THE CAUSAL RELATIONSHIP BETWEEN SAVINGS AND ECONOMIC GROWTH IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

By

Dieu Donne Katamba Nsenga

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Supervisor: Prof C.V.R Wait
Co-supervisor: Prof P. Le Roux

DECLARATION BY CANDIDATE

NAME: DIEU DONNE KATAMBA NSENGA

STUDENT NUMBER : 214254453

QUALIFICATION: MASTER OF COMMERCE

TITLE OF THE DISSERTATION: THE CAUSAL RELATIONSHIP BETWEEN SAVINGS AND ECONOMIC GROWTH IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

DECLARATION

In accordance with Rule G4.6.3, I hereby declare that the above-mentioned dissertation is my own work and has not been previously submitted for assessment to another university or for another qualification.

SIGNATURE:

DATE: 11 - April - 2018

ABSTRACT

Promoting high domestic savings rates in order to boost economic growth is one of the SADC macroeconomic targets. Based on both the Solow's (1956) and the endogenous "AK" growth models that predict a positive relationship between savings and economic growth in a closed economy, and on the Aghion-Comin-Howitt's (2006) hypothesis that assumes a positive relationship between savings and economic growth in an open economy, two separate empirical models were constructed to test the long-run relationship and the causality between savings and economic growth in the SADC region. To this end, annual time series data for ten SADC member states obtained from the World Bank Indicators over the period 1985-2015 were pooled. The Panel ARDL/Pooled Mean Group estimator developed by Pesaran, Shin and Smith (1997) was performed to analyse the data.

The main findings are that domestic savings is positively related to GDP in an open economy, whereas in a closed economy, it is insignificant. In addition, the speed of adjustment revealed a bi-directional causality between savings and economic growth. However, the speed of adjustment is much slower when the model is estimated with savings as the dependent variable but faster when GDP is regressed as the dependent variable. Thus, SADC member states are encouraged to implement policies that promote domestic savings as well as attract foreign direct investments, in order to boost economic growth. GDP growth will, in turn, increase the level of domestic savings.

DEDICATION

To my late father Felix Nkongolu Kapeta Wamudiunda….

ACKNOWLEDGEMENT

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIK	Akaike Information Criteria
ATM	Automated Teller Machine
ARDL	Autoregressive Distributed Lag
ARMA	Autoregressive-moving-average
Congo DR	The Democratic Republic of the Congo
DFE	Dynamic Fixed-Effects
FDI	Foreign Direct Investment
FPR	Final Prediction Error
GDP	Gross Domestic Product
GDS	Gross Domestic Savings
GFCF	Gross Fixed Capital Formation
GCC	Gulf Co-operation Council
GMM	Generalized Method of Moment
HQ	Hannan-Quinn
JB	Jarque-Bera
LM	Lagrange Multiplier
MG	Mean Group
OECD	Organisation for Economic Co-operation and Development
PMG	Pooled Mean Group
PP	Philip- Perron
SC	Schwarz Information Criteria
TFP	Total-factor Production
VAR	Vector Autoregressive
VECM	Vector Error Correction Model

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

CHAPTER ONE

INTRODUCTION

1.1 Background

Achieving high and sustained economic growth is an ultimate goal for policy makers in most countries. Policy makers believe that to create more jobs, reduce poverty and hence produce a high standard of living desired by citizens, the rate of economic growth must be at its highest level (Najarzadeh, Reed and Tasan, 2014). Several growth models have identified variables that matter for economic growth such as the rate of savings, among others.

The existing theories on the relationship between saving and economic growth suggest that these two variables are positively related. However, these theories have two opposing views on the direction of causality between savings and economic growth. On the one hand, the traditional growth models such as the classical, neoclassical and endogenous growth models emphasise that the direction of causality between savings and economic growth runs from the former to the latter. Classical growth models hold that higher savings rates lead indirectly to economic growth through high investment rates (Salvadori, 2003). In the neoclassical Solow (1956) growth model, savings is an exogenous factor of production and high savings can only cause temporary economic growth whereas in the endogenous growth model, saving is assumed an endogenous factor of production thus high savings rates produce permanently high economic growth (Barro and Sala-i-Martin, 1995).

On the other hand, the models developed by Kaldor (1957), as well as the life-cycle hypothesis by Ando and Modigliani (1963), point out that it is the increase in economic growth that causes high savings. Inspired by the Keynesian view on investment, Kaldor (1957) also believed that investment is set by the "animal spirits" of the capitalists. Therefore, as investment has positive effects on economic growth, increase in investment will raise the national output, which in turn will increase savings. Increase in savings is a result of increase in the income of the owners of capital.

According to Ando and Modigliani (1963), individuals save to meet their needs during the retirement period when they will be receiving no income. This implies that young people save a large portion of their income, while the elders dissave as they consume the income saved during their working time. Thus, growth in the population increases the number of savers relative to the dissavers whereas economic growth raises the income of the savers. Increases in the income of the savers mean increases in household savings, which in turn raise the aggregate national savings (Deaton, 2010).

Based on the above theories, various empirical studies have attempted to investigate the relationship between savings and economic growth, and have found a positive long-run link between the two variables. However, the direction of the causality differs from one study to another. For instance, the study by Carroll and Weil (1994), on the relationship between savings and economic growth in 38 OECD member states, showed that high GDP growth causes high savings. This finding received empirical support from many researchers such as Gavin, Hausman and Talvi (1997), Sinhaa and Sinhab (1998), and Agrawal (2001).

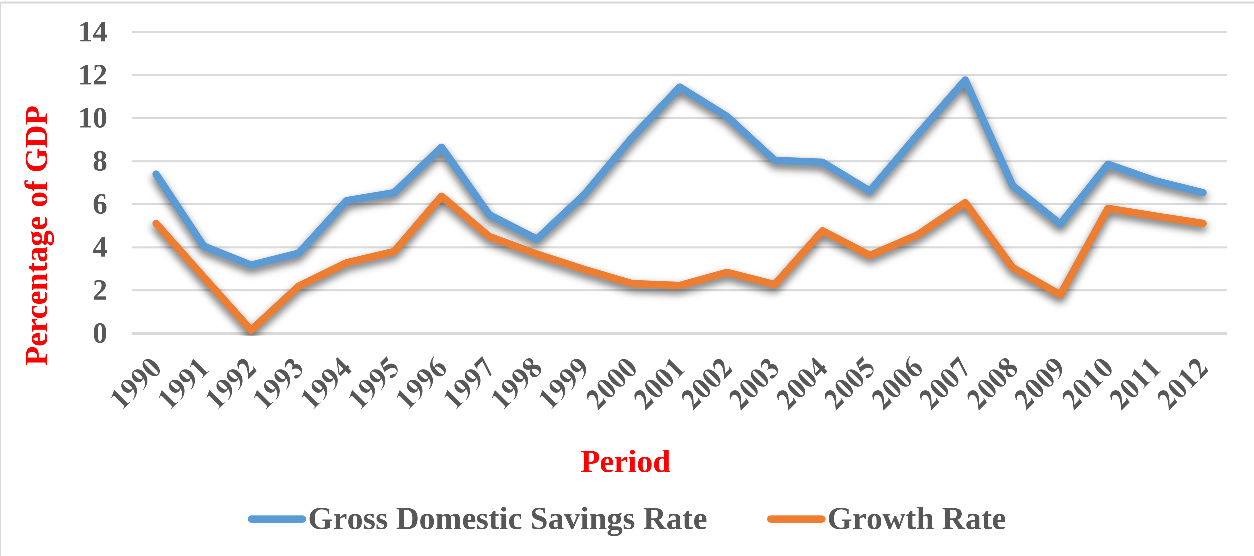
Contrary to the study by Carrol and Weil (1994), the commission on economic growth and development of the World Bank (2008) reported that "countries that recorded domestic savings and investment rates simultaneously to between 20 and 25% of GDP per annum, achieved sustainable growth". Fifteen years earlier, the World Bank (1993) investigated the role of savings in economic development and revealed that "countries with higher savings rates have achieved higher economic growth faster than those with low savings rates". Drawing on these findings, the World Bank encouraged developing countries to support policies that promote savings, as higher rates of savings as a percent of GDP have a significant and positive impact on economic growth.

In light of the World Bank's recommendations regarding savings and economic growth, the Southern African Development Community (SADC) urged its member states to generate high rates of domestic savings and investment as a percent of GDP over the period 2008-2018, in order to boost economic growth. According to the Bank of Botswana (2013), individual member states of the SADC have to achieve targets of 25% to 30 % for domestic savings and investment as a share of GDP, in order to support the required rate of GDP growth of 7% per annum. However, achieving these targets remains a big challenge for many of the SADC member states.

For the period 1991- 2012, the average growth rate for the SADC as a whole was estimated at 3.7 % and the average gross domestic savings rate as a share of GDP at 7.1% as shown in Figure 1.1. The analysis in Figure 1.1 includes the year 2008 and ends in 2012, since the SADC member states had to achieve the savings and GDP growth targets in 2008 and 2012. Three SADC member states, namely Zambia, Seychelles and Angola are left out of this analysis due to the unavailability of the data for the period of analysis in the case of the three countries. From 1992 to 1996, the trends show that the average growth rate in the SADC region rose from around 0.5% to 6%. After this period, the growth rate started declining and reached about 2% in 2001.

Similarly, over the period 1992-1996, the same movement was noticed in the gross domestic savings rate as a share of GDP. The savings rate has gone hand in hand with the GDP growth rate, from about 3% in 1992 up to above 8 % in 1996 (World Bank Indicators, 2017). However, from 1998 to 2002, one can notice that the savings and growth rates are uncorrelated. The rate of savings as a percent of GDP rose by 8.1% from 1999 to 2000, while the growth rate dropped by 1.32%. Again, from 2000 to 2001, the savings rate increased by 10.45%, whereas the growth rate decreased by 1.22%. Furthermore, over the period 2003-2004, the savings rate declined by 6 percent and over that same period, the growth rate tripled. After this period, domestic savings and growth rates have gone in the same direction (World Bank Indicators, 2017).

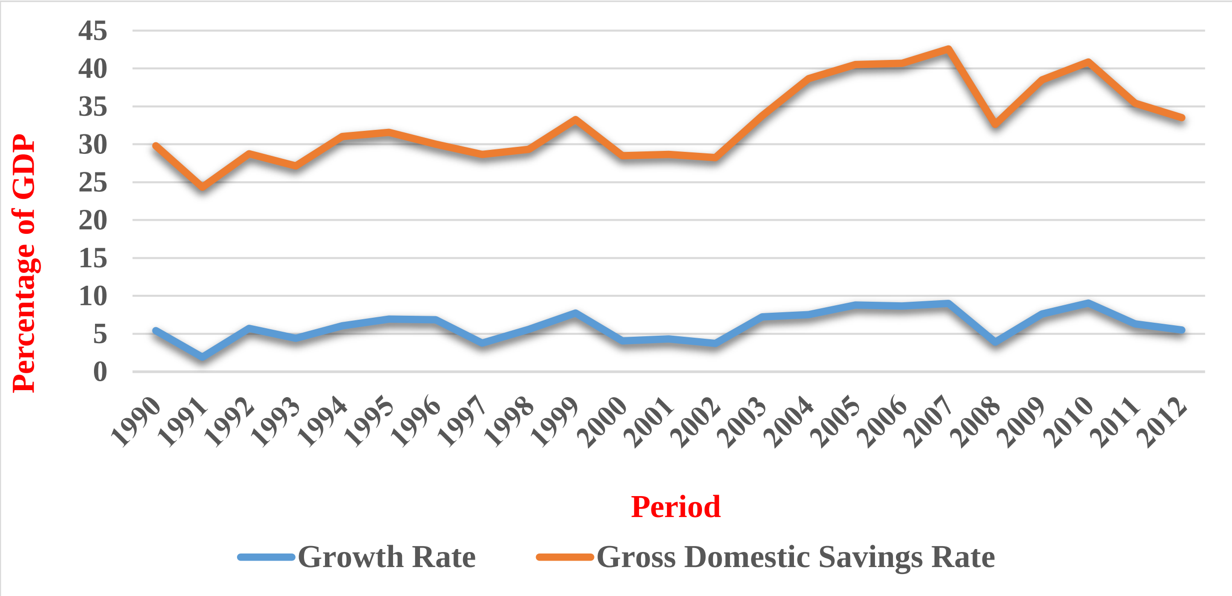
Figure 1.1: SAVINGS AND GROWTH RATES IN SADC



Source: Author’s calculations based on World Bank online database

Unlike the situation in the SADC region where there is a gap between domestic savings and economic growth over the period 1998-2004, the picture of other regions across the world such as South Asia, which recorded high savings in recent years, reveal a stable relationship between savings and economic growth as depicted in Figure 1.2.

Figure 1.2: SAVINGS AND GROWTH RATES IN SOUTH ASIA



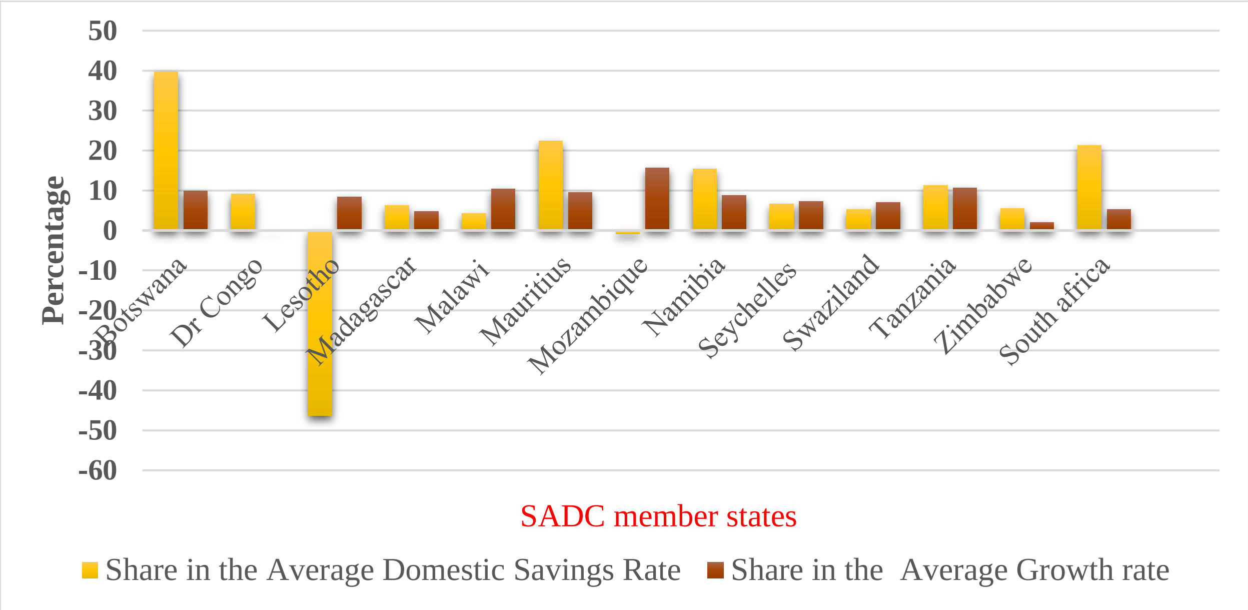
Source: Author's calculations based on World Bank online database (2017)

Although savings and growth rates for the SADC region seem to be uncorrelated over the period 1998-2004 only, the difference between savings and growth rates are significant for individual SADC member states as illustrated in Figure 1.3. Among the individual SADC member states, over the period 1990-2012, Botswana has the largest share of about 40% in average gross domestic savings as a percentage of GDP, followed by Mauritius (22%), South Africa (21%), and Namibia (15%). While Mauritius, South Africa and Namibia have recorded high rates of savings, the shares of countries such as Lesotho and Mozambique were negative, -46.3% and -0.08%, respectively (World Bank Indicators, 2017).

Based on the predictions of the neoclassical and endogenous growth theories, Botswana is expected to have the highest share in the average growth rate for the SADC as a whole, since it has the highest share of average savings as a percentage of GDP.

Surprisingly, when looking at the shares of the SADC member states in the average growth rates, Mozambique is the leading country with almost 16%, despite its negative share of the average gross domestic savings.

Figure 1.3: SHARE OF SADC MEMBERS IN THE AVERAGE SAVINGS AND GROWTH RATES FOR THE PERIOD 1990-2012



Source: Author's calculations based on World Bank online database

When looking very closely at the rates of savings and economic growth among individual SADC member states, there are three scenarios. Firstly, Zimbabwe and Lesotho have recorded negative gross domestic savings rates as a share of GDP over the period 2009-2012. The gross domestic savings rates as a share of GDP averaged -10.78 % for Zimbabwe and -36.03% for Lesotho. Despite the negative savings rates, Zimbabwe and Lesotho have attained average GDP growth of 9.98% and 5.08%, respectively (World Bank Indicators, 2017).

Secondly, the DR Congo and Mozambique have generated low average domestic savings rates of 10.71% for the DR Congo and 6.95% for Mozambique. Again, these two countries have reached average GDP growth of above 5%. The rate of savings as a percent of GDP averaged 6.73% for the DR Congo and 6.85% for Mozambique (World Bank Indicators, 2017).

The case of countries with low or negative domestic savings achieving high GDP is explained by Todaro and Smith (2011:114) as one of the shortcomings of the Harrod and Domar growth model. Todaro and Smith point out that if a country cannot generate high domestic savings, as suggested by the Harrod and Domar model, it might attract foreign savings in order to increase the national savings and therefore achieve high economic growth.

The third scenario with regard to the relationship between savings and economic growth in SADC member states contrasts with the two scenarios previously highlighted. South Africa and Botswana have failed to attain an average GDP growth of more than 5% despite their high rates of gross domestic savings as a share of GDP between 2009-2012. Note that Botswana and South Africa have managed to promote their average national savings rates as a percent of GDP to 26.25% and 20.18% respectively but at the same time, recorded average GDP rates of less than 3%, 2.925% for Botswana and 1.73% for South Africa (World Bank Indicators, 2017).

1.2 Problem Statement

Taking into account the theories that claim that higher savings cause high economic growth and the theories that hold that the causality runs from growth to savings, there is reason to believe that the causality may run from savings to economic growth or the other way around in the SADC region. Given the three scenarios highlighted above in the SADC region, there is a need to empirically investigate the relationship between savings and economic growth in the SADC region. In this regard, the following questions emerge:

(i) Is there a long-run relationship between gross domestic savings and economic growth in the SADC region?
(ii) Does the direction of causality run from savings to economic growth, or vice versa?

1.3 Objectives of the study

The main objectives of the study are:

(i) To empirically test the long-run relationship between domestic savings and economic growth in the SADC region;
(ii) To determine the direction of the causality between savings and economic growth;
(iii) To provide policy recommendations based on the findings.

1.4 Significance of the Study

The theories of savings and economic growth such as the Harrod-Domar, the Solow and the life-cycle hypothesis by Modigliani, establish a positive long-run link between the two variables with the causality running from savings to economic growth or vice-versa. SADC has set targets to increase savings to 25% of GDP annually in order to achieve an economic growth rate of 7% per annum, based on the belief that an increase in savings leads to an increase in economic growth.

Friedman (1953) claims that a "theory or hypothesis that is not verifiable by appeal to empirical evidence may not be admissible as part of scientific enquiry". This study is, therefore, important since it seeks to empirically test the relationship and the causality between savings and economic growth in the SADC context and provide recommendations to policy makers in SADC member states based on the findings.

For instance, if the outcome of the empirical work reveals that an increase in savings causes an increase in economic growth, then the SADC macroeconomic targets with regard to savings and economic growth are consistent with the SADC reality. Hence, policy makers will be advised to go ahead with the targets of promoting savings in order to accelerate economic growth. However, if the study finds that the causality runs from economic growth to savings, then policy makers in the SADC region will be advised to relook at their policies with regard to savings and economic growth.

1.5 Organisation of the Study

The rest of this study is structured as follows:

The second chapter presents and analyses trends in the rates of savings and economic growth in the SADC region. In this chapter, trends in savings as well as in economic growth are described at both regional and individual countries levels. The third chapter is the literature review. The literature review consists of the theoretical models of savings and economic growth and the empirical literature on the relationship and the causality between savings.

Chapter four explains the research methodology that will be followed to achieve the objectives of the study. The methodology starts with an estimation of the theoretical and empirical models, an explanation of the econometric model that will be applied, and ends up with a description of the data. Chapter five presents and discusses the various empirical findings of the study and the last chapter provides policy recommendations based on the main findings of the study.

CHAPTER TWO

TRENDS IN SAVINGS AND ECONOMIC GROWTH IN THE SADC REGION

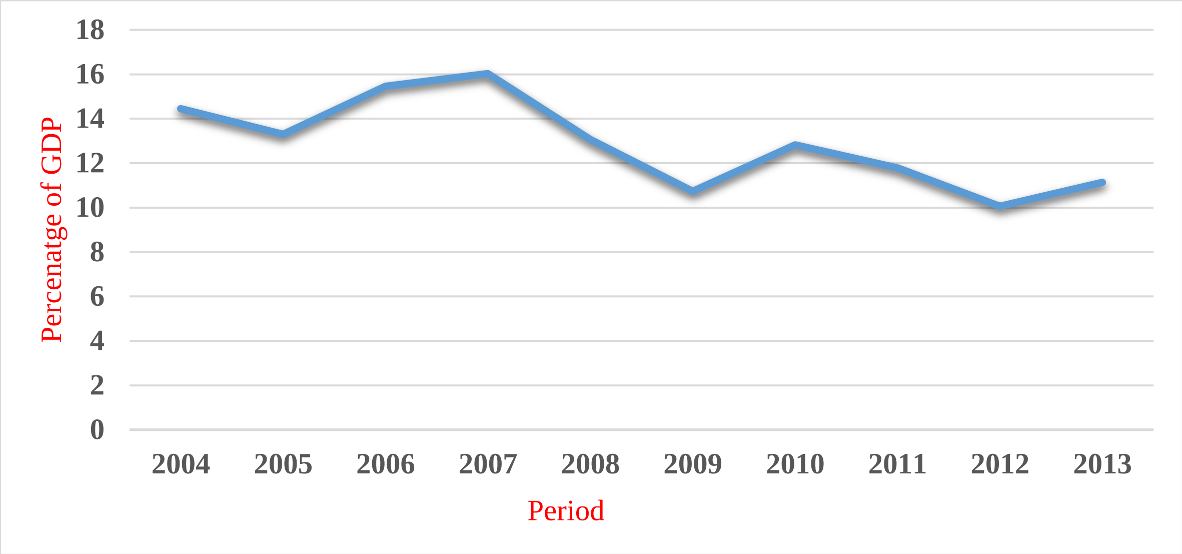
2.1 Introduction

This chapter presents and analyses trends in savings and economic growth for the SADC as a region, as well as for the individual SADC member states over the period 2004-2013.This period is chosen since it provides data for a large number of SADC member states for all the indicators needed to analyse trends in savings and economic growth. The following SADC member states were excluded due to unavailability of data for some of the studied periods, among others, Angola, Lesotho, Seychelles, Zambia and Zimbabwe. Hence, the analysis focuses on the remaining ten SADC member countries, namely Botswana, Congo DR, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland and Tanzania.

2.1.1 Trends in savings in the SADC region

The national savings measured as the gross domestic savings rate as a percentage of GDP is the sum of household savings, corporate savings and government savings. The trends in national savings for the SADC region over the period 2004-2013 are presented in Figure 2.1. As is shown in Figure 2.1, the savings rate is less than the target of 25% in 2008 and 2012. The highest savings rate was achieved in 2007 and after that period, it decreased sharply and reached its lowest rate in 2009. However, in 2010, the savings rate picked up, before declining in 2011 and 2012 and raising in 2013. Overall, the average rate of savings as a percent of GDP for the SADC region is less than 16% (World Bank Indicators, 2017).

Figure 2.1: TRENDS IN GROSS DOMESTIC SAVINGS IN THE SADC REGION



Source: Author's calculations based on World Bank online database

The trends in gross domestic savings as a percentage of GDP presented in Figure 2.1 are the average rates for the SADC region. In order to understand better the reasons behind low average savings rates in the SADC region, the trends in savings for individual SADC member states are also assessed.

2.1.2 Trends in savings for individual SADC member states

As mentioned earlier, gross domestic savings is the sum of household savings, corporate savings and government savings. However, due to the unavailability of the data for corporate and government savings in the case of individual SADC member states, the analysis focuses on households savings and it is assumed that increase in household savings, holding corporate and government savings constant, can increase the aggregate savings and vice versa.

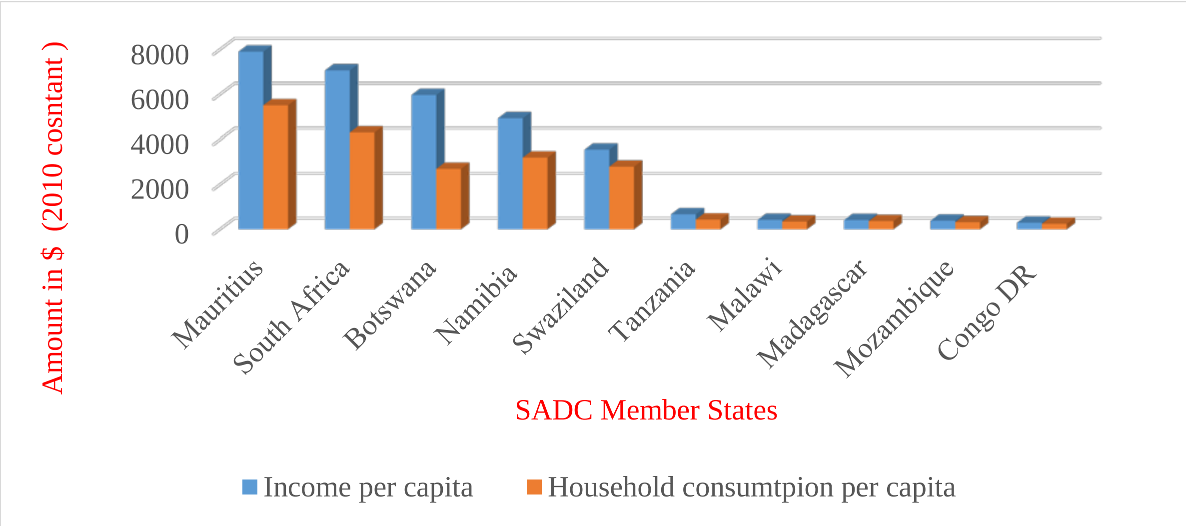
According to Keynes (1936:57), household savings represents "the excess of income over consumption". In other words, household savings can be understood as the remaining income after consumption. Hence, the gross national income per capita and the household final consumption per capita are used to understand the behaviour of household savings per capita in the individual SADC member countries.

At the regional level, the average per capita income and the average household consumption per capita increased from 2004 to 2007. Over 2008-2009, the per capita income decreased from $2932,335 down to $2892,32, probably due to the 2008 financial crisis. However, while the per capita income was falling, the amount of consumption increased from $1891,07 to $1947,98 (World Bank Indicators, 2017). Therefore, if it is assumed that the remaining per capita income after consumption represents savings, then the savings rate is expected to decline over this period due to high consumption expenditure.

The effects of high consumption expenditure, as well as the difference in the per capita income, are more significant at the individual SADC member states level than it is for the SADC as a whole. Figure 2.2 shows that on the one hand, some of the SADC member states such as Mauritius, Botswana and South Africa, recorded high per capita income of above $5000 on average from 2004 to 2013, and other countries namely Namibia and Swaziland have per capita income of above $3500 but less than $5000 (World Bank Indicators, 2017).

On the other hand, the per capita income for the rest of the countries is very low at less than $1000. Furthermore, the sum of the per capita incomes of these respective countries represents half of Botswana's per capita income, less than half of the per capita incomes of South Africa and Mauritius, and less than Swaziland's per capita income (World Bank Indicators, 2017). Turning to consumption, the figure shows that high-income countries such as South Africa and Mauritius have enjoyed high consumption relative to other SADC countries. The final household consumption per capita is nearly $5510, 87 for Mauritius and approximately $4301, 57 for South Africa (World Bank Indicators, 2017).

Figure 2.2: AVERAGE GROSS NATIONAL INCOME PER CAPITA AND HOUSEHOLD CONSUMPTION PER CAPITA IN SADC COUNTRIES FOR THE PERIOD 2004-2013

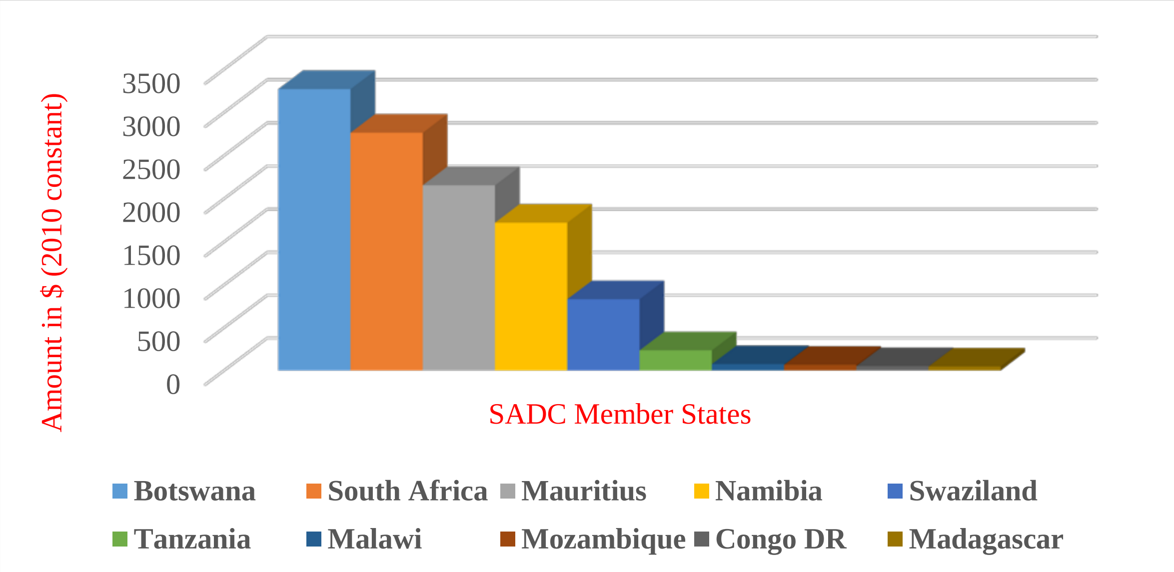


Source: Author's calculations based on World Bank online database

Drawing on the behaviours of the per capita income and of the household consumption per capita in the SADC countries presented in Figure 2.2, trends in the household savings are presented in Figure 2.3. The household savings should be understood here as the remaining per capita income after household consumption per capita. Figure 2.3 depicts that Mauritius, which recorded the highest per capita income for the whole of SADC region, is not able to mobilise the highest amount of savings due to high consumption expenditure. The amount of household savings per capita in Mauritius is estimated at $2391, 61, less than the amount of savings in South Africa, which had a lower per capita income relative to per capita income in Mauritius (World Bank Indicators, 2017).

Furthermore, the income per capita in Botswana was lower than the income per capita in both South Africa and Mauritius. However, since Botswana had low household consumption expenditure relative to South Africa and Mauritius, it recorded high average household savings per capita of $3270, 11, the highest for the whole of SADC region.

Figure 2.3: AVERAGE HOUSEHOLD SAVINGS IN SADC COUNTRIES FOR THE PERIOD 2004-2013



Source: Author's calculations based on World Bank online database

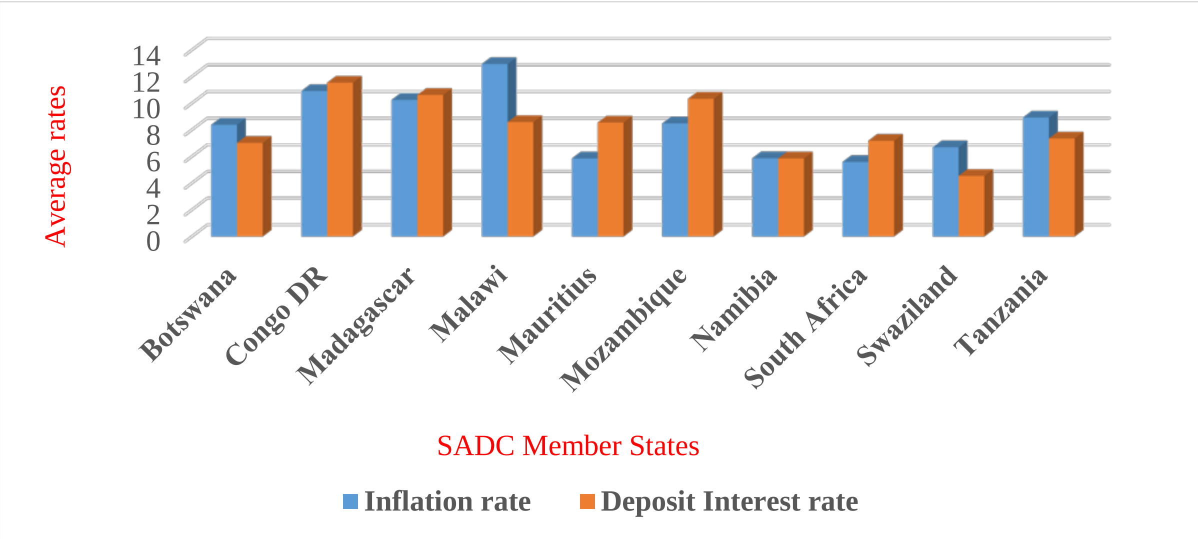
The amount of household savings, based on the definition given above, depends primarily on the levels of income and consumption. However, there might be other factors or incentives that can affect savings and hence can help us to better understand trends in the household savings in SADC countries. Three factors are found in the literature that do have an influence on the willingness and ability to save. These three factors are the rate of interest, the rate of inflation and institutions.

According to Cote and Berube (2000) and Prinsloo (2000), high rates of interest tend to encourage households to postpone consumption today in order to increase the amount that will be used to finance future consumption expenditure. Thus, an increase in the interest rate is likely to raise household savings. In the precautionary theory of savings, increase in the rate of inflation is also considered as a good incentive for savings. Deaton (1989) explains that since high inflation rates raise uncertainty about future income growth, households can decide to save their money for precautionary reasons.

In the model of household saving proposed by Beverly and Sherraden (1999), the institutions through which savings take place are believed to be the most significant factors in explaining the behaviour of household savings. Five factors are retained in this model as the major determinants of savings, which include access to banking service, incentives, information, facilitations and expectations. Due to the difficulties linked with the definition and measurement of the other four variables, only the access factor is included as the third factor, in addition to interest and inflation rates to analyse trends in household savings. Access to banking service is measured as the number of commercial banks and the number of Automated Teller Machines per 100 000 adults.

After highlighting the theoretical views on the relationship between savings and the three factors, the trends in these respective indicators will now be described. The trends in inflation and interest rates for the SADC member states presented in Figure 2.4 show that, on average, the low-income countries namely Malawi, Congo DR, Tanzania and Mozambique recorded higher rates of interest on deposits as well as higher rates of inflation. However, due to low income per capita recorded in these respective countries, the inflation and deposit rates do not significantly affect the level of savings. The difference in the rates of inflation and of interest between low income and high-income countries is not significant to explain the difference in the behaviour of the household savings among the SADC member states.

Figure 2.4: AVERAGE INTEREST AND INFLATION RATES IN SADC COUNTRIES FOR THE PERIOD 2004-2013



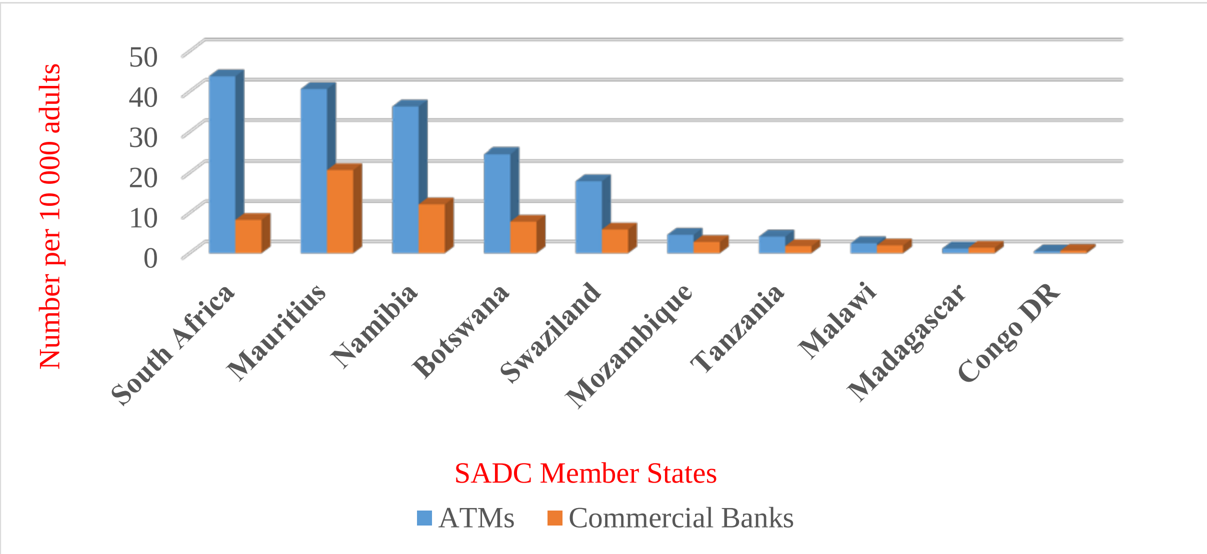
Source: Author’s calculations based on World Bank online database

Unlike the average inflation and interest rates, trends in the access to banking service presented in Figure 2.5 show that low-income countries, namely Congo DR, Madagascar, Mozambique, Malawi and Tanzania, have low number of ATMs and commercial banks. The average number of ATMs per 100 000 adults is below five whereas the average number of commercial banks per 100 000 adults is less than three (World Bank Indicators, 2017).

On the other hand, high-income countries such as South Africa, Botswana and Mauritius have at least thirty ATMs and at least seven commercial banks per 100 000 adults. In this regard, one may argue that the region is divided in two different groups. First, a group of countries that shows a banking sector that is less developed in such a way that most adults have no access to banking service due to low number of commercial banks and ATMs available per 100 000 adults. These include Congo DR, Madagascar, Malawi, Mozambique and Tanzania.

In the second group, however, the picture seems to be better than in the first. In most of the countries that fall into the second group, namely South Africa, Mauritius, Namibia and Swaziland, adults can easily have access to banking services since there is a significant number of ATMs, as well as commercial banks, available to them.

FIGURE 2.5: AVERAGE NUMBER OF ATMs AND COMMERCIAL BANKS IN SADC COUNTRIES FOR THE PERIOD 2004-2013



Source: Author's calculations based on World Bank online database

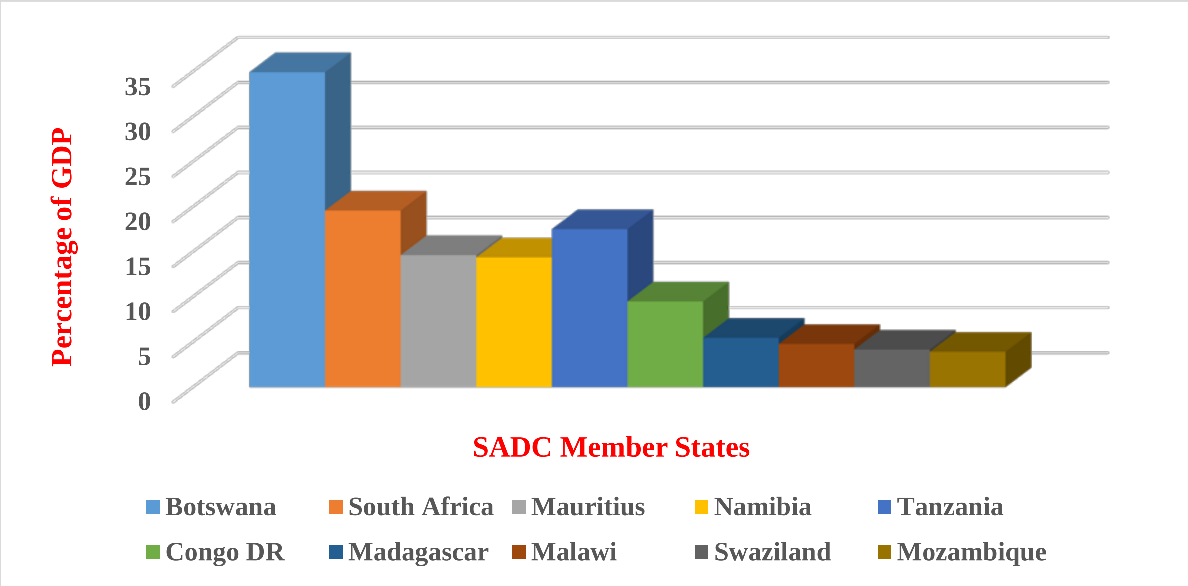
From the trends presented in Figures 2.2 and 2.5, it seems that the level of income per capita and the structure of the banking sector play an important role in explaining the differnces in household savings among the SADC member states. The SADC member states that recorded high income per capita and have allowed the household to have access to the banking sector through a large number of ATMs and commercial banks in most of the areas, mobilised higher rates of savings. On the other hand, countries that had a less developed banking sector as well as low per capita income, produced low domestic savings rates. With regards to interest and inflation rates, the trends in these respective countries showed that there is no notable difference that can explain the differences in the behaviours of household savings among the SADC members states.

Thus, the level of income and the access factor signifcantlty explain the differmce in the levels of household savings among the SADC members, since the trends showed that countries that recorded high per capita income and have allowed adults to have access to the banking sector in order to save the remaining part of their income after consumption, have achieved high household savings. Household savings are in turn a postive determinant of the aggregate savings, as the countries that mobilised high household savings, attained higher aggregate savings rates than those that produced low household savings rates. The trends in the aggregate savings rates for the SADC member states are presented in Figure 2.6.

According to Figure 2.6, countries such as Botswana, Mauritius, Namibia and South Africa that achieved a high level of household savings, recorded high aggregate savings rates as a percent of GDP over that same period. Similarly, Congo DR, Malawi, Madagascar and Mozambique that mobolised a low level of househod savings, produced low rates of national savings as a percent of GDP. Furthermore, Figure 2.6 depicts that Botswana recorded an average national savings rate as a percent of GDP of above 30 %, whereas the average national savings rates of four other countries namely South Africa, Namibia, Mauritius and Tanzania ranged between 10 and 20%.

In the rest of the countries, however, the average savings rates as a percent of GDP are below 10%. Thus, the fact that five out of ten countries are unable to promote national savings to above 10% could be the reason behind low average rates of savings as a percent of GDP in the SADC region.

Figure 2.6: AVERAGE NATIONAL SAVINGS IN SADC COUNTRIES FOR THE PERIOD 2004-2013



Source: Author's calculations based on World Bank online database

According to the World Bank (2017) and to the SADC maroeconomic targets highlighted in the introductory chapter, savings should be used to support investment projects, which in turn would raise the investment level in the country and threreby the national output. Gavin, et al. (1997) also posit that savings are indirectly related to economic growth via positive effects of investment on growth. Thus, in the next section, the mechanism through which savings can be channelled into investment is analysed before looking at trends in local investment.

2.2 Trends in local investment in the SADC region

According to the World Bank (2017), credit to the private sector by commercial banks represents a channel through which the money deposited into the commercial banks can be used to support investment projects. During this process of channelling savings into investment, another indicator also plays a key role between the lender (commercial bank) and the borrower (investor), and that is the lending interest rate. High lending rates are likely to discourage household/investors from borrowing and vice versa.

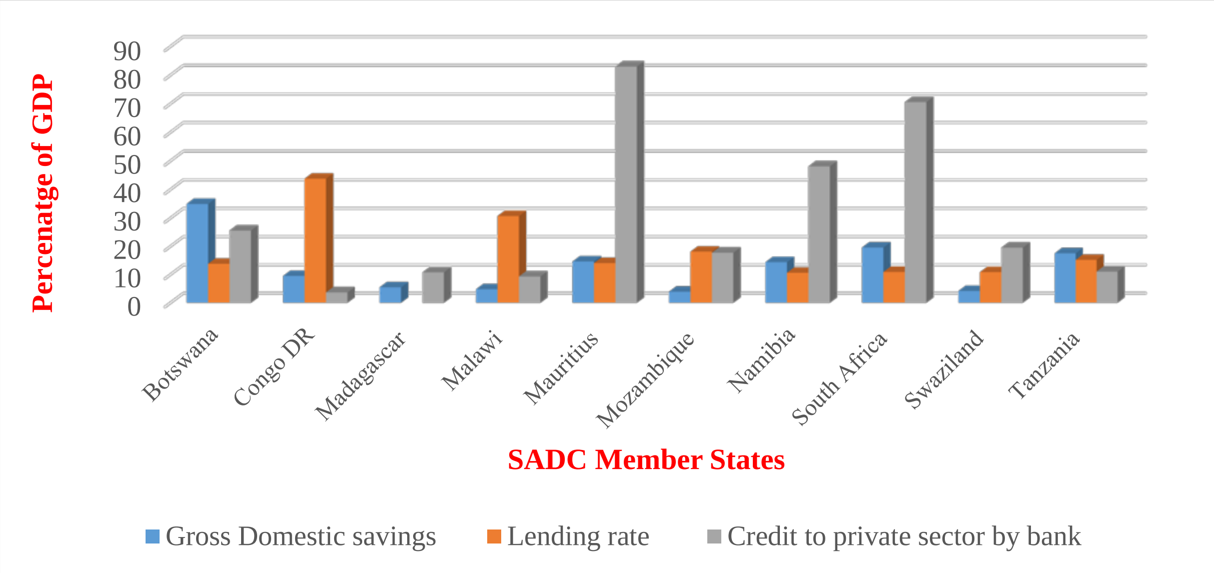
The trends in the average rate of savings as a share of GDP, the average lending rate and average credit to the private sector are presented in Figure 2.7. The average lending rate, from 2004 to 2013, is below 15% in countries such as Botswana, Mauritius, South Africa and Namibia that recorder high savings.

In contrast, countries such as Congo DR and Malawi that recorded low savings, have high interest rates estimated at 43,76% and 30,71%, respectively (World Bank Indicators, 2017). As a result of higher lending rates, the amount of credit issued by the commercial banks to the private sector is very low in these countries compared to the amount of credit issued in countries that recorded high savings. The total amount of credit issued in four countries, namely Congo DR, Madagascar, Malawi, Mozambique, Tanzania and Swaziland is equal to the amount of credit issued in South Africa and less than the amount issued in Mauritius.

In countries where the financial sector is well structured with a reasonable lending rate, the amount of credit issued by commercial banks to the private sector is high. Those countries are Botswana, South Africa, Namibia and Mauritius. Trends in these respective countries show that the average lending rate is less than 10%. Since these countries have a relatively developed banking sector, the amount of credit issued by the commercial banks as a percent of GDP is above 20%.

In Mozambique and Swaziland, however, the average lending rate is low, which may represent a good incentive for investors in these respective countries to borrow and finance their projects but, due to the low amount of savings mobilised in these respective countries, the amounts of credit issued to the private sector by commercial banks are low. Again, this can highlight how the level income and the structure of the banking sector affect the savings and investment process.

Figure 2.7: AVERAGE NATIONAL SAVINGS, LENDING RATE AND DOMESTIC CREDIT TO PRIVATE SECTOR IN SADC COUNTRIES FOR THE PERIOD 2004-2013



Source: Author's calculations based on World Bank online database

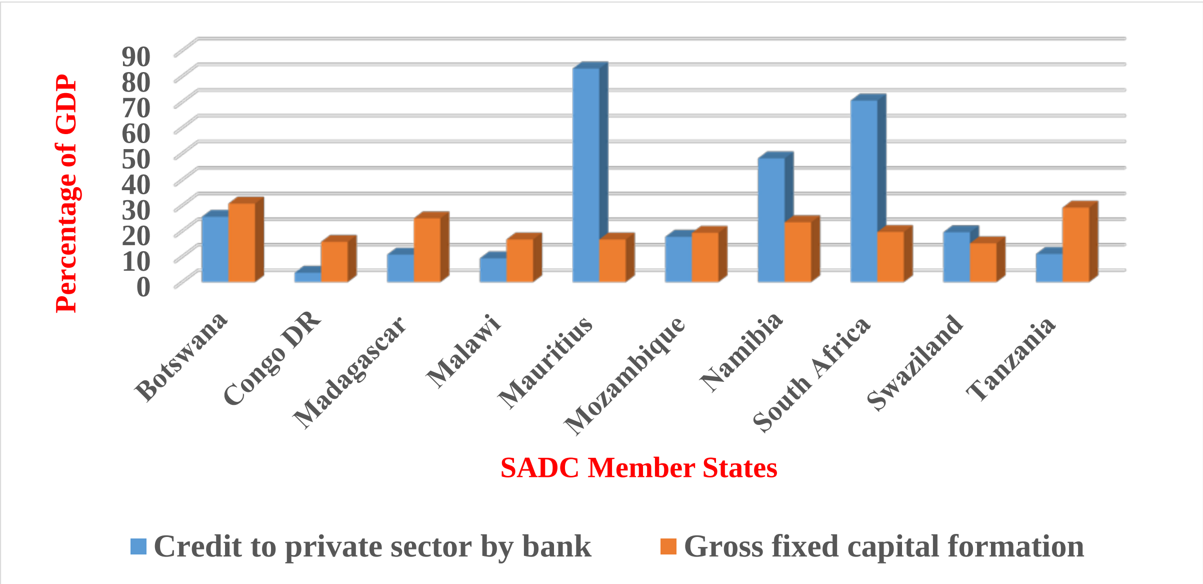
Having described the link between savings, lending rates and credit to the private sector by commercial banks, the relationship between credit extended to the private sector by banks and the local investment, measured by the gross fixed capital formation, is shown in Figure 2.8.

First, the levels of local investment are low in countries such as South Africa, Namibia and Mauritius, despite the fact their commercial banks have issued high amounts of credit to the private sector. The highest level of capital formation, however, is achieved by Botswana. In the latter country, the level of credit extended to the private sector as a percent of GDP is estimated at approximatively 25%, far below the amount of credit issued in Mauritius, South Africa and Namibia.

Second, the capital formation rates of countries such as Congo DR, Malawi, Mozambique, Madagascar and Tanzania that issued the lowest amounts of credit to the private sector, are near or higher than the capital formation of some of the countries that issued a higher amount of credit to the private sector. The average credit to private sector as a percent of GDP is estimated at 10, 76% in Madagascar, and with this low amount of credit, the country managed to increase the average rate of capital formation as percent of GDP to 24, 96%, higher than the rate of the capital formation for South Africa and Mauritius, which issued the highest amount of credit to the private sector as a percent of GDP, at 82,98% and 70, 54%, respectively (World Bank Indicators, 2017).

In the views of the World Bank (2017), credit to the private sector by commercial banks represents the means that can be used to support investment projects or can be used for consumption purposes. If savings are channelled into productive investment projects, then the level of investment will rise. However, given the high amount of credit issued by commercial banks to the private sector in countries such as South Africa and Mauritius, compared to the lower investments achieved in these respective countries, one may believe that credit issued to the private sector in South Africa and Mauritius was perhaps used for consumption purposes.

Figure 2.8: AVERAGE CREDIT TO PRIVATE SECTOR AND GROSS DOMESTIC CAPITAL FORMATION IN SADC COUNTRIES FOR THE PERIOD 2004- 2013

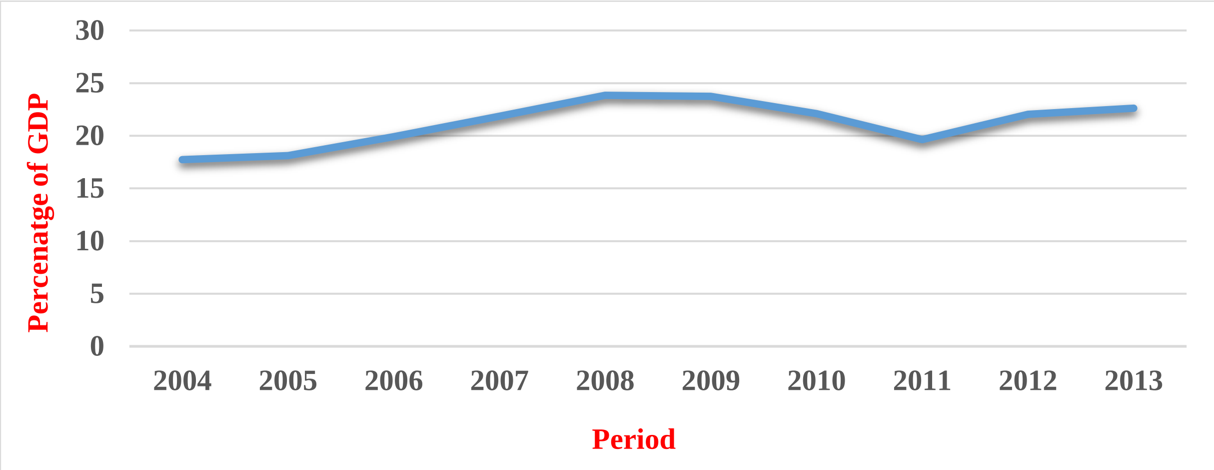


Source: Author's calculations based on World Bank online database

Overall, the rates of capital formation are above 15% in all the SADC countries, which also affected the average level of capital formation for the SADC as a whole as is illustrated in Figure 2.9. Trends in local investment show that investment rates have been rising from 2004 to 2008. After that period, probably due to the 2008 international financial crisis, investment rates started declining. The proportion of investment to GDP picked up in 2011.

In the last section of this chapter, trends in investment and economic growth are compared to see if there are any relationship between local investment and economic growth in the SADC region.

Figure 2.9: TRENDS IN GROSS CAPITAL FORMATION IN THE SADC REGION



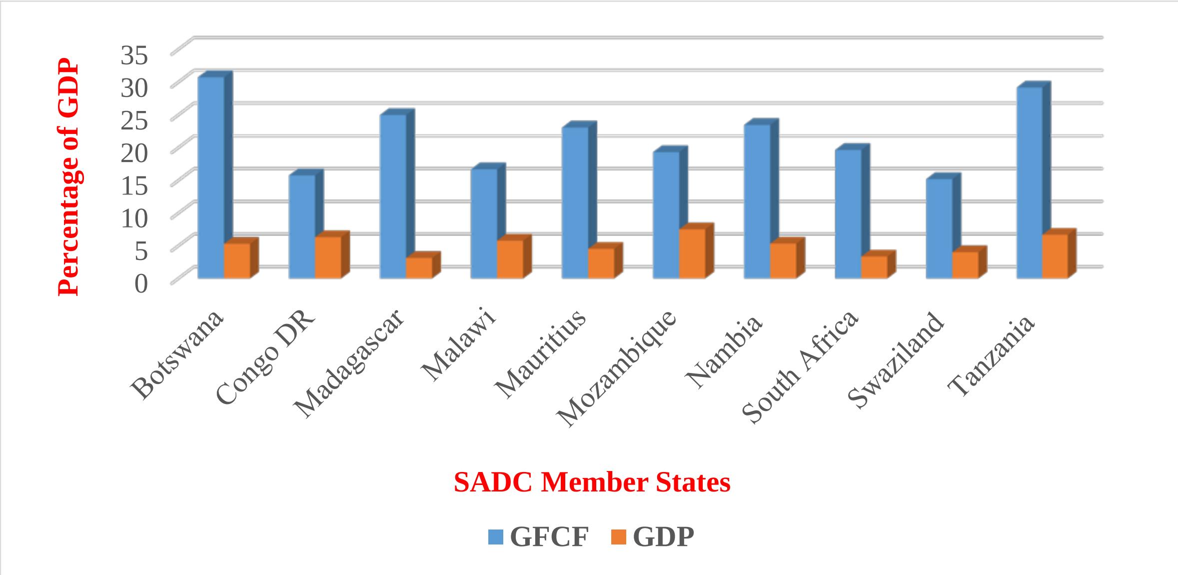
Source: Author's calculations based on World Bank online database

2.3 Trends in GDP growth in SADC countries

The average investment rates measured as gross capital formation as a share of GDP and GDP growth rates over the period 2004-2013 for the SADC member states are presented in Figure 2.10. The average GDP growth of higher local investment countries such as Botswana and Tanzania are below the average GDP growth of low local investment countries such as the Congo DR and Mozambique. Over the period 2004-2013, it was observed that Mozambique attracted the highest amount of foreign direct investments (FDI) among the SADC member states. The average FDI as a percent of GDP is estimated at 17,76% for Mozambique. Over that same period, trends show that Mozambique achieved an average GDP growth of 7,52% (World Bank Indicators, 2017).

Thus, one may argue that FDI are a significant driver of GDP in the SADC region compared to local investment. In the rest of the countries, average growth rates are less than the target of 7%. Furthermore, on average, the growth of the SADC region is estimated at 5.19%, less than the target of 7%.

Figure 2.10: AVERAGE GROSS CAPITAL FORMATION AND GDP GROWTH IN SADC COUNTRIES FOR THE PERIOD 2003-2014



Source: Author's calculations based on World Bank online database

2.4 Summary and conclusion

This chapter analysed trends in savings and economic growth in the SADC countries. In the first section related to trends in savings, the SADC region recorded low savings rates as a percent of GDP due to the low amount of savings in the majority of the countries. In six out of ten countries, the household savings, which is positively correlated to aggregate savings, was at the lowest level compared to the rest of the countries. The low household savings in these countries were the result of low per capita income and less developed banking sector.

In the second section, trends in savings were related to local investment through credit to the private sector by commercial banks, which is a powerful medium through which the money deposited into commercial banks in form of savings, can be channelled into investment projects. In some of the countries, trends showed that savings are not transformed into investment due to high lending rates, whereas in other countries, the higher amount of credit issued to the private sector by the commercial banks seems to not have any effect on local investment.

This is because, in some of the countries in which the private sector received high amounts of credit, the investment rate as a percent of GDP is lesser than the rate of investment in those countries that received smallest amounts.

Finally, trends in local investment were uncorrelated with trends in GDP growth among SADC member states. When including trends in the FDI to understand why some countries that recorded low rates of local investment as a percent of GDP achieved high GDP growth, the trends showed that FDI is an important driver of GDP in the SADC region, since countries that attracted high rates of FDI, attained high GDP growth. However, this is just a graphical analysis of trends in savings, investment and economic growth, and the comprehensive analysis using appropriate econometric tools will be carried out in chapter four. Before doing so, the theoretical as well as the empirical literature on the relationship between savings and economic growth are reviewed in the next chapter.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter reviews theoretical and empirical literature on the relationship between savings and economic growth. This chapter has therefore two main sections. The first section explains the main theories of the relationship between savings and economic growth. In the second, empirical studies are reviewed.

3.2 The relationship between savings and economic growth: theoretical considerations

The main theories of economic growth are classified by Idsardi (2014:15) in six groups, namely the Mercantilists, the Physiocrats, the classical growth theories, the Marxist theory, the neoclassical growth theories and the developmentalist theories. Under each group, there are different growth models developed by different authors. For instance, among the classical growth theories, there are growth models by Adam Smith and by David Ricardo. The growth models by Harrod-Domar (1946) can be found under the classical and Solow (1956) under the neoclassicalists. The modern growth theories such as Lucas (1988) and Romer (1992) are classified under the endogenous growth models. For the purpose of this study, only theories that explain the relationship between savings and economic growth are reviewed. These growth models are the Harrod-Domar (1946), the Solow (1956) growth model and the endogenous growth models.

3.2.1 The Harrod-Domar model

In the General Theory of Employment, Interest rate and Money, Keynes (1936) pointed out that investment is the main driver of the demand side of the economy. Based on this view, Harrod (1939) and Domar (1946) separately constructed two similar models, which later became known as the Harrod-Domar model.

In the Harrod-Domar model, it is assumed that output (Y) is proportional to the stock of capital (K) and that there is no depreciation of capital over time. Hence, change in the stock of capital is equal to the investment that took place (I).

This can be expressed as follows:

$$\Delta K = I \quad (3.1)$$

Furthermore, the Harrod and Domar model suggests that some portion of the national income must be saved to finance investment, and that all the savings are transferred into investment. Thus, savings as a portion of national income (*sY*) is equal to investment (*I*). Since investment is exactly the change in the stock of capital, savings is therefore equals to change in the stock of capital. Putting this in a mathematical form gives:

$$sY = I = \Delta K \quad (3.2)$$

The change in capital stock (ΔK) related to the change in output (ΔY) is referred to as the capital-output ratio, which is represented by *k* (Van Den Berg, 2013).

$$k = \Delta K/\Delta Y \quad (3.3)$$

From the above equation 3.3, the change in capital can be expressed as:

$$\Delta K = k/\Delta Y \quad (3.4)$$

In equation 3.2, change in capital stock (ΔK) is equal to savings as the ratio of output (*sY*), therefore savings is also equal to the capital output-ratio, that is:

$$sY = k/\Delta Y \quad (3.5)$$

Now dividing the two sides of equation 3.5 by *k* and *Y*, gives us the Harrod and Domar's (1946) equation, which implies that the growth rate of output is function of national savings and national capital-output ratio (Van Den Berg, 2013). Higher savings will raise the national capital-ratio and thereby the national output.

$$s/k = \Delta Y/Y \quad (3.6)$$

Siraj and Bengali (2007) point out that the Harrod-Domar equation, even though constructed long time ago, is still used by international organisations and donors to "determine the level of required investment for a target growth rate" and to "forecast economic growth figures".

However, despite the fact that the Harrod-Domar equation can still be useful to target the growth rate, several economists found it hard to believe that the rate of savings and capital-output ratio are constant, as assumed by the Harrod-Domar model and hence intensively criticised this model. For instance, the neoclassical economists suggested that the Harrod-Domar model neglected other variables that are crucial in the growth process. The well-known neoclassical economist, Solow (1956), saw technological change as the residual factor in explaining growth when changes in capital and labour do not explain all growth. Thus, Solow (1956) incorporated technological change in the production function in order to improve the Harrod and Domar model.

3.2.2 Solow growth model

Unlike the Harrod-Domar growth model, which assumed that labour and capital are fixed, the Solow (1956) growth model suggest that these two factors vary over time. In the Solow model, output comes from two factors; namely labour and capital, and the production function exhibits diminishing returns to capital. Another feature of the Solow model is that the rate of savings (***s***) is assumed exogenous.

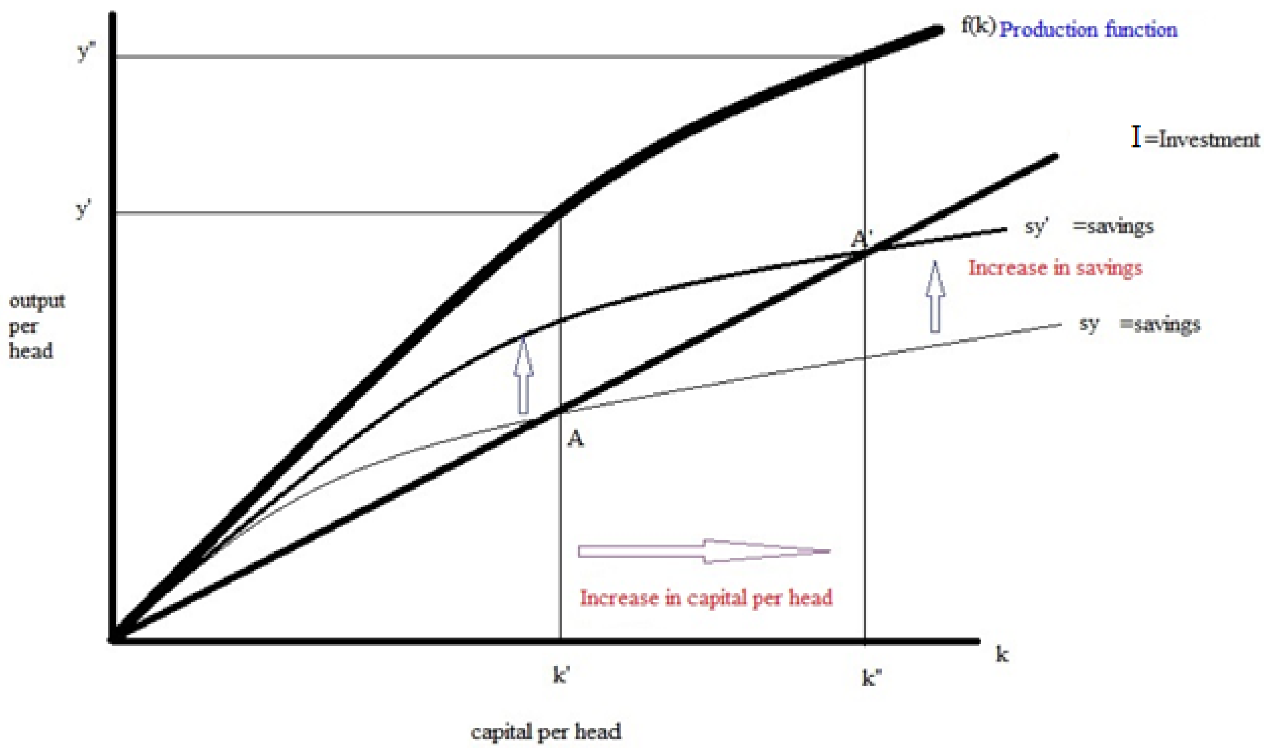
Drawing on these assumptions, Solow (1956) argued that the economy must always be able to generate enough savings that is needed to replace the machines that have worn out and to produce capital for new workers. An economy that is able to mobilise domestic savings above the desired investment will grow. However, if the mobilised savings cannot support the desired investment, the capital per head will decrease and thus the economy cannot grow over time (Dornbusch, Fischer and Startz, 2011: 63).

The main implication of the Solow model of growth is that the economy will converge towards a steady state, a point where the two factors of production cannot expand further. The steady state and the impact of an increase in savings on the output is illustrated in Figure 3.1.

It is assumed that the economy is at the steady state at point A, where the rate of savings equals the desired investment. The rate of savings is represented in Figure 3.1 by the curve ***sy,*** whereas the desired investment is represented by the straight-line ***I .*** Now suppose that savings increase from curve sy to curve sy'. As shown in Figure 3.1, an increase in savings will be associated with an increase in capital per head from ***k'*** to ***k".*** However, increased savings will meet up again with the desired investment at point A' and at that point, the capital per head will not expand or decrease, but remain constant, that is the new steady state of the economy (Dornbusch, et. al, 2011: 68).

Thus, high savings will not raise the output permanently; so an increase in saving can only have a temporary effect on the output such as raising the capital per head. Given this finding, Solow incorporated a new exogenous variable, technological progress, in his production function and argued that it is the only variable that can influence the output in the long-run.

Figure 3.1: Impact of an increase in savings on the output



Source: **Dornbusch et. al (2011: 67)**

The Solow model emphasised that the growth rate of output over the long-run depends on the exogenous factor, technological progress. The new growth models or the endogenous growth models posit that neoclassical growth models, notably the Solow model, have failed to explain growth with endogenous variables, and hence have emerged as an alternative to this model. They proposed a model where the growth process takes place within the economy.

In the Harrod-Domar (1946) and Solow (1956), growth models reviewed above, savings is related to economic growth and high savings lead to high economic growth. However, in the Harrod-Domar model, savings represents the amount of the national income saved in order to finance investment whereas in the Solow model, savings is taken as an exogenous factor of production. Thus, increases in savings are permanently linked to economic growth through increases in investment in the Harrod-Domar (1946) model, whereas in the Solow (1956) model, increases in savings raise the output temporarily and after that, the economy moves towards a steady state again.

3.2.3 The Endogenous growth models

The endogenous growth models adopted, first, Ramsey's (1928) view that savings is an outcome of rational behaviour of economic agents within the economy. In the Ramsey model, there are two categories of economic agents, firms that seek to maximize profits in a competitive market and households that seek to maximise utility constrained by their income. The household income comes from the firms in exchange for labour, and that income can be consumed and the remainder saved (D'Agata and Freni, 2003).

Second, they considered the assumption about the diminishing returns to capital made in the Solow model as the main reason why the Solow model was not able to explain the long run growth with endogenous variables. Therefore, the endogenous model sought to "eliminate" that assumption and produce a new model without diminishing returns to capital (D'Agata and Freni, 2003).

The endogenous model proposed by Rebelo (1991) posits that output (Y) is produced by a single input, namely capital (K). The capital here does not refer to physical capital only as assumed by Solow (1956), but also to other types of capital such as human capital.

Unlike Solow, The Rebelo (1991) production function is linear; that is, increases in capital lead automatically to increases in output, and vice-versa. The main implication of this model is that the capital accumulation process is determined by the level of savings. The higher the savings, the higher the investment, which in turn implies that increases in capital result in an increase in the level of output (Frankel, 1962).

The endogenous growth models suggest that high rates of saving mean high investment rates, which lead to an increase in the output rates. Dornbusch and Reynoso (1989) believe that the structure of the financial system plays an important role in ensuring that enough savings are mobilised and most importantly, channelled into productive investments that can bring about high growth rates. Benciverga and Smith (1991) explain that in well-developed financial systems, financial intermediaries such as banks bring together savers and investors. The financial intermediaries receive deposits from economic agents and then transfer these deposits into productive investments through loans or credit to the private sector.

In the process of mobilising savings, earlier theories such as the McKinnon and Shaw hypothesis, showed how a less-structured financial sector could reduce the level of savings. They held in their hypothesis that financial repression in term of an interest rate ceiling, which generally results in low interest rates makes fewer resources available for investment. On the other hand, Demetriades and Arestis (1999) acknowledged that the process of channelling savings into productive investment is a vital "function of the financial sector" and the most crucial since economic growth can only be achieved through productive investment.

Levine, Loayza and Beck (2000) argued that financial intermediaries in the well-developed financial sector could improve the productivity of investment by reducing risk through diversification or by collecting "accurate and reliable information" about the investment and analysing this information before deciding to allocate any funds to the project.

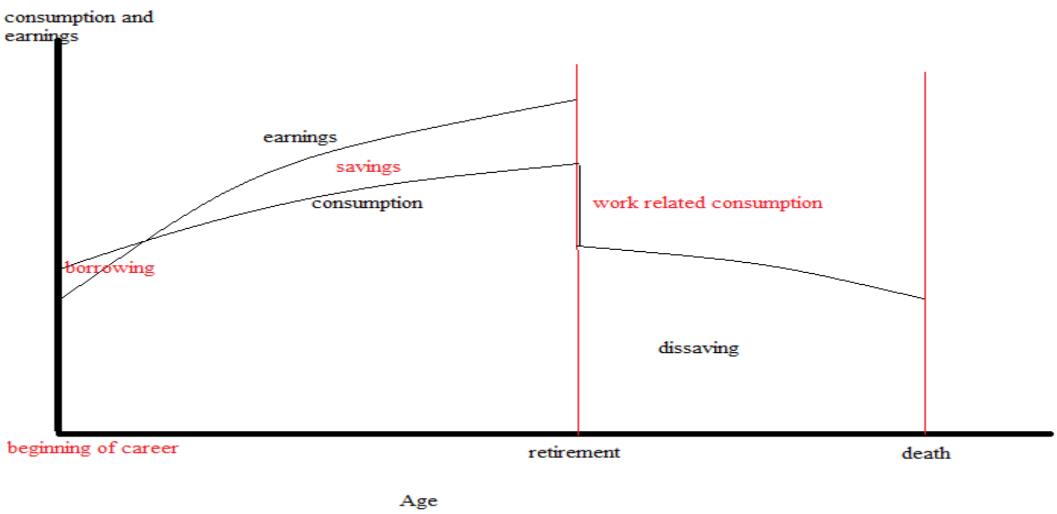
After reviewing the Harrod-Domar (1946), the Solow (1956) and the endogenous growth models, it is of great interest to again highlight some facts about the relationship between savings and economic growth. In the Harrod and Domar growth model, savings represents a portion of the national income, and an increase in savings lead to an increase in the capital ratio, which in turn bring about economic growth. In the Solow model, savings is an exogenous factor of production and increases in savings produced temporary high growth rate through the effects of savings on capital. However, in the endogenous growth models, savings is a result of the rational behaviours of the economic agents. Thus, savings is no longer an exogenous factor of production as assumed in the Solow model, but it becomes an endogenous factor of production. On the other hand, capital in the Solow model was understood as physical capital only, whereas in the endogenous growth models, capital includes both physical as well as human capital. Based on these assumptions, the endogenous models believed that savings is permanently related to economic growth and higher savings rates lead to high growth rates.

Unlike these theories that suggest that the causality runs from savings to economic growth through investment, the life-cycle hypothesis by Ando and Modigliani (1963) posits that the causality runs the other way around.

3.2.4 The Life-cycle hypothesis

The life-cycle hypothesis proposed by Ando and Modigliani (1963) views the retirement motive for savings as the most important among all the motives, since households primarily save during their working period to meet their expenses after that period, when they will be receiving no income. Hence, the age of the savers is crucial in analysing the behaviour of savings. Ando and Modigliani showed that when individuals are still under the age of 20 and have not yet started working, their income is zero and consequently their savings are zero. At the beginning of their career, their savings are expected to rise but at a very slow rate because the consumption function is believed to be high due their new expenses, such as housing acquisition. However, the savings begin to rise in the middle of their careers as they start saving for the retirement period, while at the retirement period, the savings rate starts declining as they consume their savings. Ando and Modigliani's view is illustrated in Figure 3.2.

Figure 3.2: The life-cycle hypothesis



Source: **Schmidt-Hebbez and Severn (2006: 42)**

From the basic assumption of the life-cycle hypothesis described above, one can argue that there are two groups of people within the economy; namely the young that are believed to be working and receiving income and the old that are retired and receive no income. The latter consume their savings, while the former save their income for the retirement period. Ando and Modigliani (1963) pointed out that the growth in the population will increase the number of savers (young) relative to the dissavers (old) and that growth in the national income will increase the income of the savers. Thus, growth in the population and in the income would raise household savings, which in turn will increase aggregate savings.

Another assumption made by Ando and Modigliani (1963) is that the “income growth rate for individual consumers is no higher in a high- growth economy than in a low-growth economy”. However, Carroll and Summers (1991) compared the consumption behaviours of individuals in Japan and the United States graphically, with Japan being a faster growing economy than the United States. They showed that the consumption growth of individuals increases in a faster growing economy than in a slower one. This finding is in contrast with the life-cycle hypothesis prediction. Following this finding, Carroll and Summers (1991) as well as Deaton (2010) concluded that the life-cycle hypothesis is not a good model to explain the relationship between economic growth and savings.

The existing theories of the relationship between savings and economic growth, such as the Harrod-Domar, the Solow and the endogenous growth models reviewed above, are assumed to be closed economy models, where there is no presence of foreign capital. However, an empirical study by Obstefeld and Rogoff (1996) in 22 OCED countries over the period 1960-1974 proved that there is a strong capital mobility around the world. Thus, the existing theories can no longer be consistent to explain the causality from domestic savings to economic growth in the presence of foreign capital, since savings in one country can be used to support investment in another country.

Given this shortcoming of the existing theories of savings and economic growth, Aghion, Comin and Howitt (2006) argue that economists tend to be in favour of a causality from economic growth to savings. To solve this problem, Aghion et al. (2006) have attempted to produce a model where domestic savings still have an impact on economic growth even in the presence of foreign capital, and this is the Aghion-Comin-Howitt hypothesis.

3.2.5 The Aghion-Comin-Howitt hypothesis

The Aghion, et al. (2006) hypothesis posits that the purpose of savings by workers is to invest in innovation and to consume later during the retirement period. Innovation has been a source of growth in new growth models such as Aghion and Howitt (1992). Aghion, et al. (2006) also assume that in every economy, there is also a local bank that mobilises savings in order to co-finance foreign innovation projects in the country, together with the foreign investor. Finally, there are local firms that can have access to foreign technology through a foreign investor who has access to the technology and this will be at a low cost.

The implication of these assumptions is that in the country where local investors do not have access to technology, there is need to import or attract foreign technology, which necessitates a certain amount of savings. The level of savings will, therefore, determine the level of technology, and the higher the savings, the greater will be the level of technology that can be imported, which in turn positively influences GDP growth (Aghion, et al., 2006).

The differences between the models on the relationship between savings and economic growth imply that theoretical literature on savings and economic growth is ambiguous, since the predictions or implications of some of these theories are not consistent with the empirical findings or are rejected by other theories. In this regards, economists cannot only rely on the theoretical considerations to understand the relationship between savings and economic growth. An empirical review of studies on the relationship between savings and economic growth is, therefore, conducted in the next section to help with understanding the relationship between savings and economic growth.

3.3 Relationship between savings and economic growth: empirical considerations

In the previous section of the chapter, two main groups of theories were discussed. The first one includes those that describe the direction of causality to be from savings to growth and the second group being those that argue in the opposite direction. This section reviews empirical studies that investigated the validity of the two sets of theories. The studies conducted in individual countries are discussed first, thereafter studies in more than one country with time series data are reviewed, and finally studies that used panel data are assessed.

3.3.1 Empirical studies in individual countries

In Sub-Saharan Africa, the direction of the causality tends to be from savings to economic growth, as suggested by the findings of most of the studies on this region. Seven empirical studies undertaken on data from this region will be analysed. Among the seven studies, five studies found that savings Granger–cause economic growth whereas in the remaining two, it is economic growth that is found to cause savings. The countries that were individually analysed are South Africa, Nigeria, Botswana and Ethiopia.

Romm (2005) attempted to investigate the relationship and the causality between private savings and economic growth in South Africa using annual time series data from 1946 to 1992. For the empirical analysis, Romm applied the co-integration approach developed by Johansen and Joselius (1990) and the causality test based on the Vector Error Correction Model (VECM). The findings of the study suggested that private savings Granger-cause GDP per capita directly as well as indirectly through private investment. GDP per capita was also found to have a positive impact on private savings.

Like Romm (2005), Oladipo (2010) analysed the relationship and the causality between savings and economic growth in Nigeria over the period 1970- 2006 using the Johansen and Joselius test for co-integration but, instead of the VECM based causality, Oladipo applied the Granger causality test developed by Toda and Yamamoto (1995). The empirical findings confirmed the existence of the long-run relationship between savings, foreign direct investment and GDP. In addition, the study revealed a uni-directional causality from savings to GDP, and a causality from savings and FDI to GDP.

Contrary to the two previous studies, Amusa and Busani (2013) adopted the Autoregressive Distributed Lag (ARDL) developed by Pesaran et al. (2001) to examine the relationship between savings and economic growth in Botswana using annual time series data over the period 1980-2008. Even though the approach followed is different from the two previous studies, the findings are consistent with the findings of the previous studies in the case of Botswana; that is, domestic savings is positively related to GDP in both the short-run and long run. Jagadeesh (2015) adopted the same approach as Busani and Amusa (2013) and found that savings really matter for economic growth in Botswana through their positive effects on investment for the period 1980- 2013.

In Ethiopia, Kabede (2014) also developed the ARDL approach to co-integration to test the long-run relationship between savings and economic growth and the Toda and Yamamoto (1995), Dolado and Lutkepohl (1996) tests to determine the direction of causality over the period 1969-2010. The results revealed a long-run association between savings and economic growth and a uni-directional causality running from savings to GDP via investment.

In contrast to previous findings, Odhiambo (2009) performed the Johansen approach to co-integration and VECM based causality and found a uni-directional causality from growth to savings. There was also evidence of a bi-directional between savings and foreign direct inflows and a causation from growth to foreign direct inflows over the period 1950-2005 in South Africa. Abu (2010) also reached the same finding in the case of Nigeria over the period 1970-2007. It is important to highlight that Abu, like in the studies described above, applied the Johansen test and found that there is correlation between savings and economic growth. However, instead of the Toda and Yamamoto or the VECM based causality tests used by the studies described above, Abu applied the causality test by Engle-Granger (1995).

In Asia, empirical studies reveal a mixture of results. Lean and Song (2008) tested the relationship and the direction of causality between household and economic growth, and enterprise savings and economic growth in China. The Johansen and Joselius (1990) co-integration and Granger causality tests were implemented to analyse time series data collected from the year 1955 to 2004. The key findings of this study were that the household savings Granger-cause the nominal GDP and vice versa in the short-run, whereas in the long run, there was no evidence of causality. On the other hand, enterprise savings and nominal GDP do not cause each other in the short –run, while in the long –run the causality runs from GDP to savings.

Tang (2009) applied five granger causality techniques, namely the Granger-causality test, the modified Sims causality test, the Hsiao (1981) test, the modified Wald test and the causality test by Holmes and Hutton (1998, 1990) to find out whether the causality test can influence the direction of causality in the case of Malaysia. The empirical findings supported a bi-directional causality between savings and economic growth over the period 1991:Q1- 2006Q1. Hence, Tang (2009) concluded that the causality between savings and economic growth does not depend on a specific causality test.

Najarzadeh, Reed and Tasan (2014) investigated the relationship and causality between savings and economic growth in Iran over the period 1972-2010 using the ARDL approach to co-integration. The results confirmed a positive relationship between savings and economic growth, and a bi-directional causality between the two. Similarly, Tang and Tan (2014) adopted the ARDL approach to co-integration to assess the relationship between savings and economic growth in Pakistan for the period 1971-2011 and found that savings is positively related to GDP in both short and long-run. In addition, the modified Wald causality test by Toda and Yamamoto (1995) confirmed a causation from savings to economic growth.

Abou El-Seoud (2014) ran the Johansen and VECM based causality tests to analyse the relationship and causality between savings and economic growth in Bahrain using time series data for the period 1990-2013. Abou El-Seoud concluded that there is a bi-directional causality between GDP and private savings in the short-run, whereas over the long run, the causality runs from GDP to private savings. Using the VECM approach, Mehta and Rami (2014) tested the association and causality among savings, investment and economic growth in India using annual time series data collected over the period 1951-2012.

The empirical evidence supported a long-run relationship between savings, investment and growth only if GDP is regressed as the dependant variable. Further, savings Granger-caused growth via private investment. Likewise, Patra, Murthy, Kuruva and Mohanty (2017) applied the VECM based causality test and concluded that savings Granger-cause economic growth over the period 1951-2012 in India.

In Latin America, Sinhaa and Sinhab (1998) performed the Johansen co-integration and Granger non-causality test (1961) to study the relationship and the causality between private savings and economic growth over the period 1960-1996 in Mexico. The key findings of the study were that economic growth Grange-causes domestic savings. These findings gave empirical support to the study by Gavin et al. (1997), which was criticised for not applying the appropriate econometric tools in order to determine in the direction of causality between savings and economic growth in the Latin America. The empirical evidence of Sinhaa and Sinhab (1998) was rejected by Masih and Peters (2010) study that revealed a causation from savings to economic growth in Mexico for the period 1960-1996. Unlike Sinhaa and Sinhab (1998), Masih and Peters (2010) applied the Toda Yamamoto (1995) and Dolado and Lutkepohl (1996) causality procedure and found that private and public savings Granger-cause economic growth.

Claus, Haugh, Scobie and Tornsquist (2001) moved from the implications of the Solow and Keynesian model, which are assumed more consistent with the case of a closed economy and constructed a Feldstein-Harioka (1980) equation to analyse the impact of savings on economic growth in the case of a small open economy. Annual time series data collected over the period 1972-2001 were analysed using the Granger-causality and Geweke-Meese-Dent (1983) Granger causality tests. The Granger causality test revealed that savings Granger cause investment and economic growth, whereas the Geweke-Meese-Dent suggested that investment and output Granger-causes savings.

Uddin, Alam and Gow (2016) performed three econometric models; namely the Dynamic Ordinary Least Squares, the Fully Modified Ordinary Least Squares and the Vector Error Correction Model to assess the effects of population age structure and savings on economic growth in Australia. The results of these three models were in favour of a positive relationship between the three variables. For the direction of causality, however, the findings revealed that the dependency ratio Granger-caused GDP per capita over the period 1971-2014.

Overall, the studies reviewed for individual countries confirm the existence of a long-run relationship between savings and economic growth. Although there is a long relationship between savings and economic growth, the findings with regard to the direction of causality are mixed. The causality runs from savings to economic growth or the other way around. With regard to the research methodology, it can be noted that three econometric tests, namely; Granger-causality, VECM based causality and Yoda and Yamamoto, were intensively used to determine the direction of causality. For the long-run relationship, the Johansen and the ARDL approaches to co-integration were the most applied. In addition, most of the studies used annual time series data.

Having reviewed the studies conducted in individual countries, the next section reviews studies that were carried out in more than one country. The empirical studies that used time series data for different countries are reviewed first and thereafter, those that pooled time series to form a panel are discussed.

3.3.2 Empirical studies in more than one country

In this section, the studies conducted in more than one country are reviewed. In total, five studies will be reviewed, two study conducted on the African countries, two studies in Asia and one study on different countries across the world.

In 2000, Agrawal conducted an empirical study on the causality between savings and economic growth in five Asian countries using annual time series data from 1960 to 1998. The results of the VAR Granger causality developed by Engle-Granger (1997) showed a uni-directional causality from savings to GDP in Pakistan and Bangladesh, no causality in Nepal, and causality from GDP to savings in India and Sri Lanka.

Alomar (2013) also found a mixture of results in six Gulf Council of Co-operation countries for the period 1980 - 2010. The results of the Johansen (1988) test for co-integration revealed that savings and economic growth have a long-run relationship at 5% level of significance in all countries except for Qatar where the two variables were found to be co-integrated at 10% level of significance.

The Granger causality test, on the other hand, led to a mixture of results as in the previous cases. In Bahrain, the results suggested a bi-directional causality between savings and economic growth, whereas in Oman savings was found to Granger-causes economic growth. In the rest of the countries, increases in GDP growth rates resulted in high savings.

In Africa, Anoruo and Ahmad (2001) carried out a study on the long run relationship between savings and economic growth in seven African countries using the Johansen co-integration test and the VECM based approach for the causality. The results confirmed the long run relationship between savings and economic growth in all the countries. In addition, the Granger causality test suggested a bi-directional causality between savings and economic growth in South Africa and Cote d'Ivoire, a uni-directional causality from savings to economic growth in Congo and finally a causation from growth to savings for the rest of the countries.

Adam, Musah and Ibrahim (2016) performed the Granger-causality and the Toda Yamamoto tests to determine the direction of causality in ten Sub-Saharan African countries. The results of both causality tests supported a causality from savings to growth in Mali and South Africa, absence of causality in Kenya, Madagascar and Malawi, and a mixture of results for the rest of the countries.

Ramesh (2006) applied the Johansen technique for co-integration and the Granger causality method to test the relationship between savings and economic growth in twenty-five countries with different income levels for the period 1960-2001. The countries were grouped into four, according to the level of income. The results revealed a long run relationship between savings and economic growth at 1% and 5% levels of significance in all the countries with the exception of Canada and Chile. In these two countries, there was no evidence of co-integration between savings and growth.

On the other hand, among the low –income countries, the Granger causality test confirmed a causality from savings to economic growth in Indonesia, a causality from economic growth to savings in Nigeria and Senegal, and a bi-directional causality in Cote d'Ivoire. There was also evidence of causality from economic growth to savings in three lower-middle income countries namely; Algeria, Thailand and Ecuador and in all the high-income countries except for Singapore, in which the causality was validated from savings to economic growth.

In the upper-middle income countries, a bi-directional causality was confirmed in all the countries namely; South Africa, Argentina, Chile and Brazil.

In the studies in more than one country discussed above, the two variables under investigation are found to be positively related and there is at least a causality from savings to economic growth or vice-versa in most of the countries. Although there is a mixture of results in terms of causality in these studies, the methodology followed to reach these conclusions seem to be similar in most of the studies. Four out of five studies performed the Johansen co-integration approach and found a relationship between savings and economic growth. Furthermore, out of these five studies, four implemented the Granger-causality to determine the direction of causality. In the next section, studies that pooled data for individual countries are reviewed.

3.3.3 Panel data studies

The studies in more than one country just reviewed, such as Agrawal (2000) and Alomar (2013) analysed the relationship and the causality between savings and economic growth using annual time series data of individual countries. Unlike these studies, Carroll and Weil (1994) pooled data for 64 OECD countries and found that there is a causality running from economic growth to savings. Likewise, Baharumshah and Thanoon (2006) conducted a panel study on the relationship between foreign capital, domestic savings and economic growth pooling annual time series data for six Asian countries over the period 1965-2000. The outcome of Dynamic Generalised Least Squares (DGLS) indicated the existence of a long-run relationship between domestic savings, foreign direct investment and economic growth. Moreover, FDI Granger-caused domestic savings, and savings together with FDI Granger-caused economic growth.

Aghion et al. (2006) tested the relationship between savings and economic growth in a world with capital mobility using panel data for 118 countries collected over the period 1960-2000. The countries were divided into groups based on the level of per capita income. The main findings of this empirical investigation were that, in the developing countries, where technology is not advanced, savings and productivity growth were correlated and the former positively affected the latter. Furthermore, the study revealed that the lags of savings were “highly correlated” with foreign direct investment.

Ciftcioglu and Begovic (2010) combined annual time series data for nine Central and East European countries over the period 1995-2003 and applied the pooled classical regression model to test the relationship between savings and economic growth. The results showed that the coefficient of savings was positive and significantly related to economic growth.

Based on the predictions of the Keynesian model, and of the Solow model, Misztal (2011) used the panel co-integration techniques and the Granger causality tests to analyse the relationship and the causality between savings and economic growth in developed, emerging and developing countries for the period 1980-2009. Misztal concluded savings Granger-caused growth.

Bayar (2014) pooled annual time series data for seven Asian countries to analyse the relationship between savings, investment and economic growth for the period 1982-2012. Bayar performed the panel co-integration method to test the long run and the panel causality test to determine the direction of causality. The empirical evidence supported a positive relationship between the variables of interest. Furthermore, there was evidence of bi-directional causality between savings and economic growth.

Gui-Diby, (2014) applied the GMM method developed by Blundell and Bond (1998) to test the relationship between FDI and economic growth in 50 African countries using a set of panel data collected from year 1980 to year 2009. The main findings of this study were that FDI was negatively related to GDP over the period 1980- 1994 but positively related to GDP for the period from 1995-2009. Using Generalized Method of the Moment (GMM) estimator by Arellano and Bond (1991), Mbulawa (2015) sought to understand the role of institutions in the growth process in SADC for the period 1996-2010. The empirical results showed that good quality institutions indirectly influenced growth through the improvement of the level of savings, gross fixed capital formation and trade openness.

Recently, Gocer, Akin and Atalas (2016) conducted a panel analysis to test the effects of savings and investment on economic growth in 65 developing countries over the period 1981-2014. The countries were grouped in two based on the level of income and the classical Fixed-effects and Random effects models were applied. In the first group of 36 countries, including South Africa and Lesotho, savings was found to be negatively related to investment. In the second group of 25 countries, among others, Zambia, Botswana, Ghana, Nigeria, savings had positive effects on investment and thereby on economic growth.

The empirical studies investigating the link between savings and economic growth using panel data, like the studies in more than one country and in individual country reviewed above, found a positive relationship between savings and economic growth and a mixture of results in terms of causality. The research methodology followed here, unlike in the previous studies, differs from one study to the other. Two studies have implemented the GMM test , whereas the panel co-integration techniques were performed in one study to test the long-run relationship. For the direction of causality, some studies have used the Granger-causality, whereas others applied the VECM based Granger-causality tests. However, in all the studies, time series data for individual countries were pooled to form a panel.

3.4 Summary and Conclusion

In conclusion, the empirical literature confirmed the theoretical views that the causality between savings and economic growth can run from either side. The traditional theories of growth such as the Harrod-Domar (1946), the Solow (1956) and the endogenous models argued that savings is positively related to economic growth and high savings cause economic growth through the effects of savings on the capital. The life-cycle hypothesis of Ando and Modigliani (1963) posited that savings and economic growth have a positive relationship as argued in the traditional theories of savings and economic growth. However, concerning the direction of causality, Ando and Modigliani (1963) pointed out that it is high GDP growth precedes savings.

The Aghion-Comin-Howitt (2006) hypothesis posits that the traditional theories of savings named above work perfectly in the case of a closed economy with no foreign capital as assumed by their proponents. In the presence of foreign capital, these models become irrelevant. Thus, economists tend to explain the causality as from economic growth to savings. Aghion, et al. (2006) developed a model where domestic savings still have a significant and positive impact in explaining economic growth even in the presence of foreign capital.

These theoretical models have been used to test empirically the relationship between savings and economic growth using annual time series data for individual countries, or time series data for more than one individual country or panel data.

The findings confirm the long run relationship between savings and economic growth in most of the countries whereas the causality results are mixed.

Although there is a difference in the results with regards to the direction of causality, there are some similarities in terms of methodological approach used by these studies that need to be highlighted. First, the studies on individual countries use annual time series data and perform either the Johansen and Joselius co-integration or the ARDL model to test for the long-run relationship. Second, most of the studies applied the VECM based Granger causality or the VAR Granger causality tests to determine for the direction between savings and economic growth. Finally, the studies measured savings as the ratio of gross domestic savings to GDP, investment as the ratio of gross fixed capital formation to GDP, the foreign direct investment as a ratio of GDP for foreign capital and real GDP as a proxy of economic growth. However, for the panel studies, the methodology differs from one study to the other. There are studies that utilised the GMM test to test for the relationship, whereas the others performed the panel co-integration tests. Furthermore, the causality in the panel data studies was tested using the panel Granger-causality tests or the VECM based causality tests.

Based on the theoretical and empirical literature on the relationship between savings and economic growth reviewed in this chapter, the research the methodology of the study is presented in the next chapter.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the research methodology adopted to achieve the goals and objectives of the study; namely to test for the long-run relationship and to determine the direction of causality between domestic savings and economic growth in the SADC region. The research methodology starts with the specifications of the theoretical and empirical frameworks. Thereafter, the econometrics approach applied to analyse data is explained, and the variables to be included in the empirical model, as well as the nature of data to be used are described. The research methodology ends with the a priori expectations of the study.

The theoretical model of the study is specified in the first section of this chapter. The theoretical model of the study is a mathematical expression of the theories of savings and economic growth reviewed in the first part of the previous chapter; namely the Solow growth model, the endogenous growth models and the Aghion-Comin-Howitt hypothesis. In addition to the theoretical models of savings and economic growth, the empirical literature of the previous studies on the relationship and causality between savings and economic growth reviewed in the second part of chapter three, will also be taken into consideration in order to construct a good theoretical model of the study.

Following the estimation of the theoretical model in the first section, the empirical model of the study is specified in the next section of the chapter. The empirical model is an econometric expression of the theoretical model that was previously estimated. The difference between these two models is that, the error term, which represents all the variables that are explicitly excluded from the model, is included in the empirical model (Gujarati and Porter, 2009:4).

The third section of the chapter explains the econometrics tool that is used to analyse the relationship and causality between savings and economic growth in the SADC region. In this section, all the necessary steps taken to implement such tool are explained. The fourth section of the chapter provides a description of the dataset and a definition of the variables to be included in the empirical model. A priori expectations are presented in the last section of the chapter.

4.2 Theoretical framework

Harrod-Domar's (1949) model, Solow's (1956) growth model and the "*AK*" endogenous growth model (Frankel, 1962), acknowledge the crucial role being played by the rate of savings in the process of achieving higher GDP growth rates. Various empirical studies focusing on the relationship between savings and economic growth such as Mankiw, Romer and Weil (1992), Tang, and Tan (2014) recognise the Solow model as the "starting point" for studies that seek to understand the association between these two variables.

In Solow's (1956) growth model, output ***(Y)*** is produced by capital ***(K)***, labour ***(L)*** and technological progress ***(A)***. The Cobb-Douglass production function of the Solow model is estimated as follows:

$$\boldsymbol{Y_{(t)} = K^{\alpha}_{(t)} (A_{(t)} L_{(t)})^{1-\alpha}} \quad (4.1)$$

where **t**=time, $\mathbf{0 < \alpha < 1}$.

Solow assumed that the economy grows over time and L and A expand exogenously at rates *n* and *g* respectively, thus it is easier to explain changes in the capital stock per unit of effective labour ***k*** rather than the "unadjusted" capital stock **K**. Solow termed the stock of capital per unit of effective labour ***k*** which is given by $\boldsymbol{k = \frac{K}{AL}}$ and ***y*** the level of output per effective unit of labour given by $\mathbf{y}= \boldsymbol{\frac{Y}{AL}}$ (Romer, 2012:11).

The evolution of the stock of capital per unit of effective labour ***k*** is therefore estimated as follows:

$$\boldsymbol{\dot{k}_{(t)} = sy_{(t)} - (n+g+\delta)k_{(t)}} \quad (4.2)$$

$$\boldsymbol{= sk_{(t)}^{\alpha} - (n+g+\delta)k_{(t)}} \quad (4.3)$$

where: ***s*** = is the savings, which is also assumed to be exogenously given, ***δ***=the rate of the depreciation of the capital, the term $\boldsymbol{sk_{(t)}^{\alpha}}$ is the actual investment per unit of effective labour, and $\boldsymbol{(n+g+\delta)\, k_{(t)}}$ represents the amount of investment needed to be keep ***k*** at its existing level (Mankiw, et al., 1992).

Since the economy grows until it reaches its new steady state, the new steady state of the stock of capital per unit of effective labour ***k**** is therefore given by equations (4.4) and (4.5) below:

$$sk^{*\alpha} = (n+g+\delta)\, k^{*} \quad (4.4)$$

$$k^{*} = \frac{s}{(n+g+\delta)}^{1/1-\alpha} \quad (4.5)$$

The equation (4.5) suggests that increases in savings will have positive effects on the steady-state capital-labour, which in turn will also positively affect the steady state of output per effective labour, ***y***. The steady state of output per effective labour is estimated by substituting equation (4.5) into the production function.

$$y = \frac{s}{(n+g+\delta)}^{\alpha/1-\alpha} \quad (4.6)$$

Drawing on equation (4.6), the output per worker can take the following form:

$$\frac{Y(t)}{L(t)} A \frac{s}{(n+g+\delta)}^{\alpha/1-\alpha} \quad (4.7)$$

The implication of the equation (4.7) is that as the rate of savings goes up, the rate of actual investment rises until it reaches its new steady state. This process will also lift-up the growth rate of output per worker. Solow (1956) concluded that an increase in savings would lead to a temporary increase in the output or will have level effects but cannot change the output.

However, Barry (1996) believed that the endogenous "*AK*" model of growth is just an "extension" of the Solow growth model. From the Solow model that has been described in equation (4.1), Barry sets $\alpha=1$ and ***A*** as a constant. Hence, the Solow growth model becomes:

$$Y = AK \quad (4.8)$$

where ***Y***=output, ***K***=physical and human capital and ***A***=positive constant. Unlike the Solow model, the endogenous growth model assumes that savings is endogenously given which implies that increase in savings will allow the capital accumulation to take place as shown in equation (4.9) below:

$$K' = sAk - \delta k \quad (4.9)$$

$$K = sA - \delta \quad (4.10)$$

where ***K*** is the growth rate of capital and δ the rate of depreciation of capital.

Since the growth rate of capital equals the output within the *AK* model framework, the output is therefore a function of savings, that is:

$$Y^{*} = K^{*} = sA - \delta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4.11)$$

Hence, higher savings rates will lead to higher investment rates, which in turn cause permanent economic growth. In other words, the rate of savings affects economic growth in the long-run.

4.3 Empirical framework

Drawing on the theoretical framework, the empirical model of the study can be specified as output ***(Y)*** being a function of savings ***(S)*** and domestic capital ***(K).*** Putting this in an econometric form gives:

$$Y_{it} = \mu + \beta_1 S_{it} + \beta_2 K_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots4.12)$$

where μ is the constant, $\beta 1$ and $\beta 2$ are the coefficients of the respective independent variables, ε_{it} is the error correction term, ***i*** represents individual SADC member state at ***t*** (year) time.

However, Aghion, et al. (2006) point out that the Solow and the AK growth models work perfectly in the case of a closed economy. In an open economy, these models become irrelevant. Hence, Aghion, et al. (2006) developed a model in which domestic savings still matter for economic growth even in the open economy. On the other hand, it is not advisable for a country to rely indefinitely on foreign capital but must also promote local investment.

The relationship between savings and economic growth is analysed using two models. The first includes local savings, domestic capital and economic growth as specified in equation 4.12, and the second includes local savings, foreign capital and economic growth based on Aghion et al. (2006) hypothesis. The second empirical model of the study is thus specified as follows:

$$Y_{it} = \mu + \beta_1 S_{it} + \beta_2 K'_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4.13)$$

where ***K'*** is the foreign capital.

4.4 Econometric Approach

The study aims at testing for the long run relationship as well as the causality between savings, domestic capital and economic growth, and the long run relationship between savings, foreign capital and economic growth in the SADC region. Existing econometric tests of panel co-integration and long-run relationship, such as the Pedroni (1999), Kao (1999) and Johansen and Fischer (1998), require all the series to be non-stationary at levels and stationary in the first differences.

This process requires the pretesting of the level of integration of the variables included in the panel model using the panel unit root tests, such as the Breitung (2000), Levin-Lin-Chu (2002) or the Im-Peseran-Shin (2003). If one of the series is stationary at level, while the rest of the variables are non-stationary, these models cannot be implemented. To avoid this scenario, this study performs the Panel Autoregressive Distributed Lag approach developed by Shin, Pesaran, and Smith (1997), which works with a mixture of I (0) and (I) series, or purely (0) or (1).

4.4.1 The Panel ARDL

According to Pesaran et al. (1997), the dynamic panel model can be specified as follows:

<u>In the closed economy</u>:

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=1}^{q} \delta_{ij} S_{i,t-j} + \sum_{j=1}^{q} \pi_{ij} K_{i,t-j} + \mu_i + \bar{\mho}_{it} \quad \text{.........(4.14)}$$

$$S_{it} = \sum_{j=1}^{p} \lambda_{ij} S_{i,t-j} + \sum_{j=1}^{q} \delta_{ij} Y_{i,t-j} + \sum_{j=1}^{q} \pi_{ij} K_{i,t-j} + \mu_i + \bar{\mho}_{it} \quad \text{..........(4.15)}$$

$$K_{it} = \sum_{j=1}^{p} \lambda_{ij} K_{i,t-j} + \sum_{j=1}^{q} \delta_{ij} Y_{i,t-j} + \sum_{j=1}^{q} \pi_{ij} S_{i,t-j} + \mu_i + \bar{\mho}_{it} \quad \text{...........(4.16)}$$

In the open economy:

$$Y_{it} = \sum_{J=1}^{p} \lambda i_J Y_{i,\,t-J} + \sum_{J=1}^{q} \delta i_J S_{i,\,t-J} + \sum_{J=1}^{q} \pi' i_J K'_{i,\,t-J} + \mu_i + Ʊ_{it} \quad \text{……..(4.17)}$$

$$S_{it} = \sum_{J=1}^{p} \lambda i_J S_{i,\,t-J} + \sum_{J=1}^{q} \delta i_J Y_{i,\,t-J} + \sum_{J=1}^{q} \pi' i_J K'_{i,\,t-J} + \mu_i + Ʊ_{it} \quad \text{………..(4.18)}$$

$$K'_{it} = \sum_{J=1}^{p} \lambda i_J K'_{i,\,t-J} + \sum_{J=1}^{q} \delta i_J Y_{i,\,t-J} + \sum_{J=1}^{q} \pi' i_J S_{i,\,t-J} + \mu_i + Ʊ_{it} \quad \text{……… (4.19)}$$

where $\boldsymbol{p}$ is the lag of the dependent variable and $\boldsymbol{q}$ is the lag of the independent, $\boldsymbol{i}$ = 1, 2,3,.., N number of cross sectional (N=10 in the study), $\boldsymbol{t}$ = 1,2,3,…, T Total time period (T=31), $\boldsymbol{\delta i_J S_{it}}$, $\boldsymbol{\pi i_J K_{it}}$ and $\boldsymbol{\pi' i_J K'_{it}}$ are the k×1 coefficients vector, $\boldsymbol{\lambda i_J}$ are the scalars and μ_i is the group-specific effect.

The panel ARDL equations estimated above can be used to test for a long run by applying three tests. The first is the Dynamic Fixed-Effects (DFE), which allows the intercepts to differ across the group but imposes homogeneity of all the slope coefficients and error variance. However, Pesaran et al.(1997) posit that in a dynamic panel, the slope coefficients differ significantly across the group and thus the parameter estimates produced by the DFE are inconsistent and this can lead to a serious heterogeneity bias.

As alternative to the DFE, Pesaran et al. (1997) propose two other tests: the Mean Group estimator (MG), which relies on "estimating N time-regressions and averaging the coefficient" and the Pooled Mean Group estimator (PMG), which relies on "combination of pooling and averaging of coefficients". The PMG constrains the long-run coefficients to be the same across the group but allows the short-run coefficients to vary. Thus, according to Yildirim and Yasa (2010), the PMG is an intermediate test between the MG and the DFE. Even though the PMG seems to be more reliable than the MG, Pesaran et al. (1997) suggest the use of the Likehood ratio test or the Hausman test to check for the efficiency of the estimates derived from these estimators.

However, in a number of empirical studies such as the ones by Ekrem, Gulbahar and Umit (2014), Arawomo (2014), Yasmeen and Tufail (2015), Mallick, Mallesh and Behera (2016) and Guven and Mert (2016), the Hausman test or the Likehood ratio test accepted the null hypothesis of homogeneity restriction on the long-run estimates, which implies that the PMG is more efficient than the DFE and MG. Therefore, in this study, the long-run relationship in the panel is estimated using the PMG only. Furthermore, the study uses the error term derived from the PMG to assess the direction of causality.

4.4.2 VECM Based Granger causality

According to Yildirim and Yasa (2014) and Mallick, Mallesh and Behera (2016), in the case of the variables being co-integrated, the error term should follow I(0) order in all cross-sections to have a long-run equilibrium relationship between the variables. The characteristics of co-integrated variables is that their time paths are influenced by the extent of any deviation from the long-run equilibrium. This explains that the short-run dynamics can be influenced by the deviation from equilibrium. Therefore, there is need to reparametrise the equations (4.14), (4.15), (4.16), (4.17), (4.18) and (4.19) in to an error correction equations as follows:

In the closed economy:

$$\Delta Y_{it} = \acute{\emptyset}_i (Y_{i,t-1} - \Theta_t' S_{it} - \Theta_t' K_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta Y_{i,t-J} + \sum_{J=1}^{q-1} \delta' i_J \Delta S_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta K_{i,t-J} + \mu_i + \mho_{it} \quad \text{(4.20)}$$

$$\Delta S_{it} = \acute{\emptyset}_i (S_{i,t-1} - \Theta_t' Y_{it} - \Theta_t' K_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta S_{i,t-J} + \sum_{J=1}^{q-1} \delta' i_J \Delta Y_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta K_{i,t-J} + \mu_i + \mho_{it} \quad \text{(4.21)}$$

$$\Delta K_{it} = \acute{\emptyset}_i (K_{i,t-1} - \Theta_t' Y_{it} - \Theta_t' S_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta K_{i,t-J} + \sum_{J=1}^{q-1} \delta' i_J \Delta Y_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta S_{i,t-J} + \mu_i + \mho_{it} \quad \text{(4.22)}$$

In the open economy:

$$\Delta Y_{it} = \acute{\emptyset}_i (Y_{i,t-1} - \Theta_t' S_{it} - \Theta_t' K'_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta Y_{i,t-J} + \sum_{J=1}^{q-1} \delta' i_J \delta' S_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta K'_{i,t-J} + \mu_i + \mho_{it} \quad \text{(4.23)}$$

$$\Delta S_{it} = \acute{\O}_i\ (S_{i,t-1} - \Theta_t' Y_{it} - \Theta_t' K_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta S_{i,\,t-J} + \sum_{J=1}^{q-1} \delta' i_J \delta' Y_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta K'_{i,t-J} + \mu_i + \mho_{it} \quad \text{.......(4.24)}$$

$$\Delta K'_{it} = \acute{\O}_i\ (K'_{i,t-1} - \Theta_t' Y_{it} - \Theta_t' S_{it}) + \sum_{J=1}^{p-1} \lambda' i_J \Delta K'_{i,\,t-J} + \sum_{J=1}^{q-1} \delta' i_J \delta' Y_{i,t-J} + \sum_{J=1}^{q-1} \pi' i_J \Delta S_{i,t-J} + \mu_i + \mho_{it} \quad \text{.......(4.25)}$$

where Ǿi is the speed of adjustment, which must be different from zero. A speed of adjustment equals to zero means there is no long run relationship among the variables. Like in the time series ARDL model, the speed of adjustment has to be negative and statistically significant in order to conclude that there is a long-run equilibrium among the variables. The negative sign and the significance of the speed of adjustment is also used to determine the long run causality from the independent variables to the dependent (Eggoh, Bangake and Rault, 2011).

According to econometrics theory, it is important to test for co-integration among the variables before estimating a long-run relationship using PMG estimator technique. To do so, one may perform the panel co-integration such as the Kao, Pedroni and Johansen. However, since the PMG pools and averages the coefficients of the group, and allows the coefficients to vary across the group, this study follows the Pesaran et al. (1997) approach. This consists of running a bounds test to co-integration for individual countries, and if the results suggest the existence of co-integration in the majority of the countries, then estimate the PMG for the long-run association. This approach also allows for reporting of the long run relationship, using the cross-section estimates, in the countries where there is evidence of co-integration between the variables of interest.

4.4.3 The ADRL approach for individual countries

Marashded, Al Malkawi and Abdullah (2012), Sheriff and Amoako (2014), Paksha 2014), and Davidescu (2015) point out that the ARDL test is preferred over the other co-integration techniques such as the Engle-Granger and Johansen for three reasons: First, the ARDL approach, unlike the Johasen and Joselius, and the Engle-Granger approach, does not require that all the series included in the empirical model be non-stationary at levels and stationary after the first differences; it can be applied regardless of the level of integration of the variables, whether I(1) or I(0), or the mixture of both. In this regard, there is no need to run a unit root test to check the level of integration of the variables of interest before running the ARDL model.

Second, the ARDL model produces more efficient estimates with a small sample size, unlike the Engle-Granger and Johansen, which require a very large sample in order to produce valid results. Narayan (2005) table suggests that the sample should be between 30 and 80 observations in order to apply the ARDL test, as it is the case in this study, which uses a small sample of 31 observations. Lastly, the ARDL test produces short-run and long run estimates of the equation simultaneously.

Although the ARDL approach can be applied without testing for unit roots in the series, it is always advisable to identify the level of integration of the series before estimating the regression model.

4.4.3.1 Unit Root test

This study tests the level of integration of the series included in the empirical model with the help of two conventional unit root tests, namely; the Augmented Dickey-Fuller (ADF) and the Philips and Perron (PP). This process is important, since it allows the researcher to make sure that none of the series is I(2). In the presence of I(2) series, the ARDL model cannot produce consistent estimates (Pesaran et al., 2001).

4.4.3.1.1 The ADF unit root test

The ADF test is an improvement of the standard Dickey-Fuller unit root test, which was valid only if the series is AR (1) process. In the ADF test, Dickey-Fuller assumed that Y series follows an AR ($\mathcal{P}$) process so that the model can be applied even in the presence of higher-order correlated series, unlike the standard Dickey-Fuller (Gujarati and Porter, 2009).
The general form of the model is as follows:

$$\Delta Y_t = \alpha Y_{t-1} + \alpha'_t \delta + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \ldots + \beta\rho \Delta Y_{t-\rho} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.26)$$

where α= ρ-1. The null hypothesis $H_0 = \alpha = 0$ is tested against the alternative $H_0 = \alpha < 0$ using the following t-ratio:

$$t_\alpha = \frac{\alpha\hat{}}{se(\alpha\hat{})} \quad \text{.........} (4.27)$$

where α^ is the estimate of α and se (α^) is the coefficient of the standard error.

4.4.3.1. 2 The PP test

The ADF test explained above adds the lagged difference terms of the regressand in order to control serial correlation in the error terms, which were assumed to be independently and identically distributed in the Dickey-Fuller test. The unit root test developed by Phillips and Perron (1988) adopts the non-parametric statistical method to allow for serial correlation in the error terms (Gujarati and Porter, 2009: 758).

The model is of the following form:

$$\Delta Y_t = AY_{t-1} + \alpha_t{}'\delta + \varepsilon_t \quad \text{.........} (4.28)$$

Phillips and Perron modified the t-ratio of α in order to control serial correlation.

$$\int = t_\alpha \left(\frac{\gamma 0}{f0}\right)^{1/2} - \frac{T(f0 - \gamma 0)[se(\alpha\hat{})]}{2f0^{1/2}\, S} \quad \text{.........} (4.30)$$

where α ^ is the estimate, t_α the t-ratio of α , se(α^) is the coefficient standard error, s is the standard error, f_0 an estimator of the residual spectrum at frequency 0 and γ_0 a constant estimate of error variance.

4.4.3.2 Bounds test

The first step taken to implement the Bound test, is to specify the optimal lag for the estimated model. This can be done using the available information criteria, such as the Akaike information and others. Here, the optimal lag is decided based on the outcomes of the majority of the available information criteria. The next step is to test for co-integration among the variables of interest, using the F-statistic (Pesaran et al., 2001).

The two empirical models of this study are also estimated in the case of the individual countries and the F-stat is used to test for co-integration. The two estimated empirical models are as follows:

In the closed economy:

$$\Delta Yt = a_{1Y} + \sum_{i=1}^{n} b_{iY}\, \Delta Y_{t-1} + \sum_{i=1}^{n} ci_{Y}\, \Delta S_{t-1} + \sum_{i=1}^{n} d_{iY}\, \Delta K_{t-1} + \beta_{1Y}\, Y_{t-1} + \beta_{2Y} S_{t-1} + \beta_{3Y} K_{t-1} + \varepsilon_{1t} \quad (4.31)$$

$$\Delta St = a_{2S} + \sum_{i=1}^{n} b_{iS}\, \Delta S_{t-1} + \sum_{i=1}^{n} ci_{S}\, \Delta Y_{t-1} + \sum_{i=1}^{n} d_{iS}\, \Delta K_{t-1} + \beta_{1S}\, S_{t-1} + \beta_{2S}\, Y_{t-1} + \beta_{3S}\, K_{t-1} + \varepsilon_{2t} \quad (4.32)$$

$$\Delta Kt = a_{2S} + \sum_{i=1}^{n} b_{iK}\, \Delta K_{t-1} + \sum_{i=1}^{n} ci_{K}\, \Delta Y_{t-1} + \sum_{i=1}^{n} d_{iK}\, \Delta S_{t-1} + \beta_{1K}\, K_{t-1} + \beta_{2K}\, Y_{t-1} + \beta_{3K}\, S_{t-1} + \varepsilon_{2t} \quad (4.33)$$

In the open economy:

$$\Delta Yt = a_{1Y} + \sum_{i=1}^{n} b_{iY}\, \Delta Y_{t-1} + \sum_{i=1}^{n} ci_{Y}\, \Delta S_{t-1} + \sum_{i=1}^{n} d_{iY}\, \Delta K'_{t-1} + \beta_{1Y}\, Y_{t-1} + \beta_{2Y} S_{t-1} + \beta_{3Y} K_{t-1} + \varepsilon_{1t} \quad (4.34)$$

$$\Delta St = a_{2S} + \sum_{i=1}^{n} b_{iS}\, \Delta S_{t-1} + \sum_{i=1}^{n} ci_{S}\, \Delta Y_{t-1} + \sum_{i=1}^{n} d_{iS}\, \Delta K'_{t-1} + \beta_{1S}\, S_{t-1} + \beta_{2S}\, Y_{t-1} + \beta_{3S}\, K'_{t-1} + \varepsilon_{2t} \quad (4.35)$$

$$\Delta K't = a_{2K'} + \sum_{i=1}^{n} b_{iK'}\, \Delta K'_{t-1} + \sum_{i=1}^{n} ci_{K'}\, \Delta Y_{t-1} + \sum_{i=1}^{n} d_{iS}\, S_{t-1} + \beta_{1K'}\, K'_{t-1} + \beta_{2K'}\, Y_{t-1} + \beta_{3K'} S_{t-1} + \varepsilon_{2t} \quad (4.36)$$

Pesaran et al. (2001) set two hypotheses, the null hypothesis (**H_0**) of **no co-integration** and the alternative (**H_1**) of **co-integration** to test for co-integration. From the equations of interest, the hypothesis can be specified as follows:

4.4.3. 2.1 Hypothesis Testing

*In the closed economy***:**

Equation (4.31):

$H_0 = \mho_{1Y} = \mho_{2Y} = \mho_{3Y} = 0$ (there is no co-integration)

$H_1 = \mho_{1Y} \neq \mho_{2Y} \neq \mho_{3Y} \neq 0$ (there is co-integration)

Equation (4.32):

$H_0 = \Theta_{1S} = \Theta_{2S} = \Theta_{3S} = 0$ (there is no co-integration)

$H_1 = \Theta_{1S} \neq \Theta_{2S} \neq \Theta_{3S} \neq 0$ (there is co-integration)

Equation (4.33):

$H_0 = \gamma_{1K} = \gamma_{2K} = \gamma_{3K} = 0$ (there is no co-integration)

$H_1 = \gamma_{1K} \neq \gamma_{2K} \neq {}_{3K}\gamma \neq 0$ (there is co-integration)

In the open economy:

Equation (4.34):

$H_0 = \mho_{1Y} = \mho_{2Y} = \mho_{3Y} = 0$ (there is no co-integration)

$H_1 = \mho_{1Y} \neq \mho_{2Y} \neq \mho_{3Y} \neq 0$ (there is co-integration)

Equation (4.35):

$H_0 = \Theta_{1S} = \Theta_{2S} = \Theta_{3S} = 0$ (there is no co-integration)

$H_1 = \Theta_{1S} \neq \Theta_{2S} \neq \Theta_{3S} \neq 0$ (there is co-integration)

Equation (4.36):

$H_0 = \gamma_{1K'} = \gamma_{2K'} = \gamma_{3K'} = 0$ (there is no co-integration)

$H_1 = \gamma_{1K'} \neq \gamma_{2K'} \neq \gamma_{3K'} \neq 0$ (there is co-integration)

The null hypothesis of no co-integration is rejected or accepted using the computed F-statistic. The F-stat is compared to the critical lower bound, which assumes that all the series are I (0), and to the critical upper bound value, which assumes that all the series are I(1)(see Narayan 2005 table). If the computed F-stat falls below the critical lower bound value, the null hypothesis of no co-integration cannot be rejected. However, if the computed F-stat falls between the critical lower and the critical upper bounds, the result is inconclusive. The null hypothesis of no co-integration can be rejected and the alternative of co-integration accepted only if the computed F-stat exceeds the critical upper bound (Pesaran, et al., 2001).

To check for the stability of the Bounds test results, one may perform the Cusum and Cusum of Squares (Pesaran, et al., 2001). However, since Pesaran et al. (1997) applied the traditional diagnostic tests to check for the validity of the Bounds test results before estimating the Pooled Mean Group, the study also applies the traditional diagnostic tests.

4.4.3.2.2 Diagnostic Tests

To check for the validity of the results derived from the Bounds test, four tests are conducted namely; the LM test for serial correlation and Breusch-Pagan- Godfrey test for heteroscedasticity, the Jaque-Bera test for normality, and the Ramsey test for model mi-specification.

4.4.3.2.2.1 The LM serial correlation test

The LM test is preferred over the Durbin Watson test because it allows for high order ARMA errors and lagged dependent, whereas the Durbin Watson can only be applied to AR(1) (Godfrey, 1994). The null hypothesis of no serial correlation is tested using the t-stat, which is obtained by regressing the residuals on the regressors, and lagged residuals up to order ρ.

Let us assume the regression: $Y_t = X_t\beta+\varepsilon_t$ ………………… …………………………… (4.37)

where β is the estimated coefficient and ε the error term. The residuals of this model are regressed to obtain the t-stat for lag order ρ and if the t-stat is not significant, the null hypothesis cannot be rejected. The null hypothesis is specified as follows:

$$H_0 = \rho_1 = \rho_2 = \ldots = \rho_p = 0$$

The regression for residuals is estimated as e = y- $X\beta$^ ………………………………… (4.38)

4.4.3.2.2.2 The Breusch-Pagan-Godfrey Heteroscedasticity test

In the Breusch-Pagan-Godfrey test for heteroskedaticity, the null hypothesis of no heteroscedasticity is tested against the alternative of heteroscedasticity of $\sigma^2 = \sigma^2 n(z_t'\alpha)$. Z_t represents the vector of independent variable. The Breusch-Pagan-Godfrey test has two steps. First, the squared residuals of the original equation are regressed on $(1,Z_t)$, and then the sum of squares from the new regression is divided by $2\sigma^{\wedge 4}$ to obtain the LM statistic (Gujarati and Porter, 2009: 385).

4.4.3.2.2.3 The Jarque- Bera test for non-normal distribution

The Jarque-Bera test for normality computes the skewness and kurtosis. The t-statistic of the Jarque-Bera test is given by the following equation:

$$JB = n \frac{s^2}{6} + \left(\frac{(k-3)^2}{24}\right) \ldots\ldots (4.39)$$

where n is the sample size, S stands for the skewness and K represents the kurtosis coefficient. For a normally distributed variable, s=0 while K=3. In order to reject the null hypothesis of normality, the p value associated with the t-stat has to be low. However, if the p value of the t-stat is high, the null hypothesis cannot be rejected and the variables are thus said to be normally distributed (Gujarati and Porter, 2009: 132).

After testing for co-integration in individual countries and before estimating the PMG for the long-run relationship, it is prudent to select the appropriate lags of the model in order to correct for possible serial correlation and endogeneity problem (Pesaran, et al., 1997).

4.5 Data and Variables Descriptions

Data for the empirical analysis were obtained from the World Bank online download facility on annual frequency from 1985 to 2015 for ten SADC member states namely Botswana, Congo DR, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland and Zimbabwe.

The rest of the SADC member states were excluded from the empirical analysis due to the unavailability of data for some period of the study. The period 1985-2015 allows for collecting data in ten SADC countries, which represents 75% of the SADC member states. For the individual country analysis, time series are of interest, whereas for the long-run analysis, the study uses panel data. Panel data are preferred over pure time series data or pure sectional data for several reasons. Gujarati and Porter (2009: 572) point out that panel data provides "more informative data, more sample variability and more degree of freedom, which improve the efficiency of econometric estimates". In addition, a panel data analysis can control the impact of omitted variables and detect and measure the unobserved effects, unlike in a pure time series data analysis or in a pure cross-sectional data analysis (Hsiao, 2007).

The variables to be included in the empirical models are defined as follows: real GDP growth is used to measure economic growth, while the gross domestic savings as a percentage of GDP is taken as a proxy of savings, gross fixed capital formation as a percentage of GDP for local capital and foreign direct inflows (FDI) as a percentage of GDP as a proxy of foreign capital. This study sought to include human capital measured as the expenses on education and health (Kabede, 2014). However, due to unavailability of data for some years, this variable was excluded.

4.6 A priori expectations

Based on the various theories of the relationship between savings and economic growth, and on the empirical studies reviewed in Chapter three, savings, domestic/foreign capital and economic growth are expected to be co-integrated for most of the countries. In the long-run, the coefficient of savings and domestic/foreign capital is expected to have positive effects on GDP. The rate of GDP growth is also expected to positively drive the rate of savings. However, the direction of causality between savings and economic growth is expected to run from savings to economic growth or vice –versa or a bi-directional causality between savings and economic growth.

4.7 Summary and conclusion

This chapter explained the research methodology of the study. First, Solow growth model, which assumes that savings affect economic growth via investment in the short-run, and the endogenous models, which assume a long-run relationship between savings and economic growth, were used to estimate the theoretical model of the study. In the theoretical model, it was assumed that economic growth is a function of savings and capital. An increase in savings should lead to an increase in capital and thereby in economic growth. Thus, savings is related to economic growth via capital accumulation.

Solow (1956) and the proponents of the endogenous growth models assume a relationship between savings and economic growth in a closed economy. In the presence of foreign capital inflows, both Solow and endogenous growth models can no longer establish a link between domestic savings and economic growth. This is a shortcoming of the Solow and endogenous growth models with regard to the relationship between savings and economic growth.

To address this challenge, Aghion et al. (2006) produced a model that can be used to investigate a long-run relationship between domestic savings and economic growth in the presence of foreign capital. It is, however, not advisable for a country to excessively rely on foreign capital. Two separate empirical models were, therefore, constructed to investigate the long-run relationship and the causality between savings and economic growth in the SADC region. The first model, which is assumed a closed economy and the second, which is referred to as an open economy. In the first, economic growth is incorporated as the dependent variable, and domestic savings and local capital as the independent variables. Local capital was replaced by foreign capital, in the second model, to capture the impact of savings on economic growth in the SADC region in the open economy.

This study followed the approach adopted by Pesaran, et al. (1997), which consists of running the traditional Bounds test to co-integration on individual countries in the group, and if there is evidence of co-integration in the majority of the countries, one can estimate the long-run using the Dynamic Fixed-Effects Method, the Mean Group estimator and the Pooled Mean Group estimator. Pesaran et al., (1997) suggest the use of the Hausman test or the Likehood test ratio to assess the efficiency of the estimates derived from these respective estimators.

However, in most of the empirical studies, the Hausman test was in favour of the Pooled Mean Group estimator. Thus, it was decided to apply the Pooled Mean Group estimator in this study for the long-run relationship. Further, the error correction term derived from the Pooled Mean Group is used to determine the direction of causality.

In the last section, the nature of the data, the period covered by the empirical analysis were described. Annual Data for the study were collected from the World Bank over the period from 1985-2015 for ten SADC countries, including Botswana, Congo DR, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland and Zimbabwe. The rest of the countries were excluded due to lack of data. Time series data were used for the Bounds test, whereas for the long-run estimation, the data were pooled. Panel data provide more degree of freedom, more reliability and more informative data, which improves the efficiency of the econometric estimates (Gujarati and Porter, 2009). Finally, GDS as a share of GDP, GFCF as a share of GDP, FDI as a share of GDP and real GDP growth were the variables used in the empirical models. The findings of the study are presented and discussed.

CHAPTER FIVE

EMPIRICAL RESULTS

5.1 Introduction

This chapter presents, interprets and discusses the findings of the study. First, the results of the ADF and PP unit root tests are presented and discussed. In both ADF and PP unit root tests, the values of the calculated t-statistic are compared to the critical values of the test at 1, 5 and 10% levels of significance. In the case of the calculated t-stat being greater than the critical values, the null hypothesis unit root cannot be rejected. Thus, the variable is said to be non-stationary. The variable is however said to be stationary if the calculated t-stat is less than the critical values. The unit root tests are performed in levels and in first differences. In order to proceed with the estimation of the Bound model, the series must be purely *I(0)* or *I(1)* or a mixture of *I(0)* and *I(1)* but not *I(2)*.

After unit root tests, the optimal lag is determined based on the outcome of Information criteria. Thereafter, the results of the Bounds test are presented and discussed. Here, in order to reject the null hypothesis of no co-integration and therefore conclude that there is evidence of co-integration among the variables, the calculated F-statistic must be greater than the upper bounds at 5 and 10% levels of significance. However, if the calculated F-stat falls between the two critical bounds, the results are inconclusive. The results of the Bounds tests are presented for the individual SADC member states, and if the null hypothesis of no co-integration is rejected in the majority of the countries, the study presents and discusses the results of the Panel ARDL/Pooled Mean Group estimator.

For the long run relationship between the variables of interest, the study looks at the sings and the t-statistic of the respective coefficients of the independent variables derived from the PMG. If the coefficient of an independent variable has a positive sign and its respective t-stat significant at 1, 5 or 10% level of significance, then the variable is said to be positively related to the dependent variable. In the case of the coefficient of the independent variable being negative and its t-stat significant, the independent variable is said to be having a negative impact on the dependent variable.

However, if the coefficient of the independent variable is statistically insignificant, then the independent variable does not explain the changes in the dependent variable. Lastly, the long-run relationship in the estimated model is confirmed by the negative sign of the coefficient of the error correction term and the significance of its t-statistic. The error term is also used in this study to determine the direction of the causality.

The results of the diagnostic tests namely; the Jarque-Bera test for non-normal distribution, the LM test for serial correlation, the Breusch-Pagan test for heteroscedasticity and the Ramsey test for model misspecification are presented and discussed first before the empirical findings from the PMG. The estimated model passes a diagnostic test if the null hypothesis is not rejected. Like it was the case with Bounds test for co-integration, the estimated model is said to be valid and reliable for a long-run estimation if it passes the diagnostic tests in the majority of the countries.

5.2 Unit root test results

The results of the ADF and PP unit root tests in levels and first differences are reported in Table 5.1 and 5.2 below. In order to reject the null hypothesis, the computed t-stat has to be significant at 5 or 10% level. However, if the t-stat turns out to be greater than the critical t-stat, the null hypothesis cannot be rejected and the variable is said to be non-stationary or *I(1)*. The unit root tests are performed in the general form of trend and intercept.

The ADF and PP tests in levels suggest a mixture of *I(0*) and *I(1)* in all countries under investigation, since the respective computed t-statistics of some of the four variables of interest are found to be significant, whereas the others are insignificant at 5 or 10%. Therefore, the study performed the unit roots in the first difference form to make sure that all the series that are non-stationary at level become stationary after the first difference.

In first differences, the results reveal that all the series are stationary, which implies that the Bounds test approach to co-integration can be performed in all the countries under investigation, since the series are either *I(0)* and *(I)* or purely *I(1)* in levels and *I(0)* in first differences, but not *I(2)*.

Table 5.1: ADF and PP tests results at level

Country	ADF test				PP test			
	GDS	**GFCF**	**FDI**	**GDP**	**GDS**	**GFCF**	**FDI**	**GDP**
Botswana	-3.013806	-2.280397	-3.564800*	-4.494704***	-3.131113	-2.416287	-3.483724*	-4.494704***
Congo DR	-3.837768**	-3.732544**	-5.614981***	-3.355135*	-3.5982202**	-3.698495**	-5.618324***	-2.262020
Madagascar	-3.275513*	-2.573449	-2.533876	-6.333335***	-3.379421*	-1.858792	-2.090553	-6.761211***
Malawi	-3.055557	-2.923185	-5.531122***	-7.547221***	-3.055557	-2.918226	-5.540716***	-7.472253***
Mauritius	-2.763929	-3.209340	-4.570309***	-6.202692***	-2.839781	-3.115859	-4.580800***	-6.202692***
Mozambique	-1.958123	-3.457138*	-3.169267	-5.358694***	-2.115372	-2.206780	-1.896749	-5.359333***
Namibia	-3.773325**	-2.774445	-5.646908***	-5.622100***	-3.554164**	-0.2265	-6.793925***	-8.688998***
South Africa	-2.259180	-2.304234	-5.081647***	-3.040139	-2.028265	-2.441378	-5.048981***	-2.906037
Swaziland	-5.388654***	-3.213453	-6.125485***	-3.371457*	-3.777296**	-3.213453	-6.327792***	-4.242029**
Zimbabwe	-3.297482*	-2.630502	-4.224015**	-3.109720	-3.333112*	-2.710608	-4.222820**	-3.109548

Critical values :

At 1%= -4.296729, 5%=-3.568379 and 10%=-3.218382

Critical notes :

**** 1%, ** 5% and * 10 % level of signifiance*

Table 5.2: ADF and PP tests results in the first difference form

	ADF				PP			
	GDS	**GFCF**	**FDI**	**GDP**	**GDS**	**GFCF**	**FDI**	**GDP**
Botswana	-6.030018***	-4.551036***	-5.298902***	-5.534512***	-8.268323***	-5.030441***	-10.44287***	-10.52449***
Congo DR	-6.225533***	-6.393989***	-8.785824***	-3.522059*	-14.57518***	-15.28749***	-20.85116***	-4.800620***
Madagascar	-7.351628***	-4.190344***	-3.998770**	-6.407924***	-7.633722***	-3.573623*	-4.002107**	-34.43408***
Malawi	-6.977481***	-6.515674***	-8.492708***	-12.71787***	-9.799341***	-7.058981***	-15.49593***	-46.40109***
Mauritius	-6.955724***	-8.169500***	-8.478942***	-5.482918***	-7.031714***	-7.872169***	-9.821253***	-14.63426***
Mozambique	-5.182275***	-4.998493***	-4.186924**	-5.227327***	-5.206668***	-4.930426***	-2.728744*	-10.67654***
Namibia	-6.565298***	-7.165339***	-6.286544***	-8.151018***	-10.10658***	-7.254078***	-10.29856***	-24.14422***
South Africa	-4.223400***	-3.831716**	-6.804429***	-5.211982***	-4.205520***	-3.781591**	-18.60360***	-9.064074***
Swaziland	-2.710282*	-6.492853***	-10.48041***	-7.864120***	-5.735921***	-16.71436***	-31.79413***	-8.532813***
Zimbabwe	-7.672271***	-6.641452***	-7.825106***	-6.585387***	-8.272651***	-6.665047***	-10.98725***	-7.487881***

Critical values :

At 1%= -4.323979, 5%=-3.580623 and 10%=-3.225334

Critical notes :

**** 1%, ** 5% and * 10 % level of signifiance*

5.3 Lag length selection results for Bounds test

Table 5.3 depicts the outcome of the optimal lag selection. The majority of information criteria available for the selection of the optimal lag namely; the Final Prediction Error (FPE), the Akaike Information Criteria (AIK) and the Hannan-Quinn Information Criteria (HQ) report one lag as optimal in seven countries namely; Botswana, Madagascar, Malawi, Mauritius, Mozambique, South Africa and Zimbabwe. In the rest of the countries, the optimal lag is four.

Table 5.3: Lag length selection results

Country	**LR stat**	**FPE**	**AIC**	**SC**	**HQ**
Botswana	1lag = 40.344*	1lag =1473.20*	1lag=15.8022*	1lag=16.3782*	1lag =15.97349*
Congo DR	3lag = 17.062*	4lag =2992.48*	4lag=16.2569*	1lag=17.6257*	4lag=16.8135*
Madagascar	1lag = 64.078*	1lag =1197.55*	1lag=15.5950*	1lag=16.1710*	11ag=15.7663*
Malawi	1lag = 31.043*	1lag =7481.53*	1lag=17.4272*	1lag=18.0032*	1lag=17.5985*
Mauritius	1lag=64.899*	1lag=105.812*	1lag= 13.1687*	1lag=13.7446*	1lag=13.3399*
Mozambique	1lag=39.738*	2lag=19006.58*	2lag= 18.3298*	1lag=18.9879*	1lag =18.5832*
Namibia	1lag=39.738*	1lag= 1192.52*	4lag=15.4341*	4lag=16.1668*	4lag=15.7621*
South Africa	1lag= 110.01*	1lag=1.108557*	1lag=8.610100*	1lag=9.186028*	1lag=8.781354*
Swaziland	4lag= 23.339*	4lag=711.8003*	4lag=14.82085*	1lag=16.3409*	4lag=15.47742*
Zimbabwe	1lag=55.7514*	1lag=47475.77*	1lag=19.27502*	1lag=19.85094*	1lag= 19.4462*

Note: **Lg**= Lag, **LR**= LR test statistic, **FPE**= Final Prediction Error, **AIK**= Akaike Info. Criteria **SC**= Schwarz Info Criteria, **HQ**= Hannan-Quinn Info Criterion.

5.4 Bound test results: *GDP as a dependent variable*

In the case of a closed economy, the results of the Bounds test to co-integration applied to the individual SADC member states, reveal a F-statistic greater than the critical upper bound at both 5 and 10% levels of significance in eight out ten countries. These countries are Botswana, Madagascar, Malawi, Mauritius, Mozambique, Namibia South Africa and Swaziland.

Thus, the null hypothesis of no co-integration is rejected in these respective countries, which implies that there is evidence of co-integration among the variables of interest at both 5 and 10% levels of significance. This finding is in accordance with the a priori expectations of the study and the empirical works by Romm (2005) and Jagadeesh (2015).

In one of the two remaining countries namely; Zimbabwe, the F-stat falls between the critical bounds at 5% level of significance, whereas at 10%, it is greater than the upper bound. This leads to the rejection of the null hypothesis of no co-integration at 10% level of significance in Zimbabwe. Hence, domestic savings, local investment and economic are said to be co-integrated in Zimbabwe at 10% level of significance. In the Congo DR, however, the F-stat falls between the critical bounds at both levels of significance. Therefore, the results are inconclusive. Overall, the results of the Bounds test reveal that there is evidence of co-integration among the variables of interest in nine out of ten countries under study, which is the majority. Thus, the Panel ARDL/Pooled Mean Group can be estimated to test the long-run relationship between savings and economic growth in the SADC.

For the open economy, the Bounds test approach to co-integration reveal that the computed F-statistic is higher than the critical upper bound in nine countries at both 5 and 10% levels of significance. Thus, the null hypothesis of no co-integration is rejected in the case of these respective countries, which confirms the existence of co-integration between domestic savings, foreign direct investment and economic growth. This finding is consistent with the a priori expectations of the study, as well as the study by Baharumshah and Thanoon (2006). The results of the Bounds test approach to co-integration are summarised in Table 5.4. Given that there was co-integration in the majority of the countries under study, the Panel ARDL/Pooled Mean estimator was applied for the SADC region as a whole to obtain the long-run coefficients.

Table 5.4: Bound test results: *GDP as a dependent variable*

Model : GDP= GDS+GFCF		
Country	*F-statistic*	*Co-integration*
Botswana	5.988787	Yes
Congo DR	3.964530	Inconclusive
Madagascar	9.085940	Yes
Malawi	19.44241	Yes
Mauritius	7.875285	Yes
Mozambique	16.58568	Yes
Namibia	8.200691	Yes
South Africa	7.919444	Yes
Swaziland	6.955134	Yes
Zimbabwe	4.286704	Yes
Model: GDP= GDS+ FDI		
Botswana	6.227649	Yes
Congo DR	6.375979	Yes
Madagascar	6.544978	Yes
Malawi	16.63927	Yes
Mauritius	6.517314	Yes
Mozambique	16.73602	Yes
Namibia	8.563424	Yes
South Africa	6.052348	Yes
Swaziland	4.839081	Yes
Zimbabwe	3.427486	No

Critical notes:
*At 5 percent: Lower bound =**3.79** and Upper bound = **4.85***
*At 10 percent: Lower bound =**3.17** and upper bound: **4.14.***

5.4.1 Diagnostic tests results

The results of the diagnostic tests are shown in Table 5.5. According to these results, the estimated two models pass all the diagnostic tests in most of the countries, which is good for the Bounds test results presented above. The results reveal that, in the case of a closed economy, the residuals of the model are normally distributed, not serially correlated and there is absence of heteroscedasticity in all the countries. Furthermore, the model is well specified in nine countries.

In the case of the open economy, the residuals are normally distributed in all the countries; there is no serial correlation and no presence of heteroscedasticity in nine out of ten countries and the model is well specified in eight out ten countries. Like in the previous case of the closed economy, the model passes all the diagnostic tests in the majority of the countries. The estimated models are valid and reliable for a long-run estimation.

Table 5.5: Diagnostic tests results

Model: GDP= GDS+ GFCF								
Country	**Jarque-Bera**		**LM test**		**Breusch –Pagan**		**Ramsey test**	
	J-Bera	*P.value*	*F-stat*	*Prob.*	*F-stat*	*Prob*	*t-stat*	*P-value*
Botswana	1.324208	0.515765	0.119204	0.8882	1.894558	0.1428	1.133559	0.2682
Congo DR	0.743785	0.689428	0.371758	0.8251	1.825828	0.1404	1.292025	0.2127
Madagascar	2.716881	0.257061	0.507835	0.6828	0.579013	0.7973	3.288865	0.0043
Malawi	3.623539	0.163365	0.027551	0.9729	0.931446	0.4922	0.971792	0.3422
Mauritius	0.059924	0.970482	0.459649	0.6369	2.677267	0.0679	1.662690	0.1089
Mozambique	7.315951	0.025785	1.489121	0.2507	0.943330	0.4953	1.157383	0.2608
Namibia	4.325557	0.115005	0.279201	0.7591	0.416444	0.8224	1.252851	0.2234
South Africa	0.245946	0.884288	0.936242	0.4072	0.538147	0.7454	0.246796	0.8073
Swaziland	0.324478	0.850238	0.648697	0.5401	0.778677	0.6645	2.072474	0.0587
Zimbabwe	2.044678	0.359752	1.619652	0.2271	0.478257	0.8565	0.684535	0.5024
Model: GDP= GDS+FDI								
Botswana	1.202477	0.548132	0.582326	0.5666	1.079016	0.3880	0.754867	0.4577
Congo DR	0.627947	0.730538	1.515493	0.2701	0.910228	0.5601	1.364018	0.1957
Madagascar	3.410170	0.181757	0.798597	0.5107	3.409836	0.0165	2.073065	0.0513
Malawi	0.360105	0.835227	1.082455	0.3547	1.619324	0.2090	0.501169	0.6206
Mauritius	0.829676	0.660447	3.855436	0.0404	0.985756	0.4754	1.130898	0.2722
Mozambique	4.794330	0.090976	2.378484	0.1172	1.119277	0.3779	1.578955	0.1286
Namibia	5.296452	0.070777	0.598809	0.5575	0.089868	0.9650	1.559639	0.1314
South Africa	0.290045	0.865003	0.031283	0.9692	1.461138	0.2408	0.349531	0.7300
Swaziland	0.802203	0.669582	5.465041	0.0135	0.106137	0.9998	2.867374	0.0132
Zimbabwe	0.889093	0.641115	1.994541	0.1636	0.556360	0.7598	1.516318	0.1451

5.4.2 Lag length selection for the Panel ARDL/ Pooled Mean Estimator

The outcome of the lag length selection reveals the use of two lag as optimal for Final Prediction Error (FPR) and Akaike Information Criteria (AIK), whereas the Schwarz Information Criteria (SC) and Hannan-Quinn Info Criterion (HQ) suggest one lag. A maximum of four lag was selected for the long-run relationship. The results of the lag length selection are reported in Table 5.6.

Table 5.6: Lag length selection results

Model	**LR**	**FPE**	**AIC**	**SC**	**HQ**
GDP=GDS+ GFCF	**6lg**= *26.50512**	**2lg**=*5788.992**	**2lg**=*17.17729**	**1lg**=*17.35758**	**1lg**=*17.255056**
GDP= GDS+ FDI	**6lg**=*28.39249**	**2lg**=*4207.192**	**2lg**=*16.85813**	**1lg**=*17.08784**	**1lg**=*16.98082**
GDS= GFCF+GDP	**6lg**=*26.50512**	**2lg**=*5788.992**	**2lg**=*17.17729**	**1lg**=*17.35758**	**1lg**=*17.25056**
GDS = FDI+ GDP	**6lg**=*28.39249**	**2lg**=*4207.192**	**2lg**=*16.85813**	**1lg**=*17.08784**	**1lg**=*16.98082**
GFCF=GDS+ GDP	**6lg**=*26.50512**	**2lg**=*4207.192**	**2lg**=*17.17729**	**1lg**=*17.35758**	**1lg**=*17.25056**
FDI= GDS+ GDP	**6lg=***28.39249**	**2lg**=*4207.192**	**2lg**=*16.85813**	**1lg**=*17.08784**	**1lg**=*16.98082**

Note: **Lg**= Lag, **LR**= LR test statistic**, FPE**= Final Prediction Error, **AIK**= Akaike Info. Criteria **SC**= Schwarz Info Criteria, **HQ**= Hannan-Quinn Info Criterion.

5.4.3 The ARDL Panel/ Pooled Mean Group results: *GDP as a dependent variable*

The results of the panel ARDL/ Pooled Mean Group estimator for the SADC suggest that the coefficient of GDS is positive, but statistically insignificant in the closed economy. Unlike in the closed economy, the coefficient of savings becomes highly significant in the open economy. Thus, increases in domestic savings, holding other things as constant, are expected to raise the rate of GDP growth in the open economy.

Furthermore, the findings reveal that the coefficients of GFCF and of FDI are positively related to GDP. However, the coefficient of GFCF is statistically significant at 10% level of significance, whereas FDI is significant at 5%. Thus, both GFCF and FDI can positively drive GDP growth in the SADC region.

The findings with regard to the relationship between savings and economic growth in the open economy are very consistent with the predictions and the empirical findings by Aghion et al. (2006) and Gocer, et al. (2016).

Based on these findings, FDI seems to be the most significant determinant of the relationship between savings and economic growth in the SADC region. The opening of the SADC economy to foreign inflows positively affects the relationship between domestic savings and economic growth, as domestic savings becomes a positive determinant of the GDP in the long run, which was not the case in the closed economy. Thus, there is need for the SADC region to put in place policies that aim at attracting FDI when planning to promote domestic savings in order to achieve high economic growth, since this study has proven empirically that domestic savings, together with FDI, can raise the rate of GDP growth in the SADC region.

Another interesting fact about the findings is that the domestic savings is found to be positively related to GDP over the short run in the case of the closed economy, which is consistent with the predictions of Solow (1956). Thus, if the SADC region focuses on promoting domestic savings with local investment in order to achieve high GDP growth rates, savings will only have short-run effects on economic growth, which is not desirable. In most of the cases, long-run effects are more important. However, one may argue that these findings are not consistent with the predictions of the endogenous “AK” growth model that high rates of savings imply high GDP growth rates in the closed economy over the long-run. The endogenous “AK” growth model included both human and physical capital to measure capital, which is not the case in this study, where human capital was excluded due to lack of data. Perhaps including human capital in the model would change the findings.

Lastly, the error correction term (ECT_{t-1}) has the expected negative sign and is statistically significant. The negative sign and the significance of the ECT_{t-1} confirm the long-run relationship between domestic savings, local investment/FDI and economic growth in the SADC region. Second, it suggests that the disequilibrium of the short-run dynamics is adjusted when the model moves towards the long-run. Finally, the negative sign and the significance of the $ECTt_{-1}$ implies that there is evidence of a long-run causality from GDS and GFCF to GDP in the closed economy, and from GDS and FDI to GDP in the open economy. The results of the Panel ARDL/ Pooled Mean Group are reported in Table 5.7.

Table 5.7: Panel ARDL/ Pooled Mean Group Results: *GDP as a dependent variable*

Long run estimates : GDP as a dependent variable (Model 1,1,1)			
Independent var.	*Coefficient*	*t-statistic*	*P. value*
GDS	0.063488	1.607622	0.1091
GFCF	0.072935	1.888705*	0.0600
Short run estimates			
(GDS)	0.313851	4.105595***	0.0001
(GFCF)	-0.076808	-0.543359	0.5873
ECT_{t-1}	-0.788059	-7.177861***	0.0000
Long run estimates : GDP as a dependent variable (Model 3,4,4)			
GDS	0.083199	3.599302***	0.0004
FDI	0.101631	2.028738**	0.0440
Short run estimates			
(GDS)	0.393817	3.014646**	0.0029
GDS (-1)	0.118425	1.129915	0.2600
GDS (-2)	0.124588	1.345140	0.1802
GDS (-3)	0.174170	1.947940**	0.0529
(FDI)	0.058792	0.507544	0.6124
FDI (-1)	0.044233	0.383530	0.7018
FDI (-2)	-0.179198	-2.097718**	0.0373
FDI (-3)	-0.176703	-1.466206	0.1443
ECT_{t-1}	-1.119575	-5.545907***	0.0000

5.5 Bound test results: *GDS as a dependent variable*

Following the discussion in chapter four, GDS is incorporated as the dependent variable in the second model estimated to test for co-integration among the variables of interest. The findings of the Bounds test, presented in Table 5.8, indicate that there is evidence of co-integration between the variables of interest in six out of ten countries; namely Congo DR, Madagascar, Malawi, Namibia, South Africa and Swaziland. In these respective countries, the calculated F-statistic exceeds the critical upper bound in the closed as well as in the open economy. Since six countries out of ten represents the majority, the Panel ARDL/ Pooled Mean Group is therefore estimated to get the long-run estimates.

Table 5.8: ARDL test results: *GDS as a dependent variable*

Model: GDS = GFCF +GDP		
Country	*F-statistic*	*Co-integration*
Botswana	2.057838	No
Congo DR	13.91163	Yes
Madagascar	6.054847	Yes
Malawi	3.723461	No
Mauritius	0.163765	No
Mozambique	5.178186	Yes
Namibia	7.18040	Yes
South Africa	5.451638	Yes
Swaziland	4.983075	Yes
Zimbabwe	0.460362	No
Model: GDS= GDS+FDI		
Botswana	1.651612	No
Congo DR	5.196023	Yes
Madagascar	6.916239	Yes
Malawi	2.953879	No
Mauritius	0.500510	No
Mozambique	5.233256	Yes
Namibia	6.024438	Yes
South Africa	5.569018	Yes
Swaziland	9.886753	Yes
Zimbabwe	0.891561	No

Critical notes:
*At 5 percent: Lower bound =**3.79** and Upper bound = **4.85***
*At 10 percent: Lower bound =**3.17** and upper bound: **4.14.***

5.5.1 Diagnostic tests results

Like in the previous model, where GDP is estimated as the dependent variable, the diagnostic tests, namely the Ramsey, the Jarque-Bera, the LM and the Breusch-Pagan fail to reject the null hypothesis in nine out of ten countries, which implies that the two estimated models are valid and reliable for analysis and policy implications.

Table 5.9: Diagnostic tests results

Model: GDS=GFCF+GDP								
Country	**Jarque-Bera test**		**LM test**		**Breusch-Pagan**		**Ramsey test**	
	F-stat	*Prob.*	*F-stat*	*Prob.*	*F-stat*	*Prob.*	*t-stat*	*Prob.*
Botswana	4.179924	0.123692	0.338736	0.7162	0.325682	0.8581	1.519943	0.1416
Congo DR	0.649262	0.722794	0.826005	0.5355	0.528622	0.8445	0.249325	0.8067
Madagascar	2.757429	0.251902	0.360250	0.7825	0.767594	0.6207	0.380825	0.7076
Malawi	1.468082	0.479966	0.200693	0.8195	0.143513	0.9329	0.591362	0.5596
Mauritius	0.226276	0.893027	0.399364	0.6751	1.111296	0.3624	0.102983	0.9188
Mozambique	1.287802	0.525239	1.459869	0.2549	0.411011	0.8362	0.167386	0.8686
Namibia	1.263371	0.531695	0.982975	0.3924	0.812333	0.5871	1.640329	0.1166
South Africa	1.941443	0.378810	0.245610	0.7842	0.342519	0.7948	1.811801	0.0820
Swaziland	0.465435	0.792377	3.541701	0.0449	1.484144	0.2420	1.592156	0.1239
Zimbabwe	0.272699	0.872538	0.372135	0.6933	1.551035	0.2182	0.149811	0.8822
Model: GDS=FDI+GDP								
Botswana	3.354750	0.186864	0.423799	0.6600	0.178667	0.9679	0.413073	0.6836
Congo DR	9.014460	0.011029	0.432446	0.7835	0.651130	0.6636	0.357978	0.7238
Madagascar	1.759657	0.414854	0.511836	0.6792	0.694609	0.6567	1.435747	0.1665
Malawi	1.490895	0.474522	0.576643	0.5704	0.365261	0.8670	0.795423	0.4349
Mauritius	0.748918	0.687661	0.311793	0.7351	1.288685	0.2992	0.096993	0.9235
Mozambique	1.032261	0.596826	1.444486	0.2584	0.716061	0.6178	0.163063	0.8720
Namibia	3.872652	0.144233	0.139499	0.8707	0.840882	0.5664	1.248102	0.2264
South Africa	0.533502	0.765864	0.274005	0.7628	0.726661	0.5821	1.461342	0.1569
Swaziland	0.740690	0.690496	3.162196	0.0736	0.429878	0.9108	1.138866	0.2726
Zimbabwe	0.627441	0.730723	2.313091	0.1236	3.147928	0.0261	0.281394	0.7810

5.5.2 Panel ARDL/Pooled Mean Group Results: *GDS as dependent variable*

The Panel ARDL/Pooled Mean Group results reported in Table 5.10 suggest that the coefficients of GDP are positive and highly significant in the long-run in both open and closed economies. This implies that GDP positively drives the rate of domestic savings in the case of both open and closed economies. Thus, high GDP growth implies high domestic savings in the long run, holding other things constant. In the short-run, the coefficient of GDP is highly significant in the closed economy but insignificant in the open economy. Only the coefficient of FDI has positive and significant impact on domestic savings.

The error correction term ($ECT_{t-1)}$ is also negative and significant in both models, which confirms the long-run relationship between the variables of interest. However, the speed of adjustment is very slow, at less than 30%, in the closed and about 35% in the open economy. The negative sign and the significance of the ECT_{t-1} also implies that the disequilibrium of the short-run is corrected every year when the model tends towards the long run equilibrium, by only 30% in the closed economy and by 35% in the open economy. In terms of causality, the ECT_{t-1} indicates that there is a long causality running from GFCF and GDP to GDS in the closed economy, and from FDI and GDP to GDS in the open economy.

Table 5.10: Panel ARDL/ Pooled Mean Group results: *GDS as dependent variable*

Long run estimates : GDS as a dependent variable (Model 1,1,1)			
Independent variables	*Coefficient*	*t-statistic*	*P. value*
GFCF	-0.030906	-0.294848	0.7683
GDP	0.648379	2.954120**	0.0034
Short run estimates			
(GFCF)	0.199219	1.555292	0.1211
(GDP)	0.106864	1.967930**	0.0501
ECT_{t-1}	-0.292182	-0.294848***	0.0000
Long run estimates: GDS as a dependent variable (Model 1,1,1)			
FDI	-0.204752	-4.025677	0.1968
GDP	0.698768	4.025677***	0.0001
Short run estimates			
(FDI)	0.154067	3.600486***	0.0004
(GDP)	0.053260	0.837196	0.4032
ECT_{t-1}	-0.347317	-4.843301***	0.0000

5.6 Bound test results: *GFCF and FDI as dependent variables*

The results of the Bounds test to co-integration contained in Table 5.11 suggest that in most of the countries, the null hypothesis of no co-integration cannot be rejected when GFCF is the dependent variable. The F-stat is found to be above the upper bound in only three out ten countries. Thus, the long run relationship cannot be estimated, since there is no evidence of co-integration in the majority of the countries in the group. On the other hand, when taking FDI as the dependent variable, the null hypothesis is rejected in six out of ten countries, which is the majority of the countries and a clear sign that there is co-integration in the group. Hence, the Panel ARDL/ Pooled Mean Group can be estimated.

Table 5.11: ARDL results: *GFCF and FDI as dependent variables*

Model: GFCF = GDS+GDP		
Country	*F-statistic*	*Co-integration*
Botswana	3.085866	No
Congo DR	4.943937	Yes
Madagascar	1.592585	No
Malawi	2.606405	No
Mauritius	6.733324	Yes
Mozambique	1.274162	No
Namibia	0.268704	No
South Africa	12.90438	Yes
Swaziland	3.340704	Inconclusive
Zimbabwe	1.970235	No
Model: FDI= GDS+GDP		
Botswana	5.806553	Yes
Congo DR	9.081108	Yes
Madagascar	4.064966	Yes
Malawi	0.440578	No
Mauritius	8.116832	Yes
Mozambique	1.365365	No
Namibia	2.241579	No
South Africa	12.34995	Yes
Swaziland	3.190883	Inconclusive
Zimbabwe	6.442095	Yes

Critical notes:
*At 5 percent: Lower bound =**3.79** and Upper bound = **4.85***
*At 10 percent: Lower bound =**3.17** and upper bound: **4.14.***

5.6.1 Diagnostic tests results

In the model where GFCF is the dependent variable, the findings reveal that there is no model misspecification in nine countries, no serial correlation and no heteroskedasticity in all the countries. The residuals are also normally distributed in eight countries. When FDI is taken as the dependent variable however things seem different. The model rejects the null hypothesis of normal distribution in only four out of ten countries, which is less than the majority, whereas in the rest of the diagnostic tests, the null hypothesis is not rejected in the majority of the countries. Thus, the residuals of the model are not normally distributed. However, Wooldridge (2012) argues that if the normality assumption is not valid in a model, while the other assumptions are, the coefficients of the model are still consistent. Hence, the estimates of both models are valid and consistent. The findings are reported in Table 5.12.

Table 5.12: Diagnostic tests results

Model: GFCF= GDS+ GDP								
Country	**Jarque-Bera test**		**LM test**		**Breusch-Pegan test**		**Ramsey test**	
	J.B	*Prob.*	*F-stat*	*Prob.*	*F-stat*	*Prob.*	*t-stat*	*Prob.*
Botswana	0.811448	0.666494	2.094460	0.1481	0.173502	0.9698	0.928538	0.3632
Congo DR	0.832544	0.659501	1.680267	0.2067	0.437684	0.8663	0.240620	0.8126
Madagascar	2.747494	0.253157	1.177596	0.3267	5.204177	0.0037	2.079892	0.0489
Malawi	0.498046	0.779562	0.604431	0.5561	2.168817	0.0856	4.330793	0.0003
Mauritius	0.961564	0.618300	2.085973	0.1532	0.709184	0.6807	0.420686	0.6787
Mozambique	1.030369	0.597390	2.039677	0.1520	1.271507	0.3048	0.482446	0.6337
Namibia	0.362481	0.834235	0.334989	0.7189	1.568573	0.2148	1.139942	0.2660
South Africa	0.997367	0.607330	0.188511	0.8296	1.485508	0.2291	1.030934	0.3143
Swaziland	10.70071	0.004746	0.116297	0.8913	0.548478	0.8542	0.251870	0.8054
Zimbabwe	29.01202	0.000001	0.069655	0.9329	1.103300	0.3656	0.633357	0.5323
Model: FDI = GDS+ GDP								
Botswana	25.16301	0.000003	0.032142	0.9684	0.351254	0.9015	0.566514	0.5770
Congo DR	0.128241	0.937892	1.299595	0.3146	1.026611	0.4449	3.353414	0.0035
Madagascar	1.131095	0.568049	0.298482	0.8260	3.542302	0.0140	0.339304	0.7379
Malawi	20.57402	0.000034	5.290488	0.0133	0.924011	0.4664	0.375580	0.7107
Mauritius	9.701310	0.007823	0.035474	0.9652	1.670696	0.1882	1.072018	0.2944
Mozambique	23.78775	0.000007	0.584612	0.5657	1.661776	0.1916	2.149035	0.0424
Namibia	3.670363	0.159585	3.827689	0.0361	0.327486	0.8055	1.990665	0.0576
South Africa	40.55094	0.000000	0.318647	0.7304	0.502914	0.7710	2.140514	0.0431
Swaziland	2.360216	0.307246	0.184834	0.8328	0.259112	0.9722	0.872388	0.3939
Zimbabwe	230.3054	0.000000	0.037785	0.9630	0.639958	0.6715	0.736396	0.4689

5.6.2 Panel ARDL/ Pooled Mean Group results: *GFCF and FDI as dependent variables*

The results of the Panel ARDL/ Pooled Mean Group summarised in Table 5.13 reveal that, in the long-run, the coefficient of GDP is positive and significant, whereas the coefficient of GDS is negatively associated with FDI. Thus, high rates of GDP are expected to attract more FDI, whereas increases in the domestic savings reduce the amount of FDI. In the short-run, however, the rate of savings is found to be positively linked to FDI, whereas the coefficient of GDP is insignificant. Hence, the assumptions of Aghion et al. (2006) that high savings rates attract FDI over the short-run hold in the case of the SADC region.

In the case of the closed economy, the rate of savings is insignificant, whereas the first lag of GDP is negative and statistically significant, while the second and third lags are insignificant. These findings imply that changes in domestic savings over the short-run do not explain changes in local investment, whereas GDP growth leads to a decline in domestic investment during the first year in the short-run and after that, it becomes insignificant in the following two years.

The speed of adjustment, on the other hand, has the expected negative sign and is statistically significant in the case of the open economy, which confirms the long-run equilibrium among the variables of interest when FDI is the dependent variable of the model. However, in the model where GFCF turns to be the dependent variable, the speed of adjustment is negative but insignificant. Thus, there is no long-run relationship when GFCF is the dependent variable, which is in accordance with the findings of the Bounds test performed in the individual countries. When GFCF was estimated as the dependent variable, there was co-integration in only three out of ten countries.

Table 5.13: Pooled Mean Group results: *GFCF and FDI as dependent variables*

Long run estimates : GFCF as a dependent variable (Model 4,3,3)			
Independent var.	Coefficient	t-statistic	P. value
GDS	-	-	-
GDP	-	-	-
Short run estimates			
(GDS)	0.133458	1.255644	0.2107
GDS (-1)	-0.035660	-0.450642	0.6527
GDS (-2)	0.084833	1.118127	0.2649
(GDP)	-0.408201	-2.853995**	0.0048
GDP (-1)	-0.153509	-1.322197	0.1876
GDP (-2)	-0.064935	-0.877554	0.3812
ECT_{t-1}	-0.051581	-1.614573	0.1080
Long run estimates : FDI as a dependent variable (Model 2,1,1)			
GDS	-0.076786	-2.735235**	0.0067
GDP	0.120992	2.457688**	0.0146
Short run estimates			
(GDS)	0.085661	2.141077**	0.0332
(GDP)	-0.001619	-0.032743	0.9739
ECT_{t-1}	-0.454354	-5.409506***	0.0000

5.7 Summary and conclusion

The aim of this chapter was to present and interpret the various findings of the study. First, the ADF and the PP unit root tests in levels suggested that there was a mixture of results. However, all the series were stationary in the first differences. The Bounds test revealed that there was co-integration in nine out ten countries when the model was estimated with GDP as the dependent variable, in six countries when GDS was the dependent variable and in only four when the GFCF was the dependent variable. The evidence of co-integration in more than five countries out of ten suggested that there was co-integration in the group, which implied that the estimation of a long-run relationship using the Panel ARDL/Pooled Mean Group estimator could be carried out.

The main findings of the different Panel ARDL/Pooled Mean Group estimators are that domestic savings is positively related to GDP in the long-run in the case of the open economy. This finding also suggests that in the long-run, domestic savings is more likely to explain changes in the GDP in the case of the open economy, where there are foreign inflows. In the long run, FDI positively drives GDP, whereas in the short run, it raises the level of domestic savings. The domestic savings are found to be positively related to FDI in the short-run. Therefore, one way of attracting FDI in the SADC is to implement policies that increase the level of domestic savings.

The speed of adjustment, which was used in this study to determine the direction of causality between savings and economic growth in the long-run, suggested a bi-directional causality between savings and economic growth. However, the speed of adjustment was much slower when the model was estimated with GDS as the dependent variable but faster when the model was estimated with GDP as the dependent variable. Therefore, the SADC region should first implement policies that promote domestic savings and FDI to achieve high GDP growth. However, since there is also evidence of causality from FDI and GDP to GDS, the alternative policy for the SADC is to attract FDI, which in turn will increase GDP. High rates of FDI and GDP growth will increase the level of domestic savings in the SADC. It might take some time before the SADC region experiences an increase in domestic savings, since the speed of adjustment is very slow. Drawing on these findings, policy implications and areas for future research are provided in the next chapter.

CHAPTER SIX

CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

This chapter gives a summary of the main findings of the study with regard to the research question formulated in chapter one and the three objectives of the study. Thereafter policy implications will be listed as well as suggestions for further research.

The SADC region has set macroeconomics targets, such as to increase simultaneously the level of domestic savings and domestic investment as a share of GDP to between 25 and 30% for period 2008-2018 in order to achieve high GDP growth rates. High GDP rates are believed, in most societies, to be the source of better living standards, poverty eradication and many more other benefits. However, when looking at the domestic savings and investment rates in the SADC region, the trends showed that many of the SADC individual member states are still far from achieving these targets. At the same time, countries that recorded high domestic savings rates, such as Botswana achieved low GDP growth relative to countries, such as Congo DR and Zimbabwe that recoded low domestic savings rates.

This study sought to empirically investigate the causal relationship between savings and economic growth in the SADC region, by answering two main questions; namely is there a long-run relationship and a causality between savings and economic growth in the SADC region. Drawing on these two questions, three objectives of the study were formulated. First, to test the long-run relationship between savings and economic growth in the SADC. Second, to determine the direction of causality and finally, based on the empirical findings, to discuss policy implications and possible solutions.

6.2 Summary

The study first reviewed the theories of the relationship between savings and economic growth. The theories included the Harrod-Domar growth model, the Solow growth model and the endogenous growth models. In the Harrod-Domar (1946) growth model, all savings are transferred into investment. Thus, savings is equal to the stock of capital or investment. This implies that high savings lead to an increase in stock of capital, which in turn bring about economic growth.

Unlike the Harrod-Domar growth model, the Solow (1956) growth model viewed savings as an exogenous factor of production. Therefore, an increase in savings can only have positive impact on economic growth over the short-run, through an increase in capital per head. In the endogenous growth models, savings is an endogenous factor of production and capital refers to both human and physical capital. Thus, high savings permanently increase the national output.

The Harrod-Domar, the Solow and the endogenous growth models are closed economy models. In the presence of foreign capital, these models cannot explain the relationship between savings and economic growth. Hence, to understand the relationship between savings and economic growth in the presence of foreign capital inflows, the Aghion-Comin-Howitt (2006) hypothesis was also reviewed. The Aghion-Comin-Howitt (2006) hypothesis assumes that economic growth comes from technological progress. In developing countries where technology is not advanced, there is a need to attract foreign technology. This calls for the accumulation of domestic savings so that the country can import technology, which in turn brings about economic growth. These models were used to test the relationship between savings and economic growth, and the findings suggested the existence of a long-run relationship between the two, whereas the causality was found to be running from savings to economic growth or vice-versa.

Drawing on the theories described above and on the previous empirical studies, two separate empirical models were estimated to test the relationship between savings and economic growth in the SADC region. In the first model, which was referred to as a closed economy model, GDP was regressed as the dependent variable, whereas domestic savings and local capital were the independent variables. Local capital was replaced, in the second model, by foreign capital to construct a model of an open economy. For the empirical analysis, the study performed the ARDL approach to co-integration to individual countries and the Panel ADRL/Pooled Mean Group Estimator for the long-run relationship (Pesaran et al., 1997)

The data for these respective variables were obtained from the World Bank Indicators for ten SADC countries over the period 1985-2015. Five SADC countries namely; Angola, Lesotho, Seychelles, Tanzania and Zambia were excluded from the empirical analysis due to the lack of data for some years over the chosen period of study. The data were then pooled to form a panel. Panel data analysis is more robust than the time series or the cross-section data analysis for several reasons. Panel data improves “the efficiency of the econometric estimates by providing more degree of freedom, more sample variability and less collinearity among variables” (Gujarati and Porter, 2009:22). Furthermore, in panel data analysis, the impact of the omitted variables can be controlled and also the unobserved effects can be detected and measured, unlike in the pure time series or pure cross-sectional data analysis (Hsiao, 2007).

6.3 Findings

The Bounds test approach to co-integration revealed co-integration among the variables of interest in nine countries when the model was specified with the GDP as the dependent variable and in six countries when GDS and FDI were, in turn, estimated as the dependent variables. Six out of ten countries suggested that there was evidence of co-integration in the group, thus the study proceeded with an estimation of the long-run relationship.

In the long-run, domestic savings was found to be positively related to GDP in the case of the open economy, whereas in the closed economy, savings cannot explain changes in GDP growth. GDP growth, on the other hand, was found to be positively related to savings in both the closed as well as the open economy. In the short-run, domestic savings is positively linked to GDP growth in the closed economy and to FDI in the open economy. FDI is also found to be positively driving the domestic savings.

In terms of causality, the negative sign and the significance of the speed of adjustment confirmed a bi-directional causality between domestic savings and economic growth in the SADC region. However, the speed of adjustment was found to be much slower when GDS was regressed as the dependent variable but faster when GDP was estimated as the dependent variable. This implies that the model where GDP was the dependent variable adjusts quicker when it tends towards the long-run than the model where GDS was the dependent variable.

With regards to the two main questions of the study, the findings reveal that savings and economic growth are positively related over the long-run in the open economy. When GDS turns to be the dependent variable, savings and economic growth are related in the closed as well as in the open economies. However, the speed of adjustment, which was used to assess the long-run relationship between the variables of interest, was very slow when GDS was the dependent variable but faster when GDP was the dependent variable.

This makes the results where GDP was the dependent variable more reliable for the best policy implications. Thus, it was concluded that there is a long-run-relationship between savings and economic growth in the open economy.

The speed of adjustment was also used to determine the direction of causality between savings and economic growth. The results suggested a bi-directional causality between savings and economic growth in the SADC region. The speed of adjustment was, however, faster in the model where GDP was the dependent variable, but slower in the model where GDS was the dependent variable. Thus, the causality from GDS and FDI to GDP is stronger and reliable for the best policy implications. Drawing on these findings, policy implications are provided in the next section.

6.4 Policy Implications

The findings presented in the previous section suggest that FDI is a positive factor that assures a long-run relationship between savings and economic growth in the SADC. Thus, the SADC member states should design policies that aim at increasing domestic savings and attracting FDI at the same time in order to achieve high GDP growth, highly needed in the region to improve the standards of living of the citizens.

To increase the amount of savings over the long-run in the region, there is a need to look at the incentives for savings, such as the improvement of the banking sector in most of the low-income countries namely; Congo DR, Madagascar, Mozambique and Zimbabwe. This will allow many adults to have access to banking services. Increasing domestic savings can also be done through tax breaks on income, as income was empirically investigated in the second chapter and found to be a good driver of household savings among SADC countries. The SADC can rely on FDI to increase the amount of domestic savings as these two variables are found to be mutually related over the short-run.

On the other hand, given the low savings rates in most of the SADC countries, attracting FDI would lead to GDP growth in the SADC, since FDI as an independent variable was found to be positively related to GDP. High rates of FDI and GDP growth will in turn increase the level of domestic savings. However, this might take some time, since the speed of adjustment, which confirmed the causality from FDI and GDP to GDS, was very slow.

6.5 Suggestions for further research

The policy implications, such as to increase domestic savings or attract FDI in the SADC region, require a deep analysis of the main determinants of domestic savings and FDI at both country level as well as at regional level. Therefore, for further research, it would be of great interest to investigate the determinants of savings and of FDI in SADC countries.

The findings of the study were consistent with the predictions of both the Solow (1956) growth model and the Aghion, et al. (2006) hypothesis. However, the findings rejected the implications of the endogenous growth models, since there was no evidence of a positive long-run relationship between savings and economic growth in the closed economy. In this study, local capital was measured by physical capital alone due the unavailability of data for human capital. Perhaps adding human capital to the physical capital in future research as assumed by the proponents of the endogenous growth models, would lead to a positive impact of savings on economic growth in the long-run in the case of a closed economy.

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APPENDIX

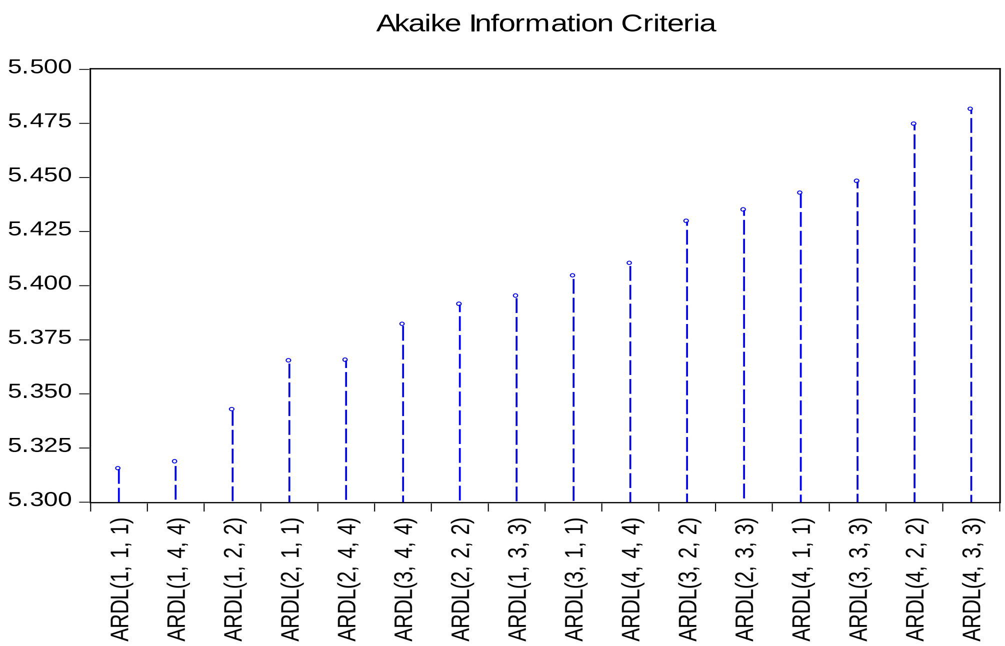
Model: GDP = GDS+ GFCF

Dependent Variable: D(GDP)
Method: ARDL
Date: 12/18/17 Time: 14:00
Sample: 1986 2015
Included observations: 300
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDS GFCF
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(1, 1, 1)
Note: final equation sample is larger than selection sample

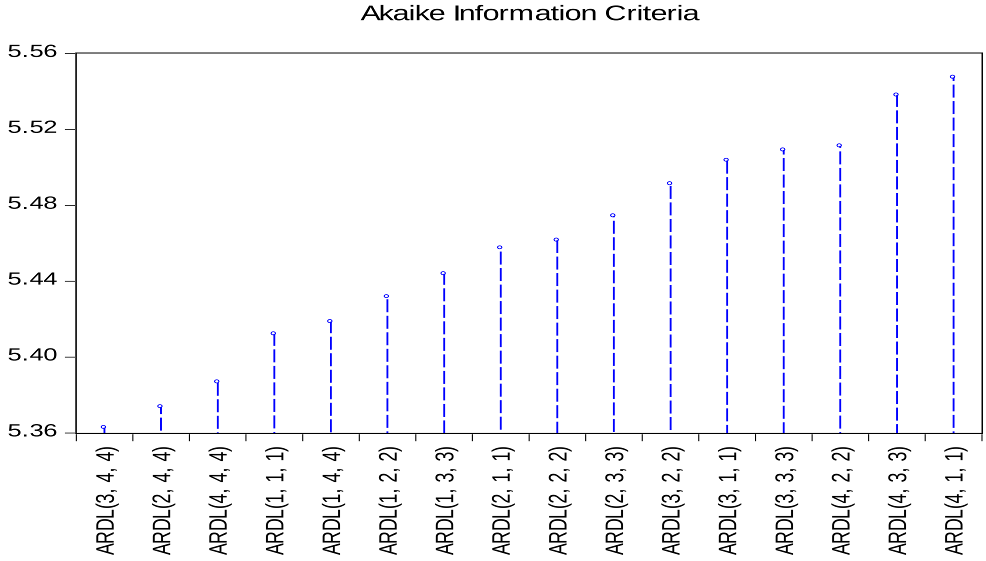
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
GDS	0.063488	0.039492	1.607622	0.1091
GFCF	0.072935	0.038617	1.888705	0.0600
		Short Run Equation		
COINTEQ01	-0.788059	0.109790	-7.177861	0.0000
D(GDS)	0.313851	0.076445	4.105595	0.0001
D(GFCF)	-0.076808	0.141357	-0.543359	0.5873
C	1.696137	0.593089	2.859835	0.0046

Mean dependent var	-0.002275	S.D. dependent var	5.753379
S.E. of regression	3.668753	Akaike info criterion	5.172088
Sum squared resid	3607.213	Schwarz criterion	5.678334
Log likelihood	-759.6737	Hannan-Quinn criter.	5.374464

*Note: p-values and any subsequent tests do not account for model selection.



Model: GDP= GDS+ FDI



Dependent Variable: D(GDP)
Method: ARDL
Date: 12/18/17 Time: 14:03
Sample: 1989 2015
Included observations: 270
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDS FDI
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(3, 4, 4)
Note: final equation sample is larger than selection sample

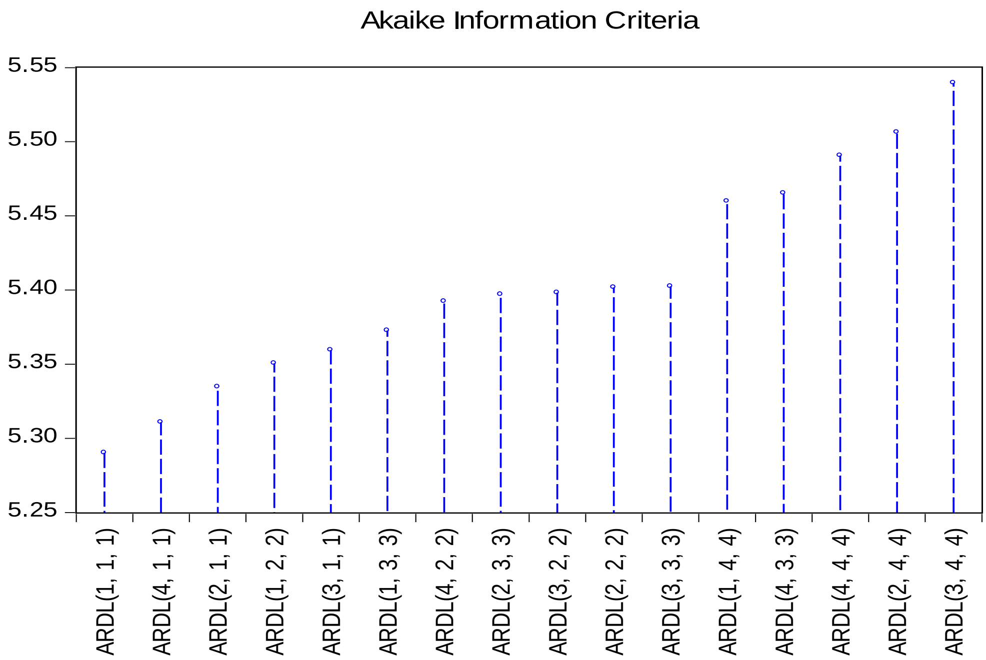
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
GDS	0.075542	0.028299	2.669429	0.0083
FDI	0.128122	0.054294	2.359775	0.0193
Short Run Equation				
COINTEQ01	-1.048850	0.180098	-5.823784	0.0000
D(GDP(-1))	0.197779	0.122351	1.616486	0.1077
D(GDP(-2))	0.023178	0.077074	0.300723	0.7640
D(GDS)	0.393817	0.130635	3.014646	0.0029
D(GDS(-1))	0.118425	0.104809	1.129915	0.2600
D(GDS(-2))	0.124588	0.092621	1.345140	0.1802
D(GDS(-3))	0.174170	0.089412	1.947940	0.0529
D(FDI)	0.058792	0.115837	0.507544	0.6124
D(FDI(-1))	0.044233	0.115331	0.383530	0.7018
D(FDI(-2))	-0.179198	0.085425	-2.097718	0.0373
D(FDI(-3))	-0.176703	0.120517	-1.466206	0.1443
C	3.442915	1.114399	3.089482	0.0023

Mean dependent var	-0.111283	S.D. dependent var	5.835360
S.E. of regression	3.333560	Akaike info criterion	4.670778
Sum squared resid	2089.173	Schwarz criterion	6.141300
Log likelihood	-601.9705	Hannan-Quinn criter.	5.258630

Table 1 :Cross-section Estimates

Model: GDP= GDS+GFCF			
Country	*Coefficient*	*t-statistic*	*Long-run relationship*
Botswana	-0.674164	-25.97682****	Yes
Congo DR	-	-	No
Madagascar	-1.287038	-78.87836***	Yes
Malawi	-1.056916	-63.28272***	Yes
Mauritius	-1.034532	-32.40181***	Yes
Mozambique	-1.029091	-33.42181***	Yes
Namibia	-0.928978	-29.63287***	Yes
South Africa	-0.730027	-14.14952***	Yes
Swaziland	-0.615687	-30.93866***	Yes
Zimbabwe	-0.375046	-22.5949***	Yes
Model: GDP= GDS+ FDI			
Botswana	-0.943903	-11.77494**	Yes
Congo DR	-0.131622	-18.69305***	Yes
Madagascar	-2.043873	-12.45851**	Yes
Malawi	-1.282961	-9.279836**	Yes
Mauritius	-0.731478	-24.79811***	Yes
Mozambique	-1.810746	-14.84862***	Yes
Namibia	-1.301435	-13.08960**	Yes
South Africa	-0.701919	-10.43639**	Yes
Swaziland	-0.796727	-26.49893***	Yes
Zimbabwe	-	-	No

Model: GDS= GFCF + GDP



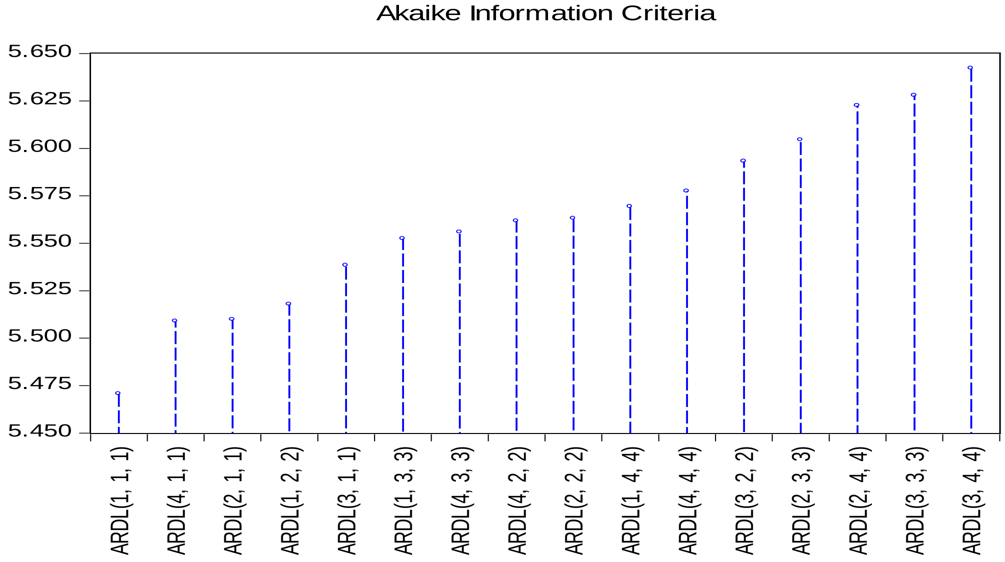
Dependent Variable: D(GDS)
Method: ARDL
Date: 12/18/17 Time: 14:07
Sample: 1986 2015
Included observations: 300
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GFCF GDP
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
GFCF	-0.030906	0.104819	-0.294848	0.7683
GDP	0.648379	0.219483	2.954120	0.0034
	Short Run Equation			
COINTEQ01	-0.292182	0.066663	-4.382972	0.0000
D(GFCF)	0.199219	0.128091	1.555292	0.1211
D(GDP)	0.106864	0.054303	1.967930	0.0501
C	2.580935	0.996366	2.590349	0.0101

Mean dependent var	-0.116652	S.D. dependent var	4.917449
S.E. of regression	3.791270	Akaike info criterion	5.164105
Sum squared resid	3852.159	Schwarz criterion	5.670350
Log likelihood	-758.4363	Hannan-Quinn criter.	5.366480

*Note: p-values and any subsequent tests do not account for model selection.

Model: GDS= GDP+ FDI



Dependent Variable: D(GDS)
Method: ARDL
Date: 01/03/18 Time: 15:48
Sample: 1986 2015
Included observations: 300
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDP FDI
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
GDP	0.698768	0.173578	4.025677	0.0001
FDI	-0.204752	0.158255	-1.293809	0.1968
		Short Run Equation		
COINTEQ01	-0.347317	0.071711	-4.843301	0.0000
D(GDP)	0.053260	0.063617	0.837196	0.4032
D(FDI)	0.154067	0.042791	3.600486	0.0004
C	3.374817	1.247005	2.706338	0.0072

Mean dependent var	-0.116652	S.D. dependent var	4.917449
S.E. of regression	4.115746	Akaike info criterion	5.316781
Sum squared resid	4539.749	Schwarz criterion	5.823026
Log likelihood	-782.1010	Hannan-Quinn criter.	5.519156

*Note: p-values and any subsequent tests do not account for model selection.

Table 2: Cross-section estimates

Model: GDS= GDP+GFCF			
Country	*Coefficient*	*t-statistic*	*Long-run relationship*
Botswana	-	-	-
Congo DR	-0.271517	-16.08622***	Yes
Madagascar	-0.478287	-30.63130***	Yes
Malawi	-	-	-
Mauritius	-	-	-
Mozambique	-0.133089	-18.72341**	Yes
Namibia	-0.576707	-23.44624***	Yes
South Africa	-0.086921	-48.45329***	Yes
Swaziland	-0.573648	-26.24588***	Yes
Zimbabwe	-	-	-
Model: GDS= GDP+ FDI			
Botswana	-0.625521	-21.42457***	Yes
Congo DR	-0.513665	-34.88991***	Yes
Madagascar	-0.513665	-34.88457***	Yes
Malawi	-	-	-
Mauritius	-	-	-
Mozambique	-0.109360	-17.96207***	Yes
Namibia	-0.580395	-23.68824***	Yes
South Africa	-0.153574	-101.9313***	Yes
Swaziland	-0.526144	-22.32157***	Yes
Zimbabwe	-	-	-

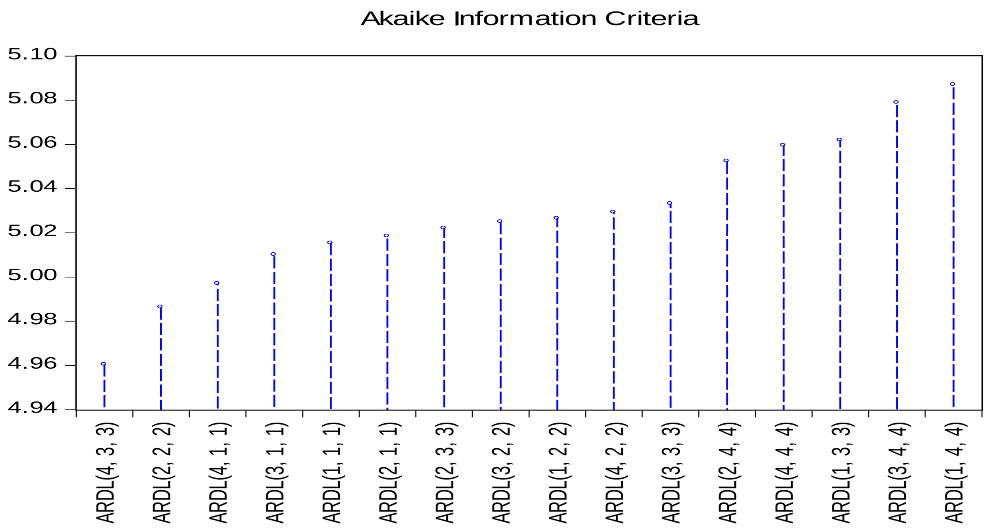
Model: GFCF= GDS + GDP

Method: ARDL
Date: 01/03/18 Time: 10:35
Sample: 1989 2015
Included observations: 270
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDS GDP
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(4, 3, 3)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
GDS	0.267767	0.237391	1.127959	0.2607
GDP	6.876075	2.102610	3.270258	0.0013
		Short Run Equation		
COINTEQ01	-0.051581	0.031947	-1.614573	0.1080
D(GFCF(-1))	-0.154921	0.136287	-1.136724	0.2570
D(GFCF(-2))	-0.155441	0.081554	-1.905979	0.0581
D(GFCF(-3))	-0.023497	0.072044	-0.326140	0.7447
D(GDS)	0.133458	0.106287	1.255644	0.2107
D(GDS(-1))	-0.035660	0.079130	-0.450642	0.6527
D(GDS(-2))	0.084833	0.075871	1.118127	0.2649
D(GDP)	-0.408201	0.143028	-2.853995	0.0048
D(GDP(-1))	-0.153509	0.116102	-1.322197	0.1876
D(GDP(-2))	-0.064935	0.073995	-0.877554	0.3812
C	-0.274339	0.541445	-0.506680	0.6129

Mean dependent var	0.035099	S.D. dependent var	4.128542
S.E. of regression	2.977657	Akaike info criterion	4.320425
Sum squared resid	1755.555	Schwarz criterion	5.670413
Log likelihood	-557.6659	Hannan-Quinn criter.	4.860093

*Note: p-values and any subsequent tests do not account for model



Model: FDI = GDS+ GDP

Dependent Variable: D(FDI)
Method: ARDL
Date: 01/03/18 Time: 10:54
Sample: 1987 2015
Included observations: 290
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDS GDP
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(2, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
GDS	-0.076786	0.028073	-2.735235	0.0067
GDP	0.120992	0.049230	2.457688	0.0146
		Short Run Equation		
COINTEQ01	-0.454354	0.083992	-5.409506	0.0000
D(FDI(-1))	-0.069867	0.096986	-0.720387	0.4719
D(GDS)	0.085661	0.040008	2.141077	0.0332
D(GDP)	-0.001619	0.049450	-0.032743	0.9739
C	1.557793	0.215306	7.235265	0.0000

Mean dependent var	0.166736	S.D. dependent var	3.064114
S.E. of regression	2.569983	Akaike info criterion	4.353272
Sum squared resid	1704.041	Schwarz criterion	4.980052
Log likelihood	-622.7571	Hannan-Quinn criter.	4.603832

*Note: p-values and any subsequent tests do not account for model selection.

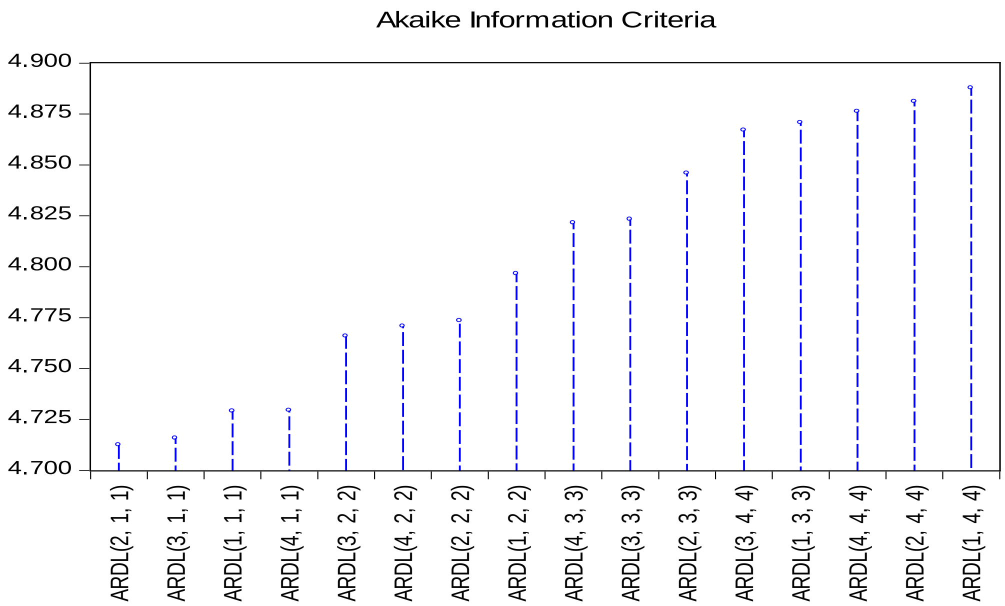


Table 3: Cross-section estimates

Model: GFCF=GDS+GDP			
Country	Coefficient	t-statistic	Long-run relationship
Botswana	-	-	No
Congo DR	-0.035708	-134.0036***	Yes
Madagascar	-	-	No
Malawi	-	-	No
Mauritius	-0.270727	-26.53786***	Yes
Mozambique	-	-	No
Namibia	-	-	No
South Africa	-0.071778	-96.96712***	Yes
Swaziland	-	-	No
Zimbabwe	-	-	No
Model: FDI=GDS+GDP			
Botswana	-0.517237	-13.51275***	Yes
Congo DR	-0.424572	-11.81637**	Yes
Madagascar	-0.139749	-20.15102***	Yes
Malawi	-	-	No
Mauritius	-0.260788	-4.127787**	Yes
Mozambique	-	-	No
Namibia	-	-	No
South Africa	-0.301253	-26.51142***	Yes
Swaziland	-	-	No
Zimbabwe	-0.645952	-16.75869***	Yes