Economic Impact of the Composition of Public Expenditure on Agricultural Growth: Case Studies from Selected SADC Countries and Implications on Regional Food Security

A mini - dissertation submitted by Manyise Timothy (11585442) in partial fulfilment of the requirements of the degree of Master of Science in Agriculture (MSCAEC) to the Department of Agricultural Economics and Agribusiness, School of Agriculture, University of Venda

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DECLARATION

I, **Timothy Manyise (11585442)**, hereby declare that this mini-dissertation for Masters of Science in Agricultural Economics (MSCAEC) at the University of Venda hereby submitted by me, has not been submitted previously for a degree at this or any other university, that it is my own work in design and in execution, and that all reference material contained therein has been duly acknowledged.

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ABSTRACT

The study aimed to analyse the economic impact of the composition of public expenditure on agricultural growth in selected SADC countries and to give implications on regional food security, as depicted by agricultural growth. Due to time constraints and paucity of data in most developing countries, the study used time series data from South Africa and Zimbabwean government offices and statistical agencies for the period between 1983-2011 and 1981-2006, respectively. The specific objectives of the study were to analyse the share and size of public expenditure on agriculture and to estimate the short and long –run impact of public expenditure on agricultural growth.

Trend analysis on the size of public expenditure revealed that both South Africa, and Zimbabwe although in most years particularly in the 1980s and few years during the new millennium allocated more resources on agriculture, there was a decline in the expenditure on agriculturewith the 1990s and the new millennium for South Africa being mostly affected. The study also employed the Stationarity, Cointegration and Error correction methodology to analyse the short - and long - run effect of public expenditure on agricultural growth using agricultural gross domestic product as a proxy for agricultural growth. From the analysis, the study revealed that capital expenditure had a positive effect on agricultural growth both in the short – and long – run for Zimbabwe and South Africa. Recurrent capital expenditure had a negative effect in the long – run for the two economies. Non-agricultural expenditure had a negative effect for the Zimbabwean agricultural growth and the reverse was true for South Africa. More so, a higher speed of adjustment to the equilibrium for the two countries was found.

Among others, the study recommended the national governments and partners in the SADC region to not only revisit their expenditure commitments and mobilise resources towards the agricultural sector, but also governments to revisit their spending priorities and increase expenditure on productive enhancing capital items for sustainable growth objectives.

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Many thanks go to my main supervisor Dr Chauke, the Land Bank Chair of Agriculture and Head of Department of Agricultural Economics and Agribusiness. His mentorship and guidance was an engine for the success of this work. I appreciate his supervision and sleepless nights throughout the course of this project. Dr Chauke you are a father, a teacher and mentor. God bless you!

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Thanks to my family relatives for their prayers and love. My brothers Maseko and Mostaph, I love you. You are awesome. God bless you. To my friends, Moi, Libie, T1, Langa, Patricks, Alu I say your hugs were a source of encouragement. Many thanks to Prophet and Man of God T.B Joshua and his ministry '*Better is not good enough the best is yet to come'*.

To the work study programme and University of Venda financial support I say the keep up the standard. God permitting I dedicate to use my acquired expertise for the benefit of the marginalised people of Africa.

Above all, it is to my full acknowledgement that The Lord was my strength and my provider. I love you Lord!

DEDICATION

To my family:

I LOVE YOU

Remember:

If God is with us, who can be against us?

Better Is Not Good Enough, The Best Is Yet To Come

LIST OF ACRONYMS

AGDP	: Agricultural Gross Domestic Product.
GDP	: Gross Domestic Product.
AU	: African Union.
NEPAD	: New Partnership for Agricultural Development.
CAADP	: Comprehensive African Agricultural Development Programme.
SADC	: Southern African Development Community.
FARA	: Forum for Agriculture Research in Africa.
MDG	: Millennium Development Goals
UN	: United Nations.
FAO	: Food Agricultural Organization.
GEA	: Government Expenditure on Agriculture.
COFOG	: Classification of Functions of Government.
USAID	: United States Agency for International Development.
IMF	: International Monetary Fund.
ECM	: Error Correction Model.
GCS	: Gross Capital stock.
RAP	: Regional Agricultural Policy.
RISDP	: Regional Indicative Strategic Development Plan.
GFS	: Government Financial Statistics.
ADF	: Augmented Dickey Fuller.
OLS	: Ordinary Least Squares
LM	: Lagrange Multiplier
AOI	: Agricultural Orientation Index
DAFF	: Department of Agriculture Forestry and Fisheries

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER I

INTRODUCTION

1.1 Introduction and Background

Governments in developing countries are faced with expenditure needs that often outstrip the resource envelops (Senoga & Matovu, 2010). However, public spending is one of the most effective instruments in boosting economic growth and reducing mass poverty. According to Fan *et al*., 2008, calls are being made in regional and international summits to increase and redirect resources to agricultural development for the achievement of various development goals. Nevertheless, such efforts by African governments are affected by a 'dearth' of information about which type of public investments yield the largest impact on growth and food security (Cabral, 2007).This study aims to shed light on the impact of the size and composition of various public expenditures in agricultural growth and crop productivity in the selected SADC region.

With increased population pressure, the 21st century saw food insecurity and poverty remaining major global challenges. According to Birner and Palaniswamy, 2006, the number of poor people in the sub-Saharan Africa has doubled during the past few decades. Many of the region's children are malnourished, and this is projected to worsen (FAO, 2011). Such trends have occurred despite the renewed strategic plans of the international community such as the Millennium Development Goals (MDG) and the Maputo Declaration meant to reduce poverty (FAO, 2011). Most of these plans put agricultural development as the best instrument for poverty reduction. In particular, in September 2000, at the United Nations Millennium Summit, world leaders made a huge commitment to economic development. At the forefront of the eight MDGs, there is the golden commitment-MDG number one (MDG1) of halving hunger and poverty in the world by 2015.

The year 2001 saw the formation of the New Partnership for African Development (NEPAD) as part of a clear political and resource commitment to foster growth and development while at the same time addressing challenges facing the African continent (Fan *et al*., 2008). Accordingly, on 6 June 2003 at The Second Assembly of African Union (AU) in Maputo, African heads of state acknowledged the importance of agriculture in their economies. For the achievement of the MDG1, a target of 6% agricultural growth was set (AU, 2003). Allocating at least 10% of the nations' resources under the Comprehensive African Agriculture Development Programme (CAADP) framework to agriculture was seen as the best instrument to achieve the set objective of growth in the sector. With such strategic plans and targets, the need for impact studies and expenditure review in African economies was given platform. In 2009, a review by CAADP found out that agriculture in Africa has not performed as well as expected during the past decade. Only a few countries in sub-Saharan Africa, namely- Mozambique, Ethiopia, Mali, Nigeria, Senegal and Gambia, have surpassed the threshold of 6% agriculture growth (NEPAD, 2012). Simulations under optimistic scenario see less than a third of African countries achieving the MDG 1 even if they achieve a 6% agricultural growth (Fan *et al*., 2008).

Various studies have tried to evaluate the Maputo Declaration and to link the impact of public expenditure to agricultural growth and poverty reduction (Inganinga & Unemhilin, 2011; Fan & Rao, 2006). Furthermore, economic theory shows it as a promising strategy to channel resource towards agriculture for food insecure and low-income economies. However, policy makers still face the challenges of giving the most working prescription for the growth of such an important sector (Cabral, 2007:1).

In most African economies, there is still insufficient understanding of the quality of agricultural spending. The extent to which it might affect food security and agricultural growth is still a knowledge gap that calls for further scrutiny. Empirical studies on returns to public expenditure have been dominated by analysis of individual public investments programmes on various functions such as research or extension (Fan *et al*., 2004; Mutangadura, 1997). However such studies have limited application when policy makers are faced with the decision to prioritise resources across alternative and often competing public investments in agriculture. More so, there are few, if any such studies which address the economic public expenditure prioritisation on agricultural growth and food security. It is, therefore, against this background that the need to analyse the economic impact of public expenditures on agricultural growth arises.

1.2 Problem statement

For many years the agricultural sector in Africa has suffered neglect. This has led to food crisis which has resulted in developmental and humanitarian challenges in the continent. Aid to agricultural development has declined; resulting in the agricultural needs outstripping the resource envelops (Fan *et al*., 2009:1). The bandwagon in many African economies, particularly the SADC, has been to ensure that resources are channelled towards meeting regional commitments and the Millennium Development Goal 1 of halving hunger and poverty by 2015 (NEPAD, 2009). However, it appears most countries will not be able to achieve this goal (Fan, 2008; Fan *et al*., 2008). Moreover, the food security situation has worsened over the past years with Africa countries leading in receiving food aid. One may want to ask why food security and agricultural growth in most African countries particularly in the SADC region are still low given the alarm calls and various summits to prioritising the agricultural sector. The answer to this question necessitates the need for an in-depth analysis on the impact of size and composition of public expenditure on agricultural growth and productivity in selected SADC countries.

1.3 Objectives

1.3.1 Broad objective

The overarching objective of the study is to shed light on the economic impact of the composition of public expenditure on agricultural growth, and thus food security in the SADC region, in particular South Africa and Zimbabwe.

1.3.2 Specific objectives

The specific objectives of the study are to:

- Analyse the share of public agricultural expenditure on total public expenditure and gross GDP, and agricultural orientation index over some given years for South Africa and Zimbabwe;
- Estimate the long and short run effect of public expenditures on agricultural growth in Zimbabwe, and South Africa.

1.4 Research Questions

The study aims to answer the following questions:

- What has been the trend of the share public agricultural expenditures on total expenditure and GDP and agricultural orientation index for South Africa, and Zimbabwe over the years?
- What is the long run and short run effect of public expenditures on agricultural growth in South Africa, and Zimbabwe?

1.5 Research Hypothesis

This study hypothesize that:

- Public expenditure on agriculture has been very low over the years.
- Public expenditure has a long and short run effect on Agricultural GDP.

1.6 Justification of the study

In Africa, public expenditure prioritisation on agriculture is particularly important, given its recent history of sluggish economic growth and food crisis.The challenge facing policy makers is that of giving the most working prescription for the growth of such an important sector (Cabral, 2007:1). Secondly, this study is important as it comes at a time when authorities are trying to fulfil their resource commitments and achieve regional agricultural growth targets of 6% in agriculture by 2020. Furthermore, with so many of the poor being dependent on agriculture, investments in agriculture and rural development are seen as central components of a strategy aimed at meeting the MDG 1 of halving hunger and poverty by 2015. Information on relative returns to the nature of spending can provide important guidance for policymakers and other stakeholders in deciding their investment priorities. With the 2015 target date approaching, and the MDG1 being unlikely to be met, this study is critical in unearthing budgetary commitments and economic objectives in selected countries.

1.7 Limitations of the study

By and large, the fundamental challenge in conducting this analysis was to get sufficient data. Specifically, this study faced challenges in accessing some of the important information and there were difficulties in operationalising and measuring appropriate indicators of inputs, outputs and outcomes; issues of data comparability, especially given that data was obtained from different sources which used different survey instruments at different points in time. Moreover, due to time and monetary limitations, the study limited itself to two cases using convenience sampling of countries with easily accessible data thus imposing a bias on the results of the study. However, the researcher tried to study the selected countries in detail and assumption was made that this two countries possess differences in terms of economic growth and importance given to the agricultural sector by SADC countries.

1.8 Key words

1.8.1 Public expenditure on agriculture.

A study by the World Bank (2011) defined public expenditure on agriculture as spending in the following categories: agricultural extension and training; research and development; marketing; supply and subsidisation of inputs; crop development; irrigation; livestock development; and food security related programmes in the sector. Government expenditure on agriculture (GEA) can be considered either as an input of the production function or as affecting the relationship of the other inputs with agricultural output (Odhiambo *et al.*, 2004). For the purpose of this study, agriculture expenditure will encompass capital and recurrent annual budget allocations to the agricultural sector as laid out by the IMF on the internationally recognised Classification of Functions of Government (COFOG).

1.8.2 Agricultural growth

To define agricultural growth requires one to first explain the meaning of economic growth. Economic growth refers to the increase in the amount of goods and services produced by an economy over time. Usually, when the term is used the concern is about the desire to improve the standard of living and, especially economic growth per capital (Ibrahim, 2009). Therefore, agricultural growth can be defined as the increase in the amount of agricultural goods and services produced within the boundaries of a given country over time. It is measured as a percentage change in the Gross Domestic Product produced within the agricultural sector (Armas *et al.*, 2012). For the purpose of this study, agricultural growth refers to an increase in the agricultural gross domestic product. More so, due to econometric problems the methodology in this study takes agriculture gross domestic product as a proxy for growth of the sector. This has been used in various public expenditure impact works such as those by Anakoya *et al.*(2013); Nasiru (2012) and Loto (2011).

1.8.3 Food security.

There are several definitions of food security revolving mostly around food availability and accessibility (FAO, 2011; SADC, 2009). The 1996 World Food Summit defined food security '*as a state that exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets the dietary needs and food preferences for an active and health life* (WHO, online)' This definition points to food availability, accessibility, utilisation and stability. USAID define the term as access by all people at all times to enough food for an active, healthy lifestyle. This study employs a definition adopted by FAO (2011) from the 1996 World Food Summit which takes food security as a situation when at all times all people have both physical and economic access to enough food for an active, health life.

1.9 Layout of the study

The remainder of the study will consist of Chapter 2 which will review related literature to see what other researchers have written about the problem. This chapter presents an overview of the literature on the impacts of government expenditure on agriculture in Zimbabwe and other agrarian economies at both regional and global levels. This review is aimed at contributing towards a clearer understanding of the nature of the problem that has been identified. It provides a framework of the research and identifies the area of knowledge that the study intends to expand. The chapter also gives an overview of what has been said, who the key writers are, what the prevailing theories and hypothesis are, what questions are being asked, and useful ideas which come from these studies.

Chapter 3 describes the materials and methods used in addressing the problem in question. It describes how the study objectives will be addressed. This chapter also outlines the various tools that will be used to conduct the study. It explains the selected procedures, methods and data sources. It also describes the research design, the sampling plan, data collection procedure, the measuring instruments and the econometric model that will be used in this study

The presentation of results based on the study objectives and discussion will be undertaken in Chapter 4. The chapter is intended to provide a picture of the research findings and also the analysis of output from the econometric model.

Finally, Chapter 5 presents a summary of the study findings and gives a conclusion and recommendations based on the study findings. This summary of the report serves two purposes: it summarises the main points and suggests future research directions on the subject and make aware of the possible limitations that future research processes might need to take in to account to prepare for further analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of the literature on the impact of government expenditure on agriculture at global and regional levels. It explains how government spending through its annual budgets impacts on agricultural production. The review is aimed at contributing towards a clearer understanding of the nature of the problem that has been identified. It provides a framework of the research and identifies the area of knowledge that the study intends to expand. An overview of what has been said, who the key writers are, what the prevailing theories and hypothesis are, what questions are being asked, and useful ideas that are relevant to the study are discussed. The chapter therefore begins by laying a theoretical framework and then explores empirical findings on government expenditure, in particular major part of fiscal policies and their impact on agricultural growth and food security in Africa and other developing countries.

2.2 Theoretical Framework

For one to be able to draw practical guidance on how public spending could be used to induce growth and reduce poverty, there is need to make reference to both applied welfare economics and the economic growth theory (Paternostro *et al.*, 2005). The theory of public economics claims that only the public sector can supply public goods efficiently as the market will always under provide. Whilst Keynesian economists see government intervention as a way of inducing economic growth, a foundation of controversy was laid by "the father of economics" Adam Smith, when he introduced the concept of the *Invisible Hand* which means if a society is to achieve its objectives all the activities should be left to operate on the market (Benin *et al.*, 2009). According to Centintas and Bagdigen (2008), welfare economics would view such *laissez-faire* as being dominated by market failure. Therefore, to address this market failure, there is need to protect weak members of society. This therefore, requires 'think tanks' in the central planning and coordination of economic activity.

If one is to look at economic efficiency, the picture will show the existence of public goods in the agricultural sector. Such goods have two characteristics: ''non excludability'' and ''non rivalry.'' According to Kherella and Goletti (2000), once such goods are provided, one cannot exclude other members of the society from consuming them and use by one cannot preclude consumption by another. Accordingly, the private sector will tend to invest below socially optimal levels in such goods because private benefits from investments will be lower than overall public benefits to the society. Good examples in agriculture include investments in basic research, extension, rural infrastructure and large irrigation systems.

Government intervention in an economy takes a number of forms, the paramount being public expenditure commitments. For the agricultural sector, development public expenditure has been seen as the best instrument for promoting growth (Fan and Saukar, 2006). Nurudeen and Usman (2010) see improvement in the factors of production as a way to promote agriculture growth.

In developing countries potentialities of government revenue are limited. Public expenditure, for example, is viewed by many as the best instrument that any government can use to promote growth and reduce mass poverty.

However, there is also a limit to the positive impacts that public expenditure has on growth. Most recent studies support the U-shaped relationship theory in which public spending may increase growth up to a certain level. Thereafter, additional increases will result in negative growth (Armas *et al*., 2012). Therefore, increasing the budget beyond a certain threshold may be associated with efficiency loss. While controversy still exists on the direction and magnitude of the impact of public spending on growth, there is growing evidence that at the macro- and micro-economic levels, public expenditure impacts on development (Armas *et al*., 2012; Fan, 2008). Whereas government intervention has been seen as inducing growth in an economy, poor planning programmes could be counterproductive.

There has been a move by some researchers on the impact of quality of public expenditures on economic growth acceleration. While Barro (1990) identifies investments in public infrastructure for growing the economy, Rizvi *et al*. (2010) emphasises the significance of research and development expenditure. Therefore, composition as well as the level of spending is critical elements for achieving growth. Various public expenditures can thus trigger complementary effects by either stimulating private spending or providing additional complement for growing private sector investments. Some other budget items such as subsidies, salaries and other recurrent expenditures can crowd out private investment. This will increase public debts which will in turn reduce availability of credit or increased income tax and corporate tax (Barro, 1990).

Some expenditures may take time before their impact on production is seen. In particular, the effects of public investment usually materialise with a lag rather than contemporaneously. Lag length depends on the type of spending. For example, the effect of public spending on agricultural research and development is expected to materialise over a longer period of, say, 15 years or more than say input subsidies which may last a few years

(Benin *et al*., 2009). However, a five year gestation period is probably sufficient for most agricultural projects to have begun bearing fruits. It is, therefore, important to distinguish between short and long run effects of investment in government expenditure. Moreover, the emerging school of thought stresses the quality or composition of public spending as a relevant issue. Therefore, if the aim is to accelerate growth, the focus should be on the more productive items of the budget. However, as to which economic items are more productive, this is a matter of empirical analysis, which this study would want to contribute to.

2.3 Conceptualisation of public expenditure composition and agriculture growth

The overall concept of this study draws from the economic classification expenditures as laid down by the International Classification of Functions of Government. Government expenditure is divided in to capital or investment expenditure and recurrent expenditure. Capital spending includes direct investment in buildings, equipment, other durable assets and capital transfers, whilst current expenditure entails spending that is meant to finance running of the economic activities. One of the important concepts in public expenditures is that the effect of some expenditure, for example, in research materialises with a lag of say 5 years. Fig 2.1 below illustrates the simple way through which public expenditure on agriculture affects agricultural growth.

Governments in many countries allocate resources annually through the national budget. In the agricultural sector, there exist various functions that impact on farm productivity and growth differently. By and large, the extension provides advice, dissemination of new technology, training of farmers and strengthening of their organisational base and the reduction of transactional costs; and research service which ensures continual production and discovery of new varieties and farming technologies, leading to generation and adaptation of new technological, sociological and economic innovation for use by farmers (Benin, 2010; FARA, 2006). Also, to cater for livestock diseases and advice, the agricultural sector invests in veterinary service, which continuously assists farmers with the best practices in livestock production and control of diseases. From all these functions, the economic classification of expenditure put two broad groups which are capital and (re)current expenditure.

The aim of the government is to influence growth of the sector and the economy at large. This means agriculture growth will contribute to increased agricultural income per capita. This ultimately will have positive implications on the availability, accessibility and utilisation of health food at all times (Fan *et al*., 2009). A well fed workforce will also tend to increase agricultural productivity.

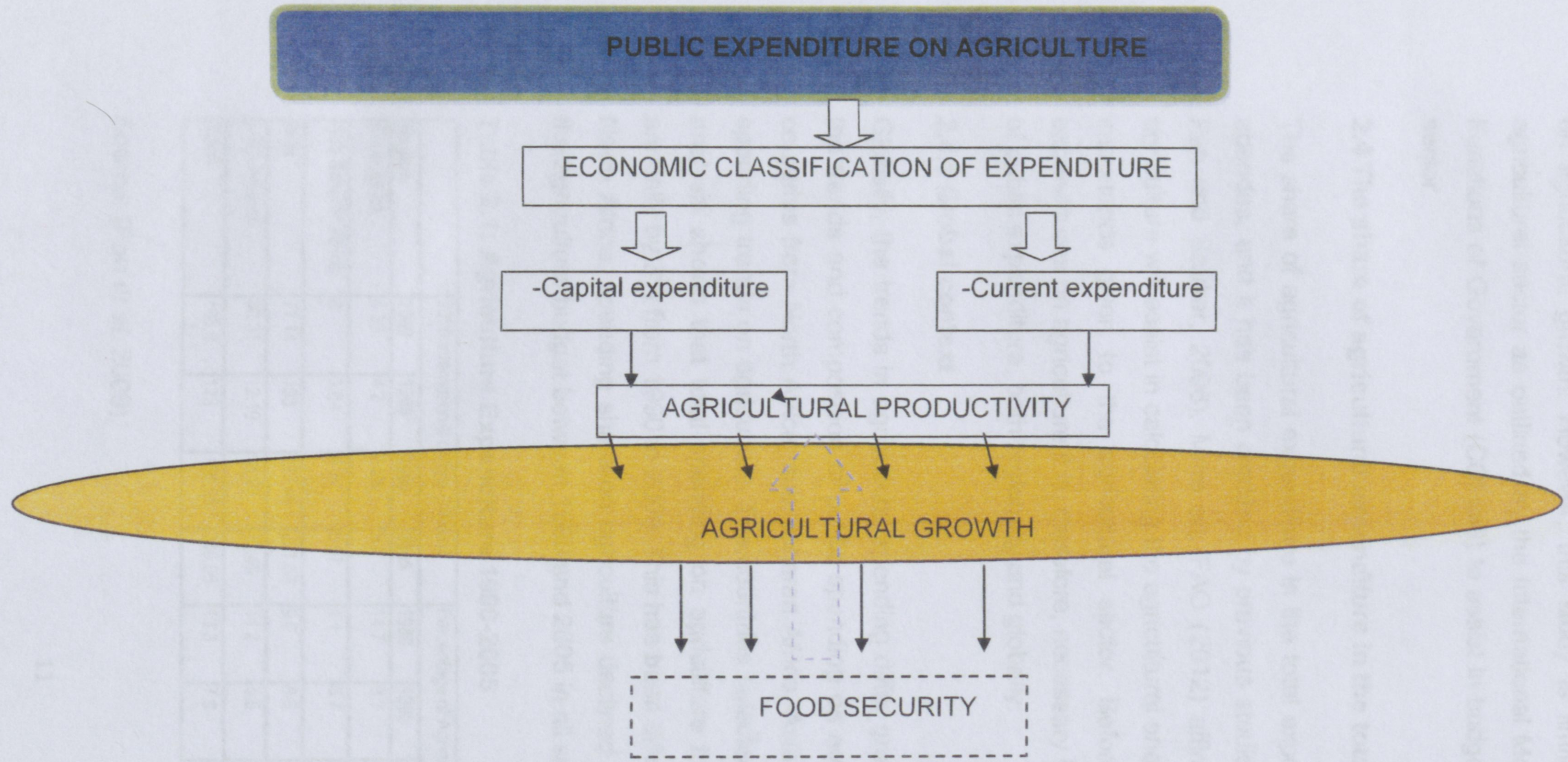

Figure 2.1 Conceptual framework for public expenditure on agriculture
Source: Adapted from Jaroensathapornkul, 2010.

However, agricultural growth is not limited to the channels discussed. There are many other pathways through which public expenditure affects agricultural growth and poverty levels. For example, Fan *et al.* (2008) shows how public expenditure on non-agricultural expenditures such as social expenditure and education, as well as rural infrastructure impact on agricultural growth. However, this study is limited to economic classification in the agricultural sector as outlined by the International Monetary Fund's (IMF) Classification of Functions of Government (COFOG) to assist in budget formulation and prioritisation for the sector.

2.4 The share of agricultural expenditure in the total expenditure

The share of agricultural expenditure in the total expenditure has been at the top of public agendas, and it has been credited by previous studies (Fan *et al.*, 2009; Fan *et al.*, 2008; Fan and Saukar, 2006). More so, FAO (2012) affirms that the share of expenditure on agriculture will assist in calculating the agricultural orientation index, which shows the overall importance given to the agricultural sector. Before looking at the impact of various expenditures on agriculture it is, therefore, necessary in this sub-section to look at the trends of public expenditure, both regionally and globally.

2.4.1 Global context

Globally, the trends in agricultural spending differ greatly. A review by Fan *et al.* (2009) on the trends and composition of public spending on agriculture using data for 43 developing countries from North Africa, sub-Saharan Africa, Asia and Latin America shows variation in spending trends on agriculture. The countries selected were based on data availability. The analysis shows that total spending on agriculture in developing countries has increased annually by 3% from 1990 to 2009. This has been driven by Asia and sub-Saharan Africa. In North Africa, spending share on agriculture declined by 30%.Table 2.1 shows a decline in the agriculture budget between 1980 and 2005 in all selected regions.

Table 2.1: Agriculture Expenditure 1980-2005

	2000 international dollars (billions)				Percentage of Agricultural GDP				Percentage on total spending			
Region	1980	1990	2000	2005	1980	1990	2000	2005	1980	1990	2000	2005
North Africa	4.35	4.2	6.29	5.2	14.7	8.7	11	8	6.4	5.4	4.7	5
Sub-Saharan Africa	3	3.64	4.24	8.67	4.1	3.7	3.7	6.4	7.1	5.5	3.8	6.3
Asia	71.14	103	127.46	201.63	9.6	8.6	7.9	10.2	14.9	12.3	6.3	6.5
Latin America	30.31	12.19	18.93	25.46	14.2	5.8	9.1	9.4	7.7	2.1	2.5	2.5
Total	108.8	123	156.93	240.96	10.3	7.9	7.8	9.9	9.33	6.33	4.33	5.08

Source: (Fan *et al.* 2009).

A survey on public agricultural expenditure between 2000 and 2007 showed that governments in the Asian and Pacific regions appeared to focus their budgetary attention on agriculture, with per capita agricultural spending growing at 8% per year from 2000 to 2007 (Fan *et al*., 2008). The study showed that in transitional economies in Eastern Europe and Central Asia, spending on agriculture doubled, whilst it declined by 2.5% in Middle East and North Africa. The survey noted that many governments do not have readily available functional classifications of expenditure and/or are not structured along functional lines.

In Africa, spending in the agricultural sector has been very low. On 6 June 2003, African heads of state met in Mozambique to discuss with the need to address food security issues in the continent. A commitment was made by all countries to aim at allocating at least 10% of the budgetary resources to agriculture under the Comprehensive African Agricultural Development (CAADP) (AU, 2003). A survey conducted by NEPAD in 2007 found that half of the countries in Africa were still spending less than 5% of their national expenditure on agricultural development (NEPAD, 2009). Fan *et al*. (2009) studied how countries are measuring up to the Maputo declaration which stipulated 10% budget allocation to agriculture. The results showed that very few countries achieved the threshold. However, there has been a significant upward trend on the progress towards the commitment.

According to Govereh *et al*. (2006), a common measure of government expenditure on agriculture relative to the size of the sector is to express public and private agricultural spending as a proportion of the agricultural GDP. From their analysis, they found out that for African countries government spending on agriculture as a percentage of agriculture GDP was lower than the average for all developing countries and remained constant at 7.8% for the period 1980 to 1998. During this period, agricultural expenditure relative to GDP decreased in about two-thirds of the African countries, particularly in southern Africa. Fan & Rao (2006) also observed that developing countries allocate less than 10% of their budgets to agriculture as a percentage of GDP. This is much less than in developed countries, which allocate more than 20%. Moreover, Fan *et al*. (2009) revealed the number of countries spending more on the agriculture sector and indicated that the inability of the African continent to significantly increase the level of their agricultural investments may have serious implications for poverty and food security.

2.4.2 Regional context: SADC

Between 1980 and 2007, African public spending on agriculture accounted for 5 – 7% of the total national budget, while allocations in Asia ranged between 6 to 15%. Despite this rather disappointing trend, it is encouraging that after the Maputo Declaration in 2003, most countries in the SADC region notably Lesotho, Mozambique, Swaziland and Zimbabwe increased their allocations to agriculture (Rugube, 2011). Fig 2.2, below shows the agricultural expenditures and the CAADP 10% target between 2003 and 2007..

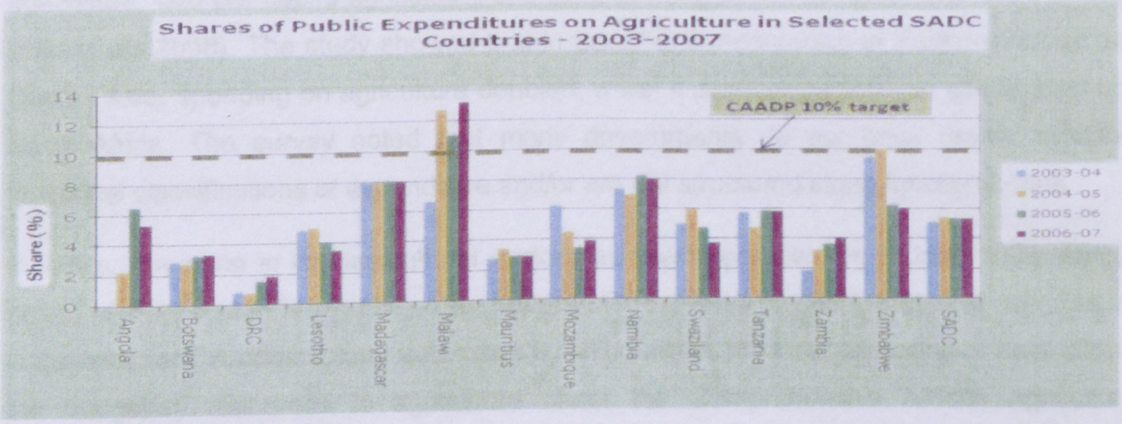

Figure 2.2: Agricultural Expenditures and the CAADP 10% Target, 2003-2007

Source: Rugube, 2011.

The declaration to adopt CAADP and commit member countries to allocating 10% of the budget to its implementation was a landmark decision in Africa. Many countries now allocate more than 5% of the national expenditure to agricultural development. Njiwa *et al*. (2008) explored the trends in the size, share and compositions of public spending on the SADC countries' agricultural sector using data from 1999 to 2007 with Malawi as the case study. From the study, results show that average expenditure on agriculture was 5.4%. Malawi was the best performer spending above 12.3% followed by Namibia, Tanzania, Zambia and Zimbabwe spending above 5% but less than 10%. In Malawi the trend has been upwards since 2003 though the bulk of spending was on subsidy programmes. For Zambia, the trend in the agricultural budget share on total rose from 7.4% in 2000 to 12.5% in 2008 (Govereh *et al*., 2009). Chilonda *et al*. (2009) attributes this increase to the need to fulfil commitments. After the Maputo Declaration, the Malawian government reacted positively and the expenditure on agriculture rose from a minimum of 17% to a maximum of 37%.

2.5 Long run and short run impact of public expenditure on agricultural growth

A corpus of literature exists on the impact of different types of public expenditure programmes on agricultural productivity and growth. However, there is a large variation on the magnitude and direction of the findings on the expenditure impacts. Fan (2008) and Benin *et al*. (2009) agree that this variation is due to the differences in the methodologies and data used. Secondly, theory develops a rationale for government to interfere in market failures through the provision of public goods and the internalisation of externalities (Akroyd & Smith, 2007). Nevertheless, such a theoretical base does not easily translate into

A survey on public agricultural expenditure between 2000 and 2007 showed that governments in the Asian and Pacific regions appeared to focus their budgetary attention on agriculture, with per capita agricultural spending growing at 8% per year from 2000 to 2007 (Fan *et al.*, 2008). The study showed that in transitional economies in Eastern Europe and Central Asia, spending on agriculture doubled, whilst it declined by 2.5% in Middle East and North Africa. The survey noted that many governments do not have readily available functional classifications of expenditure and/or are not structured along functional lines.

In Africa, spending in the agricultural sector has been very low. On 6 June 2003, African heads of state met in Mozambique to discuss with the need to address food security issues in the continent. A commitment was made by all countries to aim at allocating at least 10% of the budgetary resources to agriculture under the Comprehensive African Agricultural Development (CAADP) (AU, 2003). A survey conducted by NEPAD in 2007 found that half of the countries in Africa were still spending less than 5% of their national expenditure on agricultural development (NEPAD, 2009). Fan *et al.* (2009) studied how countries are measuring up to the Maputo declaration which stipulated 10% budget allocation to agriculture. The results showed that very few countries achieved the threshold. However, there has been a significant upward trend on the progress towards the commitment.

According to Govereh *et al.* (2006), a common measure of government expenditure on agriculture relative to the size of the sector is to express public and private agricultural spending as a proportion of the agricultural GDP. From their analysis, they found out that for African countries government spending on agriculture as a percentage of agriculture GDP was lower than the average for all developing countries and remained constant at 7.8% for the period 1980 to 1998. During this period, agricultural expenditure relative to GDP decreased in about two-thirds of the African countries, particularly in southern Africa. Fan & Rao (2006) also observed that developing countries allocate less than 10% of their budgets to agriculture as a percentage of GDP. This is much less than in developed countries, which allocate more than 20%. Moreover, Fan *et al.* (2009) revealed the number of countries spending more on the agriculture sector and indicated that the inability of the African continent to significantly increase the level of their agricultural investments may have serious implications for poverty and food security.

2.4.2 Regional context: SADC

Between 1980 and 2007, African public spending on agriculture accounted for 5 – 7% of the total national budget, while allocations in Asia ranged between 6 to 15%. Despite this rather disappointing trend, it is encouraging that after the Maputo Declaration in 2003, most countries in the SADC region notably Lesotho, Mozambique, Swaziland and Zimbabwe operational rules on the expenditure component to be prioritised (Cabral, 2007; Devarajan *et al*., 1996). Therefore, the next sub-sections discuss literature survey of the long and short-run impact public expenditure in general, and specifically, of current and capital expenditure globally and regionally.

2.5.1 Impact of public expenditure on agricultural growth

Public expenditure is one of the best instruments to influence economic performance. One of the best dimensions of investment effects are long- versus short-run impacts. Empirical evidence suggests that returns to agricultural investments tend to materialise more with a lag (Fan *et al*., 1999). Therefore, it is worth discussing some of the studies which pave a way for this analysis.

2.5.1.1 Global Context

There is a lot of econometric work on the impacts of public expenditure both in the short and long run. In Rosegrant *et al*. (1998), elasticity estimates for Indonesia, the short- and long-run productivity growth due to research investments show that the existing stock of accumulated past investments has larger impacts over the long run than over the short run. In a similar vein, Lee and Hsu (2009), using time series data from Taiwan for 1952 to 2001, reveal a lag in returns to agricultural spending. The study concludes that because of the lag time of the land productivity outcome, it is not possible to demonstrate any effect of public investment over the short run. Similarly, Chi-Hung (2008) Granger Causality tests of the impacts of public expenditure on economic growth of United States Federal Government between 1974 and 2002 found a causal relationship consistent with the Keynesian theory though the results were contrary to Wagner's Law.

Most recent studies have been focussing on estimating the long run impacts of public expenditure on the overall economic growth. Saad and Kalakech (2009) conducted an investigation on the growth effects of government expenditure in Lebanon over a period of 35 years and their focus was on sectoral expenditures. They employed multivariate cointegration analysis and the Error correction modelling approach with the Gross Domestic Product as the dependent variable and the expenditures on defense, education, agriculture and health as regressors. The study's findings were significant and positive for agriculture expenditure.

Udoh (2011) employed the Autoregressive Distributed Lag modelling (ARDL) and the Bounds Test with data spanning from 1970 to 2008 to analyse the short and long run impacts of public and private investment on agricultural output in Nigeria. Agricultural output was used as a dependent variable with public expenditure, gross fixed capital formation, labour, foreign investment and average rainfall as explanatory variables. The results of the Error Correction Model showed that increased public expenditure had a positive influence on the agricultural output growth of Nigeria.

In addition, Inganinga and Unemhilin (2011) applied the Cobb-Douglas Model, Cointegration and Error Correction Model on data from 1970 to 2011 to draw both long run and short run dynamic effects of public expenditure and other determinants of agricultural output. Agricultural output was expressed as a function of public expenditures; total commercial credits to agriculture, consumer price index, annual average rainfall, population growth rate, food importation and GDP growth rate. After performing all standard econometric tests, results of the model showed that a 1% increase in capital expenditure led to about 4.31% increases in agricultural output. The error correction term had a magnitude of 0.4231 implying that about 42% of the previous year's disequilibrium in agricultural product is adjusted for in the following year in Nigeria. The study recommended the government of Nigeria to increase investments in agriculture. This should be complemented by monitored credit facilities.

However, using the same methodology but with disaggregated data from 1961 to 2010, Nasiru (2012) found conflicting results from the previous studies. In that study government expenditure and economic growth revealed no long run relationship though the Granger Causality tests showed that capital expenditure causes economic growth. Furthermore, other studies that employed the Error Correction and Cointegration methodology found significant but negative impacts on economic growth (Loto, 2011; Nurudeen & Usman, 2010).

Barker *et al.* (2002) carried a study in Vietnam to estimate the determinants of agriculture growth and found out that public investment in irrigation was the most outstanding source of agricultural growth followed by research.

However, there is still no universally accepted econometric work on the optimal set of public expenditure. Some studies employed the Computable General equilibrium Modelling Approach to examine the interrelationship between public expenditure composition and economic growth (Senoga & Matovu, 2010). Their findings show a strong relationships between public spending and growth, which extend beyond the sector concerned through general equilibrium and economy wide effects.

Odhiambo *et al.* (2004) used the growth accounting approach on data gathered between 1965 and 2001 to explore the sources and determinants of agricultural growth and productivity. The study shows that growth for the Kenyan agricultural sector is attributable to factor inputs such as labour, land and capital. Secondly, the study establishes that public expenditure on agriculture account for total factor productivity growth.

Fan and Pardey (1998) showed that a long run investment in agricultural functions such as research, irrigation, extension and rural infrastructure contributed to long run growth for most Asian economies. They also noted that poor targeting of public spending can crowd-out private investment and result in inefficiencies and misallocation which hinders growth. A report by the World Bank (2011), on public spending, also shows that due to the law of diminishing marginal returns, excessive capital investments will be rendered unproductive. This is in line with Akroyd and Smith's (2007) findings that excessive spending on recurrent expenditure, especially when a large share of such expenditures is for wages and salaries, will have negative growth impacts on agriculture.

Fan (2006) employed the Computable General Equilibrium modelling approach on a multiple level analysis of public spending on growth and poverty reduction in Egypt for the achievement of the Millennium Development Goals. Their study confirmed that universally, the subsidy is inefficient and is costly in its attempt to achieve its intended goal.

2.5.1.2 Regional Context: SADC

In southern Africa, there are a few empirical studies on the public expenditure impact on agriculture. Recently a study by Govereh *et al*. (2009) on the trends and implication of public spending on the Zambian agricultural productivity growth was done. Using descriptive statistics, the study showed that the low productivity trends were a result of 20 years or so of neglect and low agricultural investments have choked off the process of structural transformation. The study faced challenges on the quality and availability of time series data to assess the impact of expenditure. This was fuelled by changes after 2006 in the reporting formats from economic expenditure classes to functional classification. The study recommends that, though there is a positive impact of expenditure on agriculture, the Zambian government should improve its gathering of economic data for reliable and meaningful economic analysis.

2.5.2 Impacts of current and capital public expenditure on agricultural output and growth.

2.5.2.1 Global Context.

On the empirical front, there exist various attempts to link public expenditure composition and agricultural output. Recently, is a study that was done by Anakoya *et al*. (2013) who used the three Stage Least Square (3SLS) technique and macro-econometric model of simultaneous equations to analyse the disaggregated impact of public capital in Nigeria. The results of this study confirmed that capital expenditure enhances economic growth by crowding-in effect. Similarly, Purokayo and Umaru (2012) investigated the impact of capital expenditure on agriculture output in Nigeria for the period 1990 to 2004. After performing all diagnostic tests the findings showed a positive effect of capital expenditure on the agricultural output. Recommendations were made to increase capital expenditure on agriculture.

A study by Belgrave and Craigwell (1995) used the Cointegration methodology to estimate the long-run effect of the composition of public expenditure on economic growth in Barbados. The study disaggregated public expenditure in to functional and economic categories. The findings of the study indicated that there exists a positive relationship between capital expenditure on agriculture, and all current expenditures showed negative impacts.

However, a 20 year pooled time series study for 43 developing countries including Zimbabwe, Zambia, Mauritius and Malawi by Devarajan *et al.* (1996) which employed the Constant Elasticity of Substitution Production Function to show the impacts of composition of public expenditure on economic growth came up with different results. The study results show that increasing the share of current expenditure had a positive growth effect, whilst capital expenditure has negative effects. Their results suggest diminishing marginal returns when productive expenditures are used in excess.

Diakosavvas (1990) employed the elasticity approach to compare the impact of various public expenditure returns an agricultural output for 35 developing countries in Africa, Latin America, Asia and the Near East regions between 1974 and 1984. Data on government agricultural expenditures was disaggregated into current and capital expenditures. The results showed varying results by region. Agricultural output elasticities of current expenditure were larger than those of capital expenditure in Africa and Latin America, whereas in Asia and the Near East, the output elasticities of capital expenditure exceeded those of current expenditure. The study recommended that governments in Africa, Latin America and the Near East should increase investments on development expenditure.

Using sectoral panel data for the period of 30 developing countries over the 1970 and 1980 decades, Bose *et al.* (2003) examined the impacts of capital and current expenditure on growth. Econometric results showed a positive and significant correlation between capital and economic growth but current expenditure was found to be insignificant.

Furthermore, Benin *et al.* (2009) used a three–stage least squares econometric approach on Ghana's district level data to simultaneously estimate the agricultural productivity returns to different public expenditure across various agro-ecological zones. The model results showed that public spending is the driving force behind agricultural productivity. The study also made use of the elasticity approach by differentiating the system of equations with a particular public expenditure. From the estimation, the study showed that for all rural areas, the marginal effect was 0.15; a one percent increase in agricultural public expenditure is associated with a 0.15 increase in the value of agricultural productivity. The study results compare favourably with Huffman and Evenson's (2006) elasticity estimates of public expenditure on research and extension for the United States which ranged from 0.11 to 0.19. The study recommended that the government of Ghana should to increase capital expenditure since simply paying staff salaries, administration costs and other overheads is unlikely to yield any substantive outcomes.

A study conducted in Indonesia by Rosegrant *et al.* (1998) using regional cross-section time series data for the period 1969 to 1990, shows the importance of major public expenditures on crop yield in the long run. The focus of the study was on investment on four crops, namely rice, maize, cassava, and soybean. Using an econometric model, the study showed the extent to which growth in major crops has responded to capital expenditure research, irrigation, and extension over the same period. The impact of investments in irrigation was positive, whereas the coefficients on research and extension were not statistically significant. Elasticity estimation showed that investment in agricultural research has large impacts on output in the short and long run, whereas for extension it was negative in the short run.

Fan *et al.* (1999) developed a simultaneous equations model to estimate the various direct and indirect effects of government expenditures on productivity in rural India. Of the various expenditures, the model shows that government expenditure on productivity enhancing investments, such as agricultural research, extension, irrigation, rural infrastructure and development, have also contributed to growth in agricultural productivity and poverty reduction. The study recommends that, in order to increase agricultural productivity and reduce rural poverty, the Indian government should give priority to increasing its capital expenditure on rural roads and agricultural research and extension.

A country level analysis by Mogues *et al.* (2011) on the effects of public agricultural spending on agricultural performance in Ethiopia found that public expenditures on agriculture, as a whole, do not have comparatively high output returns. This multistage analysis makes clear that the weak link between public spending and agricultural performance is the misallocation of public resources. The study findings suggest that the allocative efficiency of public expenditure needs to be examined.

2.5.2.2 Regional context: SADC

In Zimbabwe, Mutangadura (1997) used quantitative methodology to show the priority setting of public resources on research. Economic efficiency gains projections for the period of 15 years, using Net Present Values calculated. Mathematical programming was then used to project optimal resource allocation. Though the study was unique in its own set up, limitations on data availability were a drawback on the results. The study recommended that government should improve the monitoring and evaluation system to generate better information on public expenditure.

Chilonda *et al.* (2007) attempted to explain the determinants of agricultural performance in the SADC countries. The study revealed that insufficient investment in agriculture has resulted in limited growth in the average yields of key crops and in low productivity. However, the study limited itself to descriptive analysis on public expenditure impact, which may not address the needs of priority setting. Future research directions pointed to an analysis of the composition of the public expenditure on agriculture in different countries.

2.6 Chapter Summary

This chapter revealed that, though most studies present evidence to support the argument that prioritising public expenditure toward agricultural growth, including infrastructure, extension, research and irrigation, promotes growth and accelerates poverty reduction, the debate is inconclusive. This variation may be attributed to the type of data and methodologies used. Nevertheless, an emerging theme is that the economic growth theory is necessary to derive the necessary guidance on how public spending could be used to stimulate growth, and increase food security. Literature reveals that most studies on public expenditure impacts, particularly in Africa, have been estimated to see impacts on overall economic growth. This limits their easy application when policy makers are faced with sectoral budgets prioritisation for competing programmes, particularly in the agricultural sector. Therefore, given dwindling budgets, very small resource envelops and the need to meet commitments in most African countries, a study that looks at the impact of the composition of public expenditure on agricultural growth was necessary.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter outlines the various tools that were used to conduct the study. It explains the selected procedures, methods and data sources. It is this section that provides descriptions of the research design, the sampling plan, data collection procedure and also of the measuring instruments used in this study. In addition, this chapter seeks to show the relationship between the research question and the data collected, as well as the steps according to which the data was gathered and analysed.

3.2 Description and coverage of the study area

To group the countries in the region for a fairer representation, per capita income was used as a proxy for the level of development. Then the 14 SADC countries were grouped into two groups: 8 low-income countries, namely Democratic Republic of Congo, Mozambique, Lesotho, Madagascar, Malawi, Zambia, Tanzania, and Zimbabwe; and the 6 middle-income countries, namely Namibia, Angola, Swaziland, Mauritius, Botswana, and South Africa. Zimbabwe was selected to represent the low income countries. The country was chosen due to the importance of agriculture which provides more than 15% to the total GDP as compared to 3% in middle income countries. South Africa was selected among the middle income countries. The selection of the sample is also a matter of convenience in terms of data availability.

3.3 Data sources and time domain

The study utilised secondary published and unpublished data from line ministries and departments supplemented with key informant interviews. Much of the information on actual expenditure on public expenditure is not frequently published therefore the researcher had to make central office visits. Due to inconsistencies in the publishing of public expenditure data in developing countries in case, understanding of records from line ministries required key informant interviews from the ministry staff.

Unless or otherwise specified, time series data from 1981 to 2011 on public spending used in this study was collected from Ministry of Finance, Ministry of Agriculture, Reserve Bank, Zimbabwe; Treasury, Reserve Bank, Department of Agriculture, Forestry and Fisheries, South Africa supplemented with published and unpublished estimates from the Zimbabwe Statistics, and Statistics South Africa (StatsSA).

Public expenditure in agriculture is broken down into various economic categories. This study was limited to economic classification of public expenditure. Data collected include Agricultural GDP, consumer price index, annual recurrent and capital expenditures on the agriculture sector, and exchange rates.

Prices were first deflated from current local currency expenditures to a set 2005 base year prices, using each country's consumer price index. Exchange rates measured in purchasing power parity, as reported by the World Development Indicators, were used to convert local currency expenditures measured in terms of constant prices into a value aggregate expressed in terms of constant Unites States international dollars.

The selection of the countries under study was largely based on data availability and partly because these countries represent broader rural development throughout all SADC countries. While some countries use the internationally accepted Classification of the Function of Government (COFOG) suggested by the International Monetary Fund (IMF), in reality, using this standard definition is not mandatory (Fan, 2008). This study, therefore, used some components of the COFOG where necessary.

Because these countries do not have a frequently updated online time series data on agriculture, much of the information on expenditure and agricultural production were obtained through central office visits.

3.4 Data analysis

3.4.1 Objective 1: Share and level of public agriculture expenditure in Zimbabwe and South Africa

To set the stage for this study analysis of the share of agriculture expenditure as a share in the total spending and gross domestic product was done. To achieve this objective, real expenditure was obtained by dividing expenditure at current market prices by the consumer price index (CPI). There was also the need to analyse the trends in capital and recurrent expenditure over the years. Further calculation of the agricultural orientation index (AOI) was necessary to see how the share of agricultural expenditure relates to the size of agricultural sector in the economy. This was done by dividing the share of agricultural expenditure to total expenditure with the share of agricultural gross domestic product to the total gross domestic product. Results are presented using line and bar graphs, and tables in Chapter 4.

3.4.2 Objective 2:To estimate the long and short run effect of public expenditures on agricultural growth in Zimbabwe, and South Africa

Stationarity test

Most time series variables face the problem of non-stationarity. According to Gujarati (2003), stationarity implies that the distribution of a process remains unchanged when shifted in time by an arbitrary value. A time series is strictly stationary if all the moments of its probability distribution are invariant over time. According to Endes (1995), shocks to a stationary time series are necessarily temporary. Overtime, the effects of the shock will dissipate and the series will converge to the unconditional mean of the series.

In time series data, the assumption that the error term from the successive observations are uncorrelated is frequently invalid. Thus practically, most econometric time series are non-stationary. The mean and variance of such series are a function of time, and hence there is no tendency to hold back to a given value. Accordingly, Gujarati (2003) argued that econometric analysis with such data may yield impressive-seeming regressions, which are wholly spurious. These regressions tend to yield a high R^2 value and significant t-ratios. All that is reflected is contemporaneous correlations rather than meaningful causal relations (Ketema, 2006).

Econometric estimations with non-stationary series render efforts with Ordinary Least Squares regression meaningless as a result of spurious regressions. To avoid this problem, the study employed the Augmented Dickey Fuller test to detect the presence of unit roots in the series.

Augmented Dickey Fuller (ADF) Test

The first step was to test for the presence of unit root by testing the order of integration to determine how many times the variable needed to be differenced to arrive at a stationary point. The Augmented Dickey Fuller (ADF) test was carried out and the augmentation, here, according to Gujarati (2003), involves the addition of lagged values (p) of first occurrence of autocorrelation. The following equation was tested and ADF was calculated as t-ratios of the coefficient on X_{t-1} in the following equation:

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \sum_{i=1}^{n} \beta i \Delta X t_{-i} + \mu_t \quad (3.1)$$

Where **X** is the series, t is trend factor, α_0 is constant term, **μ** is the stochastic error term and βi is the lag length.

Estimation of the above equations using Ordinary Least Squares was made and the resulting t-statistics were compared with the respective critical values given in McKinnon critical values. If the t-calculated is less than its critical value from the Fuller's table, then the series is stationary. When using estimated residuals the critical values are different from the Fuller's table, and the McKinnon critical value s used for any sample size (Gujarati, 2003; Asteriou and Hall, 2007).

For confirmatory purposes of the Augmented Dickey Fuller test which adds lagged differenced terms on the right hand side, the Philips-Perron test was employed. This makes a correction to the t-statistic of the coefficient from the regression.

Secondly, data was non-stationary and there was need to make it stationary. The most effective way to remove non-stationarity in time series data is differencing and detrending (Thomas, 1997; Gujarati, 2003). However, since this study dealt with macro-economic data series, differencing until it is stationary was the most appropriate since such series were difference stationary. First differences of an Y_t were taken:

$$\Delta Y_t = Y_t - Y_{t-1} \qquad (3.2)$$

where Y was the series in case.

Model specification

The study employed an endogenous growth modelling approach in which agriculture growth was a function of various expenditures specified as:

$$Y_t = \alpha + \sum_{0=1}^{n} \beta_i X_{it} + \mu_t \qquad (3.3)$$

Where

- Y_t refers to agricultural growth of a specific country at year ***t***. Gross Domestic Product for the agricultural sector was used as a proxy for growth of the sector following studies by Anakoya *et al*., (2013), Fan *et al*., (2009, and Loto, (2011),
- ***A*** is the constant term,
- ***β*** refers to parameter estimates,
- ***X*** refers to a latent of explanatory variables that are assumed to affect agriculture growth for the countries under study in different lags,
- **μ** is the error term that captures other variables which are not included in the model.

Model: Economic budget composition and agriculture growth

To estimate the impact of recurrent and capital expenditure impacts on agriculture growth for each country, the same growth accounting model was employed. Time series data from 1981 to 2011 is used. However, in this study agricultural recurrent and capital expenditure and other factors impacting on growth ere regressed against agricultural Gross Domestic Product (AGDP).

Because endogenous growth models are non-linear variables had to be transformed in to logs to linearise the model. The general model was then specified as follows:

$$lRAGDP\$_t = \alpha_0 + \sum_{t=1}^{ki} \beta_1\, lRACE\$_t + \sum_{t=1}^{ki} \beta_2\, lRARE\$_t + \sum_{t=1}^{ki} \beta_3\, lRNAE\$_t + \sum_{t=1}^{ki} \beta_4\, \phi D_t + \varepsilon_t$$

.... (3.4)

Note that the model followed the generalto-specific modelling approach to determine appropriate lag length for each variable for a particular country as shown in E-views 6 estimations in Appendix D.

Where;

RAGDP$	=Agricultural Gross Domestic Product per year measured in million United States dollars ($USm)
RNAE$	= Non agricultural expenditures measured in million United States dollars ($USm)
RAGDP$ $_{t-1}$	=one year lagged Agricultural Gross Domestic Product per year measured in million United States dollars ($USm)
RARE$	=Annual Recurrent expenditure measured in million United States dollars ($USm)
RACE$	=Annual Capital expenditure measures in million United States dollars ($USm)
DR	= Dummy variable for a seasonal shock such as policy change taking the value of 0 and 1
μ	= stochastic error term

Cointegration test

Cointegration is an overriding requirement for an economic model using non-stationary time series data due to the implication that non-stationary variables can lead to spurious regression. According to Asteriou and Hall (2007), whenever variables are not cointegrated, econometric work becomes almost meaningless.

The key point here is that even if a genuine long run relationship exists between variables, although the variables will rise over time there will be a common trend that links them together. Gujarati (2003) contends that a linear combination of variables that is stationary variable an I(0) is required for a long run relationship to exist.

The most important aspect in cointegration is about the choice of order of integration of variables in a multivariate model. The requirement was that variables should be integrated of the same order (an I(1)). However, Harris (1995) challenged this requirement saying it is not necessary for all variables in the model to have the same order unless n=2. The is possibility for cointegration to exist when there is a mix of I(0), I(1) variables in the model. Therefore there is no point of excluding non stationary variables in the model especially if theory *a priori* suggests that such variables should be included.

To perform this 'mandatory' test of the long run association between variables, the study employed the residual based Engle Granger test, which assumes that cointegrated equations will always have residuals that are I(0). Due to the short period used of the data set, the Johansen method was neglected due to the sample size which was not long enough to capture the 'long wave' effect among variables.Thus the Engle-Granger approach was used. Though the method is limited that is by failing to give the number of cointegrating vectors due to use of residuals from single relationship, this method has been shown to be simple and continues to be largely used in econometric modelling.

Engle Granger (1987) Cointegration Approach

Assuming that all variables used in the model are integrated of the same order I(1), residuals from the equation in question will be obtained. If these deviations from long-run equilibrium are found to be stationary, then there is contegration. This is done by performing the Dickey Fuller test using the following equation with neither a constant nor a trend:

$$\Delta\hat{e}_t = \alpha_1 \hat{e}_{t-1} + \sum_{i=1}^{n} \delta\Delta\, \hat{e}_{t-1} + \varepsilon_t \quad \text{...} \quad (3.5)$$

When the $\hat{e}_t \sim I(0)$ the null that variables in the model are not cointegrated is rejected and concludes that there is a long run association among variables.

Error correction Model (ECM)

After realising a long-run relationship among the variables in the models, residuals from the equilibrium regressions were used to estimate the error correction models associated with long run estimates on the above equations, in order to obtain the short run dynamic elasticities. The general ECM for the models was assumed to be as follows assuming that all variables as significant:

1. *ECM for economic expenditure and agriculture growth*

$$\Delta lRAGDP\$_t = \alpha_0 + \sum_{t=1}^{ki} \beta_1\, \Delta\pi lRACE\$_t + \sum_{t=1}^{ki} \beta_2\, \Delta\psi lRARE\$_t + \sum_{t=1}^{ki} \beta_3\, \Delta\eta lRNAE\$_t + \sum_{t=1}^{ki} \beta_4\, \phi D_t + \lambda\hat{\mu}_{t-1} + \varepsilon_t$$

Where Δ is the first difference operator and all the differences are lagged k_i number of times, including the dependent variable ($\Delta LRAGDP\$_t$). These differences represent the short run dynamics of output (the dependent variable). The parameters β_1...... β_6 represent how changes in the explanatory variables lead to changes in agriculture GDP. The fitted error correction term (μ_{t-1}) shows the speed of adjustment to the equilibrium. In other words it measures how fast the system corrects its previous disequilibrium after a shock. Of particular note is that to arrive at a parsimonious ECM, the study followed the General-to – Specific modelling approach basing on the Akaike information criterion to select appropriate lags.

Diagnostic Tests

The White (Langrange Multiplier) test of Heteroskedasticity

One of the assumptions of the classical regression model is that the disturbance μ_i in the regression has the same variance. However, normally most residuals of time series data have unstable variance thus they are heteroskedastic (Asteriou & Hall, 2007). The White test of the following equation was used;

$$\mu_i^2 = \alpha_0 + \alpha_0 x_0 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_1^2 + \alpha_4 x_2^2 + \alpha_5 x_1 x_2 + v_i$$

where the Xs represent variables in question *and* μ_i *refers to residuals from ECM*

Ramsey RESET (1969) Test

Before interpreting results from the long run model there was need to check if there are any specification errors of the model used. These errors can be as a result of omitted important variables or error resulting from specifying the functional form of the model (Gujarati, 2003). In this study the Ramsey Regression specification Error Test (RESET) 1969 which is both an F-form and Lagrange Multiplier form was employed.

Breusch-Godfrey Lagrange Multiplier (LM) test for higher order Autocorrelation

There is also a tendency of the disturbance term (μ_i) picking up the influence of those variables not included in the equation (Gujarati, 2003). This might be due to the omission of relevant explanatory variables. In this case the Breusch-Godfrey test was employed. This test detects higher order autocorrelation such as Auto-regressive AR(1) and AR(2) or higher order moving averages.

Assuming that the error terms follow a ρ^{th} order autoregressive AR(ρ) the following equation will be tested such that;

$$\mu_t = \rho_1\mu_{t-1} + \rho_2\mu_{t-2} + \rho_3\mu_{t-3} + \rho_4\mu_{t-4} + \rho_5\mu_{t-5} \ldots\ldots\ldots\ldots\ldots + \rho_p\mu_{t-p} + e_t$$

Detected autocorrelation was corrected using first differences. This was done on one condition that Durbin Watson statistic was less than R^2.

Stability Tests (Chow Test 1960)

With the presence of structural breaks due to policy changes and shocks, there was need to test if a single equation is more efficient to estimate the whole period than two separate regressions. Assuming that the error terms are normally distributed with homoskedastic variances, the study employed the Chow test.

Model justification

By and large, the reason of using ECM in this study was because error correction models represent a powerful way of modelling economic time series. According to Gujarati (2003), these models aim to construct a well-specified statistical model, which separates the long and short run dynamics between economic variables taking care of problems of non-stationarity.

Secondly, there is no standard model for such type of studies. The error correction model serves as a convenient model that measures the correction from the disequilibrium of the previous period, which has a very good economic implication. Moreover, with cointegration ECMs are formulated in terms of differences which typically eliminate trends from the variables involved and hence resolve the problem of spurious regressions (Asteriou and Hall, 2007)

Above all, error correction models easily fit to the general-to-specific approach to econometric modelling. This is, in fact, a search for the most parsimonious ECM that best fits the given data sets. The model has important features that the disequilibrium error term is a stationary variable. Due to this, the ECM implies that the variables are cointegrated and there is some adjustment process which prevents the errors in long run relationships becoming larger and larger.

3.5 Ethical consideration

This study followed research ethics outlined in the University of Venda Research Policy. The study tried by all means not to harm any organisation, institution and individual physically, emotionally or politically. This was made possible by seeking consent from various government officials involved in the study. Clearance from relevant ministries was sought. Besides, all the all information from secondary sources cited in this study is duly acknowledged. Data gathered in this study was only for the need to partially fulfil the requirements of the Masters of Science degree in Agricultural Economics at the University of Venda.

3.6 Summary of Objectives, Research Questions, Hypothesis, Data Required and Analytical Tool.

Table: 3.1 Objectives, Research Questions, Hypothesis, Required Data and Analytical Tools.

Specific Objective	Research Question	Hypothesis (H_o)	Required Data	Analytical Tools
1. To analyse the share of major public expenditure functions of agriculture on total public agriculture, agricultural gross domestic product over the years for selected countries.	1. What has been the share and trend of major public expenditure of agriculture on total public expenditure on agriculture over the years?	1. Public expenditures on agriculture have been very low over the years.	❖ Expenditure on agriculture (1981-2011) ❖ Total expenditure(1981-2011) ❖ Agriculture gross domestic product (AGDP) (1981-2011)	❖ Microsoft Excel
3. To estimate the long and short run effect of public expenditures on agricultural growth in Zimbabwe and South Africa.	3. What is the long run and short run effect of public expenditures on agriculture growth in selected countries?	3.Public expenditure on agriculture has a long and short run effect on agricultural GDP	❖ Recurrent expenditure on agriculture (1981-2011) ❖ Capital expenditure (1981-2011) ❖ Agricultural GDP (1981-2012) ❖ Agriculture labour (1981-2011) ❖ Annual rainfall (1981-201) ❖ Consumer price index (1981-2011)	❖ E-views 8 ❖ Log-linear regression Model ❖ Error Correction Model

Table 3.2 Summary on Definition of variables in the model

Acronym	Description of variable	Measure (South Africa)	Measure (Zimbabwe)	Expected sign
RACE$	Real capital expenditure on agriculture	Million US$ (1983-2011)	Million US$ (1981-2006)	+ve
RARE$	Real recurrent expenditure on agriculture	Million US$ (1983-2011)	Million US$ (1981-2006)	-ve
RNAE$	Real non-agricultural expenditure on agriculture	Million US$ (1983-2011)	Million US$ (1981-2006)	-ve/+ve
RAGDP$(-1)	Real agricultural gross domestic product	Million US$ (1983-2011)	Million US$ (1981-2006)	+ve
DRC	Dummy of regime change	0= before change 1=after change		-ve

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The main aim of the study was to analyse the economic impact of the composition of public expenditure on agricultural growth and give implications on regional food security using evidence from selected Southern African Development Community. South Africa and Zimbabwe were used as case studies. This chapter starts by presenting the trends in the size and composition of expenditures on agriculture. Second, results from econometric estimations on the impact of public expenditure on agricultural gross domestic product are presented and discussed. Finally, discussion of the best practice from case studies findings giving implication on food security is done.

4.2 Presentation of results

4.2.1 Share and level of public agriculture expenditure in South Africa and Zimbabwe

The share of public expenditure on agriculture, total public expenditure and agricultural gross domestic product is very important in determining the level of priority given to the sector by policy makers (Chilonda *et al.*, 2009). This section therefore, presents the trends on the share of public agricultural expenditure for South Africa, and Zimbabwe between 1981and 2011.

4.2.1.1 Agricultural expenditure as a percentage of total expenditure outlays.

By and large, African governments made a solemn commitment to allocate at least 10% of their annual financial resources towards the agricultural sector; a benchmark that seeks to channel more resources towards the agricultural sector under the Comprehensive African Agricultural Development Programme (CAADP)(NEPAD, 2009). It is therefore important to track how countries are measuring to this benchmark.

The following discussions are based on data derived from Appendix C. Consequently Figure 4.1 shows the size of agricultural expenditure in relation to total expenditure for South Africa and Zimbabwe.

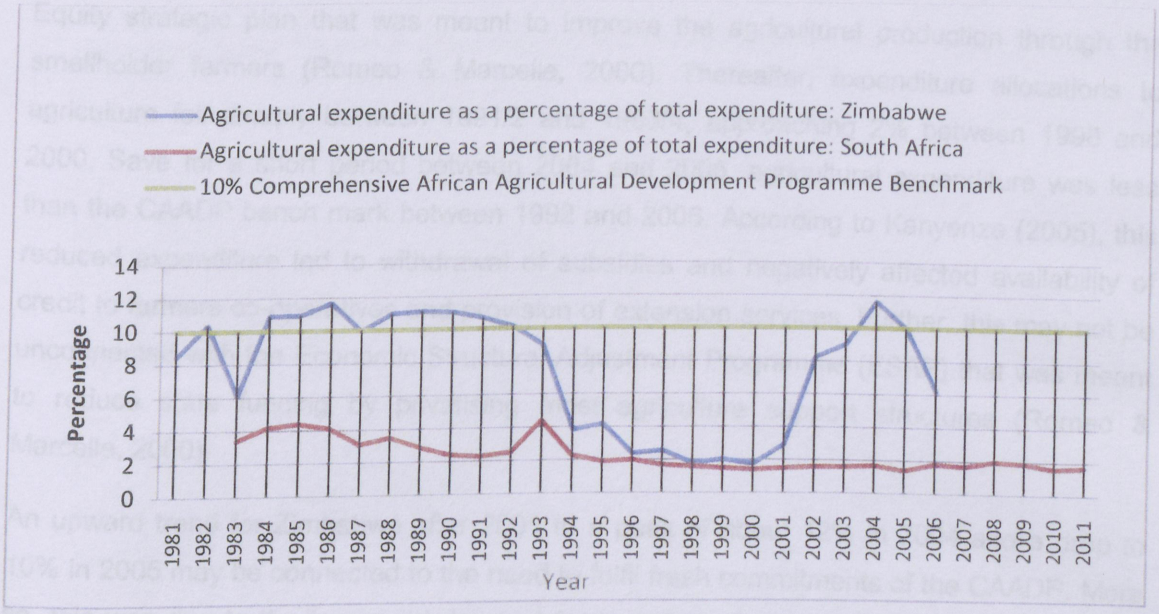

Figure 4.1 Agricultural expenditure as a percentage of total expenditure in Zimbabwe and South Africa measured in United States dollars (1981-2011).

Source: Author's computations using data from Reserve Bank of South Africa and Zimstats. (See appendix B and C).

According to the above graph agricultural expenditure as a % of total expenditure for South Africa increased steadily between 1983 and 1985 when it reached a peak of about 4.3%. Thereafter, it decreased to about 3% in 1987, shot up to about 4% in 1988 but fell once more gradually until it stabilized at about 2% between 1990 and 1992. It shot drastically to above 4% in 1993 but continued to stabilize once more at about 2% until in recent years (2010/11). Throughout the period from 1983 to 2011 expenditure was much lower than the CAADP bench mark in South Africa.

Data for the Zimbabwean case study is only up to 2006 due to the hyperinflationary environment that distorted measuring instruments during the 2007 and 2008 and the dollarization after 2009. Figure 4.1 shows that the Zimbabwean government, although inconsistent has managed in some years to meet the CAADP Benchmark of 10% resource allocation to agriculture. Save for the year 1983 when agricultural expenditure was 6% of the total, it managed to apportion above the benchmark up to 1992. Although in some years it reached the South African levels, its percentage expenditure to agriculture has mostly been above 6% and sometimes surpassed the benchmark. Specifically, during the first decade of independence there was a visible expansion in the allocation to the Ministry of Agriculture.In 1981 it allocated less than 10% followed with allocation of about 10% in 1982, 6% in 1983, and above 10% between 1984 and 1992. This allocation was linked to the first Growth with

Equity strategic plan that was meant to improve the agricultural production through the smallholder farmers (Romeo & Marcelle, 2000). Thereafter, expenditure allocations to agriculture fell sharply between 1991/2 and 1993/4, approaching 2% between 1998 and 2000. Save for a short period between 2004 and 2005, agricultural expenditure was less than the CAADP bench mark between 1992 and 2006. According to Kanyenze (2005), this reduced expenditure led to withdrawal of subsidies and negatively affected availability of credit to farmers co-operatives and provision of extension services. Further, this may not be unconnected with the Economic Structural Adjustment Programme (ESAP) that was meant to reduce state funding by privatising most agriculture support structures (Romeo & Marcelle, 2000).

An upward trend for Zimbabwe after 2001 to a peak of about 12% in 2004 and a drop to 10% in 2005 may be connected to the need to fulfil fresh commitments of the CAADP. More so, this was due to the increased demand for technical services on newly acquired farms (Kanyenze, 2006). However, after 2005, there has been a sharp fall in the agricultural expenditure to 6% in 2006. This shows that policy makers only put efforts in fresh commitments. Given the unstable economic environment that was prevailing in Zimbabwe, effort could have been diverted to meet local objectives of stabilising the economy than on regional commitments.

4.2.1.2 Agricultural expenditure as a percentage of agricultural gross domestic product measured in United States dollars for Zimbabwe and South Africa.

Another more comprehensive way of showing the extent to which the agricultural sector is supported through the national budget is to measure the agricultural expenditure as a share of agricultural gross domestic product (Chilonda et al., 2007). Figure 4.2 derived from data appearing in Appendix C shows the trend in the size of agricultural expenditure in relation to total gross domestic product for South Africa and Zimbabwe from 1981 to 2011. As explained above, data for Zimbabwe is only up to 2006 wherein the Zimbabwean dollar was in use and the economic environment was stable for reliability of measuring instruments.

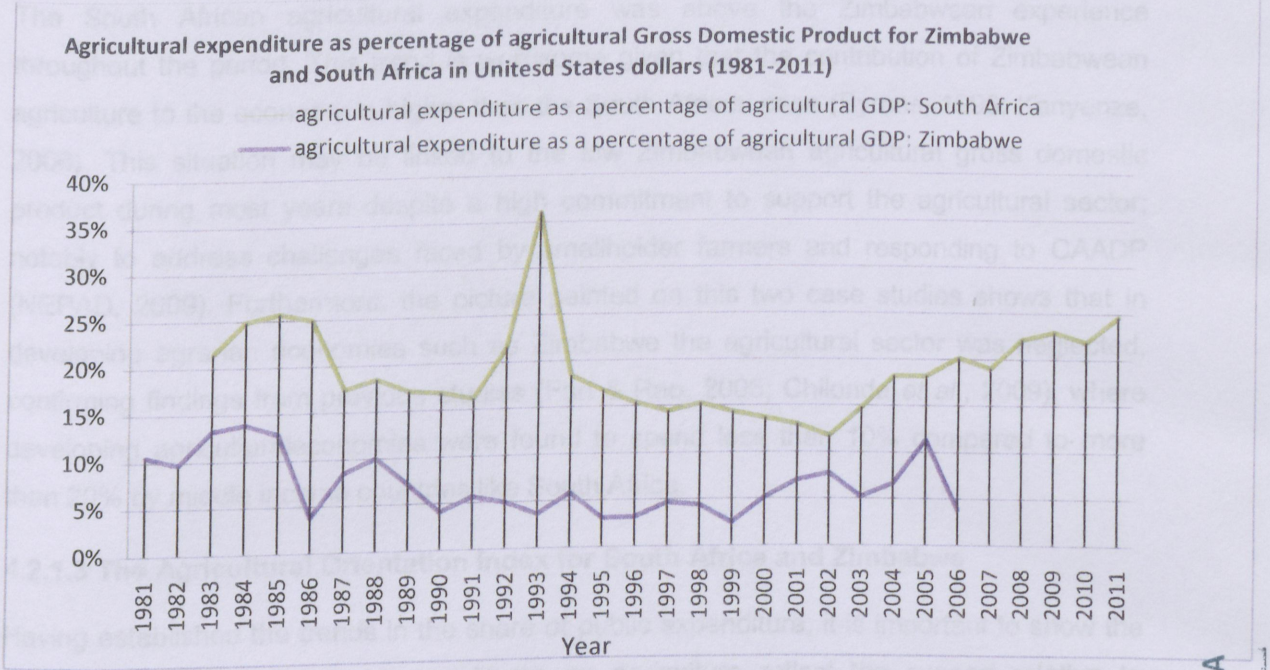

Figure 4.2 South Africa and Zimbabwe Agricultural expenditure as a percentage of agricultural gross domestic product (1981-2011) measured in United States Dollars.

Source: Authors computations using data from Reserve Bank of South Africa and ZimStats, various issues. (See appendix B and C).

As can be drawn from Figure 4.2 throughout the period in question, the size of public expenditure on agriculture as a percentage of the agricultural GDP in South Africa was 15% and above except the 1997,1999, 2000, 2001, 2002 and 2003 years. There was a steady increase between 1983 and 1985 when it reached 26%. Thereafter, it fell slightly to 25%, continuously up to 16% in 1991. An upshot to 36% in 1993 was followed with a sharp fall to18% in 1994. Save for a stabilisation between 14% and 15% in 1997/1998 years, the agricultural expenditure per agricultural GDP was falling up to 2002. Between 1999 and 2002 it was less than 15%. After 2002, there was a continuous increase that temporarily dropped in 2007 and 2010 years, and reached about 25% in 2011.

Figure 4.2 also shows the expenditures in relation to total GDP of the Zimbabwe agricultural sector. There was a steady increase that reached the peak in 1984 and a slight decrease to 13% in 1985 that drastically fell to 4% 1in 1986. Thereafter, it rose to 10% in 1988; fell again to 5% in 1990. After 1990 there was a protracted up and down trends up to 2002 which was temporarily constant between 1995 and 1996 before a slight increase in 1997, which fell to less than 5% in 1999 before a rise again to 7% in 2002. Agricultural expenditure fell during the 2002/3 period and rose to 11% in 2005 before a sharp fall to 4% between 2005/6.

The South African agricultural expenditure was above the Zimbabwean experience throughout the period. This trend is worrisome given that the contribution of Zimbabwean agriculture to the economy is higher than the South African case (Byrnes, 1996; Kanyenze, 2006). This situation may be linked to the low Zimbabwean agricultural gross domestic product during most years despite a high commitment to support the agricultural sector; notably to address challenges faced by smallholder farmers and responding to CAADP (NEPAD, 2009). Furthermore, the picture painted on this two case studies shows that in developing agrarian economies such as Zimbabwe the agricultural sector was neglected, confirming findings from previous studies (Fan & Rao, 2006; Chilonda *et al.*, 2009), where developing agriculturaleconomies were found to spend less than 10% compared to more than 20% by middle income countries like South Africa.

4.2.1.3 The Agricultural Orientation Index for South Africa and Zimbabwe

Having established the trends in the share of public expenditure, it is important to show the extent to which government expenditures on agriculture reflect the support relative to importance of the sector to the overall economy. This can be derived through the agricultural orientation index (AOI), constructed by dividing the share of agricultural expenditure per total government expenditure by the share of agriculture GDP per total GDP (FAO, 2012). An AOI of less than 1 indicates a smaller share of total spending than the representation of agriculture in the economy (FAO, 2012).

Figure 4.3 derived from data in Appendix C shows the AOIs for Zimbabwe (1981 to 2008) and South Africa (1983 to 2011) Data for Zimbabwe after 2008 was affected with change in the currencies which affected measuring instruments. The South African agricultural sector received more attention up to 1989 as shown by an AOI of more than 1. Specifically, there was a shot to a peak of about 1.9 in 1984 before a decrease to 1.1 in 1987. A temporary rise was experienced in 1988 after which the AOI fell to 0.7 in 1991 before a shot up to 1.5 in 1993. Thereafter, there was a drastic fall to 0.8 in 1994 and a continuous fall after 1995 to 0.61 in 1998. After 1998, there was a fall to 0.5 in 2000 which rose to 0.62 in 2004. A drop again to 0.6 in 2004 was followed by a sudden rise to 0.81 in 2006 which smoothened up to 2008, fell to 0.7 in 2010 and slightly increased again to 0.8 in 2011. Overall, the AOI for South Africa was more than 1 before 1994; a trend showing that during the apartheid years agriculture received substantial attention, but after 1994 the new government failed to support the sector adequately. In which case, it could be that new governments like South Africa neglect the agricultural sector.

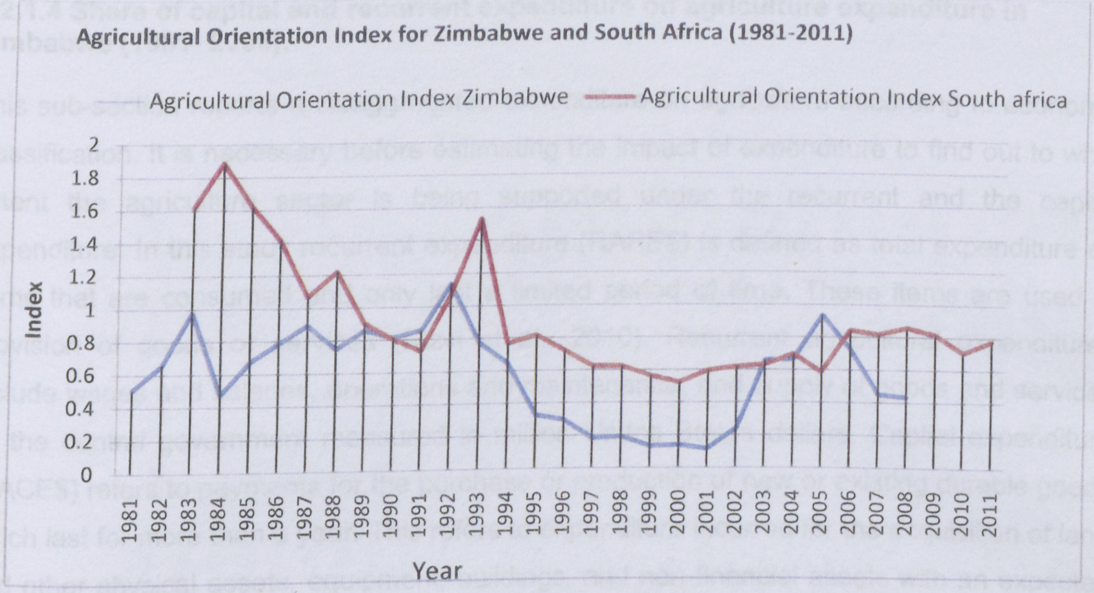

Figure 4.3 Agricultural Orientation Index for South Africa and Zimbabwe (1981-2011).

Source: Author's computations using data from Reserve Bank of South Africa and Zimstats. (See appendix B and C).

For the Zimbabwean case, figure 4.3 shows that the AOI was substantially lower than the South African case and less than 1, a situation which persisted up to 1990. The AOI for Zimbabwe increased steadily from 0.5 in 1981 to 1 in 1983, before a sharp fall to 0.5 again in 1984. Thereafter, AOI rose to 0.89 in 1987 before a slight drop to 0.75 in 1988 followed with a rise in 1989 which after 1991 surpassed 1 in 1992. Between 1993 and 2001, there was continuous fall up to 1997 which stabilised temporarily in 1998 before falling to 0.1 in 2001. AOI then increased sharply in 2003 to 0.61, stabilising in 2004 and shot again in 2005 to 0.84 before a continuous fall in the later years (2006/2007). Generally, save for 1992, the AOI of less than 1 from 1981 shows that the Zimbabwean agricultural sector received less attention with the 1990s mostly affected. This in itself gives a worrisome trend given that more than 70% of Zimbabwean population depend on agriculture for overall income and food (Makamure *et al*., 2001).

It is therefore important to check the trends in the economic composition of public expenditure on agricultural expenditure before determining how these have affected the performance of the agricultural sectors of Zimbabwe and South Africa.

4.2.1.4 Share of capital and recurrent expenditure on agriculture expenditure in Zimbabwe (1981- 2006).

This sub-section reports a disaggregated expenditure on agriculture according to economic classification. It is necessary before estimating the impact of expenditure to find out to what extent the agriculture sector is being supported under the recurrent and the capital expenditure. In this study recurrent expenditure (RARE$) is defined as total expenditure on items that are consumed and only last a limited period of time. These items are used in provision of goods or services (Rizvi et al., 2010). Recurrent agricultural expenditures include wages and salaries, operations and maintenance, and supply of goods and services by the central government measured in million Unites States dollars. Capital expenditure (RACE$) refers to payments for the purchase or production of new or existing durable goods which last for more than a year. This refers to expenditure incurred for the acquisition of land and other physical assets, equipment, buildings, and non-financial assets with an expected lifetime of more than one year (World Bank, 2011). Figure 4.4and 4.5 show the trends in terms of the recurrent and capital expenditure for South Africa and Zimbabwe respectively.

Figure 4.4 derived from data in Appendix C shows the trends in public expenditure composition on agriculture disaggregated into capital and recurrent expenditure for the South African economy. The South African agricultural sector has continued to show very low capital expenditure support over the past three decades. Over the years, capital expenditure has remained less than 20%, except in 1991 and 2002 when capital expenditure slightly surpassed and reached near 20% respectively. Capital expenditure fell from 13% in 1983 to 7% in 1987 before a temporary rise to 10% in 1988. Thereafter a fall in 1989 was followed with an increase to 21% in 1991 that dropped again in 1992 to 8%. An increase to 16% in 1994 was followed with downward trend which reached 7% in 2000 before a rise to 19% in 2002. Save for 2004 capital expenditure continued to fall up to 2007 when it approached 3% and in the recent years (2008-2011) smoothened around 5% and 6%. On the other hand, save for 1991, recurrent expenditure has been over 80% throughout the period from 1983 to 2011. This is particularly due to expenditure on salaries and wages, goods and services as well support services given to farmers in the form of subsidies (OECD, 2006). The situation presented in the South African public expenditure is a characteristic of most countries where salaries and wages as well as transfer payments form the larger part of the sector budget (World Bank, 2011). Of course, in a middle economy such as South Africa, agriculture contributes less to the economy (Vink & Rooyen, 2009), hence priority given to capital goods in the sector may tend to become lower.

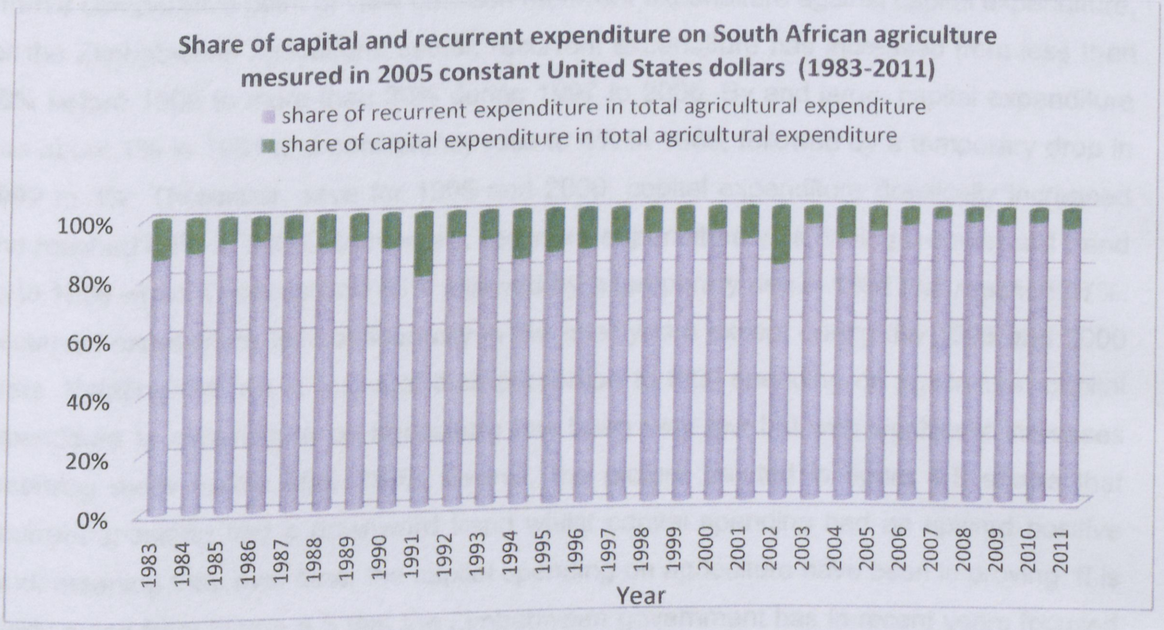

Figure 4.4 Public expenditure composition on agriculture in South Africa (1983-2011).

Source: Author's computations using data from Reserve Bank of South Africa and Treasury, online. (See appendix B and C).

Deriving from data in Appendix B and C, Figure 4.5 shows the expenditure composition of the Zimbabwean agricultural sector from 1981 up to 2006. Once more, the period after 2006 could not be considered due to the hyperinflationary environment that affected measuring instruments.

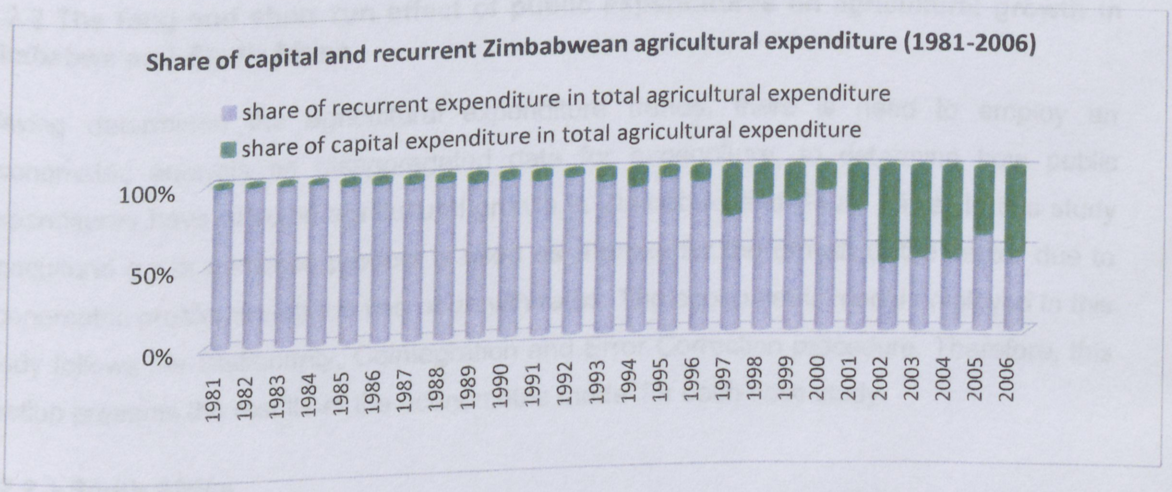

Figure 4.5.Public expenditure composition on agriculture for Zimbabwe (1981-2006).

Source: Author's computations using data from Zimstats and Ministry of Finance, Zimbabwe. (See appendix B and C).

From a comparative point of view between recurrent expenditure against capital expenditure, for the Zimbabwean agricultural sector, recurrent expenditure has increased from less than 10% before 1996 to more than 30% during 1997 to 2006. By and large, capital expenditure was about 1% in 1981 and consistently rose to 4% in 1989, followed by a temporary drop in 1992 to 3%. Thereafter, save for 1995 and 2000, capital expenditure drastically increased and reached 54% in 2006. Conversely, recurrent expenditure was having a downward trend up to 1989 when it approached 86% followed by a temporary rise in 1992 that reached 97%. Recurrent expenditure fell continuously in the later years except during the 1995 and 2000 years. Relating the two in terms of their proportion to total spending on agriculture, capital expenditure to expenditure on agriculture has been very low but with significant increases becoming more visible after 1997. Overall, the picture painted in figure 4.5 shows that recurrent spending had a downward trend whilst capital spending had an upward positive trend, meaning that, over time, the capital spending on agriculture have been improving. It is clearly noted from Figure 4.5 that the Zimbabwean government has in recent years focused more on direct investment in agriculture at the expense of curtailing recurrent expenditure on wages.

Having presented the trends in the size and shares of public expenditures on the agricultural sector, the next section presents empirical results of the Error Correction Model. This will show the impact of public expenditure on agricultural growth both in the short - and long-run; an analysis that employed various econometric tests from determination of level of integration of each variable to diagnostic test of the Error Correction Model.

4.2.2 The long and short run effect of public expenditures on agricultural growth in Zimbabwe and South Africa.

Having determined the agricultural expenditure trends, there is need to employ an econometric analysis on disaggregated data for expenditure, to determine how public expenditures have affected agricultural growth in Zimbabwe and South Africa. In this study agricultural gross domestic product is used as a proxy for the growth of the sector due to econometric problems with the use of growth rates. The econometric model employed in this study follows the Stationarity, Cointegration and Error Correction procedure. Therefore, this section presents the results of the econometric model for each case study.

4.2.2.1 South Africa

Augmented Dickey fuller and Philips Perron Stationarity tests

Using South Africa country level time series data from 1983 to 2011 as mentioned in chapter 3, LRAGDP$ refers to real agricultural GDP, LRNAE$ refers to real non-agricultural expenditures, LRACE$ is real agricultural capital expenditure, and LRARE$ is real recurrent expenditure. All the variables are in natural logarithms measured in million United States dollars.

To set the stage for Cointegration and Error correction model, the first step was to determine the order of integration of all variables to be used in the models and then subject them to their levels of stationarity through the process of differencing. The study employed the Augmented Dickey Fuller (ADF) and Philips Perron tests. Equations with a constant and a trend; intercept and none were performed and the results in Table 4.1 show that all the variables were integrated of order one I (1), a desirable state to Cointegration. The stationarity test is important to avoid spurious results which might occur if the variables are integrated of different order (Asteriou & Hall, 2007; Gujarati, 2003). With all important variables integrated at the same order the series validate formulating econometric models for the Zimbabwean and South African agriculture sectors.

Table 4.1 ADF and Philips Perron Unit root Test for South Africa.

		Variables at level		Variables at 1st difference		Decision
Series	Model	AD stat	Philips Perron	ADFstat	Philips Perron	Integration
LRAGDP$	Trend and intercept	-4.517194**	-4.573183***	-5.837357***	-8.508578***	I(1)
	Intercept	-1.636009	-2.856013*	-5.953943***	-8.740543***	
	None	1.714192	1.648780	-5.489636***	-7.220570***	
LRARE$	Trend and intercept	-2.861093	-3.109972	-5.480363***	-5.878551***	I(1)
	Intercept	-0.568188	-1.033565	-5.580386***	-6.047773***	
	None	2.109722	3.380025	-4.152581***	-4.733686	
LRACE$	Trend and intercept	-3.036645	-5.046543***	-5.748726***	-10.26306***	I(1)
	Intercept	-2.442405	-4.068117***	-5.850870***	-10.47336***	
	None	-0.768243	-0.621123	-5.933208***	-10.56679***	
LRNAE$	Trend and intercept	-1.830134	-2.129746	-4.222565**	-6.165696***	I(1)
	Intercept	0.705626	1.148678	-4.033872***	-5.970686***	
	None	4.026822	6.164251	-1.949206*	-3.440730***	

*, ** and *** denotes rejection of the null hypothesis of non stationarity at 10%, 5% and 1% respectively.

Long and short run models for South Africa

Long run impact of public expenditure on South African agricultural growth

Following the integration tests, the long run model of the impact of agricultural public expenditures on agricultural growth, where agricultural GDP is a proxy for growth, was specified as natural logarithm of real agricultural gross domestic product (LRAGDP$) as a function of the natural logarithm of real capital agricultural expenditure (LRACE$), real recurrent expenditure LRARE$) and real non agricultural expenditure (LRNAE$), and a dummy of regime change (DRC) in taking the value of 0 for the 1994 and 1 the period after 1994.The results are depicted in Table 4.2.

Table 4.2 Long run impact of public expenditures on South Africa agricultural growth.

Dependent Variable: LRAGDP$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRACE$(-1)	0.079887	0.051743	1.543913	0.0486**
LRNAE$	0.403536	0.134923	2.990866	0.0113**
LRARE$(-1)	-0.228261	0.117078	-1.949649	0.0750*
LRAGDP$(-1)	0.681787	0.132814	5.133393	0.0002***
DRC	-0.293079	0.128951	-2.272793	0.0422**
C	-0.473793	0.792429	-0.597900	0.5610

R-squared = 0.953994; Adjusted R-squared =0.934824; Durbin-Watson stat= 1.788964; F-statistic =49.76671 (0.000000)

Source: Authors computation using E-views 6 (See also Appendix D).

Statistically, the model is good enough to explain changes in real agricultural gross domestic product. After penalising the degrees of freedom, the model still has a higher explanatory power of about 93%. The Durbin Watson statistic of 1.8 is greater than R-squared (0.95) showing absence of spurious regression. The joint significance of all variable used is less than 1% (0.00000). Though the t-statistic is invalid it is important to comment on the direction of the significant variables that will assist in estimating the error correction model if cointegration is found.

In the long-run one year lagged recurrent expenditure (LRARE$(-1)) was found to have a negative impact on agricultural growth, with a coefficient of 0.228. This means that a 1% increase in real recurrent expenditure resulted in a 0.22% reduction in real agricultural gross domestic product. This finding is inconsistent with economic theory. However, for South Africa this finding is evident that most programmes that have been financed by the South African government were not productive or maybe it is still early to judge their effectiveness as argued by Liebenberg and Pardey (2010). Among the programmes are the Land Reform and Restitution programmes implemented starting 1994 and establishment of several support programs for black farmers. These consist of the launch of the Land Redistribution for Agricultural Development program in 2000; provision of post-settlement support through the Comprehensive Agricultural Support Program, as part of a land reform program (Vink & Rooyen, 2009). Expenditures such as this were meant to address equity issues rather than production efficiency for the sector.

One year lagged real capital expenditure (LRACE$(-1)) was found to be statistically significant to explain agricultural growth in the long run with a positive coefficient of 0.8%. This finding is consistent with economic theory, and confirms that investment on capital goods crowd-in private investment and accelerates growth for the agricultural sector.

For the South African agricultural sector, a one year lag in real non agricultural expenditure was found to have a strong relationship with agricultural growth. A 1% increase on this variable was found to have a 0.40% increase on agricultural growth in the long run.

The dummy variable of policy change is meaningful in explaining changes in agricultural gross domestic product. A regime change resulted in a reduction in agricultural gross domestic product.

The past levels of agricultural gross domestic product determine the current level of agricultural gross domestic product for the South African agricultural sector. A one year lag of agricultural gross domestic product has a coefficient of 0.681787 meaning that a 1% change in agricultural gross domestic product of the previous period had a 0.68% positive effect on the following year change in agricultural growth.

Engle Granger-Dickey Fuller (EGDF) Cointegration test

When estimating an economic relationship with integrated variables it is important to see the short run dynamics of the model (Harris, 1995). This is important in policy formulation. However, there is need to first check if the variables have a long-run relationship or cointegration. This process can be performed either by Johansen eigenvalue and trace procedure or the Engle Granger residuals based test (Asteriou & Hall, 2007). This study adopted the Engle Granger test due to its simplicity and the limited number of variables which the Johansen may not capture the long wave effect. Taking residuals from the model, the ADF test equation with neither a constant nor trend was performed and the results are reported in Table 4.3, showing that the ADF statistic (-5.615688) is less than the critical values (-2.660720, 1.955020, 1.609070) meaning that the residuals (U) are stationary at level and hence there is evidence of cointegration.

Table 4.3 Engle Granger Cointegration (South Africa)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.615688	0.0000
Test critical values:	1% level	-2.660720	
	5% level	-1.955020	
	10% level	-1.609070	

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

Source: Author's Computation using E-views 6. (See also Appendix D).

Short run impact of public expenditure on agricultural growth for South Africa

From the cointegration test the results show that there is long run association among variables. According to Engle Granger (1987), where cointegrations exist, there is an error correction model behind. There for there was a need to estimate a parsimonious error correction model to determine the short run impact of public expenditure on agricultural growth. This process was performed using the general-to-specific Hendry's modelling approach and selection of the model based on the Akaike Information Criterion, significance levels as well and the R-square value.

Table 4.4 The Parsimonious Error Correction Regression Estimate for South Africa.

Dependent Variable: ΔLRAGDP$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔLRACE$	0.088678	0.040054	2.213959	0.0380**
ΔLRNAE$	0.603677	0.135029	4.470711	0.0002***
U(-1)	-0.516003	0.128127	-4.027278	0.0089***

R-squared =0.599159; Adjusted R-squared =0.503720; Durbin-Watson stat =1.679807; F-statistic= 6.277963(0.001037).

Having found long run association among variable on the South African model, variables in the error correction model still shows a high explanatory power of about 60% though most variables even after over parameterisation turned to be statistically insignificant to explain the changes in agricultural gross domestic product in the short run. The Durbin Watson statistic of 1.67 is greater than the R-squared of 0.599159 showing that the model is not spurious. The F-statistic of 0.001037 shows that regressors in the model are jointly significant in explaining changes in agricultural gross domestic product.

Before interpreting the model it was necessary to validate the model by testing for presence of heteroskedasticity, misspecification, serial correlation, structural break and whether residuals are normally distributed. Drawing from E-views estimations in Appendix C,Table 4.5 reports the diagnostic tests of the model.

Table 4.5 Diagnostic tests

Econometric Test	Prob. Chi-square
Ramsey RESET	0.7593
Breusch-Godfrey serial Correlation LM test	0.0914
Chow Break Point test	0.1373
Jacque-Berra Normality test	Probability : 0.394303
White Heteroskedasticity Test:	0.8179

Source: Author's computation using E-veiws 6. (See Appendix D).

Econometrically, the model passed all diagnostic tests. At 5% significance level all null hypothesis failed to be rejected. Using the Ramsey Regression Specification Error Test (RESET), the model proved to be well specified. Secondly, there is absence of serial correlation as evidenced by the Breusch-Godfrey Serial Correlation LM Test of 0.979265. Thirdly, residuals in the model are normally distributed using the Jacque-Bera Normality test. More so, using the White heteroskedasciticity test with no cross terms, the model shows absence of heteroskedasticity. The Chow break point test of the year 1994 also shows that the model is structurally stable and justifies the use of a single equation from 1983-2011.

By and large, the error term which measures the speed of adjustment to the equilibrium in the system is negative and significant with a coefficient of -0.516003, showing that the system corrects itself its previous disequilibrum at the speed of 52% per annum. For policy making purposes this magnitude and direction of the error term shows that it takes about 2 years for a fiscal policy launched now to manifest in agricultural growth.

Government capital expenditure on agriculture shows a positive relationship with agricultural gross domestic product in the short run. The coefficient of 0.088678 has been found to be statistically significant with a t-statistic of 2.213959 which is greater than 2, the rule of thumb. This means that a 1% increase in government capital expenditure on agriculture was associated with a 0.88% increase in agricultural gross domestic product during the period. This finding is consistent with economic theory where capital expenditure is supposed to crowd-id in private investment and increases economic activity in the sector which in turn increases agricultural growth (Barro, 1990).

Non agricultural expenditures have been found to have a positive relationship with agricultural gross domestic product in the short run. A coefficient of 0.603677 has been found with a t-statistic of 4.47. This means that a 1% increase in non agricultural expenditures was associated with a 0. 61% increase in agricultural gross domestic product. This relationship may be connected with the linkages of agricultural sector with other non-agricultural sectors such as transport service sector, health and education whereby improved transport, infrastructure, medical facilities and education will have a multiplier effect on economic growth at large (Fan *et al.*, 2004).

4.2.2.2 Zimbabwe Case study

Augmented Dickey Fuller and Philips Perron Stationarity Tests

Due to paucity and inconsistency as well as differences in measuring instruments the Zimbabwean case study used annual time series data from 1981 to 2006, where LRAGDP$ refers to real agricultural GDP, LRNAE$ refers to real non-agricultural expenditures, LRACE$ is real agricultural capital expenditure, and LRARE$ is real recurrent expenditure. All the variables are in natural logarithms measured in million United States dollars.

As said earlier, the analysis adopted the Error Correction methodology, where the overriding requirement was to test for stationarity and subject all variables to their levels of stationarity through differencing. Table 4.7 reports stationarity results.

Table 4.6 ADF and Philips Perron Unit root Test for Zimbabwe.

		Variables at level		Variables at 1st difference		Decision
Series	Model	ADFstat	Philips Perron	ADFstat	Philips Perron	Integration
LRAGDP$	Trend and intercept	-2.227643	-2.665406	-5.209527***	-6.905417***	I(1)
	Intercept	-1.899214	-2.291332	-5.209527***	-7.019984***	
	None	0.271393	0.474708	-5.274618***	-7.117985***	
LRARE$	Trend and intercept	-2.727909	-3.113319	-4.109293***	-6.405615***	I(1)
	Intercept	-1.961248	-2.789462*	-4.249014***	-6.496933***	
	None	-0.183247	0.030264	-4.352888***	-6.636441***	
LRACE$	Trend and intercept	-1.817613	-2.570345	-4.068959**	-5.235068***	I(1)
	Intercept	-1.369216	-1.471468	-4.244800***	-5.312309***	
	None	0.397993	1.012267	-4.038638***	-5.180971***	
LRNAE$	Trend and intercept	-2.576277	-2.735323	-3.744519***	-5.616430***	I(1)
	Intercept	-2.590002	-2.795092*	-3.872368***	-5.769270***	
	None	-1.317132	-1.507079	-3.939853***	-5.854908***	

*, ** and *** denotes rejection of the null hypothesis of non stationarity at 10%, 5% and 1% respectively.

Short and long run impact public expenditure on agriculture for Zimbabwe

This section report the model results for the case of Zimbabwe, following the Stationarity, cointegration and error correction methodology. The long run model was specified as logarithm of real agricultural gross domestic product (LRAGDP$) as a function of the natural logarithm of real capital agricultural expenditure (LRACE$), the natural logarithm of real recurrent expenditure LRARE$), the natural logarithm of real non agricultural expenditure (LRNAE$ and one year lagged LRAGDP$.

Table 4.7, reports the long run model results for the impact of capital and recurrent expenditure on agricultural growth.

Table 4.7 Long run impact of public expenditure impact on agricultural growth for Zimbabwe

Dependent variable LAGDPU$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRACE$	0.414354	0.180873	2.290858	0.0336**
LRNAE$	-0.159481	0.068253	-2.336618	0.0306**
LRARE$	-0.239120	0.114478	-2.088782	0.0504**
LAGDP$(-1)	0.446706	0.170819	2.615087	0.0170**
C	7.590639	0.106747	1.242992	0.2290

R-Squared = 0.709200; Adjusted R-squared 0.617368; DW stat = 2.005927; F Stat = 7.722835 (0.000263)

From the long run model results, capital expenditure (LRACE$), recurrent expenditure (LRARE$), non agricultural expenditures (LRNAE$) and previous levels of GDP [LAGDP$(-1)] were found to be statistically significant in explaining variation in the agricultural gross domestic product. The goodness of fit of the model after penalising degrees of freedom shows an Adjusted R-square of about 62%, showing that the variables in the model are good in explaining changes in agricultural gross domestic product. Further, the Durbin Watson statistic of 2.005927 is greater than the R-squared of 0.709200 showing absence of spurious regression hence interpretation of the Long run model is validated.

Real capital expenditure on agriculture has a positive relationship with agricultural GDP. It has a coefficient of 0.414354 meaning that a 1% increase in real capital expenditure on agriculture was accompanied with a 0.4% increase in real agricultural GDP. This finding is consistent with expectation and economic theory. It is supported by Anakoya *et al* (2013) and Purokayo and Umaru (2012) who explained this finding as a result of crowd-in-effect which takes place when provision of public resources creates an environment conducive for private sector investment.

Real recurrent agricultural expenditure is negatively related with real agricultural gross domestic product. The variable has a coefficient of -0.239120. This means than a 1% increase in real recurrent expenditures was associated with a reduction in real agricultural gross domestic product. This finding is supported by previous studies in Africa which show that most governments allocate more than half of the resources to non-productive functions such as salaries and wages, which have higher opportunity cost to development (World Bank, 2011). For Zimbabwe, this finding may be due to periods of high inflation when the government has to increase the budget to cope with economic hardships.

Real non agricultural expenditures were found to be negatively related to real agricultural GDP. A coefficient of -0.159481 means that a 1% increase in non agricultural expenditures was associated with a 0.16% reduction in GDP in the long run, a situation that is inconsistent with findings from the South African case study.

Previous levels of agricultural GDP were found to be positively related to the current levels of agricultural GDP. The variable has a coefficient of 0.4467 which means that a 1% increase in the previous levels of GDP was associated with a 0.45% increase in the next year agricultural GDP.

Cointegration Test

Having estimated the long run model, as previously highlighted in the methodology section, it is important to determine if the variables in the model has a long run relationship. The Engle-Granger residual based test to Cointegration is performed and the results are reported in the Table 4.8.

Table 4.8 Engle-Granger Cointegration Test (Zimbabwe)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.875843	0.0000
Test critical values:	1% level	-2.664853	
	5% level	-1.955681	
	10% level	-1.608793	

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

Source: Author's Computation using E-views

As reported in table 4.9, the ADF test statistic of -5.875843 is less that all critical values at 1%, 5% and 10%. This means that the null hypothesis of non-stationarity of the long run deviations was rejected at one all significant levels, meaning that agricultural growth and its determinants were co-integrated.

Following the Engle-Granger residual test to error correction model, the study over parameterized the first differenced form of the variables and used Schwarz Information Criterion to guide parsimonious reduction of the model. This was meant to identify the major dynamic pattern in the model and to guarantee that the dynamics of the model have not been constrained by inappropriate lag length specification.

Table 4.9 shows the results of the model of public expenditures and agricultural growth in Zimbabwe.

Table 4.9 The Parsimonious Error Correction Regression Estimate for Zimbabwe.

Dependent Variable: ΔLRAGDP$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔLRACE$	0.537484	0.177837	3.022333	0.0073***
ΔLRNAE$	-0.179880	0.082876	-2.170466	0.0436**
ΔLRARE$	-0.249636	0.103156	-2.419986	0.0263**
U(-1)	-0.691323	0.303107	-2.280789	0.0350**
C	-0.004473	0.044427	-0.100683	0.9209

R-Squared= 0.656541; Adjusted R-squared = 0.542055; Durbin-Watson stat = 1.909377; F-statistic= 5.734677 (0.001750).

Source: Author's Computation.

From the estimation, all variables of interest except lagged agricultural gross domestic product were found to be statistically significant. The parsimonious error correction model showed that the explanatory power of 54% (after penalising degrees of freedom) is relatively high for meaningful economic interpretation. This means that the system explains at least 54% of variations in agricultural gross domestic product - a proxy for agricultural growth. Furthermore, the F-statistics of 5.73 (0.0018) indicate that the model fit the data relatively well while the Durbin Watson statistics (1.91) that is greater than the R-squared validates absence of spurious regression. More so, the error correction U(-1) coefficient and magnitude of the model had the expected negative sign and was significant at one per cent.

Short-run public expenditures on agricultural growth for Zimbabwe

It was also necessary to report the validity of the model used using econometric diagnostics. Drawing from E-views estimations in Appendix D, Table 4.10 shows the diagnostics, of the parsimonious error correction model presented above. Using the White Heteroskedasticity test the null hypothesis of fail to be rejected and hence the model is not heteroskedasctic. Looking at the Breush-Godfrey LM test and Ramsey RESET, the model showed absence of serial correlation and present to be well specified respectively. The Jacque-Berra statistic of 0.394823, shows that the errors are normally distributed. More so, Chow Breakpoint test showed that the model is structurally stable; hence this calls for meaningful economic interpretation of the variable coefficients.

As said earlier the notion of running an error correction model is to check how fast the system corrects its previous disequilibrium. In this case study, the error correction term has been found to be negative and statistically significant at 5% validating the results of the model. The coefficient has been found to be -0.691323 which has meaningful economic implications.

Table 4.10 Diagnostic tests (Zimbabwe)

Ramsey RESET	0.4669
Breusch-Godfrey serial Correlation LM test	0.8111
Chow Break Point test 1991	0.6877
Jacque-Berra Normality test	Probability: 0.394823
White Heteroskedasticity Test	0.5090

Source: Author's Computation using Eviews 6. (See Appendix D)

This means that the system correct its previous period disequilibrium at a speed of 69% annually. For policy purposes, it takes less than years for an agricultural fiscal policy to manifest in agricultural growth.

Though the error correction model does not attach much value the statistical properties of the other variables, it was found necessary to present the significant variables findings. The coefficient of capital expenditure on agriculture was found to be 0.54 and statistically significant at all levels. This means that a 1% increase in capital expenditure on agriculture (RACE$) was associated with a 0.53% increase in agricultural gross domestic product.

From the analysis, recurrent public expenditure on agriculture was found to be statistically significant at 5% with a coefficient of -0.25. This means that a 1% increase in recurrent expenditure on agriculture was associated with a 0.25% reduction in agricultural GDP during the period between 1980 and 2006.

The relationship between public non-agricultural expenditure and agricultural gross domestic product has been found to be negative. The variable is statistically significant, with a coefficient of -0.179880. This means that a 1% increase in public non agricultural expenditure was associated with a 0.18% reduction in agricultural gross domestic product.

4.3 Discussion of results.

The size and economic impacts of public spending on agriculture in South Africa and Zimbabwe present general information that guide policy on how best public spending in agriculture can be allocated, and how governments can attain higher and more importantly sustain returns from these scarce and declining resources. Therefore, this section discusses the findings from the case of South Africa and Zimbabwe and gives implication of public expenditure induced growth on regional food security.

By and large, public expenditure time series data for South Africa and Zimbabwe on agriculture present a picture about how the agricultural sector was supported over the years. This discussion is drawn from the share of expenditure on total expenditure and on agricultural GDP, Agricultural Orientation Index and composition of expenditure on agriculture over the years.

Regarding the agricultural expenditure as a percentage of total expenditure for South Africa (1983-2011) and Zimbabwe (1981-2006) the study revealed that the former increased steadily between 1983 and 1985 with up and down movements reaching a low of about 2% in recent years as measured against the 10% CAADP benchmark. Although the contribution of agriculture to the total economy is as less as 3% (Hall & Aliber, 2010), after 1994 public resources allocation to agriculture declined to less than 2%, revealing the less attention given to the sector. This finding is supported by (Byrnes, 1996) who argued that during the period before the post-apartheid era of 1994, the South African agriculture sector was receiving more attention, due to the policies that were supporting the white farmers. For Zimbabwe, although inconsistent she managed in some years to meet the CAADP Benchmark of 10% resource allocation to agriculture. Save for the year 1983 when agricultural expenditure was 6% of the total, it managed to apportion above the benchmark up to 1992. Thereafter, save for a short period between 2004 and 2005, agricultural expenditure was less than the CAADP bench mark between 1992 and 2006. Despite its economic dependence on agriculture (Romeo & Marcelle, 2000), there has been reduced investment in this sector during the nineties that was driven by a combination of factors such as the economic structural adjustment programme and an ideological shift from state intervention in agriculture and liberalization of agricultural markets (Mutangadura, 1997).

The general finding from the study is that South Africa and Zimbabwe though in most years particularly in the 1980s and few years during the new millennium allocated above the CAADP, there was a decline in the expenditure on agriculture. However, drawing from Johnson *et al.* (2008), sector share of agricultural public expenditure did not only happen in some African countries, but also in Asia and Latin America. According to Fan *et al.* (2009), trends in government expenditure in Sub-Saharan Africa have also shown that the region has given less priority to the agricultural sector with majority of African countries increasing their spending on agriculture since 2003. Of particular note is that the situation for South Africa is different to Africa as a whole where share of agricultural spending averaged above 4% since 1980 (Johnson *et al.*, 2008). But, regarding meeting expenditure commitments, it was only during the 1980s that the share of expenditure in Africa at large was close to the target of 10% (Cramon-Taubadel et al., 2009). Furthermore, a study by (Fan *et al.*, 1999) shows that the shares of public expenditure on agriculture in Africa are very low as compared to Asian economies such as China, India and Thailand where agricultural expenditure averages between 8-16% of the budget. Cramon-Taubadel *et al.* (2009), ascribe the overal reduction of expenditure on agriculture in Africa to increased expenditure on health, social protection and education at the expense of the agricultural sector.

Secondly, drawing from Zimbabwe and South Africa time series data on the agricultural expenditure as a share of agricultural gross domestic product, the study found out that throughout the period in question, in South Africa though with up and down trends the size was 15% and above except the 1997,1999, 2000, 2001, 2002 and 2003 years. Conversely, for Zimbabwe the size of expenditure as a percentage of agricultural GDP was much lesser though it reached 11% in 2005 before falling to 4% in 2006. The Zimbabwean trend is worrisome given that the contribution of Zimbabwean agriculture to the economy is higher than the South African case (Byrnes, 1996; Kanyenze, 2006). Furthermore, the picture painted on this two case studies shows that in developing agrarian economies such as Zimbabwe the agricultural sector was neglected, confirming findings from previous studies (Fan & Rao, 2006; Chilonda *et al.*, 2009), where developing agricultural economies were found to spend less than 10% compared to more than 20% by middle income countries in which South Africa is classified.

Thirdly, Agricultural Orientation Index which is the extent to which government expenditures on agriculture reflect the support relative to importance of the sector to the overall economy is important in guiding policy making (FAO, 2012). Case findings from Zimbabwe and South Africa show that the South African agricultural sector received more attention during most years before 1994, indicated by an AOI of more than 1, a trend showing that during the apartheid years agriculture received substantial attention, but after 1994 the new government failed to support the sector adequately. However, the AOI for Zimbabwe was substantially lower than the South African case and only more than 1 in 1992 with the 1990s mostly affected. It is also worthy of note that trends in South Africa show a higher index which fares favorably with Food and Agricultural Organization standards. However, Zimbabwe, over the years has been spending less in relation to the importance of the sector. Looking at overall AOI, the trend by low and middle income countries has been as low as about 0.4 (Cramon-Taubadel et al., 2009) meaning that relative to the size of the sector both the South African and Zimbabwean agricultural sectors are better financed though with a decreasing trend and Zimbabwe being below South Africa even though the majority of her population depends on agriculture as a source of food and income (Kanyenze, 2006).

Furthermore, a disaggregated analysis of the extent to which the agriculture sector is being supported under the recurrent and the capital expenditure found that over the years the South African agricultural sector has continued to show very low capital expenditure in relation to recurrent expenditure support. Save for 1991,capital expenditure remained less than 20% as opposed to recurrent expenditure of more than 80% due to expenditure on salaries and wages, goods and services as well as support services given to farmers in the form of subsidies (OECD, 2006). However, the Zimbabwean agricultural sector, though with temporary drops capital expenditure has increased from less than 10% before 1996 to more than 30% during 1997 to 2006 as compared to recurrent expenditure which in most years experienced a downward trend. The situation presented in the South African public expenditure, and Zimbabwe during the period before 1998,is a characteristic of most developing countries where salaries and wages form the larger part of the sector budget (World Bank, 2011).

The study also estimated the short and long-run effect of public expenditure for Zimbabwe and South Africa using Stationarity, Cointegration and Error Correction Methodology. Disaggregated public expenditure time series data for Zimbabwe (1981-2006) and South Africa (1983-2011) was used. Of particular note is that public expenditure is one of the best equations to agricultural growth, if and only if it is properly allocated to most productive areas, and is implemented alongside a favourable policy environment (Fan et al., 2008). Without prejudicing the calls to increase budget allocation to the agriculture sector by Comprehensive African Agricultural Programme (CAADP) and other international bodies, it is also necessary to discuss the impact of the economic composition of public expenditure on agricultural growth looking at the capital, recurrent and non-agricultural expenditures.

Firstly, for both Zimbabwe and South Africa, capital expenditure has been found to be positively related to agricultural growth. Significant positive long-run coefficients of 0.41 and 0.8, for Zimbabwe and South Africa respectively, shows that investing in capital expenditure is very important for growth of the agricultural sector though regrettably both South Africa, and Zimbabwe in some years, have been allocating a big share to the recurrent expenditure. Consistent with economic theory, the study also found out that capital government agricultural expenditure will positively impact short-run agricultural growth rate. Anakoya *et al.* (2013) and Purokayo and Umaru (2012) found similar results for the Nigerian agricultural sector. Therefore, this finding proves that increased capital expenditure on the agricultural sector has a multiplier effect on growth of the agricultural sector for both Zimbabwe and South Africa, which has a good economic implication for other Southern African countries faced with the need to adapt to the need of meeting growth objectives and reducing food insecurity (SADC, 2011).

Secondly, recurrent expenditure has been found to be negatively associated with agricultural gross domestic product in the long-run for both Zimbabwe and South Africa. This confirms World Bank (2011) findings that current expenditures such as salaries and subsidies are non-productive despite their forming more than 80% of the budgets of most developing countries. This finding is also supported by Belgrave & Craigwell (1995) and Bose *et al.* (2003) who found a negative effect of recurrent expenditure using similar methodology for the Barbados economy and 30 developing economies, respectively. However, Devarajan *et al.* (1996) argued that capital expenditure may not translate into meaningful production in most developing countries especially when it is excessively allocated. Having noted this, it is imperative for expenditure to be allocated in reasonable quantities that will not result in negative effects.

Thirdly, non-agricultural expenditures have different impact on the two economies in the case study. For Zimbabwe, non agricultural expenditure had negative relationship with agricultural expenditures whilst for South Africa the effect was positive both in the short – and long - run. This shows the differences in terms of rigidities and links between sectors in different economies. Non-agricultural expenditure in the Zimbabwean economy had negative growth effect for the agricultural sector. However, this finding is in conflict with Fan (2006)'s macro-level analysis for the Egyptian agricultural sector where non-agricultural expenditure was found to contribute positively to agricultural growth through the general equilibrium wide distribution effects. Nevertheless, evidence from the Zimbabwe case where the agricultural sector is dominant and drives the economy (Kanyenze, 2006), suggest that diverting resources from agriculture may have a negative consequences on growth of such an important sector. Conversely, the finding from the South African situation is consistent with those by Fan (2006), where less agricultural expenditures are positively related to agricultural growth. This happens when there is interrelatedness of sectors in the economy. For the South African economy growth in non-agricultural expenditure was associated with growth in agricultural gross domestic product which confirms the backward and forward linkage of other sectors with the South African agricultural sector (AgriSETA, 2010).

More so, the study found out that the speed of adjustment to the equilibrium for both South Africa and Zimbabwe is more than 50%. This in itself means that the two economic systems adjust fast to disequilibrium after a fiscal policy shock. In which case it takes around two years for both economies two see the results of expenditure reforms. This speed range compares favourably with other studies such as of Nurudeen & Usman (2010) with -0.482955 and Inganinga & Unemhilin, 2011 who found -0.42 in their estimation of Nigerian agricultural sector. Their fore the results of this study are valid for policy recommendations.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The aim of the study was to analyse the impact of economic composition of public expenditure on agricultural growth in selected SADC countries and to give implications on regional agricultural growth as a proxy for food security. Due to time constraints and paucity of data in most developing countries, South Africa and Zimbabwe were singled as case studies for a period between 1983-2006 and 1981-2006, respectively. The specific objectives of the study were to analyse the share of public expenditure on agriculture, to determine the short and long –run impact of public expenditure on agriculture and to make recommendations based on the findings of the study. This chapter therefore, gives a summary, conclusion on the main findings of the study and recommends on the national government pertaining use of budget instrument to boost economic growth and reduce food insecurity in the SADC region.

5.2 Summary of the findings

The study revealed the following:

- Agricultural expenditure as a percentage of total expenditure for South Africa and Zimbabwe was higher in the 1980s compared to the 10% Comprehensive African Agriculture Development Programme (CAADP) benchmark. For both South Africa, and Zimbabwe though in most years particularly in the 1980s and few years during the new millennium allocated above the CAADP benchmark, there was a decline in the expenditure on agriculture driven by a combination of factors such as the economic structural adjustment programme and an ideological shift from state intervention in agriculture and liberalization of agricultural markets. More so the shares of agricultural expenditure are far less than other developing countries in Asia and Latin America.

- Agricultural expenditure as a percentage of agricultural gross domestic product for South Africa was higher whilst for Zimbabwe was lesser showing that in developing agrarian economies such as Zimbabwe the agricultural sector was neglected, as compared to middle income countries in which South Africa is classified.

- Agricultural orientation index (AOI) for the two countries shows that the South African agricultural sector received more attention during the apartheid years and later new government failed to support the sector adequately. Although the South Africa AOI was closer to FAO standards, the trend evidently shows a neglect of the sector in recent years. Conversely, Zimbabwe, over the years has been spending less and less in relation to the importance of the sector.

- A disaggregated analysis of capital versus recurrent expenditure for Zimbabwe and South Africa show that in most years the South African agricultural sector has continued to show very low capital expenditure in relation to recurrent expenditure support. For Zimbabwe, though with temporary drops after 1998 capital expenditure has increased substantially as compared to recurrent expenditure which in most years after 1998 particularly experienced a downward trend.

- Econometric results on capital expenditure found capital expenditure to be positively related with agricultural growth in both the short – and long – run, showing that investing in capital expenditure has a multiplier effect on growth of the agricultural sector though regrettably both South Africa, and Zimbabwe in some years, have been allocating a big share to the recurrent expenditure.

- Recurrent expenditure for both Zimbabwe and South Africa was found to be negatively associated with agricultural gross domestic product in the long-run confirming previous findings that current expenditures such as salaries and subsidies are non-productive despite their forming a larger share of the agricultural budgets of most developing countries.

- Econometric results on non-agricultural expenditure found different impact on Zimbabwe and South Africa. For Zimbabwe, non agricultural expenditure had negative relationship with agricultural expenditures whilst for South Africa the effect was positive both in the short – and long – run. This shows that expenditure impact on other sectors may impact the agricultural sector differently due to on the one hand higher opportunity cost of public expenditure resources, and on the other the close linkage between agriculture and other sectors.

- Econometric findings show that the two systems both Zimbabwe and South are fast to correct the previous disequilibrium after a fiscal policy shock. It takes around two years for both economies two see the results of fiscal policy adjustments, and this compares favourably with other fast growing economies.

5.3 Conclusion

- The first hypothesis was that public expenditure on agriculture has been very low over the years. Both South Africa, and Zimbabwe although in most years particularly in the 1980s and few years during the new millennium allocated above the CAADP, there was a declining trend in the expenditure on agriculture. Secondly, although for South Africa the agricultural expenditure as a percentage of agricultural gross domestic product was higher than Zimbabwe the general trend shows a decline over the years. Thirdly, despite the Agricultural orientation index for the two countries being above other regions the downward trend shows that the agricultural sector received lesser attention in recent years. More so, lower capital expenditure versus recurrent expenditure for Zimbabwe and South Africa shows that expenditure on productive goods and services was lower save for Zimbabwe in recent years. Therefore the study concludes that public expenditure on agriculture was declining over the years with the 1990s being mostly affected for the two economies and thus confirming the hypothesis.

- The second hypothesis was that public expenditures have a long and short run effect on Agricultural gross domestic product – a proxy for agricultural growth and thus food security. From econometric estimations only capital and non-agricultural expenditure had both short – and long –run effect on agricultural GDP for the two countries. Capital expenditure had positive short – and -long run effects for the two case studies. Non – agricultural expenditure had negative short and long run effects on Zimbabwe whilst for South Africa it was positive. Further, recurrent expenditure had negative long – run effect but with negative short - run effects for Zimbabwe only. Save for recurrent expenditure in Zimbabwe and non-agricultural expenditure for South Africa, the hypothesis is accepted.

5.4 Recommendations

- The study found out that the size of public agricultural expenditure has been declining in recent years. The recommendation could be the need for governments in case, including other partners in the region, to mobilise resources towards the agricultural sector. This could be done by designing policies that support agricultural sector and a follow up on expenditure commitments.

- Secondly, the study noted that governments have been allocating a larger share to recurrent rather than capital expenditure despite its growth retarding effects. On the other hand it was clear that governments spend less on capital goods and services which are in fact a source of growth. Therefore, governments need to revisit their spending priorities and increase expenditure on capital goods for achieving sustainable growth objectives. Specifically, though current expenditure contributes to the running of projects and administration there is need to strike a balance between the two expenditure patterns. In the final analysis increased expenditure on salaries, wages and other recurrent expenditure need to be gradually reduced.

- Furthermore, non-agricultural expenditures have shown to have both negative and positive impact on agricultural growth, depending on the economy in case. For economies with strong sectoral linkages like South Africa, it is wise to increase overall total expenditure. However increased non-agricultural expenditure, especially for lower income countries with smaller expenditure envelops such as Zimbabwe, policy makers should not increase their non-agricultural expenditure at the expense of the agricultural sector, since diverting resources from agriculture to other sectors has higher opportunity cost.

5.5 Issues for further investigation

Due to time and budgetary constraints, this study could not look into the following issues:

- The functional composition of the budget impact on the agricultural growth and food security
- The institutional context of public expenditure and conditions for efficient provision of public goods and services in the agricultural sector. In particular, how governments can design mechanisms to mobilize public resources towards the agricultural productive efficiently.
- How government ministries engages in the budget planning and execution process from preparation of a time line of expenditure. Specifically, issues regarding the extent to which the process is consultative and an attempt to link agriculture spending to poverty.
- The crowd-in and out effect of public agricultural expenditure on private investments.

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Appendix A: Consent form

I **Manyise Timothy, BN560558** am conducting a research entitled **Impact of the Composition of Public Expenditure on Agricultural Growth. Case studies from selected SADC countries and implications on regional food security**. This research project is a part of my studies on the Masters of Science degree in Agricultural economics at the University of Venda.

Purpose of the study

Governments in developing countries are often faced with expenditure needs that often outstrip the resource envelops. Efforts in effective resource allocation by African governments are affected by information scarcity *inter alia,* on effects of public investments. The study is carried to shed light on the impact of composition of public expenditures on agricultural growth and implications on food regional security using 2 SADC selected SADC countries.

Participation selection

Being a SADC member your country has been selected together with one other country using convenient sampling to provide information that will make this project a success. Much of the published information on public expenditure is not complete to make this project a success. Your Department/Ministry is kindly asked to participate in this undertaking. As an authority of the department or ministry you are kindly asked to provide necessary information and time series data that will assist in estimating the impact of public expenditure on the agricultural growth.

Potential risks

There are no personal risks attached to this study. However, it is the responsibility of the researcher to make sure that confidential information collected from your offices is meant specifically for the successful completion of the Masters of Science in Agriculture Economics at University of Venda in South Africa. The researcher is fully aware of the laws regarding the use of country data and the implications upon violating these laws. By no way will the use of gathered information be of political or any other reasons that may destroy the image of the department or your state.

Confidentiality

Information collected in this study will only available to the researcher and his assistants. The researcher promise to keep the collected data under lock and key. All interviews conducted with key informants will not be voice recorded and are meant only to give direction in the econometric modelling and interpretations and if so the participant will be made aware.

Potential befits

There are no direct benefits to the participant. However, your cooperation will help the researcher to successfully complete his studies. The results will be made available to the ministry to assist in the policy making process wherever necessary.

Compensation

Participation in this project is voluntary. There is no any remuneration or reward in any form that is attached to this project.

Questions and Concerns

Should you have questions feel free to ask them now or later. If you wish to ask questions later, you may contact Manyise T. on 0027711428362/ manyisetim@gmail.com. This research has been approved by the University of Venda Research and Publication Committee which is the highest board of the University responsible for making sure that all research ethics and protocols are observed. For further inquiries you may also conduct Dr Chauke or Mr Pfumayaramba on 0027794963140 and 0027799821988, who are the supervisors of this undertaking.

Signature

I have read and fully understand this consent. I we agree to participate voluntarily. A copy of this form has been given to me.

Signature of Participant_____________________ Date________________

I certify that I have fully explained the contents of this document before requesting the signatures of participant.

Signature of researcher/ research assistant_________ Date_______________

Appendix B: Data used

Where, AGDP, is agricultural gross domestic product in million Rands for South Africa and million dollars for Zimbabwe at current prices.

AEX is agricultural expenditure in million Rands for South Africa and million dollars for Zimbabwe at current prices.

TEX is total expenditure in million Rands for South Africa and million dollars for Zimbabwe at current prices.

ACE refers to total agricultural expenditure in million Rands for South Africa and million dollars for Zimbabwe at current prices.

ARE refers to total agricultural expenditure in million Rands for South Africa and million dollars for Zimbabwe at current prices.

NAE refers to total agricultural expenditure in million Rands for South Africa and million dollars for Zimbabwe at current prices.

CPI (2005) refers to the Consumer Price Index at 2005 prices.

R_$ is the exchange for South African Rand per United States dollar.

Z_$ is the exchange rate for Zimbabwean dollar per United States dollar.

AGDP CONTRIBUTION is the share of agricultural gross domestic product in total gross domestic percentage in percentage.

Data:

SOUTHAFRICA

YEAR	AGDP (Million RANDS)	AEX	TEX	ACE	ARE	NAE	R_$	GDP DEFLATOR	AGDP CONTRIBUTION
1983	3873	833	24500.0	724.7	108.3	23667.0	1.114	9.789	2.1%
1984	4902	1220	29047.6	1085.8	134.2	27827.6	1.475	10.916	2.2%
1985	6091	1565	35568.2	1437.6	127.4	34003.2	2.229	12.750	2.7%
1986	6831	1706	41609.8	1575.2	130.8	39903.8	2.285	14.926	2.9%
1987	8994	1571	50677.4	1459.9	111.1	49106.4	2.036	17.090	2.9%
1988	11149	2058	58800.0	1846.4	211.6	56742.0	2.273	19.684	2.9%
1989	12332	2110	72758.6	1938.2	171.8	70648.6	2.623	23.082	1.5%

1990	12184	2055	85625.0	1829.0	226.1	83570.0	2.587	26.664	3.0%
1991	13825	2240	97391.3	1769.6	470.4	95151.3	2.761	30.858	3.2%
1992	13056	2817	112680.0	2591.6	225.4	109863.0	2.852	35.354	2.3%
1993	16284	5868	133363.6	5339.9	528.1	127495.6	3.268	39.981	2.9%
1994	20252	3717	161608.7	3122.3	594.7	157891.7	3.551	43.817	3.0%
1995	19317	3239	170473.7	2785.5	453.5	167234.7	3.627	48.309	2.3%
1996	23720	3651	182550.0	3176.4	474.6	178899.0	4.299	52.217	2.8%
1997	25140	3623	213117.6	3224.5	398.5	209494.6	4.608	56.449	2.7%
1998	25434	3885	242812.5	3568.8	316.2	238927.5	5.528	60.802	2.6%
1999	26179	3746	249733.3	3458.8	287.2	245987.3	6.109	65.103	2.7%
2000	27451	3743	267357.1	3478.4	264.6	263614.1	6.940	70.838	2.7%
2001	32588	4224	281600.0	3789.8	434.2	277376.0	8.609	76.269	2.5%
2002	44232	5190	324375.0	4198.2	991.8	319185.0	10.541	84.467	2.6%
2003	39644	5855	365937.5	5549.4	305.6	360082.5	7.565	89.156	2.5%
2004	39490	7192	423058.8	6472.8	719.2	415866.8	6.460	94.836	2.4%
2005	37402	6806	486142.9	6307.7	498.3	479336.9	6.359	100.000	2.4%
2006	45351	9156	508666.7	8672.6	483.4	499510.7	6.772	106.528	2.1%
2007	53833	10221	601235.3	9914.4	306.6	591014.3	7.045	115.134	2.1%
2008	60547	13418	670900.0	12881.3	536.7	657482.0	8.261	124.688	2.3%
2009	63655	14639	770473.7	13907.1	732.0	755834.7	8.474	134.227	2.3%
2010	61999	13591	849437.5	13047.4	543.6	835846.5	7.321	144.780	2.3%
2011	64578	15889	934647.1	14935.7	953.3	918758.1	7.261	156.370	2.2%

ZIMBABWE

YEAR	AGDP	EXP	TEX	ACE	ARE	NAE	Z_$	GDP DEFLATOR	Agricultural GDP Contribution
1981	58.272.73	6.41	75.8	0.05	6.36	69.40	1.4	117.520	17%
1982	88.3	8.83	85.1	0.05	8.77	76.29	1.1	122.055	16%
1983	118.5385	15.41	253.2	0.09	15.32	237.78	0.9	109.238	6%
1984	161.5714	22.62	207.4	0.10	22.52	184.74	0.7	91.110	23%
1985	157.9231	20.53	187.9	0.50	20.03	167.33	0.6	75.606	16%

1986	663.17	24.98	214.2	0.64	24.34	189.23	0.6	81.674	15%
1987	434.375	34.75	349.2	1.07	33.68	314.45	0.6	87.546	11%
1988	655.06	66.79	607.7	2.11	64.68	540.91	0.5	94.361	15%
1989	436.01	35.05	315.5	1.47	33.58	280.43	0.4	95.110	13%
1990	376.05	30.97	280.5	0.97	30.00	249.52	0.4	94.234	13%
1991	767.82	43.40	406.8	1.86	41.54	363.38	5.1	87.848	15%
1992	589.75	29.36	290.1	0.77	28.58	260.73	5.5	75.435	9%
1993	749.70	27.20	303.2	1.69	25.51	276.02	6.9	72.575	12%
1994	804.53	46.86	1,226.6	4.58	42.27	1,179.74	8.9	69.748	6%
1995	743.50	22.72	543.6	0.93	21.79	520.86	9.3	71.867	13%
1996	890.82	27.78	1,157.3	2.04	25.74	1,129.54	10.8	78.324	8%
1997	919.66	42.84	1,660.3	12.53	30.30	1,617.45	18.0	76.069	14%
1998	940.64	41.24	2,266.2	7.69	33.56	2,224.94	24.4	55.493	14%
1999	974.73	23.86	1,169.6	4.79	19.07	1,145.70	38.3	59.937	15%
2000	976.09	50.10	2,846.6	6.70	43.40	2,796.47	44.4	60.313	15%
2001	1100.46	76.73	2,627.7	19.72	57.01	2,550.95	55.0	60.234	24%
2002	867.77	67.13	812.7	39.45	27.69	745.61	55.6	61.868	34%
2003	788.88	41.09	455.6	22.47	18.63	414.47	759.92	67.313	14%
2004	728.55	48.41	417.3	26.70	21.71	368.92	5127.92	72.437	18%
2005	683.95	77.59	775.9	31.40	46.19	698.28	24108.87	100	17%
2006	654.60	25.13	405.4	13.59	11.54	380.25	58470.04	74.621	7%

Source : Authors computation using data from Zimstats and StatsSA

APPENDIX C: Formulae and Calculations

Calculation	Acronym	Formulae
total agricultural expenditure in US Million dollars	AEX$	AEX/EXCHANGE RATE
non agricultural expenditure in US Million dollars	NAE$	NAE/ EXCHANGE RATE
capital expenditure in US Million dollars	ACE$	ACE/ EXCHANGE RATE
recurrent expenditure in US Million dollars	ARE$	ACE/ EXCHANGE RATE
total expenditure in US Million dollars	TEX$	TEX/ EXCHANGE RATE
Real total agricultural expenditure (Constant 2005 prices)	RAEX$	AEX$/GDP DEFLATOR
Real non agricultural expenditure (Constant 2005 prices)	RNAE$	NAE$/GDP DEFLATOR
Real capital expenditure (Constant 2005 prices)	RACE$	ACE$/GDP DEFLATOR
Real recurrent expenditure (Constant 2005 prices)	RARE$	ARE$/GDP DEFLATOR
Real total expenditure (Constant 2005 prices)	RTEX$	TEX$/GDP DEFLATOR
Agricultural expenditure as a percentage of total expenditure	SHARE AEX$	RAEX$/RTEX$*100
Agricultural expenditure as a percentage of agricultural gross domestic product	SHARE GDP$	RAEX$/RAGDP$*100
Agricultural Orientation Index	AOI	SHARE AEX$/ AGDP CONTRIBUTION

	COUNTRY: SOUTH AFRICA			ZIMBABWE		
YEAR	SHARE AEX$	SHARE GDP$	AOI	SHARE AEX$	SHARE GDP$	AOI
1981				8.46	11%	0.51
1982				10.37	10%	0.66
1983	3.4%	22%	1.62	6.086	13%	0.98
1984	4.2%	25%	1.89	10.91	14%	0.47
1985	4.4%	26%	1.62	10.93	13%	0.67
1986	4.1%	25%	1.42	11.66	4%	0.79
1987	3.1%	17%	1.07	9.95	8%	0.89
1988	3.5%	18%	1.22	10.99	10%	0.75
1989	2.9%	17%	0.83	11.11	5%	0.86
1990	2.4%	17%	0.8	11.04	4%	0.82
1991	2.3%	16%	0.73	10.67	6%	0.73
1992	2.5%	22%	1.07	10.12	5%	1.14
1993	4.4%	36%	1.53	8.97	4%	0.77
1994	2.3%	18%	0.77	3.82	6%	0.65
1995	1.9%	17%	0.82	4.18	3%	0.32
1996	2.0%	15%	0.72	2.4	3%	0.30
1997	1.7%	14%	0.63	2.58	5%	0.18
1998	1.6%	15%	0.62	1.82	4%	0.13
1999	1.5%	14%	0.56	2.04	2%	0.14
2000	1.4%	14%	0.52	1.76	5%	0.12
2001	1.5%	13%	0.6	2.92	7%	0.12
2002	1.6%	12%	0.62	8.26	8%	0.24
2003	1.6%	15%	0.63	9.02	5%	0.66
2004	1.7%	18%	0.7	11.6	7%	0.66
2005	1.4%	18%	0.59	10	11%	0.84
2006	1.8%	20%	0.84	6.2	4%	0.59
2007	1.7%	19%	0.82			
2008	2.0%	22%	0.86			
2009	1.9%	23%	0.82			
2010	1.6%	22%	0.71			
2011	1.7%	25%	0.78			

Source: Authors computations using data from Zimstats and StatsSA

Appendix D: Econometric estimations

D.1 Cointegration

D1.1.1South Africa

Null Hypothesis: U has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.615688	0.0000
Test critical values:	1% level	-2.660720	
	5% level	-1.955020	
	10% level	-1.609070	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(U)
Method: Least Squares
Date: 11/13/13 Time: 08:32
Sample (adjusted): 1987 2011
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U(-1)	-1.459289	0.259859	-5.615688	0.0000
D(U(-1))	0.449224	0.177713	2.527810	0.0188

R-squared	0.605201	Mean dependent var	-0.004606
Adjusted R-squared	0.588035	S.D. dependent var	0.132300
S.E. of regression	0.084916	Akaike info criterion	-2.017686
Sum squared resid	0.165847	Schwarz criterion	-1.920176
Log likelihood	27.22108	Hannan-Quinn criter.	-1.990641
Durbin-Watson stat	1.663662		

D1.2 Zimbabwe

Null Hypothesis: U has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=5)

		t-Statstic	Prob.*
Augmented Dickey-Fuller test statistic		-5.875843	0.0000
Test critical values:	1% level	-2.664853	
	5% level	-1.955681	
	10% level	-1.608793	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(U)
Method: Least Squares
Date: 11/13/13 Time: 08:43
Sample (adjusted): 1983 2006
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U(-1)	-1.199934	0.204215	-5.875843	0.0000

R-squared	0.600177	Mean dependent var	0.000224
Adjusted R-squared	0.600177	S.D. dependent var	0.361435
S.E. of regression	0.228541	Akaike info criterion	-0.073428
Sum squared resid	1.201314	Schwarz criterion	-0.024342
Log likelihood	1.881131	Hannan-Quinn criter.	-0.060405
Durbin-Watson stat	1.961736		

D.2Short run model estimations

D2.1South Africa

Dependent Variable: DLRAGDP$
Method: Least Squares
Date: 11/13/13 Time: 08:25
Sample (adjusted): 1986 2011
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRAGDP$(-1)	0.064822	0.237017	0.273489	0.7873
DLRACE$	0.088678	0.040054	2.213959	0.0380
DLRNAE$	0.603677	0.135029	4.470711	0.0002
DLRARE$	0.024308	0.083640	0.290632	0.7743
U(-1)	-0.516003	0.128127	-4.027278	0.0089
C	-0.032215	0.024226	-1.329763	0.1986

R-squared	0.599159	Mean dependent var	-0.051019
Adjusted R-squared	0.503720	S.D. dependent var	0.119293
S.E. of regression	0.094060	Akaike info criterion	-1.690595
Sum squared resid	0.176945	Schwarz criterion	-1.400266
Log likelihood	27.97774	Hannan-Quinn criter.	-1.606991
F-statistic	6.277963	Durbin-Watson stat	1.679807
Prob(F-statistic)	0.001037		

D2.2 Zimbabwe

Dependent Variable: DLRAGDP$
Method: Least Squares
Date: 11/13/13 Time: 08:47
Sample (adjusted): 1983 2006
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRACE$	0.537484	0.177837	3.022333	0.0073
DLRNAE$	-0.179880	0.082876	-2.170466	0.0436
DLRARE$	-0.249636	0.103156	-2.419986	0.0263
U(-1)	-0.691323	0.303107	-2.280789	0.0350
C	-0.004473	0.044427	-0.100683	0.9209

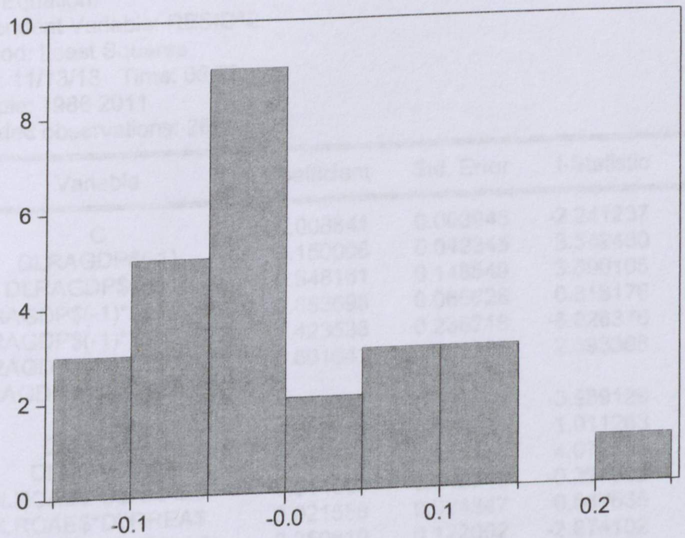
R-squared	0.656541	Mean dependent var	0.009817
Adjusted R-squared	0.542055	S.D. dependent var	0.325272
S.E. of regression	0.228367	Akaike info criterion	0.067323
Sum squared resid	0.990875	Schwarz criterion	0.312751
Log likelihood	4.192120	Hannan-Quinn criter.	0.132435

F-statistic	5.734677	Durbin-Watson stat	1.909377
Prob(F-statistic)	0.001750		

D.3Diagnostic tests

D.3.1South Africa

Normality Test



Series: Residuals	
Sample 1986 2011	
Observations 26	
Mean	-4.80e-18
Median	-0.014885
Maximum	0.213757
Minimum	-0.127981
Std. Dev.	0.084130
Skewness	0.653816
Kurtosis	2.909462
Jarque-Bera	1.861273
Probability	0.394303

Serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.029435	Prob. F(2,18)	0.1604
Obs*R-squared	4.784044	Prob. Chi-Square(2)	0.0914

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/13/13 Time: 08:28
Sample: 1986 2011
Included observations: 26
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRAGDP$(-1)	-0.047486	0.227903	-0.208360	0.8373
DLRCAE$	0.017895	0.040824	0.438338	0.6664
DLRNAE$	0.004153	0.152971	0.027147	0.9786
DLRREA$	0.015490	0.080361	0.192752	0.8493
U(-1)	-0.249933	0.365795	-0.683260	0.5031
C	-0.000463	0.023092	-0.020068	0.9842
RESID(-1)	0.481038	0.357472	1.345667	0.1951
RESID(-2)	-0.355383	0.218387	-1.627308	0.1210

R-squared	0.184002	Mean dependent var	-4.80E-18
Adjusted R-squared	-0.133331	S.D. dependent var	0.084130
S.E. of regression	0.089563	Akaike info criterion	-1.740092
Sum squared resid	0.144387	Schwarz criterion	-1.352986

Log likelihood	30.62120	Hannan-Quinn criter.	-1.628620
F-statistic	0.579838	Durbin-Watson stat	2.178056
Prob(F-statistic)	0.763374		

Heteroskedasticity Test

White Heteroskedasticity

F-statistic	8.004193	Prob. F(20,5)	0.0149
Obs*R-squared	25.21252	Prob. Chi-Square(20)	0.1934
Scaled explained SS	14.24330	Prob. Chi-Square(20)	0.8179

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/13/13 Time: 08:29
Sample: 1986 2011
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.008841	0.003945	-2.241237	0.0751
DLRAGDP$(-1)	0.150006	0.042345	3.542430	0.0165
DLRAGDP$(-1)^2	0.548161	0.148549	3.690105	0.0141
DLRAGDP$(-1)*DLRCAE$	0.053696	0.065628	0.818176	0.4505
DLRAGDP$(-1)*DLRNAE$	-1.423538	0.236218	-6.026376	0.0018
DLRAGDP$(-1)*DLRREA$	0.601641	0.251385	2.393308	0.0621
DLRAGDP$(-1)*RESID01(-1)	-1.335951	0.334898	-3.989129	0.0104
DLRCAE$	0.004582	0.004531	1.011263	0.3583
DLRCAE$^2	0.053384	0.013108	4.072553	0.0096
DLRCAE$*DLRNAE$	-0.014809	0.049813	-0.297302	0.7782
DLRCAE$*DLRREA$	0.021558	0.024847	0.867635	0.4253
DLRCAE$*RESID01(-1)	-0.350819	0.122062	-2.874102	0.0348
DLRNAE$	-0.118788	0.024724	-4.804539	0.0049
DLRNAE$^2	0.938730	0.139845	6.712666	0.0011
DLRNAE$*DLRREA$	-0.610989	0.112925	-5.410588	0.0029
DLRNAE$*RESID01(-1)	1.465493	0.242493	6.043455	0.0018
DLRREA$	-0.017435	0.014571	-1.196548	0.2851
DLRREA$^2	-0.057503	0.027568	-2.085894	0.0914
DLRREA$*RESID01(-1)	-0.294340	0.196641	-1.496843	0.1947
U(-1)	-0.200506	0.050483	-3.971734	0.0106
U(-1)^2	1.234941	0.348088	3.547788	0.0164

R-squared	0.969712	Mean dependent var	0.006806
Adjusted R-squared	0.848562	S.D. dependent var	0.009590
S.E. of regression	0.003732	Akaike info criterion	-8.376955
Sum squared resid	6.96E-05	Schwarz criterion	-7.360800
Log likelihood	129.9004	Hannan-Quinn criter.	-8.084339
F-statistic	8.004193	Durbin-Watson stat	3.028801
Prob(F-statistic)	0.014902		

Regression Specification Error Test.

Ramsey RESET Test:

F-statistic	0.192698	Prob. F(2,18)	0.8264
Log likelihood ratio	0.550806	Prob. Chi-Square(2)	0.7593

Test Equation:
Dependent Variable: DLRAGDP$
Method: Least Squares
Date: 11/13/13 Time: 08:30

Sample: 1986 2011
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRAGDP$(-1)	0.074596	0.255021	0.292508	0.7732
DLRCAE$	0.091184	0.070293	1.297206	0.2109
DLRNAE$	0.628654	0.333068	1.887466	0.0753
DLRREA$	0.040358	0.092067	0.438349	0.6663
U(-1)	-0.158709	0.344847	-0.460231	0.6509
C	-0.023719	0.033029	-0.718132	0.4819
FITTED^2	-1.422645	2.541813	-0.559697	0.5826
FITTED^3	-12.16223	31.30451	-0.388514	0.7022

R-squared	0.513069	Mean dependent var	-0.051019
Adjusted R-squared	0.323707	S.D. dependent var	0.119293
S.E. of regression	0.098103	Akaike info criterion	-1.557934
Sum squared resid	0.173236	Schwarz criterion	-1.170828
Log likelihood	28.25314	Hannan-Quinn criter.	-1.446461
F-statistic	2.709464	Durbin-Watson stat	1.689502
Prob(F-statistic)	0.041787		

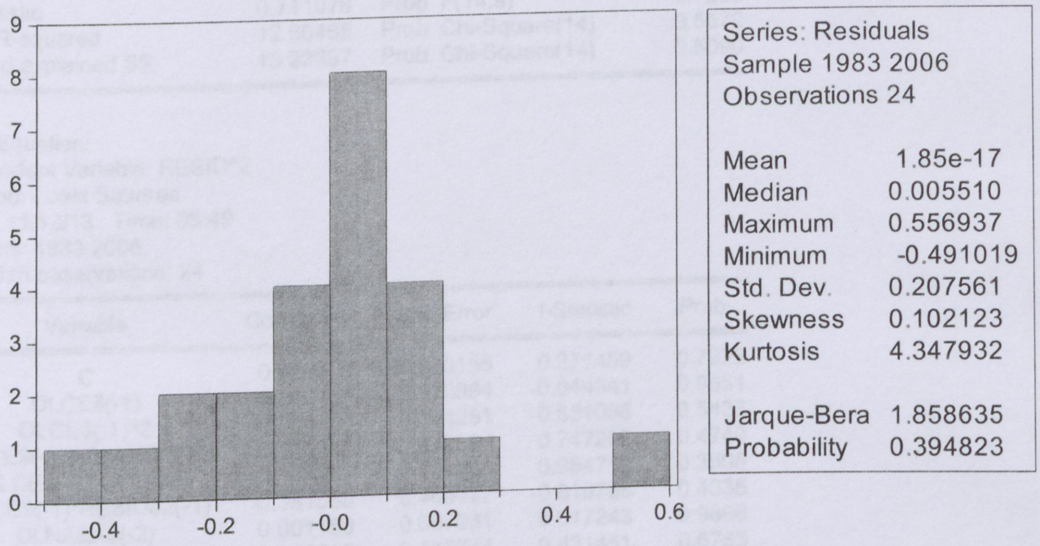
Structural Break test

Chow Breakpoint Test: 1994
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1986 2011

F-statistic	1.618685	Prob. F(6,14)	0.2142
Log likelihood ratio	13.70014	Prob. Chi-Square(6)	0.0332
Wald Statistic	9.712111	Prob. Chi-Square(6)	0.1373

D4.2 Zimbabwe

Normality Test



Serial correlation test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.150919	Prob. F(2,17)	0.8611
Obs*R-squared	0.418690	Prob. Chi-Square(2)	0.8111

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/13/13 Time: 08:49
Sample: 1983 2006
Included observations: 24
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLCE$(-1)	0.002029	0.053187	0.038149	0.9700
DLNAEX$(-2)	-0.012827	0.074181	-0.172916	0.8648
DLREX$	-0.004199	0.077278	-0.054330	0.9573
RESID02(-1)	-0.007542	0.279249	-0.027008	0.9788
C	0.000842	0.050607	0.016639	0.9869
RESID(-1)	0.010458	0.310143	0.033719	0.9735
RESID(-2)	-0.143437	0.261220	-0.549103	0.5901

R-squared	0.017445	Mean dependent var	1.85E-17
Adjusted R-squared	-0.329339	S.D. dependent var	0.207561
S.E. of regression	0.239311	Akaike info criterion	0.216391
Sum squared resid	0.973589	Schwarz criterion	0.559990
Log likelihood	4.403312	Hannan-Quinn criter.	0.307548
F-statistic	0.050306	Durbin-Watson stat	1.763801
Prob(F-statistic)	0.999320		

Heteroskedasticity Test

Heteroskedasticity Test: White

F-statistic	0.711078	Prob. F(14,9)	0.7263
Obs*R-squared	12.60465	Prob. Chi-Square(14)	0.5579
Scaled explained SS	13.22397	Prob. Chi-Square(14)	0.5090

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/13/13 Time: 08:49
Sample: 1983 2006
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010900	0.040155	0.271459	0.7922
DLCE$(-1)	-0.003191	0.070994	-0.044941	0.9651
DLCE$(-1)^2	-0.034236	0.054251	-0.631056	0.5437
DLCE$(-1)*DLNAEX$(-2)	0.105043	0.140564	0.747295	0.4740
DLCE$(-1)*DLREX$	0.146962	0.149244	0.984710	0.3505
DLCE$(-1)*RESID02(-1)	-0.381568	0.465477	-0.819736	0.4335
DLNAEX$(-2)	0.001156	0.067061	0.017243	0.9866
DLNAEX$(-2)^2	0.050369	0.116744	0.431451	0.6763
DLNAEX$(-2)*DLREX$	-0.247570	0.374680	-0.660751	0.5253
DLNAEX$(-2)*RESID02(-1)	0.140900	0.335534	0.419926	0.6844
DLREX$	0.040763	0.169985	0.239806	0.8159
DLREX$^2	-0.034012	0.037219	-0.913841	0.3846
DLREX$*RESID02(-1)	-0.149789	0.400462	-0.374041	0.7170
RESID02(-1)	0.201137	0.237772	0.845924	0.4195
RESID02(-1)^2	0.428699	0.611728	0.700800	0.5011

R-squared	0.525194	Mean dependent var	0.041286
Adjusted R-squared	-0.213394	S.D. dependent var	0.077168
S.E. of regression	0.085004	Akaike info criterion	-1.823069
Sum squared resid	0.065031	Schwarz criterion	-1.086786
Log likelihood	36.87683	Hannan-Quinn criter.	-1.627733
F-statistic	0.711078	Durbin-Watson stat	1.581619
Prob(F-statistic)	0.726344		

Regression specification error Test.

Ramsey RESET Test:

F-statistic	0.556964	Prob. F(2,17)	0.5831
Log likelihood ratio	1.523227	Prob. Chi-Square(2)	0.4669

Test Equation:
Dependent Variable: DLAGDPU$
Method: Least Squares
Date: 11/13/13 Time: 08:50
Sample: 1983 2006
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLCE$(-1)	0.107672	0.093019	1.157527	0.2631
DLNAEX$(-2)	-0.100154	0.128501	-0.779402	0.4465
DLREX$	0.047342	0.075281	0.628880	0.5378
RESID02(-1)	-0.359634	0.231426	-1.553989	0.1386
C	0.045990	0.066590	0.690641	0.4991
FITTED^2	-0.382276	0.568662	-0.672237	0.5105
FITTED^3	1.263301	1.270779	0.994116	0.3341

R-squared	0.617851	Mean dependent var	0.009817
Adjusted R-squared	0.482975	S.D. dependent var	0.325272

S.E. of regression	0.233885	Akaike info criterion	0.170522
Sum squared resid	0.929941	Schwarz criterion	0.514121
Log likelihood	4.953733	Hannan-Quinn criter.	0.261679
F-statistic	4.580877	Durbin-Watson stat	1.881916
Prob(F-statistic)	0.006092		

Testing for Structural break

Chow Breakpoint Test: 1991
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1983 2006

F-statistic	0.615966	Prob. F(5,14)	0.6898
Log likelihood ratio	4.772182	Prob. Chi-Square(5)	0.4443
Wald Statistic	3.079830	Prob. Chi-Square(5)	0.6877

Editing Report

This letter serves to confirm that I, Dr I. Ndlovu of the English Department, University of Venda, have proofread a mini dissertation entitled *Economic Impact of the Composition of Public Expenditures on Agricultural Growth: Case studies from selected SADC countries and Implications on Regional Food Security* by Timothy Manyise (11585442).

I carefully read through the chapters, focusing on proofreading and minor editorial issues. The recommended changes are clearly highlighted. It is now up to the student to effect these recommendations.

Yours Sincerely

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