empirical growth literature as a sign of conditional convergence. In other words, poorer African countries tend to grow more rapidly than richer one. However, it should be bear in mind that these economies might converge towards diverse levels of per capita GDP, since in our empirical analysis; we keep for structural differences between countries through a set of explanatory variables.

The empirical results also suggest that the lag value of the dependent variable GDP (lnY_{it-1}) is positive and statistically significant, meaning that, the past value of GDP per capita has a positive impact on its present value, therefore, holding other independent variables constant, a percentage increase in the past value of GDP will lead to approximately 0.15 per cent increase in its present value.

The coefficient of trade openness in our empirical estimation are found to be negative related and statistically significant implying that a percentage change in trade openness is associated with a 0.86% decrease in economic growth in the short run, at the 1% significant level, on average ceteris paripus, hence, trade openness and economic growth exhibits an inelastic relationship. This result confirms previous findings by Dowrick and Golly (2004), Sundaram and Arnim (2008) and Huchet- Bourdon and al (2011) implying that specialization in primary exports is bad for economic growth. Some more reasons can also justify the detrimental effects of international trade on economic growth: the incapability of domestic industries in developing countries to compete multinational companies (MNCs) and the developing economies' dependence on essential imports, which can worsen terms of trade.

The estimated regression coefficient of Human Capital in the analysis by system GMM is found to be positively correlated and statistically significant at 5% level, implying that if the Human Capital increases by 1%, the GDP per capita increases on average by 0.357% which is supported by Meijers (2014) and Donou-Adonsou(2019).

The estimated empirical result in system GMM of gross fixed capital formation (GFCF) is positively related with GDP and statistically significant at 10% level. The result implies that a unit increase in GFCF increases on average GDP per capita growth by 0.34%.

As indicated from the regression result, the coefficient of the Active Population is positive. The result implies that a percentage increase in the Active population will amount to approximately 0.211 percent increase in gross domestic product. However, the p-value stands at 0.211, meaning that such impact is not significant.

Moreover, the coefficient of FDI is 0.07. This means that in line with a priori expectation, the FDI has a positive impact on economic growth. Thus, holding other independent variables constant, a percentage increase in FDI will amount to about 0.07 percent increase in gross domestic product. Its corresponding p-value is 0.057, which is less than 10 per cent (at 10% significant level). It can, therefore, be concluded that FDI has a significant positive impact on the growth of African countries within the period under study.

In order to test the sensitivity of the results to the conditioning variables included, Table 4.4 gives the results of the models estimated by system GMM with different specifications including also Interaction terms.

Table 4.4. Results of system GMM for different specifications

Variables	System GMM Model 1	System GMM Model 2	System GMM Model 3
lnGDPit-1	0.238*** (0.000)	0.151*** (0.000)	0.147*** (0.000)
lnOpenness	- 0.844*** (0.000)	- 0.833* (0.091)	- 0.881*** (0.000)
ln (HC)	0.369*** (0.000)	0.327*** (0.000)	0.361*** (0.000)
ln (GFCF)	0.401*** (0.000)	0.359 (0.311)	0.348*** (0.000)
ln (AP)	0.009 (0.967)	…….	0.223 (0.285)
ln(FDI)	……..	0.076*** (0.000)	----------
ln Openness*lnGDPit-1	**0.131*** (0.000)**	……	…….
ln(GFCF) * ln (Openness)		**- 0.012 (0.938)**	…….
ln(FDI) * ln (Openness)			**0.024 (0.001)**
constant	0.413 (0.058)	0.5 (0.650)	- 0.482 (0.638)
number of observation	557	644	644
Hansen test- level	0.3	0.287	0.283
Number of Instruments	28	29	29
Sargan test, p-level	0.198	0.148	0.12
AR (1) test, p-level	0	0	0
AR (2) test, p-level	0.3	0.287	0.235

Source: own computation using STATA

Notes: ***, **,* showed significance at 1%, 5% and 10% respectively. P-values are in parentheses

The first column of table 4.4 depicted estimated regression coefficients when an interaction term between initial GDP per capita and trade openness is involved. The estimated coefficient of the lagged GDP per capita growth is positive related and statistically significant at the 1% significance level. The result indicated that, opening up the external sector of African countries is negatively related to GDP per capita growth. Nevertheless, when trade is interacted with growth performance, the estimated coefficient of interaction variable is positive and statistically significant at the 1% level of significance, this means that, trade openness impact on economic growth in Africa is dependent on the level of economic development of Countries. As a result, the positive effect of trade openness on economic growth decrease as the level of per capita

income decline. More precisely, trade openness become more beneficial for countries with higher initial per capita, from these set of countries. This results also supported by the studies of Calderon et al (2004)

It can be noticed that the variable Gross Fixed Capital Formation and the interaction term between trade openness and GFCF are included in the model 2 of table 4.4. The estimated result of the lagged GDP per capita growth in system GMM of the analysis is positive and statistically significant. In this specification the trade openness has negative sign and significant. Nevertheless, when trade is interacted with GFCF, the coefficient of interaction variable is positive and not statistically significant.

Estimation result for the trade openness-growth nexus in Africa Countries are presented in the model 3 of table 4.4 when trade openness is interacted with FDI. The coefficient of lagged GDP per capita growth is positive and statistically significant at the 1% significance level. Openness as measured by trade is negatively related to GDP per capita growth. The interaction variable between trade openness and FDI has a positive coefficient with a magnitude of 0.024. The estimated coefficient is statistically significant at the 1% significant level and implies that countries with higher level of FDI are more advantageous than countries with lower level of FDI.

Human capital is with positive sign in all models and statistically significant in all specification of model analysis, at the level of significance of 10%. The estimation result of gross fixed capital formation indicated significant in the first and third models and positively affect GDP per capita growth.

Table 4.5 Two-step system GMM: Long-run results.

Variables	Coefficient	Standard Error	Z- statistics
Ln (Openness)	-1.012***	0.066	-15.35
ln (HC)	0.385***	0.088	4.38
ln(FDI)	0.09***	0.018	4.93

Source: own computation using STATA

GDP (lnY) is a dependent variable.

* p<0.1.

** p<0.05.

*** p<0.01.

Parallel to this, the study also analyzed the long-run results of the system GMM estimator. From Table 4.5, the long run results showed that Human capital and FDI exerted a positive and statistically significant effect on economic growth. Trade openness, however, exerted a negative and statistically significant effect on economic growth. From the regression analysis, the estimated coefficient of trade openness are found to be negative and statistically significant implying that a percentage change in trade openness is associated with a -1.012% decrease in economic growth in the long run, at the 1% significant level, on average ceteris paripus hence, trade openness and economic growth exhibits an inelastic relationship.

The results also show that the coefficient of Human Capital is positive and statistically significant indicated that a positive influence on economic growth. Human Capital is positive and significant at 1 percent with a coefficient of 0.385 signifying an increase in economic growth by this amount (0.385) if there is a 1 percent increase in the Human Capital.

Furthermore, the coefficient of foreign Direct Investment (FDI) carried positive sign and is statistically significant at 1 percent significance level. Thus, if the country's FDI increases by 1 percent, real GDP per capita growth will increase by approximately 0.09 percent in the long run. That is, the economic rationale for providing special incentives to attract FDI frequently derived from the belief that foreign investments bring economic stimulation in the form of development of human capital, technology transfers and spillovers.

THE ECONOMETRIC SPECIFICATION TESTS: Hansen J-test, Sargan test and Arellano Bond test for autocorrelation (AR (2)) are also reported. Insignificant P-value of the Hansen J-test ascertains the robustness of the estimation to over-identification and the validity of the instruments (see Table 4.3 and 4.4), proofing the robustness of the model to over-identification. Similarly, the Sargan statistics also show insignificant P-value (see Table 4.3 and 4.4), thus, the results suggest the validity of instruments of the system GMM estimator. The AR (2) test for autocorrelation has a null hypothesis of no autocorrelation. It is applied to the differenced residuals and just like the Sargan test; a higher p-value is preferred. This is because; it implies failure to reject the null hypothesis that there is no autocorrelation. The p-values described for the AR (2) tests in table 4.3 and 4.4, implies the nonexistence of autocorrelation in the specification of the estimated model.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with conclusion and recommendations based on the findings of the study. Accordingly this chapter is organized in to two subsections. Section 5.1 presents the conclusions and section 5.2 presents the recommendations.

5.1. CONCLUSIONS

The role of trade openness in economic activities has been at the forefront of economic debates. This paper adds to the literature by answering the question: Does trade openness matter for economic growth in the African countries? It is against this backdrop that this study sought to examine the effect of trade openness on GDP per capita growth of 40 African Countries by adopting system GMM estimation techniques on a panel data set spanning from 1996 to 2019.

Employing System GMM methods which decreases dynamic panel estimation bias and applying internal instruments for endogeneous explanatory variables, the study revealed that a negative and statistically significant influence on economic growth of African countries due to trade openness both in the short and long run. A possible reason for the negative impact of trade openness on economic growth is that Africa countries do not export diversified products, heavy dependence on Agricultural products, a high ratio of import to GDP and a significant proportion of these imports is in the form of intermediate inputs, raw materials and plant and machineries.

Both in the short run and long run the variable Human capital and foreign direct investment exerted a positive impact and significantly influence the economic growth of the African countries. GFCF exerted positive and significant effect on economic growth in the short run but in the Long run it exerted positive and insignificant effect on economic growth.

Econometric analysis of the study also depicted that the impact of trade openness on African countries economic growth is contingent on their initial level of income per capita and other independent variables included in the model. That is to say that trade openness is more beneficial

and advantageous for counties in Africa having relatively higher GDP per capita. Furthermore, the empirical study also demonstrated that trade openness is more favorable for countries having higher level of FDI and high Human capital skill.

5.2 RECOMMENDATIONS

Considering the findings of this study, it is important to propose the following recommendations in order to achieve positive contribution of trade openness on the economic growth of African countries.

- Africa countries should moderate their trade openness policies as their economies prove to be weak in absorbing the negative shock from external trade.
- Africa countries should diversify the export structure and export more manufactured products, this will improve employment and economic development.
- It is imperative to put in place proper check and balances against further unfairness to the continent. This may involve proper regional integration through the Africa Continental free trade area, a healthy industrialization organization, and bridging out the infrastructural gap.

Finally, policy makers should speed up the process of trade liberalization if they want to grow faster in the long run. The remarkable growth experience of the Asian tigers over the years and the recent positive growth experiences of some of the developing countries, such as China and India, indeed indicate the superiority of outward-oriented policies over the inward-oriented policies. However, the process of trade openness could be enforced step by step.

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APPENDIXES

Descriptive statistics

	lnGDP	lnGDP_~1	lnOpness	lnFDI	lnGFCF	lnAP	lnHC
lnGDP	1.0000						
lnGDP_lag1	0.3167	1.0000					
LnTRADE	-0.4968	-0.2255	1.0000				
lnFDI	0.1921	0.1705	0.0342	1.0000			
LnGFCF	0.1466	0.0959	0.1234	0.2775	1.0000		
lnAP	0.1287	0.1545	-0.2825	0.0270	-0.1258	1.0000	
lnHC	-0.0326	-0.0581	0.4345	0.1483	0.2894	-0.4988	1.0000

. correlation matrix

Variable	Obs	Mean	Std. Dev.	Min	Max
lnGDP	806	.7448965	1.062561	-6.350065	3.356059
lnGDP_lag1	773	.7500194	1.071725	-6.350065	3.356059
lnTRADE	869	2.656253	.8933201	-.0708265	6.880989
LnFDI	910	.5880718	1.351565	-6.280461	3.834607
lnGFCF	959	2.958744	.4793937	-1.228027	4.375276
lnAP	960	4.175713	.1952954	3.7467	4.50358
LnHC	960	3.632808	.8126951	1.016787	18.19637

Pooled OLS

```
. regress lnGDP lnGDP_lag1 lnOpnnesslnFDIlnGFCFlnAPlnHC

      Source |       SS           df       MS      Number of obs   =       644
                          #NAME?
       Model |  248.696757         6  41.4494594   Prob> F        =    0.0000
    Residual |  434.404891       637  .681954303   R-squared      =    0.3641
-------------+----------------------------------   Adj R-squared   =    0.3581
       Total |  683.101648       643  1.06236648   Root MSE       =    .82581

------------------------------------------------------------------------------
lnGDP        |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnGDP_lag1   |   .1660918   .0336314     4.94   0.000       .10005    .2321337
LnOpnness    |  -.7129959   .0471602   -15.12   0.000    -.8056041   -.6203877
LnFDI        |   .0968445   .0269331     3.60   0.000     .0439562    .1497328
LnGFCF       |    .325753   .0954645     3.41   0.001       .13829    .5132161
LnAP         |    .290224     .19433     1.49   0.136    -.0913808    .6718288
LnHC         |   .3134966   .0670258     4.68   0.000     .1818784    .4451147
_cons        |   -.969773   .9740727    -1.00   0.320    -2.882555    .9430088
------------------------------------------------------------------------------
```

Fixed effects

```
Fixed-effects (within) regression               Number of obs      =       644
Group variable: c_id                            Number of groups   =        40

R-sq:                                           Obs per group:
     within  = 0.4070                                         min =         6
     between = 0.2464                                         avg =      16.1
     overall = 0.3332                                         max =        23

                                                F(6,598)           =     68.40
corr(u_i, Xb)  = -0.4368                        Prob> F            =    0.0000

------------------------------------------------------------------------------
lnGDP              |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
lnGDP_lag1         |   .1021737   .0325584     3.14   0.002      .038231    .1661164
LnOpnness          |  -1.018754   .0544881   -18.70   0.000    -1.125765   -.9117429
LnFDI              |   .0220553    .034624     0.64   0.524    -.0459442    .0900548
LnGFCF             |   .4408638   .1304288     3.38   0.001     .1847097     .697018
LnAP               |   .2502216   1.076714     0.23   0.816    -1.864379    2.364822
lnHC               |   .2388206   .1120771     2.13   0.034      .018708    .4589331
_cons              |   .0048802   4.685144     0.00   0.999    -9.196456    9.206216
-------------------+----------------------------------------------------------------
sigma_u |  .46733264
sigma_e |  .75344156
            rho |  .27783619   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(39, 598) = 4.29                     Prob> F = 0.0000
```

Two step-Systems GMM

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: c_id                            Number of obs       =       644
Time variable : year                            Number of groups    =        40
Number of instruments = 29                      Obs per group: min  =         6
F(6, 39)      =    374.79                                        avg  =     16.10
Prob> F       =     0.000                                        max  =        23
------------------------------------------------------------------------------
LnGDP              |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
lnGDP_lag1         |   .1491015   .0217313     6.86   0.015     .1051458    .1930572
lnOpnness          |  -.8601889   .0463581   -18.56   0.000    -.9539569   -.7664208
lnFDI              |   .0704468   .0179422     3.93   0.057     .0341553    .1067382
lnGFCF             |   .3400429   .0797032     4.27   0.053      .178828    .5012577
lnAP               |   .2107853   .2054296     1.03   0.311    -.2047354    .6263059
lnHC               |   .3571123   .0719633     4.96   0.021     .2115528    .5026718
_cons              |  -.4502186   1.018304    -0.44   0.661    -2.509933    1.609496
------------------------------------------------------------------------------
Warning: Uncorrected two-step standard errors are unreliable.

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnOpnnesslnFDIlnGFCFlnAPlnHC)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/23).lnGDP_lag1 collapsed
Instruments for levels equation
  Standard
lnOpnnesslnFDIlnGFCFlnAPlnHC
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lnGDP_lag1 collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.83  Pr> z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   1.25  Pr> z =  0.212
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   =  29.53  Prob> chi2 =  0.130
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  25.28  Prob> chi2 =  0.284
  (Robust, but weakened by many instruments.)
```

System GMM

Model 1

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: c_id                            Number of obs      =       557
Time variable : year                            Number of groups   =        40
Number of instruments = 29                      Obs per group: min =         5
F(6, 39)      =    374.18                                      avg =     13.93
Prob> F       =     0.000                                      max =        22
------------------------------------------------------------------------------
lnGDP              |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
lnGDP_lag1         |   .2380815   .0181347    13.13   0.000     .2014007    .2747624
lnOpnness          |  -.8448697   .0554864   -15.23   0.000    -.9571016   -.7326378
lnGFCF             |   .4007515   .0912206     4.39   0.000     .2162404    .5852625
lnAP               |   .0093696   .2280588     0.04   0.967    -.4519228    .4706621
lnHC               |   .3690497   .0690165     5.35   0.000     .2294507    .5086486
lnOpnn* lnGDP_LAG1 |   .1312751    .025098     5.23   0.000     .0805096    .1820407
             _cons |  -.0179705   .9578473    -0.02   0.985      -1.9554    1.919459
------------------------------------------------------------------------------
Warning: Uncorrected two-step standard errors are unreliable.

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnOpennesslnGFCFlnAPlnHCopennessFDI)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/23).lnGDP_lag1 collapsed
Instruments for levels equation
  Standard
lnOpennesslnGFCFlnAPlnHCopennessFDI
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lnGDP_lag1 collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.09  Pr> z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.51  Pr> z =  0.612
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   =  27.35  Prob> chi2 =  0.198
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  24.84  Prob> chi2 =  0.305
  (Robust, but weakened by many instruments.)
```

System GMM

Model 2

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: c_id                            Number of obs        =       644
Time variable : year                            Number of groups     =        40
Number of instruments = 29                      Obs per group: min   =         6
F(6, 39)      =    342.33                                      avg   =     16.10
Prob> F       =     0.000                                      max   =        23
------------------------------------------------------------------------------
lnGDP            |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
lnGDP_lag1       |   .1509937   .0212722     7.10   0.000     .1079666    .1940209
lnTRADE          |  -.8335051   .4812176    -1.73   0.091     -1.80686    .1398495
lnF              |   .0766553   .0156589     4.90   0.000     .0449822    .1083284
lnGFCF           |   .3598911   .3507223     1.03   0.311    -.3495117    1.069294
lnHC             |   .3270181   .0723902     4.52   0.000     .1805951     .473441
lnopenness*lnGFCF |  -.0118299   .1513699    -0.08   0.938    -.3180044    .2943446
 _cons           |   .5001463   1.093139     0.46   0.650    -1.710935    2.711228
------------------------------------------------------------------------------
Warning: Uncorrected two-step standard errors are unreliable.

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnOpennesslnFDIlnGFCFlnHClnopenness*lnGFCF)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/23).lnGDP_lag1 collapsed
Instruments for levels equation
  Standard
lnOpennesslnFDIlnGFCFlnHClnopenness*lnGFCF
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lnGDP_lag1 collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.79  Pr> z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   1.25  Pr> z =  0.212
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   =  28.88  Prob> chi2 =  0.148
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  25.22  Prob> chi2 =  0.287
```

System GMM

Model 3

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: c_id                            Number of obs          =       644
Time variable : year                            Number of groups       =        40
Number of instruments = 29                      Obs per group: min     =         6
F(6, 39)      =    568.27                                      avg     =     16.10
Prob> F       =     0.000                                      max     =        23
------------------------------------------------------------------------------------
lnGDP              |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
lnGDP_lag1         |   .1472766   .0211185     6.97   0.000     .1045605    .1899928
lnTRADE            |  -.8815272   .0469483   -18.78   0.000    -.9764892   -.7865652
lnGFCF             |   .3483507    .079503     4.38   0.000     .1875407    .5091607
lnAP               |   .2236215   .2060755     1.09   0.285    -.1932055    .6404484
lnHC               |   .3618741   .0708493     5.11   0.000     .2185678    .5051803
lnopenness*lnFDI   |   .0240174   .0068221     3.52   0.001     .0102184    .0378165
             _cons |  -.4826388   1.018082    -0.47   0.638    -2.541905    1.576627
------------------------------------------------------------------------------------
Warning: Uncorrected two-step standard errors are unreliable.

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnOpennesslnGFCFlnAPlnHClnopenness*lnFDI)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/23).lnGDP_lag1 collapsed
Instruments for levels equation
  Standard
lnOpennesslnGFCFlnAPlnHClnopenness*lnFDI
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.lnGDP_lag1 collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.80  Pr> z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   1.19  Pr> z =  0.235
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   =  29.95  Prob> chi2 =  0.120
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  25.30  Prob> chi2 =  0.283
  (Robust, but weakened by many instruments.)
```

Two-step system GMM: Long-run results.

```
. nlcom (_b[lnOenness])/(1-_b[lnGDPlag_lag1])

       _nl_1:  (_b[lnOpenness])/(1-_b[lnGDPlag_lag1])

------------------------------------------------------------------------------
       lnGDP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.011894   .0659366   -15.35   0.000    -1.141127   -.8826604
------------------------------------------------------------------------------
```

```
. nlcom (_b[lnHC])/(1-_b[lnGDP_lag1])

       _nl_1:  (_b[lnHC])/(1-_b[lnGDP_lag1])

------------------------------------------------------------------------------
       lnGDP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3851774   .0880342     4.38   0.000     .2126336    .5577212
------------------------------------------------------------------------------
```

```
. nlcom (_b[lnFDI])/(1-_b[lnGDP_lag1])

       _nl_1:  (_b[lnFDI])/(1-_b[lnGDP_lag1])

------------------------------------------------------------------------------
       lnGDP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0902882   .0182996     4.93   0.000     .0544217    .1261548
------------------------------------------------------------------------------
```

```
. nlcom (_b[lnGFCF])/(1-_b[lnGDP_lag1])

       _nl_1:  (_b[lnGFCF])/(1-_b[lnGDP_lag1])

------------------------------------------------------------------------------
       lnGDP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4238968   .4151901     1.02   0.307    -.3898608    1.237654
------------------------------------------------------------------------------



. nlcom (_b[lnHumanCapital])/(1-_b[lnGDP_lag1])

       _nl_1:  (_b[lnHumanCapital])/(1-_b[lnGDP_lag1])

------------------------------------------------------------------------------
       lnGDP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3851774   .0880342     4.38   0.000     .2126336    .5577212
------------------------------------------------------------------------------
```

Country list

Algeria	Congo, Dem. Rep.	Kenya	Nigeria
Benin	Congo, Rep.	Madagascar	Rwanda
Botswana	Cote d'Ivoire	Malawi	Senegal
Burkina Faso	Egypt, Arab Rep.	Mali	Sierra Leone
Burundi	Eswatini	Mauritania	South Africa
Cabo Verde	Ethiopia	Mauritius	Sudan
Cameroon	Gabon	Morocco	Togo
Central African Republic	Gambia, The	Mozambique	Tunisia
Chad	Ghana	Namibia	Uganda
Comoros	Guinea	Niger	Zimbabwe