



UNIVERSITY of
RWANDA



**FOREIGN AID AND ECONOMIC GROWTH: AN ECONOMETRIC
STUDY OF RWANDA**

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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December 2020

DECLARATION

I declare that this dissertation entitled”**Foreign aid and Economic Growth:An Econometric Study of Rwanda**” 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.

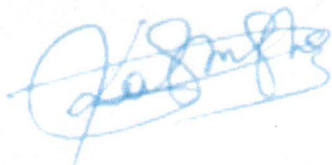
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Signature

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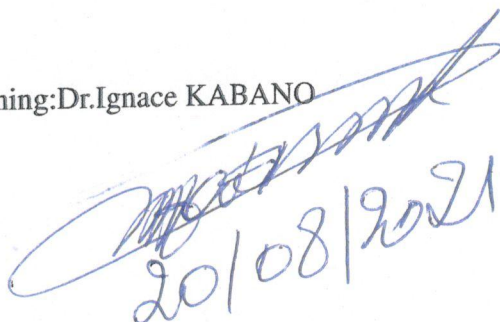
APPROVAL SHEET

This dissertation entitled "Foreign aid and Economic Growth: An Econometric Study of Rwanda" written and submitted by "Isaie BYUKUSENGE" 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 18 Percent which is less than 20 Percent accepted by the African Centre of Excellence in Data Science (ACE-DS).



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20/08/2021

DEDICATION

This work is dedicated to:
My family members for their support especially my Wife(Jeannette TUYISENGE) and My Child
(Latisha Byukusenge)through the research process.

My brothers and sisters;

My relatives and friends;

My colleagues.

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I am greatly indebted to my former classmates of Masters' of data Science in econometrics and lecturers as well as the authorities for their help to make this 'dream' come true and all other people who rendered their moral support during my studies.

God bless you all.

Abstract

This thesis aims to assess the effects of foreign aid in Rwanda's economic growth using Quarterly data from 2006Q1–2019Q4. To achieve the main objective, the specific objectives were : to demonstrate how foreign aid has caused change in exchange rate and how exchange rate has had an effect on exports. This study uses various time series techniques such as Johansen–Cointegration test, Granger causality test, Vector auto-regression (VAR) models and Variance decomposition to find out the short-run and long-run equilibrium dynamics among the variables under consideration. The empirical results confirmed that long-run relationship exists among economic growth, foreign aid inflows, domestic investment, Exports and Exchange rate in Rwanda.

The results revealed that the percentage change in foreign aid (LODA) is associated with an increase of 0.24 in real gross domestic Products (LGDP) on average *ceteris paribus* in long -run. It is also revealed that in long-run , the exports increased by 0.22 on average and exchange rate increase by 0.69 on average and this caused the increase of domestic investment by 0.29 On average.

In the short-run ,The findings showed that LODA, LGCF, LEXPORT and LEXR did not have an impact on economic growth in short-run. But the exchange rate was statistically significant, the results revealed that real exchange rate influenced exports in short-run, while foreign aid didn't cause change in exports in short-run.

Keywords: GDP Per Capita, Foreign aid, Domestic Investment, Exchange rate and Imports.

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LIST OF ACRONYMS AND ABBREVIATIONS

EAC: East African Community
EDPRS: Economic Development and Poverty Reduction Strategy
EXR: Exchange rate
FDI: Foreign Direct Investment
GCF: Gross Capital Formation
GDP: Gross Domestic Product
GDPPC: Gross Domestic Product Per Capita
GLS Generalized least squares
GoR : Government of Rwanda
HDI: Human Development Index
IMF: International Monetary Funds
MINECOFIN: Ministry of Finance and Economic Planning
NGOs: Non-Governmental Organizations
NST: National Strategy for Transformation
ODA: Official Development Assistance
OECD: Organization for Economic Cooperation and Development
OLS: Ordinary Least Squares
PRSP: Poverty Reduction Strategy Papers
RGDPP: Real Gross Domestic Products per Capita
RWF: Rwandan Francs
UNDP: United Nations Development Program
UR: University of Rwanda
USD: US dollar
VAR: Vector autoregressive
VECM: Vector Error Correction Model
WB: World Bank

CHAPTER 1

GENERAL INTRODUCTION

1.1 Background of Study

Among academics, the influence of foreign aid has long been contested. Whether foreign aid has a positive effect on the stability and economic growth of a developing country is the source of this dispute. Many developing nations receive an abundance of foreign aid from developed countries, international organisations, and non-governmental organizations every year (NGOs). Yet, many of these nations are not advancing or developing as rapidly and consistently.

Many researchers claim that foreign aid helps foster economic growth and development in developing countries, since economic theory suggests that the more capital and investment a nation receives, the greater the overall productivity of the country will increase. However, this idea that capital investment contributes to productivity and eventually to economic growth does not always hold true when studying the facts of the effects of foreign aid in developing countries (Jones, 2014).

Furthermore, in developing countries such as Rwanda, foreign aid is considered an important source for funding the development program. Foreign aid has been a subject of intense discussion because of its role in Rwanda's development process.

Foreign aid, with its repercussions and the killing of developed countries in the fight against poverty reduction, is an important issue. In addition, its role in stimulating and boosting economic growth is to reinforce internal funding bases, such as reserve funds, thereby growing speculation and capital stock levels. Therefore, it is important to note that there has been a substantial shift in aid proceeds and contribution to advancing nations in current circumstances, while various forms of commitment, such as other private sources and foreign direct investment, are blurring.

In addition, the importance of this study is attributable to the impact of foreign aid, which has been the focus of a broad review for the beneficiary country. The critical analysis is whether the aid has any effect on the growth of Rwanda and its level of poverty. Despite the fact that there is still no clear and specific answer, this question has been raised from a number of viewpoints. It is therefore important to take note of these not just reasons, such as the sum and form of money-related guide affecting the feasibility of conceivable finances, but also the adequate use of these tools by the accumulating nation plays an important role.

Impact of foreign aid on Rwanda

Net bilateral funding flows from DAC donors are the net disbursements of official development aid (ODA) or foreign aid provided by members of the Development Assistance Committee (DAC). Net disbursements are sums or gross disbursements in terms of grants, and loans subtract principal repayments from prior loans.

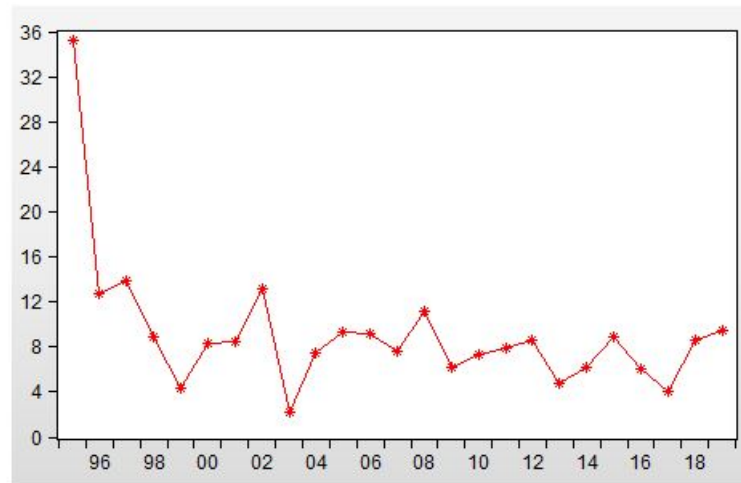
ODA consists of loans made on concessional money terms (estimated at a discount rate of 10 percent with a grant portion of 10 percent) and grants made in the DAC list of ODA recipients to encourage economic growth and provide countries/territories with well-being. In Part II of the DAC list of recipients, official aid flows from official donor countries to countries and territories are described as: the more developed countries of Central and Eastern Europe, the countries of the former Soviet Union and certain advanced developing countries and territories. Developing countries receive two other major sources of public (official) bilateral and multilateral development assistance from foreign exchange and private (unofficial) aid from non-governmental organizations. Both of these activities are forms of foreign aid, but official figures generally only quantify public aid (Nejadrezaei & Ben-Othmen, 2019)

Generally speaking, Rwanda is an extremely poor country which has few natural resources and little industrial development. Since 1994, Rwanda's Official Development Assistance (ODA) has played an important role, and continues to play, in promoting national development and poverty reduction efforts. Since then, the essence of ODA has changed dramatically, changing from one mainly characterized as humanitarian by non-governmental organizations (NGOs) to one characterized as a development priority, with the majority of ODA now provided by the Government of Rwanda (GoR). Today, Rwanda's ODA is complementing domestic capital in support of national goals as articulated in Rwanda's Economic Growth and Poverty Reduction Strategy (EDPRS), National Transformation Strategy (NST1) towards Vision 2020, as long as Rwanda's Vision 2050. For Rwanda, aid has a positive and important impact on economic growth. In 1995, the value of GDP growth in Rwanda was 35.22%, and the rise in GDP in the first post-war year reflected a revival of economic activity. Over 307.4 million in emergency humanitarian aid in the immediate post-war period from mid-1994 to 1995 was largely directed at relief efforts in Rwanda and refugee camps in neighboring countries where Rwandans fled during the war. In 1996, humanitarian relief aid began to shift to reconstruction and development assistance.

As seen in the table A.1 in the appendix, the percentage aid has both a positive and a significant impact on the rate of economic growth over the last 25 years, achieving a maximum value of 35.22 in 1995 and a minimum value of 2.202 in 2003. By improving tax revenue collection, accelerating privatization of state enterprises to stop the drain on government finances, and continued increase in export crops and food production, the Government of Rwanda posted a 13 percent GDP growth rate in 1996. Tea plantations and factories continue to be rehabilitated, and coffee is more seriously rehabilitated and tended as the sense of security of the farmers returns, often a smallholder's crop. The road to recovery would, however, be slow (Karake, 2007)

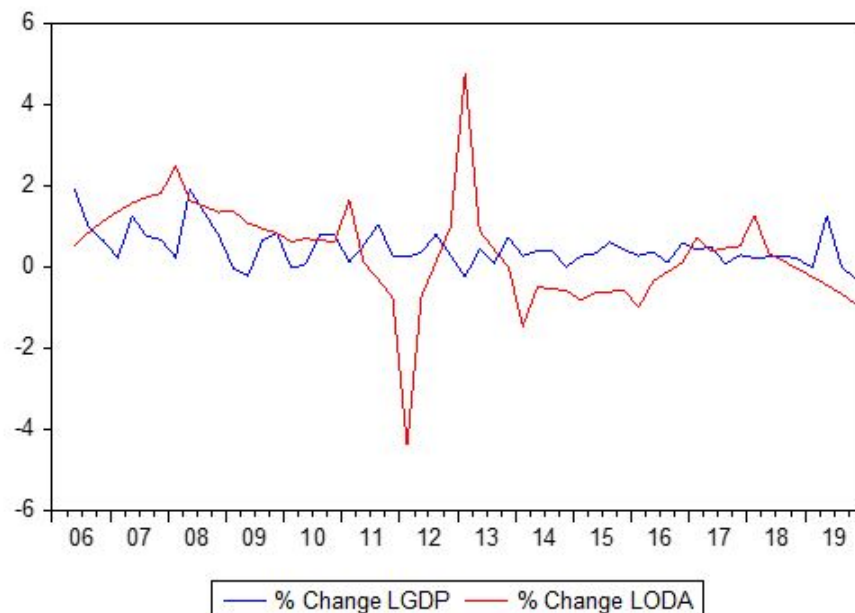
This post genocide period is called second regime and was marked by reorganization of society, economic recovery and economic building (Bigsten & Drott, 2006). Different techniques were developed and implemented to improve public administration, budgeting and financial management implementation. These techniques in terms of reforms include: privatization of public enterprises, creation of a system of public accounts, liberalization of trade facilitation and the banking sector as well as creation of different specialized institutions including Rwanda Revenue Authority to get budget support and Nation Tender Board. In 1999 tax on coffee exports was abolished in collaboration of the maximum level from 100% to 40%. Rwanda also joined the World Trade

Figure 1.1: Trend of GDP Growth (Annual%) in Rwanda



Organization.

Figure 1.2: Percentage Change in LODA and LGDP in Rwanda



The value for official development assistance in Rwanda was 380.7 billions in FRWS during 2019. By referring the graph below shows, over the past 25 years this indicator reached a maximum value of 459.2 billions in 2013 and a minimum value of 31.4 billion in 1996.

1.2 Problem Statement

ODA has played and continues to play an important role in supporting national growth and the efforts to reduce poverty in Rwanda since 1994([Atta-Dakwa, 2018](#)). Foreign aid is only effective in the presence of good policies which have an enormous impact on donors and policy makers([Burnside & Dollar, 2000a](#))

Rwanda has been at a crossroads since 2006, moving from a period of humanitarian assistance linked to the 1994 genocide to one of sustainable development. Rwanda began to use foreign aid to accomplish this initiative by relying on government preferences such as the Rwanda Aid Policy since it is said to be that day's leading mechanism and supporting tool.

Despite these optimistic developments, it is important to bear in mind that a large percentage of the population still lives below the poverty line (60.4percent in 2000/01 and 38.2 percent in 2016/2017), but was almost stable in 2018/2019. For 2018, the value of the Rwanda Human Development Index (HDI) was 0.536 percent, which put the country in the low category of human development.([Sciarelli & Rinaldi, 2017](#))

Therefore, the first issue induced by this study is that, in addition to scoring very low in its Human Development Rating, Rwanda, like many other aid recipient nations, continues to suffer from persistent economic poverty despite enormous quantities of aid pouring into the country each year (although there may be so many reasons to account for this, ranging from: Non-competitive manufacturing; high cost factor; inability to achieve its growth potential in the agriculture, forestry and mining sectors and restrictions on the implementation of public investment programmes through increased capacity for public expenditure; attractiveness of Foreign Direct Investment (FDI) through strengthened fiscal policy, market regulatory system and property rights;etc)

Rwanda still faces some challenges, including high poverty levels. Nutrition indicators are slow to improve, and particularly stunting levels remain high at 38% , hampering early childhood development and in turn affecting the learning outcomes. Economic growth was solid, averaging 6.1% over (2013 – 2016) against the target of 11.5% over the period 2013 – 2020, this showed that the targets were not achieved([Speidel, 2018](#))

From this perspective, the overall objective of this study is to examine the role played by foreign aids in Rwanda towards achieving economic growth and development.

An argument that has been presented by many authors is the fact that foreign aid can cause Dutch Disease, which is when a focus on one sector of the economy causes a decline in the other sectors of an economy.

To be able to achieve self-sustained growth, a country cannot be too dependent on foreign aid. This tends to make donors a more important group than domestic citizens, and that in turn may undermine the long-term sustainability of policies. The experience from the structural adjustment programmes is that the results have been limited by the fact that the programmes were not owned by the governments supposed to implement them. Therefore, they were not effectively implemented, and the expected results were not achieved. A large inflow of aid may also overburden the weak

administrative machinery in the recipient country, although this will to some extent depend on the type of aid transfer. The control of government resources including aid should lie in the hands of the government, and this should also be held responsible when things go wrong. Increased emphasis on budget support and debt relief is a step in this direction.

Rwanda is well poised to receive a large rise in help inflows over the coming years. Despite the potential for additional aid inflows to increase the country's income levels, raising them can cause structural changes that may be undesirable in the economy. One such shift is the appreciation of the real exchange rate, resulting in a contraction in the conventional export sectors and a loss of competitiveness in exports.

There are many short-term symptoms of Dutch disease, such as currency appreciation, loss of foreign competitiveness, real wage growth, increased imports of regular or luxury goods, indirect deindustrialization, income inequality, and symptoms of unemployment, deteriorating fiscal budget, declines in the manufacturing sector and current account deficit in the long-term. Basing on such symptoms of Dutch disease, one the demand side effects of increased government demand is the Dutch disease effect.

In the case of Rwanda, the Poverty and Social Impact Analysis(PSIA) does not consider this to be a serious issue, but we agree that if the Rwandan export strategy is to succeed, one will need to think about this in the longer term. The prospects are more favorable if investments have short-term effects on demand while having long-term effects on supply. The PSIA (p. 62) believes that the low level of exports represents primarily non-price impact.

The study also notes that an appreciation leads to cheaper imports, making it easier for e.g. g. Farmers must afford imported fertilizers and investors must afford imported products for investment. However, the export producers are losing, and the smallholder producers of coffee and tea are undoubtedly among them. The soft conclusion is that "the effects of the Dutch disease on exports are not likely to be serious enough to justify grant rejection."A certain impact on the exchange rate of help inflows is possible, but we accept that this is not a legitimate excuse to refuse grants. Nevertheless, the question about the real appreciation of the exchange rate and its impacts on exports, as well as economic growth, would not have been rejected. For the prospect of an export strategy(Kanyarukiga et al., 2006), the price effects are definitely relevant in the long run.

Since Rwanda is one of the recipient countries of the assistance, the question arises as to whether these cash inflows result in Dutch disease or whether they boost export production and economic growth in general, provided that the exchange rate of the Rwandan franc continues to be determined by the demand and supply forces of the foreign exchange market.

It has been noted that there has been a boom in foreign aid inflows to Rwanda since 1995, and the highest amount of foreign aid was recorded in 2013. Aid inflows can, in principle, allow the real exchange rate to appreciate. The experience of Rwanda, on the other hand, is that aid inflows have been characterized by a depreciating real exchange rate. The massive inflow of aid was also accompanied by a high positive growth in manufacturing production and export performance, contrary to the Dutch disease postulates. This prompts us to analyze if foreign aid caused change in

exchange rate and investigate if exchange rate has had an effect on exports in Rwanda(Ezemenari et al., 2008)

1.3 Rational of the Study

As a result of the author's awareness of the great importance of foreign aid in the sustainable economic development of a country, the inspiration to undertake this study emerged. Investment, both domestic and international in general, has the ability to increase production for local consumption and export. It can reduce trade deficits and make a major contribution to the balance of payments, which is particularly relevant for developing countries, such as Rwanda.

For the purposes of this study, we see that during post-war reconstruction, aid will have a positive effect on a country in the short-run. It is extremely probable that the country's economic/economic system no longer exists, depending on the degree of the dispute. Any inflow of capital would, therefore, produce a major increase in economic growth. We also see that aid may have a negative effect on economic growth in the years after the war, due to the dependency that countries have on aid. The policies that can arise from aid dependence may also influence the political system, which can also have an effect on the country's economic performance. It can also be hypothesized that, initially, foreign aid would have a positive effect on the economy of a nation experiencing post-war reconstruction; but, due to the strong dependence on aid, it will inevitably have a negative impact on the economy of that country.

The key purpose behind this research is to examine the impact of foreign aid on economic growth in Rwanda. This is due to the fact that there are very inadequate studies examining the position of foreign aid and economic growth in Rwanda.

1.4 Research objectives

The objectives of the study are categorized as general and specific objectives as shown below:

1.4.1 General Objective

The general objective is to assess the effect of foreign aid on economic growth of Rwanda.

1.4.2 Specific Objectives

- 1) To Demonstrate if foreign aid caused change in Exchange rate
- 2) To Investigate if exchange rate has had an effect on exports
- 3) To assess the role of policy variables in explaining changes in economic growth through variance decomposition.

1.4.3 Research questions

To achieve the main objective of this research, I will be addressing the core question: what has been the impact of foreign aid on the economic growth of Rwanda as from 2006Q1 to 2019Q4? In answering this question, the following sub questions will be addressed:

- 1) What is the relationship between foreign aid inflows and Rwanda's exchange rate?
- 2) How did exchange rate affect exports in Rwanda?
- 3) How policy variables explaining changes in economic growth through variance decomposition?

1.5 Significance of the study

The interests of this study are the important policies and implications that bring out; therefore, this research is useful to the researchers and policymakers.

1.5.1 Policy- makers

Based on the expected outcomes, this research is very significant for policy makers in improving measures related to:

Limited aid (Dependency):the findings will help the Rwandan Government to take adequate measures for foreign aid management and reinforce the economic policies to be able to achieve self-sustained growth.

Sustainable Foreign Debt:The country is on its way to the completion point of the Heavily Indebted Poor Countries (HIPC) which is believed to mean that it has achieved a manageable level of debt. However the government is keen to borrow more and if exports do not take off the country will face problems due to its debt in the future.Hence the findings will help the policy-makers to adopt the measures for the management of foreign aid ,exports, gross capital formation and exchange rate.

1.5.2 Interest to the researchers

Based on the findings of this research, policy makers may use this research's findings and take adequate measures which may affect positively the economic growth in Rwanda (GDP), and boost the sustainable development of Rwanda.

1.6 Organization of the Research

This was divided into five chapters: chapter one is a general introduction and consists of the study's context, problem statement, study rationale, research objectives, research questions, study significance and research organization. This chapter deals with the definition of the key concept, theoretical reviews, conceptual framework, critical reviews and partial conclusion. Chapter two introduces

the literature in relation to the subject under study. The different research methods are briefly illustrated in chapter three; this chapter merely demonstrates the specification of the model, model theories, model estimation and data analysis. The data analysis and interpretation of the results were discussed in chapter four. The overview of observations, conclusions and recommendations are included in Chapter five.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter offers a summary of key concepts, a review of existing problems that have been discussed and examined by numerous authors on the subject. It is ultimately related to the points of view extracted from books, the internet, papers, tables, etc.

2.2 Definition of Key terms

This part named the definition of key terms is aiming to make deep understanding of variables:

2.2.1 Economic growth

Economic growth implies an increase in the market value of products and services generated by the economy over time. It is conventionally calculated as the growth rate of the real gross domestic product, or real GDP, is more significant than the growth of the GDP-to-population ratio. Increased growth due to more effective use of inputs is referred to as intensive growth. GDP growth induced only by an increase in inputs, such as capital, population or territory, is called extensive growth (Munteanu, 2019)

2.2.2 Gross Capital Formation

Annual average growth of gross capital formation based on constant local currency. Gross fixed capital development (formerly gross domestic fixed investment) involves land improvement (fences, ditches, drains, etc.); procurement of plant, machinery and equipment; and construction of roads, railroads, and the like, including schools, offices, hospitals, private homes, and commercial and industrial buildings. (Orji et al., 2019)

2.2.3 Foreign Aid

Foreign Aid is a term often used by people, especially in government and the media, but what does that mean? In its broadest context, it means financial or technical assistance from the government of one nation to another to assist social and economic growth or to respond to a disaster in the host country. It may include providing financial grants or loans, technical advice, training, equipment and commodities such as food, health, infrastructure and transport (Wells et al., 2015)

2.2.4 Exchange rate

Essentially, the real exchange rate can be defined as the nominal exchange rate that takes into account inflation differentials between countries. Its value stems from the fact that it can be used as a measure of a country's foreign trade competitiveness. The value of the real exchange rate for the Central Bank is connected to the impact of the real exchange rate on the Central Bank's balance sheet and, in turn, to its ability to conduct a prudent monetary policy. Any adjustment in real exchange rates will lead to volatility in short-term capital flows. These fluctuations will then have an effect on the net foreign reserves of the Central Bank. Changes in the value of net foreign assets will contribute to changes in the volume of currency in circulation on the balance sheet liability side. As a result, changes in the amount of currency in circulation will entail the management of liquidity fluctuations in the economy through the use of monetary policy instruments by the Central Bank, whose final goal is price stability ([Kıpıcı & Kesriyeli, 1997](#))

2.2.5 Terms of Trade(ToT)

Linked with the balance of payments and current accounts, this term applies to the ratio of export costs to import charges. The terms of exchange of the nation increase if the export prices of that country increase at a higher level than the prices of the country's imports. As a result, higher sales result in greater demand for its currency and an increase in the value of the country's currency. These implications in appreciation of the exchange rate ([Abdullah, 2019](#))

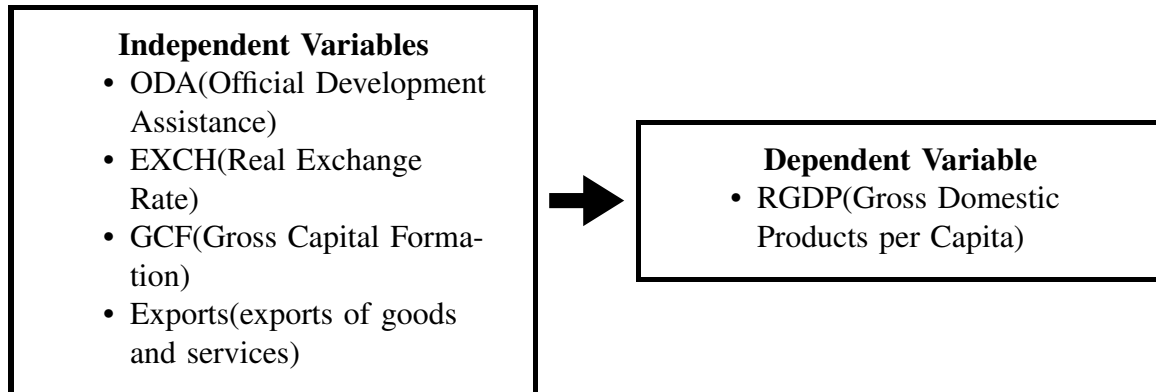
2.2.6 Exports

Export can be defined as an international trade function in which commodities that produced in one country are shipped to other country that can be used for future trade ([Johnson & Noguera, 2012](#)). Moreover, export is greatly explained when speaking about global trade, which is simply the exchange of goods and services with other worldwide countries. In contrast to exports, imports are goods and services that are brought into a country. The difference in the total value of exports and the overall value of imports is stated as a country's balance of trade.

2.3 Conceptual Framework

Below are the independent variables included in the research subject, The foreign aid and economic growth, the conceptual structure interlinks independent and dependent variables as shown in the figure 2.1:

Figure 2.1: Conceptual Framework



Source: Author's compilation

2.4 Theoretical Review

An systematic literature analysis of the idea of foreign aid and economic growth reveals that three generations of aid-growth nexus studies have been performed. Each of this generation of studies demonstrates the driving force behind the aid-growth nexus. The first generation, based on the theory put forward by Harrod-Domar (H-D), put more emphasis on savings. This category of study emphasized the connection between foreign aid and savings. The assumption that driven this generation of studies was that savings produced investment that, in turn, led to growth. The next wave of studies (second generation) focused on investigating the connection between foreign aid, investment and economic growth. They concentrated more on investment without paying attention or recognizing the possibility of savings as one of the channels for growth and development. The third generation of studies did not consider savings or investments to be channels of foreign aid to growth; rather, they saw other channels by which foreign aid enhances economic growth. Some of these channels provide country coverage quality, a secure environment and low corruption (S. Singh et al., 2019).

However, this study will be rooted in the convergence of second and third generation studies on foreign aid and economic growth, with specific reference to the Rwandan economy.

The ideas behind foreign aid derive mainly from the popular two-gaps model expanded by the Harrod-Domar growth model. In addition to the investment gap, the second gap is foreign exchange. Savings gap takes into account that domestic savings are insufficient to sustain the pace of growth that could be allowed due to the import purchasing power of the economy and the level of other resources.

The foreign exchange gap takes into account that the import purchasing power conferred by the value of exports plus capital transfers may be insufficient to sustain the pace of growth allowed by the level of domestic savings. In order to fill the two holes, it was advised that the availability

of international assistance should make it possible for a less balanced method of rapid growth to make fuller use of domestic resources([Chenery, 1967](#)).

It was also urged that some of the possible bottlenecks of expertise, savings or foreign exchange which be temporarily eased by the inclusion of external resources for which current payments are not needed. As a result, maximum use of other resources can be made and total production growth can be considerably higher than would be allowed by the rate of increase of the most restrictive domestic factor.

In some studies, the literature review in the preceding section reports mixed, contradictory findings and convergence. Just one report specifically analyzed the impact of foreign aid on the economic growth of Rwanda through the use of aid flows in ODA Member States for the period 1995 to 2013([Sekanabo \(2016\)](#)),

The panel data approach, based on the pooled OLS process, was used to measure the effect of aid on Rwanda's economic development, and the results showed that international aid had a substantial positive impact on economic growth. However, very few studies have empirically examined the effect of foreign aid on economic growth on developing countries, especially the members of the East African community(EAC).

The foreign aid needed to fill the gap is determined by the prevailing gap at a given point in time.If the savings deficit is greater than the foreign exchange gap, the economy is said to be limited by savings, and if the foreign exchange gap is larger than the savings gap, the economy is constrained by foreign exchange([Kolawole, 2013](#))

In 1961, when the United Nations embarked on its first decade of progress, it was understood by both rich and poor countries that greater effort would have to be made to mobilize internal and external resources if the specified growth targets were to be met. The big push theory assumes that poverty traps arising from various causes, such as poor savings, low production capacity and high population, impede growth and development and thus, a large push (involving a temporary infusion of capital in the form of ODA) increases investment in several different sectors leading to a start-up of self-sustaining growth ([Veledinah, 2014](#))

However, another author argued that the influx of large quantities of foreign aid could have adverse consequences on the governments of the receiving countries and could end up causing more harm than good under a variety of circumstances([Abuzeid, 2009](#))

“.....aid may not always be successful in promoting economic growth - however good institutional and policy frameworks enhance aid effectiveness and this remains a paramount requisite for improving the prospects that aid is transformed into economic growth.In fact, there is a growing awareness that aid itself can be instrumental in promoting good economic governance, which in turn leads to improved aid effectiveness”([Mercieca, 2010](#))

2.5 Theoretical Frameworks

2.5.1 Theories related to Foreign aid

Foreign aid, development and poverty have been explained in broad terms, there is need to analyze some of the contending theories on the nature of foreign aid. Four theories are hereby selected for some detailed analysis. To this end, this study is principally informed by four major theoretical frameworks namely the Modernization Theory, the Dependency Theory, the Interactionist Theory and the Feminist Theory. These contending theories on aid provide various windows by which the impact of foreign aid on poverty alleviation and economic development can be objectively assessed.

Modernization Theory and Foreign Aid

One of the first models used to understand how states and regions started on the path to economic growth was Rostow's Modernization Theory. Analyses of European growth after World War II indicated a fairly rapid and linear trajectory of economic growth that was built on a simplistic model of saving and investment. According to Rostow's analysis, modernization takes place in a series of five stages characterized as follows:

1. The traditional society.
2. Preconditions for take-off into self-sustaining growth such as increased education, manufacturing, and other forms of capital development.
3. Take-off stage occurs when the economic norms become established at micro, mezzo and macro levels, which lead to
4. A drive to maturity characterized by economic diversification and increased standards of living.
5. The final stage is characterized by mass consumption, which drives continued production, technological development, and job growth(Todaro & Smith, 2012)

These phases mean that the GDP growth rate is jointly determined by the national savings ratio and the national capital ratio. More precisely, it notes that the growth rate of national income, in the absence of government regulation, would be directly linked to the savings ratio.

The economic logic of this model is simple: economies must obey the stages diligently in order to develop, and they must focus on savings and local and direct foreign investment in order to meet the imperatives of each stage.

At the time, the Harrod-Domar growth model, which was the basis for the savings + investment = growth formula, Rostow assumed the validity of the primary economic model of growth. Although intuitively appealing (to the capitalist worldview) and empirically validated at the time, linear growth on the basis of the two isolated savings and investment variables was believed. Although this trend seemed to be the case in Europe after the World Wars, the benefit of Europe over

other regions (such as Southeast Asia and Africa) is that it already has a pre-existing infrastructure and a population that is already trained in the skills and standards needed for technological existence. Hegemonic effects of having military, political and economic power at the disposal of a state/region to procure resources external to itself are overlooked, among other factors.

In order to progress, this theory assumes that the 'Third World' needs Western donations. Indeed, one can observe that the international aid debate is rooted in the philosophy of modernization. The theory of modernization understands the world's "underdeveloped" nations as traditional societies. All cultures have been 'conventional' at some stage in history. Through innovation and technological development, these societies have been able to advance to modern social organization, especially within a capitalist system where capital is privately owned.

The person is motivated by capitalism to continually strive to better their product. This drive for out-performance promotes growth, while costs are minimized and effectiveness is promoted. Thus, just as modernization and capitalism drive a country to modernity, it is possible to attribute the suffering of developed nations to their failure to innovate, resulting in a technical and therefore economic deficiency, and therefore an inability to modernize. Foreign aid, perceived as a way of enhancing living standards in underdeveloped countries, is rooted in modernist thinking. It is the functional manifestation of the metaphysical principle that modernized nations are morally obliged to help other nations shift to modernization (Todaro & Smith, 2012). To this end, the theorists of modernization will embrace the idea that third world nations should always look west in order to progress by dealing with western development models. Thus, international assistance can be viewed as a rescue package for the liberation of an afflicted nation from hunger and poverty. This takes us to the major critiques against the theory of modernization, primarily by theoreticians of dependency, including Marxists.

The Dependency Theory and Foreign Aid

Over the years, the discussions between liberal reformers, Marxists and the theorists of world systems have been intense and critically stimulating. Among the different levels of dependency theorists, there are still points of significant disagreement and it is a mistake to assume that there is only one single dependency theory.

The debates among the liberal reformers, the Marxists, and the world systems theorists have been vigorous and intellectually challenging over the years. There are still points of serious disagreements among the various planes of dependency theorists and it is a mistake to think that there is only one unified theory of dependency.

Over the years, the discussions between liberal reformers, Marxists and the theorists of world systems have been intense and critically stimulating. Among the different levels of dependency theorists, there are still points of significant disagreement and it is a mistake to assume that there is only one single dependency theory (Delgado et al., 2016), (Ibrahim et al., n.d.) emphasizes the historical dimension of the dependency relationships in his definition:

Dependence is a historical state in which a certain system of the world economy is formed in such a way that it benefits certain countries to the detriment of others and restricts the possibilities

of subordinate economic growth, a situation in which the economy of a certain community of countries is conditioned by the development and expansion of another economy to which it is subject

Interactionism and Foreign Aid

A significant sociological viewpoint that puts emphasis on micro-scale social interaction is symbolic interactionism. Symbolic interactionism is derived from the work of George Herbert Mead, in particular. Interactionism's underlying premise is that people behave on things based on the meaning these things have for them; and these meanings are extracted and altered through interpretation from social interaction. Human beings are, in other words, best described in relation to their environment.

Human beings, in other words, are better understood in relation to Their environment. [Blumer \(1986\)](#) ,who coined the word "symbolic interactionism," outlined three fundamental viewpoints:

1. Based on the meanings they ascribe to such things, humans behave towards things.
2. TThe importance of such things stems from the social contact that one has with others and culture, or emerges from it.
3. These meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he/she encounters.

Feminism and Foreign Aid

Unlike interactionism, Feminism provides an interpretation of how a gender viewpoint has not been embraced by economic models, policies and budget systems and procedures, and how this has forced women to bear the brunt of poverty.

The theory laments that economic models, strategies and budgetary mechanisms adopted by various African governments and institutions frequently disregard women's living realities; but that not only the means of production, but also economic decision-making are overwhelmingly dominated and governed by men. In Sub-Saharan Africa, most nations have dual economies which consist of both formal and informal sectors. In the formal sector, men are dominant, while females rule the informal and communal sectors. In Sub-Saharan Africa, there is a discernible pattern that economic and development policies target the formal sector, marginalizing the informal and communal sectors in which women are often active([Makaza-Mazingi, 2009](#))

2.5.2 Theories related to Dutch Disease

Dutch Disease and Foreign aid

The term Dutch Disease refers to the adverse effects on the development in "discoveries" of natural resources. In particular, when a country experiences a resource boom due to the discovery of a tradable resource and/or a rise in the price of a resource, it is usually subject to a real appreciation of its exchange rate and, as a result of increasing wages, to the shift of some of the labor

force to the resource sector. Since resource-based exports crowd out commodity exports generated by those sectors, a real appreciation reduces the international competitiveness of other tradable sectors([Krugman, 1987](#)).The nation faces the risk of a process of de-industrialization. In the late 1950s, when natural gas discoveries in the Netherlands gradually harmed the competitiveness of the Dutch manufacturing industry, this phenomenon, known as the 'Dutch Disease', first attracted attention.

The word 'Dutch disease' is used by economists to describe a decline in the export output of a country as a result of an exchange rate appreciation after a natural resource such as oil has been discovered([Barder, 2006a](#)) The Dutch Disease' was the title of a 1977 report in The Economist on the effect of the discovery of natural gas in the North Sea on the economy of the Netherlands([Ayat, 1977](#)).The Huge foreign exchange earnings from gas exports led to a shift in prices and exchange rates, leading to a loss of market share by previously competitive exporters and a decline in production of these exports. Aid is typically a foreign currency transfer([Ayat \(1977\)](#)). This helps the recipient country by allowing it to import products and services without having to pay for them by generating and selling exports. Since aid is a gift of foreign currency, some combination of the following three things must happen in order for the recipient country to have any benefit:

1. Export production shift: exports can be reduced while imports remain the same; this frees up productive resources (particularly people) in order to increase the production of additional non-tradable products which are then consumed locally;
2. Production shift from import substitutes: goods and services may be imported rather than manufactured locally; the consumption of these goods is unchanged but supplied from abroad; this also frees up domestic resources for local consumption of additional non-tradables to be produced,
3. Additional imports: it is possible to import additional goods and services; these additional imports add to local demand and are not affordable without the aid.

The first two of these are collectively referred to as "Dutch Disease," a change in production from exports and import replacements, which are together called "tradables." As domestic production of tradables has been limited, it is called a "disease". In both cases, however, help allows for higher consumption of non-tradables than was possible without aid, by turning valuable capital from tradables into non-tradables.

The core Dutch disease model

[Corden & Neary \(1982\)](#) and [Corden \(1984\)](#) are credited with the main model defining the Dutch disease. They set out a basic model consisting of three sectors: two sectors manufacture goods that are exchanged at exogenous world prices, while the third sector produces non-traded goods at flexible prices with a view to equalizing domestic demand and supply.

According to [Corden & Neary \(1982\)](#), "Energy" and "manufacturers" are the two traded goods, while branded services are the non-traded goods. In designing the basic model, there are some simplifying assumptions made. All commodities are assumed to be used only for final use (not as

an intermediate input into production), national output is at all times equal to national expenditure (ensuring an overall trade balance), wages are perfectly versatile (ensuring maximum jobs at all times), models are strictly actual (ignoring any monetary considerations), where only relative prices are determined. In addition, where labor is the mobile factor, the model considers various degrees of intersectoral factor mobility, while the sector-specific factors (capital) are not. [Corden & Neary \(1982\)](#), differentiate between two forms of resource boom effects that they consider to be a key feature of the model. Such effects are the influence of resource movement and the effect of spending.

The spending effect

In view of the fact that the booming sector produces higher foreign exchange inflows and that all the extra income is not spent on imports, some of the extra income is spent on non-tradables, as long as the income elasticity of the market for non-tradables is positive. The boom would therefore produce excess demand for non-tradables and thus raise their prices relative to tradable prices, leading to a real appreciation of the exchange rate.

Resource movement effect

In a boom, the marginal productivity of labour in this sector increases, so that the demand for labour in this sector increases at a constant wage. This will drive wages up and eventually induce from the other two sectors a transfer of labor to the booming economy. Two parts have this influence. Second, the transition of labor from the lagging sector to the booming sector decreases demand in the former.

This is called direct deindustrialization, since it does not include the non-tradable economy or allows the actual exchange rate to be appreciated. Second, at a constant real exchange rate, there is a transfer of labor from the non-tradable sector into the booming sector. This generates excess demand for non-tradable products, which is generated by the spending effect, resulting in more appreciation.

This results in a further transfer of labor from the lagging sector to the non-tradable sector, leading to indirect deindustrialization. The bottom line is that the conventional export sector (manufacturing or agriculture) is crowded with booming and non-tradable sectors because of these two results. Nevertheless, [Corden \(1984\)](#) points out that "the Core model can be varied in many ways, so that none of the results can be considered inevitable."

2.6 Empirical Review

The aid-growth outcomes are mixed in terms of empirical literature. Although some studies show that aid has a positive effect on development, some studies show that it can be negative and that the impact of foreign aid is negligible. Empirical studies show that the positive impact of support for growth depends on factors such as macroeconomic conditions, political stability and the level of corruption in the recipient country. In this research, Papanek (1973) separated foreign aid flows from other forms of foreign capital flows in order to explore the relation between foreign aid,

saving and foreign private investment, among the studies that found a significant positive impact of foreign aid on the economy of the recipient country. Its findings indicated that foreign aid should be directed to countries suffering from a limit on the balance of payments.

Subsequent research by [Levy \(1988\)](#) explored the empirical correlation between foreign aid and economic growth of the countries of sub-Saharan Africa. The findings showed a strong positive correlation between aid and investment, as well as between aid and economic growth in Sub-Saharan Africa. Likewise, [R. D. Singh \(1985\)](#), [Mühleisen et al. \(1995\)](#) found that international aid had a positive significant effect on the economic growth of the recipient. [Clemens et al. \(2004\)](#) differentiates between short-term and long-term aid and identifies a strong and positive impact of aid on growth.

2.6.1 Positive Impact of foreign aid on economic growth

[Papanek \(1973\)](#), [Burnside & Dollar \(2000b\)](#), [Dalgaard et al. \(2004\)](#) and [Jena & Sethi \(2020\)](#) found that foreign assistance had a positive effect on recipient countries' economic growth. [Papanek \(1973\)](#) performed a cross-country study using a regression method for 34 countries in the 1950s and 51 countries in the 1960s, explanatory variables being foreign aid, foreign investment, other flows and domestic savings. They discovered that foreign aid has a much greater positive impact on development as it helps to fill the foreign exchange deficit and the gap between saving and investment. The relationship between foreign aid inflow and the growth rate of Gross Domestic Product in 69 developing countries over three periods (the 1960s, the 1970s and 1980-1987) was studied by [\(Papanek, 1973, 1972\)](#), then expanded by [Mosley et al. \(1987\)](#) and [Snyder \(1993\)](#), integrating country size (measured by gross domestic product) into the model. They find that when the size of the country is not taken into account, the effects of the aid are small and negligible, but that the aid coefficient becomes positive and important when the same factor is taken into account. [Irandoust & Hatemi \(2005\)](#), for a panel of six developing Asian and African countries from 1974 to 1996, investigated the long-term relationship between foreign aid and real economic growth. The outcome of the co-integration test indicates that, by supplementing domestic investments, foreign aid has a substantial positive impact on economic growth.

2.6.2 Negative Impact of foreign aid on economic growth

In the other hand, however, foreign aid helps to import inappropriate technology, distorts the distribution of domestic income and encourages a bigger, inefficient and corrupt government in developing countries [K. Griffin \(1978\)](#), [K. B. Griffin & Enos \(1970\)](#) and [Easterly \(1999\)](#). One of the key reasons responsible for the ineffectiveness of aid ([Boone, 1996](#)) is the unproductive application of foreign aid for consumption purposes. Pessimists further argue that the aid's fungibility portion adds to its ineffectiveness ([Rajan & Subramanian, 2011](#)).

Aid may also lead the recipient country to be happy with the amount of aid received and, thus, may lead the country not to finance tax expenditure that makes it less liable for domestic accounting ([Collier & Dollar, 2004](#)), [Askarov & Doucouliagos \(2015\)](#). [Feeny & McGillivray \(2009\)](#) Discuss the absorption ability constraints that result in ineffectiveness of aid in a country, thereby

inhibiting the growth of the same. They list five key constraints, namely human and physical capital constraints, political and structural constraints, macroeconomic constraints, deficiencies in the way foreign aid is delivered by the international donor community, and social and cultural constraints. [Pedersen \(1996\)](#), It has been argued that it is not possible to conclude that foreign aid has a positive effect on economic growth. The study has found, using game theory technique, that the effect of aid on growth is not positive. According to [\(Mallik, 2008\)](#), his paper explores the efficacy of foreign aid for economic growth in the Central African Republic, Malawi, Mali, Niger, Sierra Leone and Togo, the six poorest and highly aid-dependent African countries. Using cointegration study, we discovered that there is a long-term correlation between real GDP per capita, aid as a percentage of GDP, investment as a percentage of GDP and openness. However, for the majority of these nations, the long-term impact of aid on growth has been found to be negative.

The panel data methods, namely Pooled OLS, Random Effects and Fixed Effects, were used by [Liew et al. \(2012\)](#) to analyze the influence of foreign aid on economic growth in East African countries between 1985 and 2010. The findings indicate that foreign aid has had a substantial negative effect on these countries' economic development. This calls for additional studies to examine potential avenues by which foreign aid can have a positive impact on growth.

2.7 General summary of literature review

Author	Case Study	Approach	Findings
Malik (2008)	Six Poorest African Countries	Cointegration analysis	There is a long run relationship exists between per-capita real GDP, aid as a percentage of GDP, investment as a percentage of GDP and openness
Liew et al. (2012)	East African Countries	Panel data Methods	Results revealed that foreign aid has significant negative influence on economic growth for these countries
Mosley et al. (1987)	Less Developed Countries	VAR	Found a weak, negative correlation between aid and growth
Pedersen (1996)	Bangladesh	VECM	indicate lack of any significant short-run and long-run relation between foreign aid and per-capita real income
Levy (1988)	Sub-Saharan Africa countries	Multiple Regression	the findings revealed that aid is positively and significantly correlated with investment and economic growth in Africa.
Papanek (1973)	Ireland and Australia	Cross-Country Impact Assessment	Foreign Aid had a greater impact on economic growth
Sekanabo (2016)	Rwanda	Panel data	Study reveals that foreign aid inflows are associated with economic growth rate and per capita growth rate in from of aid effectiveness
Kolawole (2013)	Nigeria	VECM	study a negative relationship between FDI and real growth as ODA exerts no impact on real growth in the country

2.8 Research gap

Foreign aid, as referenced in the literature, has an effect on economic development. However, most of the researchers have argued that, contrary to the Dutch disease, massive aid inflows were correlated with high positive growth and export results, but not much has been done for Rwanda; in theory, aid inflows will cause exports to appreciate and decrease at the real exchange rate. Thus, this study helps to understand the effect of foreign aid on economic growth and end repercussion to know whether the cash inflows result in dutch disease or whether they stimulate export performance and economic growth in general.

CHAPTER 3

METHODOLOGY

3.1 Introduction

On the basis of previous discussions on foreign aid and economic growth, the purpose of this chapter will be to disclose data sources and to create a model system suitable for foreign aid and economic growth in Rwanda. The chapter will also explain how different approaches will be used to evaluate foreign aid and economic growth in Rwanda.

3.2 Theoretical Framework

Following country level research, previous authors of the aid-growth literature derived respective models based on various requirements. For example, [Girma \(2015\)](#); [Fasanya & Onakoya \(2012\)](#) derived their theoretical models from the specification of the neoclassical growth model in accounting for the relationship between aid and growth, which they stated as follows:

$$Y(t) = f(K(t), A(t)L(t)) \quad (3.1)$$

Where Y is real GDP; K denotes capital input; A and L respectively reflect total productivity factor and labor efficiency) and Cobb-Douglas functions as:

$$F(K, AL) = K^\lambda AL^{1-\lambda}, 0 < \lambda < 1 \quad (3.2)$$

Where λ reflects capital and labour production elasticity. One of their rationales for using the production function of Cobb-Douglas is that it shows constant returns to scale, which yields an output value of a balanced growth path and is consistent with their models. This model, however, has been criticised for its poor assumption of an impossible constant return to scale [Murthy \(2002\)](#), Since production in all situations will not exhibit a constant return to scale. On the other hand, [Setargie \(2015\)](#) derived its empirical model from the Harrod-Domar growth model in which savings and the capital production ratio jointly decide the growth of a given economy. That is, how much money the economy can save and how profitable it is to spend. He suggested a model of growth that can be interpreted in its simplest form as:

$$g = s/\theta \quad (3.3)$$

Where g = production growth rate; S = saving rate and θ = ratio of capital output; (that is, the amount of investment the economy needs in order to produce one additional unit of output). In order to achieve growth, the Harrod-Domar growth model attempts to lay a foundation for how a nation can increase its saving and capital production ratio. For developing nations, this may be especially important as they suffer from savings deficits that go a long way to reduce the amount of capital accumulation through investment. Therefore, this model implies that, as a result of saving, the economic growth of a given country depends on macroeconomic policies in order to encourage investment. Most developing countries, however, suffer from structural constraints that can effectively make this happen as a result of the persistence of the predominant savings gap, thus creating space for an alternative source of revenue to fill this vacuum.

Against this backlog, the theoretical specification of the two gap economic growth model was followed by [Mbah & Amassoma \(2014\)](#), which is an extension of the Harrod-Domar growth model as it takes into account the assumption of an open economy and also integrates the practical relationship between the inflow of foreign aid and the country's economic growth. The theoretical basis of this model is based on the argument that most developing countries are either suffering from a shortage of domestic savings to meet investment demands (likely as a result of low per capita income) or from a shortage of foreign exchange to fund import demands. This model can be further developed in more detail, and as an entry point, I begin by presenting the identity of national income (which is the basis of this model) where Aggregate Output = Aggregate Expenditure (assuming there is no government sector) as follows:

$$Y = C + I + (X - M) \quad (3.4)$$

Y = Gross Domestic Product; C = Consumption; I = Investment or Formation of Domestic Capital; X = Exports; and M = Imports. By splitting the equation into "source of resources used in the economy" and "use of resources in the economy" respectively, we would have:

$$Y + M = C + I + X \quad (3.5)$$

Subtracting C from both sides of the equation, we would get:

$$Y - C + M = I + X \quad (3.6)$$

$$\text{Since, } Y - C = S(\text{Savings}) \quad (3.7)$$

$$\text{Therefore, } S + M = I + X \quad (3.8)$$

(Withdrawal) = (Injection) This link can also be restated as:

$$M-X = I-S \quad (3.9)$$

(Foreign Exchange Gap) = (Savings Gap) According to the theoretical context of this model, foreign assistance is therefore required here to compensate for these current gaps (because it is the only alternative means of acquiring foreign exchange to fund demand for imports and finance capital to meet investment demand) so that developing countries can expand faster than their capacity for internal resources. This equation can therefore be further structurally interpreted in order to integrate foreign aid according to the national income accounting identity approach, provided that aggregate expenditure is equivalent to aggregate production as follows:

$$E-Y = I-S = M-X = F \quad (3.10)$$

Where national spending is E and international assistance is denoted by F. Despite the theoretical importance of this model to the subject matter under review, however, foreign assistance is frequently followed by interest payments, which may often lead to problems with debt repayment or debt sustainability in circumstances where the country's economic potential is inadequate to satisfy its debt repayment obligations. Mbah and Amassoma included other growth determinant variables for foreign aid in line with the context of this model and reported a growth function as follows:

$$GRGDP = (AID, INV, EXP, IMP) \quad (3.11)$$

Where : *GRGDP* is Real Gross Domestic Product growth, *AID* is ODA aid, *INV* is investment level, *EXP* is export growth, and *IMP* is import aid. Therefore, the empirical model for estimating the aid-development relationship in Rwanda will be derived from the two gap model, based on its power to clarify the subject matter under investigation by taking into account the functional relationship between international aid and the country's economic growth. This is contrary to other neoclassical and post-Keynesian models that other researchers have used, such as the Cobb-Douglas output function and the Harrod-Domar growth model, respectively. Therefore, in order to define the empirical model to be used in this study, I assume that :

$$Y = (A, W) \quad (3.12)$$

Where, *Y*: production level and, in this case, Real GDP; *A*: foreign aid that is net Official Development Assistance; and *W* denotes other variables that assess growth as found in the empirical literature that are important to a country's economic growth, including: net domestic investment; human capital accumulation; economic policy that can foster economic growth as claimed by Burnside and Dollar, inflation rate and population growth rate.

In general, the majority of poor countries have insufficient savings levels, and foreign aid should complement domestic savings that could be geared towards investment. In this situation, we presume that, for investment purposes, all foreign aid will be allocated. In fact, this is not the case for poor African countries in particular.

Poor countries also have inadequate export earnings that are needed to import investment capital goods. Foreign aid is therefore expected to enable these countries to fill this void, thus supplementing the export earnings needed for the importation of capital goods.

Initially, [Bacha \(1990\)](#) and [Taylor \(1990\)](#) were specifically modelled on the fiscal gap. Many emerging, undeveloped and, in particular, poor countries do not have the capacity to raise revenue to cover the desired amount of public spending. Thus, to fill this gap, foreign aid is seen as necessary. Despite the aid objectives described in theoretical models, recent studies, particularly for the poorest African countries, have not been able to address unambiguously whether aid promotes development. One of the issues is that most aid-growth relationship studies are focused on cross-country regressions, lumping together heterogeneous characteristics and size of countries. Using single country time series data, there are very few studies of the poorest African countries that analyze the issue. The topic of reverse causality still exists. In response to poor growth (and saving) results, for example, help can follow, creating a high correlation between low growth and high aid flows.

3.3 Model Specification

On this note, I will work to expand the appropriate model for this study (3.13). It is a suitable model for the case of Rwanda, in that other authors have not taken into account the Dutch disease that can be triggered by the appreciation of the exchange rate, and this can have a negative effect on exports as long as economic growth continues. In view of the above discussion, the following equation has been used as the basic model for evaluating the impact of foreign aid on Rwanda's economic growth.

$$RGDPPC_t = f(ODA, GCF, EXR, EXPORT) \quad (3.13)$$

Where, RGDPPC_t stands for Real Gross Domestic products per capita(the dependent variable) and Gross capital Formation(GCF) , Exchange Rate(EXR) and EXPORT are the explanatory variables.

3.4 Data Used

Quarterly Data were used for the empirical validation from 2006Q1 – 2019Q4.

3.4.1 Description of Variables

All the necessary data were collected from National institute of Statistics of Rwanda and National Bank of Rwanda(BNR) published by the NISR in 2019. The detailed description of variables, their sources and their corresponding measurements are represented in table 3.1.

All the variables are expressed in Billion Rwandan Francs, except exchange rate.

Table 3.1: Description of Variables

Variables	Symbols	Measurement	Data Source
Dependent Variable			
Gross Domestic Products Per Capita	GDPPC	Currency Rwf	NISR
Independent Variables			
Foreign aid	ODA	Currency Rwf	NISR
Gross Capital Formation	GCF	Currency Rwf	NISR
Exchange Rate	EXR	Currency US \$	NISR
Exports	EXPORT	Currency Rwf	BNR

3.4.2 Data Transformation

In the data collection, the implementation of econometric modeling requires the same order of integration. So, to have consistent estimates (Shahbaz & Rahman, 2010), The researcher converted data set into log linear specifications.

All the independent variables foreign aid, domestic investment, exports and exchange rate and along with the dependent variable economic growth are converted into natural logs to make the data stationary and to avoid the issue of heteroscedasticity from the fitted model, and foreign aid data were collected annually and transformed into quarterly using the quadratic match sum in E-Views. This was done to increase the sample size of the study. The empirical equation 3.13 was transformed into logarithm specification and modeled as follows:

$$\log GDPPC_t = \lambda_1 + \lambda_2 \log ODA_t + \lambda_3 \log GCF_t + \lambda_4 \log EXR_t + \lambda_5 \log EXPORT_t + \mu_t \quad (3.14)$$

Where :

- $GDPPC_t$ = Gross domestic products at time t

- ODA_t =Net ODA(official development aid) received at time t
- GCF_t =Gross Capital Formation at time t
- EXR_t =Real Exchange rate at time t
- $EXPORT_t$ =Exports of goods and services t

3.5 Data Analytic Methods

In this chapter, we explain how the findings of our empirical research have been achieved. Foreign aid and economic growth, an econometric study of Rwanda and other selected macroeconomic variables are being studied.

3.5.1 Descriptive Statistics

Before applying any time series technique, the statistical properties of the variables were tested to determine both long-run and short-run causal relationships and the summary statistics of all variables in this analysis.

3.5.2 Estimation Procedure

The study used Time series data, therefore we have to ensure that all data collected by annually basis, met all required of good characteristics of data quality and ensure that all techniques expected to use are the appropriate one before final conclusion.

The analysis therefore used the ordinary least Squares (OLS) to estimate the parameters. I used co-integration techniques to evaluate this relationship between foreign aid and economic growth in Rwanda, using a Vector Autoregressive Model (VAR) and Variance Decomposition that provides estimates of both the short-run and long-run. If variables are not stationary, co-integration between variables is found to occur and refuses to die off after taking their first difference ([Setargie, 2015](#))

3.5.3 Diagnostic Tests

Heterocedasticity test (If the likelihood of JarqueBera is greater than 10 percent level of significance, the residuals are said to be normally distributed, and this represents the good quality of the model), Heterocedasticity test (If the probability of obs* R-square is greater than 10 percent level of significance, this means that the model is homoscedastic), Breusch-Godfrey Serial Correlation LM Test (The results of the Breusch-Godfrey Serial Correlation test that tests for the model's absence of autocorrelation. The results with less than 5 percent probability indicate the absence of autocorrelation for the data used, and otherwise the presence of autocorrelation) and the stability test of VAR (if all the roots are less than 1, and blue points lie inside the unit circle, VAR is stable)

3.5.4 Unit root test

Since this study uses time series data, testing the stationary variables becomes mandatory since most variables from time series are non-stationary and could lead to spurious regressions if we use them in the model without checking and making required corrections. By transforming the series following different processes, stationarity can be achieved. For example, if a variable is diagnosed with a deterministic trend, a trend variable must be included in the regression to eliminate the trend component in order to make it stationary. This mechanism is called the stationary trend. However, some data from time series can only have a stochastic pattern characteristic that allows the series to be separated to obtain stationarity. This process is called, trend stationary.

However, some data from time series can only have a stochastic pattern characteristic that allows the series to be separated to obtain stationarity. This mechanism is called the stationary process of difference. As a result, in order to know the structure of the sequence, it is very important that we perform diagnostic tests, taking into account these various elements. The Augmented Dickey Fuller (ADF) tests, which are an improvement of the Dickey-Fuller (DF) test, were used to perform the unit root test. The ADF was developed to overcome this challenge by integrating lagged first differences of the dependent variable (Tadesse, 2011) since the DF test suffered from residual autocorrelation problem.

It notes the hypothesis to be tested as follows:

$$H_0 : Y = \Theta \text{ or } (\Theta = 1; Y \text{ is not stationary}) \quad H_1 : Y < \Theta \text{ or } (\Theta < 1); Y \text{ is stationary} \quad (3.15)$$

The null hypothesis is rejected, if the absolute value of t-statistic is more than the critical value, otherwise it cannot be rejected.

3.5.5 Optimum lag selection criteria

In addition, to select the appropriate lag, optimum lag selection parameters are used, as it is important to use advanced econometric techniques such as the Cointegration test and the Granger-Causality test. Five lag order selection criteria, such as Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ), were used for this analysis to choose the optimal lag criterion, the lowest value of each criterion will be selected as the optimum lag.

3.5.6 Test for Co-integration

It is important for us to test the existence of co-integration among the variables because; co-integration indicates the existence of a long run relationship among non stationary variables in the equation. Therefore, the test for co-integration identifies the existence of any long-run relationship between economic growth and its dependent variables. If the variables are said to be co-integrated even after their first difference, it becomes necessary to apply the Vector Error Correction Model (VECM), since over differencing the variables to obtain stationarity may generate a model that does not show any long run behavior among the variables (Tadesse, 2011)

The existence of co-integration can be tested using the Engle-Granger (E-G) Method or the Johansen maximum Likelihood Procedure, but in this analysis, the Johansen maximum Likelihood Procedure has been used, based on its advantage over the later since it enables testing and estimating for the presence of multiple co-integration associations, in a single step procedure [Setargie \(2015\)](#). Before we test for co-integration, it is necessary to first estimate a VAR model and to do this, it is also necessary to determine the adequate lags to be included in the model.

A VAR model, developed by [Sims \(1980\)](#), is an extension of the univariate autoregressive model and is used in conducting dynamic multivariate time series analysis. VAR models have proven to be particularly useful for forecasting. However, they are also effectively used for economic analysis or structural inference and policy analysis, since they describe the joint generational mechanism of the variables involved. They are also used for testing causality between two or more variables. The basic assumptions of the VAR model follows that: every error term has a zero mean and is normally distributed, and the series of all variables are stationary and integrated of order of zero ($I(0)$), otherwise the Vector Error Correction Model (VECM) is used. Therefore, a VECM is not required if co-integration is not found and the data is stationary at level form or after first difference.

3.5.7 Granger causality test

Finally, does aid flow into Rwanda within several years, significantly increases its economic growth? That is, does aid inflow into the country exhibit [Granger \(1969\)](#) causation of economic growth? For sure, this is an interesting question that any donor interested in promoting Rwanda's economic growth through aid would want to know. For robustness check, a Granger Causality test was also conducted at the end of the analysis, in order to provide an answer to this question.

3.5.8 Vector Autoregression (VAR)

VAR models are advantageous over conventional simultaneous equations technique or structural modeling procedure (such as ordinary least squares (OLS) and two-stage least squares (2SLS) methods) in that, they account for Sims' critique which claims that, the exogeneity of assumptions for some of the variables in the latter are often not backed by fully developed theories and are ad-hoc in nature ([Lütkepohl, 2011a](#)). In addition, conventional simultaneous equations technique or structural modeling procedures have also been dismissed for being too restrictive in nature, and that the selection of exogenous and endogenous variables following these techniques is far too judgmental and arbitrary. On the contrary, in a VAR system, all the variables in the model can be written as a linear function of their own lagged values and are all endogenous. It is necessary to note that the variables on the right side may be endogenous and may also be on the left side as dependent variables. In this case, vector autoregression (VAR) estimation can be used to evaluate the dynamics of the relationships between the variables. The VAR technique is a non-structural approach to modeling time series; it imposes no structure a priori. Indeed, by treating any endogenous variable in the model as a function of its lagging values and the lagging values of all other endogenous variables, the VAR technique allows us to estimate the relationships without using a

structural model. At the base, the equation is as follows:

$$y_t = \sum_{j=1}^p \alpha_j y_{t-j} + \sum_{j=1}^q \beta'_j x_{t-j} \quad (3.16)$$

In the first equation of the VAR model y_t represents the Economic growth x_t represents the vector of explanatory variables α_j and β_j are scalars and coefficient vectors, respectively.

Except for the intercept and the dummy variables for the change in the current account, we treat all the variables as endogenous. We simultaneously estimate a set of VAR equations. In addition to the intercept and the dummy variable for the change in Rwanda's Gross Domestic Products, each of the equations uses one of the endogenous variables as the dependent variable and its lagged values and the lagged values of the other endogenous variables on the right-hand side.

3.5.9 Variance decomposition

The decomposition of the forecast error is the proportion of the variance of the error made in predicting a variable (e.g. economic growth) due to a specific shock (e.g. the error term in the foreign aid policy rate) at a given horizon (such as five years). The key interest of this analysis is to assess the role of policy variables in explaining changes in economic growth over the period covered by the study. Variance decomposition results are helpful in validating the results from the impulse response function.

3.5.10 Impulse Response Checks

As an additional diagnostic co-integration test finding that is often used in conjunction with the VAR model, the analysis also uses an Impulse Response Feature. The marginal effects of subsequent unintended shocks to the regressor(s) on the variable(s) under observation over time or how a shock on one variable will affect another over time are captured by an Impulse Response analysis. A unit shock is applied to each vector in order to measure the magnitude of this shock to see its effect on the VAR system [Asari et al. \(2011\)](#). We would be interested in knowing the effects of potential shocks or unexpected developments on ODA on RGDP growth, which are our key variables of interest, in the case of this study.

3.5.11 Sensitivity Analysis

Finally, in order to further examine the effectiveness of foreign aid for Rwanda's economic growth, a sensitivity study was carried out in order to provide additional answers to my research question (what are 5 steps for enhancing the effectiveness of foreign aid in eradicating poverty?) and also for the purpose of robustness checks.

CHAPTER 4

EMPIRICAL RESULTS , DATA ANALYSIS AND RESULTS INTERPRETATION

4.1 Introduction

We present the findings of our empirical study in this section. The following empirical hypothesis is intended to address whether foreign aid and economic growth have a causal relationship in relation to selected macroeconomic variables. So far, the econometric structure over which this analysis is based on has been developed, following the objective of study and conceptual framework. This section further improves on that, as it brings out the findings of the various statistical analyses. The findings were based on these specific objectives: to show whether foreign aid has induced a shift in the exchange rate, to examine whether exchange rates have had an effect on exports and to identify steps to increase foreign effectiveness in eradicating poverty.

These results are also discussed and inferences are made based on the correlation between our perceptions and the actual results. It has been divided as follows: the descriptive figures are described in section 4.2.1, section 4.2.3 presents the diagnostic tests, section 4.2.2 presents the unit root test results for variables at level and after first difference, section 4.6 is on Johansen Co-integration Test result of variables after first difference; section 4.7 deals on the Vector Auto Regressive estimates, Section 4.8 shows the variance decomposition and section 4.2.10 focuses on the sensitivity analysis results.

4.2 Empirical Results and analysis

4.2.1 Descriptive Statistics

The statistical properties of the variables are tested to determine both long-run and short-run causal relationships prior to applying any time series technique. Table 4.1 provides the GDP, ODA, GCF, EXPORT and EXR overview statistics for Rwanda for the period 2006Q1-2019Q4. We find that the Gross Domestic Product per Capita(GDP) dependent variable varies from 5.99 to 7.76, and in Rwanda, ODA ranges from 3.70 to 4.76.

4.2.2 Unit Root Test

In order to conduct the empirical study, the research uses a broad variety of econometric instruments. The problem of non-stationarity for which the ADF unit root test is carried out must be solved, as the study highlights around the years of quarterly data from 2006Q1-2019Q4. The unit root test is a prerequisite for testing two or more times for the long-run relationship between the series data set (Granger, 1981). Therefore, non-stationary data-sets should be transformed into their stationary forms by considering the first method of difference.

Table 4.1: Descriptive Statistics

Statistics	LGDP	LODA	LGCF	LEXPORT	LEXR
Mean	7.045403	4.442636	5.546317	5.088857	6.498628
Median	7.113916	4.515922	5.688347	5.043425	6.446902
Maximum	7.760467	4.763882	6.548219	6.198479	6.820344
Minimum	5.998937	3.702042	4.127134	3.784190	6.297754
Std. Dev.	0.483701	0.279910	0.604601	0.648251	0.173849
Skewness	-0.38671	-1.39788	-0.63077	-0.00934	0.479713
Kurtosis	2.134938	4.011929	2.558565	1.897190	1.763635
Jarque-Bera	3.141833	20.62737	4.168165	2.838592	5.714561
Probability	0.207855	0.000033	0.124421	0.241884	0.057425
Sum	394.5426	248.7876	310.5937	284.9760	363.9232
Sum Sq. Dev.	12.86817	4.309232	20.10481	23.11265	1.662283
Observations	56	56	56	56	56

Table 4.2: ADF Unit Root Test Results

Variable	Crit. Val. (5%)	ADF Stat.	p-value	Decision
LGDP	-2.91552	-3.47703	0.0123	In absolute value, the ADF statistic is greater than the critical value at 5% and the p-value is less than 5% of the significance level. The null hypothesis that a unit root is rejected, then the series has become stationary at level I (0).
LODA	-2.921175	-3.3068	0.0198	The absolute value of the ADF statistic is higher than the critical value at 5% and the p-value is less than the significance level of 5%. The null hypothesis says that a unit root is rejected, so the sequence has become stationary at level I (0).
LGCF	-2.916566	-9.8043	0.0000	In absolute value, the ADF statistic is greater than the critical value at 5% and the p-value is less than 5% of the significance level. The null hypothesis notes that a unit root is rejected, so the series became stationary after its first difference was transformed (Stationarity at the first difference. I(1))
LEXPORT	-2.916566	-10.7416	0.0000	The absolute value of the ADF statistic is higher than the critical value at 5% and the p-value is less than the significance level of 5%. The null hypothesis notes that a unit root is rejected, so the series became stationary after its first difference was transformed (Stationarity at first difference. I(1))
LEXR	-2.916566	-3.78382	0.0053	In absolute value, the ADF statistic is greater than the critical value at 5% and the p-value is less than 5% of the significance level. The null hypothesis notes that a unit root is rejected, so the series became stationary after its first difference was transformed (Stationarity at the first difference. I(1))

The 4.2 table shows the outcome of the unit root test for the ADF test at both the stage and first differences. The results of the ADF test show that LGDP and LODA are stationary at the level and other LGCF, LEXPORT and LEXR variables are non-stationary at their level, which means that there is a unit root presence. We found that all of them were stationary and incorporated from order one i.e I (1), by translating the variables into the first differences. This means the null hypotheses are null, i.e. H_0 : no root unit present, for all the variables are rejected at the ADF test in their first differences.

4.2.3 Diagnostic Test

Checking the model's fitness and stability, We used the normality test, the heteroskedasticity test, the stability test and Breusch-Godfrey Serial Correlation LM.

Normality test

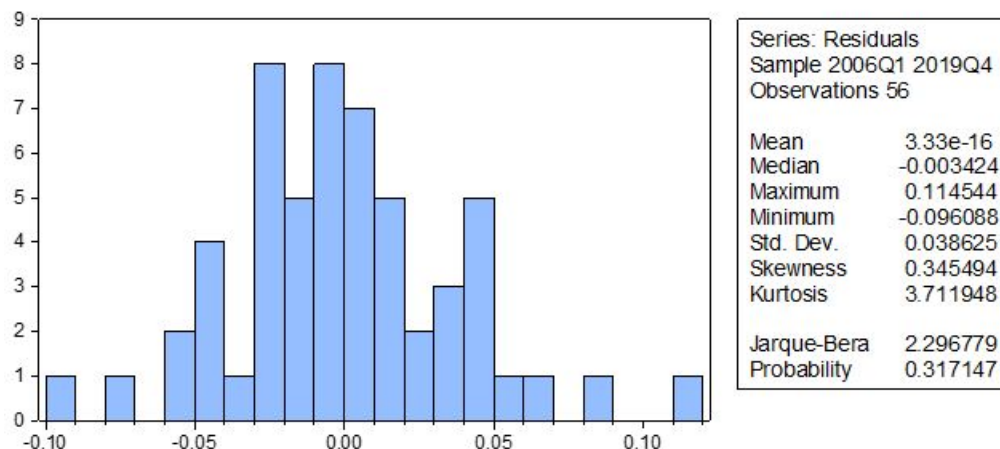
The assumption of this test is as follow:

H_0 :(null hypothesis): The residuals are normal distributed

H_1 :(alternative): The residuals are not normal distributed

The null hypothesis is rejected at 10 percent level of significance

Figure 4.1: Histogram Normality test



The likelihood of JarqueBera is 0.31 greater than 10 percent significance level, as seen in figure 4.3, so the null hypothesis that residuals are typically distributed is not rejected. The residuals are usually distributed, and this represents the model's good quality.

Breusch-Godfrey serial correlation LM test

Breusch-Godfrey Serial Correlation test results to check for the lack of autocorrelation in the model. For the data used, the findings with a likelihood of less than 5 Percent indicate the absence of autocorrelation. An observation of the 4.3 table reveals that the corresponding F statistics

Table 4.3: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.656411	Prob. F(2,49)	0.0331
Obs*R-squared	7.272198	Prob. Chi-Square(2)	0.0264

probability values and χ^2 are less than 5 percent. Hence, we accept the null hypothesis that there is no serial correlation in the model, this entails that the model is free from the problem of autocorrelation.

4.2.4 Heteroskedasticity Test: ARCH

The assumptions of this test are as:

H0= the model is heteroskedastic

H1= the model is homoskedastic

The null hypothesis is rejected when the probability value is less than 10 percent level of significance.

Table 4.4: Heteroskedasticity Test: ARCH

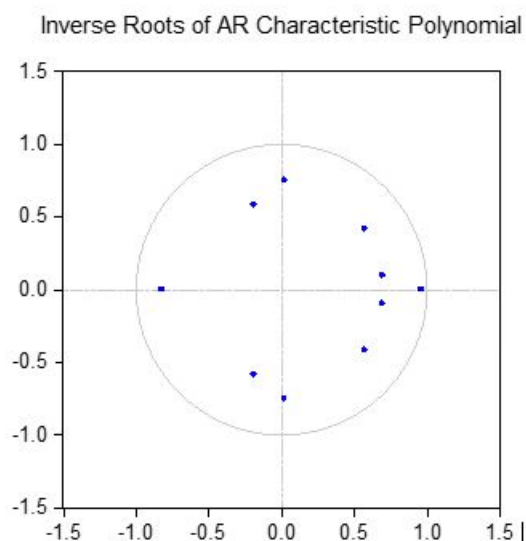
Heteroskedasticity Test: ARCH			
F-statistic	5.619482	Prob. F(1,53)	0.0214
Obs*R-squared	5.272505	Prob. Chi-Square(1)	0.0217

This implies that the model is homoscedastic if the likelihood of obs*R-square is greater than 10 percent significance amount. The results of table 4.4 suggested that obs*R-square(5.27) is greater than 10 percent significance level, and the likelihood value is less than 10 percent significance level, indicating that the null hypothesis is rejected that there is heteroscedasticity in the model.

VAR stability test stability

The stability test of the model was conducted and results for the 2 lag VAR are presented in Figure below:

Figure 4.2: Histogram Normality test



The results in Figure indicate that all the roots are less than 1, and lie inside the unit circle. Hence, the 2 lag VAR is stable.

4.2.5 Optimum Lag Selection Criteria

In addition, to select the appropriate lag, optimum lag selection criteria are used, as it is important to use advanced econometric techniques such as the Cointegration test and the Granger-Causality test. Five lag order selection criteria, such as Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ), were used for this analysis to choose the optimal lag criterion. As shown in Table 4.5. The lowest value of each criterion is used to select the optimum lag. Based on the above reasoning lag order selected for this study is 1 at Akaike Information Criterion (AIC).

4.2.6 Johansen's method of Cointegration

Since all the variables are cointegrated in their first order such as $I(1)$, Johansen multivariate cointegration test can be used. This test was applied to find out the cointegration vector (denoted by r) among the time series variables. This test uses two likelihood estimators such as, Trace test and Maximum Eigen Value test.

Table 4.5: Optimum Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	198.9292	NA	3.97e-10	-7.458815	-7.271195	-7.386886
1	509.0875	548.7416*	6.88e-15*	-18.42644*	-17.30072*	-17.99487*
2	530.2903	33.43518	8.18e-15	-18.28039	-16.21658	-17.48918
3	555.4710	34.86559	8.72e-15	-18.28735	-15.28543	-17.13648
4	581.1382	30.60322	9.78e-15	-18.31301	-14.373	-16.8025
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

We reject the null hypothesis, which shows no cointegration between the variables, with regard to the data, or support the null hypothesis, which shows the existence of the vector of cointegration. By considering $H_0: r = 0.0$, we begin the test. Then we proceed to test if $H_0: r = 1$ if it is rejected. Unless the null hypothesis is accepted, this process will continue. The results of co-integration test are reported in the following Table 4.6.

Table 4.6: Unrestricted Cointegration Rank Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.439246	85.59493	69.81889	0.0017
At most 1 *	0.405097	54.35735	47.85613	0.0108
At most 2	0.259665	26.31205	29.79707	0.1196
At most 3	0.170230	10.07685	15.49471	0.2749
At most 4	1.87E-06	0.000101	3.841466	0.9932
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Table 4.6, Trace Test indicates the presence of 2 cointegrating eqn(s) at 5 per cent level of significance, the trace statistic (85.59),(54.35) is greater than its critical value at 5 percent (69.81),(47.85),and the probability (0.0017) and (0.0108) is less than 5 percent level of significance.

If the series are co-integrated , this implies that they exhibit a long-run relationship, and series are related and they can be written in a linear fashion. That is , even if there are shocks in short-

run, which may affect movement in the individual series, they would converge with time in the long-run. For that reason, the appropriate estimation techniques are Vector Auto-regressive (VAR) Model.

4.2.7 Vector Auto-regressive(VAR)Model

Reference to the equation 3.16, we use the Vector Autoregression estimates to arrive at the relationship among the variables in short-run. The dependent variable in VAR model is a function of its lagged values (Lag 1) and the lagged values of all other variables under consideration. By estimating the individual coefficients in the VAR model, this is used to answer the research questions: What is the relationship between foreign aid inflows and Rwanda's exchange rate?, how did exchange rate affect exports in Rwanda?, all these questions will be answered to assess the impact of these macroeconomic variables on economic growth in Short run.

Short-run Dynamics of foreign aid inflows and Rwanda's economic growth

The VAR approach bypasses the need for structural modeling by treating every variable as endogenous in the model as a function of the lagged values of all endogenous variables in the system. The results from the Table 4.7, revealed 5 functions for LGDP, LODA, LGCF, LEXPORT and LEXR. Foreign aid (ODA) was not statistically significant for the first function, this means that its probability value (0.2094) is greater than 5 percent level of significance, hence it did not affect economic growth in short-run.

Foreign aid was also not significant in the fifth function, the results revealed that the probability value (0.1014) is greater than 5 percent level of significance, and this implies that foreign aid was not statistically significant and did not influence the exchange rate in short-run.

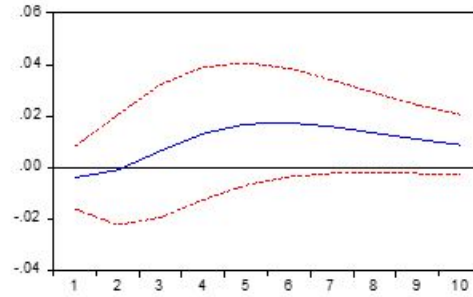
To demonstrate if foreign aid caused change in exchange rate, The findings are in-line with many views from the literature review such as (Yang et al., 2006), Barder (2006b), who argued that the country generally experiences an appreciation of its real exchange rate as it industrializes. As productivity, output and incomes increase relative to the rest of the world, the relative price of its nontradables rises relative to tradables. In the case where this occurs without aid, the long-run appreciation of the real exchange rate is driven by a rise in productivity, output and incomes. The appreciated real exchange rate is the corollary of higher levels of incomes and consumption that the country enjoys as productivity increases and its citizens become richer. The appreciation resulting from the inflow of aid is different: the aid causes the exchange rate to instantly appreciate before productivity and output rises.

The exchange rate was statistically significant in the fourth function, the results revealed that the probability value (0.0043) is less than 5 percent level of significance. This implies that exchange rate influenced exports in short-run. This means that the one unit increase in Exchange rate caused the exports to increase by 1.16 percent in short-run, ceteris paribus.

Table 4.7: VAR Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	0.878986	0.102467	8.578265	0.0000
LODA(-1)	0.045276	0.035977	1.258492	0.2094
LGCF(-1)	-0.010462	0.040158	-0.26052	0.7947
LEXPORT(-1)	0.021437	0.040835	0.524957	0.6001
LEXR(-1)	0.179166	0.125217	1.430844	0.1537
LGDP(-1)	-0.017496	0.190795	-0.0917	0.927
LODA(-1)	0.892594	0.066989	13.32447	0.0000
LGCF(-1)	0.044103	0.074776	0.589801	0.5559
LEXPORT(-1)	0.016277	0.076036	0.214075	0.8307
LEXR(-1)	-0.174786	0.233156	-0.74965	0.4542
LGDP(-1)	1.593046	0.397999	4.002641	0.0001
LODA(-1)	-0.193686	0.139739	-1.38605	0.167
LGCF(-1)	0.146985	0.155983	0.942315	0.347
LEXPORT(-1)	-0.123261	0.158612	-0.77713	0.4378
LEXR(-1)	-1.054342	0.486364	-2.1678	0.0311
LGDP(-1)	0.375002	0.331168	1.132362	0.2586
LODA(-1)	0.015056	0.116275	0.12949	0.8971
LGCF(-1)	-0.009062	0.12979	-0.06982	0.9444
LEXPORT(-1)	0.403946	0.131978	3.06071	0.0025
LEXR(-1)	1.167074	0.404695	2.883837	0.0043
LGDP(-1)	0.009208	0.022357	0.41185	0.6808
LODA(-1)	-0.012908	0.00785	-1.64434	0.1014
LGCF(-1)	0.021485	0.008762	2.452062	0.0149
LEXPORT(-1)	-0.006748	0.00891	-0.75732	0.4496
LEXR(-1)	0.966825	0.027321	35.38739	0.0000

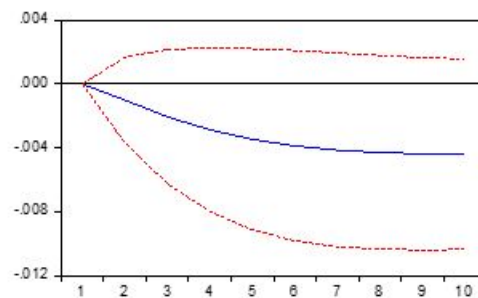
Figure 4.3: Response of LODA to LGDP



Impulse Response Function

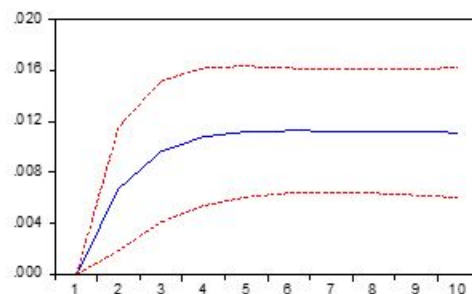
For the figure 4.3, It can be seen that the response of LODA (shock) to economic growth (LGDP), From the period two, Foreign aid has a positive impact on growth in the short run and this diminishes in the subsequent periods, since its series consistently moves around zero.

Figure 4.4: Response of LODA to LEXR



It can be observed in figure 4.4 that the impulse response (Shock) of LODA to LEXR carries negative signs as its series consistently moves with a slight negative fluctuation.

Figure 4.5: Response of LEXR to LEXPORT



The figure 4.5 showed that the shocks of exchange rate to exports is positive signs. It has had a positive impact on the exports of Rwanda over this period. This relationship has been further explained by the VAR results from table 4.7.

To investigate if exchange rate has had an effect on export, These findings are in line with research by [Barder \(2006b\)](#), found that By contrast with the effect of aid on exports, economic statisticians have not found a strong relationship between the amount of aid a country receives and its real exchange rate. One empirical study found that a doubling of aid might lead to an appreciation of the real exchange rate of 4 percent in the short term and up to 30 percent over a decade ([Prati, n.d.](#)) , But aid to Africa has often been associated with depreciation, not appreciation, of the real exchange rate.

It is hard to statistically disentangle the Figures. However, if the statistics tell us anything, the lack of a clear correlation between a high level of aid and an appreciation of the real exchange rate casts some doubt on the view that the most important cause of problems in the export sector is a high level of aid. This makes it more probable that the link between high aid and slow-growing exports is because countries with poor export performance tend to get more aid.

4.2.8 Variance Decomposition

In regards to the signs of the coefficient of various variables, which represent the magnitudes at which the respective variables do impact Rwanda's economic growth, it can be observed that lag one of aid carries positive signs, aid is not significant. This implies that, even though foreign aid could be important, it is not statistically significant for Rwanda's GDP in short run over the period of 2006Q1-2019Q4. The results are consistent with several views from the literature review, such as [Papanek \(1973\)](#), [Burnside & Dollar \(2000b\)](#), [Dalgaard et al. \(2004\)](#), [Jena & Sethi \(2020\)](#), [Mosley et al. \(1987\)](#) and [Snyder \(1993\)](#) who found that aid and economic growth were positively linked, but not significantly.

A variance decomposition or forecast error variance decomposition (FEVD) is used in econometrics and other multivariate time series analysis applications to assist in the interpretation of vector autoregression (VAR) model after it has been fitted. The variance decomposition of the forecast error gives the percentage of unexpected variation in each variable that is produced by shocks from other variables.

In interpreting the results from variance decomposition, the assessment of economic significance of the impact as percentage of the forecast error was done. In short-run, two periods were chosen and year three up to year five for long-run. The results from the table 4.8 indicates that economic growth (LGDP) 100 percent of the forecast error variance in LGDP is explained the variable itself. This means that other variables in the model do not have any strong influence on LGDP in short-run of one year, and decrease over the time. Apart from its own shocks which largely account for its variance decomposition, the other key cause of change in variance decomposition of error of gross domestic product (GDP) is foreign aid (LODA). During the period after the shock the magnitude of the response in LGDP due to foreign aid (LODA) increases with time and reaches 2.92 percent in fifth year.

Table 4.8: Variance Decomposition

Variance Decomposition of LGDP:						
Period	S.E.	LGDP	LODA	LGCF	LEXPORT	LEXR
1	0.027423	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.036590	99.26967	0.362961	0.068441	0.219332	0.079598
3	0.042558	98.12748	1.096818	0.054356	0.426490	0.294859
4	0.047001	96.77201	2.001575	0.063207	0.533087	0.630125
5	0.050579	95.33739	2.917493	0.132872	0.562373	1.049871
Variance Decomposition of LODA:						
Period	S.E.	LGDP	LODA	LGCF	LEXPORT	LEXR
1	0.051063	1.487667	98.51233	0.000000	0.000000	0.000000
2	0.068587	1.158345	98.42785	0.344825	0.047423	0.021560
3	0.079705	0.910740	98.46914	0.461527	0.076535	0.082058
4	0.087577	0.755958	98.49670	0.465286	0.106195	0.175860
5	0.093518	0.666524	98.46472	0.434486	0.142155	0.292113
Variance Decomposition of LGCF:						
Period	S.E.	LGDP	LODA	LGCF	LEXPORT	LEXR
1	0.106517	14.69986	0.003586	85.29655	0.000000	0.000000
2	0.118309	27.88860	0.611060	70.54515	0.691529	0.263663
3	0.125762	35.69311	0.722760	62.50611	0.635237	0.442783
4	0.130753	40.18788	0.669377	58.00730	0.638620	0.496825
5	0.134206	42.92511	0.704177	55.16104	0.718926	0.490752
Variance Decomposition of LEXPORT:						
Period	S.E.	LGDP	LODA	LGCF	LEXPORT	LEXR
1	0.088631	7.218930	0.030382	0.533933	92.21676	0.000000
2	0.097191	10.31820	0.029350	0.492255	88.68150	0.478701
3	0.100305	13.13506	0.028775	0.527185	84.93499	1.373988
4	0.102741	15.68751	0.027506	0.742760	81.12778	2.414450
5	0.105164	18.05472	0.029593	1.043317	77.43581	3.436564
Variance Decomposition of LEXR:						
Period	S.E.	LGDP	LODA	LGCF	LEXPORT	LEXR
1	0.005984	1.151751	1.185045	3.866264	1.070332	92.72661
2	0.009138	3.836020	2.472378	14.65940	2.106279	76.92592
3	0.011699	7.933973	4.449162	17.58938	3.099215	66.92827
4	0.013922	12.53336	6.476524	17.65777	3.598876	59.73346
5	0.015927	17.04080	8.228737	16.80630	3.719775	54.20438
Cholesky Ordering: LGDP LODA LGCF LEXPORT LEXR						

The results revealed that foreign aid (LODA) 98 percent of the forecast error variance in LODA is explained the variable itself. This means that other variables in the model do not have any strong influence on LODA in short-run of one year, and decrease over the time. Apart from its own shocks which largely account for its variance decomposition, the other cause of change in variance decomposition of error of foreign aid (LODA) is Gross domestic products (LGDP). During the period after the shock the magnitude of the response in LODA due to Gross domestic products (LGDP) increases by 1.15 percent in short-run for the second year, and decreases by 0.67 percent in long-run for the fifth year.

For the gross capital formation, The results revealed that gross capital formation (LGCF) 85 percent of the forecast error variance in LGCF is explained the variable itself. This means that other variables (LEXPORT and LEXR) in the model do not have any strong influence on LGCF in short-run of one year, and decreases over the time. Apart from its own shocks which largely account for its variance decomposition, the other main source of change in variance decomposition of error of gross capital formation (LGCF) are LEXPORT, LODA, LGDP and LEXR . During the period after the shock the magnitude of the response in LGCF due to LEXPORT, LODA, LGDP and LEXR increases by 0.72, 0.70, 18 and 0.49 percent respectively in long-run for the fifth year.

The exports, The results revealed that exports (LEXPORT) 92 percent of the forecast error variance in LEXPORT is explained by the variable itself. This means that other variable (LEXR) in the model do not have any strong influence on LEXPORT in short-run of one year, and decreases over the time. Apart from its own shocks which largely account for its variance decomposition, the other main source of change in variance decomposition of error of exports (LEXPORT) are LGDP and LEXR . During the period after the shock the magnitude of the response in LEXPORT due to LGDP and LEXR increases respectively by 18 percent and 3.43 percent in long-run for the fifth year.

Finally, the exchange rate, the results revealed that that exchange rate (LEXR) 93 percent of the forecast error variance in LEXR is explained by the variable itself and decreases over the time. Apart from its own shocks which largely account for its variance decomposition, the other main source of change in variance decomposition of error of exchange rate (LEXR) are LGDP, LGCF, LODA, and LEXPORT . During the period after the shock the magnitude of the response in LEXR due to LGDP, LGCF, LODA, and LEXPORT increases over the time by 17, 16.8, 18, 8.23 and 3.72 percent respectively in long-run for the fifth year.

The results revealed that 99 percent, the variance of dependent variable (LGDP) is explained by the independent variables. Foreign aid, Gross capital Formation, Exports and exchange rate are statistically significant with the probability value less than 5 percent level of significance. The estimation results showed that the percentage change in foreign aid (ODA) is associated with an increase of 0.24 in real gross domestic products (GDP) on average ceteris paribus in long -run. It is also revealed that in long-run, the exports increased by 0.22 on average, exchange rate increased by 0.69 on average.

In the short-run, the findings VAR estimates showed that foreign aid, gross capital formation, export and exchange rate did not affect economic growth (GDP) .

The exchange rate was statistically significant, the percentage change in exchange rate (LEXR) is associated with an increase of 0.16 in Exports (LEXPORT) on average *ceteris paribus* in short-run and the foreign aid (LODA) didn't cause change in exchange rate in short-run.

4.2.9 Granger causality test

Granger's Causality Test [Granger \(1969\)](#) is used to examine for the forecasting relationship between two variables. The co-integration test ignores the effect of the past values of one variable on the current value of the other variable. The Granger causality test was hence used to examine such possible instances. There are 4 ways for Causality checks: Regressor's statistic, Granger/Wald Causality test on lagged explanatory variables, Wald Coefficient Test and Pairwise Granger causality test on direction of causality, for this study, we used Granger causality test. H_0 : is no granger causality, and H_1 : null hypothesis is not true. For the decision, we reject null hypothesis if probability value of f-statistic is less than 5 percent.

Table 4.9 shows the results of pairwise Granger Causality test. In this Thesis, we set different hypotheses to find out the causal relationship between variables of our concern. In the first hypothesis, we take into account the causal relationship between ODA and economic growth (GDP). It is clear from the above table that there exists an independent causality between LODA and LGDP for the period 2006Q1-2019Q4 in short-run. The null hypothesis is not rejected because their probability value is greater than 5 percent level of significance. LODA does not granger cause LGD and LGDP does not granger cause LODA. There is also independent causality, the LEXR does not granger cause LODA and LODA does not granger cause LEXR and there is no such causal relationship between Exchange rate (LEXR) and Exports (LEXPORT) at 5 percent level of significance. However, there seems to exist a unidirectional causal relationship between Exports (LEXPORT) and that of exchange rate (LEXR). The null hypothesis that states LEXR does not granger cause Exports (LEXPORT) is rejected because the probability value (0.031) is less than 5 percent level of significance.

4.2.10 Sensitivity analysis

Given the arguments of aid supporters such as Jeffery Sachs and Paul Collier, "that aid can be more efficient when obtained in higher volumes," I go further in this study to perform a robustness review to decide if aid was more efficient when obtained in higher volumes compared to times when less aid was received. The findings showed that foreign aid had positive impact on economic growth in long-run, and foreign aid was not statistically significant and the theory of Jeffery Sachs and Paul Collier "that aid can be more efficient when obtained in higher volumes," is not true for the case of Rwanda.

Given also to the argument that has been presented by many authors [K. B. Griffin & Enos \(1970\)](#), [K. Griffin \(1978\)](#), [Boone \(1996\)](#), [Easterly \(1999\)](#), [Rajan & Subramanian \(2011\)](#) and [Mbah & Amassoma \(2014\)](#) that foreign aid can cause Dutch Disease through the appreciation in low developing countries, for the case of Rwanda, the findings showed that it is unlikely that a long-term, sustained and predictable increase in aid would, through the impact of the real exchange rate, do more harm

Table 4.9: Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
LODA does not Granger Cause LGDP	0.10320	0.9021
LGDP does not Granger Cause LODA	0.00363	0.9964
LGCF does not Granger Cause LGDP	1.75377	0.1838
LGDP does not Granger Cause LGCF	5.40792	0.0075
LEXPORT does not Granger Cause LGDP	1.10518	0.3393
LGDP does not Granger Cause LEX-PORT	1.26707	0.2907
LEXR does not Granger Cause LGDP	0.69030	0.5062
LGDP does not Granger Cause LEXR	5.01335	0.0105
LGCF does not Granger Cause LODA	0.05952	0.9423
LODA does not Granger Cause LGCF	0.03974	0.9611
LEXPORT does not Granger Cause LODA	0.04127	0.9596
LODA does not Granger Cause LEX-PORT	0.95019	0.3937
LEXR does not Granger Cause LODA	0.97199	0.3855
LODA does not Granger Cause LEXR	1.43658	0.2476
LEXPORT does not Granger Cause LGCF	3.36286	0.0428
LGCF does not Granger Cause LEX-PORT	0.62007	0.5421
LEXR does not Granger Cause LGCF	1.01827	0.3687
LGCF does not Granger Cause LEXR	6.54809	0.003
LEXR does not Granger Cause LEX-PORT	2.64677	0.031
LEXPORT does not Granger Cause LEXR	2.33588	0.1074

than good for the following reasons: There is not necessarily an adverse impact on exports from Dutch Disease, and they may be no impact on economic growth and aid spent in part of improving the supply side (investing in infrastructure, education, government institutions and health results in productivity benefits or gains for the whole economy), which can compensate for any loss of competitiveness from the impact of the Dutch Disease (Appreciation of real exchange rate)

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This Chapter presents a summary of the study findings. The chapter ends with conclusions drawn from research objectives and recommendations to help in improvement of economic growth in Rwanda and areas for further studies.

5.2 Summary of Findings

A group of beneficiaries, including the Government of Rwanda (GoR), the Civil Society, the general public and other researchers, appear to benefit tremendously from this thesis. The Government of Rwanda is the intended recipient of the findings of this research in particular. The study results placed Rwanda in the driver's seat and help to devise development programs of Rwanda and in leading coordination processes to improve the relationship between country and the donor countries to become mutually beneficial.

Via intellectual vigour, it will inspire and encourage other researchers to constantly advance scholarship in this seemingly grey area. Basing on the research objectives of this thesis, the findings are as follow: The general objective of this research was to assess the effect of foreign aid in economic growth in Rwanda, the findings revealed that aid contributes positively to economic growth in the long run, and its short run effect appeared insignificant. The findings in figure 4.3 also showed that the growth impact of aid is positive implying the role of aid policy in the long run.

In Summary, The results revealed that the percentage change in foreign aid (LODA) is associated with an increase of 0.24 in real gross domestic Products (LGDP) on average *ceteris paribus* in long-run. It is also revealed that in long-run, the exports increased by 0.61 on average and exchange rate increase by 0.22 on average, exchange rate increased 0.69 on average and this caused the increase of domestic investment by 0.29 On average.

In the short-run, The findings showed that LODA, LGCF, LEXPORT and LEXR did not have an impact on economic growth in short-run. But the exchange rate was statistically significant, the results revealed that real exchange rate influenced exports in short-run, while foreign aid didn't cause change in exports in short-run.

5.3 CONCLUSION

In conclusion, the objective of this study was to examine the effects of foreign aid on economic growth from 2006Q1 to 2019Q4. In order to find out the short-run and long-run equilibrium dynamics among the variables under consideration, this analysis uses different time series techniques

such as the Johansen Cointegration Test, Granger causality test , VAR and Variance Decomposition .The empirical results confirmed that long-run relationship exists among economic growth, foreign aid inflows, domestic investment,Exports and real Exchange rate in Rwanda.

The overall result shows the importance of increasing the flow of foreign aid to Rwanda, despite contributing less to boosting investment and growth due to unfavorable policies. In the long run, however, rather than simply filling holes, assistance should help close gaps in Rwanda, as this reduces reliance on future aid and foreign borrowing.

5.4 Recommendation

On this premise I thereby suggest that, donors should put in place sound political and macro-economic policies (since they are collectively inclusive) in order to ensure that aid revenue is invested into developmental projects that will promote the nation's investment given its potentials to boost up its RGDP growth.

Use the aid to build up foreign exchange reserves.This means that the assistance is not instantly,but the benefit are spread overtime.

Spend the aid in ways that obviously have large short term benefits to exporters(example:Improving the power generation capacity)

In order to stabilize the domestic economic cycle and transform the external economy, efforts should be made by the government to introduce sound monetary and fiscal policies. In combination with the liberalization agenda, sound macroeconomic policies would help to disseminate information and encourage further investment and imports of high-tech goods. All of this will make the economy more sustainable, resulting in steady growth and raising the country's living standards.

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Appendices

Appendix A

Used Data

Table A.1: Relationship between Official Development Assistance (ODA) and economic growth in Rwanda from 1995 to 2019 ¹

Year	GDP Growth	ODA	Year	GDP Growth	ODA
1995	35.224	38.4	2008	11.161	279.8
1996	12.746	31.4	2009	6.248	347.4
1997	13.85	37.7	2010	7.335	397.4
1998	8.859	33.0	2011	7.958	443.1
1999	4.322	63.5	2012	8.642	345.5
2000	8.371	76.7	2013	4.72	459.2
2001	8.485	64.2	2014	6.164	421.8
2002	13.192	70.8	2015	8.868	374.6
2003	2.202	76.2	2016	5.982	339.3
2004	7.448	128.7	2017	3.987	359.7
2005	9.378	164.5	2018	8.57	398.7
2006	9.227	169.1	2019	9.407	380.7
2007	7.633	207.3			

¹ Data of GDP Growth were from World Bank national accounts data, and OECD National Accounts data files

² Data of official Development Assistance (ODA) were from National Institute of Statistics of Rwanda (NISR)

Table A.2: Quarterly Used data

Period	GDP	ODA	GCF	EXPORT	EXR
2006Q1	403.00	40.53	62.00	44.00	553.54
2006Q2	453.00	41.34	76.00	60.00	552.16
2006Q3	481.00	42.68	72.00	53.00	551.36
2006Q4	501.00	44.54	82.00	54.00	549.94
2007Q1	508.00	46.90	92.00	75.00	548.11
2007Q2	549.00	49.83	91.00	82.00	546.19
2007Q3	576.00	53.29	100.00	87.00	548.19
2007Q4	601.00	57.28	112.00	84.00	545.53
2008Q1	610.00	63.34	116.00	74.00	543.89
2008Q2	689.00	67.80	164.00	87.00	543.35
2008Q3	752.00	72.18	165.00	86.00	552.21
2008Q4	791.00	76.48	191.00	86.00	553.02
2009Q1	789.00	81.20	201.00	87.00	566.47
2009Q2	777.00	85.15	180.00	84.00	567.89
2009Q3	812.00	88.82	161.00	96.00	568.71
2009Q4	859.00	92.22	172.00	91.00	569.97
2010Q1	857.00	94.83	197.00	90.00	572.50
2010Q2	861.00	97.89	176.00	97.00	579.00
2010Q3	909.00	100.88	183.00	112.00	588.90
2010Q4	959.00	103.80	218.00	106.00	592.12
2011Q1	967.00	112.09	234.00	121.00	598.84
2011Q2	1003.00	112.71	205.00	119.00	600.18
2011Q3	1079.00	111.08	223.00	155.00	600.03
2011Q4	1100.00	107.22	252.00	143.00	602.17
2012Q1	1119.00	87.27	272.00	140.00	605.42
2012Q2	1148.00	84.47	258.00	128.00	608.51
2012Q3	1215.00	84.98	288.00	154.00	614.89
2012Q4	1240.00	88.78	340.00	155.00	628.33
2013Q1	1218.00	110.04	324.00	155.00	633.17

Table A.3: Quarterly Used data, Continued

2013Q2	1258.00	114.79	318.00	193.00	639.72
2013Q3	1266.00	117.17	314.00	181.00	649.17
2013Q4	1334.00	117.20	352.00	166.00	664.44
2014Q1	1360.00	109.34	327.00	193.00	674.74
2014Q2	1400.00	106.85	282.00	190.00	680.23
2014Q3	1443.00	104.20	303.00	211.00	684.39
2014Q4	1442.00	101.41	383.00	203.00	692.31
2015Q1	1471.00	97.61	377.00	237.00	701.72
2015Q2	1507.00	94.85	359.00	246.00	712.98
2015Q3	1575.00	92.27	367.00	249.00	725.02
2015Q4	1625.00	89.88	457.00	251.00	738.89
2016Q1	1659.00	85.96	446.00	251.00	758.56
2016Q2	1704.00	84.62	476.00	253.00	776.07
2016Q3	1718.00	84.16	392.00	288.00	799.18
2016Q4	1795.00	84.56	421.00	278.00	815.23
2017Q1	1854.00	87.29	449.00	339.00	823.53
2017Q2	1925.00	88.85	463.00	357.00	827.97
2017Q3	1936.00	90.71	498.00	386.00	833.66
2017Q4	1979.00	92.85	424.00	384.00	841.71
2018Q1	2013.00	98.25	418.00	391.00	849.42
2018Q2	2052.00	99.79	366.00	417.00	856.16
2018Q3	2097.00	100.45	465.00	389.00	864.39
2018Q4	2130.00	100.21	537.00	387.00	874.88
2019Q1	2126.00	99.09	487.00	383.00	884.12
2019Q2	2342.00	97.07	673.00	397.00	893.15
2019Q3	2346.00	94.17	519.00	461.00	904.12
2019Q4	2290.00	90.37	698.00	492.00	916.30

Appendix B

Estimation Results

Table B.1: Estimation of Results

Dependent Variable: LGDP				
Method: Least Squares				
Date: 12/04/20 Time: 16:01				
Sample: 2006Q1 2019Q4				
Included observations: 56				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LODA	0.241462	0.040005	6.035792	0.0000
LGCF	0.296169	0.035349	8.378344	0.0000
LEXPORT	0.227253	0.049275	4.611944	0.0000
LEXR	0.694086	0.150925	4.59889	0.0000
C	-1.33704	0.853343	-1.56683	0.1233
R-squared	0.993623	Mean dependent var		7.045403
Adjusted R-squared	0.993123	S.D. dependent var		0.483701
S.E. of regression	0.040111	Akaike info criterion		-3.50928
Sum squared resid	0.082054	Schwarz criterion		-3.32844
Log likelihood	103.2597	Hannan-Quinn criter.		-3.43917
F-statistic	1986.766	Durbin-Watson stat		1.310129
Prob(F-statistic)	0.0000			

Table B.2: Vector Autoregression Estimates

Standard errors in () & t-statistics in []					
	LGDP	LODA	LGCF	LEXPORT	LEXR
LGDP(-1)	0.878986	-0.0175	1.593046	0.375002	0.009208
	(0.10247)	(0.19079)	(0.39800)	(0.33117)	(0.02236)
	[8.57827]	[-0.09170]	[4.00264]	[1.13236]	[0.41185]
LODA(-1)	0.045276	0.892594	-0.193686	0.015056	-0.012908
	(0.03598)	(0.06699)	(0.13974)	(0.11627)	(0.00785)
	[1.25849]	[13.3245]	[-1.38605]	[0.12949]	[-1.64434]
LGCF(-1)	-0.010462	0.044103	0.146985	-0.009062	0.021485
	(0.04016)	(0.07478)	(0.15598)	(0.12979)	(0.00876)
	[-0.26052]	[0.58980]	[0.94231]	[-0.06982]	[2.45206]
LEXPORT(-1)	0.021437	0.016277	-0.123261	0.403946	-0.006748
	(0.04084)	(0.07604)	(0.15861)	(0.13198)	(0.00891)
	[0.52496]	[0.21408]	[-0.77713]	[3.06071]	[-0.75732]
LEXR(-1)	0.179166	-0.17479	-1.054342	1.167074	0.966825
	(0.12522)	(0.23316)	(0.48636)	(0.40469)	(0.02732)
	[1.43084]	[-0.74965]	[-2.16780]	[2.88384]	[35.3874]
C	-0.532541	1.423213	1.886571	-7.166556	0.132561
	(0.59871)	(1.11480)	(2.32548)	(1.93499)	(0.13063)
	[-0.88949]	[1.27665]	[0.81126]	[-3.70366]	[1.01477]
R-squared	0.996865	0.965937	0.969207	0.981996	0.998923
Adj. R-squared	0.996545	0.962461	0.966064	0.980159	0.998813
Sum sq. resids	0.036850	0.127763	0.555949	0.384917	0.001754
S.E. equation	0.027423	0.051063	0.106517	0.088631	0.005984
F-statistic	3115.879	277.9021	308.4494	534.5244	9087.024
Log likelihood	122.9349	88.74348	48.30473	58.41508	206.6660
Akaike AIC	-4.252176	-3.00885	-1.538354	-1.906003	-7.296946
Schwarz SC	-4.033195	-2.78987	-1.319372	-1.687021	-7.077964
Mean dependent	7.064430	4.456102	5.572120	5.112578	6.501943
S.D. dependent	0.466531	0.263551	0.578217	0.629220	0.173656
Determinant resid covariance (dof adj.)		4.50E-15			
Determinant resid covariance		2.52E-15			
Log likelihood		534.1548			
Akaike information criterion		-18.3329			
Schwarz criterion		-17.238			

Appendix C

Stationarity tests

Table C.1: Stationarity for LGDP

Null Hypothesis: LGDP has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.47703	0.0123
Test critical values:	1% level		-3.55502	
	5% level		-2.91552	
	10% level		-2.59557	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LGDP)				
Method: Least Squares				
Date: 12/07/20 Time: 10:02				
Sample (adjusted): 2006Q2 2019Q4				
Included observations: 55 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.02742	0.007887	-3.47703	0.001
C	0.22445	0.055593	4.037351	0.0002
R-squared	0.18574	Mean dependent var		0.031589
Adjusted R-squared	0.170376	S.D. dependent var		0.030469
S.E. of regression	0.027753	Akaike info criterion		-4.29529
Sum squared resid	0.040821	Schwarz criterion		-4.2223
Log likelihood	120.1205	Hannan-Quinn criter.		-4.26706
F-statistic	12.08974	Durbin-Watson stat		1.875854
Prob(F-statistic)	0.001021			

Table C.2: Stationarity for LODA

Null Hypothesis: LGDP has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.47703	0.0123
Test critical values:	1% level		-3.55502	
	5% level		-2.91552	
	10% level		-2.59557	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LGDP)				
Method: Least Squares				
Date: 12/07/20 Time: 10:02				
Sample (adjusted): 2006Q2 2019Q4				
Included observations: 55 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.02742	0.007887	-3.47703	0.001
C	0.22445	0.055593	4.037351	0.0002
R-squared	0.18574	Mean dependent var		0.031589
Adjusted R-squared	0.170376	S.D. dependent var		0.030469
S.E. of regression	0.027753	Akaike info criterion		-4.29529
Sum squared resid	0.040821	Schwarz criterion		-4.2223
Log likelihood	120.1205	Hannan-Quinn criter.		-4.26706
F-statistic	12.08974	Durbin-Watson stat		1.875854
Prob(F-statistic)	0.001021			

Table C.3: LGCF-Not Stationarity at the level

Null Hypothesis: LGCF has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.67269	0.4392
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LGCF)				
Method: Least Squares				
Date: 12/07/20 Time: 10:07				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGCF(-1)	-0.04981	0.029779	-1.67269	0.1005
D(LGCF(-1))	-0.33772	0.132797	-2.54312	0.0141
C	0.331008	0.166729	1.985304	0.0525
R-squared	0.144958	Mean dependent var		0.041065
Adjusted R-squared	0.111427	S.D. dependent var		0.130165
S.E. of regression	0.122699	Akaike info criterion		-1.30421
Sum squared resid	0.767807	Schwarz criterion		-1.19371
Log likelihood	38.21373	Hannan-Quinn criter.		-1.2616
F-statistic	4.323101	Durbin-Watson stat		1.99757
Prob(F-statistic)	0.018436			

Table C.4: Stationarity at the first Difference

Null Hypothesis: D(LGCF) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-9.80427	0.0000
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LGCF,2)				
Method: Least Squares				
Date: 12/07/20 Time: 10:08				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGCF(-1))	-1.32014	0.134649	-9.80427	0.0000
C	0.053661	0.017791	3.016265	0.004
R-squared	0.648942	Mean dependent var		0.001717
Adjusted R-squared	0.642191	S.D. dependent var		0.208639
S.E. of regression	0.124802	Akaike info criterion		-1.28784
Sum squared resid	0.80993	Schwarz criterion		-1.21418
Log likelihood	36.7717	Hannan-Quinn criter.		-1.25943
F-statistic	96.12365	Durbin-Watson stat		2.008472
Prob(F-statistic)	0.0000			

Table C.5: Not Stationarity at the level - LEXPORT

Null Hypothesis: LEXPORT has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.41092	0.8996
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LEXPORT)				
Method: Least Squares				
Date: 12/07/20 Time: 10:09				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXPORT(-1)	-0.008599	0.020926	-0.41092	0.6829
D(LEXPORT(-1))	-0.31348	0.123311	-2.54218	0.0141
C	0.096394	0.107422	0.897332	0.3738
R-squared	0.115333	Mean dependent var		0.038965
Adjusted R-squared	0.08064	S.D. dependent var		0.098035
S.E. of regression	0.093999	Akaike info criterion		-1.83712
Sum squared resid	0.450624	Schwarz criterion		-1.72662
Log likelihood	52.60216	Hannan-Quinn criter.		-1.7945
F-statistic	3.324413	Durbin-Watson stat		1.994828
Prob(F-statistic)	0.043942			

Table C.6: Stationary at the first Difference-LEXPORT

Null Hypothesis: D(LEXPORT) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-10.7416	0.0000
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LEXPORT,2)				
Method: Least Squares				
Date: 12/07/20 Time: 10:10				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXPORT(-1))	-1.31389	0.122318	-10.7416	0.0000
C	0.052621	0.01376	3.8243	0.0004
R-squared	0.689333	Mean dependent var		-0.00454
Adjusted R-squared	0.683358	S.D. dependent var		0.165706
S.E. of regression	0.093245	Akaike info criterion		-1.87085
Sum squared resid	0.452116	Schwarz criterion		-1.79718
Log likelihood	52.51291	Hannan-Quinn criter.		-1.84244
F-statistic	115.3817	Durbin-Watson stat		2.003643
Prob(F-statistic)	0.0000			

Table C.7: Not Stationary at the level-LEXR

Null Hypothesis: LEXR has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			1.496335	0.9991
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LEXR)				
Method: Least Squares				
Date: 12/07/20 Time: 10:11				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	0.009092	0.006076	1.496335	0.1407
D(LEXR(-1))	0.495549	0.123811	4.002464	0.0002
C	-0.05419	0.038951	-1.39118	0.1702
R-squared	0.381306	Mean dependent var		0.00938
Adjusted R-squared	0.357044	S.D. dependent var		0.008188
S.E. of regression	0.006566	Akaike info criterion		-7.15999
Sum squared resid	0.002198	Schwarz criterion		-7.04949
Log likelihood	196.3198	Hannan-Quinn criter.		-7.11738
F-statistic	15.71588	Durbin-Watson stat		2.231977
Prob(F-statistic)	0.000005			

Table C.8: Stationarity at first difference-LEXR

Null Hypothesis: D(LEXR) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.78382	0.0053
Test critical values:	1% level		-3.55747	
	5% level		-2.91657	
	10% level		-2.59612	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LEXR,2)				
Method: Least Squares				
Date: 12/07/20 Time: 10:12				
Sample (adjusted): 2006Q3 2019Q4				
Included observations: 54 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-0.41473	0.109606	-3.78382	0.0004
C	0.004062	0.001345	3.020189	0.0039
R-squared	0.215891	Mean dependent var		0.000294
Adjusted R-squared	0.200812	S.D. dependent var		0.007431
S.E. of regression	0.006643	Akaike info criterion		-7.15406
Sum squared resid	0.002295	Schwarz criterion		-7.0804
Log likelihood	195.1597	Hannan-Quinn criter.		-7.12565
F-statistic	14.31732	Durbin-Watson stat		2.340727
Prob(F-statistic)	0.000401			

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