AN INVESTIGATION OF THE DETERMINANTS OF PUBLIC HEALTH EXPENDITURE IN SADC

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Peter Nsokolo Mumba

(201302798)

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Supervisor: Dr Jacob M. Nyambe (University of Namibia)

Abstract

The prime objective of this study was to investigate the determinants of domestic public health expenditure in the Southern African Development Community (SADC) using annual panel data for the period 2000 to 2016. Combinations of macroeconomic, technological and demographic factors were used as select determinants. The study also made an inquiry into the income elasticity of health and the stochastic convergence of domestic public health expenditures in SADC. In trying to fulfil these objectives, the study employed a heterogeneous dynamic panel, making use of the Autoregressive Distributed Lag (ARDL), Pooled Mean Group Estimator. The study established that in the long-run, GDP per capita, infant mortality rate and the ageing population had negative and significant relationships with domestic public health expenditures. Meanwhile, unemployment had a positive and significant relationship with domestic public health expenditures. However, in the short run, the results were almost insignificant. The results also indicate that health is a necessity in SADC. Additionally, the stochastic convergence test confirmed that there is growth in domestic public health expenditures towards the regional average. These empirical results imply that staying committed to the efficient collection and equitable distribution of domestic resources for health will see many governments' meet the 2001 Abuja declaration on health target.

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List of Abbreviations and/or Acronyms

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
AIDS	Acquired Immunodeficiency Syndrome
ARDL	Autoregressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
CUSUM	Cumulative Sum of Recursive Residuals
CUSUM SQ	Cumulative Sum of Recursive Residuals of Squares
DRC	Democratic Republic of Congo
DPHE	Domestic Public Health Expenditure
ECO	Economic Cooperation Organization
ECOWAS	Economic Community of West African States
ECT	Error Correction Term
EU	European Union
GDP	Gross Domestic Product
GGE	Genera Government Expenditure
GLS	Generalized Least Squares
GMM	Generalized Method of Moments
GNI	Gross National Income

GNP	Gross National Product
HIPC	Heavily Indebted Poor Countries
HIV	Human Immunodeficiency Virus
IPS	Im, Pesaran and Shin
LGDPPC	Logarithm of Gross Domestic Product Per Capita
LIMR	Logarithm of Infant Mortality Rate
LLC	Levin, Lin, and Chu
LPHE	Logarithm of Public Health Expenditure
LPOP75	Logarithm of Population Age 75 years and above
LUNE	Logarithm of Unemployment
MDG's	Millennium Development Goals
MDR	Multi-Drug Resistant
NGO	Non-Governmental Organization
OAU	Organization of African Unity
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PMG	Pooled Mean Group

POLS	Pooled Ordinary Least Squares
SADC	Southern African Development Community
SBC	Schwarz Bayesian Criterion
SSA	Sub Saharan Africa
SWAP	Sector Wide Approach
TB	Tuberculosis
UHC	Universal Health Coverage
USA	United States of America
UK	United Kingdom
WDI	World Development Indicators
WHO	World Health Organization
XDR	Extensively Drug-Resistant

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Dedication

I would love to dedicate this Master's degree thesis to my Mom Mercy and the three men who relentlessly toiled to see me become of value. Angel Mumba, Peter.Y. Ntenga and Nicholas Ntenga, this is for you, MYSRIP.

Declaration

I, Peter Nsokolo Mumba, hereby declare that this study is my own work and is a true reflection of my research and that this work or any part thereof has not been submitted for a degree at any other institution.

Name of Student .....

Signature.....

Date.....

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter gives a brief orientation of public health expenditure. It then sheds light on issues patterning to the determinants and convergence of public health expenditures. Furthermore, it discusses the problem statement, specifies the objectives, states the hypotheses, significance, limitations and finally provides a description of the rest of the study.

1.2 Orientation of the study

The World Health Organization (WHO) defined health as a state of complete physical, mental and social wellbeing, and not the absence of disease or infirmity (WH0, 1948). Health is an investment hence, investments in the health of individuals improve their lives and reduce mortality. According to Grossman (1972), the demand for healthcare is derived demand for health. This means individuals do not demand healthcare in itself but rather they demand health by seeking healthcare and engaging in health-improving activities. Thus, a healthy population provides sufficient human capital by allowing individuals to participate in economic activities and contribute to economic development. Therefore, many countries around the world have devised policies to ensure that their health sectors are adequately financed. Also, a good number of multilateral and bilateral institutions and foundations, Non-Governmental Organizations (NGOs), and joint donor initiatives are assisting countries to finance, rationalize, and operationalize health reforms (Gottret & Schieber, 2006).

Health financing options mainly comprise of public health expenditure and private health expenditure. According to Gottret and Schieber (2006), public health financing comprises

of tax collections, budget reallocations, donor funding whilst private health finances mainly comprises of voluntary health insurance and out of pocket expenditure which is considered regressive. In the recent past, health financing policy has focused on public health expenditure by placing an emphasis on the obligation of governments to raise enough funds for their health sectors (Molla, Chi & Mondaca, 2017; Gottret & Schieber, 2006).

However, there are significant variations in the level of public health expenditures across countries. Numerous studies around the world have explored the various factors that are likely to affect governments share in health expenditure and varying conclusions have been reached. What is known is that health expenditures vary significantly across countries with different income categories. This is to say, income is the most important determinant of public health expenditures (Baltagi & Moscone, 2010; Kouassi et al 2017; Furuoka et al 2011; Ke, Saksena & Holly, 2011). In high-income countries, the public share of total health expenditures is higher than in the middle and low-income countries. It accounts for 56 per cent in high-income countries whilst only 42 and 29 per cent in middle income and low-income countries respectively. This is because the later suffers the lowest global per capita health expenditure due to its relatively low Gross Domestic Product (GDP), the absence of sound national health financing strategies and very low resources allocation for the provision and maintenance of health-related infrastructure, poor tax systems, large and diverse health needs and adverse economic challenges (Sambo, Kirigia & Ki-Zerbo, 2010). This explains why health sectors in Sub Saharan Africa are largely financed by resources from grants, loans, and donations (Novignon, Olakojo & Nonvignon, 2012; Gottret & Schieber, 2006).

Other non-income factors such as demographic factors, environmental factors, technology as well as economic and institutional characteristics, which are amenable by political and managerial decisions have also been noted as factors that potentially affect the level of public health expenditure (Angko, 2013 & Christiansen et al, 2007). It has also been observed that regional affiliations are likely to encourage the growth of public health expenditures by promoting quality health service delivery and improvements in health outcomes agendas in their geographical boundaries. This indicates that markets and social choices regarding the supply of services, remuneration of health care providers, the degree of diffusion of health care technology and the institutional arrangements for the finance of health care vary across countries (Odhiambo, 2014).

In the recent past, there has been a commitment by African governments to increase the level of public health expenditure. In 2001 the Organization of African Unity (OAU) heads of state convened in Abuja, Nigeria and agreed to improve their health sectors by increasing their budgetary allocations to health to 15%. At the same time, they also urged donor countries to fulfil their target of 0.7% of their Gross National Product (GNP) as Official Development Assistance (ODA) to developing countries (WHO, 2011). In 2004, donor promises were revised at the G8 summit held in Gleneagles, United Kingdom. It was agreed that the G8 countries would increase their levels of ODA to Africa and many of them pledged to meet the 0.7% of GNI earlier promised. The OECD secretariat also estimated that the new pledges would increase aid from around US$ 80 billion in 2004 to nearly US$ 130 billion in 2010. Following this, a number of OAU governments including those in SADC have since increased their budgetary allocations to their health sectors. Additionally, OAU member states adopted a program on shared responsibility and global

solidarity for AIDS, TB and Malaria Response in Africa. Under this program, the member states pledged concerted action to strengthen and diversify health funding, strengthen health leadership and governance, and enhance access to affordable and quality-assured medicines (Dieleman et al, 2015).

However, in 2009, ODA was just over 0.31% of GNI on average and only five countries reached 0.7% of GNI devoted to ODA. Thus, the overall net bilateral ODA to Africa was just US$ 27 billion. This means that since 2001, overall ODA to Africa has actually decreased (WHO, 2011).

Therefore, more than a third of African countries have not been able to meet the Abuja declaration target. Several countries have either stopped pursuing the Abuja target or are not implementing it fully (WHO, 2011). This is attributed to the lack of commitment and inconsistencies in implementation by governments (Tandon & Cashin, 2010; WHO, 2011). According to Odhiambo (2014), most of the countries that have met the Abuja declaration target are heavily reliant on donor funding and grants. Specifically, in SADC only Zambia and Malawi have met the Abuja declaration target with the assistance of donor funding and grants.

Following this, many African governments are working on policies that would see them generate enough funds from their domestic economies to increase the level of health finance. However, this has been a challenge considering the economic situation in Africa. Very few countries are able to sustainably finance health from their domestic resources. In SADC, on average between 2000 and 2016 domestic public health expenditure as a percentage of government expenditure was 9.1%. It was highest in Namibia with 17.9% followed by Swaziland with 13.6% and the lowest was Zimbabwe with 2.5%. This shows

that between 2000 and 2016 on average only Namibia had achieved the Abuja declaration target using domestic resources to finance health.

1.3 Problem Statement

The level of domestic public health expenditure has remained low in many Sub Sahara African countries. Specifically, more than three-thirds of the SADC countries have not met the Abuja declaration target. Many of these countries are also heavily reliant on grants, loans, and donations for health financing. Moreover, there has been a significant decrease in donations and grants to finance health. These grants and donations are also inconsistent and cannot be heavily relied on because they are greatly influenced by political characteristics (Molla, Chi & Mondaca, 2017). This places emphasis on the government's role in health financing using domestic resources. In SADC, only Namibia has achieved the Abuja declaration target using domestic resources. Therefore, in the process of formulating policies that would necessitate meeting the minimum health expenditure level, it is important to investigate the factors that potentially determine the growth of domestic public health expenditure. It is also important to know the income elasticity of health because this will guide policy as to whether to encourage more government intervention in the health sector or rather to allow market forces to control prices in the health sector. Although SADC countries have similar development patterns, it is unclear whether or not domestic public health expenditures in SADC are following a similar trend. It is also true that the SADC region is under-researched in the determining triggers of public health expenditure as evidenced by limited literature on this subject matter. A number of studies have been done on the determinants of public health expenditure in developed countries. Most of the studies that have been done in developing

regions are country-based and have focused on the relationships between health expenditures and economic growth. For instance, a study by Kouassi et al (2017) investigated health expenditure and growth dynamics in SADC. However, no specific study of this nature has been done in SADC. Hence, this present study purposes to fill this literature gap.

1.4 Objectives

The main objective of this study is to investigate the determinants of domestic public health expenditure in SADC.

The specific objectives are:

- To investigate the relationships between domestic public health expenditures and the select determinants in SADC.
- To investigate the income elasticity of health in SADC.
- To test the convergence of domestic public health expenditures in SADC.

1.5 Hypotheses

H_{A0} : There are no significant relationships between domestic public health expenditure and the select determinants in SADC.

H_{A1}: There are significant relationships between domestic public health expenditure and the select determinants in SADC.

H_{B0}: The income elasticity of health is inelastic in SADC.

H_{B1}: The income elasticity of health is elastic in SADC.

H_{C0}: There is no convergence of domestic public health expenditures in SADC.

H_{C1}: There is convergence of domestic public health expenditures in SADC.

1.6 Significance of the study

This study contributes to the literature on public health expenditure in four ways. Firstly, most of the studies that have been done on public health expenditure do not consider the fact that loans, donor funding, and grants are inconsistent. Hence, heavy reliance on these types of funding brings about irregular public spending on health. Therefore, this study is cognizant of this fact. Secondly, this present study makes use of the Pooled Mean Group (PMG) estimator which assumes that the long-run relationships among variables are homogeneous across the panel. This provides some methodological advantages because this study focuses on countries that are regionally integrated and as such these countries may have some common characteristics

Thirdly, the removal of cross-border barriers to allow regional economic integration may enable technological transfers and spillovers, hence, promoting economic convergence. Also, the fact that SADC countries share similar development patterns makes the study of convergence of domestic public health expenditure essential for understanding how health systems are integrated and homogeneity in the quality of health service delivery in SADC (Odhiambo, 2015; Dobrinsky & Havlik, 2014). Finally, this study also brings out unique policy recommendations regarding ways in which governments may increase their domestic revenue collection in an effort to increase their budgetary allocations to their health sectors. Therefore, to the best of the author's knowledge, no study of this nature has been specific to the SADC region. Hence, this study will add to the available literature on this subject matter.

1.7 Limitations of the Study

The literature on the determinants of domestic public health expenditure is quite diverse. This study includes both demand-side and supply-side factors but does not include the institutional characteristics which include political factors, governance, corruption and managerial decisions due to data unavailability.

1.8 Organization of the study

The rest of this study is organized in five chapters. Chapter two gives an overview of the health statistics in SADC. Chapter three consists of the literature review, while chapter four discusses the relevant methodology and chapter five presents the empirical estimations and analysis of the results obtained. Finally, chapter six includes a summary and conclusion of the study and provides policy recommendations options.

CHAPTER TWO: AN OVERVIEW OF THE PERFORMANCE OF ECONOMIC INDICATORS AND TRENDS IN DOMESTIC PUBLIC HEALTH EXPENDITURE IN SADC

2.1 Introduction

This chapter provides an overview of the study by elaborating on the performance of the economic indicators in SADC including trends in domestic public health expenditure. It also outlines some of the efforts being made by SADC to increase the level of domestic public health expenditure.

2.2 Overview of public health expenditure in SADC

The Southern African Development Community (SADC) is a regional integration group founded in 1980 with the aim of reducing economic dependence particularly, but not only, on South Africa which is the biggest economy in SADC; to forge links to create genuine and equitable regional integration; to mobilize resources for implementing national and interstate policies; and to take concerted action to secure international co-operation within the framework of the strategy of economic liberation (Umuhoza & Ataguba, 2018).

Besides the 2001 Abuja declaration on health, SADC signed a protocol on health in 1999, which accounted for health policies within the region (SADC, 1999). In 2000, the SADC health policy was approved and Governments committed themselves to give the entire population access to a defined package of health benefits with financial protection. Following this, member states have also made efforts to enhance the Universal Health Coverage (UHC) agenda by including it in the SADC protocol on health. Also, SADC member states have made strong commitments in the area of Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) by legislating the 2004

Maseru Declaration on HIV and AIDS where member states agreed to integrate the health-related components of the HIV response into the health policy and planning framework (Mthetwa, 2017).

According to data from the World Development Indicators (WDI), between 2000 and 2016 population size varied from 1.2 million people in Lesotho to 51 million in South Africa. The population growth rate ranges from 0.4% in Mauritius to 7.65% in Seychelles. Countries with moderate population growth rates include Comoros and Zimbabwe with growth rates estimated at 2.4 % and 2.8% respectively. SADC countries have different levels of economic development. Between 2000 and 2016, average GDP per capita was US$ 3,084. Average per capita gross domestic product (GDP) ranged from US$325 in Malawi to US$11,571 in Seychelles. GDP growth rate was lowest in Zimbabwe with 0.6% and highest in Mozambique with 7%.

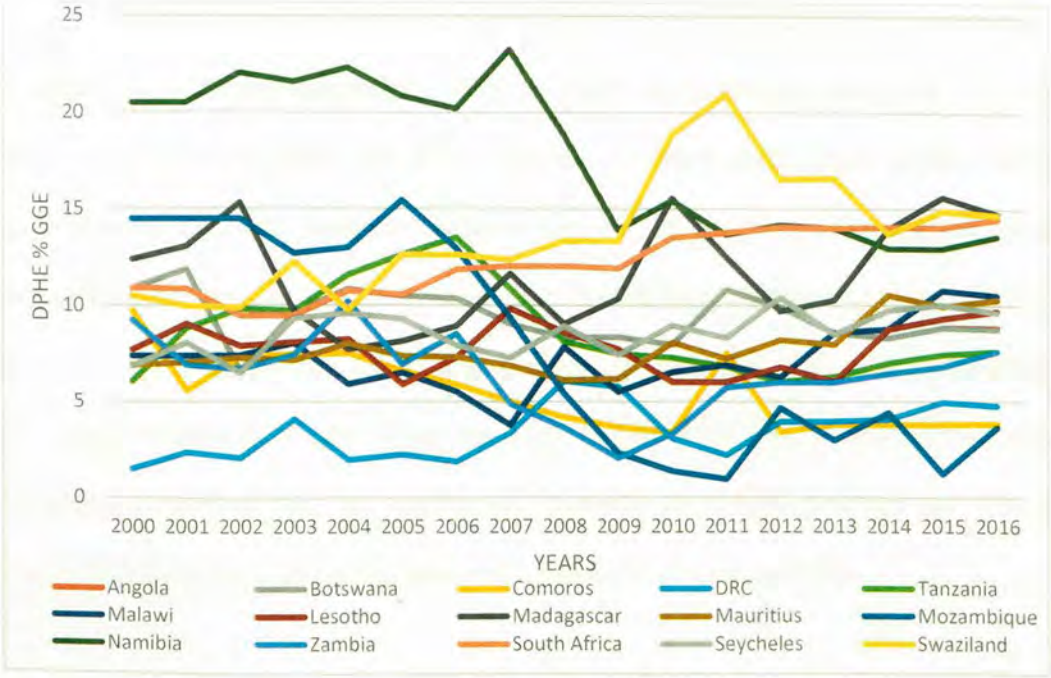
Overall, the annual GDP growth rate in the SADC region averaged 3.7% between 2000 and 2016. Age dependency ratio young as a percentage of the working population averaged between 32.4% in Mauritius and 93.8% in Angola. The median scores were from Comoros and Zambia who recorded 75% and 75.6% respectively. Whilst the age dependency ratio old as a percentage of the working-age population averaged between 4.7% in Angola and 11.2% in Seychelles.

The Southern African region has the highest burden of disease in Africa. Specifically, it has the most severe prevalence of HIV and AIDS. Tuberculosis (TB) is also experiencing resurgence in cases of Multi-Drug Resistant (MDR) and Extensively Drug-Resistant (XDR) Tuberculosis which are very costly to treat. Also, eight countries in the region including Zambia, Zimbabwe, Malawi, Botswana, South Africa, Namibia, Lesotho, and

Swaziland are among fifteen countries with the highest incidences of TB globally. There is also an increase in the burden of non-communicable diseases (Bradshaw & Timaeus, 2006; Mengel et al, 2014; Chaisson & Martinson, 2008). All these challenges require increased government spending on health.

The main sources of funding for health among SADC member states are governments, households, international donors, and the private sector (Mthetwa, 2017). Total health expenditure as a share of GDP ranges from 8.9% in South Africa to 5.0% in Zimbabwe. Mauritius 2.4% and Zambia 3.7% have the lowest levels of government spending on health as a proportion of GDP. Total government health expenditure in Zambia (18.1%) and in Malawi (16.2%) exceeded the Abuja target of 15%. According to Odhiambo (2014), between 2001 and 2011, Malawi and Zambia were the only countries from SADC who had met the Abuja target. However, most of the countries that have met the Abuja declaration target are heavily reliant on donor funding and grants and most of them are beneficiaries of the Heavily Indebted Poor Countries (HIPC) relief program. These donations and grants are inconsistent and cannot be heavily relied on. Hence, public health expenditure should be financed by domestic resources (Odhiambo, 2014).

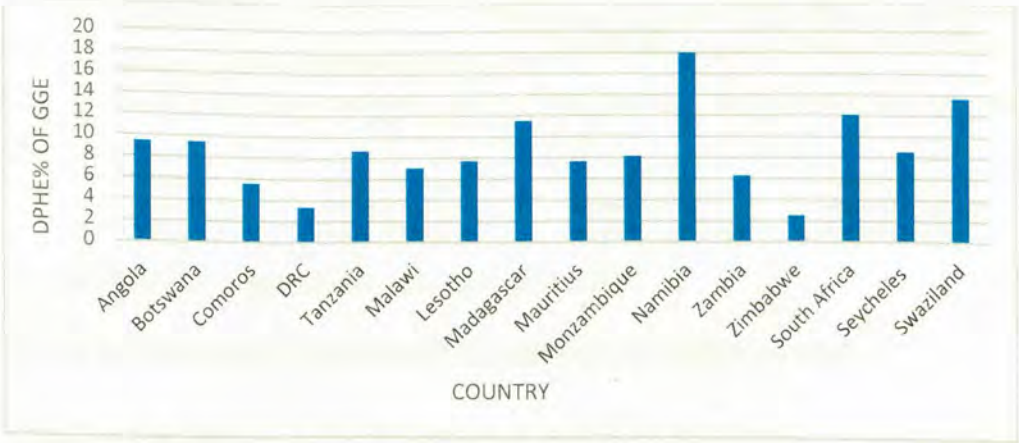
Figure 2.1 below shows the trends of domestic public health expenditure in SADC countries between 2000 and 2016. The highest trend in DGHE is observed to have come from Namibia. The Namibian government allocated over 20% of domestic resources to health from 2000 but after the global economic crunch of 2008-2009, this percentage dropped to below 15%. Swaziland and South Africa have also shown efforts of trying to meet and exceed the 15% threshold.



Source: Author's computations using data from WDI

Figure 2.1: Domestic Public Health Expenditure (DPHE) per country

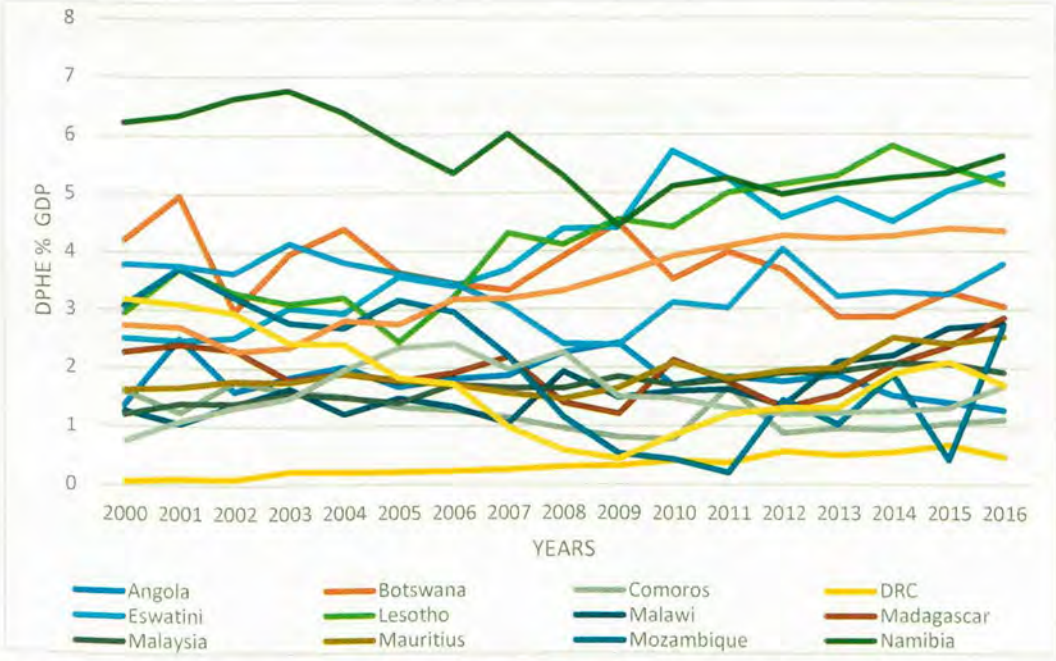
Majority of countries have allocated about only 10% of their domestic resources to health. DRC has really performed poorly as they have allocated less than 5% of its domestic resources to health.



Source: Author's computations using data from WDI

Figure 2.2: Average Domestic Public Health Expenditure (DPHE) per country

Figure 2.3 above shows that Domestic Public Health Expenditure (DPHE) as a percentage of General Government Expenditure (GGE) in SADC has been fluctuating over the past few years. Between 2000 and 2016 Namibia recorded the highest public health expenditure by domestic resources of about 17.9% of total government expenditure. This makes Namibia the only country to have exceeded the Abuja declaration target of 15%. However, Swaziland, South Africa, and Madagascar were also close to accomplishing the Abuja declaration target. They recorded 13.6%, 12% and 11.5% respectively. However, Zimbabwe and the Democratic Republic of Congo recorded the lowest budgetary allocation to the health sector of 2.5% and 5.5% respectively



Source: Author's computations using data from WDI

Figure 2.3: Domestic Public Health Expenditure % GDP per country

There has also been an increasing interest in how much governments allocate to health as a percentage of their GDP's. Figure 2.3 below shows the individual country trends in

DPHE % of GDP. The figure shows that on average Namibia has the highest percentage in SADC particularly between 2000 and 2009. Swaziland and Lesotho also have relatively high values of DPHE as a % of GDP. This could be attributed to their relatively low populations. However, DRC shows the lowest DPHE as a % of GDP value in SADC between 2000 and 2016.

2.3 Conclusion

Like in any other Sub Saharan African region, health expenditures have been relatively low in SADC. However, total health financing seems to be increasing over the past few years due to the fact that many countries are now in pursuit of the Millennium Development Goals (MDG's) through their focus on specific diseases such as HIV/AIDS, malaria and issues such as maternal and infant mortality rates.

CHAPTER THREE: LITERATURE REVIEW

3.1 Introduction

This chapter reviews public expenditure theories and elaborates on the determinants of public health expenditure. It also covers issues on the convergence of public health expenditures and also reviews various studies done on this subject matter and their findings.

3.2 Theoretical Literature

3.2.1 The Keynesian approach to public spending

One of the fundamental arguments in economic growth theory is the relationship between economic growth and government expenditure. Determining the link between government spending and economic growth is vital because it has implications for government spending as a fiscal policy tool (Dandan, 2011). The role and size of the government in a country have been explored from different perspectives in economic literature and the existence of an optimal government share in the economy has been subject to considerable theoretical debate. Gemmell, Kneller, and Sanz (2013) alluded that within the economic and fiscal aspects of public expenditure growth, economic research has taken two main approaches in analyzing the expansion of the public economy. One of the approaches has attempted to determine the level of government expenditure at which the rate of economic growth is optimized while the second one investigates the forces that drive the expansion of the size of the public economy.

The Keynesians advocate for government intervention in the economy (Chipaumire et al. 2014). The Keynesian macroeconomic theory has generally assumed that increased government spending tends to increase aggregate demand and therefore leads to a rapid

increase in national income. The Keynesian view also postulates that government expenditure is a component of fiscal policy and can be used as a policy instrument to influence growth. This implies that public expenditure is a key contributor to an increase in the income level of a country (Dandan, 2011; Samudram, Nair & Vaithilingam, 2009). A number of studies have been done and their findings resonate with the Keynesian school of thought on public expenditure (Boussalem et al, 2014, Rajeshkumar and Nalraj, 2014 and Odior, 2011). Therefore, increasing government spending on different sectors may lead to increases in the national income level of a country.

3.2.2 Positive theory of public expenditure

The fundamental argument between Wagner's Law and the Keynesians theory focuses on the relationship between government expenditure and economic growth. Adolph Wagner opposed the laissez-faire doctrine by offering the state an active role in the economy. Hence, in trying to link economic growth to growth in public sector expenditure, Wagner (1883) suggested that during the process of economic development, the share of public expenditure to GDP increases due to the increasing need for public facilities such as housing, hospitals, health centers, and other infrastructure. According to Zaghini and Lamartina (2014), Wagner's law postulates that as the economy grows, it triggers industrialization through an increase in the goods and services provided by the government, redistribution of income through transfers and also the activities of public enterprises. There are three reasons to support this, firstly, the administrative and protective functions of the government would substitute public functions for private activities. Secondly, there will be a need for increased provision of social and cultural

goods and thirdly, governments would need to regulate, manage and finance natural monopolies and to ensure the smooth operation of market forces.

Sagarik (2016) opined that Wagner's law explains a positive long-run relationship between government expenditures and economic growth. This means as per capita income increases, there is a long-run tendency for public expenditure to increase relative to national income. Although Wagner's law is the most widely tested explanation of the relative growth in-state activity, it has not been without criticism. Peacock and Wiseman (1961), in the displacement hypothesis, argue that governments always profitably disburse available finances and also respond to the citizen's wishes although citizens are not willing to accept higher taxes (Henrekson, 1990).

Other theories have also argued with the Wagner's law such as the public choice theory of Buchanan and Tullock (1962) which hypothesizes that the appropriate size of the state is derived from a model in which the state supplies its constituents with public goods and services, which are paid for with tax revenues. Furthermore, using the degree of openness hypothesis, Cameron (1978) argued that increasing trade openness may facilitate the development of social infrastructures, the density of unionization, the scope of collective bargaining and the strength of labour confederations, leading to the growth of the public sector.

3.2.3 Tax-Spend Hypotheses

Another controversial issue that has attracted attention from researchers in public finance and macroeconomics is the nature of the relationship between government revenues and spending. This has sparked debate between politicians and economists because of the increased budget deficits in many developed and developing countries. Hence, in

understanding the revenue-expenditure nexus, four tax spending hypotheses have been advanced. According to Ewing and Payne (1998), Friedman (1978) advanced the first tax-spend hypothesis by arguing that changes in government revenues lead to changes in government expenditures. Particularly, by increasing taxation, governments generate more revenues and reduce budget deficits, hence, government spending will increase. This implies a positive relationship between government revenues and government spending.

However, according to Aregbeyen and Insah (2013), Buchanan and Wagner (1977) put forward an alternative version of the tax-and-spend hypothesis because taxpayers suffer from tax illusion. Tax illusion occurs when governments levy indirect taxation through high-interest rates and inflation hence the taxpayers perceive the price of government spending to be low. As a result, an increase in taxation leads to a decrease in government spending (Aregbeyen & Insah, 2013). Peacock and Wiseman (1979) also argued by proposing the displacement effect. The displacement effect became the second hypothesis called the spend-tax hypothesis. It postulates that temporary increases in government expenditures due to political and economic crises can lead to permanent increases in government revenues. The spend-tax hypothesis suggests that a political system determines government expenditure by making adjustments in tax policy and revenue sources. This means that changes in public expenditure bring about changes in public revenue (Aregbeyen & Insah, 2013; Richter & Dimitrios, 2013). This hypothesis is consistent with Barro (1979) who in the context of the Ricardian equivalence proposition ruled out fiscal illusion by stating that today's deficit-financed expenditure means

increased taxation in the future. Therefore, in order to reduce budget deficits, governments should decrease expenditure (Rahman & Wadud, 2014).

The third hypothesis was advanced by Musgrave (1966) as well as Meltzer and Richard (1981) as cited in Richter and Dimitrios, (2013). It is called the fiscal synchronization hypothesis and it postulates that voters compare the marginal benefits and marginal costs of government services when formulating a decision in terms of the appropriate levels of government revenues and expenditures. Finally, Baghestani and McNown (1994) advanced the fourth hypothesis referred to as the fiscal neutrality. It relates the institutional separation of the expenditure and taxation decisions of government. This perspective suggests that revenues and expenditures are not related to each other because government expenditure and revenues are each determined by the long-run economic growth reflecting the institutional separation between government revenues and expenditure (Mehrara & Rezaei, 2014).

3.2.4 Determinants of public health expenditure

From the works of Newhouse (1977) and Kleiman (1974), GDP per capita has been identified as an important determinant of health expenditures. It is opined that GDP per capita (national income) explains a high percentage of the variations in health expenditures. Thus, health expenditures vary across countries with different income levels. In high-income countries, the public share of total health expenditures is higher than in the middle and low-income countries. This is attributed to the premise that public health expenditure in many low-income and middle-income countries is largely financed by resources from grants and loans which may be due to the poor tax systems, large and

diverse health needs and adverse economic challenges (Novignon, Olakojo & Nonvignon, 2012; Gottret & Schieber, 2006).

Income elasticity of health expenditure is also of major concern in the efficient allocation of resources to the health sector (Newhouse, 1977). In the recent past, the debate on this link has moved to whether the income elasticity of health expenditure is greater or less than one. When income elasticity of health is less than one, health care expenditure is classified as income inelastic and therefore, health is a "necessary good. On the other hand, if the elasticity is higher than one, health will be classified as a "luxury" good (Sghari & Hammami, 2013). According to Baltagi and Moscone (2010), advocates of healthcare being a necessity encourage more government intervention in the health sector whilst advocates for health care being a luxury are of the opinion that health care is a commodity and like any other good it should be left to market forces.

There are also a number of non-income determinants of public health expenditure. One of them is medical technological progress. Dybczak and Przywara (2010) defined medical technology as the pharmaceutical drugs and vaccines, medical equipment, health-care procedures, supportive systems and the administrative systems that drive medical healthcare. Emerging from the work of Newhouse (1992) who found that growth in health care expenditure in industrialized countries can be attributed to medical technological growth, many other authors have also opined that growth in medical technology is an important driver for burgeoning health expenditures (Sorenson, Drummond & Khan, 2013; Nghiem & Connelly, 2014; Karampli et al. 2014).

However, due to the lack of empirical data and a uniform methodology to quantify the impact of medical technology on health care costs, three general approaches have been

used in practice to estimate the size of its effect. The first one is the residual approach which is based on the assumption that technology is responsible for all changes not accounted for by the other quantifiable determinants of health expenditure. The second one is the proxy approach which uses an alternative measure to proxy the total impact of technology which assumes that its change follows the evolution of technology. The common proxies used by a number of studies (Dregen and Reimers, 2005; Okunade and Murthy, 2002) are life expectancy at birth and infant mortality rate. Another set of authors (Baker & Wheeler 1998; Weil, 1995) investigated how medical technology influenced healthcare costs cross-section models by using surgical procedures and the number of specific medical equipment as proxies (Ke, Saksena & Holly, 2011). Lastly, case studies are used to analyse the effect of a specific technology on the cost of treating a particular medical condition (Dybczak & Przywara, 2010).

Another factor affecting public health expenditures is the pure demographic effect. This broadly refers to population size, population age structure and employment structure of a country. The pure effect of ageing on health expenditure is described as a "red herring". Meaning an ageing population (over 65 years of age) translates into an increase in health expenditures because elderly people usually have a higher per capita health cost (Harris & Sharma, 2018). In a similar way, the younger population, particularly, infants under five years of age, tend to have higher medical treatment costs because of the diverse health needs they require (Nguyen et al, 2015; Ke, Saksena & Holly, 2011).

The effects of population growth on public health expenditure are cumulative. When population growth outpaces budget increases, the net effect would be deterioration in the provision of health services (Shamsi & Waqas, 2016). As unemployment increases,

affected individuals might confront an increased risk for developing or aggravating mental and physical health problems (Pellegrini, Monguio & Qian, 2014). Grossman (1978) also postulated that when individuals are unemployed, their nutrition levels tend to deteriorate. Deterioration in nutrition levels often translates into poor health. This would then imply increased government spending on health.

3.2.5 Convergence in the Neoclassical Growth Model

Economic convergence is an issue that has gained prominence among researchers in the recent past (Dobrinsky & Havlik, 2014; Charles, Darne & Hoarau, 2010; Wang, 2009). It hypothesizes that poor countries tend to grow faster than rich countries. The literature shows evidence of different types of economic convergence.

Economic convergence draws its theoretical framework from the neoclassical economic growth model. Developed by Solow (1956) and Swan (1956) as cited in Odhiambo (2014), the neoclassical growth model links economic growth to technological change, capital accumulation, and labour force growth. It postulates that output per capita converges to its steady-state independently of initial conditions in the long run. Under economic convergence, the only potential sources of economic growth are continued exogenous increases in the primary factors such as population growth and exogenously given technological change. It also postulates that neither the savings rate nor investment level affects the long-run growth rate (Ferrara & Guerrini, 2008).

The neoclassical growth model aims to provide a theoretical framework for understanding the world-wide growth of output and the persistence of geographical differences in per capita income. It supposes that per capita growth rate tends to be inversely related to the starting level of output or income per person. In particular, if economies are similar with

respect to preferences and technology, countries or regions initially having relatively low levels of development tend to grow faster during the transition as they catch up with rich countries and approach similar steady-state growth paths in competitive markets whilst assuming diminishing returns to each production factor. Which is to say that poor countries or regions tend to grow faster than rich ones hence, reaching a common value (Barro & Sala-I-Martin, 1992; Wang, 2009).

Newhouse (1992) argues that as income tends to converge between countries, the income-dependent health expenditure should also follow similar paths. This simply means that as GDP per capita of a group of countries converges, public health expenditure is likely to follow a similar path because the income level of countries is the most important factor in explaining the variations in the level and growth of public health expenditure (Baltagi & Moscone, 2010).

Hitiris and Nixon (2001) argue that EU economic integration leads to income convergence and to convergence in various sectors including the health sector. Other important factors that encourage convergence in health expenditure include the integration of health care markets and common policies to promote health and the coordination of medical and health research (Newhouse, 1992). Therefore, Nghiem and Connelly (2017) argued that health expenditure in countries of similar economic development levels seems to converge over time. This is because countries of similar development levels have common features which affect the cost of healthcare. Moreover, under the convergence analysis of health expenditure, it is hypothesized that low healthcare spending countries tend to catch up with high health care spending ones to a common value (Hitiris, 1997; Narayan, 2007).

3.2.6 Conceptualization of Convergence

Economic literature presents various convergence concepts including Beta convergence, Sigma convergence, stochastic convergence and club convergence (Odhiambo, 2014). Convergence which occurs when health expenditures in low health spending countries increase faster than in countries with high health expenditure over a given time period, allows the expenditure gap to narrow as the expenditures follow a similar trend (Narayan, 2007). This is referred to as Beta (β) convergence. The second one is called sigma (δ) convergence and it occurs when the variations in cross-country expenditures decline overtime (Hitiris & Nixon, 2001). Meanwhile, stochastic convergence occurs when the health expenditure of one country relative to a reference country's health expenditure is stationary leading to a steady-state (Carrion-i-Silvestre, 2005; Jewell at al, 2003). Stochastic convergence can also be analyzed for a group of countries in a region relative to that region's average (Kumo, 2011). In the context of health expenditures, this would try to assess whether health expenditures of individual countries experience convergence towards the regional average. Club convergence is another concept that has gained prominence in the recent past. According to Odhiambo (2014), in the context of health expenditure, a convergence club refers to a group of countries whose health expenditure tends to converge to multiple steady states. Club convergence can be categorized in two forms. Firstly, the upward convergence club which consists of countries where the members catch up with the richer ones. High health expenditure countries are associated with the upward convergence club. Secondly, the downward convergence club comprises extremely poor countries. This form of convergence minimizes the difference between high and low health care spending countries.

3.3 Empirical Literature

Previous studies on determinants of health expenditure have used both time series and cross-section data. These studies have also applied various methodologies therefore obtaining different results.

Samadi and Rad (2013) surveyed the determinants of health expenditures in the Economic Cooperation Organization (ECO) countries between 1995 and 2009 using panel data econometric methods. The study used the Westerlund panel cointegration test. The model was then estimated with Continuous-Updated Fully Modified (CUP-FM) estimator. The results obtained show that a long-run relationship exists between per capita health expenditures and GDP per capita, the proportion of population below 15 and above 65 years old, number of physicians, and urbanization. The study concluded that the coefficient of GDP per capita was less than one, hence, health is counted as a necessary good in ECO countries. These results correspond with the income elasticity obtained in Organization for Economic Cooperation and Development (OECD) countries and confirm that health care expenses are unresponsive to changes in individual or household income.

Phi (2017) investigated the determinants of health care expenditures for a sample of thirty-five countries in the OECD from 2000 to 2013. The investigation was done by estimating a heterogeneous panel model with cross-sectional data and comparing its three regression outcomes that include Ordinary Least Square (OLS), Fixed Effects Model (FEM), and Random Effects Model (REM). The empirical findings presented in this paper provide empirical evidence that per capita GDP plays a key role in explaining the cost of health care in OECD countries and that the coefficient estimate of GDP per capita

is smaller than one. This backs up the intuitive expectation of income elasticity to be less than unity, indicating that health care is more as a necessity than a luxury. Additionally, non-income determinants provide evidence that the key driving force of both health expenditure and health expenditure as a share of GDP is medical progress, which is reflected in two variables, life expectancy and population aged 65 years and older.

Dogan, Tuluce, and Dogan (2014) studied the dynamics of health expenditures in 15 OECD countries that had high income per capita for the time period of 1995-2011. The study made use of Autoregressive Distributed Lag (ARDL) models and causality tests. The study yields that the largest and the smallest impacts on health expenditures are caused by public spending and the influences of age dependency ratio young respectively. The study also establishes that income and age dependency ratio old have positive impacts on health expenditures. Another striking inference is that while the young working population rate is increasing, health expenditure is decreasing.

Using a decision tree model with the CART algorithm to categorize the member of countries by health expenditure, Akca, Sonmez, and Yilmaz (2017) studied the determinants of health expenditure in OECD countries. The study used a population comprising 2014 data of the 35 OECD countries using the Orange data mining software package. The results show that GDP per capita, life expectancy at birth, age dependency ratio, number of hospitals and percentage of the population with a bad perceived health status were identified as the major determinants of health expenditure. According to the results, the decision tree model categorized OECD countries into six groups. According to the CART algorithm used in the model, the classification accuracy rate and the precision of estimation were computed as 80.56% and 81.25%, respectively.

Furuoka et al (2011) examined the determinants of health care expenditure in twelve Asian countries (i.e. Cambodia, China, Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, South Korea, Singapore, Thailand, and Vietnam) for the period of 1995-2008. The study employed Pooled Ordinary Least Squares (OLS). Then with the aim of obtaining more reliable results, the study incorporated five separate methods to analyze the model. These are the restricted model, the one-way fixed effects model, the two-way fixed effects model, the one-way random effect model, and the two-way random-effects model. However, the findings imply that only the two-way fixed-effect model is the best model. The empirical results indicated that only two independent variables (GDP and Population above 65 years) have significant and positive relationships with health care expenditure in these countries.

However, different results were obtained when the methodology was changed. Sagarik (2016) examined the determinants of health expenditures in the Association of Southeast Asian Nations (ASEAN) countries between 2002 and 2011. The study employed a two-stage least squares regression. Unlike the results obtained by Furuoka et al. (2011), this found that health expenditures as a percentage of GDP are not significantly determined by the number of elderly people. However, it increases significantly with industrialization and foreign direct investment. The study also finds that the economy and urbanization grow faster than health expenditures.

Di Matteo and Cantarero-Prieto (2018), investigated the determinants of public health care expenditure in two of the most decentralized countries in the world (Canada and Spain) for two partly overlapping time-spans of data availability: Canada, 1981 to 2013 and Spain, 2002 to 2013. Data were available for 17 Spanish regions from 2002 to 2013

and for 10 Canadian provinces for the period 1981 to 2013. The study used Generalized Least Squares (GLS) including separate pooled time-series cross-section regressions. The results obtained indicate that the key determinants of public health care spending include time trend, income, physician numbers, and regional fixed effects.

Similar results have been obtained by similar studies that have been done in Africa using panel data such as Lv and Zhu (2014) who studied the relationship between per capita health care expenditure and per capita GDP for forty-two African countries over the period 1995–2009. The study employed semiparametric panel data analysis. The results show that infant mortality rate per 1,000 live births has a negative effect on per capita health expenditure while the proportion of the population aged sixty-five is statistically insignificant in African countries. Furthermore, the study found that the income elasticity is not constant but varies with income level, and health care is a necessity rather than a luxury for African countries.

Also, Olaniyan, Onisanwa, and Oyinlola (2013) examined health care expenditures and GDP in Sub-Sahara African countries using panel data. Their analysis indicates that health care expenditure and change in the standard of living are non-stationary and that they are linked in the long-run. The results of the study show that elasticity of healthcare is below unity for Sub– Sahara African countries indicating that health care is a necessity good. The majority of the countries present income elasticity lower than one, confirming that health is, overall, a necessity good. One reason behind these results might be the fact that there exist unobserved cross border movements of recipients that alter the relationship between health spending and income at the country level.

However, Kouassi et al (2017) investigated the long-run relationship between health care expenditure and economic growth, using panel data for fourteen SADC member countries over the period 1995–2012. This study examined both the non-stationarity and cointegration properties between health expenditure per capita and GDP per capita whilst controlling for cross-section dependence and heterogeneity between countries. The results suggest that health expenditure and GDP per capita are non-stationary and cointegrated. The estimated income elasticity is below unity but higher than what was obtained for the OECD regional grouping hence, health is a necessity in the SADC region. These results correspond with other studies.

A number of studies on determinants of public health expenditure have also been done on individual countries and again similar results have been obtained. Nguyen et al (2009), investigated the determinants of health care expenditures in a decentralized health care system in Finland. The study used two 2-way fixed-effects models and applying a simple two-stage estimation procedure to municipality-level panel data (N = 415) for the period 1993–2004. Findings of the study show that the proportion of elderly, the rate of disability pensions, the employment-to-population ratio, the municipal tax rate, the state reimbursements of prescription medicines and private dental care, income, and population density are the determinants of health care expenditure. Additionally, both measures of income elasticity were small (0.045 and 0.020), implying that public health care is a major necessity good.

Khan, Razali, and Shafie (2016) modelled the determinants of health expenditure and investigated the short-run and long-run equilibrium dynamic causal relationship between health care and income per capita within the time series framework from 1981 to 2014 in

Malaysia. The study used Ordinary least square (OLS) method to estimate the long-run parameters. Long run co-integration was investigated by Auto-Regressive Distributed Lag (ARDL) model bound approach, and for the Engle-Granger method was used for causality analysis. The resulted confirmed that income, population structure, and population growth was identified as the significant contributing factors to explain variations in health care expenditure. Like the results obtained by Nguyen et al (2009), the estimated income elasticity for health care expenditure was also found to be 0.99 which is less than 1. Hence, showing that health care was a necessity. The results also confirmed a feed-back hypothesis between health expenditure and income per capita.

Murthy and Okunade (2016) tried to identify some major drivers of per capita real health spending in the United States of America (U.S.A). The study employed annual time-series data for modelling for the period between 1960 and 2012. The study then applied the Autoregressive Distributed Lag Cointegration (ARDL) approach. The empirical findings in this study indicate that per capita real income, the population per cent above 65 years and the level of health care technology are cointegrated. Unlike prior studies, this study presented new empirical evidence indicating that the income elasticity estimate was around 0.92 indicating that health care in the U.S.A is a necessity. We also find that medical technology advances play a major role in the long-run rise of the U.S.A health expenditure. These results correspond with other findings from Finland and Malaysia where health is also a necessity.

Some studied have also been done on individual African using various methodologies and their results show similarities. Dhoro et al (2011) investigated the determinants of the public health care expenditure of Zimbabwe using yearly time series data for the period

1975-2005. The study used the Engle-Granger cointegration technique to explain the main factors that affect public health care expenditure in Zimbabwe. The empirical results indicate that the key determinants of public health expenditure are real GDP per capita income, literacy rate, inflation and foreign health aid per capita while population and life expectancy were statistically insignificant.

Boachie et al (2014) examined the determinants of public healthcare expenditure in Ghana using annual time series data from 1970 to 2008. The study explored the stationarity and cointegration properties between public healthcare expenditure, and environmental and socio-economic indicators using ERS optimal point unit root test and Engle-Granger cointegration tests. FMOLS technique was applied to estimate the long-run multipliers of public health expenditure in the model. The results of the study show that public health expenditure in Ghana is positively affected by real GDP, policies that aim to improve the healthiness of the population as measured by life expectancy and crude birth rates. The study also finds strong evidence that healthcare is a necessity in Ghana.

Olawunmi (2014) empirically examined the determinants of public health expenditure in Nigeria between 1990 and 2012. Factor analysis was used to identify the major determinant of public health expenditure in Nigeria. Regression analysis results show that real gross domestic product and health expenditure share in total government expenditure is positively related to total health expenditure. However, unemployment and political instability have a negative relationship on gross total health expenditure of the government.

Most empirical studies on the convergence of health expenditure have focused on developed regions such as the United States, European Union and OECD (Wang, 2009; Hitiris & Nixon, 2001; Aslan, 2008; Narayan, 2007; Panopoulou & Pantelidis, 2012). A variety of estimation methods and data have been used to test for convergence. The methods used include time-series, cross-sectional and panel data econometric methods. One group of studies used time series econometrics to test for convergence in health expenditures. This entails the use of the univariate and panel units root tests such as Augmented cross-section (ADF), Lagrange Multiplier (LM) with structural breaks and the nonlinear asymmetric heterogeneous panel unit root test. Narayan (2007) examined the 'catch-up' hypothesis of per capita health expenditures of the United Kingdom (UK), Canada, Japan, Switzerland, and Spain with the per capita health expenditures of the United States of America (USA) over the period 1960–2000. The study employed the ADF test and LM univariate test. The ADF estimates showed that there was no convergence in real per capita health expenditure between the USA and three countries (Spain, Canada, and Japan) but showed weak convergence with that of the UK. Taking structural breaks into account, the LM test shows evidence of stochastic convergence in per capita health expenditure of the five countries to the USA per capita health expenditure. The study then concluded that per capita health expenditure in UK, Canada, Japan, Switzerland, and Spain converged to USA's per capita health expenditure.

Another group of studies has used pooled cross-section data to test the existence of health expenditure convergence (Hitiris & Nixon, 2001; Nixon, 2000; Kerem et al, 2008 & Wang, 2009). Hitiris and Nixon (2001) studied the convergence of health care expenditure in the European Union countries over the period 1980 to 1995. The study

tested for absolute and conditional convergence of two measures of real expenditure. The findings support the notion of beta convergence. Also, the results confirm the view that countries with a social insurance system of health care spend more on health care than countries with a National Health System.

Nixon (2000) examined sigma-convergence in health care expenditures of 15 EU countries between 1960 and 1995 and beta-convergence in health care expenditures of the same countries between 1980 and 1995. Results showed upward convergence in health care spending of Southern Mediterranean countries towards EU meanwhile downward convergence in health care expenditures of EU countries of the North.

Similarly, Kerem et al, (2008) analyzed the convergence of health expenditures in the European Union (EU) using cross-sectional data with variables measured as averages over the period 1992 to 2004. The countries were divided into three groups: 23 (EU-23), 15 (EU-15) and 8 (EU-8). The study employed Kendall's index of rank concordance to test for Beta and Sigma in health care expenditure as a share of GDP and per capita. The results indicated that there was both sigma and beta convergence in health care expenditure as a share of GDP. These results correspond to those of Hitiris and Nixon (2001) although a different methodology was used.

Convergence cannot always be studied among countries and regions but also among states. Wang (2009) examined the degree of convergence in per capita health care expenditure and its nine components across 50 US states from 1980 to 2004. This study employed the multivariate version of the KPSS unit root test to test for convergence club. Some of the findings are that the rate of convergence is relatively slow with an unconditional convergence rate of -1.7% annually, which is partly caused by a reversal

in the convergence process starting in 2000. The results also show that evidence from the time series analysis is similar. Moreover, health care expenditures in 38 states converged to around 16 different steady states (equal in the long run). The remaining 12 states did not converge to any other states.

Another group of studies used panel time series methods to test the existence of health expenditure convergence (Aslan, 2008; Apergis et al, 2013; Pekkurnaz, 2015; Albulescu, Oros & Tiwari, 2017; Lau & Fung, 2013). Some studies were done in the European Union (EU) show evidence of no convergence in health expenditures. For instance, Lau and Fung (2013) examined the stochastic convergence hypothesis of health care expenditure per capita of 14 EU countries during 1975–2008. The study applied the Cerrato et al., (2009) nonlinear panel unit root test. These results show that health care expenditures of each country do not converge to the EU average. Therefore, the empirical findings imply that the existing "EU health policy reforms" and "European law on health care provision" may not be able to encourage greater health care convergence in the EU.

These results resonate with those obtained by Albulescu, Oros, and Tiwari (2017) who investigated the degree of convergence in health expenditures for six EU countries over the time-span 1972 to 2013, namely Austria, Finland, Germany, Netherlands, Portugal, and Spain. This study employed recent developments in unit root tests of bounded series to compare the overall expenditure, governmental expenditure, and private expenditure. The unit root tests employed included the Phillips-Perron test – PP, Augmented Dickey-Fuller test – ADF and Ng-Perron test – MZ. The study also used both OLS and GLS de-meaned data for all tests. The finding of the study shows that the health expenditures

spread from the group average and it was concluded that there was no significant convergence.

Some studies from OECD countries have also been done. By applying Lima and Resende (2007) persistence methodology, Aslan (2008) investigated the convergence of health care expenditures per capita in nineteen OECD for the period 1970–2005. The study employed panel data unit root tests advanced by Im, Pesaran, and Shin (2003) to test for convergence. The results indicated a very strong form of persistence associated with the null hypothesis of a unit root. Hence, there is a very strong form of persistence for OECD expenditures inequality. This indicated there was no stochastic convergence of per capita health expenditure in OECD.

However, Pekkurnaz (2015) found conflicting results by examining the convergence in health expenditure across 22 OECD countries between 1980 and 2012. The study employed a nonlinear asymmetric heterogeneous panel unit root test. The results show that both the symmetric and the asymmetric nonlinear panel unit root tests indicate the stationarity of the panel. Specifically, nonlinear asymmetric panel unit root tests show that almost 23 per cent of the countries are found to be converging. Additionally, introducing asymmetric structure helps to uncover additional converging countries which cannot be detected using linear and nonlinear symmetric panel unit root tests.

Some studies have used panel data estimation methods to test for convergence in both EU and OECD counties. Kulyk and Augustowski (2017) assessed the level of convergence of government health expenditure in the European Union countries. The aim of the study was to investigate the phenomenon of sigma and beta unconditional (absolute) convergence of the level of government spending on healthcare for sixteen EU countries

in the period 2002–2015. The results indicated that due to the differences between the social and family structures as well as the specific characteristics of welfare states, convergence in the expenditure group under consideration cannot be stated. Therefore, there is a clear divergence of health care expenditure.

A similar study by Apergis et al (2013), examined the convergence of various types of public expenditures as percentages of GDP for seventeen European Union (EU) countries for the period 1990 to 2012. The study applied a panel convergence test developed by Phillips and Sul (2007) which permits testing for the club convergence hypothesis. The results are similar to those of Kulyk and Augustowski (2017) by indicating that there was no evidence of club convergence in public health expenditures for the EU countries studied. The study then concluded that public health expenditure measures in EU countries do not follow similar paths.

Similarly, Panopoulou and Pantelidis (2012) analyzed the Convergence in Per Capita Health Expenditures and Health Outcomes for nineteen OECD Countries for the period 1972-2006. The study tested for conditional sigma convergence and club convergence in a panel of countries the paper using methodology developed by Phillips and Sul (2007). The results indicate that per capita health expenditure for the nineteen OECD countries diverged at the rate of 0.5%. However, the study also identified two convergence clubs. One club comprised of Norway and USA with a higher per capita health expenditure. The second convergence club comprised of the other seventeen OECD countries.

In Africa, studies by Oyedele and Adebayao (2015) and Odhiambo, Wabangu and Kiriti-Ng'ang'a (2015) also used panel data estimation methods to examine regional health expenditure convergence. Odhiambo, Wabangu and Kiriti-Ng'ang'a (2015) examined the

Convergence of Health Expenditure in Sub-Saharan Africa in the post-Abuja declaration period of 2001 to 2011. The study employed a linear dynamic panel model which was estimated by GMM-IV method on a panel of 41 Sub-Saharan Africa (SSA) countries. The empirical results show evidence of both absolute and conditional convergence of health expenditure in SSA.

These results are similar to those found by Oyedele and Adebayo (2015) who examined the convergence of health expenditures as well as health outcomes for a group of Economic Community of West African States (ECOWAS) using panel annual time series data between 1995 and 2011. The study employed the beta convergence test and Johansen Co-integration technique to investigate convergence in health expenditure and health outcomes. The evidence from the results shows there was no convergence in health expenditures in ECOWAS. However, the study found evidence of convergence in health outcomes.

3.4 Summary

The importance of public health expenditures to an economy can only be emphasized. When governments spend on things like the health, there is a tendency of increased activity in the health sector in terms of increased health employment levels and consumption of health which is likely to translate into improved health outcomes. Many studies have made use of the demand function to specify their models and have concluded that health care expenditures are hypothesized to be a function of real per capita income and other non-income factors. Some of the non-income determinants identified are population age structure, infant mortality rate, life expectancy, unemployment, and population growth, inflation, literacy rate and the number of physicians. The income

elasticity of health has also proven to be a fundamental phenomenal in public health expenditure. In many regions of the world, health is a necessary good. Literature also confirms that regional integration is a major requirement for convergence in public health expenditures. The empirical studies show that there is scant literature on the convergence of public health expenditures in the developing regions including Africa.

CHAPTER FOUR: RESEARCH METHODS

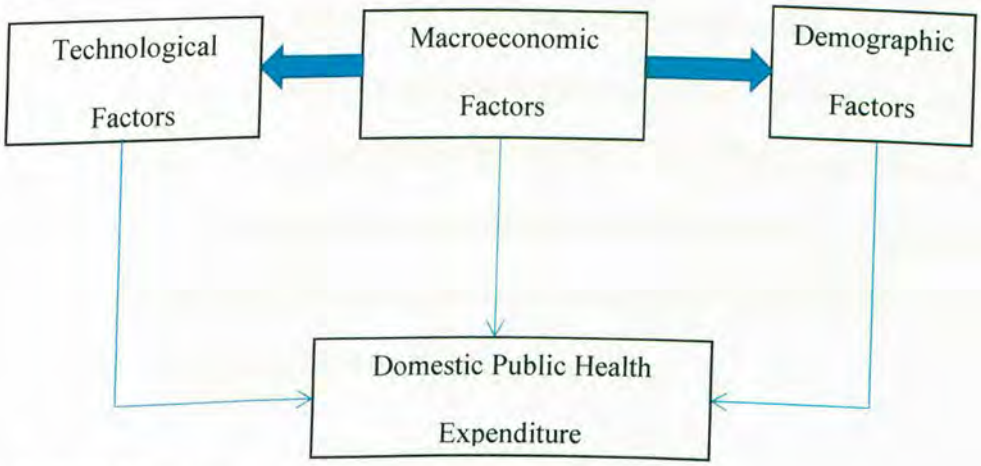
4.1 Introduction

This chapter is fourfold. It consists of the research design which introduces the conceptual framework of the study. Then the model is specified and light is shade on the procedure of the study. It then elaborates on the data analysis and finally the research ethics.

4.2 Research design

This study uses a longitudinal research design. It also makes use of a quantitative research strategy. It incorporates a conceptual framework and makes use of a heterogeneous dynamic panel to investigate the determinants of domestic public health expenditures in SADC. The conceptual framework of this study is drawn from the work of Abbas and Hiemenz (2011), Baltagi and Moscone (2010), Furuoka et al (2011), Samadi and Rad (2013) and Khan, Razali and Shafie (2016) based on the premise that public health expenditure is determined by a host of macroeconomic,

technological and demographic factors. The conceptual framework of this study is presented as follows:



Source: Author's Construct

Figure 4.1: Conceptual framework for the determinants of domestic public health expenditure

Variation in the level of public health expenditure among countries is usually explained by macroeconomic issues. The most important macroeconomic determinant of public health expenditure is a country's income level (Baltagi & Moscone, 2010; Abbas & Hiemenz, 2011). Hence, this study uses GDP per capita as a macroeconomic determinant of public health expenditure. Medical technological progress is another important determinant of public health expenditure. This is due to the assumption that medical technology is said to be the major driver of improved health and thus, with those variables as health outcomes, an improvement in them would also then be interpreted as resulting from improved medical technology. Consequently, some studies (Dregen and Reimers, 2005; Okunade and Murthy, 2002) have used infant mortality rate and life expectancy at birth as proxies for medical technological progress.

However, this study opts to use infant mortality rate as a proxy because SSA has the highest global risk of death in the first month of life (Amouzou et al, 2017).

The pure demographic effect explains the demographic determinants of public health expenditure. These are identified as population size, population age structure and employment structure of a country (Harris & Sharma, 2018). This study uses the unemployment rate and the ageing population. While many studies have used population age $\geq$ 65 years as a measure of the ageing population, this study uses the population age $\geq$ 75 years due to inconsistency in data for these two variables.

There are also possible relationships among the factors considered in the conceptual framework. Macroeconomic factors potentially affect both the technological and demographic factors.

4.3 Model specification

Based on the conceptual framework above, the linear regression model for this study is specified below. Transforming a linear specification into a natural log-log model makes the estimated parameters direct long-run elasticities (Angko, 2013). Therefore, this study uses the following specified model;

$$LPHE_{it} = \alpha + \beta_{1it}LGDPPC_{it} + \beta_{2it}LIMR_{it} + \beta_{3it}LPOP75_{it} + \beta_{4it}LUNE_{it} + \varepsilon_{it} \quad (1)$$

Where LPHE is the natural log of Public health expenditure, LGDPPC is the natural log of GDP per capita, LIMR is the natural log of infant mortality rate at birth, LPOP75 is the natural log of the number of people from 75 years of age and above, LUNE is the natural log unemployment rate and ε_{it} is the error term. The coefficients $\beta_1, \beta_2, \beta_3$ and β_4 are respectively the elasticities of public health expenditure with respect to GDPPC, IMR, POP75, and UNE.

Various economic policies show their effects on other economic variables in a delay of a specific time period. For instance, an investment made in the health sector today will have its effects captured in future periods. Because of this, it is necessary to include lagged variables in the estimation. The inclusion of a lagged dependent variable amongst the regressors translates into a dynamic panel. According to Nabila, Shazia, and Muhammed (2015), when dealing with dynamic panel models, the asymptotic of a large number of cross-sections (N) and large time periods (T) dynamic panels differ from the asymptotic of the common large N and small T dynamic panels. In small T panel estimations, it is

common to pool the individual cross-sections and only allow the constant term to vary across the cross-sections. This entails the use of estimation techniques such as the Generalized Method of Moments (GMM) presented by Arellano and Bond (1991) and the fixed and random effect estimators (Nabila, Shazia & Muhammed, 2015). However, using these estimation techniques in data sets with large T, causes the estimator to break down, hence, making them inappropriate. An alternative and appropriate estimation technique is the Pooled Mean Group (PMG) estimator because it involves both pooling and averaging. This study, therefore, opts to use the PMG estimator.

According to Rafindadi and Yosuf (2013), the main characteristic of the PMG estimator is that it allows short-run coefficients, including the intercepts, the speed of adjustment and error variances to be heterogeneous across countries while the long-run slope coefficients are restricted to be homogeneous across countries. There are sound reasons to assume that the long-run equilibrium relationships between variables are homogeneous across groups. This could be due to budget or solvency constraints, arbitrage conditions, or common technologies influencing all groups in a similar way (Pesaran, Shin & Smith, 1999).

According to Pesaran, Shin and Smith (1997), the PMG estimator takes the form of a simple Autoregressive Distributed Lag (ARDL) model which has become popular because of the various advantages it possesses such as the ability to estimate variables with different orders of integration. Traditionally, Ordinary Least Squares (OLS) is suitable for stationary I (0) variables. The inclusion of variables that are I (1) makes OLS inappropriate and may lead to spurious results.

Therefore, unlike other approaches like Johansen methodology which requires variables to be integrated of the same order, the ARDL can use variables of any order provided they are not I (2). ARDL models are also able to estimate both the long and short-run parameters of the model simultaneously while avoiding the problems associated with non-stationary data. According to Aliha et al (2017), the ARDL is a much more statistically significant approach to cointegration for small samples while allowing different optimal lags of variables. The other advantage of using ARDL models is that they provide unbiased estimates of the long-run model (Belloumi, 2012). The generalized ARDL $(p, q, q, \ldots, q)$ model based on Pesaran, Shin and Smith (1998) is specified as follows:

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \gamma'_i d_t + \varepsilon_{it} \quad (2)$$

Where, Y_{it} is the dependent variable; domestic public health expenditure, X_{it} are vectors of the select determinants; that vary across groups and time periods and d_t are also vectors of the regressors but only vary overtime periods; λ_{ij} are the coefficients of the lagged dependent variables; δ_{ij} and γ_i are vectors of the regressors; the number of groups $i = 1, \ldots, N$; number of time periods $t = 1, \ldots, T$; $(p \; and \; q)$ are optimal lag orders and ε_{it} is the error term.

Therefore, in order to estimate equation (1) by Ordinary Least Squares (OLS), this study transforms equation (1) into a panel ARDL model that ought to be analyzed for the bounds test method as follows:

$$\Delta LPHE_{it} = \delta_1 + \sum_{i=1}^{p} \beta_{ij} \Delta LPHE_{i,t-j} + \sum_{i=0}^{q} \beta_{ij} \Delta LGDPPC_{i,t-j} +$$

$$\sum_{i=0}^{q} \beta_{ij} \Delta LIMR_{i,t-j} + \sum_{i=0}^{q} \beta_{ij} \Delta LPOP75_{i,t-j} + \sum_{i=0}^{q} \beta_{ij} \Delta LUNE_{i,t-j} + \beta_1 LPHE_{i,t-1} +$$

$$\beta_2 LGDPPC_{i,t-1} + \beta_3 LIMR_{i,t-1} + \beta_4 LPOP75_{i,t-1} + \beta_5 LUNE_{i,t-1} + \varepsilon_{it} \quad (3)$$

4.4 Data Sources

This study uses annual panel data for fifteen SADC countries between 2000 and 2016. The selection of countries and variables is based on data availability. This study excludes Zimbabwe due to data unavailability. All the data were collected from the World Bank's global health expenditure database. Finally, the study used EViews 10 statistical package to analyze the data.

4.5 Description of variables and priori expectations

4.5.1 Domestic public health expenditure as a percentage of general government expenditure

This is a common measure of government expenditure on health. It was also the target variable at the 2001 Abuja declaration on health for raising health expenditure in Sub Saharan Africa. It comprises of funds disbursed for both capital and recurrent expenditure on health. It sums up expenditure by governments on hospitals, clinics, and public health affairs and services; for medical, dental and paramedical practitioners; for pharmaceuticals, prosthesis, medical equipment, and appliances; for applied research and experimental development on health and for health affairs (Angko, 2013).

4.5.2 Real Gross Domestic Product (GDP) per capita

Real GDP per capita measures the income level of a country. Baltagi and Moscone (2010) opine that income is the most important determinant of health expenditure. The income level of a country most likely determines the level of government expenditure on health. Countries with high-income levels experience higher levels of government expenditure on health compared to those with low-income levels. Therefore, the economic theory posits a positive relationship between GDP per capita and domestic public health expenditure.

4.5.3 Infant Mortality Rate

The infant mortality rate is the probability of dying between birth and age of 1 year per 1000 live births (World Health Organization, 2015). Although theory indicates that medical technological progress is an important determinant of public health expenditures, finding a sound variable or proxy for this has posed to be a challenge. This study uses infant mortality rate measured in years as a proxy for medical technological progress. Theoretically, decreasing infant mortality rate is associated with increased long-term costs of health care. Therefore, a negative sign is expected if marginal decreases in the infant mortality rate lead to an increase in domestic public health expenditures.

4.5.4 Number of people aged 75 years and above

This variable captures the ageing population. It also captures the human capital of the population. From the work of Grossman (1972), the health stock of an individual depreciates over time. This means as an individual gets older, their health is likely to depreciate over time. Therefore, it is important for governments to invest more in the health of the elderly as opposed to the young. Therefore, the expected relationship between the ageing population and public health expenditure is positive.

4.5.5 Unemployment rate

This variable captures the proportion of the labour force that is unemployed. When people are unemployed, they often do not earn a wage. Grossman (1972) asserts that when people do not earn wages, they are likely to experience poor nutrition and therefore, low levels of health. Also, this means they cannot own private medical insurance and would obviously have low private out of pocket health expenditure. Many of them are likely to

rely on the government's provision of health care services. Therefore, the expected relationship between unemployment rate and public health expenditure is negative.

4.6 Data Analysis

4.6.1 Descriptive statistics

The present study reviewed the descriptive statistics of the raw data set including measures of central tendency and dispersion and normality. The mean simply shows the average value for each of the variables. The median is the middle value after sorting the observations. The maximum and minimum show the highest and lowest values respectively in each of the variables. The standard deviation shows the deviation from the sample means of each variable. Skewness and kurtosis are measures of normality. They provide useful information about the symmetry of the probability distribution of the various series as well as the thickness of the tails of these distributions respectively (Oyedele & Adebayo, 2015). Specifically, skewness measures the degree of asymmetry of the series whilst kurtosis measures the peakedness or flatness of the distribution of the series. The Jarque-Bera statistic measures the difference between the skewness and kurtosis with those from the normal distribution. The probability is that the absolute value of a Jarque Bera statistic exceeds the observed value under the null hypothesis – a small probability value leads to the rejection of the null hypothesis of a null hypothesis. The null hypothesis of the Jarque Bera test is that the distribution is normal.

4.6.2 Correlation analysis

The present study then analyzed the correlation among the variables by using a correlation matrix. This relationship is represented by the correlation coefficient which is a number

between -1 and 1. A correlation coefficient of 1 shows a perfect correlation whilst a coefficient of zero shows no correlation between variables.

4.6.3 Cross-Sectional Dependence Test

It is a common assumption that errors in panel data models could be serially dependent (Pesaran & Tosseti, 2011; Chudik & Pesaran, 2013; Sarafidis & Wansbeek, 2012). This can lead to serious estimation problems such as invalid test statistics and estimator inefficiency. Therefore, before proceeding with panel data analysis, it is important to check whether there is cross-sectional dependence or independence. Following the shortcomings of other cross-sectional dependence tests such as the Breusch and Pagans LM test, this study employs the Pesaran CD test to evaluate the presence or absence of cross-sectional dependence. This test seems suitable for this study because the time period (T_{ij}) is relatively small. Pesaran (2004) proposed this alternative test which is based on pairwise correlation coefficients as opposed to the squares of the coefficients used in the LM test:

$$CD = \sqrt{\frac{2}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij}\hat{\rho}_{ij}\right) \rightarrow N(0,1) \quad (4)$$

The Pesaran CD test proposes asymptotic normality for $T_{ij} \rightarrow \infty$ and $N \rightarrow \infty$. Where N is the cross-section and T is the time period.

$\hat{\rho}_{ij} = \sum_{t=1}^{T} e_{it}\, e_{jt} / (\sum_{t=1}^{T} e_{it}^2)^{1/2} (\sum_{t=1}^{T} e_{jt}^2)^{1/2}$ where, e_{it} denotes the OLS residuals based on T observations for each $i = 1, \ldots, N$. Under this test, the null hypothesis of no cross-section dependence is defined by;

$$H_0: \mu_{it} = \sigma_i \varepsilon_{it}, \text{ with } \varepsilon_{it} \sim IID\ (0,1) \text{ for all } i \text{ and } t.$$

4.6.4 Unit Root Tests

The growing involvement of macroeconomic applications using panel data which has large samples constitutes the cross-sectional dimension providing data over long time series gives rise to issues of stationarity (Asteriou & Hall, 2007). It is a well-known fact by econometricians that data with a unit root often results in spurious results. Hence, it is important to ascertain the stationarity of variables.

This study incorporates an ARDL bounds test which is able to use variables with different orders of integration provided they are not I (2). Therefore, to ensure that I (2) variables are not used in the model, it is necessary to conduct panel unit root tests. Assuming cross-sectional independence, the study employs two first generation unit root tests; Levin, Lin, and Chu (2002) and the Im, Pesaran, and Shin (2003) unit root tests. However, if cross sectional dependence will be present among the variables, the study will make use of panel unit root tests on the residual estimates. These residuals should be I (0) in order for the estimations to produce unbiased (Pesaran, 2007).

a) Levin, Lin and Chu unit root test

The Levin, Lin, and Chu (2002), (LLC) unit root test is an extension of the Dickey-Fuller (DF) test because it is a pooled DF and it allows for two-way fixed effects which allow for heterogeneity across all units of the panel. According to Baltagi (2008), the LLC argues that individual unit root tests tend to have limited power against alternative hypotheses with highly persistent deviations from equilibrium. The null hypothesis is that each individual time series contains a unit root against the alternative hypothesis that each time series is stationary (Baltagi, 2008). Therefore, the main equation is;

$$\Delta y_{it} = \delta y_{it-1} + \sum_{L=1}^{\rho_i} \theta_{iL} \Delta y_{it-L} + \varphi_{mi} d_{mt} + \varepsilon_{it} \qquad m = 1,2,3 \qquad (5)$$

Where, d_{mt} indicates the vector of deterministic variables, whilst φ_{mi} indicates the vector of coefficients for the model; m=1, 2, 3, whilst. Particularly, $d_{1t} = \{empty\ set\}$, $d_{2t} = \{1\}$, $d_{3t} = \{1, t\}$. This shows which deterministic element should be included in the testing procedure. LCC suggests a three-step procedure to implement this test because of the lag order ρ_i is unknown. The first step involves performing the Augmented Dickey-Fuller (ADF) regressions for each cross-section separately. At this stage, the lag order is allowed to vary across individual cross sections. The second step is to estimate the ratio of the long run to short-run standard deviation. The third step involves computing the panel test statistics and to run the pooled regression;

$$\tilde{e}_{it} = \rho\tilde{v}_{i,t-1} + \tilde{\varepsilon}_{it} \tag{6}$$

Equation (6) is based on a total of $N\tilde{T}$ observations where, $\tilde{T} = T - \bar{p} - 1$ is the average number of observations per individual in the panel. The hypotheses of this test are;

$$H_0: \rho_i = \rho = 0$$

$$H_1: \rho_i = \rho < 0 \text{ for all i}$$

The computed adjusted t-statistic is;

$$t^*_\rho = \frac{t_\rho - N\tilde{T}\hat{S}_N\hat{\sigma}_{\tilde{\varepsilon}}^{-2}(\bar{\rho})\mu^*_{m\tilde{T}}}{\sigma^*_{m\tilde{T}}} \tag{7}$$

However, the major weakness of this test is that it restricts the coefficient of the lagged dependent variable to be homogeneous across all units of the panel.

b) Im, Pesaran and Shin unit root test

The Im, Pesaran and Shin (2003), (IPS) unit root test was designed to test for unit root in heterogeneous panels (Nabila, Shazia & Muhammed, 2015). The IPS was also designed to solve the weakness of the LLC by allowing for heterogeneity on the lagged dependent

variable (Asteriou & Hall, 2007). It is based on the ADF test and can be presented as follows:

$$\Delta y_{it} = \overline{w}_i + \rho y_{it-1} + \sum_{j=1}^{\rho_i} \rho_{i,j} \Delta y_{i,t-j} + v_{it} \quad (8)$$

It allows for a heterogeneous v_{it} and averages individual unit root test statistics. According to Baltagi (2008), the IPS suggests an average of the ADF tests when the errors are serially correlated with different serial correlation properties across cross-sections. The null hypothesis is that each cross-section contains a unit root

$$H_1: \begin{Bmatrix} \rho_i < 0 \, for \; i = 1,2, \ldots, N_1 \\ \rho_i = 0 \, for \; i = N_1 + 1, \ldots, N \end{Bmatrix}$$

One necessary condition for the consistency of the panel unit root test is $\lim_{N\to\infty} \left(\frac{N_1}{N}\right) = \delta$, where $0 < \delta \leq 1$. This means the fraction of the stationary individual time series should be non-zero. The IPS unit root test equation can be expressed as t bar because it averages the individual ADF statistics as follows;

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_{\rho i} \quad (9)$$

Where $t_{\rho i}$ is the individual t-statistic for testing H_0: $\rho_i = 0$ for all i. The IPS test statistic is thus calculated as;

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E\{t_{iT}|\rho_i = 0\})}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} var\{t_{iT}|\rho_i = 0\}}} \Rightarrow N(0,1) \quad (10)$$

4.7 Optimal Lag Determination

Usually, the dependent variable responds to the explanatory variables within a lag of time. Therefore, prior to estimating the ARDL model, it is important to determine the number of lags for each variable and the entire model. This study selects the optimal lags based on the lowest value of the Akaike Information Criterion (AIC) or Schwarz Bayesian

Criterion (SBC) which are often used in panel estimations (Kutu & Ngalawa, 2016). Following the optimal lag determination, the selected model is also tested using the benchmark analysis to ascertain its strength before running the ARDL regression.

4.8 ARDL Bounds Test

To fulfil the first objective of this present study, an ARDL Bounds test was carried out in order to ascertain the presence of a long-run relationship amongst the variables. The Bounds test is based on the joint F test which involves asymptotic critical value bounds, depending on whether the variables are I (0) or I (1) or a mixture of both (Aliha et al, 2017). The null hypothesis of no cointegration among the variables is set against the alternative hypothesis of cointegration among the variables based on this study as follows:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (No cointegration)

$H_1: \beta_1 \neq 0$ or $\beta_2 \neq 0$ or $\beta_3 \neq 0$ or $\beta_4 \neq 0$ or $\beta_5 \neq 0$ (Cointegration)

According to Pesaran et al. (2001), there are two sets of critical values for a given significance level. The first set is calculated on the assumption that all the variables included in the ARDL model are I (0), while the second one is calculated on the assumption that the variables are I (1) (Belloumi, 2012).

4.9 Model Estimation

According to Asghar, Qureshi, and Nadeem (2015), cointegrated variables tend to counter any deviance from long-run equilibrium. Therefore, equation (2) can be reparametrized as an Unrestricted Error Correction Model (ECM) system:

$$\Delta Y_{it} = \theta_i(Y_{i,t-1} - \beta_i X_{i,t-1}) + \sum_{j=1}^{p-1} \gamma_{ij}^{*} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*} \Delta X_{i,t-j} + \varphi'_i d_t + \varepsilon_{it} \quad (11)$$

Where the β_i are the long-run parameters and $\theta_i$are the error-correction parameters. Hence, in the presence of cointegration, this study specifies the UECM to be estimated as below:

$$\Delta LPHE_{it} = \delta_2 + \sum_{i=1}^{p-1} \beta_{ij} \Delta LPHE_{i,t-j} + \sum_{i=0}^{q-1} \beta_{ij} \Delta LGDPPC_{i,t-j} + \sum_{i=0}^{q-1} \beta_{ij} \Delta LIMR_{i,t-j} + \sum_{i=0}^{q-1} \beta_{ij} \Delta LPOP75_{i,t-j} + \sum_{i=0}^{q-1} \beta_{ij} \Delta LUNE_{i,t-j} + \gamma ECT_{i,t-j} + \varepsilon_{it} \quad (12)$$

Where ECT is the error correction term and γ is the coefficient of the error correction term that is expected to be negative. It is from this estimated equation that the second objective can be fulfilled. The decision rule is that if the coefficient of LGDPPC is greater than one, then healthcare is a luxury and if it turns out that the coefficient of LGDPPC is less than one, then healthcare is a necessity.

4.10 Test for Stochastic Convergence

In order to fulfil the last objective of this study, the convergence of public health expenditure in SADC is tested. Drawing its background from the neoclassical growth model, literature (Baumol, 1986; Sala-i-Martin, 1992, 1995) provides various methodologies of testing the convergence hypothesis depending on the objectives to be achieved.

Following the 2001 Abuja declaration on health, this study tests whether or not public health expenditure in SADC converges to a common stochastic trend. According to Kumo (2011), amongst other methodologies, convergence can also be tested by directly examining the time series properties of various specific variable series where convergence is analysed as a dynamic stochastic process. Odhiambo, Wambugu and Kiriti-Ng'ang'a (2015) elaborates that stochastic convergence occurs when health

expenditure of one country relative to a reference country's health expenditure is stationary, hence, leading to a steady-state. This entails the use of either time series or panel unit root tests for stationarity. Kumo (2011) further states that for convergence to be present between two variables, their difference must not be characterised by a boundless drift. This implies that variables converge when they share a common stochastic trend. Carmignani (2006) also confirms that if the difference between a variable in two countries revolves around a stationary process, then the presence of convergence is inevitable.

This test is suitable for this study as it is concerned with the convergence among SADC countries to the regional average of public health expenditure as a percentage of total general government expenditure. This shows the "catch up" or growth in public health expenditures within the region.

This study adopts a model by Aslan (2008) and Lima and Resende (2007) who used the Im, Pesaran, and Shin (IPS) (2003) panel unit root test to check for stochastic convergence. This is because the IPS panel unit root test considers unit-specific slope coefficients (Lima & Resende, 2007). The IPS are also based on the ADF panel unit root test therefore; it is able to show the intermediate ADF test results. The model was then specified as follows:

$$\Delta Y_{it} = \alpha_i + \beta_t Y_{i,t-1} + \varepsilon_{it} \quad (13)$$

Where, α_i is an intercept, β_t is the coefficient of the augmented lagged differences in public health expenditure as a percentage of total general government expenditure. Therefore, if x_{t-1} is stationary, then there is convergence. Specifically, for this study, the econometric test for convergence is based on the following equation:

$$\left(LPHE_{it} - LPHE_{b\,i,t}\right) = \beta_t(LPHE_{i,t-1} - LPHE_{\boldsymbol{b}\,i,t-1}) + \varepsilon_{it} \quad (14)$$

Where, $LPHE_{b\,i,t}$ denotes the benchmark variable, which in this case is the natural logarithm of the regional average of public health expenditures as a percentage of total general government expenditures; the variables on the right side of the equation are simply the one period lags also expressed in natural logarithms and ε_t is the covariance stationary error term. Let $y_{it} = \left(LPHE_{it} - LPHE_{b\,i,t}\right)$, then equation (12) can be expressed as an Autoregressive (AR) (p) process; $y_t = \beta_t y_{t-1} + \varepsilon_t$. Here (p=1) and the convergence test leads to a unit root test on y_{t-1}.

4.11 Diagnostic Checks

Some diagnostic checks were also done in order to check the validity and consistency of the results obtained from the estimations of this present study. However, these diagnostic checks were not done on the panel, instead, they were group-specific so that the results can be compared. Under these diagnostic checks, Ramsey's RESET test for misspecification was done. The null hypothesis which states that the model is correctly specified was tested against the alternative hypothesis. If the test statistic is insignificant, then the null hypothesis cannot be rejected. Some stability tests including the Cumulative Sum of Recursive Residuals (CUSUM) test and the Cumulative Sum of Recursive Residuals of Squares (CUSUMSQ) test for model stability were also done. If the lines fall within the bands, then the model is stable. However, if they fall outside the bands then the model is unstable. To check if the residuals were correlated, the residual serial correlation LM test was done. Under this test, the null hypothesis of no serial correlation was tested against the alternative hypothesis. If the test statistic is insignificant, then the null hypothesis cannot be rejected. For the normality test, if the Jarque-Bera statistic is

insignificant, then the residuals are normally distributed. However, if the Jarque-Bera statistic is significant, then the residuals are not normally distributed. Then finally, the Breusch-Pagan-Godfrey test for heteroscedasticity was done. The null hypothesis of homoscedasticity was tested against the alternative hypothesis of heteroscedasticity. If the p-value of the F-statistic is insignificant then there is homoskedasticity. However, if they are insignificant, this implies the presence of heteroscedasticity.

4.12 Research ethics

This study adheres to ethical practice when collecting data and reporting results. The data used in this study has not been distorted, fabricated nor falsified in any manner. Furthermore, the results of this study have been published as obtained by the estimation techniques and the estimation software. All sources of literature have also been correctly acknowledged using Harvard referencing style as prescribed by the University of Namibia.

4.13 Conclusion

This chapter described the research methods including the conceptual framework, specific tests of this study and the research ethics. The subsequent chapter presents the data analysis and discussion of results.

CHAPTER FIVE: EMPIRICAL ANALYSIS AND DISCUSSION OF RESULTS

5.1 Introduction

Following the research methods presented in the preceding chapter, this chapter presents the descriptive statistics and correlation analysis. It also discusses the findings of the various tests conducted including; cross-sectional dependence test, unit root tests, optimal lag selection criteria, ARDL Bounds test and the estimated model based on the PMG estimator. Finally, this chapter presents the results of the public health expenditures convergence test and a few diagnostic checks to validate the results.

5.2 Descriptive statistics

In order to assess the characteristics of the raw data, a summary of descriptive statistics for each variable is displayed in the table below.

Table 5.1: Descriptive Statistics

	PHE	GDPPC	IMR	UNE	POP75
Mean	9.14849	2953.65	59.0059	13.2007	14.9136
Median	8.58295	1315.22	59.3	8.49	1.40704
Maximum	23.2453	15077.9	122.6	38.04	155.759
Minimum	0.93953	146.762	11.7	0.08748	0.0333
Std. Dev.	4.18255	3323.2	26.5176	9.75002	35.1458
Skewness	0.7851	1.51019	-0.0786	0.42715	3.23613
Kurtosis	4.04366	4.86734	2.47718	1.85775	12.0611
Jarque-Bera	37.7691	133.977	3.16699	21.6172	1317.43
Probability	0.00000	0.00000	0.20526	0.00002	0.00000

Observations	255	255	255	255	255

Source: Author's computations

According to Table 5.1, GDPPC had the largest mean whilst PHE had the lowest mean. With regards to the median, GDPPC again had the largest median values whilst UNE had the lowest median value. GDPPC showed the largest dispersion from the sample mean whilst PHE had the lowest dispersion from the sample mean. All the data showed a high level of consistency because their mean and median values all lie within the maximum and minimum values of these series. The results show that PHE and UNE mirror normal skewness whilst GDPPC and POP75 show positive skewness (long right tail). However, IMR has a negative skewness (long left tail). With regards to kurtosis, PHE, GDPPC and POP75 show positive kurtosis (peaked curve) whilst IMR and UNE show negative kurtosis (flatted curve). The probabilities under the Jarque Bera statistic for PHE, GDPPC, UNE and POP75 are highly statistically significant. This implies that these variables are not normally distributed. However, IMR has an insignificant Jarque Bera statistic implying that it is normally distributed.

5.3 Correlation Analysis

Before estimating the model, it is also essential to check the correlation between the variables. Therefore, the correlation matrix is presented in the table below.

Table 5.2: Correlation Matrix

	LPHE	**LGDPPC**	**LIMR**	**LUNE**	**LPOP75**
LPHE	1				
LGDPPC	0.344060617	1			
LIMR	-0.07426187	-0.65001569	1		

LUNE	0.240329456	0.081389638	0.450345	1	
LPOP75	-0.470043518	-0.53084852	0.36817	-0.0763	1

Source: Author's computations

Table 5.2 shows that there is no perfect correlation amongst the variables. The highest correlation coefficient is between LGDPPC and LIMR. It shows a negative correlation with a value of -0.65001569. The lowest correlation coefficient is between LPHE and LIMR.

5.4 Residual Cross-Sectional Dependence Test

The residuals of the cross-section often tend to be correlated when analyzing panel data. This correlation may arise from common global shocks with different impacts within the cross-section (Samadi & Rad, 2013). In this regard, the Pesaran CD test is performed to test the following hypothesis:

H_0: There is no correlation of residuals

H_1: There is correlation of residuals

Table 5.3: Pesaran CD test

Test	Statistic	Probability
Pesaran CD	-2.024468	0.0429**

*Source: Author's computations. Note: ** shows statistical significance at 5% level.*

The Pesaran cross-sectional dependence test results presented in table 5.3 show that the probability value is less than 0.05 therefore, the test statistic is significant. This means that the null hypothesis cannot be rejected in favour of the alternative. This shows the presence of cross-sectional dependence among the residuals in the model. The presence of cross sectional dependence among the variables can be explained by regional

integration in SADC which may lead to technological transfers and spillovers across the borders. Therefore, if this is ignored, the study might obtain biased estimates.

As seen from table 5.3, the Pesaran CD test results confirm the presence of cross-sectional dependence among the residuals in the model, therefore, in order to obtain unbiased estimates, a diagnostic test is performed by applying panel unit root tests (at levels) on the residual estimates (Pesaran, 2007). The results of the panel unit root tests on the residual are presented in table 5.4 below:

Table 5.4: Residual panel unit root tests

Unit root test	Statistics	Probability	Cross Sections
Levine, Lin & Chu	-3.05964*	0.0011	15
Im, Pesaran and Shin W-stat	-2.25943**	0.0119	15
ADF-Fisher Chi-square	54.6303*	0.0039	15
PP-Fisher Chi-square	63.6768*	0.0003	15

*Source: Author's computations. The p-values are in parenthesis. Note: *, ** and *** denote rejection of the null hypothesis at 1%, 5% and 10% significance level respectively.*

The results of the residual panel unit root tests at levels indicate that the residual is stationary. This means the residual is I (0). I (0) residuals deal with the issue of cross sectional dependence and validate the estimates of the PMG ARDL (Olayungbo & Quadri, 2019).

5.5 Panel unit root analysis

The study employs the LLC and IPS unit root tests. These different tests are used for the purpose of comparing and validating results and also to ensure consistency in the results. Each variable was tested at levels and at first difference. This was done in the intercept and then in the intercept and trend. The Hypothesis for the LLC unit root test is set below;

H_0: Individual time series contains unit root (Non-stationary)

H_1: Individual time series does not contain unit root (Stationary)

If the p-values show reasonable significance levels, then the null hypothesis is rejected in favour of the alternative hypothesis.

Table 5.5: LLC unit root test

	Intercept		**Intercept and Trend**	
	Levels	**First Difference**	**Levels**	**First Difference**
LPHE	-2.99840*** (0.0014)	-15.3307 (0.0000)	-3.26175*** (0.0006)	-12.5525 (0.0000)
LGDPPC	-4.74727*** (0.0000)	-15.2363 (0.0000)	3.89638 (1.0000)	-17.2396*** (0.0000)
LIMR	-5.07207*** (0.0000)	-3.82766 (0.0001)	-2.39535*** (0.0083)	-1.87235 (0.0306)
LUNE	-2.55476*** (0.0053)	-3.76413 (0.0001)	-1.12357*** (0.0001)	-4.10886 (0.0000)
LPOP75	-0.59661 (0.2754)	-15.9623*** (0.0000)	-11.3442*** (0.0000)	1.58221 (0.9432)

*Source: Author's computations. The p-values are in parenthesis. Note: *, ** and *** denote rejection of the null hypothesis at 1%, 5% and 10% significance level respectively.*

The results of the LLC unit root test presented in Table 5.5 show that at the intercept, all the variables were stationary at levels except LPOP75 which became stationary only after first difference. At the intercept and trend, all variables were also stationary at levels except LGDPPC which became stationary only after first difference. These results show that under the LLC unit root test, there is a mixture of I (0) and I (1) variables. The IPS test has a slightly different hypothesis. The hypothesis for the IPS to be tested is set below;

H_0: Cross-section contains unit root (Non-stationary)

H_1: Cross-section does not contain unit root (Stationary)

If the p-values show significance, then the null hypothesis is rejected in favour of the alternative hypothesis.

Table 5.6: IPS unit root test

	Intercept		**Intercept and Trend**	
	levels	**First Difference**	**Levels**	**First Difference**
LPHE	-1.59067** (0.0153)	-3.76413 (0.0000)	-1.38058*** (0.0042)	-4.10886 (0.0000)
LGDPPC	-1.43338* (0.0759)	-9.35656 (0.0000)	4.68412 (1.0000)	-12.1166*** (0.0000)
LIMR	-0.07409 (0.4705)	-0.07409*** (0.0008)	-0.36550 (0.3574)	-3.10624*** (0.0009)

LUNE	-1.59067* (0.0558)	-5.09174 (0.0000)	-1.38058*** (0.0000)	-4.16151 (0.0000)
LPOP75	3.13704 (0.9991)	-11.9173*** (0.0000)	-8.18832*** (0.0000)	-5.52985 (0.0000)

*Source: Author's computations. The p-values are in parenthesis. Note: *, ** and *** denote rejection of the null hypothesis at 1%, 5% and 10% significance level respectively.*

The IPS results presented in table 5.6 show that at the intercept all the variables were stationary after first levels apart from LIMR and LPOP75 which were stationary after first difference. When tested at the intercept and trend, LPHE, LUNE and LPOP75 were stationary at levels were as LGDPPC and LIMR only became stationary after first difference.

The results of the first generation unit root tests show that there is a mixture of I (0) and I (1) variables but none of the variables is I (2). These results, therefore, meet the requirements of conducting an ARDL bounds test by Pesaran et al. (2001).

5.6 Optimal lag selection

Before estimating the panel ARDL, it is important to determine the maximum number of lags for each variable and also for the entire model. For panel estimations, the selection of lags is done using the AIC and the SC criteria. Since each variable can be assigned a specific lag, the model was run and the automatic lag selection was done based on the AIC and settled for a maximum of 2 lags for all the five variables. The unrestricted likelihood ratio test was also done to ascertain the optimum lag length for the entire

model. The results in table 5.7 show that the lowest value was that of the AIC which was at 2 lags. Therefore, lag 2 is the optimal lag length of the model.

Table 5.7: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1191	NA	0.14627	12.267	12.351	12.301
1	1087.72	4417.28	1.34E-11	-10.848	-10.345	-10.644
2	1182.13	178.179	6.57*	-11.560*	-10.637*	-11.186*
3	1201.83	36.1578	6.94E-12	-11.506	-10.163	-10.962
4	1227.08	45.06809*	6.94E-12	-11.509	-9.7461	-10.794

*Source: Author's computations. Where * indicates the lag-order selected by the criterion*

LR: Sequential modified LR test statistic (each test at 5% level)

FPE: Final information error

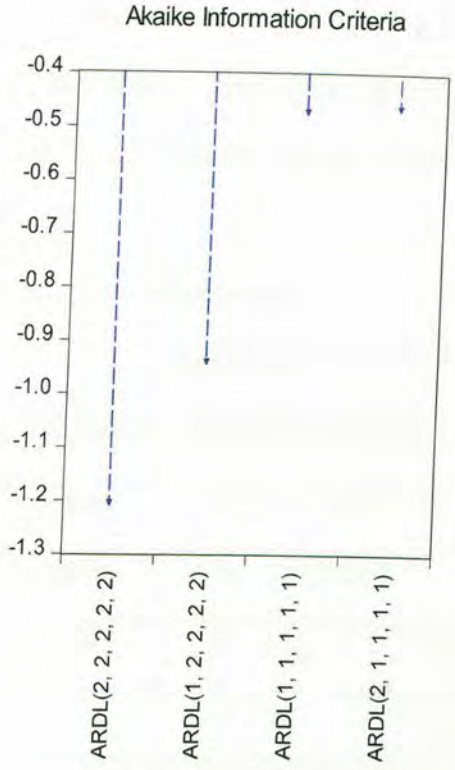
AIC: Akaike information criterion

SC: Schwarz information criteria

HQ: Hannan-Quinn information criterion

5.7 Measuring the strength of the model selection criteria

Following the optimal lag determination, it is also necessary to assess the strength of the model chosen and also the strength of the AIC over other criteria like the Schwarz information criteria and the Hannan-Quinn information criterion. To do this, this study employs the benchmark analysis.



Source: Author's Computations

Figure 5.1: Benchmark Analysis based on AIC

The benchmark analysis results shown in figure 5.1 compares four different models. The results show that the ARDL (2, 2, 2, 2, 2) model appears to be the most preferred model over others because it gives the lowest AIC value. This is followed by the ARDL (1, 2, 2, 2, 2), then ARDL (1, 1, 1, 1, 1). The least preferred is model is the ARDL (2, 1, 1, 1, 1). Therefore, this study makes use of ARDL (2, 2, 2, 2, 2).

5.8 Panel ARDL Bounds test

Following the unit root tests, it is confirmed that no variable is I (2). Therefore, the ARDL bounds test is applied. The Bounds test for cointegration is based on the joint F test. Therefore, the joint F test is done under the Wald test. There are three decision rules in the Wald test; if the F statistic exceeds the upper bound critical value, then the null

hypothesis of no cointegration is rejected. If the F statistic falls between the bounds, then it is inconclusive as to whether there is cointegration or not. However, if the F statistic falls below the upper bound critical value, the null hypothesis of no cointegration cannot be rejected (Aliha et al, 2017).

Table 5.8: ARDL Bounds test for cointegration

Wald Test			
Equation: ARDL (2, 2, 2, 2, 2)			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	5.354420	(5, 192)	0.0001***
Chi-square	26.77210	5	0.0001***
Critical value	**Lower Bound value**	**Upper bound value**	**Null Hypothesis**
1%	3.74	5.06	Rejected
5%	2.86	4.01	Rejected
10%	2.45	3.52	Rejected

*Source: Author's computations. Where *** shows statistical significance at 1% level.*

Note: The critical values are cited from Pesaran et al. (2001)

The results of the Wald test presented in Table 5.8 show that the F statistic for the ARDL (2, 2, 2, 2, 2) model is 5.354420 and it is highly statistically significant. Following the Wald test decision rules, it is clear that the F statistic exceeds the upper bound value of the 1%, 5% and 10% critical values. Therefore, the null hypothesis of no cointegration is rejected and it is concluded that the variables in the model are cointegrated. When

variables are cointegrated, they tend to counter any deviance from long-run equilibrium. Therefore, it is necessary to estimate the error correction model.

5.9 Interpretation of results

5.9.1 ARDL long-run estimates

The results of the Bounds test confirm the presence of cointegration among the variables. Therefore, the next step is to examine the long-run elasticities of LGDPPC, LIMR, LUNE and LPOP75. This will fulfil part of the second objective of the study. To do this, the error correction model is estimated based on the PMG estimator using equation 12. Under the PMG estimator, the long-run elasticities are assumed to be homogeneous across countries. Table 5.9 presents the long-run elasticities of the variables.

Table 5.9: Long-run PMG estimations for ARDL

Long Run Equation			
Variable	**Coefficient**	**t-statistic**	**Prob.**
LGDPPC	-0.366878	-8.786001	0.0000
LIMR	-2.463944	-13.57875	0.0000
LUNE	0.035423	2.955114	0.0040
LPOP75	-2.325374	-10.00378	0.0000

Source: Author's computations

The long-run results presented in table 5.9 reveal that all the variables are statistically significant in explaining the variations in domestic public health expenditures. This study poses several implications in the long run. Firstly, the largest and smallest variations in domestic public health expenditures are caused by infant mortality rate and unemployment rate respectively. The results also reveal that the relationship between

GDP per capita and domestic public health expenditures is negative. This relationship is inconsistent with theory and a priori expectations. It also contradicts the findings of Dogan, Tuluce and Dogan (2014) and Furuoka et al (2011). One explanation for these findings is that in many middle-income countries which includes most SADC countries, budget allocations to different sectors of the economy are dominated by political negotiation and they depend on the ability of the political system to effectively govern the allocation of funds. This is to say, governments perceive that their health sectors are less productive, therefore, when the income level of a country increases, governments tend to allocate more funds to other sectors which are perceived to be more productive (Ke et al, 2011 & Angko, 2013).

The coefficient of LGDPPC is observed to be less than one (-0.366878). An elasticity of less than one implies that public health expenditure is income inelastic. This means that public health expenditure is a necessity in SADC. These results are consistent with the findings of Kaussi et al (2017), Olaniyan, Onisanwa and Oyinlola (2013), Boachie et al (2014) and Lv and Zhu (2014).

Table 9 also shows that in the long-run, the relationship between unemployment and domestic public health expenditures and unemployment is positive. This relationship is consistent with theory and a priori expectations. It is also consistent with the findings of Omotor (2009) but contradicts with the findings of Omitogun (2014).

Technological progress as proxied by infant mortality rate is found to have a negative relationship with domestic public health expenditures. This relationship is also in line with a priori expectations. Although these findings contradict the results obtained by Dreger and Reimers (2005), the implication of this is that, when governments devote

more funds to increase the stock of medical technology, the infant mortality rate is likely to decrease. The proportion of the population aged 75 years and above has a negative relationship with domestic public health expenditures. Although these results are not consistent with a priori expectations, they are not strange to this study because the ageing population is not really a dominant issue in many middles- and low-income countries. Most of the elderly people in these countries live in villages and informal locations, and they are heavily reliant on traditional medicines.

5.9.2 Short-run dynamics

The other step is to examine the short-run elasticity of all the variable dynamics of domestic public health expenditures in the SADC. This will fulfil part of the second objective of this study. The PMG estimator assumes that the short-run elasticities are heterogeneous across countries. Under the ECM, the long-run relationship amongst the variables in the model is determined by the negative and significant value of the Error Correction Term (ECT). Equation 14 was used to estimate the short-run dynamics and the results are provided in Table 5.10 below.

Table 5.10: Short-run PMG estimations for ARDL

Dependent variable: LPHE

Short Run Equation			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
ECT	-0.686483	-3.908942	0.0002
D(LPHE(-1))	-0.080431	0.116672	0.4924
D(LGDPPC)	0.200997	0.321768	0.5338
D(LGDPPC(-1))	0.424308	0.364219	0.2472

D(LIMR)	-6.287163	7.132141	0.3805
D(LIMR(-1))	13.35603	7.506952	0.0787
D(LUNE)	-0.201015	4.124658	0.9612
D(LUNE(-1))	-20.99148	17.83127	0.2424
D(LPOP75)	5.72276	2.762758	0.0413
D(LPOP75(-1))	5.534295	3.465788	0.114
C	11.2364	2.779155	0.0001

Source: Author's computations

From the results presented in Table 5.10, it is found that in the short run all the variables are insignificant in determining the variations of domestic public health expenditures except for the non-lagged of population aged 75 years and above. The parameter of the short-run coefficient (ECT) is negative and highly statistically significant as expected. A highly statistically significant ECT implies the existence of a stable and appropriate model. This also confirms the presence of cointegration among the variables. Furthermore, the coefficient of the ECT indicates that approximately 69% of the disequilibrium in domestic public health expenditures from the previous period's shocks on the select determinants will converge back to the long-run equilibrium in the current year.

The results also show that domestic public health expenditures from previous periods have inverse relationships with current domestic public health expenditures. This means that governments usually consider the previous periods of budget allocation when preparing the budget for the current period. These results are in line with the findings of Angko (2013).

Most short-run results are different from those of the long run. In the short run, GDP per capita has a positive but insignificant influence on domestic public health expenditure which is consistent with theory and prior expectations. These results also align with the findings of Dogan, Tuluce and Dogan (2014). However, the coefficients of GDP per capita and its lag is less than one indicating that even in the short run, domestic public health expenditure is still a necessity in SADC.

Infant mortality rate maintains the negative relationship as in the long run but its lag shows a positive relationship with public health expenditures in the short run. Additionally, in the short run, unemployment rate and its lag show a negative relationship with public health expenditures. Another striking inference is that unlike the long run, in the short run an ageing population and its lag have positive effects on domestic public health expenditures. This relationship is consistent with theory and prior expectations but contradicts the findings of Dogan, Tuluce and Dogan (2014).

5.1 Test for Convergence

In order to fulfil the last objective of the study, the convergence of domestic public health expenditure to the regional average is tested. Convergence towards the regional average means growth in domestic public health expenditures in the region. Put differently, it means that countries with low domestic public health expenditures will eventually catch up with the regional average. To achieve this, this study tests for stochastic convergence using the Im, Pesaran and Shin (2003) panel unit root test which is based on the ADF panel unit root test and the results are presented in the table below;

Table 5.11: ADF unit root test for domestic public health expenditures deviations from the regional average in 15 SADC countries in levels with the trend, and with the trend and intercept.

Cross Section	Trend	Null Hypothesis	Trend & Intercept	Null Hypothesis
Angola	-5.2228** (0.0010)	Rejected	-5.2603** (0.0042)	Rejected
Botswana	-5.2279** (0.0010)	Rejected	-5.2554** (0.0042)	Rejected
DRC	-4.5305** (0.0045)	Rejected	-4.3854** (0.0042)	Rejected
Tanzania	-3.3614** (0.0302)	Rejected	-3.0123 (0.1609)	Not rejected
Malawi	-6.0824** (0.0002)	Rejected	-4.1152** (0.0299)	Rejected
Lesotho	-4.2080** (0.0063)	Rejected	-4.5525** (0.0134)	Rejected
Madagascar	-3.6524** (0.0188)	Rejected	-4.6272** (0.0132)	Rejected
Mauritius	-4.5897** (0.0031)	Rejected	-4.9367** (0.0071)	Rejected

Mozambique	-3.2414** (0.0407)	Rejected	-3.1955 (0.1280)	Not rejected
Namibia	-4.5510** (0.0038)	Rejected	-4.3801** (0.0195)	Rejected
Zambia	-3.4771** (0.0244)	Rejected	-3.4623 ** (0.0807)	Rejected
South Africa	-3.0530 (0.0526)	Not rejected	-3.0513 (0.1519)	Not rejected
Seychelles	-6.7881** (0.0001)	Rejected	-6.6141** (0.0005)	Rejected
Swaziland	-4.6998** (0.0026)	Rejected	-4.5349** (0.0005)	Rejected
Comoros	-7.0799** (0.0000)	Rejected	-6.7857** (0.0004)	Rejected

*Source: Author's computations. Note: ** represents a rejection of the null hypothesis of non-stationarity at 5% significance level.*

The results presented in Table 5.11 show the convergence behaviour of domestic public health expenditures in SADC at the trend, and at the trend and intercept. The hypothesis was tested at the 5% level of significance. If the p-values are less than 0.05, then the null hypothesis of non-stationarity is rejected. When tested at the trend only, the results indicate that the null hypothesis of non-stationarity was rejected for all countries except

for South Africa. This implies that at the trend, domestic public health expenditures for South Africa tend tends to diverge from the regional average. Then when tested at both trend and intercept, the results indicate that the null hypothesis again was rejected for all countries except, Tanzania, Mauritius, Mozambique and South Africa. This also implies that at both the trend and intercept, domestic public health expenditures for Tanzania, Mozambique and South Africa tend to diverge from the regional average.

The differences in public health expenditures from the regional average of public health expenditure for most of the 15 SADC countries have no unit roots indicating that the series of these countries converge to a common stochastic trend. However, the results show that domestic public health expenditure in South Africa diverges from the regional average. This finding is counter-intuitive and therefore needs further investigation because South Africa has experienced growth in domestic public health expenditure through the many policy initiatives put forward by its government. Otherwise, on average, these results show that there is growth in domestic public health expenditures within the region. The results of this present study are consistent with previous empirical studies on the convergence of public health expenditures in SSA (Odhiambo, Wabangu and Kiriti-Ng'ang'a, 2015), European Union (Narayan, 2007; Wang, 2009) and the OECD countries (Pekkurnaz, 2015). However, the results of this present study contradict the findings of a similar study by Oyedele and Adebayo (2015).

5.11 Diagnostic Checks

Having carried out the estimations above, some post-diagnostic checks were done in order to validate the results obtained. The table below shows the results of the various tests done.

Table 5.12: Group-specific diagnostic checks

	Ramsey's Test	CUSUM Test	CUSUM SQ	LM Test	Jarque Bera Stat	Breusch-Pagan-Godfrey
Angola	0.925	S	S	0.462	0.098	0.733
Botswana	0.501	S	S	0.701	0.845	0.069
Comoros	0.978	S	US	0.351	0.397	0.986
DRC	0.591	S	US	0.768	0.731	0.600
Tanzania	0.055	US	S	0.243	0.594	0.492
Malawi	0.359	S	S	0.305	0.080	0.499
Lesotho	0.587	S	S	0.523	0.963	0.662
Madagascar	0.573	US	S	0.195	0.865	0.144
Mauritius	0.007	S	US	0.761	0.685	0.077
Mozambique	0.059	S	US	0.683	0.942	0.754
Namibia	0.131	S	S	0.979	0.092	0.622
Zambia	0.738	S	S	0.236	0.028	0.911
South Africa	0.897	S	S	0.478	0.997	0.727
Seychelles	0.022	S	S	0.759	0.823	0.626
Swaziland	0.053	S	S	0.860	0.819	0.529

Source: Author's computations. Note: 'S' represents Stable and 'US' represents Unstable.

According to table 5.12, the results of Ramsey's RESET test show that the test statistic is insignificant (greater than 0.05%) for all of the countries. This means the null hypothesis

fails to be rejected and it is concluded that the model is correctly specified in all the countries. The results of the CUSUM test and CUSUMSQ test shows that the lines of most countries fall between the bands with 5% significance. Hence, most of the coefficient estimates are stable. The results also show that the LM statistic is insignificant for all countries meaning that there is no serial correlation among the residuals, which is desirable. The results of the normality tests showed that the Jarque-Bera statistics are also insignificant for almost all the countries, therefore, it is evident that the residuals are normally distributed. Lastly, the results of the Breusch-pagan-Godfrey test for heteroskedasticity show that the p-values of the F-statistics are all insignificant implying that there is homoskedasticity, which is also desirable. Therefore, following the results of the diagnostic checks, which are all desirable, the results obtained by this present study are valid and consistent and can be relied on.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter provides a summary of the results obtained by the present study. It also provides a conclusion to this study and finally offers some policy recommendations following the results obtained. Finally, it suggests some options for further research on this subject matter.

6.2 Conclusion

The main objective of this study was to investigate the determinants of public health expenditures from domestic sources in SADC. This study also made an inquiry into the convergence and income elasticity of public health expenditures in SADC. To do this, the study employed a heterogeneous dynamic panel and used panel annual data from 2000 to 2016. The selected determinants include GDP per capita, infant mortality rate, unemployment rate and population 75 years of age and above.

This study reviewed the descriptive statistics of the variables and the correlation matrix to check for correlation among the variables. Before estimating the specified model, the study employed the residual cross-sectional dependence test to check for cross-sectional dependence and the results confirmed that the residuals of the cross-sections were dependent on each other. In order to correct for cross sectional dependence, the study employed panel unit root tests on the residual estimate at levels. The residual estimate was found to be I (0), therefore dealing with issue of cross sectional dependence.

The study then carried out panel unit root tests which included; the LLC and IPS panel unit root tests to avoid using non-stationary variables. The results of the unit root tests showed that all variables were stationary at levels and after first difference at the 5%

significance level. None of them was stationary after second difference. Specifically, the LLC showed that LPHE, LIMR and LPOP75 were I (0) whilst LGDPPC and LUNE were I (0). The IPS unit root test showed similar results only that LIMR was I (1) and LUNE was I (0). The mixture of I (0) and I (1) variables validated the use of the ARDL model for this present study.

Following the results of the unit root tests, the ARDL Bounds test was employed in order to fulfil the second and third objectives. Prior to conducting the Bounds test, the study determined the optimal number of lags provided by various information criterion. The results suggested by the efficient AIC chose 2 lags. The results of the benchmark analysis confirm that the ARDL (2, 2, 2, 2, 2) model appeared to be the most preferred. Following this, the ARDL Bounds test was done and the results reveal that there is a cointegrating relationship between domestic public health expenditures and the selected determinants in SADC. The model was then estimated using the ARDL PMG estimator and it was established that in the long run, GDP per capita, medical technological progress, unemployment and an ageing population are major contributors to the variation in public health expenditure from domestic sources in SADC. However, in the short run, only the non-lag of the ageing population was found to contribute significantly to the variations in domestic public health expenditure. Some of the most interesting results were that GDP per capita was found to have an inverse relationship with public health expenditure. Although these results were not as expected, they are not strange to this study because SADC comprises mainly of lower-middle-income countries whose public expenditure is subject to political negotiation. Additionally, it was expected that an ageing population would have a positive relationship with public health expenditures. But the results of this

study show otherwise. The results also revealed that following an exogenous shock, 69% of the system will converge back to equilibrium. The study also established that domestic public health expenditure is income inelastic in SADC. The study then used the IPS unit root test to check whether public health expenditure convergences to or diverges from the regional average in SADC. The results confirmed that public health expenditures converge to the regional average in SADC. These results are as expected following the regional and country-specific efforts that have been put in place to increase domestic public health expenditures.

This study concludes that in the long run, all the select determinants have significant relationships with domestic public health expenditures in SADC. However, the short-run results are almost insignificant. The study also concludes that health is a necessity and domestic public health expenditures converge towards the regional average in SADC.

6.3 Recommendations

The findings of this present study pose several policy implications deemed necessary to increase the level of domestic public health expenditure so as to meet and exceed the threshold of the 2001 Abuja declaration target. Listed below is an unexhausted list of recommended policy interventions:

Firstly, it is imperative that an increase in income should translate into increased public health expenditure. However, individual country socio-political characteristics are important for achieving this. Therefore, SADC governments should consider implementing policies that would limit their political influence on the amount they allocate to health. One of such mechanisms is moving towards Universal Health Coverage (UHC) through National Health Insurance (NHI) schemes. Under NHI, governments

study show otherwise. The results also revealed that following an exogenous shock, 69% of the system will converge back to equilibrium. The study also established that domestic public health expenditure is income inelastic in SADC. The study then used the IPS unit root test to check whether public health expenditure convergences to or diverges from the regional average in SADC. The results confirmed that public health expenditures converge to the regional average in SADC. These results are as expected following the regional and country-specific efforts that have been put in place to increase domestic public health expenditures.

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should aim to pool funds by enrolling the entire population and introducing mandatory tailor-made health insurance packages suitable for both informal and formal sector employees.

Secondly, it is evident that there is growth in domestic public health expenditures in SADC. Therefore, SADC governments should stay committed to increasing their budgetary allocations to health in order to meet the 15% minimum requirements by increasing domestic resource mobilization efforts such as increasing their tax revenue collection efforts without necessarily raising taxes. Some key tax revenue increasing mechanisms adopted by South Africa, Kenya and Nigeria could also be instrumental in SADC. These include: granting autonomy to domestic tax collection agencies in order to improve their operational efficiency; governments should also impose strict legislation on corruption and misuse of public funds; governments can also invest in technology such as computers in order to increase efficiency and simplify the tax filing system; they should also try to offer amnesty to tax defaulters who voluntarily declare themselves but severely punish those who continue to default taxes.

Governments can also try to raise additional revenue by directing to the health sector, consumption taxes levied on selected products that pose a threat to the health of individuals such as alcohol, tobacco and sugar. They can also direct to the health sector, taxes levied on financial transactions and also a certain percentage of the taxes paid by industries, mines and motor vehicle owners. Additionally, governments can also raise funds for health through efficiency savings and levies such as air passenger taxes and mobile phone levies.

Finally, health in SADC is income inelastic which, means that health is a necessity. Therefore, governments should be actively involved in regulating and subsidizing health, especially under the NHI. Priority with regards to coverage should be given to vulnerable groups such as the young, ageing and unemployed populations. This is because these groups are believed to have the greatest need and the greatest difficulty in obtaining medical health care.

6.4 Areas for further research

Firstly, public health expenditure in developing countries especially in Sub Saharan Africa is heavily influenced by institutional characteristics such as corruption and political factors. Therefore, further inquiry into the determinants of this subject matter should be cognizant of these institutional characteristics including issues of governance and managerial decisions. Secondly, if many SADC countries are to move away from their heavy reliance on donor funding for health, there is a need for empirical inquiry on the efficiency, equity and sustainability of domestic and alternative healthcare financing mechanisms from different SADC countries that is based on various methodologies.

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Appendix

Appendix A: Output tables for tests

A.1 Residual Cross-Sectional Dependence Test

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 17
Cross-sections included: 15
Total panel observations: 255
Cross-section effects were removed during estimation

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	313.8850	105	0.0000
Pesaran scaled LM	14.41444		0.0000
Bias-corrected scaled LM	13.94569		0.0000
Pesaran CD	-2.024468		0.0429

A. 2 Stochastic convergence test (Intercept only)

Null Hypothesis: Unit root (individual unit root process)
Series: FPHE
Date: 07/28/19 Time: 14:12
Sample: 2000 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on AIC: 0 to 2
Total number of observations: 219
Cross-sections included: 15

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-12.3595	0.0000

** Probabilities are computed assuming asymptotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
1	-5.2228	0.0010	-1.514	0.923	0	2	15
2	-5.2279	0.0010	-1.514	0.923	0	2	15

3	-4.5305	0.0045	-1.360	1.215	2	2	13
4	-3.3614	0.0302	-1.514	0.923	0	2	15
5	-6.0824	0.0002	-1.514	0.923	0	2	15
6	-4.2080	0.0063	-1.514	0.923	0	2	15
7	-3.6524	0.0188	-1.500	1.060	1	2	14
8	-4.5897	0.0031	-1.514	0.923	0	2	15
9	-3.2414	0.0407	-1.360	1.215	2	2	13
10	-4.5510	0.0038	-1.500	1.060	1	2	14
11	-3.4771	0.0244	-1.514	0.923	0	2	15
12	-3.0530	0.0526	-1.514	0.923	0	2	15
13	-6.7881	0.0001	-1.514	0.923	0	2	15
14	-4.6998	0.0026	-1.514	0.923	0	2	15
15	-7.0799	0.0000	-1.514	0.923	0	2	15
Average	-4.6510		-1.492	0.980			

A. 3 Stochastic convergence test (Intercept & trend)

Null Hypothesis: Unit root (individual unit root process)
Series: FPHE
Date: 07/28/19 Time: 13:21
Sample: 2000 2016
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on AIC: 0 to 2
Total number of observations: 218
Cross-sections included: 15

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-9.48720	0.0000

** Probabilities are computed assuming asymptotic normality

Intermediate ADF test results

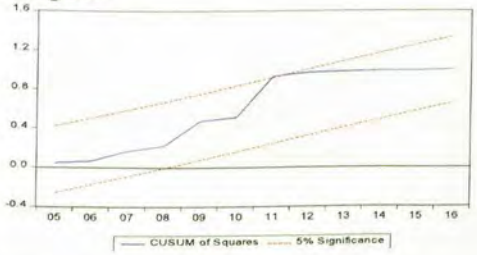
Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
1	-5.2603	0.0042	-2.167	0.869	0	2	15
2	-5.2554	0.0042	-2.167	0.869	0	2	15
3	-4.3854	0.0042	-1.965	1.272	2	2	13
4	-3.0123	0.1609	-2.167	0.869	0	2	15
5	-4.1152	0.0299	-2.170	1.071	1	2	14
6	-4.5525	0.0134	-2.167	0.869	0	2	15
7	-4.6272	0.0132	-2.170	1.071	1	2	14

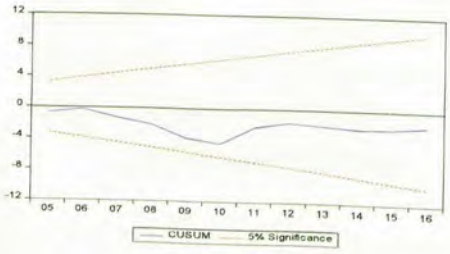
8	-4.9367	0.0071	-2.167	0.869	0	2	15
9	-3.1955	0.1280	-1.965	1.272	2	2	13
10	-4.3801	0.0195	-2.170	1.071	1	2	14
11	-3.4623	0.0807	-2.167	0.869	0	2	15
12	-3.0513	0.1519	-2.167	0.869	0	2	15
13	-6.6141	0.0005	-2.167	0.869	0	2	15
14	-4.5349	0.0005	-2.167	0.869	0	2	15
15	-6.7857	0.0004	-2.167	0.869	0	2	15
Average	-4.5446		-2.141	0.963			

Appendix B: Stability Checks

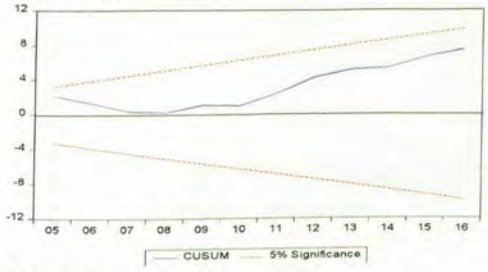
B. 1 Country specific CUSUM and CUSUM of Squares tests

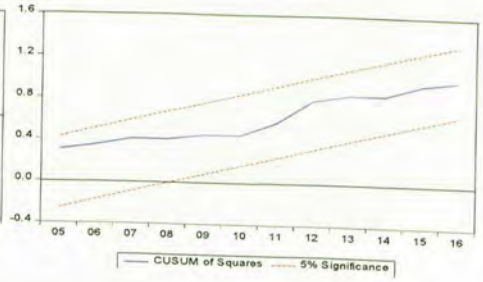
Angola



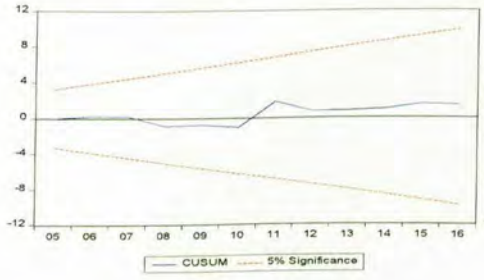


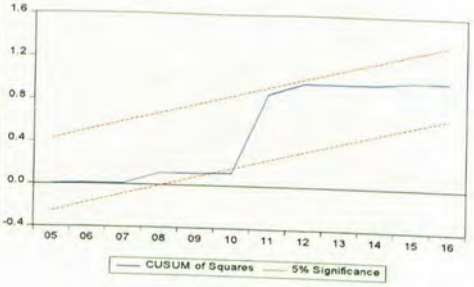
Botswana



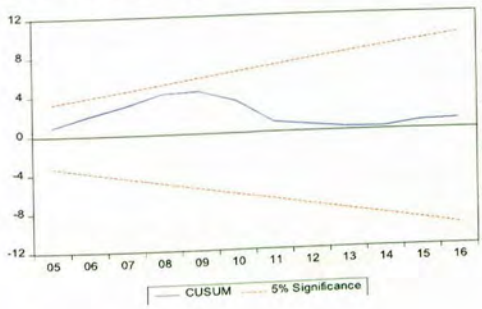


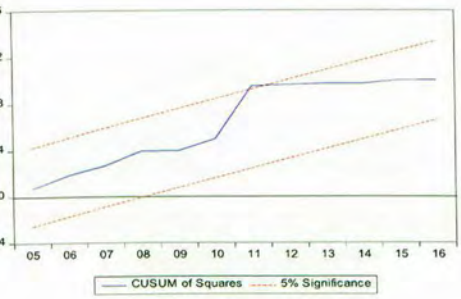
Comoros



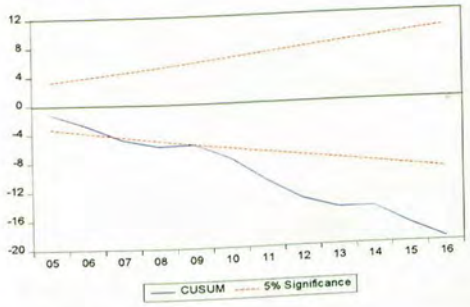


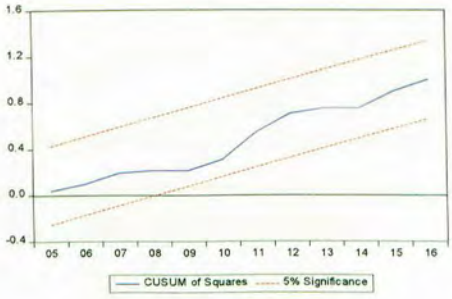
Democratic Republic of Congo





Tanzania





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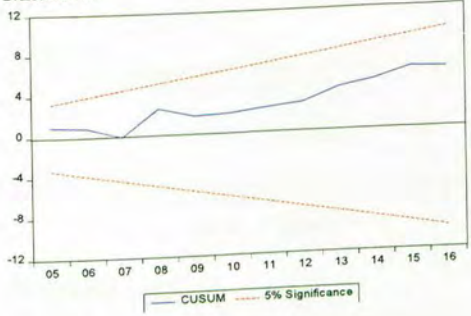
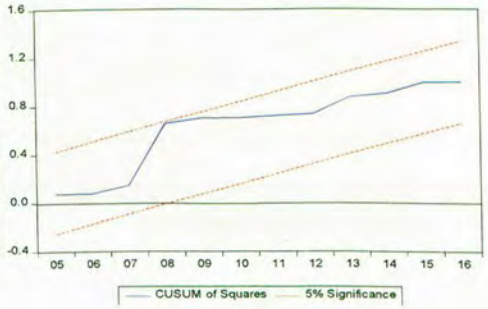
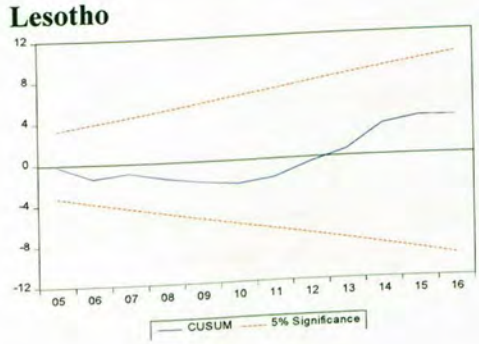
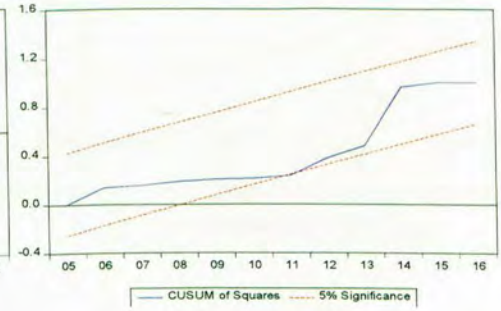


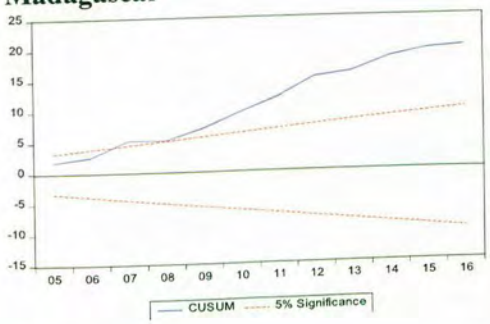


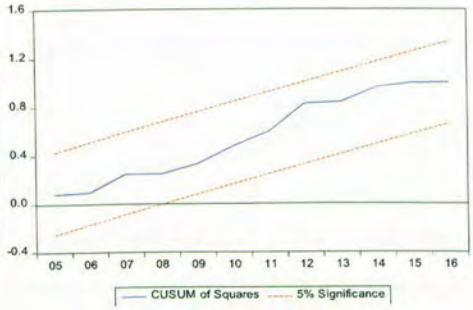
Lesotho



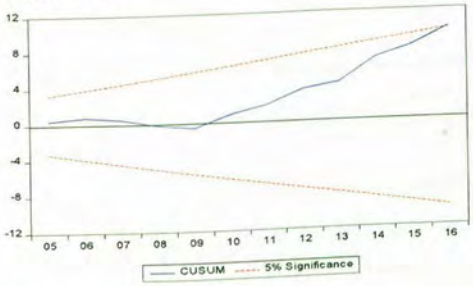


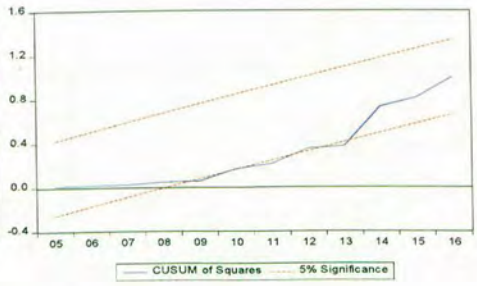
Madagascar



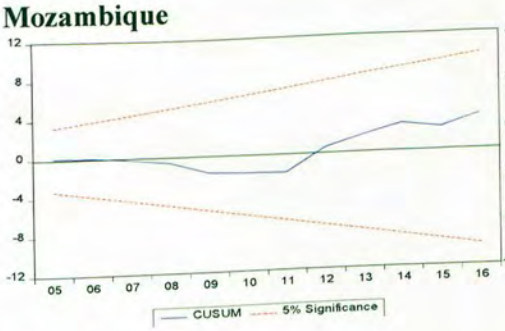


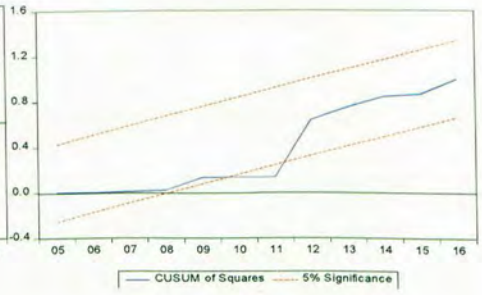
Mauritius





Mozambique





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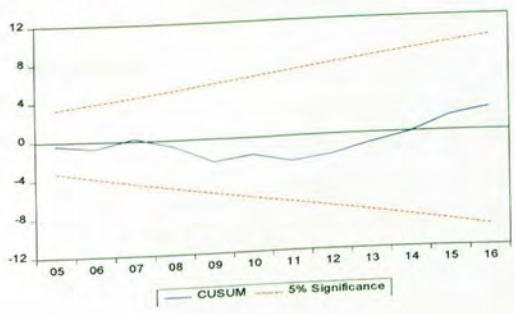
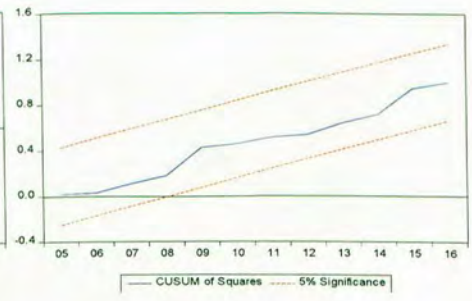
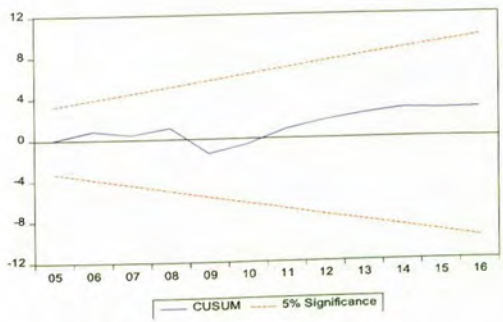
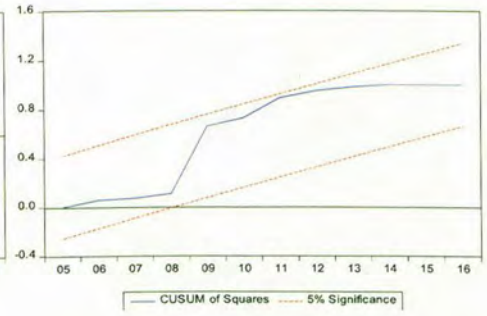


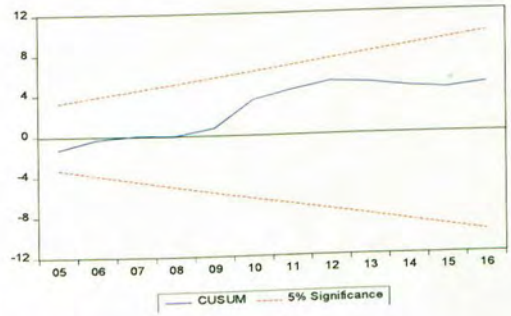


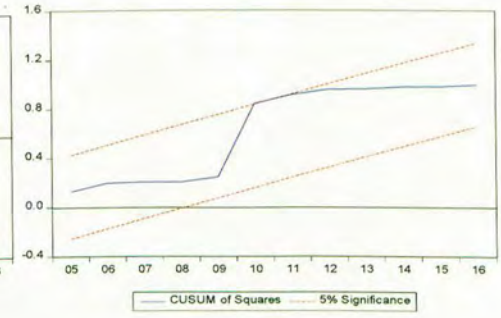
Zambia



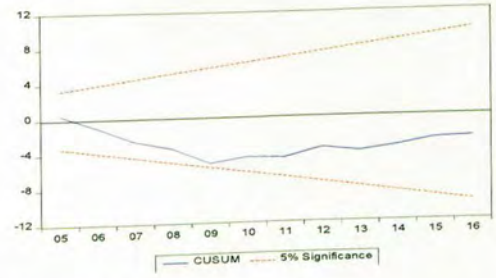


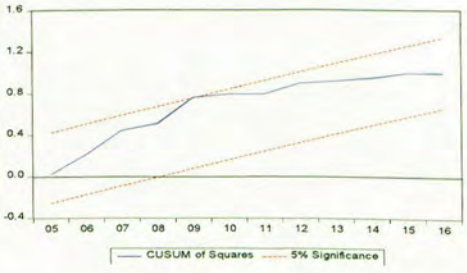
South Africa





Seychelles





Swaziland