IMPACT OF INTERNATIONAL TRADE ON ECONOMIC GROWTH IN RWANDA OVER PERIOD 2006-2019

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN DATA SCIENCE IN ECONOMETRICS IN THE AFRICAN CENTRE OF EXCELLENCE IN DATA SCIENCE, COLLEGE OF BUSINESS AND ECONOMICS (CBE), UNIVERSITY OF RWANDA

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September, 2020

DECLARATION

I declare that this dissertation entitled **"Impact of international trade on economic growth in Rwanda over period 2006-2019"** is the result of my own work and has not been submitted for any other degree at the University of Rwanda or any other institution.

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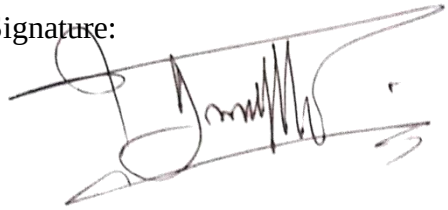

APPROVAL SHEET

This dissertation entitled **"Impact of international trade on economic growth in Rwanda over the period of 2006-2019"** written and submitted by David NTIHEMUKA in partial fulfilment of the requirements for the degree of Master of Science in Data Science majoring in Econometrics is hereby accepted and approved. The rate of plagiarism tested using Turnitin is 19% which is less than 20% accepted by the African Centre of Excellence in Data Science (ACE-DS).

Dr Ildephonse Musafiri

Supervisor

17.8.2021

Dr Ignace Kabano

Head of Training

DEDICATION

To

The Almighty God,

My wife

NIYOMUKIZA Germaine

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ABSTRACT

International trade has been considered as an important tool to boost an economic growth of Rwanda and achieve its aspirations (a high-income economy by 2050). This research is intended to investigate the effect of foreign trade on Rwanda's economic growth (2006-2019). Several scientific research, as well as some economic theories, advocate a positive relationship between international trade and economic development. The Unit Root Augmented Dickey Fuller (ADF) test shows that the order of the sequence was integrated at the same level. Johansen cointegration approach and VECM technique were employed to assess long run and short-run relationship. Long run relationship estimation result shows a positive and significant relationship between trade openness, exchange rate and trade balance with GDP. The relationship between customs duties with Gross Domestic Product was found to be negative and statistically insignificant. Short-run relationship estimation result shows a positive and significant relationship between exchange rate and Gross Domestic Product, while the short run relationship between trade openness, Trade balance and Customs duties were found to be statistically insignificant. The speed of adjustment term was also found to be statistically significant with a negative sign. Basing on above results there is positive relationship between international trade and economic growth. Therefore, I recommend to enhance trade facilitation policy and strengthen outward oriented strategy.

Keywords: international trade, economic growth and cointegration approach

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ACRONYMS

ADF	Augmented Dickey Fuller
AR	Autoregressive
ARDL	Autoregressive Distributed Lag
BNR	National Bank of Rwanda
BOP	Balance of Payment
CPI	Consumer Price Index
EAC	East African Community
ECM	Error Correction Model
EDPRS	Economic Development and Poverty Reduction Strategy
FY	Fiscal year
GDP	Gross Domestic Product
H_0	Null Hypothesis
H_1	Alternative Hypothesis
IMF	International Monetary Fund
LDCs	Less Developed Countries.
LIC	Low Income Country
MINECOFIN	Ministry of Finance and Economic Planning
OLS	Ordinary Least Squares
PP	Philipps Perron
RRA	Rwanda Revenue Authority
SPSS	Statistical Package for the Social Sciences
SSA	Sub Sahara Africa
UK	United Kingdom
US	United States
USD	United States Dollars
VAR	Vector Autoregressive
VECM	Vector Error Correction Mechanism
WBG	World Bank Group

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CHAPTER ONE INTRODUCTION

1.1 Background

World economy is struggling to achieve high and sustainable economic growth; international trade become a more crucial tool to determine their economic growth. Both developed and developing countries have experienced the significant role that international trade has played in terms of their growth process (Ijirshar,2019)

Global financial institutions such as the World Bank, International Monetary Fund or World Trade Organization have advised countries to put a lot of efforts in guarantying trade liberalization and ensuring macroeconomic stability as well as pay favorable attention to the other determinants of economic growth (Muhammad Tahir,2012)

The relationship between international trade and economic growth is a well-researched topic in international economics literature. Theories of international trade strongly support the hypothesis that increased openness to international trade can influence economic growth positively(Muhammad Tahir,2012) but the positivity and the negativity of the relationship are still debatable. Despite its great contribution on growth, some researchers have argued that trade openness hinder growth (Zahonogo,2017). Hence, the literature is indecisive partially due to the fact that different methodologies are used when it comes to analyzing different proxies for trade liberalization by trade analysts.

This research aims at evaluating the impact of international trade on economic growth in Rwanda over period 2006-2019, to have a better understanding of the trade-growth relationship using empirical analysis through econometric modeling of macroeconomic variables relevant to this research.

It is important for Rwandan businesses to explore more opportunities beyond our borders to expand markets. Effective participation in foreign trade is a good opportunity to speed up economic growth and contribute towards putting the economy on a sustainable growth path(MINICOM,2010). The study gives the literature on international trade and economic growth by providing empirical evidence that considers effects of foreign trade in Rwanda. Moreover, we will focus on the direct effect of trade on growth, this study goes also and explores other variables through which trade can affect economic progress

1.2 Problem Statement

The economic growth has been one of the priority concerns for the government of Rwanda in its efforts to build a self-sustainable Rwandan economy as well as improve people's standards of living. Even though Rwandan economy has recovered considerably since the 1994 genocide against the Tutsi, in the year 2000, the government of Rwanda established Vision 2020(a long-term development strategy with its main target to transform Rwanda into a middle-income country). The government of Rwanda was tasked with ensuring good governance, which includes integrity, professionalism, transparency, accountability and efficiency in deploying scarce resources to key sectors of the national economy. The government established different institutions that would help it achieve its objectives enshrined in Vision 2020(MINECOFIN, 2012)

MINECOFIN (2019) recently recorded 8.9 percent as the rate of economic output in fiscal year 2017/2018, which was 3.4 percent higher than the previous fiscal year. The service sector, where trade increased by 15 percent and taxes by 8 percent, is a major driver of this substantial growth. With these findings, we can also conclude that trade is a significant contributor to Rwanda's Gross Domestic Product.

According to the World Bank report (2019), Rwanda is ranked in top 29th easiest place to do business in the world the only low-income country (LIC) in the top 30. This is due to the fact that it is easier for people to start a business, getting loans and has reduced the time release required to export and import by implementing the Single Customs Territory.

Although Rwanda has 9.5 percent of economic growth, it imports more goods than exports (BNR, 2019), this leads to trade deficit where Rwanda's participation in trade is still low. Rwanda needs to have specific solutions to resolve these issues to attain double-digit average annual growth rate for achieving its aspirations (targeting an upper-middle-income country by 2035 and a high-income economy by 2050) by promoting foreign trade to become one of main drivers of economic growth.

This research analyzed the effect of international trade on country's economic growth by including variables that reflect the role of international trade on economic growth such as trade openness, trade balance, customs duty and Exchange rate. The difference in opinions and empirical results on the impact of international trade on economic growth has become a pain in the neck, especially to developing countries; and necessitates further researches. This is the gap

that this economic research needs to acquaint. This research aims at contributing to the debate on the impact of trade on economic growth with Rwanda as a case study.

1.3 Research Objectives

The main aim of this research is to evaluate the impact of international trade to economic growth in Rwanda. The study will focus on the following specific objectives:

i) To identify long-run relationship between the components of foreign trade and economic growth in Rwanda.

ii) To determine whether trade openness, exchange rate, customs duties, trade balance and economic growth has short-run relationship in Rwanda

iii) To suggest relevant trade policies that can be implemented by the government to boost economic growth in Rwanda.

1.4 Research Questions

The study needs to test the hypothesis with this study's key questions: The main research question: *what is impact of international trade on economic growth in Rwanda?* It is not easy to directly answer this above research question, unless you first answer the following specific questions:

i) Is there long-run relationship between the components of international trade and economic growth in Rwanda?

ii) To what extent trade openness, exchange rate, customs duties, trade balance and economic growth in Rwanda are correlated in short-run?

iii) What is trade policy that can be implemented by the government of Rwanda to increase economic growth?

1.5 Significance of Study

This study conducted on time series data will analyze the link between economic growth and international trade in Rwanda. Special attention is paid to trade policies that needs to be based on policy formulation to boost economic growth of Rwanda. The results of the study may be used in the decision-making process of different institutions of Rwanda specialized in above-mentioned policies. Assessing the effects of foreign trade on economic growth in Rwanda is

therefore an important researchable topic to not only policy makers but also economic researchers.

1.6 Scope of Study

The study covered the period from 2006 to 2019. The variables to be used include Trade Openness, Trade balance, customs duty, Exchange rate, and GDP of Rwanda.

1.7 Organization of Study

Five chapters make up this dissertation. The first chapter one covers the background of the study, the problem statement, research objectives, research questions, significance of the study, scope of study, and the organization of the study; the second chapter is the literature review which discuss theories and empirical studies related to the topic under study; the third chapter entails the methodology used and sources of data. The fourth chapter covers data analysis and interpretation of the results; the fifth chapter covers summary of study, the conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter focuses on the theoretical and empirical literature regarding international trade and its influence on economic growth in Rwanda. The causality effect between above variables has been a controversial issue for long years. Many researchers have found a positive and others found negative relationship between foreign trade and Economic growth. However, many researchers found that the growth rate of open economies is higher than closed economies.

2.2 Theoretical Literature Review

2.2.1 Theories on International Trade

2.2.1.1 *Definition of the concept of "International Trade"*

The word "International trade," according to UNCTAD(2019)refers to the exchange of goods and services between countries. Visible trade (goods) or Invisible trade (services) included Rwanda is one of the countries in which trade constitutes a large proportion of gross domestic product (GDP)

2.2.1.2 *Evolution of International trade.*

Mercantilists argue in the 16th century that the best interest of a nation in sustaining a trade surplus in order to export more than it imports, encourages government interference in order to achieve a trade balance surplus, reflects trade as a zero-sum game, one in which one country's benefit results in another country 's loss. Mercantilism 's primary aim was to increase the strength of the nation's state wealth, which is calculated by its treasury holdings such as gold(**Dibiku**, **2017)**.The importance of mercantilism to economic growth indicates that local industries should be covered by introducing high tariffs in order to deter imports and encourage exports.

This theory put forward by Adam Smith (1776) was developed to explain gains from international trade as result of specialization between countries. It means that a country has an absolute advantage in the production of goods when it is more efficient than any other country in producing it and enhance global efficiency through participation in free trade regime. Given two countries and same amount of the resources, a country is said to have an absolute advantage over another in the production of a given product if it can produce that commodity more efficiently at a lower inputs cost". Therefore, without foreign trade, countries would be limited to the goods and services produced within their own borders. Smith found that workers become

more skilled by repeating the same tasks, do not lose time in switching from the production of one kind of product to another and longer production runs provide greater incentives for the development of more effective working methods (Dibiku, 2017)**.** Hence more efficiency, more output and more benefits from international trade

David Ricardo (1817), the author of the classical theory of international trade and the doctrine of comparative advantage. Ricardo was the first to demonstrate that foreign trade arises not from difference in absolute advantage but from difference in comparative advantage. Comparative advantage is the ability of the country to produce the product at less opportunity cost than another is. Hence, international trade arises out of the need to minimize the cost of production. (Bwebare&Mirembe,2017) By "comparative advantage" is meant by "competitive advantage". Hence, in the situation of two countries and two commodities, trade would still take place even if one country was more efficient in the production of both commodities (Dorobăţ, 2015). Thus, when country finds that it is cheaper to consume imported goods and services than consuming those domestically produced, it would be engaged in international trade. Therefore, country should be specialized in production of product in which is more efficient, to increase the gain from foreign trade and boost country's economic growth.

The Neo-classical economics tried to alter the feature of some classical theory with the evolutionary theory of trade. A more satisfactory reason for the presence of comparative cost differences between countries is advanced by their theory; capital has been added as a second development factor. Heckscher (1919) and Bertil(1933) presume that two nations, two goods, and two factors of production exist. The possible stumbling block is the fact that, while nations share the same technology, the commodity produced at home by comparatively labor-intensive techniques is the product. It may be produced abroad by relatively capital-intensive techniques. The theorem of Heckscher Ohlin, which specifically states that each nation exports the commodity produced in that nation, is fatally flawed, allowing relatively intensive use of the factor contained in relative abundance in that country. This implies that if a nation produces a relatively labor-intensive product, it must do so in exchange for the product generated by labor-intensive techniques in the relatively abundant resources of a foreign country. To each of them, the introduction of a second production factor seems significant. This makes the methodology of Neo-classical theory distinct from classical theory in some fundamental ways, namely in the handling of the relationship between factor allocation, distribution of income and foreign trade (Carmen Elena Dorobăt,2015).

As a major contributor to the new trade theory, Paul Krugman concentrated on obtaining economies of scale (declining unit production costs associated with a broad output scale) and market weakness such as imperfect competition and externalities as drivers of trade, the theory offered a basis for industrial policy. Hence, industrial policy can therefore work to increase national income by helping domestic firms to gain market power abroad by encouraging the establishment of industries with positive externalities(Dibiku, 2017)

2.2.2 Theories on Economic Growth

There are three main directions to carry out current theoretical analysis of economic growth: Post-Keynesian, neoclassical (exogenous) and endogenous.

2.2.2.1 *Post-Keynesian Theory*

The Neo-Keynesian theory of economic growth was proposed by the American economist Evsey Domar and the British economist Roy Harrod, who explained and augmented John Keynes 's theory that investment is not only a factor in the creation of production power, but also a factor in sales, and thus a factor in the development of production and supply of goods. The theory of Domar defines the pace at which investments should develop to ensure revenue growth. This pace is directly dependent on the share of national income savings (MPS) and average investment performance. A significant conclusion for economic policy has therefore been drawn: only ever-increasing capital accumulation, i.e., investment growth, provides the economy with a complex equilibrium between aggregate demand and aggregate supply. The government will influence the share of savings in national income or the pace of technological development to maintain balanced investment growth, thereby deciding the productivity of capital (I. A. Sharipov,2015)

2.2.2.2 **Neoclassical growth theories and the exogenous theory of Robert Solow**

Robert Solow's first neoclassical growth theories emerged in the 1950s and 1960s, contradicting the government's participation in the economy and enabling large companies to achieve their growth potential in a competitive market by using most of the resources available to them (I. Sharipov, 2012)

The Theory of Robert Solow

The theory of Solow illustrates the interdependence between three economic growth sources: capital, labor and technological innovation. The theory shows that the savings rate is a significant determinant of the degree of capital intensity and influences the production of the economy by adjusting the labor force. Higher saving rates produce higher investment and, thus,

higher production levels. The Solow model considers technological change to be an exogenous variable and clarifies how it functions in the economic growth phase with other variables. In the Solow model, with population growth and technological progress, equality between the net marginal product of capital and the steady-state growth rate of total income is described as the Golden Rule steady state. In addition, the author introduced a "golden rule of accumulation" formula, which defines the optimum amount of capital intensity. Thus, Solow's theory emphasizes technological progress as the lonely basis of sustainable population welfare growth(N Gregory Mankiw, 2009)

2.2.2.3 **The endogenous growth theory**

The endogenous growth theory was developed on the basis of the difficulties of the neoclassical model of economic growth, as cited in Mogoe & Mongale (2014). The importance of the endogeneity of capital in the growth process is acknowledged by this new growth theory. Another differentiating feature was the expectation of rising returns as opposed to constant capital returns typical of the neoclassical growth theory. Lucas argues that investment in education contributes to human capital development, which is a key factor in the growth process.

The implication of this theory for developing countries is that by implementing new expertise in science and new technology and hence the need to encourage trade transparency, such a government stands to benefit more from trade with developed nations(Kargbo,2014). This theory therefore demonstrates that, in the sense of Rwanda's knowledge-based economy, the efficiency of human capital's effect on the production of the country should be the foundation for achieving the recently identified 2050 vision for sustainable economic growth.

2.3 Empirical Literature Review

According to Gries and Redlin (2012), the correlation between openness and growth was evaluated in 158 countries and found that there is a strong long-run relationship . Then, using the Error Correction Model, he analyzed the short-run relationship, came up with a negative short-run adjustment, and suggest that transparency can be detrimental to economy in the course of short-run adjustment. Although the long-run impact of keeping mostly positive and important is positive, when the income is positive, the short run adjustment becomes positives. Therefore, the results recommend different trade structures in low-income and high-income countries.

As Muhammad Tahir(2012) carried out empirical research exploring openness and growth relationship through panel fixed effects estimation process, and data was utilized for two

samples of the developed countries for the period 1990-2009. Key findings indicate that the relationship between trade openness and economic growth is positive and statistically important. There is also a strong and statistically important effect of domestic investment, labor, education, and democracy on economic development. The results also show that unpredictable policies, such as the price instability of markets, are harmful to long-run economic development. Finally, they suggest that developed countries liberalize foreign trade, maintain macroeconomic stability and, in order to expand faster in the long-run pay favorable attention to other determinants of economic development.

A report has been performed in South Africa on the effect of foreign trade on economic growth. The Vector Autoregressive was used in this study and includes as component under investigation GDP, export, trade openness and exchange rate. The findings indicate the cointegration among variables. The research identified a number of unidirectional relationships between the pairs of variables analyzed in the model, using Granger-causality analysis. In terms of policy formulation and design for South Africa's economy, policymakers may use the outcomes and recommendations of this study. The research findings could be used to enhance economic policy for South Africa and other developing countries along the same route (I. Journal et al., 2017)

The relationship between trade and economic growth in the Czech and Slovak Republics is examined by Fitzová & Žídek, (2015). Using Cointegration, the vector error correction model and Granger causal approaches, the empirical analysis of the relationship between trade and economic growth is used to research both short-term and long-term panel data dynamics. In both countries, therefore, a long-run equilibrium is established between the variables examined. Finally, the empirical results also show that exports play an important role in economic development in the two republics. We conclude that it is possible to classify economic growth as export-led in both countries.

The increase in global trade volumes and the removal of trade barriers have sparked ongoing discussion and research on the effect of international trade on economic growth. It was also found that the speed of adjustment term (ECM) was significant. The effect of short-term causality indicates the existence of short-term causality between exports, domestic investment and Gross Domestic Product exchange rate, running from Gross Domestic Product variables (Kamar &Abubakar, 2015). Unfortunately, as addressed in the abstract of this report, there was no variable representing the importance of the trade barrier. Therefore, the findings of this debate are inaccurate.

Import, export, domestic expenditure and exchange rate are used to examine their relationship with GDP using the Wald test, using empirical analysis, and find that series are cointegrated. The results of the short-term and long-term relationship calculation indicate a positive and important relationship between exports and GDP with domestic investment. Imports and exchange rates have both been found to be negatively related and statistically important to GDP. International trade is being liberalized by countries around the world because trade is viewed as one of the key instruments for improving economic development. The study analyzes the influence of trade openness on Kenya's economic growth over the period 1970-2014 empirically. The coefficient of enrolment as a percentage of the total population of secondary and tertiary institutions used as human capital was negative and statistically important. The macroeconomic stability coefficient of inflation used was negative and statistically important. Finally, they noticed that Kenya should accelerate the process of trade openness to speed up the rate of economic growth and increase the quality of living of the masses (Abdillahi Umulkher Ali, 2017)

The other research work carried out by Lawal & Ezeuchenne(2017) was aimed at evaluating the effect on economic growth in Nigeria of foreign trade. Variables included in this analysis are imports, exports, balance of trade and trade openness and actual gross domestic product. The result showed that there is a long-term relationship between foreign trade and economic growth, while import and trade openness are both negligible, export and trade balance are relevant both in the short and long term. The causality test revealed that there is no correlation between economic growth and imports, exports and trade balance, but that economic growth is unidirectional with openness to trade. Finally, the report advises that, in order to improve economic growth, the government should improve its exports of finished goods and reduce the importation of finished goods.

In Pakistan, an analysis of the effect of foreign trade on economic growth was carried out using the following variables: imports to GDP, total exports to GDP ratio, trade conditions, trade openness, investment to GDP ratio, and GDP inflation. The Chow test is used to test the fitness of the model and structural breakage. The OLS is used to describe the relation between exogenous and endogenous variables. The approximate results suggest that explanatory variables have a major positive effect on Pakistan's economic development. The results show a positive effect of imports of raw materials, manufacturing and jobs on the production of the country.

Likewise, openness to trade has a positive impact on Pakistan's economy. It concludes that, in order to enrich Pakistan's economy, foreign trade can play an important role (Hussain et al., 2012).

A competitive growth model for the sub-Saharan African economies in which Rwanda is located, has been tested in this report. The findings indicate that trade openness may have a positive impact on growth in the long run, but the effect is not linear. Our findings indicate that openness to trade has a positive and important impact on economic growth These results are stable with respect to improvements in trade transparency controls. The non-linear relationship between openness to trade and economic growth indicates that trade benefits are not inevitable. According to the degree of trade openness, the effect of trade openness may differ. Sub-Saharan African countries must therefore productively regulate the openness of trade particularly imports of consumer goods, by increasing their economic growth through foreign trade.

Our findings recommend that openness to trade should be followed by complementary policies aimed at fostering new investment funding and improving the efficiency of institutions and the capacity to adapt and develop new skills. Thus, the globalization of trade cannot be seen in isolation. To improve its effect on economic growth, additional strategies and policies are needed. Appropriate policy reform should be carried out by the Sub-Saharan countries in order to promote investment, facilitate effective governance, and promote human capital accumulation. (Zahonogo, 2016)

2.4 Trade and Economic growth in Rwanda

An open framework of liberalized markets has been embraced by Rwanda as a precondition for its economic growth. It has put in place the right policies to ensure that liberalization completely benefits Rwanda and to ensure that the possible negative consequences are mitigated. Successful and productive involvement in foreign trade is a perfect way to stimulate global growth and contributes to a sustainable development direction for the economy. To this end, trade policy is important to foster broad-based, sustainable economic growth and inclusive development aimed at eradicating poverty. While Ministry of Trade and industries is responsible for developing trade in Rwanda, a number of policy documents contain current policies affecting the development of trade and competitiveness in Rwanda, and implementation is carried out across a number of institutions and ministries. Interventions in international policy should therefore be harmonized and consolidated into a cohesive trade policy. The Trade Policy Document defines a formal policy framework for the coordination of

these initiatives and provides a policy framework for resource utilization by the Government of Rwanda(MINICOM, 2010)

2.4.1 Rwanda's Trade Performance

Rwanda, with a population of 12.2 million people and a Gross Domestic Product (GDP) of USD 9.14 billion, is a small but growing market, according to the World Bank report(2019), Rwanda is experiencing solid economic growth, which over the last two decades has averaged over 7%. The country's economy grew more than 8 percent in 2018 as higher global prices for some conventional exports, improved agricultural production,transport and tourism growth, and a recovery in construction activities helped the country recover from drought and a cyclical downturn in 2016. In 2019 and 2020, the IMF expects the real Gross Domestic Product of Rwanda to rise between 7-8 percent. There are several optimistic economic signs: inflation in 2018 was below 5%, the country maintains its reputation for low corruption, Rwanda's debt-to - GDP ratio is relatively low and rising steadily at 47.1%, and the percentage of foreign assistance (external grants and loans) in the country's annual budget has fallen from over 80% a decade ago to 32.4% a decade ago. Rwanda is ranked high in the World Bank's Ease of Doing Business Index, which ranked Rwanda 29th out of 190 economies behind Mauritius in the 2019 survey, second best in sub-Saharan Africa.

2.4.1.1 Rwanda's export performance

Export expansion is typically related to growth spurts in an economy. Therefore, it was recommended that in order to fulfill the goal of achieving middle-income status and further ambitions, Rwanda needs stronger export results. The small domestic market alone, which is expected to rise by 220,000 per year between 2015-2020, will not generate employment for the working-age population. By leveraging economies of scale, integrating international technology, management and business practices, exports often generate complex productivity gains.In addition , higher productivity gains leading to wage premiums and job growth are correlated with export industries(World Bank, 2015).

Exports of products have increased by 37 percent in value, to USD 1152.0 million from USD 840.7 million reported in 16/17, according to MINECOFIN (2018), In particular, this increase was attributed to the output of minerals (+59.7%) and other ordinary items (+53.4%). In addition, exports of tea and coffee increased by 17.8 percent and 18.5 percent, respectively, attributable to a rise in export value of 10.0 and 10.5 percent. Re-exports increased by 26.9

percent, especially due to the high demand from neighboring Burundi and DRC countries, which contributed to a 30.1 percent increase in volume. Rwanda exports its main products: coffee , tea and minerals. In the short term, agricultural products such as fruit and nuts, oil and grain seeds, spices, vegetable textile fibers, vegetable fats, beans and so on are most likely to be exported to Rwanda. More advanced export products that could be promoted by Rwanda in the medium term include refined food and beverage products (confectionery, cereals, honey, milk, juices), wood products (wood, charcoal, sawn wood), building materials (rebars, marble or other stone-based building materials), rubber products (natural rubber and pneumatic inner tubes) and the extraction of the essence of tires. The figure below describes the value and amount of goods and services exported from 2004 to 2016 by Rwanda. There is a major effect on production from 2010 to 2016 due to various strategies taken by EDPRS

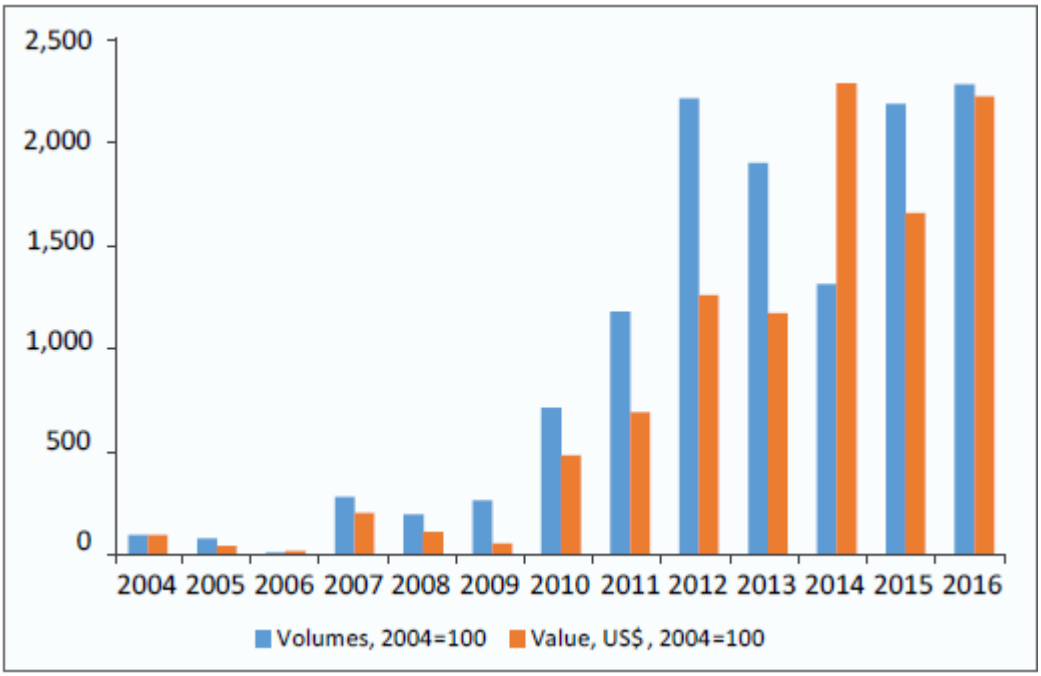

Figure 2 1: Rwanda export of goods and services (BoP, current US$ million)

Source: Central Bank of Rwanda (BNR, 2017)

2.4.1.2 **Import of good and services in Rwanda**

According to MINECOFIN report (2018), imports of goods increased by 6.6 percent in fiscal year 2017/18, resulting from an increase of 14.2 percent and 14.0 percent in energy products and intermediate goods compared to the previous fiscal year, leading to a volume increase of 17.7 percent and 15.2 percent, respectively. After a decline in the previous fiscal year, capital

goods also grew by 1.9 percent. Due to a rise in volume of 15.3 percent compared to the 16/17 fiscal year, consumer products have increased by 5.8 percent.

According to Frazer(2017), one of the benefits that a developing country like Rwanda can gain through imports is access to higher-technology and/or higher-quality inputs. High-quality factors of production have been shown to be essential to create the high-quality products that succeed on the export market. Imported factors of productions may still be worth it in order to create the high-quality goods to enter export markets, but we should at least know the impact on employment.

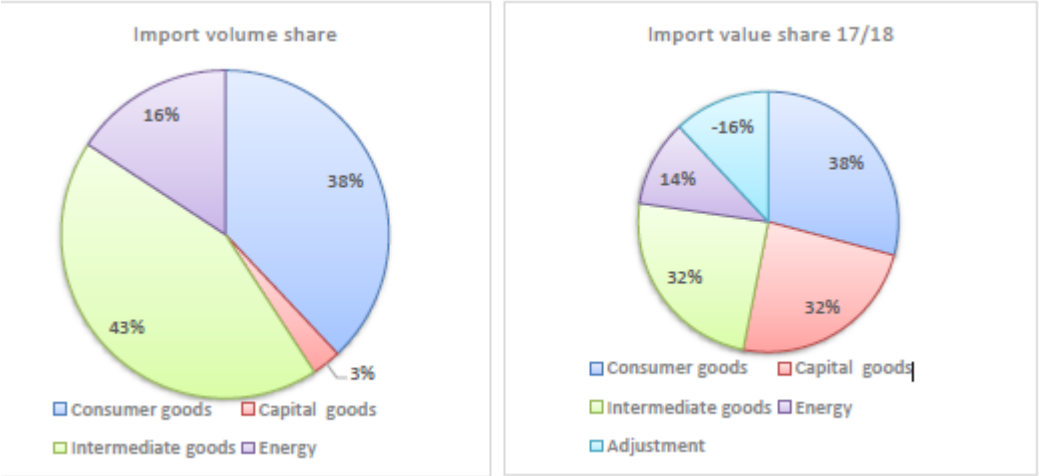

Figure 2 2 the composition of import by volume and value of fiscal year 2018/2019

Source: BNR, department of Statistics.

2.4.1.3 **Trade Balance in Rwanda**

In fiscal year 2019, the trade balance improved by 8.4 percent to US$ -1,058.4 million from US$ -1,155.2 million in the previous fiscal year 2016/2017, according to the MINECOFIN Report (2019). This was attributed to a rise in value of 37.0 percent in exports compared to a marginal increase in import value of 6.6 percent in 2017/2018 compared to the previous year of 2016/2017. It increased to 58.3 percent in 2017/2018 from 45.3 percent in the preceding year, according to the export coverage of imports. The service sector did not perform well as its deficit increased by 66.1 percent as service debit (import) increased by 11.5 percent compared to service

Credit (export) by 2.8 percent due to a 14.6 percent rise in travel debit (import) compared to a 10.3 percent decrease in travel credit (export).

2.4.2 Economic Growth Performance

In 2018, the global economy expanded by 3.6 per cent, down from 3.8 per cent in 2017. On average, industrialized economies expanded by 2.2 percent in 2018, compared to 2.4 percent in 2017. After 4.8 percent in 2017, emerging and developing economies expanded by 4.5 percent in 2018, following a downward revision for China and India. Economic growth in Sub-Saharan Africa grew from 2.9 percent in 2017 to 3.1 percent in 2018 and is expected to rise to 3.4 percent in 2019, indicating better output in non-resource-intensive and oil-exporting countries. The Rwandan economic growth rate reaches to 9.5% in 2018-19 compared to 8.9 % achieved in 2017-18. This performance was largely accelerated by the service sector, which contributed 4.5% points, followed by industry sector (2.9% points) and agriculture sector (1.2% points). Good economic performance was broad-based across sectors. The industry sector grew by 15.9 % from 8.1% recorded in the previous financial year, driven by the construction grew 24.9 %, manufacturing grew 2.0% and electricity subsectors grew by 9.2%. The service sector grew by 9.3 % in fiscal year 2018-19 from 9.7 percent recorded in the previous financial year. The agriculture sector increased by 4.6 percent in 2018-19, supported by favorable weather conditions. (BNR, 2019). Currently, the global economy is projected to decelerate in upcoming year due to uncertainty caused by Corona Virus 2019.

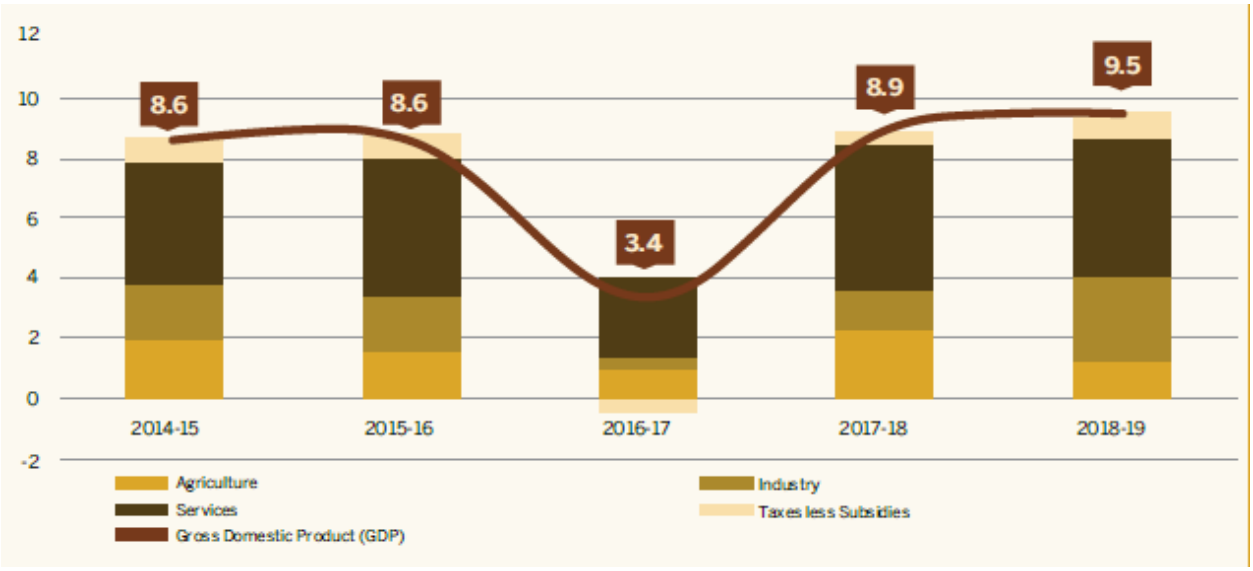

Figure 2 3 National economic growth

Source: IMF

According to MINECOFIN (2019), the Rwandan economy grew by 8.9 percent and 5.5 percentage points during fiscal year 2017/18 compared to fiscal year 2016/2017, where

economic growth was 3.4 percent. This was driven mainly by the tertiary sector, which rose from 5 percent in fiscal year 2016/17 to 10 percent in fiscal year 2017/18 due in part to trade and transport and taxes, resp. The manufacturing sector grew by 8% and the agricultural sector grew by 8%. As a result, the data available indicate that GDP per capita in 2017 was USD 774, compared with USD 735 in 2016.

2.5 Concept Framework

The main objective of this dissertation is to observe the effects international trade on economic growth. The significance of trade in the long run has been documented by several studies. Some macro-econometric studies have shown that open economies are experiencing faster economic growth than closed economies, while micro-econometric results support the fact that companies that are experiencing faster growth are already entering the export market. According to the Comparative Advantage Model of David Ricardo, a country has only to specialize in the manufacturing and export of products in which it is more efficient to benefit from foreign trade, because nations can export and import in the days of trade liberalization. If all nations follow his model, foreign trade will increase and resources will be used effectively and efficiently.

The aim of this study is to analyze the following variables: trade openness, exchange rate, trade balance and import duties on economic growth. Trade openness opens the market to international investors, inducing a booming position in the market. Romer (1986) and Lucas (1988) have provided very compelling evidence for the positive effect of transparency on economic growth, according to new growth theories. They argue that the more countries are open to foreign trade, the greater their capacity to absorb advanced developed-country technology that can improve developing countries ' economic growth.

The government can adjust the overall incentive structure of the economy by manipulating the real exchange rate by regulating macroeconomic variables and, consequently, the output trajectory of the country. Via many transmission mechanisms, the real exchange rate influences economic growth. Its impact on foreign trade flows by adjusting relative prices is the most direct one. The appreciation of the domestic currency makes tradable goods manufactured locally more costly compared to those manufactured abroad, reducing exports and increasing imports. Moreover, he added that the development of a country depends on the degree of the openness of the trade. Another theory from Wagner (2007) stated that more active participation in the export world market: the more competition and development of the country would be seen.

The theoretical impact of the real exchange rate on Costa Rica's exports and imports from 1991 to 2006 is empirically confirmed by Mora and Torres (2008) who found that sustaining an undervalued currency to encourage economic growth was considered to have a "beggar my neighbor impact" that could lead to competitive devaluations with a detrimental effect on the economies involved. The spread and worsening of the Great Depression of the 1930s led to this process (Eichengreen & Sachs, 1986). Concerns about China's currency undervaluation policy are also based on this argument (Mbaye, 2012)

However, when a nation tries to defend its domestic industries by imposing an additional tariff or quota on imported products, a trade war begins. Naila Iqbal Khan (2019) found that this strategy tends to be beneficial to local producers in the short term and helps to generate employment, but it costs employment in the long-run and hampers the overall trade and development of all the countries involved. This tariff is detrimental to economic growth.

Finally, we expected positive influence of trade openness, trade balance and exchange rate on economic growth and negative influence of customs duties on economic growth. Therefore, we should conduct investigation on above macroeconomic variables and recommend relevant trade policy to achieve economic growth.

2.6 Chapter Summary

The second chapter we reviewed the theoretical and empirical literature of international trade and economic growth. The literature has given more attention to relationship between international trade which consists of trade openness, customs duties, Trade balance and exchange rate and also, they are effect on Rwanda economy. Theoretical review on international trade from mercantilism to new trade theory where trade is considered as engine of growth was discussed in the first sub-section of first section in this chapter. Theories on economic growth were categorized into three main directions including post-keynesian, neoclassical and endogenous theory. Empirical literature review of different authors with similar literature were reviewed and found most of them support that international trade positively affect economic growth. This chapter describe current situation of trade economic performance in Eastergn Africa as well as Rwanda. Furthermore, concept framework was illustrated and discussed in this chapter.

CHAPTER III METHODOLOGY

3.1. Introduction

The chapter three focuses on the specification of a model, approaches, justification of the variables that affect the relationship between economic growth and international trade. This chapter also presents the data to make estimations. The study uses a time series data and the cointegration approach.

3.2 Trade and Economic performance in East African Community

Over the period 2013-17, the East African Community maintained an average economic growth of 5 percent. Private consumption and public investment, especially infrastructure and development in the extractive sectors, were the main drivers of growth in the Eastern African Community. Household consumption contributed to over 88% of Kenya's growth, while infrastructure development contributed to more than 45% of Uganda's growth in 2017.Since 2012, Rwanda has continued to report growth of an average of 7 percent, with a peak of about 8.9 percent in 2015 and a decrease to 6 percent in 2016. Economic growth was primarily driven by growth in the agricultural and services industries, which accounted for about 31% and 46.4% of GDP in 2017, respectively. Among the EAC countries that reported growth of 7.1 percent in 2017, Tanzania was the fastest growing economy. The growth of Gross Domestic Product in 2017 was mainly driven by the development of infrastructure, mining and quarrying, and agricultural production. The rapidly rising sector of the economy consists of: Mining and quarrying with a 17.5 percent rise in water supply at 16.7 percent, 16.6 percent in transportation and storage, 14.7 percent in information and communication and 14.1 percent in construction, Burundi's economy recovered from a negative growth of about 3.9 percent in 2015 to a positive growth of about 1.7 percent in 2017 over the period. The current BOP account of the EAC countries remained in deficit for the period 2013-17. Increases in imports of goods and services have been due to a persistent current account deficit. The EAC's intra-regional trade consists mainly of manufactured goods , especially petroleum, cement, sugar, salt confectionery, beer, steel and steel goods, paper , plastics, fats and oils, and pharmaceuticals(EAC, 2019).In 2017, droughts caused regional growth to slow to 4.5 percent; but in 2018, agriculture rebounded in most countries of the East African Group. In 2018, growth in the area is estimated at 5.9%, well above the SSA average (figure). Not only in the EAC but also in the SSA as a whole, Rwanda's growth rate was the fastest. For 2019, as both agricultural production and aggregate demand recover (World Bank Group, 2019), average growth for the regional block is expected to hit 6.1

percent. The following figure shows economic growth through East African Community and Sub-Saharan Africa countries:

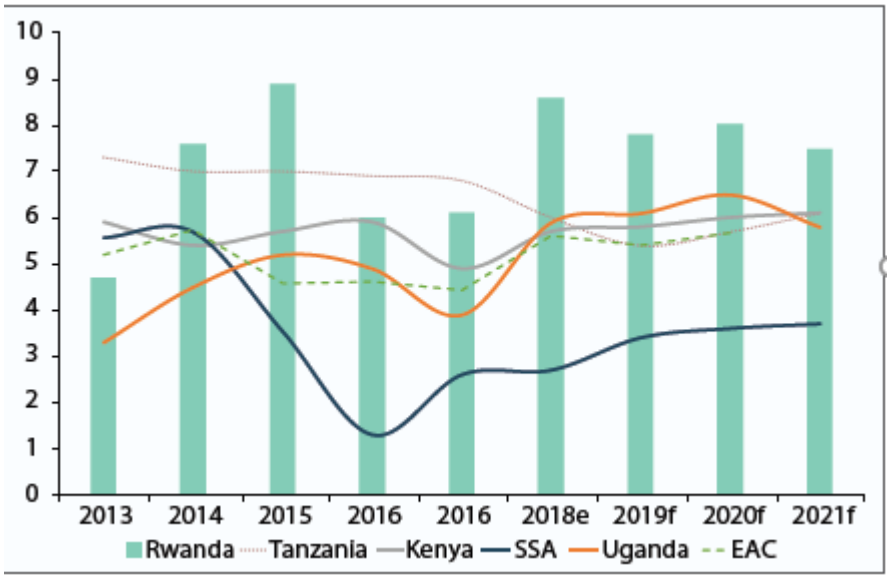

Figure 2 4: Global and Regional integration economic growth in (%)

Source: World Bank Group.

Note: **SSA**: Sub-Saharan Africa **EAC:** East African Community

The empirical study of the EAC Economic Growth Effect Assessment of Agricultural Trade was conducted and reported mixed results for the various EAC member states. Bi-directional relationships between agricultural exports and economic growth in Kenya, uni-directional relationships in Rwanda, and no relationship at all in Burundi, Tanzania and Uganda have been established using the granger causality test.

In order to achieve high economic growth, this research suggests that the governments of Kenya and Rwanda have to adopt policies to promote agricultural trade, in particular agricultural exports, to make agricultural exports more transparent by reducing technical barriers, since empirical results show that Kenya and Rwanda have a predictive capacity for agricultural exports to predict economic growth(A. Journal et al., 2016).

3.3 Research Design

3.3.1 Econometric Model

We have created an econometric model in this study to provide a better understanding of the relationship between foreign trade and economic growth in the economy of Rwanda. Time series econometrics methods such as the Augmented Dickey Fuller (ADF) stationary test (unit

root test), the Johansen cointegration test and the Vector Error Correction (VEC) model were used to calculate adjustment speed and the complex relationship between Trade Openness, Trade Balance, Exchange Rate, and Customs Duty.

The study uses the model, which can be expressed in its functional forms as follows:

GDP = f (OP, TB, ER, CD)

where

GDP = Gross Domestic Product is dependent variable

OP = Trade Openness

TB = Trade Balance

ER = Exchange Rate

CD = Customs Duty

$GDP = OP + TB + ER + CD + \varepsilon$

For better interpretation, variables were transformed into log form and the model become:

$LNGDP = LNOP + LNTB + LNER + LNCD + \varepsilon$

3.3.2 Definition and Justification of Variables

The model hypothesizes that GDP is a function of trade openness, trade balance, exchange rate, and tariffs, as expressed in the above paragraph. Although some other variables, such as domestic investment, government spending and others, may also affect GDP, they are not included in this model because we want to mainly evaluate the causal relationship between international trade and economic growth. Therefore, in this study's econometric model, other variables are excluded.

3.3.2.1 Trade openness

Economic openness, also referred to as the Impex rate, is the degree to which non-domestic transactions (imports and exports) take place in the political economy and influence the size and development of the national economy. It is possible to convey the ratio by percentage. Trade openness is calculated as a percentage of GDP by the number of exports and imports. With respect to transparency and economic growth or progress, these are comparative metrics. Trade transparency is determined using the equation below:

$$\textit{Trade openness ratio} = \frac{\textit{Export+Import of goods and services}}{\textit{Gross Domestic Product}}$$

3.3.2.2 Trade balance

The balance of trade shall be the net amount of the exports and imports of goods of a nation without taking into account all savings, capital flows and other capital components. Trading balance is the official term used in the current account for net exports. It shows whether the foreign exchange of a nation produces a surplus or a deficit over a given period. Balance of Exchange is an essential component of any current economic asset, as it calculates the net profits of a nation gained on global assets.

Trade balance is calculate using the following equation:

$$\textit{Trade balance} = \textit{Country's Export} - \textit{Country's Import.}$$

3.3.2.3 Exchange rate

Payments in foreign currencies such as the euro, pound, dollars and yen are part of international trade. Rwandan importers have to pay for the goods they purchase in those currencies and are, thus obliged to exchange Rwandan francs for those currencies. There is therefore a market for Euros, pounds, dollars and yen, among others, on the part of Rwandan importers.

3.3.2.4 Customs Duty

The indirect tax levied on imports or exports of products in international trade is a customs duty. It is a form of international trade regulation and a policy, which taxes foreign products to promote or safeguard the local industry. It can be fixed or variable (advarorem tax) (specific tax).

Taxing imported products and services ensures that, as they become more costly, individuals are less likely to purchase them. Therefore, tariffs offer an opportunity to increase demand and to substitute domestic goods for imports. Tariffs minimize international rivalry tensions and decrease the trade deficit. Tariffs can have a negative impact on economic growth and economic welfare in the political economy, while free trade and the elimination of trade barriers have a positive impact on economic growth. In this analysis, this assertion should be checked and confirmed. Data on foreign trade tax was collected from the Customs Services Department of the Revenue Authority of Rwanda.

3.3.2.5 Economic growth

Economic growth is the concept that economists use to characterize the rate of increase in the economy's goods and services. It can be the result of either an increase in the physical output factor in the economy or an improvement in the quality and usage of existing input levels (Florio et al., 2005). Economists use gross domestic product statistics to measure economic growth, which calculates the overall profits of everybody in the economy (N Gregory Mankiw, 2009)

3.3.3 The Source of Data

This study used quarterly time series data on macroeconomic variables described in subsection 3.3.2. Those data were collected from the different sources as described in the following table:

Table 3. 1 Source of Data

VARIABLES		SOURCES
Nominal GDP (RWF Billion)	**2006Q1-2019Q4**	**BNR**
Trade Openness (Index)	**2000Q1-2019Q4**	**BNR**
Exchange Rate (RWF/USD)	**2000Q1-2019Q4**	**BNR**
Trade Balance (USD million)	**2000Q1-2019Q4**	**BNR**
Customs Duties (RWF billion)	**2005Q1- 2019Q4**	**RRA**

3.4 Methods and techniques of Data analysis

The study used quantitative research method using quarterly data set from 2000-2019. Since most economic variables are found to be nonstationary at level,then the study used cointegration methodology to analyze the data.

3.4.1 Stationarity/Unit Root Test

Using non-stationary time series data in econometrical models, as cited in Gujarati (2011) produces inaccurate and spurious results and leads to poor understanding and forecasting.First, in each variable, it is important to evaluate stationarity and if you find instances of non-stationarity, the solution to the problem is to convert the time series data to become stationary. If the non-stationary process is a random walk with drift or random walk without a drift, it is transformed to stationary process to avoid spurious results in data analysis by differencing or detrending accordingly.

Several statistical tests have been developed to test order of integration of a time series. The pioneering work on testing for unit root in time series was done by **Dickey and Fuller Filler (1976), Dickey and Fuller (1979)** by testing whether a series is a random walk against the H_1 that it is stationary.

$Y_t = \theta Y_{t-1} + \varepsilon_t$ (3.1)

then $\Delta Y_t = (\theta - 1)Y_{t-1} + \varepsilon_t$ (3.2)

and therefore $\Delta Y_t = \mu Y_{t-1} + \varepsilon_t$, (3.3)

The testing procedure implies that one calculates a t-statistic on the OLS estimate for and test for whether this is significantly different from zero. $H_0: \mu = 0$ and $H_1: \mu < 0$, The test is therefore simply the t- test for H_0:

$$\hat{t}_{DF} = \frac{\hat{\theta} - 1}{SE(\hat{\theta})} = \frac{\hat{\mu}}{SE(\hat{\mu})} \quad (3.4)$$

If $\theta = 1$ the variance of *Yt is* infinitely large so that $\hat{t}$ *DF* as defined in (3.4) will be small so that using standard t-statistics one may reject a unit root too often even if the series is a random walk.

The same approach can be applied allowing an intercept and trend in the testing strategy, which is composed of the following two models in addition to the equation:

$Y_t = \alpha_0 + \theta Y_{t-1} + \varepsilon_t$ (3.5) become $\Delta Y_t = \alpha_0 + \mu Y_{t-1} + \varepsilon_t$ (3.7)

$\boldsymbol{Y_t} = \alpha_0 + \alpha_1 t + \theta Y_{t-1} + \varepsilon_t$ (3.6) become $\Delta Y_t = \alpha_0 + \alpha_1 t + \mu Y_{t-1} + \varepsilon_t$ **(**3.8)

Equations (3.1), (3.5) and (3.6) have only one lag structure. This supposes that the error term is a white noise and particularly that it is assumed to not be auto correlated. This will not be the case if the dynamics require more lags. In that case, residuals in the three equations will be auto correlated due to left out dynamics in. The Augmented Dickey Fuller (ADF) test controls for this by using p lags of the dependent variable. In other words, by allowing following an AR (p) process, with P≥1.

If we allow for p lags, p > 1, we would get (3.1), (3.5) and (3.6) become the following regression respectively (3.9), (3.10) and (3.11):

$$\Delta Y_t = \mu Y_{t-1} + \sum_{i=1}^{p} \gamma_j \Delta Y_{t-i} + \varepsilon_t \quad (3.9)$$

$$\Delta Y_t = \alpha + \mu Y_{t-1} + \sum_{i=1}^{p} \gamma_j \Delta Y_{t-i} + \varepsilon_t \quad (3.10)$$

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \mu Y_{t-1} + \sum_{i=1}^{p} \gamma_j \Delta Y_{t-i} + \varepsilon_t \quad (3.11)$$

For (3.1) and (3.9) the null hypothesis remains the same $H_0: \mu = 0$, In the case of (3.10) $H_0: \alpha = \mu = 0$ and for (3.11) the $H_0: \alpha_0 = \alpha_1 = \mu = 0$.

If the conclusion is non-stationary, the first difference of a variable will be tested. Variables should ideally be integrated of the same order, preferably I (1). If all the variables are I (0), there will be no problem of a spurious regression and a standard regression may be estimated.(Brooks, 2008)

3.4.2 Johansen Cointegration test.

Cointegration test is suitable approach that may be employed to test for the existence of long run relationships among the series. Two nonstationary series are Cointegrated if they tend to move together through time(Greene, 2002). This analysis is used to ascertain long run relationship between the explanatory variables and the dependent variable.

There are two approaches that can be employed to test cointegration among the series: The Engle and Granger two-stage cointegration analysis and Johansen's Maximum Likelihood Method. The Engle and Granger two-stage cointegration approach is suitable for conducting a test involving two variables, while Johansen's Method is a multivariate approach.(Chris brook,2008).

According to (Ronald , 2017), testing for and estimating cointegration system using the Johansen techniques follows below procedures:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + - - - - + \beta_K Y_{t-k} + u_t \quad \textbf{(3.12)}$$

Where: $\mathbf{Y_t}$ is an nx1 vector of variables that are cointegrated to order one [I(1)];

$\boldsymbol{u_t}$ is an nx1 vector of innovation.

Let turn above VARs into a VECM form; as follow:

$$\Delta Y_t = \Pi Y_{t-k} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \cdots + \Gamma_{k-1} \Delta Y_{t-(k-1)} + u_t \quad \textbf{(3.13)}$$

Where $\Pi = \left(\sum_{j=1}^{K} \beta_i\right) - I$ and $\Gamma_i = \left(\sum_{j=1}^{i} \beta_j\right) - I$

If a long run coefficient matrix **Π** has reduced rank r<*n*, then there exist *r*xn matrices **α** and **β** each with rank r such that **Π** = **αβ′** and *t* **β′y** is stationary. *r* is the number of cointegrating relationships, the elements of **α** are known as the adjustment parameters in the vector error correction model and each column of **β** is a cointegrating vector.

Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the **Π** matrix: the trace test and maximum eigenvalue test, shown in equations (**3.14**) and (**3.15**) respectively.

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln (1 - \hat{\lambda}_i) \quad \textbf{(3.14)}$$

$$J_{max} = -T \ln (1 - \hat{\lambda}_{i+1}) \quad \textbf{(3.15)}$$

Here *T* is the sample size and $i\hat{\lambda}_i$ is the *i*:th largest canonical correlation. The trace test tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *n* cointegrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *r* +1 cointegrating vectors.

As cited in Hjalmarsson & Österholm (2010), neither of these test statistics follows a chi square distribution in general; asymptotic critical values can be found in Johansen and Juselius (1990) and are given by most econometric software packages. Since the critical values used for the maximum eigenvalue and trace test statistics are based on a pure unit-root assumption, they will no longer be correct when the variables in the system are near-unit-root processes. Thus, the real question is how sensitive Johansen's procedures are to deviations from the pure-unit root assumption.

3.4.3 Vector error correction model (VECM)

The cointegration regression only considers the long-run relationaship between the level series of variables, while the Vector Error Correction Model (ECM) is developed to measure any dynamic adjustments between the first differences of the variables(Asari et al., 2011).

The Granger representation theorem states that if a set of variables are cointegrated, then there exists a valid error-correction representation of the data. According to the Granger representation theorem, if Y_t and X_t are both I (1) and have a cointegrating vector. There is an

error-correction model describing how Y_t and X_t behave in the short-run consistent with a long-run relationship. In other word, there must be some force pulling the equilibrium error back towards zero. According to Pfaff (2007) multivariate I(1) vector (Y_t, X_t)`=Y_t with cointegration vector The regression equation form for VECM is as follows:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha_1} + \boldsymbol{\gamma_1}(\boldsymbol{Y_{t-1}} - \boldsymbol{\beta_2 X_{t-1}}) + \sum_{i=1}^{k} \boldsymbol{\varphi_{1i}}\, \boldsymbol{Y_{t-i}} + \sum_{i=1}^{l} \boldsymbol{\varphi_{2i}} \Delta \boldsymbol{X_{t-i}} + \boldsymbol{\varepsilon_{1t}} \qquad \textbf{(3.16)}$$

$$\Delta \boldsymbol{X_t} = \boldsymbol{\alpha_2} + \boldsymbol{\gamma_2}(\boldsymbol{Y_{t-1}} - \boldsymbol{\beta_2 X_{t-1}}) + \sum_{i=1}^{k} \boldsymbol{\varphi_{1i}}\, \Delta \boldsymbol{Y_{t-i}} + \sum_{i=1}^{l} \boldsymbol{\varphi_{2i}} \Delta \boldsymbol{X_{t-i}} + \boldsymbol{\varepsilon_{2t}} \qquad \textbf{(3.17)}$$

When there is long-term relationship (cointegration) between series we apply Vector Error Correction Model in order to assess the short run over time. In case of variables being nonstationary (no cointegration), VECM is no longer required.

3.4.4 Residual and stability diagnostic

The diagnostic tests were used in this study to check adequacy of econometric model. Wald Test has been used to check significance of short-run coefficient of VECM. Jacque-Berra used to check normal distribution of residual, Breusch-Godfrey test used to check serial correlation, Breusch-Pagan Godfrey to check heteroscedaskicity and for assessing stability in model the CUSUM test has been used.

3.5 Summary and conclusion

This chapter focus on approach used to study link between international trade and economic growth. It shows econometric model and explain different macroeconomic variables used in this study. We have collected quarterly time series data from different institutions. ADF were used for testing stationarity in variables, Johansen cointegration and Vector error correction model were used to test whether variables have relationship in the long-run and short-run respectively. In addition, software used in data analysis is E-views.

CHAPTER FOUR RESULTS AND INTERPRETATIONS

This chapter aims to respond the objectives that were set in first chapter. The chapter comprises of six parts and it presents the results and interpretation. It includes the stationarity tests, lag selection criteria, cointegration analysis, the Vector error correction model, residual and stability diagnostic and chapter summary.

4.1 Test of Stationarity

4.1.1 Unit Root Test Using Augmented Dickey Fuller Test

This sub-section presents a first step in the estimation of the model of testing unit root in time-series data. This model involves GDP, Exchange rate, Trade Openness, Trade Balance and Customs Duties. We have collected quarterly time-series data from 200601 to 201912.

Table 4. 1 The Augmented Dickey Fuller Test

Variables	Model level	ADF At Level	ADF at First Difference	Order of integration
LNGDP	Intercept	(-2.842442)* (-2.915522)	(-5.761884)* (-2.916566)	I(1)
LNOP	Intercept	(-2.389549)* (-2.915522)	(-9.666821)* (-2.916566)	I(1)
LNER	Trend and Intercept	(-2.555786)* (-3.495295)	(-4.503589)* (-3.495295)	I(1)
LNCD	Intercept	(1.146014)* (-2.915522)	(-5.140924)* (-2.916566)	I(1)
LNTB	Intercept	(-2.287956)* (-2.915522)	(-7.626681) (-2.916566)	I(1)

Source: Own computation using EViews 9.0 software

NOTE: I(2) Being stationary at second difference

I(1) being stationary at first difference

( ) indicates critical value at 5% significance level

* indicates ADF test statistic

The Augmented Dickey Fuller test results presented in Table 4.1 indicates that at all variable are non-stationarity at level but after transformation they become stationary as it was greater negative on ADF test statistics than the critical value at 5%. Therefore, ADF test shows that all variable are integrated in the same order.

4.2 Lag Selection Criteria

In this study, to determine the lag length based on the unrestricted VAR lag order selection criteria. Hence, the optimal lags should be the smaller the value among the criteria. The results are indicated below.

Table 4. 2Lag Selection Criteria

VAR Lag Order Selection Criteria						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	206.6732	NA	2.94e-10	7.756661	-7.569041	-7.684732
1	512.5696	541.2013	6.01e-15*	-18.5606037*	-174.43465*	-18.12879*
2	524.6372	19.02971	1.02e-14	-18.06297	-15.99915	-17.27175
3	543.6795	26.36624	1.37e-14	-17.83383	-14.83191	-16.68296
4	576.2679	38.85547*	1.18e-14	-18.12569	-14.18568	-16.61518
* **Indicates lag order selected by criteria**						
LR sequential modified LR test statistic (each test at 5%)						
FPE : Final Prediction Error						
AIC : Akaike Information Criterion						
SC : Schwarz Information Criteria						
HQ: Hannan-Quinn information Criterion						

Source: Own computation using E-Views 9.0 software

A reasonable way on how to select the lag length of the VAR model is to fit VAR (p) models with different orders p=0,…….,p max and choose p with the minimum value among model selection criteria. In this study, the asterisk indicates that all criteria except LogL are

appropriate, employing one lag length. Hence, Akaike information criterion is to be employed as it gives smallest value of p. Thus, lag1 is selected .

According to results of ADF unit root test, we found that all variables are integrated of the same order I(1), so we can perform Johansen Cointegration test

4.3 Johansen cointegration

The aim of this approach is to assess a long run equilibrium relationship amongst all the variables. According to results of ADF unit root test, we found that all variables are integrated of the same order I(1), so we can perform Johansen Cointegration test. The null hypothesis tested is that there are no cointegrating equations. The alternative hypothesis is that there is at least one cointegrating equation. As multivariate model, it is advised to use Johansen to measure long-run relationship among variables. The summary of the cointegration test results are presented in Table 4.3, 4.4, and 4.5 and the complete portion is found in Appendix.

Table 4.3 Johansen Cointegration (Trace Test)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No .of CE(s)	**Eigen value**	**Trace statistic**	**0.05 Critical value**	**Probabilities ****
None*	0.476126	76.33358	69.81889	0.0138
At most 1	0.358891	41.42239	47.85613	0.1756
At most 2	0.186793	17.41636	29.79707	0.6092
At most 3	0.109039	6.250801	15.49471	0.6659
At most 4	0.00301	0.016267	3.841466	0.8984

Source: Own computation using EViews 9.0 software

Table 4.3 presents results of trace test statistic, Null hypothesis is not accepted as the trace statistic value is greater than the critical value (76.334 > 69.819) while the Probability value is less than 1.38% which less than significance of 5%. . We have to reject null hypothesis. This means that there is at least one cointegrating equation at the 5% of level of significance. The corresponding probability values are less than 5%. As trace test show a statistically significance results, that is there is long-run relationship between independent variables in study with GDP.

Table 4. 4 Johansen Cointegration using Maximum Eigen Value.

Unrestricted cointegration r Rank Test (Maximum Eigen Value)				
Hypothesized No. of CE(s)	**EigenValue**	**Max-Eigen statistic**	**0.05 Critical**	**P-Value**
None*	0.476126	34.91119	33.87687	0.0375
At most 1	0.358891	24.00603	27.58434	0.1345
At most 2	0.186793	11.16556	21.13162	0.6307
At most 3	0.109039	6.234534	14.26460	0.5833
At most 4	0.000301	0.016267	3.841466	0.8984

Source: Own computation using EViews 9.0 software

Table 4.4 present results of the maximum eigenvalue tests and reject the null hypothesis of no cointegration. According to Max-Eigenvalue test results, shows that Max-Eigen Statistic is greater than the critical value 34.91119>33.87687 while the probability value is less than 5%. This indicates that there is a presence of one cointegrating equations at 5% level of significance at each test. This indicates that there is a long run relationship between the dependent variable Gross Domestic Products and its regressors. Given that the probability values in Table 4.5 are close to zeros, the null hypotheses are rejected.

Based on results in table 4.3 and 4.4 reveal that the series are cointegrated, it means that there is one cointegration vector. These imply that there exists a long-run relationship between the dependent variables GDP with Trade openness, exchange rate, trade balance and customs duties. The following table presents Johansen Normalization coefficients.

Table 4. 5 Johansen Normalization Interpretation

Normalized cointegration coefficients (Standard error in parentheses)				
LNGDP	**LNOP**	**LNER**	**LNCD**	**LNTB**
1.000000	-2.742095	-2.703326	0.411193	-1.052265
	(0.59961)	(1.32430)	(0.72846)	(0.41106)

Source: Own computation using E-Views 9.0 software

Table 4.5 indicates Johansen normalized coefficients. These results show contribution of each variable in the long-run. When interpreting the long run coefficients of cointegration, the signs are reversed. In our model, LNOP, LNER and LNTB are statistically significant and have positive long-run impact on LNGDP while LNCD is statistically insignificance and has negative impact on LNGDP.

When the variables are transformed into logarithms, the coefficients can be interpreted as long run elasticity (degree of responsiveness of dependent variable to changes in independent variables). In our case, we find that all significant coefficients are elastic as they are greater than one. It means that trade openness, exchange rate and trade balanced increases proportionately greater than gross Domestic product.

Specifically, the partial slope coefficient 2.74 measures elasticity of GDP with respect to trade openness, it means that if trade openness increased by 1 percent on the average, GDP goes up about 2.74 percent, holding the other independent variables constant in long-run.

The partial slope coefficient, 2.7 measures elasticity of GDP with respect to exchange rate, that is if exchange rate increases by 1 percent, on the average GDP will goes up by 2.7 percent, ceteris paribus. The last significant partial slope is 1.05, which measures degree of responsiveness of GDP to change in Trade Balance, that is if trade balance increase by 1 percent, on the average GDP will goes up about 1.1 percent, holding the other independent variables constant in long-run. The partial coefficient, 0.41 that measures degree of responsiveness of gross domestic product to change in customs duties is statistically insignificant in the long-run model of the study.

Our research expected that trade openness positively influences country's GDP, devaluation of currency favor export, which increases domestic production, and trade balance positively contribute to GDP. While customs duties, as tariff barrier of international trade negatively influence GDP in long run. It means that above findings meet somehow meet our expectations.

As trace test and Eigen Maximum Eigen Value showed that above macroeconomic variables are cointegrated, we can estimate Vector Error Correction Model.

4.4 Vector Error Correction Model

Since non-stationary series are cointegrated, we compute a restricted VAR and estimating Vector Error Correction Model. This model separates the long-term convergence from short-run adjustment dynamics. In the ECM, which is known as error correction model, the cointegration term is the error correction term, because the long run equilibrium deviation is

corrected gradually through short-run adjustments. The following are Vector Error Correction Estimates:

Table 4. 6 presents Vector Error Correction Estimates.

Cointegration Eq					
	D(LNGDP)	**D(LNER)**	**D9LNCD)**	**D(LNOP)**	**D(LNTB)**
CointEq1	-0.254254	0.060595	-0.11955	0.216544	0.855225
	(0.09423)	(0.02301)	(0.35955)	(0.32857)	(0.40400]
	[-2.69812]	[2.63304]	[-0.33252]	[0.65904]	[2.11691]

Source: Own computation using E-Views 9.0 software

Table 4. 7 Vector Error Correction Model

Dependent Variable: D(LNGDP)				
Method: Least Squares (Gauss Newton/Marquardt steps)				
	Coefficient	**Std Error**	**t-statistic**	**Prob**
C(1)	-0.254254	0.094233	-2.698124	0.0101
C(2)	-0.004549	0.173885	-0.026163	0.9793
C(3)	-0.401266	0.159462	-2.516382	0.0159
C(4)	0.024777	0.044655	0.554856	0.5820
C(5)	0.025481	0.044787	0.568943	0.5725
C(6)	-0.951691	0.584733	-1.627565	0.1113
C(7)	-0.715883	0.575107	-1.223508	0.2281
C(8)	0.012451	0.052523	0.237052	0.8138
C(9)	0.116762	0.054572	2.139602	0.0384
C(10)	0.079288	0.046078	1.720724	0.0928
C(11)	0.054212	0.040265	1.346372	0.1856
C(12)	0.059579	0.010189	5.847502	0.0000

Source: Own computation using E-Views 9.0 software

As it has been presented in the Table.4.3 and Table 4.4 , there is cointegration among variables, then after , results presented in Table 4.6 and 4.7 shows short-run coefficients where deviation from long-run equilibrium is quarterly corrected at speed of 25.4 percent. This is speed of adjustment toward long run equilibrium.We have to perform Wald test to perform diagnostic of above coefficients.

Table 4. 8 Wald Test

Wald Test			
Equation:EQ01			
Test Statistic	Value	df	Probability
F-static	4.688840	(2,41)	0.0147
Chi-square	9.377680	2	0.0092
Null hypothesis: C(6)=C7)=0			

Source: Own computation using EViews 9.0 software

Wald test in Table 4.8 were responsible to test if explanatory variables have short-run effect on GDP which revealed that all explanatory variable are insignificant at 5% expect exchange rate which has short run effect on GDP. In addition, speed of adjustment coefficient is statistically significant and has negative sign.

4.5 Diagnostic and Stability test

The diagnostic tests were performed for checking adequacy and stability of model. Firstly, we owe to conduct residual diagnostic. Breusch-Godfrey test has been used to test serial correlation, Breusch-Pagan-Godfrey test to check heteroskedasticity and Jarque-Bera to check normality. Secondly, we have to undertake stability diagnostic, CUSUM test has been used to check stability.

4.5.1 Residual Diagnostic

Table 4. 9 Residual Analysis

TESTS	**P-VALUE**
Breusch-Godfrey Serial Correlation	0.0582
Breusch-Pagan-Godfrey Heteroskedasticity	0.6178

Jarque-Bera Normality	0.0766

Source: Own computation using E-Views 9.0 software

The results of the residual diagnostic was performed to test for the adequacy of the model as contained in Table 4.9, since all the probability values are greater than 5%, we cannot reject null hypothesis, therefore residuals are homoscedastic and normally distributed and model has no serial correlation.

4.5.2 Stability Diagnostic

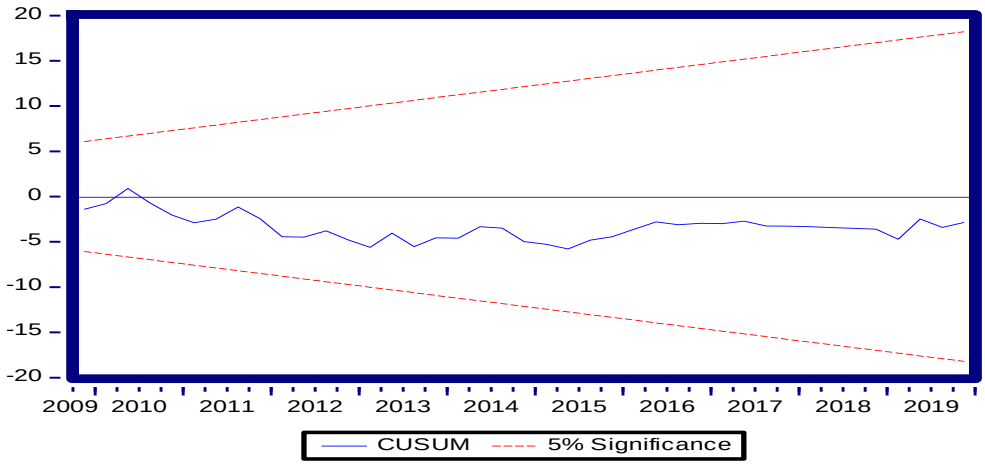

Figure 4. 1 CUSUM test for stability diagnostic

The results in figure 4.1 confirm that there is stability in our model, since blue line it lies within two red lines. It is significant at 5%.

4.6 Chapter Summary

The fourth chapter presented results based on the objectives that were set to be achieved in first chapter. ADF were used to test stationarity in Variables, where all variable are integrated of first order (I(1)). We have also determined lag length through the unrestricted VAR lag order selection criteria and found that optimal lag is one. The next step was to test for long term correlation between GDP and its independent variables. The results came back showing that they are cointegrated. VEC Model has a significant speed of adjustment coefficient with a negative a negative sign. Finally, the coefficient, Residual and stability diagnostic test took place to check respectively significance of short-run coefficient, serial correlation, heteroscedasticity, normality and stability in model and we are happy for results from those tests that confirm adequacy in this model.

CHAPTER FIVE SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary of the study

This study analyzed the effect of international trade on economic growth in Rwanda. The main step was to address the objectives of the study. First specific objective: to identify long-run relationship between the components of international trade and economic growth in Rwanda. The second objective: to determine whether trade openness, exchange rate, customs duties, trade balance and economic growth has short-run relationship in Rwanda. The last objective: to suggest relevant trade policy can be implemented by the government Rwanda to boost economic growth.

Some theories and empirical study related to international trade and economic growth were reviewed in chapter two. The methodology that consist of econometric model, the data techniques, that were reviewed in chapter in order to achieve our objectives in chapter one.The data from 200601-201904 were sourced from BNR, NISR and RRA. The data analysis techniques performed include ADF to measure stationarity in variables. After finding lag length criteria, we have performed Johansen cointegration to measure long run relationship among variables. VECM was estimated and we found a significant coefficient of speed of adjustment a and some short run coefficient. Stability and residual diagnostic of the model were performed and found good results.

5.2 Conclusion

The results obtained by running Johansen Cointegration test show that all the variables produce a long run relationship. Since, Both the maximum eigenvalue and trace tests rejected the null hypothesis as indicated in table 4.3 and table 4.4, therefore, the first objective of the study was met. The VECM results in table 4.7 show that the speed of adjustment towards the long run equilibrium is significant and have a negative sign. Diagnostic of Short-run coefficients show that only exchange rate which influence on GDP in short-run as indicated in table 4.8. The residual diagnostic including the Breush -Godfrey, Breush Pagan Godfrey and Jacque-Bera were respectively employed to test serial correlation, heteroskedasticity and normality and we found that there is no serial correlation, residuals are homoscedastic and normally distributed as indicated in the table 4.9.

This research assessed the impact of international trade on economic growth in Rwanda considering the variables that were used, such as exchange rate, trade openness and Trade

balance are positively related to GDP in long-run, while customs duties have negative insignificant impact on GDP. Based on results, It has been shown that in the long run trade openness can potentially enhance economic growth by improving total factors of productivity through technology diffusion, providing access to goods and services, achieving efficiency in the allocation of resources and knowledge dissemination.

In fact, Rwandan economy exchange rate can also be regarded as important tool as it has a positive relationship with GDP and increase trade internationally; it has an urge impact when trading takes place. The level of trade deficit will positively influence economic growth only if country mostly imports capital goods for boosting domestic production. The results show that customs duties have insignificant impact on economic growth in both long run and short run.

5.3 Recommendations

The aim of the research was to assess the effect of international trade on Rwandan economic growth. Rwanda needs to have specific policy to attain double-digit average annual growth rate for achieving its aspirations (a high-income economy by 2050) through promoting international trade as one of main drivers of economic growth.

Since, this study was found that trade openness positively influence economic growth in long run, government should create favourable investment climate to attract domestic and foreign investors by promoting Doing business and reducing tariff and non-tariff barriers. Thus, this will help in implementation of outward oriented strategy.

Government should stimulate domestic production by exempting importation of raw material and capital goods and develop human capital that can absorb technologies coming from Developed Countries. This will boost country's economic growth, promote export and reduce trade deficit.

The results of this study revealed that exchange rate positively impact economic growth in both short-run and long run, as it is a tool for stimulating export and domestic production, government must put an emphasis on the currency value, by working on it so that the economy can gain from it.

The trade policies are endless that why the further study may investigated this model by using variables such as terms of trade and Foreign Direct Investment using ARDL approach for more results.

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APPENDIX

APPENDIX A: JOHANSEN COINTEGRATION

Date: 09/13/20 Time: 21:17

Sample (adjusted): 2006Q3 2019Q4

Included observations: 54 after adjustments

Trend assumption: Linear deterministic trend

Series: LNGDP LNOP LNER LNCD

LNTB

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.476126	76.33358	69.81889	0.0138
At most 1	0.358891	41.42239	47.85613	0.1756
At most 2	0.186793	17.41636	29.79707	0.6092
At most 3	0.109039	6.250801	15.49471	0.6659
At most 4	0.000301	0.016267	3.841466	0.8984

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Hypothesized No. of CE(s)	Eigenvalue	Hypothesized No. of CE(s)	Eigenvalue
None *	0.476126	None *	0.476126	None *	0.476126
At most 1	0.358891	At most 1	0.358891	At most 1	0.358891
At most 2	0.186793	At most 2	0.186793	At most 2	0.186793

At most 3	0.109039	At most 3	0.109039	At most 3	0.109039
At most 4	0.000301	At most 4	0.000301	At most 4	0.000301

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNGDP	LNOP	LNER	LNCD	LNTB
-3.194648	8.760028	8.636177	-1.313618	3.361617
-25.88787	0.936435	20.17008	7.087420	-8.726608
2.369059	-2.741495	-26.11916	14.44639	7.786243
4.345628	-8.760991	0.632903	-1.569811	0.433658
-5.200639	3.622293	15.95238	0.129799	0.320371

Unrestricted Adjustment Coefficients (alpha):

D(LNGDP)	0.003073	0.005288	-0.001165	0.004783	-0.000315
D(LNOP)	-0.027776	-0.013655	0.008878	0.021947	-0.000191
D(LNER)	-0.002598	-0.000500	-0.000308	-0.001169	-5.55E-05
D(LNCD)	0.006336	-0.021119	-0.022343	0.011250	-0.000913
D(LNTB)	-0.017839	0.036378	-0.015127	-0.004945	0.001229

1 Cointegrating Equation(s):	Log likelihood	521.3688

Normalized cointegrating coefficients (standard error in parentheses)

LNGDP	LNOP	LNER	LNCD	LNTB

1.000000	-2.742095	-2.703326	0.411193	-1.052265
	(0.59961)	(1.32430)	(0.72846)	(0.41106)

Adjustment coefficients (standard error in parentheses)

D(LNGDP)	-0.009818
	(0.01174)
D(LNOP)	0.088733
	(0.03707)
D(LNER)	0.008300
	(0.00261)
D(LNCD)	-0.020240
	(0.04138)
D(LNTB)	0.056990
	(0.04776)

2 Cointegrating Equation(s): Log likelihood 533.3718

Normalized cointegrating coefficients (standard error in parentheses)

LNGDP	LNOP	LNER	LNCD	LNTB
1.000000	0.000000	-0.753410	-0.282930	0.355666
		(0.20097)	(0.11164)	(0.06230)
0.000000	1.000000	0.711105	-0.253136	0.513451
		(0.47018)	(0.26118)	(0.14576)

Adjustment coefficients (standard error in parentheses)

D(LNGDP)	-0.146719	0.031873
	(0.09371)	(0.03165)
D(LNOP)	0.442235	-0.256102
	(0.29821)	(0.10072)
D(LNER)	0.021232	-0.023227
	(0.02123)	(0.00717)

D(LNCD)	0.526497	0.035724	
	(0.32821)	(0.11085)	
D(LNTB)	-0.884760	-0.122208	
	(0.36459)	(0.12314)	

3 Cointegrating Equation(s): Log likelihood 538.9546

Normalized cointegrating coefficients (standard error in parentheses)

LNGDP	LNOP	LNER	LNCD	LNTB
1.000000	0.000000	0.000000	-0.768358	0.074585
			(0.07545)	(0.07646)
0.000000	1.000000	0.000000	0.205034	0.778748
			(0.12533)	(0.12701)
0.000000	0.000000	1.000000	-0.644308	-0.373078
			(0.07976)	(0.08083)

Adjustment coefficients (standard error in parentheses)

D(LNGDP)	-0.149479	0.035068	0.163641
	(0.09399)	(0.03311)	(0.12241)
D(LNOP)	0.463268	-0.280441	-0.747184
	(0.29751)	(0.10480)	(0.38747)
D(LNER)	0.020501	-0.022382	-0.024457
	(0.02129)	(0.00750)	(0.02773)
D(LNCD)	0.473565	0.096976	0.212311
	(0.31831)	(0.11213)	(0.41457)
D(LNTB)	-0.920597	-0.080737	0.974792
	(0.36150)	(0.12735)	(0.47081)

4 Cointegrating Equation(s):	Log likelihood	542.0719	

Normalized cointegrating coefficients (standard error in parentheses)

LNGDP	LNOP	LNER	LNCD	LNTB
1.000000	0.000000	0.000000	0.000000	1.460797
				(0.21897)
0.000000	1.000000	0.000000	0.000000	0.408842
				(0.05968)
0.000000	0.000000	1.000000	0.000000	0.789332
				(0.18027)
0.000000	0.000000	0.000000	1.000000	1.804121
				(0.29358)

Adjustment coefficients (standard error in parentheses)

D(LNGDP)	-0.128696	-0.006832	0.166668	0.009101
	(0.09346)	(0.04479)	(0.12010)	(0.05710)
D(LNOP)	0.558641	-0.472718	-0.733293	0.033508
	(0.28935)	(0.13867)	(0.37183)	(0.17678)
D(LNER)	0.015422	-0.012142	-0.025197	-0.002749
	(0.02110)	(0.01011)	(0.02711)	(0.01289)
D(LNCD)	0.522454	-0.001586	0.219431	-0.498439
	(0.31971)	(0.15322)	(0.41085)	(0.19533)
D(LNTB)	-0.942085	-0.037416	0.971663	0.070491
	(0.36594)	(0.17537)	(0.47025)	(0.22358)

APPENDIX B: VECTOR ERROR CORRECTION ESTIMATES

Vector Error Correction Estimates

Date: 09/14/20 Time: 13:28

Sample (adjusted): 2006Q4 2019Q4

Included observations: 53 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNGDP(-1)	1.000000
LNER(-1)	-1.272406
	(0.18718)
	[-6.79761]
LNCD(-1)	-0.025069
	(0.10293)
	[-0.24355]
LNOP(-1)	-0.129091
	(0.09368)
	[-1.37807]
LNTB(-1)	0.361058
	(0.06120)
	[5.89916]
C	3.686706

Error Correction:	D(LNGDP)	D(LNER)	D(LNCD)	D(LNOP)	D(LNTB)
CointEq1	-0.254254	0.060595	-0.119555	0.216544	-0.855225
	(0.09423)	(0.02301)	(0.35955)	(0.32857)	(0.40400)
	[-2.69812]	[2.63304]	[-0.33252]	[0.65904]	[-2.11691]
D(LNGDP(-1))	-0.004549	-0.016018	0.298350	0.186276	0.360127
	(0.17389)	(0.04247)	(0.66346)	(0.60630)	(0.74548)
	[-0.02616]	[-0.37719]	[0.44969]	[0.30723]	[0.48308]
D(LNGDP(-2))	-0.401266	0.001805	-0.583037	-0.762818	-0.273566

	(0.15946)	(0.03894)	(0.60842)	(0.55601)	(0.68364)
	[-2.51638]	[0.04635]	[-0.95828]	[-1.37195]	[-0.40016]
D(LNER(-1))	-0.951691	0.388315	0.321965	-4.228709	2.089352
	(0.58473)	(0.14280)	(2.23104)	(2.03885)	(2.50687)
	[-1.62756]	[2.71925]	[0.14431]	[-2.07406]	[0.83345]
D(LNER(-2))	-0.715883	0.344462	-4.499357	1.376993	3.747033
	(0.58511)	(0.14289)	(2.23246)	(2.04016)	(2.50847)
	[-1.22351]	[2.41062]	[-2.01542]	[0.67495]	[1.49375]
D(LNCD(-1))	0.012451	0.018946	-0.216360	0.144442	-0.296912
	(0.05252)	(0.01283)	(0.20040)	(0.18314)	(0.22518)
	[0.23705]	[1.47700]	[-1.07963]	[0.78870]	[-1.31857]
D(LNCD(-2))	0.116762	-0.003637	0.150059	0.297946	-0.066447
	(0.05457)	(0.01333)	(0.20822)	(0.19028)	(0.23396)
	[2.13960]	[-0.27287]	[0.72068]	[1.56581]	[-0.28401]
D(LNOP(-1))	0.024777	0.002557	-0.022010	-0.282989	0.126778
	(0.04466)	(0.01091)	(0.17038)	(0.15570)	(0.19145)
	[0.55486]	[0.23446]	[-0.12918]	[-1.81749]	[0.66222]
D(LNOP(-2))	0.025481	-0.011229	0.000506	-0.067731	0.222770
	(0.04479)	(0.01094)	(0.17088)	(0.15616)	(0.19201)
	[0.56894]	[-1.02662]	[0.00296]	[-0.43372]	[1.16020]
D(LNTB(-1))	0.079288	-0.018456	0.161912	0.042847	-0.035637
	(0.04608)	(0.01125)	(0.17581)	(0.16067)	(0.19755)
	[1.72072]	[-1.64005]	[0.92095]	[0.26668]	[-0.18040]
D(LNTB(-2))	0.054212	-0.016429	0.032587	0.175794	0.052136

	(0.04027)	(0.00983)	(0.15363)	(0.14040)	(0.17262)
	[1.34637]	[-1.67077]	[0.21211]	[1.25213]	[0.30202]
C	0.059579	0.001468	0.094846	0.057889	-0.085197
	(0.01019)	(0.00249)	(0.03888)	(0.03553)	(0.04368)
	[5.84750]	[0.59001]	[2.43977]	[1.62948]	[-1.95043]
R-squared	0.318494	0.552802	0.177153	0.246511	0.295139
Adj. R-squared	0.135651	0.432822	-0.043611	0.044356	0.106030
Sum sq. resids	0.025752	0.001536	0.374899	0.313092	0.473329
S.E. equation	0.025062	0.006121	0.095624	0.087386	0.107446
F-statistic	1.741897	4.607459	0.802455	1.219414	1.560680
Log likelihood	126.9786	201.6925	56.00808	60.78231	49.83003
Akaike AIC	-4.338816	-7.158206	-1.660682	-1.840842	-1.427548
Schwarz SC	-3.892712	-6.712102	-1.214578	-1.394738	-0.981444
Mean dependent	0.030810	0.009584	0.036983	0.013980	-0.038547
S.D. dependent	0.026957	0.008127	0.093604	0.089391	0.113639

Determinant resid covariance (dof adj.)	4.39E-15
Determinant resid covariance	1.22E-15
Log likelihood	534.0733
Akaike information criterion	-17.70088
Schwarz criterion	-15.28449

APPENDIX C: VECTOR ERROR CORRECTION MODEL

Dependent Variable: D(LNGDP)

Method: Least Squares (Gauss-Newton / Marquardt steps)

Date: 09/14/20 Time: 13:32

Sample (adjusted): 2006Q4 2019Q4

Included observations: 53 after adjustments

D(LNGDP) = C(1)*(LNGDP(-1) - 1.27240578514*LNER(-1) - 0.0250688328359*LNCD(-1) - 0.129091113797*LNOP(-1) + 0.361057848234*LNTB(-1) + 3.68670568681) + C(2)*D(LNGDP(-1)) + C(3)*D(LNGDP(-2)) + C(4)*D(LNER(-1)) + C(5)*D(LNER(-2)) + C(6) *D(LNCD(-1)) + C(7)*D(LNCD(-2)) + C(8)*D(LNOP(-1)) + C(9) *D(LNOP(-2)) + C(10)*D(LNTB(-1)) + C(11)*D(LNTB(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.254254	0.094233	-2.698124	0.0101
C(2)	-0.004549	0.173885	-0.026163	0.9793
C(3)	-0.401266	0.159462	-2.516382	0.0159
C(4)	-0.951691	0.584733	-1.627565	0.1113
C(5)	-0.715883	0.585107	-1.223508	0.2281
C(6)	0.012451	0.052523	0.237052	0.8138
C(7)	0.116762	0.054572	2.139602	0.0384
C(8)	0.024777	0.044655	0.554856	0.5820
C(9)	0.025481	0.044787	0.568943	0.5725
C(10)	0.079288	0.046078	1.720724	0.0928
C(11)	0.054212	0.040265	1.346372	0.1856
C(12)	0.059579	0.010189	5.847502	0.0000

R-squared	0.318494	Mean dependent var	0.030810
Adjusted R-squared	0.135651	S.D. dependent var	0.026957
S.E. of regression	0.025062	Akaike info criterion	-4.338816

Sum squared resid	0.025752	Schwarz criterion	-3.892712
Log likelihood	126.9786	Hannan-Quinn criter.	-4.167266
F-statistic	1.741897	Durbin-Watson stat	2.260231
Prob(F-statistic)	0.097920		

APPENDIX D: WALD TEST

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.688840	(2, 41)	0.0147
Chi-square	9.377680	2	0.0092

Null Hypothesis: C(4)=C(5)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.951691	0.584733
C(5)	-0.715883	0.585107

Restrictions are linear in coefficients.

APPENDIX E: SERIAL CORRELATION

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.343797	Prob. F(2,39)	0.1093
Obs*R-squared	5.686798	Prob. Chi-Square(2)	0.0582

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 09/15/20 Time: 09:16

Sample: 2006Q4 2019Q4

Included observations: 53

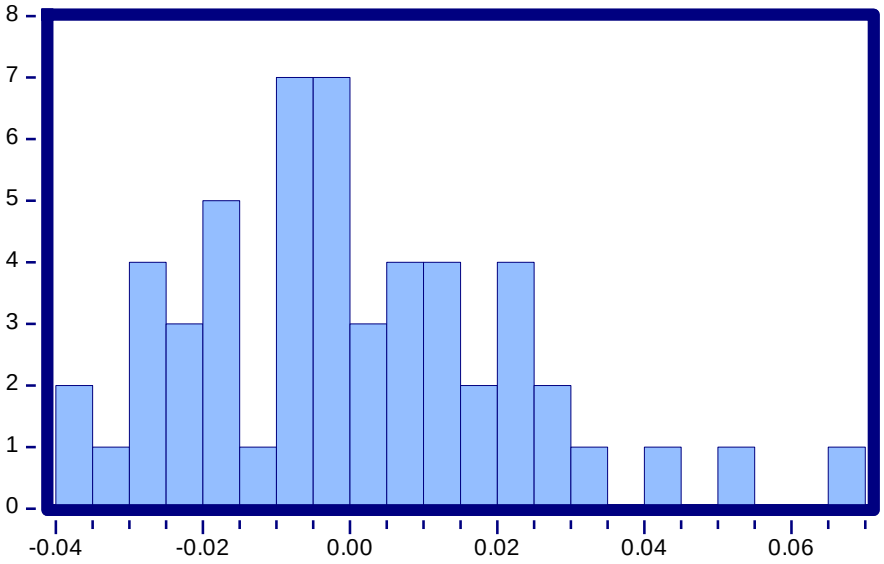
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.079526	0.102103	0.778887	0.4407
C(2)	0.558996	0.314413	1.777906	0.0832
C(3)	-0.005234	0.247087	-0.021182	0.9832
C(4)	0.241715	0.614962	0.393057	0.6964
C(5)	0.487025	0.618291	0.787696	0.4356
C(6)	-0.007924	0.052840	-0.149964	0.8816
C(7)	-0.001972	0.053158	-0.037102	0.9706
C(8)	-0.056078	0.051609	-1.086606	0.2839
C(9)	-0.014250	0.043010	-0.331311	0.7422
C(10)	0.001326	0.043804	0.030264	0.9760
C(11)	-0.030349	0.045598	-0.665579	0.5096
C(12)	-0.026165	0.017924	-1.459739	0.1524
RESID(-1)	-0.800368	0.370992	-2.157375	0.0372

RESID(-2)	0.081098	0.338870	0.239318	0.8121

R-squared	0.107298	Mean dependent var	8.87E-17
Adjusted R-squared	-0.190269	S.D. dependent var	0.022254
S.E. of regression	0.024279	Akaike info criterion	-4.376846
Sum squared resid	0.022989	Schwarz criterion	-3.856392
Log likelihood	129.9864	Hannan-Quinn criter.	-4.176705
F-statistic	0.360584	Durbin-Watson stat	1.998038
Prob(F-statistic)	0.974586		

APPENDIX F: NORMALITY TEST



Series: Residuals	
Sample 2006Q4 2019Q4	
Observations 53	
Mean	8.87e-17
Median	-0.001627
Maximum	0.069285
Minimum	-0.039419
Std. Dev.	0.022254
Skewness	0.674397
Kurtosis	3.712368
Jarque-Bera	5.138156
Probability	0.076606

APPENDIX G: AUGMENTED DICKEY FULLER TEST : LNGDP

Null Hypothesis: D(LNGDP) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.761884	0.0000
Test critical values:	1% level	-3.560019	
	5% level	-2.917650	
	10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNGDP,2)

Method: Least Squares

Date: 09/27/20 Time: 14:41

Sample (adjusted): 2006Q4 2019Q4

Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-1.037426	0.180050	-5.761884	0.0000
D(LNGDP(-1),2)	0.095201	0.129571	0.734735	0.4659
C	0.032179	0.006900	4.663573	0.0000

R-squared	0.487154	Mean dependent var	-0.000358
Adjusted R-squared	0.466641	S.D. dependent var	0.037400
S.E. of regression	0.027313	Akaike info criterion	-4.307937
Sum squared resid	0.037301	Schwarz criterion	-4.196411

Log likelihood	117.1603	Hannan-Quinn criter.	-4.265050
F-statistic	23.74762	Durbin-Watson stat	2.024074
Prob(F-statistic)	0.000000		

APPENDIX H: AUGMENTED DICKEY FULLER TEST : LNOP

Null Hypothesis: D(LNOP) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.666821	0.0000
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNOP,2)

Method: Least Squares

Date: 09/27/20 Time: 14:47

Sample (adjusted): 2006Q3 2019Q4

Included observations: 54 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNOP(-1))	-1.197814	0.123910	-9.666821	0.0000
C	0.015107	0.012330	1.225283	0.2260

R-squared	0.642483	Mean dependent var	-0.006634
Adjusted R-squared	0.635607	S.D. dependent var	0.147575
S.E. of regression	0.089084	Akaike info criterion	-1.962145
Sum squared resid	0.412668	Schwarz criterion	-1.888479

Log likelihood	54.97791	Hannan-Quinn criter.	-1.933735
F-statistic	93.44743	Durbin-Watson stat	1.959613
Prob(F-statistic)	0.000000		

APPENDIX I: AUGMENTED DICKEY FULLER TEST : LNER

Null Hypothesis: D(LNER) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.785525	0.0053
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNER,2)

Method: Least Squares

Date: 09/27/20 Time: 14:50

Sample (adjusted): 2006Q3 2019Q4

Included observations: 54 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNER(-1))	-0.415029	0.109636	-3.785525	0.0004
C	0.004065	0.001345	3.021314	0.0039

R-squared	0.216043	Mean dependent var	0.000294
Adjusted R-squared	0.200967	S.D. dependent var	0.007435
S.E. of regression	0.006646	Akaike info criterion	-7.153374
Sum squared resid	0.002297	Schwarz criterion	-7.079708
Log likelihood	195.1411	Hannan-Quinn criter.	-7.124964

F-statistic	14.33020	Durbin-Watson stat	2.340959
Prob(F-statistic)	0.000399		

APPENDIX J: AUGMENTED DICKEY FULLER TEST: LNER

Null Hypothesis: D(LNTB) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.626681	0.0000
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNTB,2)

Method: Least Squares

Date: 09/27/20 Time: 14:53

Sample (adjusted): 2006Q3 2019Q4

Included observations: 54 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNTB(-1))	-1.051414	0.137860	-7.626681	0.0000
C	-0.042502	0.016596	-2.560916	0.0134

R-squared	0.527986	Mean dependent var	0.001751
Adjusted R-squared	0.518909	S.D. dependent var	0.164734
S.E. of regression	0.114261	Akaike info criterion	-1.464333
Sum squared resid	0.678887	Schwarz criterion	-1.390667
Log likelihood	41.53700	Hannan-Quinn criter.	-1.435923
F-statistic	58.16626	Durbin-Watson stat	2.021523
Prob(F-statistic)	0.000000		

APPENDIX K: AUGMENTED DICKEY FULLER TEST : LNCD

Null Hypothesis: D(LNCD) has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.140924	0.0001
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNCD,2)

Method: Least Squares

Date: 09/27/20 Time: 14:55

Sample (adjusted): 2007Q3 2019Q4

Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCD(-1))	-1.884734	0.366614	-5.140924	0.0000
D(LNCD(-1),2)	0.638437	0.319734	1.996775	0.0521
D(LNCD(-2),2)	0.642831	0.269134	2.388514	0.0213
D(LNCD(-3),2)	0.557619	0.215819	2.583741	0.0132
D(LNCD(-4),2)	0.415218	0.141648	2.931332	0.0053
C	0.065882	0.018285	3.603151	0.0008

R-squared	0.680172	Mean dependent var	0.000653
Adjusted R-squared	0.643828	S.D. dependent var	0.149254
S.E. of regression	0.089075	Akaike info criterion	-1.886514

Sum squared resid	0.349110	Schwarz criterion	-1.657071
Log likelihood	53.16285	Hannan-Quinn criter.	-1.799141
F-statistic	18.71478	Durbin-Watson stat	1.926139
Prob(F-statistic)	0.000000		

APPENDIX L : DATA SET

Period	Nominal GDP, FRW billion	Trade openness index	customs duties (billion RWF)	Exchange Rate WF/USD	Trade Balance (million in usd)
2006Q1	402	17.3	17.63	553.54	(47.54)
2006Q2	452	23.7	18.38	552.16	(53.69)
2006Q3	480	21.0	17.62	551.36	(61.46)
2006Q4	500	20.0	19.77	549.94	(57.98)
2007Q1	507	18.6	21.72	548.11	(60.13)
2007Q2	548	21.4	22.25	546.19	(68.45)
2007Q3	575	24.4	23.85	548.19	(82.62)
2007Q4	600	24.5	25.11	545.53	(95.01)
2008Q1	609	22.3	23.84	543.89	(81.30)
2008Q2	688	28.3	35.10	543.35	(115.67)
2008Q3	751	29.4	37.34	552.21	(143.39)
2008Q4	790	27.6	39.47	553.02	(134.72)
2009Q1	787	26.9	40.50	566.47	(161.40)

2009Q2	776	25.7	35.35	567.89	(152.51)
2009Q3	810	25.1	28.95	568.71	(137.48)
2009Q4	857	22.5	31.67	569.97	(136.23)
2010Q1	855	24.6	31.61	572.50	(155.84)
2010Q2	859	26.1	32.08	579.00	(156.94)
2010Q3	907	28.3	39.00	588.90	(162.48)
2010Q4	957	28.0	42.98	592.12	(186.97)
2011Q1	965	30.8	41.76	598.84	(199.57)
2011Q2	1001	31.0	42.59	600.18	(220.30)
2011Q3	1076	37.5	49.22	600.03	(254.54)
2011Q4	1098	32.5	49.70	602.17	(227.86)
2012Q1	1116	33.3	48.56	605.42	(243.23)
2012Q2	1146	33.4	52.76	608.51	(270.69)
2012Q3	1213	38.6	55.95	614.89	(291.15)
2012Q4	1237	34.4	52.79	628.33	(249.04)
2013Q1	1216	33.7	49.99	633.17	(244.40)

2013Q2	1255	35.6	52.38	639.72	(242.70)
2013Q3	1264	38.3	56.63	649.17	(285.93)
2013Q4	1331	36.4	61.36	664.44	(311.32)
2014Q1	1357	34.6	60.45	674.74	(294.26)
2014Q2	1397	38.6	61.66	680.23	(316.53)
2014Q3	1440	36.0	60.85	684.39	(304.12)
2014Q4	1438	35.7	66.22	692.31	(305.55)
2015Q1	1468	32.8	66.68	701.72	(288.24)
2015Q2	1503	34.3	74.34	712.98	(319.57)
2015Q3	1571	34.5	72.87	725.02	(330.26)
2015Q4	1621	32.5	84.49	738.89	(323.63)
2016Q1	1663	28.5	76.75	758.56	(406.70)
2016Q2	1714	29.6	91.96	776.07	(409.52)
2016Q3	1701	28.9	90.15	799.18	(406.30)
2016Q4	1781	26.5	99.02	815.23	(368.46)
2017Q1	1845	33.1	90.45	823.53	(279.67)

2017Q2	1916	34.6	97.10	827.97	(281.45)
2017Q3	1944	36.9	98.09	833.66	(296.22)
2017Q4	1988	36.6	99.74	841.71	(293.30)
2018Q1	2026	36.8	98.43	849.42	(321.48)
2018Q2	2056	36.4	98.70	856.16	(305.22)
2018Q3	2081	38.5	105.71	864.39	(362.21)
2018Q4	2139	38.6	113.88	874.88	(400.32)
2019Q1	2152	35.75	108.60	884.12	(368.03)
2019Q2	2348	38.62	131.28	893.15	(445.55)
2019Q3	2358	46.20	118.17	904.12	(461.49)
2019Q4	2457	44.07	125.10	916.30	(474.08)

APPENDIX O: SIMILARITY REPORT

Impact of international trade on economic growth in Rwanda

ORIGINALITY REPORT

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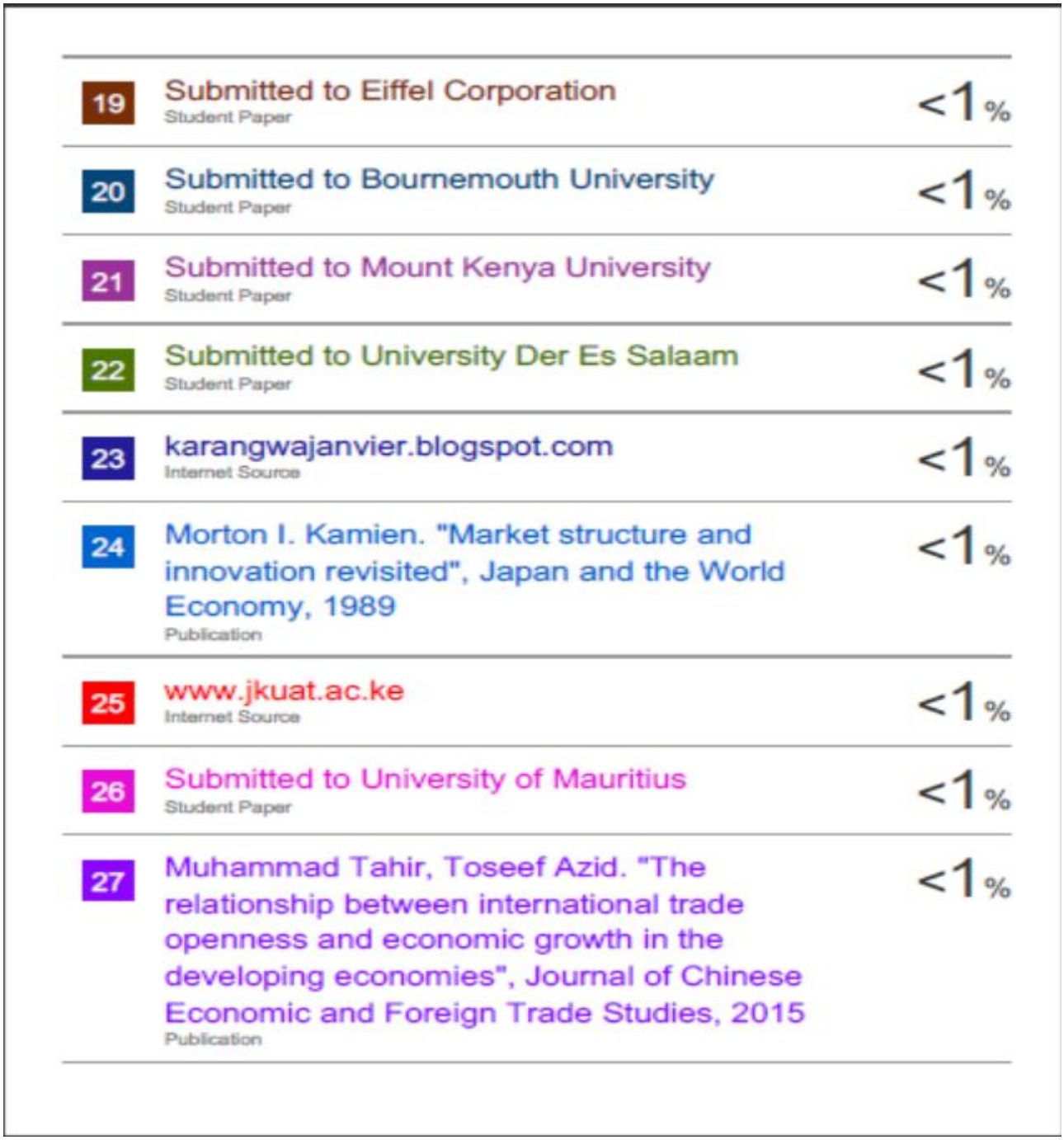

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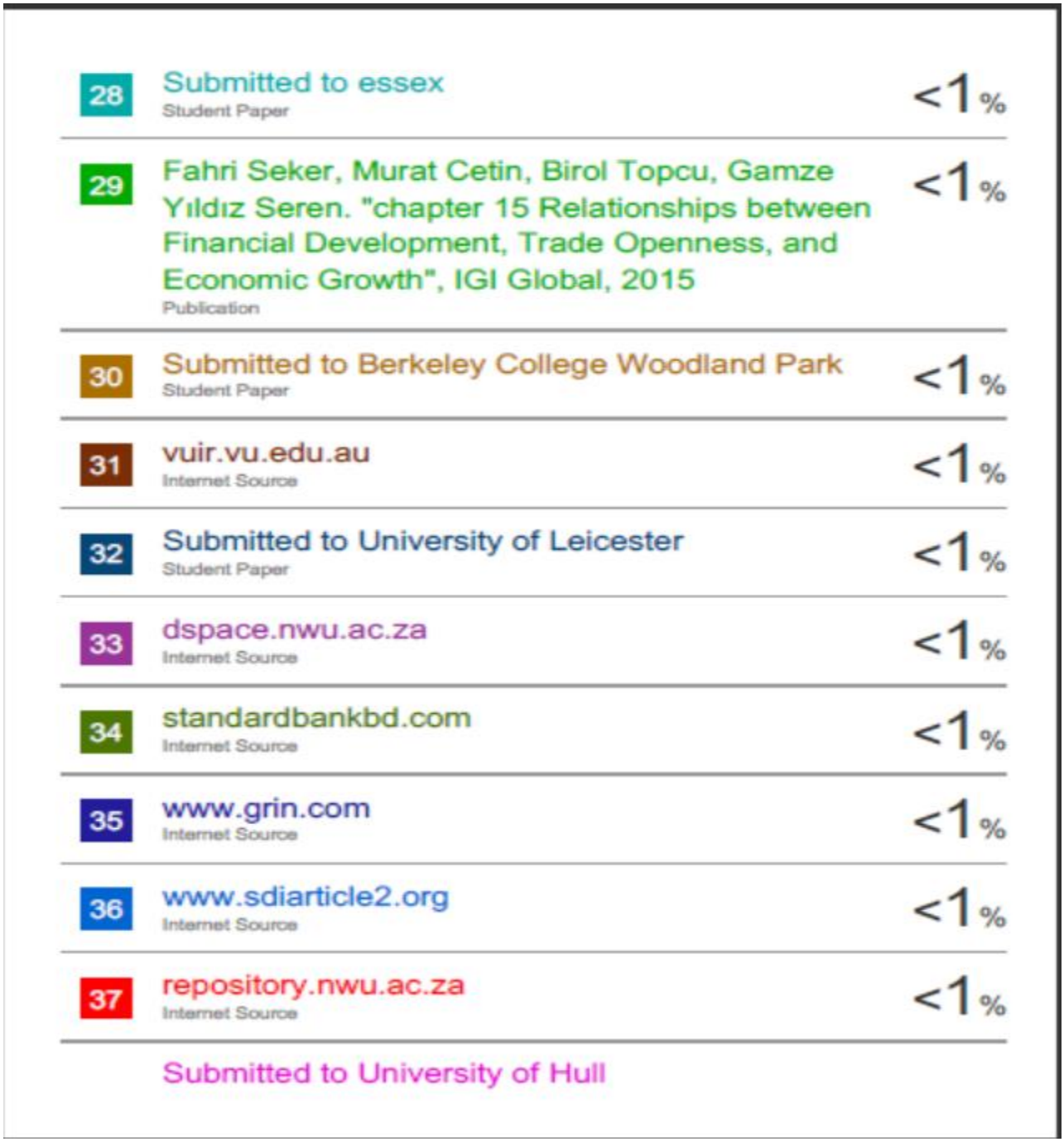
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