

An analysis of maize trade in the Southern African Development Community

By

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DECLARATION

I declare that the thesis hereby submitted in partial fulfilment of the requirements for the degree Master of Science (Agricultural Economics) at the University of Pretoria has not been submitted by me for any other degree at any other institution.

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ABSTRACT

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Maize is the most grown staple crop in Africa, and white maize is of particular importance because it is the dominant staple food particularly throughout southern Africa to the extent that maize shortages lead to food security emergencies. These emergencies are compounded by SADC's limited ability to respond to production and supply shocks. In response to these shocks, SADC countries supplement local maize production with trade and food aid leading to a robust regional white maize market.

In an attempt to bolster trade SADC member states sign substantial regional arrangements, with similar objectives and common participants all in the hope of strengthening trade and with it maize trade. This study seeks to find means to improve intra-SADC maize trade relations, through defining the determinants for intra-regional maize trade, and determine if SADC members' sub-regional groupings have an effect on maize trade. The study makes use of a gravity model to estimate the value of trade; specifically a Tobit model with random effects by Maximum Likelihood Estimation.

The partner country population was found to have a positive effect (0.749) on maize trade at 5% level of significance. This suggests that countries that have greater populations and consequently larger market sizes for the regional staple maize tend to trade more. Maize aid distribution was found to be a statistically significant determinant of intra-regional maize trade to the extent that it encourages regional maize trade. Transport infrastructure was also found to positively influence intra-SADC maize trade, as infrastructure transportation systems are critical for the purposes of moving goods and labour to facilitate production and

trade. The premise that bilateral maize trade between any two countries is negatively related to the relative importance of economic relationships between the reporter country and the partner countries that are located far away, as opposed to those located nearby, is supported by the negative impact distance has on maize trade (-1.670 significant at 10% level), while the propensity to trade increases if the two trading countries share a common border. The net grain position of member states influences intra-SADC maize trade as shown by the statistically significant positive relationship between trade and a net grain deficit position, suggesting that SADC member states are likely to engage in intra-SADC trade should they find themselves in a deficit trade position presumably from the nearest most accessible surplus state. Sub-regional groups SACU and COMESA were found to have no influence on maize trade.

Key words: Gravity Model, SADC, Maize Trade.

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Acronyms

Abbreviation	Expansion
AAGR	Average Annual Growth Rate
AATF	African Agricultural Technology Foundation
AfDB	African Development Bank
ACP	African, Caribbean and Pacific
AICD	Africa Infrastructure Country Diagnostic
AIDS	Acquired Immune Deficiency Syndrome
AMU	Arab Maghreb Union
ASEAN	Association of South East Asian Nations
BLNS	Botswana Lesotho Namibia and Swaziland
CBI	Cross Border Initiative
CEEAC	<i>Communauté Économique des États de l'Afrique Centrale</i> or <i>Comunidade Económica dos Estados da África Central</i>
CEMAC	Central African Economic Monetary Community
CEPGL	Economic Community of the Great Lake States
CEN-SAD	Community of Sahel Saharan States
CFTA	Continental Free Trade Area
CIMMYT	International Maize and Wheat Improvement Centre
CMA	Common Monetary Area
COMESA	Common Market for East and Southern Africa
EAC	East African Community
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
ESA- EPA	East and Southern Africa–European Union Economic Partnership Agreement
EPA	Economic Partnership Agreement
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organisation
FAOSTAT	Food and Agriculture Organisation Statistics
FDI	Foreign Direct Investment
FEWSNET	Famine Early Warning Systems Network

Abbreviation	Expansion
FSSP	Food Self Sufficiency Programme
FTA	Free Trade Area
GATT	General Agreement on Trade and Tariffs
GDP	Gross Domestic Product
GM	Gravity Model
GMB	Grain Marketing Board
GNP	Gross National Product
HIV	Human Immune Virus
HS code	Harmonised System Code
IFPRI	International Food Policy Research Institute
IGAD	Intergovernmental Authority on Development
IMF	International Monetary Fund
IOC	Indian Ocean Commission
IOR-ARC	Indian Ocean Rim Association for Regional Co-operation
Kcal	Kilo-calories
MERCOSUR	Latin America Southern Cone Common Market
MLE	Maximum Likelihood Estimation
MMA	Multilateral Monetary Area
MT	Metric Tonnes
NAFTA	North American Free Trade Agreement
NTB	Non-Tariff Barriers
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PTA(ESA)	Preferential Trade Area for Eastern and Southern Africa
RIA	Regional Integration Agreements
RIFF	Regional Integration Facilitation Forum
RMA	Rand Monetary Area
RSF	Revenue Sharing Formula
RTA	Regional Trade Agreement
SACU	Southern African Customs Union
SADC	Southern Africa Development Community
SADC EPA	Southern Africa Development Community Economic Partnership Agreement

Abbreviation	Expansion
SADC FANR	Southern Africa Development Community Food, Agriculture and Natural Resources
SADC FSWS	Southern Africa Development Community Food Security Warning System
SADCC	Southern Africa Development Coordination Conference
SADCC'	Southern African Development Coordination Conference'
SGR	Strategic Grain Reserve
SITC	Standard International Trade Classification
SNL	Swazi Nation Land
SPS	Sanitary and Phyto-sanitary
SSA	Sub-Saharan Africa
TIPS	Trade and Industrial Policy Strategies
UDEAC	<i>Union Douanière et Économique de l'Afrique Centrale</i> or Central African Customs and Economic Union
UN Comtrade	United Nations Commodity Trade
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNDP	United Nations Development Programme
WEF	World Economic Forum
WFP	World Food Programme
WRI	World Resources Institute
WTO	World Trade Organisation
ZNFU	Zambian National Farmers' Union

CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

Maize is one of the three most important grains in the world. According to FAO (2012) 161 765 387.50 hectares were harvested globally in 2010¹. According to AATF (2009), maize is the most widely grown staple crop in Africa. More than 300 million Africans depend on it as their main food source, and white maize is of particular importance because it is the dominant staple food throughout southern Africa (Calcaterra, 2002). Some scholars even state that maize is a key and strategic food crop whose availability is seen to equate to food security in a number of east and southern African states (Miti, 2005).

According to Economist Intelligence Unit (2010) the rise in global maize consumption, which faltered in 2008/09, has regained momentum, as increasing industrial usage offsets periodic uneven demand for animal feed. The Economist Intelligence Unit (2010) goes on to say that production of maize-based ethanol has risen sharply, particularly in the USA, while production of maize starch has been growing in China. There remains strong competition from lower-grade wheat and industrial co-products, while a decrease in consumption of meat in many countries has constrained the usage of animal feedstuffs (Economist Intelligence Unit, 2010). As a mild economic recovery is expected to boost disposable incomes, feed demand is forecast to improve in the coming years, particularly in parts of Latin America and Asia. The Economist Intelligence Unit (2010) forecasts a rise in global consumption of maize to a record 805 million MT (Metric Tonnes) in 2009/10, an increase of 3.4% from 2008/09. Assuming rising ethanol production and a modest upswing in feed demand in some countries, a further increase of 1.7%, to 818 million MT, is forecast for 2010/11 (Economist Intelligence Unit, 2010).

Grant, Wolfaardt and Louw, (2012) state that Africa's food consumption patterns are expected to change dramatically during the coming decades, a trend that is driven by changing household consumption patterns within the region - a consequence of increasing

¹ This is the latest available data FAOSTAT (<http://faostat.fao.org>): area harvested 2010 (downloaded December, 2012).

urbanization and growing per capita incomes. With regard to the SADC, Grant, *et al.* (2012) identify population growth as the main driver of maize consumption in this region (excluding South Africa). Therefore, future maize consumption is expected to remain fairly constant with an expected growth rate of 0.51% per annum between the production periods 2009/2010 to 2013/2014 (Grant, *et al.*, 2012).

Within the SADC region, maize is the major staple food crop in most countries (Mano, Isaacson and Dardel, 2003). According to Grant, *et al.*, (2012), maize comprised just about half of the calorie intake in 11 of 12 SADC countries that provided data on calorie intake. In addition, maize's contribution to the cereal calorie intake (in kilocalories) ranges from 67% in Malawi, Swaziland and Zambia to 38% in Namibia. Maize consumption as a percentage of the entire diet (in Kcal), for the SADC (excluding the D.R.C, and Madagascar), is shown in Table 1.1.

Table 1.1: Cereals' contribution per SADC countries' total calorie intake for 2004.

Countries	Cereals as a % of total diet	Maize as a % of cereals diet	Maize as a % of total diet
Malawi	67	91	61
Zambia	69	90	62
Swaziland	85	85	64
Angola	35	77	27
Zimbabwe	62	76	47
Tanzania	38	68	26
Mozambique	44	66	29
Lesotho	75	65	49
South Africa	54	65	35
Botswana	56	55	31
Namibia	60	38	23
Mauritius	48	*	*

*Data unavailable

Source: Grant, *et al.*, (2012).

The exponential increase in maize demand presents a critical test for poor underdeveloped countries. Lofgren and Richard (2003) state that there are only three ways of obtaining food, these being: own production, trade and grant (food aid). In the short to medium term, the possibility for increasing the maize productivity growth rate for the food-maize sector is doubtful – especially for the subsistence farming systems of the tropics. This hinges on the

fact that private sector investment in tropical food-maize production has been found to be generally unprofitable, a position that is unlikely to change in the near future. Food aid becomes a precarious option to least developed countries, as there is a chance that an unforeseen natural disaster may take centre stage, relegating the food aid dependent countries to the periphery. These two sources of food are important, and have a role to play in mitigation of food aid emergencies, but the least explored option, especially in southern Africa, is the facilitation of unimpeded trade of maize and its associated forms.

The rest of Chapter 1 is outlined as follows; Section 1.2 gives a description of the RTAs scenario in Africa, giving an indication on the complexity of RTAs in Africa. Building on this insight, Section 1.3 briefly characterises the nature of cereal trade policies throughout the SADC. Section 1.4 gives a synopsis into the factors that are thought to influence maize trade in the SADC region; while Section 1.5 proceeds to define the study's problem statement. Following that Sections 1.6 and 1.7 lay out the study's research questions and the study hypotheses respectively. Section 1.8 focuses on the objectives of the study and the final section (Section 1.9), underscores the study's justification.

1.2 Regional Trade Agreements Scenario in Africa

Goode (2007) defines regionalism as “actions by governments to liberalize or facilitate trade on a regional basis, sometimes through free-trade areas or customs unions” a phenomenon that has gained prominence the world over. In fact Freund and Ornelas (2010) report that regionalism has proliferated and in 2010, each member of the WTO was involved in at least 15 trade agreements². Moreover, the WTO (2012) reports that there have been some 511 notifications of RTAs (counting goods and services separately) received by the GATT/WTO. Of the 511 notifications, 319 were in force.

The African continent has also been part of this movement resulting in the formation of various regional groupings, with the hopes of economic integration (and ultimately significant economic union) among African states at a continental level. Geda and Kebret (2008) identified seven regional economic communities within the continent that were

² This refers to as recent as the 15 January 2012.

perceived as the main building blocks for such a continent-wide integration initiative. These are the AMU, COMESA, ECCAS, ECOWAS, SADC, IGAD and CEN-SAD.

Consequently, the continent has the highest number of regional integration and cooperation agreements brokered and signed in comparison to any other continent. It is no surprise that as early as 2008, there is no African country that is not a member of at least one regional economic group (Geda and Kebret, 2008). In 2012 at the AU summit, all the African heads of state showed their willingness to improve intra-regional trade by committing to form a Continental Free Trade Area (CFTA), by 2017 (Nkuepo, 2012). The manner chosen to achieve this is that of amalgamating the smaller RTAs, starting principally with the EAC, COMESA and SADC tripartite arrangement, scheduled to occur in 2014 (Nkuepo, 2012). The idea is to create a template for integration, and this template will allow the other smaller regional blocs to learn from the tripartite experience, with the hope of eventually consolidating into one CFTA initiative between 2015 and 2016 (Nkuepo, 2012).

Schiff and Winters (1998) identified the motivation driving the formation of regional groupings as originating from four factors; the first being the fact that between 55% and 60% of world trade occurs within regional trading blocs – a view that was concurred with by Geda and Kebret (2008). The second factor, which Schiff and Winters (1998) noted is the formation and strengthening of various regional blocks on other continents (i.e. in Europe, Asia and the Americas), which could lead to marginalisation of the bulk of African countries if they maintain the status quo.³ The third factor that Schiff and Winters (1998) identified is that national markets of African countries are not large enough to provide the benefits of economies of scale and specialisation. Finally, Schiff and Winters (1998) mentioned the legacy of the Bretton Woods rooted liberalisation initiatives that created an environment promoting outward looking economic policy as a factor that promotes regionalisation.

The SADC Protocol on Trade, signed in 2000, is a response to the many changes in the global trade scene, with its focus mainly on trade in goods, with the hope of extending this to services once negotiations are complete. Burfisher, Robinson and Thierfelder (2004) mention this historic perception of “integration” amongst countries as a continuum ranging from

³ There are a few exceptions to this; a typical example is South Africa that has managed to broker and sign agreements with Argentina, Brazil and is in talks with India and as a SACU member with SADC, for further trade arrangements.

“shallow” to “deep” – shallow representing trade in goods and deep representing trade in services as well as factors of production. On such a scale, Saurombe (2009) reports that integration has occurred in the goods market, equivalent to “shallow” on the Burfisher *et al.* (2004) scale. The fear of states losing their sovereignty on trade policy hampers deep integration of regional trade.

According to Roxburgh, Dörr, Leke, Tazi-Riffi, van Wamelen, Lund, Chironga, Alatovik, Atkins, Terfous, and Zeino-Mahmalat, (2010) African agricultural sector is worth US\$280 billion annually (as of 2010) and has the potential to expand to US 880 billion annually by 2030. Beyond these trade figures there are other non-monetary gains that are by-products of intra-regional trade make trade a worthwhile endeavour. These by products include but are not limited to, the benefits of increased food security and the transfer of technology. Additionally, improved intra-Africa trade holds the potential for reducing the continent’s dependence on developed economies as instruments of growth. Intra-Africa trade provides an opportunity for African producers and exporters to develop the required products, capacities, competitive competencies, scale economies, skills and experience necessary for effective integration and participation in the global trading system (Daya, Ronto and Letsalo, 2006). The WEF’s (2011) clustering of countries according to their economic structures supports this view. The indication is that the more diverse an economy is (i.e. the wider range of manufactured goods it produces and trades) the faster its growth rate in tradable goods.

1.3 Characteristics of Cereal Trade Policies within SADC

Although there are different cereal trade policies among SADC members, similarities can be drawn across countries that belong to sub-regional groupings. For instance, members of SACU,⁴ through its Common External Tariff, have low tariffs on cereal trade with the SADC region, noting that intra maize tariffs for the entire SADC region fell away in 2008. For example Botswana and Lesotho uses a variety of trade tools to regulate imports of maize, and other agricultural products on the basis of sustaining some level of local production. This includes the use of infant industry protection provisions (CTA, 2011). The regulation of maize imports in a context of significant import dependence is also a characteristic of the

⁴ SACU countries consist of Botswana, Lesotho, Namibia, South Africa and Swaziland.

Namibian and Swazi agricultural sector with over half of all cereals (maize included) consumed in Namibia are imported while only 40% of Swaziland's domestic requirements are met by local production (CTA, 2011). These SACU countries are however net importers of maize with the exception of South Africa which is the major agricultural producer of all its basic foodstuffs including maize.

Malawi, Zambia and Zimbabwe, who are members of both COMESA and the SADC, enjoy tariff-free trade with each other for most cereal products, but lack harmonisation on trade policies regarding trade with the rest of the world. The production of cereals and trade policies in these countries is characterised by a comparable state-interventionist history. Recent years have seen the rise in the dominance of Malawi and Zambia as maize exporters. These countries are also renowned for the ad hoc trade policies that lead to the introduction of maize export and import bans that ultimately have an effect on maize trade (CTA, 2011).

Malawi eliminated tariffs on maize grain, but still has a trade license requirement. On the other hand, Zambia has no import license requirement for trade in cereals, but imports are subject to tariffs of up to 25% as of 2006. Additionally, Zambia has in place numerous antidumping, rules of origin and SPS measures. Cereal imports into Zimbabwe are subject to tariffs as high as 30% (as of 2005), and continue to face several SPS restrictions a position that has not changed significantly since then. The Zimbabwean Grain Marketing Board (GMB) – a state trading enterprise – has legal authority to engage in, or issue licenses for trade in grains. The few private import enterprises that are granted licences are charged import levies, even in the face of chronic famine.

According to Abdula and Tschirley (2007), Mozambique's cereal sector has the least regulated maize market in the region. The tariffs range from as low as 2.5% to 7.5%, spiking for wheat and maize flour at 25%. Even so, trading licenses, extensive inspections, and non-trivial taxes govern trade (Mutambatsere, 2006). Tanzania and Zimbabwe have similar policies that restrict exports, and trade can only occur amongst those that possess state-issued licenses.

1.4 Factors Influencing SADC Maize Trade

Visser and Hartzenberg (2004) identified a number of trade influencing factors of trade which can be summarised as: the presence of NTBs⁵; access to market information; transport and communications infrastructure; and service delivery systems (i.e. financial, electricity, and technical support⁶). These factors also hold true for maize trade. Although this list is not exhaustive, the factors that influence regional maize trade would be incomplete without the inclusion of agricultural investment, and regional policy coordination. Agricultural investment and all the preceding factors will be discussed in the ensuing discussion which centres on the various aspects of the aforementioned factors.

The SADC region is plagued with trade barriers – that begin as rules and regulations that are set up with good intentions but in implementation these rules and regulations have unintended consequences that impede trade. In the past each SADC member state had its own set of laws with respect to food quality and safety, with the noble aim of protecting member states against the spread of pests and diseases and to safeguard human life. Although the importance of SPS and food safety measures is unquestionable, the manner in which they are currently set up has ensured that SPS measures have become a barrier to trade.

Another example of the unintended consequences of rules and regulations is in the form of burdensome customs processes and documentation that continue to be a hindrance to regional trade, regardless of agreements at the regional level within SADC (Munyaradzi and Phiri, 2011). Chauvin and Gaulier (2002) identify a number of non-tariff barriers that impede trade. Their list includes surcharges on imports, cumbersome customs documentation and related procedures, time-consuming border related control on foreign exchange clearance and settlement systems, transportation of goods and persons, and delays in payments. There has since been considerable effort to harmonise SPS and customs measures with the hope of removing the impediments to trade.⁷ In fact in the SADC trade protocol SPS and customs

⁵ NTBs are usually in the form of complex SPS regulations, (standards and certification/technical restrictions, rules of origin), and customs and border procedures.

⁶ With reference to maize trade, technical support presents itself as agricultural extension.

⁷ The sterling example of harmonising customs procedures is the one stop border post between Zimbabwe and Zambia. Before the one stop border post became operational import/export clearing times ranged from 3 (three) to 5 (five) days. With the one stop border fully operational the clearing times have been reduced to a day. An average of 480 trucks cross at Chirundu every day so a daily total of 960 to 1920 travel days are saved.

measures have been identified as a key focus point⁸ in a bid to improve regional trade. In addition to this the SADC is notorious for the number of government instituted NTBs. These include periodic maize import/export bans, and changes to maize trade requirements which are ad hoc and often not communicated to traders in advance.

As previously mentioned another factor that influences maize production and which is critical in the determination of the level of intra-regional trade that occurs in SADC is agricultural investment (particularly FDI). The classical assumption that exists, according to Burfisher *et al.* (2004), is that investment as a result of trade plays a role in stimulating productivity growth through various channels. These include the transmission of ideas, addressing technological differences among countries, knowledge spill-over, and market expansion. Within the SADC region this is epitomised in Malawi and Zambia's adoption of former Zimbabwean farmers that were dispossessed of their farms following the fast track land reform programme. In addition to this, Malawi and Zambia have invested heavily in agriculture through the provision of subsidies to maize farmers. Other factors influencing maize production are, *inter alia*, government and private sector expenditure on agricultural extension services, the available agricultural technology, and variability in the climate, particularly focusing on rainfall information, as well as sharing price data throughout the region.

Concerns regarding policy coordination on pertinent issues must be addressed for the improvement of maize trade policy. An example that comes to mind is the production and sale of genetically modified grains. Mutambatsere (2006) reports that of the 15 member states in the SADC, South Africa and Zimbabwe are the only two states that have clear legislation on genetically modified agricultural produce, and these two policy positions differ in various respects.

All the aforementioned factors also influence trade in the SADC region, but the factors that are of interest to this study are the net maize grain position of a specific country; the importance of relative economic relationships and contiguity factors between the two trading

⁸ SADC member states agreed to gradually phase out tariffs in most economic sectors by 2012 in an attempt to promote regional trade. The aim of the "Protocol on Trade" is to increase trade without any impediment, by eliminating import duties (Article 4), eliminating export duties (Article 5) and eliminating non-tariff barriers (Article 6) in the SADC member states (Oosthuizen, 2006).

countries; the infrastructure network between trading countries; the party to sub-regional groupings of the trading countries; the purchasing power and market sizes of the two trading countries; and the distribution of maize aid. These are discussed in detail in Chapter 2 as they are the factors that the study will focus on individually.

1.5 Problem Statement

The SADC region experiences localised pockets of food security emergencies. This could be attributed to a number of reasons, one of them being the SADC region's limited ability to respond to production and supply shocks. Production shocks that afflict SADC countries come in many forms; *inter alia*, civil-social unrest, climate shocks, minimal investment in shock absorbing agricultural technology, lack of investor confidence in governments' institutions, and limited investment by private and public enterprises in research and development, are a few of the prevailing shocks⁹.

White maize – the region's staple whose availability has the ability to influence national, and to some extent regional food security¹⁰ – has not been spared the ill effects of these shocks. Consequently, some SADC countries that face white maize deficit, supplement local maize production with maize imports and food aid in order to prevent crisis situations¹¹. However, mostly yellow maize is traded on world markets while the majority of SADC consumers prefer white maize (Muzhingi, Langyintuo, Malaba, and Banziger, 2008). According to latest available estimates (1997) world production of white maize was placed at a meagre 12% to 13% of the annual world output of all maize (FAO and CIMMYT, 1997)¹². The volatility in maize production and the dominance of trade in yellow maize have led to the creation of a regional white maize market. In spite of the positive development of the region,¹³ SADC

⁹ See Mutambatsere (2006).

¹⁰ As a matter of fact, a number of studies have used maize availability as a proxy for food security status, examples of such studies include the work done by Mashinini, Ajuruchukwu; and van Schalkwyk (2006): Maunder and Wiggins(2006); and Mano, *et. al.* (2003).

¹¹ The exception to this is South Africa that has consistently produced surplus over the period 2000-2011. The only time South Africa required maize imports was in the instance of the severe 1992 drought.

¹² This figure may have declined significantly as there has been increasing demand for (ethanol) further strengthening the regional white maize market.

¹³ The SADC has achieved quite a bit since its inception, which includes the rehabilitation of roads, railway lines and harbours as well as the development through research of a number of seed varieties to cater for the different climatic conditions of the SADC Region. In addition to this, the SADC has achieved intangible goals that include: demonstration that regional cooperation is not only desirable but possible; development of a sense of regional belonging as well as a tradition of consultation among the people and governments of southern Africa (SADC, 2008).

finds itself battling to mitigate food crisis situations and still experiences localised food shortages from as far back as the 1990s.

Over 50% of SADC countries are already members of a number of regional trade initiatives in existence in sub-Saharan Africa (SSA). In spite of all these regional initiatives, intra-regional goods trade in the SADC region contributes a modest share of total goods trade volumes amongst SADC countries; however, the trend is significantly different for maize trade.

The SPS and customs concerns (discussed earlier in Section 1.4) tend to discourage trade transactions and in addition to the aforementioned, uncertainty in maize trade policy - a common feature in SADC countries - deters trade. Shifts in maize trade policy position in SADC countries are frequent, and is often based on the stability of producer incomes and domestic food prices (Mano, *et al.*, 2003; Jayne, Zulu, Mather, Mgheny, Chirwa and Tschirley, 2005). A typical example of such policy shift is the imposition of occasional and unsystematic temporary import bans on agricultural commodities from all countries, a commonplace event in the SADC agricultural trade policy space. Although these aspects are particularly important, they are very difficult to measure and will receive no further attention in this study.

1.6 Research Questions

The preceding section described the situation that has prompted the question “How can SADC members improve intra-maize trade relations?” In answering this question, it is necessary to answer the following supporting questions:

1. To what extent do: the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure; the purchasing power and market sizes of the two trading countries; the distribution of maize aid influence maize trade?
2. Do SADC members’ sub-regional groupings have an effect (either positive or negative) on maize trade?

1.7 Hypothesis

The study seeks to test the following hypotheses:

Hypothesis 1: Intra-regional maize trade in the SADC region is determined by the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries¹⁴; infrastructure¹⁵, purchasing power and market sizes of the two trading countries¹⁶; and the distribution of maize aid.

The SADC member states are party to a number of sub regional initiatives as well as a number of bilateral arrangements that are aimed at improving trade (which are introduced in Chapter 2 and discussed in greater detail in Chapter 4). It is feared that these numerous agreements could possibly have the unintended consequence of restricting trade in the SADC region, by way of numerous conflicting requirements from the different initiatives. The study discusses a number of trade integration initiatives¹⁷, and focuses on COMESA and SACU. The reason for choosing to focus only on SACU and COMESA in the model for analysis purposes is the on-going negotiations in creating a tripartite FTA that encompasses the three FTAs; i.e. EAC, COMESA and SADC¹⁸. It is envisioned that the tripartite FTA will provide a seamless economic space of substantially greater magnitude which should support higher volumes of trade and investment. In addition to this SACU and COMESA are the only fully functional FTAs that involve at least two SADC countries for which the SADC TIPS database has is reliable reporter country data. It is on this basis that the second hypothesis is framed.

Hypothesis 2: Bilateral and plurilateral agreements between/amongst SADC members (in the sub-regional groupings SACU and COMESA) have an influence on SADC maize trade.

¹⁴ The the importance of relative economic relationships and contiguity factors between the two trading countries are proxied by the distance between the capital cities of the two trading countries (Frankel 1997).

¹⁵ Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones and the length of such is used to proxy the quality of infrastructure.

¹⁶ The purchasing power and market size is proxied by the contribution of agriculture to the member state's GDP, and the population of the maize importing/exporting SADC country respectively.

¹⁷ SADC has a number of different types of trade integration initiatives and the initiatives discussed in this study are Free Trade Areas (COMESA, EAC, ECCAS); a customs union (SACU); a common money area (MMA); and a number of non-binding regional trade initiatives that have been instituted to improve trade (IOC, IOR-ARC and RIFF)

¹⁸ By including SADC it *de facto* includes the SACU region as all SACU members belong to SADC. Tanzania is the only member of the EAC that is also a member of the SADC region, and as a result the model would not have been able to assess if being a member of the EAC would have had an impact on intra-SADC trade.

1.8 Objectives

The overall objective of this study is to identify the determinants of SADC intra-maize trade.

The sub-objectives of this study are as follows;

1. The study seeks to determine the extent to which the: net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure, purchasing power and market sizes of the two trading countries; and the distribution of maize aid influence intra-SADC maize trade.
2. Determine the effect of being party to a number of other regional trading arrangements specifically COMESA and SACU.

The study makes use of the GM model in a sub-sector analysis of the maize grain trade in the SADC region with the aim of evaluating the determinants of maize grain (corn) trade (HS-100519).

1.9 Justification

A significant number of sub-Saharan Africa countries have notably high poverty rates and are aid-dependent, receiving aid flows greater than 10% of GNP (Birdsall, 2007). As the literature suggests,²⁰ enhanced intra-Africa trade (South–South trade) can potentially drive sustained economic growth and is likely to reap greater benefits as opposed to North–South trade. A study to determine the significant factors that affect maize trade would provide the ground-work to help ensure improved food security. The premise for this is that regional food security is best served through open trade, enabling commodities and products to move from surplus to deficit areas driven by the private sector and market forces.

The special attention given to maize aid, in this study is as a result of the likely impacts that food aid could have on recipient countries ability to attain future food security and the tendency of food aid being used as a foreign policy tool by donor countries in a bid to push some agenda. Duchesne, Langlois, and Larue (2012) state that there are three types of food aid delivery namely: direct transfer, local purchases and triangular purchases and each of

¹⁹ This particular specification takes into account the other maize (corn) products as well as maize grain, but excludes seed maize. In some of the countries in the dataset, the class HS-1005: MAIZE (CORN): was used because that country did not trade in products other than grain and hence there were only two classes: seed maize and the former, which is in fact everything other than seed maize.

²⁰ The literature referred to here is the work of Page (2004); Dihel (2006) and Daya *et al.* (2006).

these delivery methods have their inherent, advantages and disadvantages to both the donors and the recipients, which are briefly explained below.

The direct transfer delivery method corresponds to food aid physically shipped from the donor country directly to the recipient country, while the local purchase delivery method entails local (within country) purchases of food aid that is then distributed to the points where there is high food insecurity within the country. Finally, triangular purchases are transactions which involve the provision of food aid purchased from third country (usually within the region of the recipient country) for the recipient country. This form of aid and is aimed at increasing food trade between developing countries, and is also dependent on infrastructure and the availability of the commodity in the region.

The direct transfer delivery method is the most distortionary type of aid as it upsets the local maize markets and can be perceived to be a form of subsidy that is given to the farmers in the recipient countries. For example, the United States and Canada (two of the largest food aid donors) have legislation that requires that a significant percentage of any food aid must come from domestic production (Duchesne *et. al.* 2012). On this basis, this form of aid is seen as tied aid because it comes from the donor's national production to the benefits of national stakeholders²¹.

In terms of promotion of regional maize trade, a shift from direct transfer delivery towards cash based food aid (either local purchases or triangular purchases); would go a considerable way towards promoting African producers and exporters by giving them the opportunity to develop the required products, capacities, competitive competencies, scale economies, skills and experience necessary for effective integration and participation in the global trading system.

Once the determinants of intra-regional maize trade are identified through this study, scholars and policy makers can start the debate on the best ways to remove the bottlenecks. As already noted, Africa's integration into international markets is lagging behind in terms of "real" integration at local, national and regional market levels²². As a result, Africa depends on world markets and a world price that may not necessarily reflect the real cost of production

²¹ It must be noted that Aid exporters are not legally bound to buy a proportion of food aid from their national producers, administrative decisions generally give a significant advantage to a national supplier (Clay 2006 in Duchesne *et. al.* (2012)

²² Although Africa (particularly southern Africa) is party to a number of regional trade agreements, the bulk of trade is with the developed countries.

due to domestic and other subsidies, but is more likely to reflect surplus production elsewhere.

Previous studies, which include the work of Chauvin and Gaulier (2002) and Kanda and Jordaan (2010), generally focussed on intra-regional trade in a number of commodities. The novelty of this study is its focus on maize grain, which is an important strategic commodity for the SADC region. This study endeavours to identify hindrances in solving chronic food shortages similar to those that beleaguer the region. It will test the argument that a lasting solution entails improving regional maize trade, by way of improving the determinants of intraregional trade as well as reducing the restrictions on maize in its processed or grain forms.

The sheer size of the region, the climatologic variations and the assortment of agro-ecological conditions in the region nearly guarantee the possibility of a good crop in at least some parts of the region in any growing season (Rwelamira and Kleynhans, 1998). The ideal situation is a region that allows unimpeded cross-border maize grain movement, and minimal non-tariff barriers. This could then create a regional market for maize, incentivising the private sector to take advantage of the market opportunities. With state, private sector and foreign investment, the region can create the capacity to bolster food production and thereby reduce the region's dependence on aid.

The major source of variability in the SADC region's food production is inter-annual rainfall with respect to quantity and seasonal distribution. According to Arya (2007), crop production in the region is predominantly dependent on rain-fed agricultural systems, with only 3.5% of the region's arable land currently under irrigation. Thus, it is no surprise that the region experiences acute food shortages and hunger whenever there is a drought. Needless to say the high variability of rains and the vulnerability of the region to food security is a cause of concern, in order to meet the SADC's food security objectives, unimpeded maize grain trade within the SADC region is imperative.

The study utilises the gravity model (GM) to evaluate the determinants of trade for specific agricultural products (in this case maize). The GM is founded on the basic principle that trade between two entities is directly proportional to the size of the two country's economies and

inversely proportional to the distance between the two countries. The gravity model, originating from Newtonian physics law, is an ex-post analysis approach, which uses historical data to analyse policy effects (Rahman, Shadat and Das, 2006). Tinbergen (1962) suggested that the same functional form of the Newtonian law could be relevant to international trade flows and it has since been applied to a wide spectrum of social interactions that include foreign direct investment (Brenton, Mauro and Lucke, 1999; Frankel and Cavallo, 2004), market area analysis (Baker, 2000), and migration (Karemera, Oguledo and Davis, 2000).

The following chapter serves to provide a detailed overview of the SADC region and a general description of the maize trade and is split into five major sections. The first section (Section 2.1) gives a background and overview of the SADC region. Section 2.2 follows with the characterization of the global, African and southern African maize production landscape and then goes into detail discussing the different characteristics of maize production in the SADC countries. The third section takes cognisance of the role that transport infrastructure plays in intra-SADC trade, and gives a description of the state of transport infrastructure in the region. The fourth section (Section 2.4) takes a brief introductory look at the other regional sub-groupings that SADC countries find themselves party to. The fifth section (Section 2.5) summarises the findings of Chapter 2.

The third chapter then delves into the details of the methodology used in this study. Specifically this chapter concentrates on the gravity model (GM), and develops the specifications for a GM to estimate trade flows for regional maize trade, taking the reader through the thought processes that led to the chosen model specification used in the study. The chapter then focuses on the data utilised, highlighting the basic statistical trends and values of the independent variables.

The fourth chapter discusses findings of the analysis with emphasis on the first research question posed in Section 1.6 which states: *“To what extent do: the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure; the purchasing power and market sizes of the two trading countries; the distribution of maize aid influence maize trade?”*

The fifth chapter speaks to the findings of the analysis in the context of the second research question which states *“Do SADC members’ sub-regional groupings have an effect (either*

positive or negative) on maize trade?” This discussion is prefaced by a brief background on the various regional groupings introduced in the Chapter 2, namely the Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Economic Community of Central African States (EACCS), Indian Ocean Commission (IOC), Indian Ocean Rim Association for Regional Cooperation (IOR ARC), Multilateral Money Area (MMA), and Regional Integration Facilitation Forum.

The final chapter brings the entire study into perspective bringing together the study objectives and the findings from Chapters 4 and 5 and culminates with the study conclusions.

CHAPTER 2

MAIZE PRODUCTION TRENDS IN THE SADC REGION

This chapter serves to provide a detailed overview of the SADC region and a general description of the maize trade scenario. Section 2.1 gives a background and overview of the SADC region. Section 2.2 describes the global, African and southern African maize production characteristics and then goes into detail discussing the different characteristics of maize production in the SADC countries. Section 2.3 takes cognisance of the role that transport infrastructure plays in intra-SADC trade. Section 2.4 introduces the other regional sub-groupings that SADC countries find themselves party to. Section 2.5 summarises the findings of the chapter.

2.1 The SADC Region

The past two decades have seen the SADC – a 15 country sub-Saharan Africa intra-regional grouping – undergo market reforms that are pro trade liberalisation, with the aim of promoting free trade amongst its members. Like most African countries, agriculture is an important sector for economic growth in the majority of SADC member states. Agriculture contributes over 70% of employment for the 228 million people in the SADC region and 35% to the region's GDP (Arya, 2003). Although the SADC is not in its true sense a regional trading block, the promotion of intra-regional trade has become one of its core objectives.²³

The founding members of the then Southern African Development Coordination Conference (SADCC) were Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Instituted in 1980, they endeavoured to decrease their economic dependence on other non-member states, in particular South Africa. The SADCC was successful on some fronts, for example, by improving the communication and transport networks within the region (Cattaneo, 1998). Radlet (1999) reports that the result of this latter effort to be epitomised in the 40% increase in traffic moving through SADCC ports between 1980 and 1990. This traffic originated mainly from the six landlocked member states. The

²³ SADC member states agreed to gradually phase out tariffs in most economic sectors by 2012 in an attempt to promote regional trade. The aim of the "Protocol on Trade" is to increase trade without any impediment, by eliminating import duties (Article 4), eliminating export duties (Article 5) and eliminating non-tariff barriers (Article 6) in the SADC member states (Oosthuizen, 2006).

most noteworthy transport venture was the improvement of the link between Zimbabwe and Mozambique (also called the Beira corridor), which substantially reduced Zimbabwe's dependence on South African ports (Foroutan, 1993). SADCC also made inroads in improving the region's power generation capacity through connecting member states' national power grids (Radlet, 1999). Other advances came in the form of enhanced food security and joint ventures in agricultural research, evidenced by the development of crop strains (Radlet, 1999).

The SADCC gave southern Africa a regional identity and supported the view that economic integration and cooperation was a necessary requirement for sustainable economic growth and development. In 1990, soon after Namibia gained its independence, it became the tenth member of the SADCC. The transformation from a coordination conference to a development community occurred in 1992. The differences between the two entities were: a modified mandate to include South Africa as an official trading partner (which formally joined the SADC in 1994 becoming the eleventh partner); the implementation of new trade policies; and a movement from the initial 'loose' co-ordination arrangement to a legally binding arrangement (Ligthelm, 2007).

The purpose of transforming SADCC into SADC was to promote deeper economic cooperation and integration, and to utilise this larger market to restructure the economies of its member states. This transformation would result in a move away from dependence on a few primary exports and help address constraints to protracted economic growth and socio-economic development.

Mauritius joined the community in 1995, becoming the twelfth member, and with the acceptance of Seychelles and the Democratic Republic of Congo in 1997, SADC grew to 14 members, respectively. However, the Seychelles withdrew from the community in July 2003. One of the reasons for withdrawal include amongst others, the cost of abiding by the protocols (Rossouw, 2006).²⁴ In 2005, Madagascar²⁵ became the 15th SADC member and in

²⁴ Costs arose from the previous arrangement that required an equal subscription (contribution by each member state) of US\$ 800 000 per annum. This placed an unequal burden on the smaller countries like Seychelles and forced them into giving notice of membership and 'non-participation' of the DRC due to financial arrears. This has since changed under the Regional Indicative Strategic Development Plan that saw the reorganisation of member subscriptions and the development of a new subscription formula based on size of GDP and the ability

2006 the Seychelles has announced that it will re-join SADC to be in line with the increasingly globalised world. Figure 2.1 gives a cartographical presentation of the SADC region.

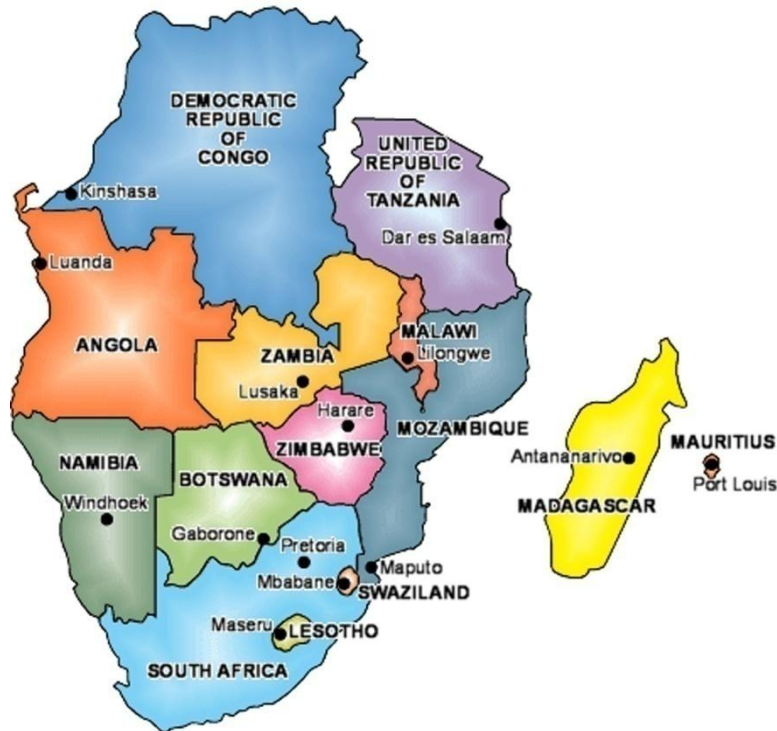


Figure 2.1: The SADC region.

Source: Oosthuizen (2006).

SADC states envision a region characterised by economic well-being, achieved through the improvement of the standards of living and quality of life of its citizens. This shared vision anchors on the common values, and principles, as well as on the historical and cultural affinities that exist between the people of southern Africa (SADC, 2008). The regional grouping also seeks to achieve freedom, social justice and to attain peace and security (Oosthuizen, 2006). Inextricably linked to this is the need for sustainable food security,²⁶ which led to the formation of the Directorate of Food, Agriculture and Natural Resources (FANR) that deals specifically with issues concerning food security. Its vision is in line with

to pay. Under the new arrangement, South Africa pays 20% of the budget, while the smaller countries pay a minimum of 5% (Mills, 2000).

²⁵ At the time of writing (December 2012), Madagascar's membership is currently suspended after the *coup d'état* that saw the ousting of Marc Ravalomanana by Andry Rajoelina that occurred in January 2009.

²⁶ The overall goal of the Directorate is to improve food security and foster economic development. To achieve this goal, the Directorate proposes policies that develop, promote, coordinate and facilitate programmes which aim to increase agricultural productivity, sustainable natural resource utilisation and trade (SADC, 2008).

SADC's vision of a region in which all people have access to adequate nutritious food for an active and normal life (SADC, 2008).

2.2 Maize Production Characteristics

The International Grains Council (2011), estimated world maize production for the 2010/2011 season to reach 826 million MT, and forecast 855 million MT for the 2011/2012 season. Historically, the larger proportion of total global maize production (approximately 75%) is yellow maize, and the remaining 25% comprises of white maize, a position that has not changed significantly since the 1990's. Important to this study is the fact that consumers in southern Africa have shown a strong preference for the grain staple white maize, a commodity that is not widely traded on world grain markets (Trueblood, Shapouri, and Henneberry, 2001).

2.2.1 Africa's Maize Production

According to FAO (2012) data (depicted in Figure 2.2), Africa's maize production has been on an upward trend between 1961 and 2010, with relative high variability between 1981 and 1996. This variability was driven mainly by a decline in southern Africa's²⁷ maize production figures and to a lesser extent a reduction in eastern Africa's²⁸ maize production. According to FAO (2012) data the average annual growth rate of maize production in the west²⁹ and middle Africa³⁰ region for the period between 1961 and 2011 was 4.91% and 2.48% respectively. While in eastern and southern Africa, production experienced a growth of 2.4% and 1.09% correspondingly (FAO, 2012). In the period 1961-2010, northern Africa³¹ experienced an average annual growth in production of 2.71%.

Since the 1970's east Africa and southern Africa have been the dominant producers of maize, with the southern African production oscillating around the 10 million MT post 1970, and

²⁷ FAO defines southern Africa as Botswana, Lesotho, Namibia, South Africa and Swaziland.

²⁸ FAO defines eastern Africa as Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Ethiopia PDR, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Réunion, Rwanda, Somalia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

²⁹ FAO defines western Africa as the following countries: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo

³⁰ Middle Africa refers to Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Gabon and Sao Tome and Principe.

³¹ Northern Africa refers to Algeria, Egypt, Libya, Morocco and Sudan (former).

east Africa maize production surpassing the 20 million MT mark in 2009 and 2010. This comes as no surprise given that maize is the staple food of approximately 25 million households in these two regions. As Figure 2.2 shows, western Africa has gained in prominence as a maize producer (post 1983) and by 2005 western Africa exceeded southern Africa as a producer of maize. North and middle Africa did not produce over 10 million MT during the period under consideration.

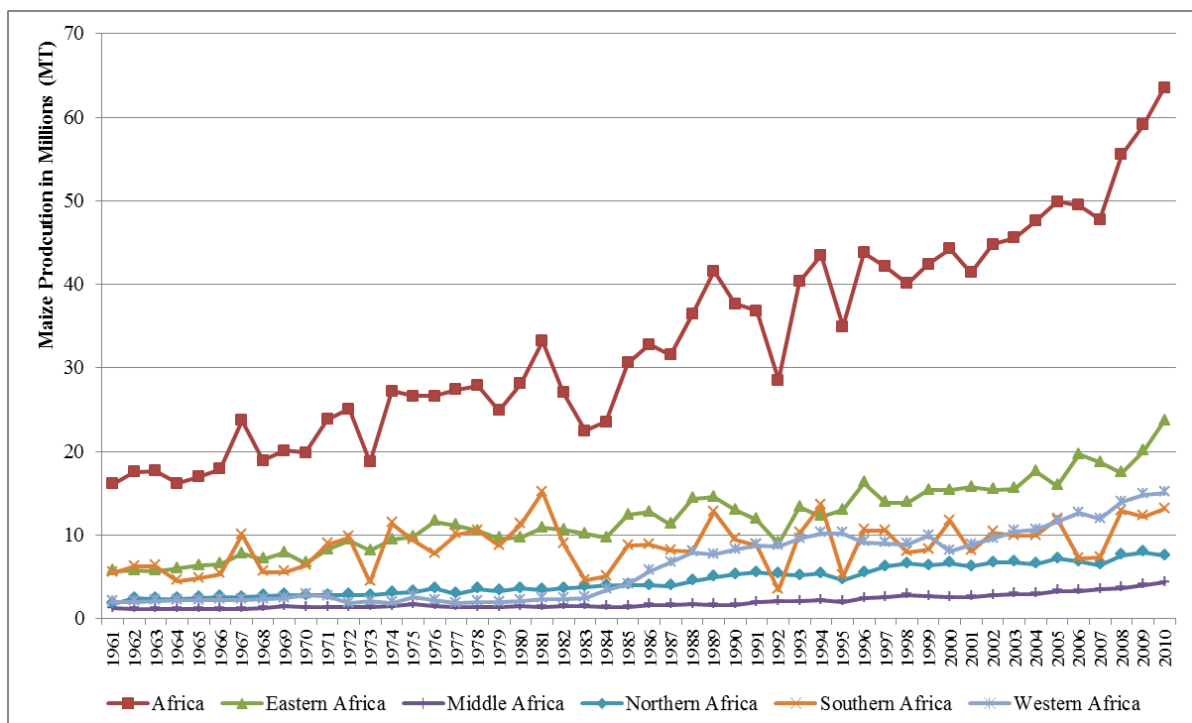


Figure 2.2: African maize production patterns from 1961 to 2010.

Source: FAOSTAT (2012).

2.2.2 Southern African Maize Production

Maize is an important food crop in the southern African region. A number of studies have intrinsically linked overall food security in southern Africa, principally at the national level, to maize production (Njukia, 2006; Mano *et. al.*, 2003). Given the importance of maize grain, a fair amount of study has gone into detailing the production, consumption, import and export patterns of most southern African countries, which is epitomised in the maize balance sheets. Figure 2.3 summaries the net grain position of the SADC countries (1995-2005). South Africa had an average maize grain surplus of nearly two million MT, a total that is greater than the rest of SADC countries' cumulative maize deficit. This implies, on average, that South Africa is capable of providing maize for the region. The maize production landscape seems to be changing, though, with Malawi, Zambia and Mozambique emerging as net

surplus grain producers, while Zimbabwe (a former surplus grain producer) has moved to a deficit position during 1995-2010 period.

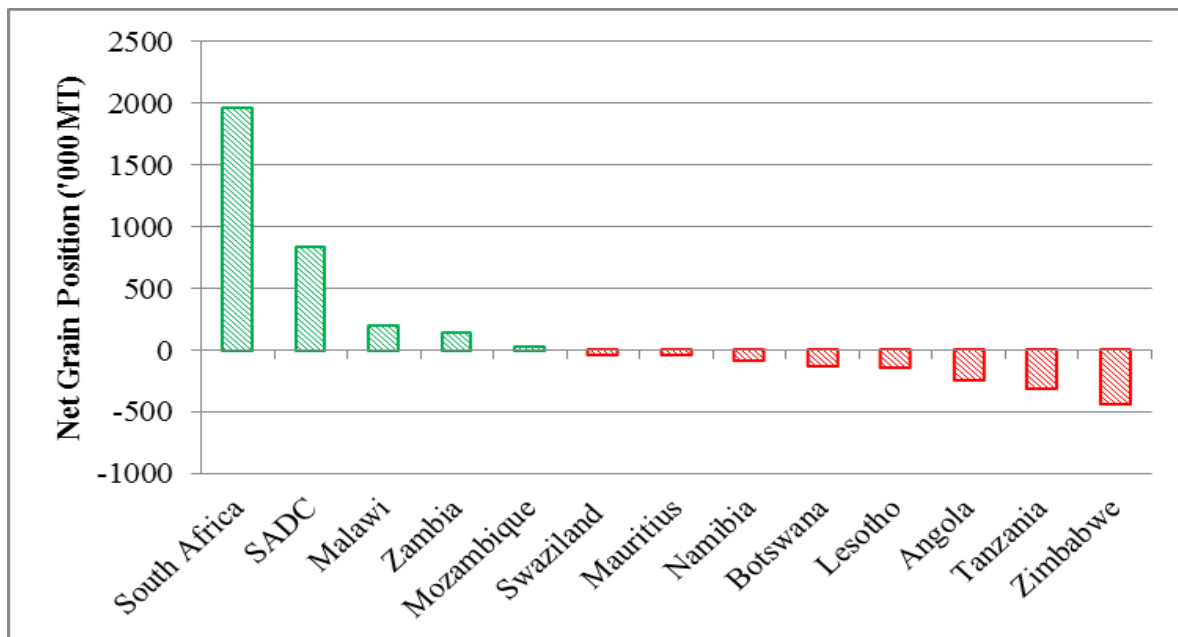


Figure 2.3: SADC countries' average net grain position, 1995-2010.

Source: Author's calculation using SADC (1995-2007; 2009 and 2010)³².

For ease of reading, the SADC countries have been grouped into four groups listed below

- 1) Net surplus maize states (South Africa, Malawi, Zambia and Mozambique),
- 2) Minor deficit states (Swaziland, Mauritius, Namibia and Botswana),
- 3) Severe deficit states (Lesotho, Angola, Tanzania and Zimbabwe).
- 4) The final grouping includes those countries that have data constraints (Democratic Republic of Congo, Madagascar and Seychelles).

The following sections will first focus on the importance of the agricultural sector to these countries (taking in to consideration the contribution of the agricultural sector to GDP and also the agricultural sector employment absorption) and then move to the importance of maize as a food crop and finally comment on the trends in production in the context of the aforementioned groupings.

³²This summary excludes the DRC, Madagascar, and Seychelles due to data constraints. The series was constructed by compiling the trade data of the various years ranging from 1995-2007, 2009 and 2010. The series has a missing year (2008) and the average of the preceding and following year (2007 and 2009 respectively) was used as a place holder for the purposes of continuity.

2.2.3 Net Surplus Maize States

The countries that were found to have an average net surplus in the period 1995-2010 were South Africa, Malawi, Zambia and Mozambique. The surpluses ranged from 140 000MT to a little under of 2 000 000MT.

2.2.3.1 Importance of the Agricultural Sector to the Economy

Agriculture contributed on average 35% to Malawi's GDP over the period 1990-2009, and in the period 1990-2011 employed an average of 34% of Malawi's total population (see Figure 2.4). In 1990 agriculture's contribution to GDP was 45% and with the exception of the 1993 record 48.9% contribution, the agricultural sector's contribution to GDP decreased steadily to 25.08% in 1994. From 1995 the agriculture sector's contribution to GDP progressively improved and since 1995 remained between 30% and 40% per annum.

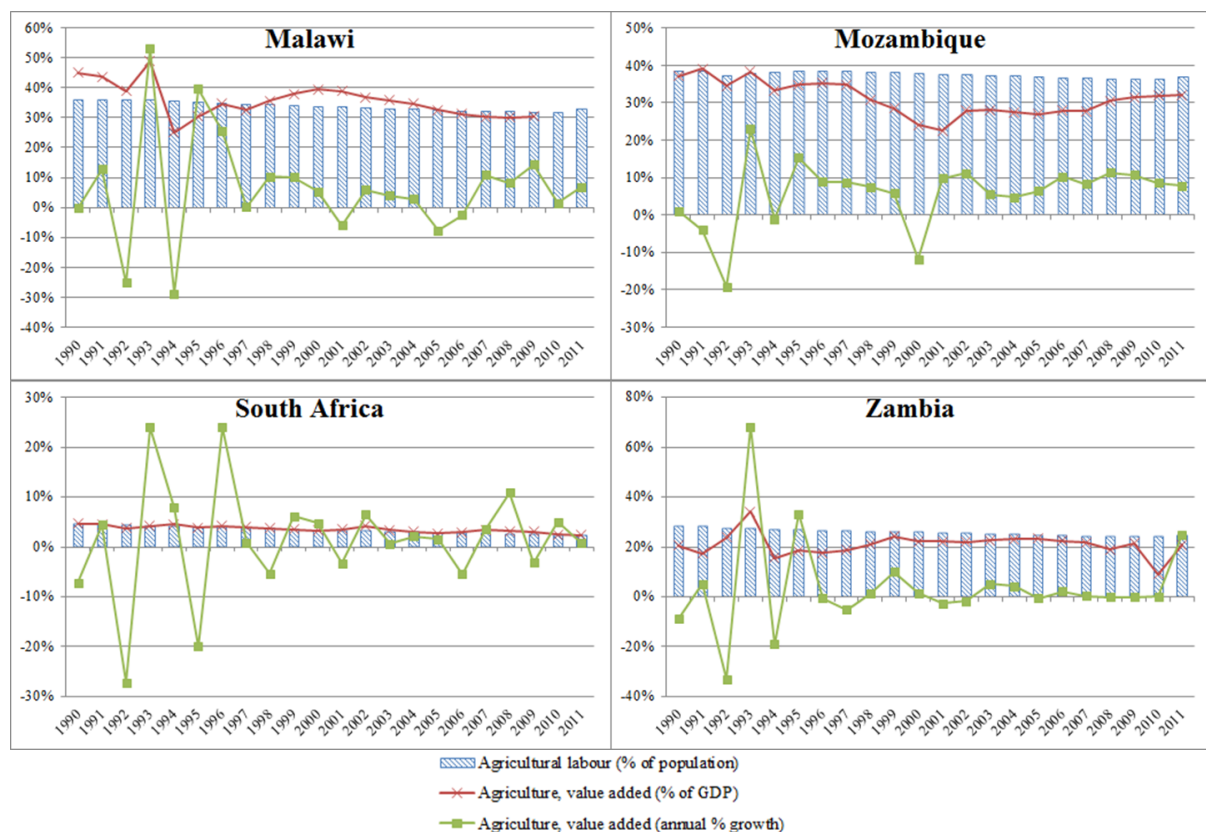


Figure 2.4: Net surplus countries' agricultural value added as a percentage of GDP, 1995-2010.

Source: Author's calculations based on World Bank (2012) and UNCTAD (2012).

In addition to this, agriculture provides 64% of total income of the rural population and contributes 90% to foreign exchange earnings (Masanganise, 2009). Agriculture also supplies

in excess of 65% of raw materials to the agro-industry.³³ The agricultural sector itself is represented by two main farming regimes; the smallholder component and the larger estates, a scenario that is slightly different to that of Mozambique.

The agricultural sector in Mozambique is marginally different to Malawi in that the bulk of the producers in Mozambique agricultural sector consist of small farmers that contribute 95% of agricultural GDP, with the balance coming from a relatively small number of medium and large commercial farms (Nankani, Baxter, Scobey and Perumalpillai-Essex, 2006). Agriculture is an important sector in Mozambique's economy and over the period 1990-2011 on average accounted for 31.12% of GDP (see Figure 2.4). Between 1997 and 2001, the contribution to the GDP seemed to take a downward trend (Figure 2.4), only to rebound significantly in 2002 and the share of agriculture in the GDP oscillating around the 27% mark between 2002 and 2007. Mozambique's agricultural sector is an important income and a food source for about 80% of the population particularly in the rural areas with approximately 73% living in the rural areas (Zavale, Mlay, Boughton, Chamusso, and Chilonda, 2011). In the period 1990-2011 agricultural sector employed, on average, 37.55% of Mozambique's total population, a significant proportion when compared to South Africa's agricultural employment.

In South Africa, agriculture's importance as an employer and means to an income is significant, accounting for employing a little over 1.1 million people in 2011 (see Addendum 1 Table 1). The relative importance of agriculture in the economy has however been declining over the long term as evidenced by the reduction in agriculture's contribution to GDP from 4.63% in 1990 to 2.4% in 2011 (see Figure 2.4). South Africa is among the world's leading exporters of agro-food products such as wine, fresh fruits and sugar; with the EU the largest agricultural importer of South African exports, absorbing almost half of the country's agricultural exports (Mtanga, 2012). According to Mtanga (2012) agricultural products accounted for 5.4% of South Africa's total exports in 2011. Over the years South Africa's reliance on agriculture as a contributor to GDP has dwindled somewhat, a situation that is different to that of Zambia.

³³ From the figures it is evident that agriculture is the backbone of Malawi's economy. Beyond the figures, agriculture constitutes an essential element of Malawi's social fabric.

Zambia's agricultural sector is pivotal to the country's economic growth, particularly in the face of declining mineral output. The sector generated on average of 20.97% of Zambia's GDP between 1990 and 2011, (see Addendum 1 Table 1). For most of the years in the series the agricultural sector contributed at least 20% to GDP (see Figure 2.4), with the exceptions to 1992, 1993 and 2010. Agriculture employed on average over the period 1990-2011 a little over a quarter (25.71%) of Zambia's population, (see Addendum 1 Table 1). According to Lekprichakul (2008), Zambian agriculture consists of mixture of small land holders and large to very large scale corporate farmers. In this mix, 85% of farming households hold less than 5 (five) hectares of land and employ relatively primitive production technologies (Lekprichakul, 2008). While the remaining 15% of large scale farmers cultivate 20-150 hectares of land and use mechanized farming techniques (Lekprichakul, 2008).

2.2.3.2 Maize Production Trends

Maize grows everywhere in Malawi and it is the main staple food commodity. It is the principal determinant of national and household food security in terms of availability and accessibility (Jayne, Sitko, Ricker-Gilbert, and Mangisoni, 2010). The long-term development of Malawi's domestic maize production shows an upward trend from 0.85 million MT in the early 1960s, approaching 2 million MT at the turn of the century (FAO, 2012) but declined up to 2005. Post the 2005 season and with the exception of 2008, the maize production increased yearly (Figure 2.5). Around two thirds of these increases occurring prior to 2006 could be attributed to an increase in the area under maize plantation (Zant, 2006). In response to the said maize production plunge in the 2004 and 2005 seasons with a consequential famine, the government introduced agricultural subsidies that have brought about a significant increase in production since 2005 (Jayne *et al.*, 2010). Malawi received in total 2 471 829 MT of maize aid in the period 1988–2008, with a third of that amount being disbursed in the period 1995–2005 (WFP, 2012). Between 1985 and 2003, cereal imports amounted to 65% of the total food import bill and were the single largest component of the total food imports for Malawi (Zant, 2006). As expected, food aid deliveries have significantly declined in general from 2006 onwards (Figure 2.5)

Maize is the staple food and principal cash crop in Mozambique (as is the case with Malawi). Unlike in Malawi though, maize production is dominated by smallholders who sell their surpluses to generate income. Due to the vast nature of the country, as well as the great disparities in weather patterns, trade between regions within the country is paramount to avert

food security crises. Figure 2.5 depicts the maize production trends as well as the trends in food aid deliveries. Following the 15-year guerrilla war, from 1977 to 1992, maize production suffered due to civil unrest and only improved after the first multi-party elections in 1994. Figure 2.5 indicates that from 1995 onwards maize production increased, while food aid deliveries continued on a downward trend. Mozambique had an average yearly maize yield of 1 216 721.25MT for the period 1995–2010 (FAO, 2012). Notwithstanding Mozambique's self-sufficiency in maize production, total maize aid distributed to Mozambique was over 3.2 million MT in the period 1988–2008 with 550 000MT being distributed in the period 1995–2005 according to WFP (2012). Mozambique still faces a number of infrastructural challenges but, given its climatic conditions, Mozambique has the potential to produce significantly more maize than it is currently producing and perhaps become one of the principle sources of maize in the SADC region.

Maize is the most important staple food grain crop in South Africa and is the second largest crop produced after sugar cane (Morokolo, 2011). The maize industry is important to the economy both as an employer and earner of foreign currency, with maize acting as a key raw material input in a number of manufactured products such as paper, paint, textiles, medicine and food (Morokolo, 2011). According to FAO (2012), the total South African maize production accounts for slightly above 50% of the maize production in the SADC region. South Africa only faced a critical shortage of maize in the drought years of 1991–1992 and had to increase maize imports (Morokolo, 2011). For most of the 1996–2010 period, South Africa was a net maize exporter (Figure 2.5), except for the years 1998 and 2005. The decline in production that occurred in 2006 and 2007 can be attributed to a decline in maize price as a result of increased supply from 2005.

In Zambia, maize is the preferred crop and accounts for over 70% of the value of marketed agricultural products (Govereh, 2007). Maize production in Zambia is particularly sensitive to weather shocks and as a result it has experienced high volatility, mainly because of the occurrence of a series of droughts and floods that have impacted Zambia's mainly rain fed agriculture (Lekprichakul, 2008). In the period under consideration (1995- 2010) Zambia has experienced 5 (five) droughts in the following seasons; 1994/1995, 1997/1998, 2000/2001, 2001/2002 and 2004/2005 (Lekprichakul, 2008). Floods in the south of Zambia in the 2007/2008 season seemed to have had the effect of depressing maize production somewhat (Figure 2.5), while 2009 and 2010 saw record maize production, surpassing the production

levels of preceding years in the period under consideration. The average annual maize production over the 1995–2010 period was 1 183 659MT (FAOSTAT, 2012).

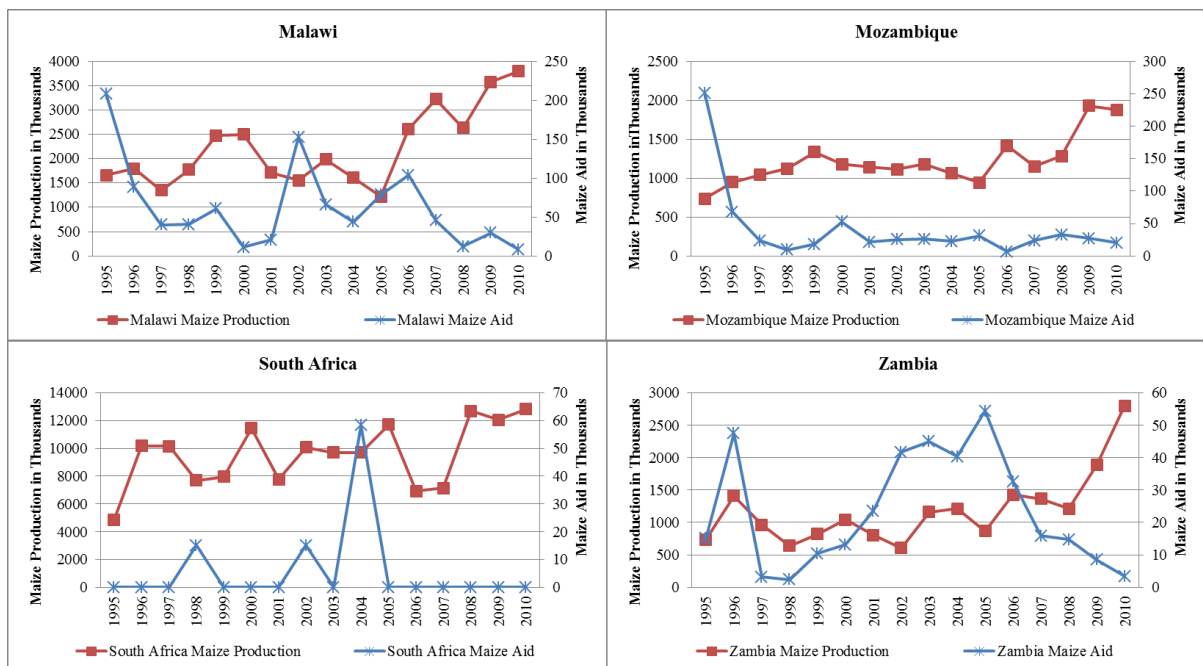


Figure 2.5: Malawi, Mozambique, South Africa and Zambia: State of net surplus maize production and food aid trends per country, 1995–2010.

Source: FAO (2012); WFP (2012).

2.2.4 Minor Deficit States

The countries that were found to have a minor deficit in the period 1995-2010 were Swaziland, Mauritius, Namibia and Botswana. The average deficit over the 1995-2010 period ranged from 40 000MT to 137 000MT. The following discussion will focus on the importance of the agricultural sector to these countries, and then move to the importance of maize as a food crop and comment on the trends in production.

2.2.4.1 Importance of the Agricultural Sector to the Economy

The Swazi agricultural economy is characterized by dualism, with the bulk of commercial arable estates generating more than 81% of the value of all agricultural output, which translates to an average of 10.38% of Swaziland’s GDP over the period 1990-2011 (see Addendum 1 Table 2). The agricultural sector employment figures in Swaziland have declined by 3.27 percentage points between 1990 and 2011 (from 16.1% in 1990 to 12.83% in 2011) and a major contributing factor to this decline could be the incidence of the AIDS

pandemic³⁴. The smallholder agricultural sector is mainly rain fed subsistence farming with maize as the predominant crop, although Swaziland and another minor deficit state, Mauritius are major exporters of sugar to the European Union under the Sugar Protocol of the Cotonou Agreement³⁵.

Sugar production was the backbone of the Mauritian economy, and efforts have been made to diversify the Mauritian economy with some success. At the time of independence in 1968, agriculture was the largest sector in the economy and accounted for more than 25% of GDP. However, the contribution of agriculture to the GDP declined from 12.85% in 1990 to 3.25% in 2011 (a decline clearly visible in Figure 2.6). Agricultural employment in Mauritius has been on the decline, from employing 7.08% of the total population in 1990 to 3.65% in 2011 (see Addendum 1 Table 2). A key industry in the agricultural sector is the sugar industry contributing 13.26% to Mauritius total exports in 2011 (UN Comtrade, 2012), and a large proportion of sugar exports were destined for the European Union³⁶. This is set to change as the European Union's internal sugar market reforms unfold. Mauritius relies heavily on imports to meet the ever-growing needs of its domestic food market, and in this vein has been classified as a net food importing developing country by the WTO.

Similar to Mauritius, agriculture also plays a critical role in rural livelihoods of Namibia, acting as the principal source of income to 11.57% of Namibia's total population in 2011 (see Addendum 1 Table 2). Agriculture has remained a pertinent sector of the Namibian economy although its contribution to GDP has been declining, from 11.72% in 1990 to 7.33% in 2011 (clearly illustrated in Figure 2.6). According to the World Bank's most recent figures (2009) approximately 47.13% of Namibia's land area is classified as arable (World Bank, 2012), although in areas of relative high rainfall, agricultural production is deemed to be risky.

³⁴ Swaziland has the highest estimated HIV prevalence in the world; 26% of the working-age population is estimated to be HIV positive (UNAIDS, 2010)

³⁵ Under the Sugar protocol, the EU undertook to purchase and import 1.3m tonnes of sugar annually at guaranteed prices from a number of countries that include the DRC, Madagascar, Malawi, Mauritius, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. These countries, in turn, committed to supply those volumes. This came to an end in 2009, and the EPAs have since opened the sugar market- allowing for all developing countries that can supply sugar competitively to do so. In order to ease the adjustment process, the European Union pledged to give development assistance to the tune of €1.25 billion between 2006 and 2013 to the aforementioned countries to assist towards, diversification, restructuring and adaptation of their economies.

³⁶ Sugar is seen as a multifunctional pillar of the economy, given its direct contribution to economic growth, rural stability, increased social welfare provision and the protection of the environment, (Sawkut, Verena, Boopen, and Vinesh 2009). As mentioned earlier, Mauritius is one of the former sugar protocol countries that have sought to diversify away from sugar production to other industries in different sectors in order to mitigate the change that will emanate from the European Union sugar reforms.

Namibia is characterized by a dualistic agricultural sector, where a strong commercial sector exists along with a sector comprised of households in freehold or non-freehold areas, where the main agricultural activity is for subsistence (Mushendami, Biwa and Gaomab, 2006)³⁷. Subsistence farming is confined to communal lands in the northern parts of Namibia.

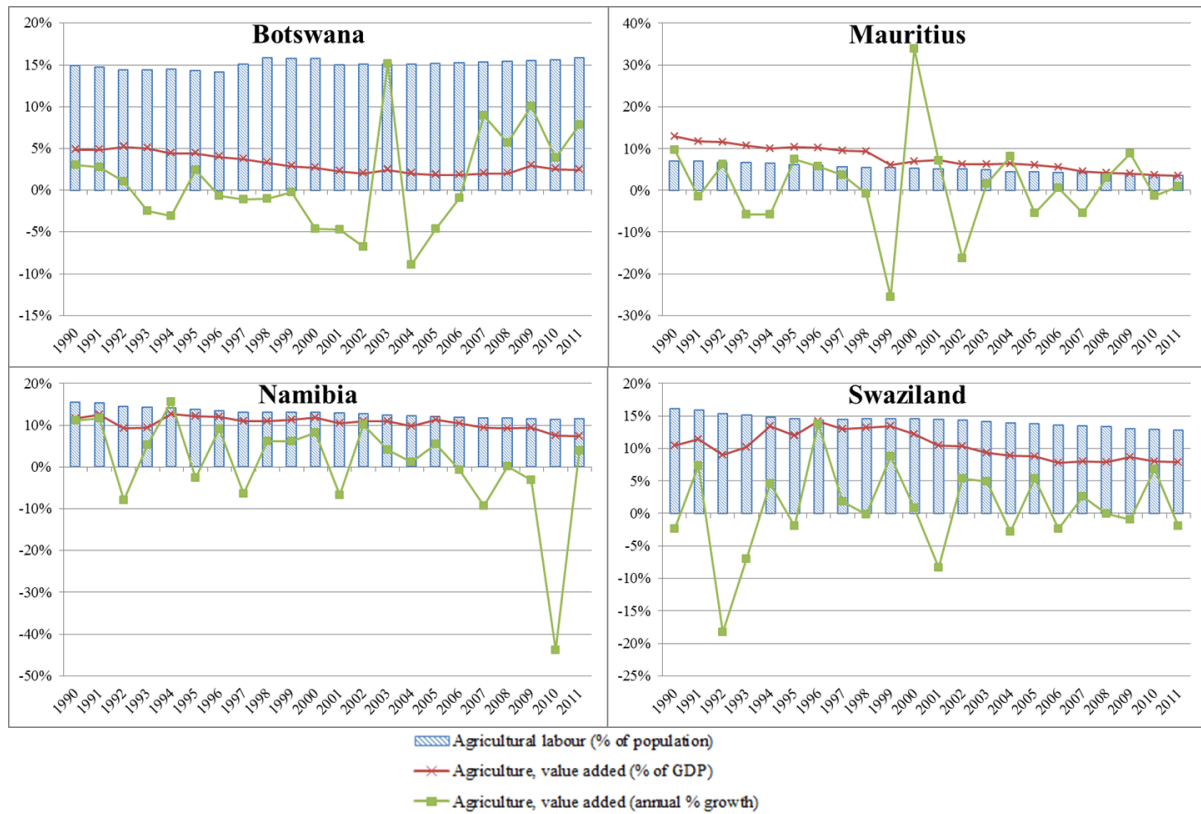


Figure 2.6: Minor deficit states’ agricultural value added as a percentage of GDP, 1995-2010.

Source: Author’s calculations based on World Bank (2012) and UNCTAD (2012)

Like Namibia, the agricultural sector in Botswana is composed of two distinct farming systems, the commercial and the traditional systems, which both engage in crop and livestock production. The traditional farming systems, which constitute the bulk of the agricultural production, are mainly for subsistence. The differences in commercial and traditional farming lie in the land tenure systems and the adoption/use of technology. The contribution of the agricultural sector to GDP in Botswana decreased from 40% at independence in 1966, to 3.16% in 2011(see Addendum 1 Table 2). This can be explained - in part - by the expansion of the mining sector as well as by the stagnation of the agricultural sector itself and recurrent droughts. Notwithstanding this, the agricultural sector remains vital as a source of income for

³⁷Freehold refers to the holding of a title deed on a property.

nearly 15.6% of the total population as of 2011 (see Addendum 1 Table 2). Due to an arid climate and lack of arable land, Botswana produces only 23% of its cereal consumption requirements and can afford cereal imports from the proceeds of its export-oriented mineral sector.

2.2.4.2 Maize Production Trends

Maize remains the most important food crop in Swaziland and the country struggled, especially since 1998, to achieve food self-sufficiency (Figure 2.7). The time series data in Figure 2.7 indicates that maize production in Swaziland has been on a downward trend. Access to adequate food supplies remains a serious issue for poor households, which could be ascribed to declining household incomes,³⁸ high unemployment rates, and the impact of HIV/AIDS (UNAIDS, 2010).³⁹ Moreover, the existing inefficient marketing and pricing policies, which work against poor consumers, have further worsened the situation. Swaziland had an average annual production of 92 533MT over the period 1990–2005.

Figure 2.7 depicts the production and food aid delivery patterns for maize in Mauritius for 1995–2010. Mauritius received a total of 63 654MT in maize food aid over the 20 year period 1988–2008 (WFP, 2012). However, no maize aid was sent to Mauritius in the period 1997–2010, as reported by the WFP.

As in a number of countries in southern Africa, white maize remains one of the most important sources of staple food in Namibia. White maize is one of the largest commercial grain crops produced in Namibia and in the period 1995–2010 the average maize production achieved by Namibia was 37 396MT (FAO, 2012). In the period 1995–2010 maize food aid peaked at 22 768MT (2002) and totalled to 30 541.2MT.

Maize provides a high percentage of the daily calories in most diets in Botswana, as is the case in Namibia and according to Lekgari and Setimela, (2001) (the latest work available) maize is the most popular carbohydrate source in Botswana. Botswana received a relatively

³⁸ Although maize prices dropped in the 2005 season by 10% compared to the previous season, the overall 45% price hike in 2002 continues to put a significant strain on Swaziland's households' budgets, making it increasingly difficult for the poor to purchase enough food for their needs.

³⁹ HIV/ AIDS pandemic has had an impact on food security mainly through the loss of household breadwinners as well as the loss in productive time as family members care for the ill and infirmed.

small quantity of maize food aid totalling 27 506 729MT over the 20 year period 1988–2008 (WFP, 2012). During 1995–2010 Botswana did not receive any food aid (Figure 2.7).

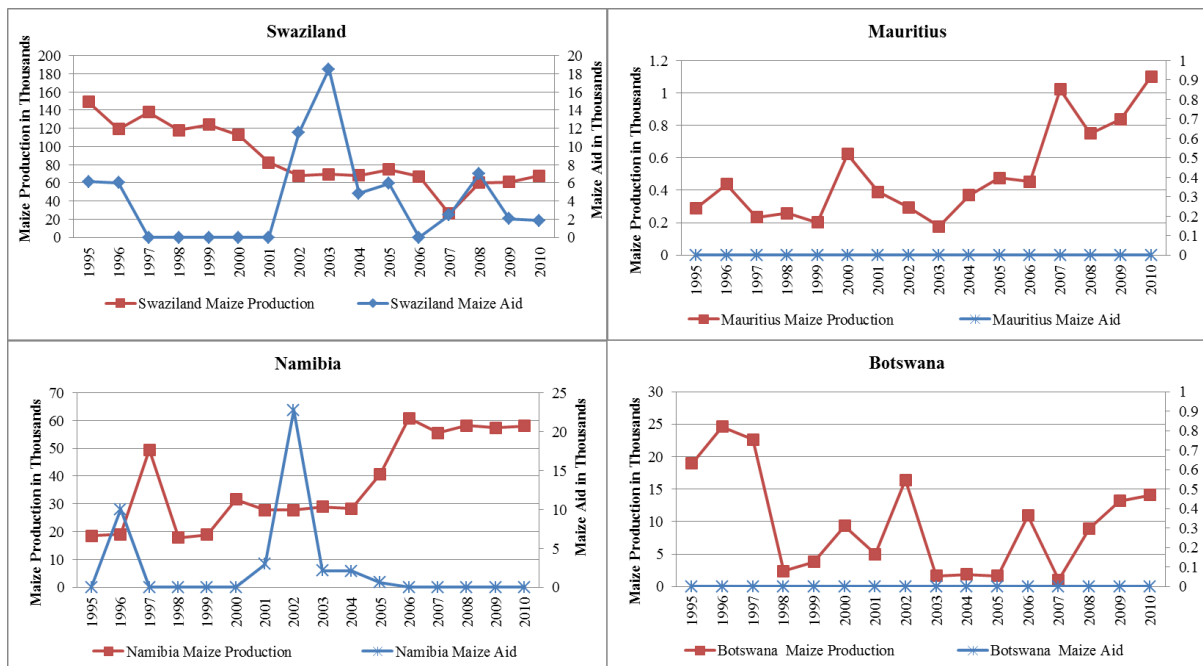


Figure 2.7: Swaziland, Mauritius, Namibia and Botswana: Countries with minor deficit maize production and food aid trends, 1995–2010.

Source: FAO (2012); WFP (2012).

2.2.5 Severe Deficit States

The Severe deficit states Lesotho, Angola, Tanzania and Zimbabwe were found to have an average deficit that ranged from 140 000MT to 500 000MT, respectively. As is the case with the other sub-groupings in the preceding text, the discussion matter on the aforementioned countries will focus on the importance of the agricultural sector to these countries, and then move to the importance of Maize as a food crop and comment on the trends in production.

2.2.5.1 Importance of the Agricultural Sector to the Economy

The discovery of revenue-generating oil in Angola has had the effect of seeing other sectors neglected, and the agricultural sector has not been spared this ill effect (Thompson, 2010). A once vibrant coffee exporter, the devastating 27 year civil war, destroyed most of the infrastructure and left the country a net food importer (Rwelamira and Kleynhans, 1998; Maritz, 2012)⁴⁰. That being said efforts to awaken the sleeping giant that is the Angolan

⁴⁰ The civil war in Angola began in 1975 (at the end of the war for independence from Portugal). The war featured conflict between two primary Angolan factions, the Communist MPLA and the anti-Communist

agricultural sector are underway as the government seeks to diversify the economy (Maritz, 2012). The Agricultural sector's contribution to the GDP declined from 17.94% in 1990 to 10.06% in 2011 as depicted in Figure 2.8. The decline could be as a result of the increase in the GDP brought about by the oil revenues coupled with the neglect of the agricultural sector. In light of this the agricultural sector plays a key role in the lives of Angolan people with 30.77% of the total population in 2011 making a living from the sector (see Addendum 1 Table 3) making this a key sector - a scenario that is similar to that of Lesotho.

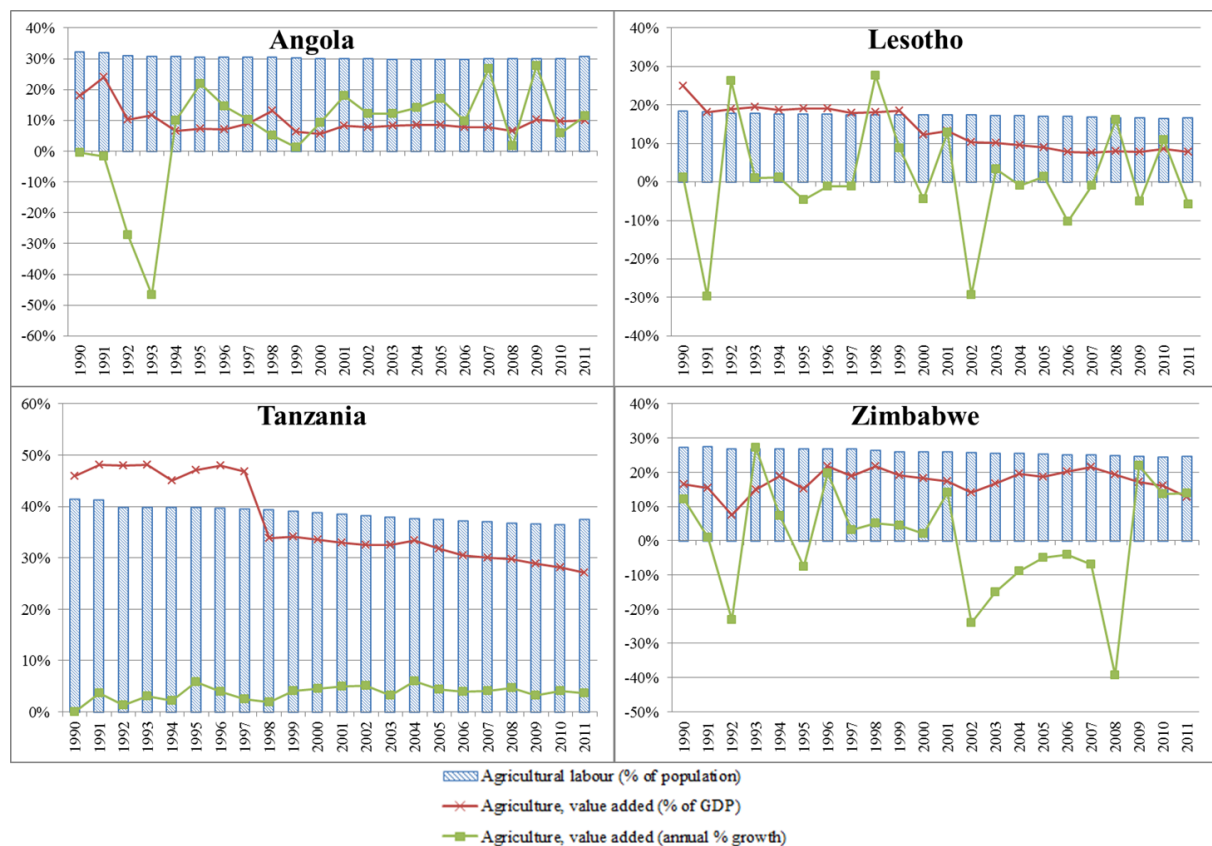


Figure 2.8: Severe deficit states' agricultural value added as a percentage of GDP, 1995-2010.

Source: Author's calculations based on World Bank (2012) and UNCTAD (2012).

The principal crops grown in Lesotho are maize, sorghum, and wheat, which are planted on nearly 85% of the cultivated area (Gwimbi, Hachigonta, Sibanda, and Thomas, 2012). Agriculture accounted for 7.76% of the GDP in 2011, a fall of 17.19 percentage points from 24.95% in 1990 (see Addendum 1 Table 3). Like Angola, Lesotho's agricultural sector still constitutes the livelihood of most rural residents and employs 17.36% of the Lesotho's total

UNITA. The civil war formally came to an end in 2002, leaving behind a trail of destruction and severe loss of life.

population; with Gwimbi *et al.* (2012) reporting that between 60% and 70% of Lesotho's labour force is employed by the agricultural sector.

The Tanzanian economy is based on the agricultural sector and it contributed on 27.11% to GDP in 2011, a decline of 18.85% from the 45.96% contribution to GDP in 1990 (Figure 2.8). In 2011 the agricultural sector also acted as a means to an income for about 38.67% of the total population (see Addendum 1 Table 3) and constituted 30% of exports (Ngaiza, 2012). The agricultural sector has linkages with the non-farm sector through forward linkages to agro-processing and provides 65% raw materials processed in the manufacturing sector (Ngaiza, 2012). According Kinabo, Bader, Palma, and Claude, (2012) Tanzania is described as having a dual agricultural economy that is characterised by a smallholder subsistence sub-sector and a commercial sub-sector (large-scale farming), with the smallholder subsistence sub-sector being dominated by subsistence farmers that operate under rain-fed conditions increasing susceptibility to climatological shocks (Kinabo, *et al.*, 2012).

Agriculture is the backbone of Zimbabwe's economy and underpins the socio-economic existence of the majority of the people of Zimbabwe (Maiyaki, 2010). The significance of the agricultural sector is epitomised by the provision of food, employment, and foreign exchange to the people of Zimbabwe and the economy (Kapuya, 2011). On average the agricultural sector provided jobs for approximately 25.99% of Zimbabwe's population (see Addendum 1 Table 3) in the period 1990-2011. In addition to this, the agricultural sector's contribution to GDP declined by 3.62 percentage points from 16.48% in 1990 to 12.76% in 2011. The largest contributing factor to this decline could be the debilitating economic climate that reigned in the land reform era after 2000 that led to the development of hyper inflationary economic environment. The major fluctuations in the contribution of Agriculture to GDP were in 1992 and 2002 the years that Zimbabwe experienced severe droughts, revealing the sector's sensitivity to climatological shocks (see Figure 2.8).

2.2.5.2 Maize Production Trends

Maize is the staple food crop in Angola. In southern Angola maize is consumed in different forms, while in the northern part of Angola where cassava is the dominant crop, maize is consumed green (Kiakanua, Chichicuhua, Pedro, Nzambi, and Jezo, 2011). Maize production is concentrated in Huambo, Benguela and Bié, where maize constitutes close to 40% of total crop production (Kiakanua *et al.*, 2011). In addition to this, maize is seen as a dual purpose crop produced for both subsistence and for market. Figure 2.9 depicts Angola's trends in

maize production and food aid delivery for 1995 to 2010. It is evident that maize production has experienced a general upward trend, as is expected, given the country is undergoing a post war agro-industry revival. For the period 1995–2005, the amount of maize aid that Angola received never exceeded the 200 000MT mark and beyond the year 2003 there has been a sharp decline in maize aid delivered. Angola shows potential in maize production and given the current maize production trajectory, Angola could be a net exporter of maize. This can only occur if there is political will from the policymakers to develop the sector and if maize production takes centre stage in the policy debate.

Maize is seen as a staple crop in Lesotho, but the production of maize is severely limited by Lesotho's topography which is characterised by limited and shallow soils on steep slopes with variable climatic conditions⁴¹. As a result maize production has suffered considerably, with the production volumes showing high variability as depicted in Figure 2.9. This could be attributed to a number of factors that include; lack of access to yield enhancing technologies/inputs, severe land degradation (as a result of overgrazing - a consequence of poor grazing management and soil erosion and associated declining fertility due to unsustainable farming practices) as well as increasingly persistent climate change-induced disasters (Mufunda, 2012). From these trends it appears that Lesotho is perennially facing a maize deficit and needs food aid in order to meet national food security requirements. Over the 20 year period 1988–2008, Lesotho received a total of 108 221 169MT of maize food aid (WFP, 2012).

In Tanzania, emerging farmers are increasingly important and contribute towards the agricultural sector GDP through the production of high value horticulture/floriculture for export (SADC, 2011). Large scale enterprises produce beverage and/or industrial crops such as tea, coffee and sisal. Finally, urban and peri-urban agriculture has also emerged as a household food security measure to cultivate produce for the immediate local market (SADC, 2011). Tanzania has almost always been able to meet its subsistence requirements and has managed to sustain a steady rise in maize production, with an annual average yield of 2 688 390MT over the period under investigation. The food aid that was distributed in Tanzania was probably meant for the vulnerable groups that were unable to purchase food on the domestic market.

⁴¹ An example of Lesotho's climatic variability is exemplified by the floods that led to reduced maize yields in the 2010-2011 season and the drought that followed in the 2011-2012 season (Mufunda 2012).

The average yearly maize production in Zimbabwe fell from 1.88 million MT in the years 1994/95 to 1998/99 to an average of 1.30 million MT in the years 1999/2000 to 2002/03 (FEWSNET, 2004). This can be attributed in part to poor crop growing conditions over some of these years, especially the 2001/02 and 2002/03 seasons. The political unrest around commercial farm land within the country worsened the downward trend due to a drastic decline in the commercial farming sector, effectively rendering the country a net food importer. The political impasse in Zimbabwe has had a severe impact on maize production. Zimbabwe has, in the past been, referred to as the bread basket of southern Africa and on this basis there is no doubt on Zimbabwe’s ability to produce surplus maize. In order for Zimbabwe to return to its golden days of maize production, there needs to be a reinvestment in agriculture particularly that which can be described as soft infrastructure that is, research and extension services, resuscitation of financial support to farmers as well as extensive market reforms that will unlock private investment into maize production.

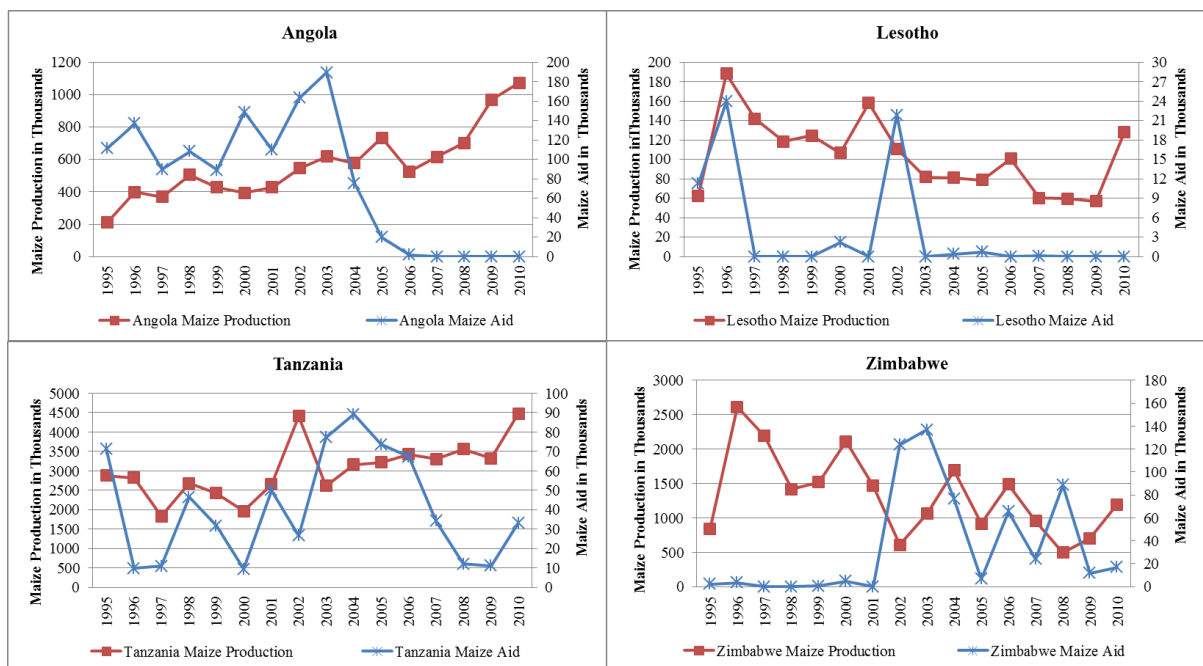


Figure 2.9: Angola, Lesotho, Tanzania and Zimbabwe: Countries with severe deficit maize production and food aid trends in the period 1995–2010.

Source: FAO (2012); WFP (2012).

2.2.6 Data Constrained SADC Countries

This section focuses on the discourse around the SADC countries that were identified to have data constraints (DRC, Madagascar and Seychelles). The discussion takes the same form as

the preceding sections – beginning with the description of the importance of the agricultural sector, followed by a discussion on the importance of maize to that country.

2.2.6.1 Importance of the Agricultural Sector to the Economy

The African Development Bank, (AfDB) the OECD Development Centre, the United Nations Economic Commission for Africa (UNECA), and the United Nations Development Programme (UNDP) (2012) all identify the DRC's agricultural sector as having great potential for growth but this potential has to date been weakly exploited. This failure to exploit the salient potential culminates in the country's failure to meet the country's own food needs. In 1990, the agricultural sector's contribution to GDP was reported as 30.96% and was on an upward trend achieving 57% of GDP in 1995 (see Addendum 1 Table 4). In 1996, when the political instability and civil unrest commenced⁴², the agricultural sector's contribution declined to 33.55% of GDP and experienced high volatility between 1996 and 2002 owing largely to the civil war. The agricultural sector's contribution to GDP then stabilised from 2003 onwards ending at 42.91% in 2009 (see Figure 2.10). In 2010 the expectation is that the agricultural sector's contribution to GDP is expected to rise even further as the DRC has undertaken to upgrade agricultural service roads and the implementation of plans for the development of export crops (AfDB, *et. al*, 2012). The agricultural sector, which comprises of 3 (three) farming systems namely, the traditional system⁴³, the intermediate system⁴⁴ and the modern system⁴⁵, provided employment for 21.31% of the population in 2011 a decline of 4.64 percentage points from the 25.98% in

⁴² After much looting and plundering of precious natural resources in the country and the inevitable destruction of infrastructure, the civil unrest came to an end in 2002. The war had a negative impact on agricultural production.

⁴³The traditional system is mainly for subsistence and produces 78% of the national production. Self-consumption needs are met through mixed farming (cassava, maize, sweet potato, rice, beans, etc.). Cash crops are also grown on a small scale and cattle is produced extensively with very low technology.

⁴⁴ The intermediate system differs from the traditional system in the organisation of farmers into groups. They rely on family labour and employ modern agricultural techniques (line planting, rational row spacing, use of disease-free varieties, fertilisers, pesticides, rational feeding of farm animals, etc.). The system plays an important role in disseminating modern agricultural techniques and encouraging traditional farmers to adopt innovations.

⁴⁵ The modern system is a highly mechanised system that plays an important role in the national economy as a source of employment and foreign currency revenue. All activities in this system are market-oriented, and there is a continuous effort to tweak production methods, employ agronomic innovations with and optimising inputs (hybrid seed, fertiliser, etc.) endeavouring for better yields. They grow mostly oil palm, coffee, cocoa, sugar cane, tea, cotton, tobacco, etc. for export and engage in animal husbandry through extensive ranching. Commercial farmers supply local and mostly foreign industries with raw materials.

1990. Peace, political stability, research support development and most importantly infrastructure⁴⁶ are key elements if the DRC is to achieve its full agricultural potential.

The Madagascan agricultural sector contributes on average 28.4% of the national GDP over the period 1990-2009, with very little variation (see Addendum 1 Table 4). Approximately 60% of the agricultural GDP is derived from crop production; a quarter of GDP is generated from animal husbandry and fishing, and 15% from forestry. Rice is the staple food crop, and is one of the major crops grown in Madagascar, making it the second largest producer of rice in Africa. Madagascar also produces roots and tubers for local consumption, as well as a range of industrial crops and cash crops. The agricultural contribution is severely limited because much of Madagascar's land is unsuitable for cultivation given the inconsistent rainfall, mountainous terrain, and extensive lateralization⁴⁷ (Rwelamira and Kleyhans, 1998). Approximately 5% of the land area is cultivated at any one time. That being said, the sector is responsible for employing, on average, a little more than a third (33.9%) of Madagascar's total population in the period (1990-2011) making the sector a key source of income (see Addendum 1 Table 4).

The agricultural sector in Seychelles has lost most of its economic importance over the last two decades, with the fisheries industry becoming an increasingly important economic pillar. In the period 1990-2001, on average 34.67% of Seychelles' total population was employed in the agricultural, fisheries and forestry sectors (see Addendum 1 Table 4). There is stern competition for agricultural land as tourism development, housing and other socio-economic activities gain prominence in the national debate, and it is estimated that approximately 500ha is presently under agricultural production. Seychelles has two major farming systems first consists of registered commercial farmers who have engage in their farming activities on pieces of land measuring 0.5ha on average. The farmers that belong to this first farming system either practice olericulture, or rear livestock and in most instances they practise both (mixed farming). The second farming system consists of home gardeners that produce for subsistence, and the surplus is bartered or sold to friends, relatives and neighbours. The most

⁴⁶ The limitations to growth attributable to infrastructure are further elaborated on in Section 2.3.

⁴⁷ Lateralization is defined as a high concentration of iron and aluminium-rich oxides within the topsoil. It is usually a result of the preferential removal of silica from the soil profile during extensive weathering. In the absence of humic acids, these stable oxides therefore accumulate in the soil. The exposure of these iron and aluminium sesquioxides to air results in hardening, through desiccation, to form a rock-like material called laterite.

prevalent agricultural produce grown in the Seychelles are fruits,⁴⁸ vegetables⁴⁹ and some root crops⁵⁰.

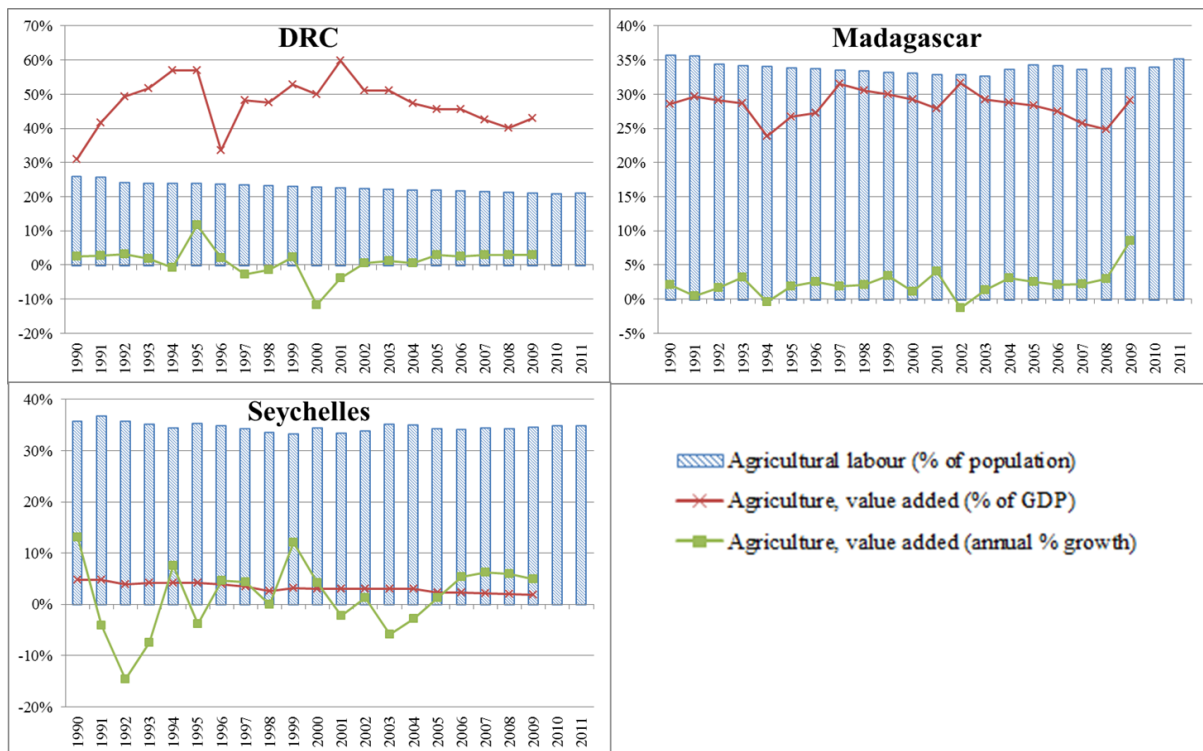


Figure 2.10: Data constrained states' agricultural value added as a percentage of GDP, 1995-2010.

Source: Author's calculations based on World Bank (2012) and UNCTAD (2012).

2.2.6.2 Maize Production Trends

Even in the presence of favourable climatic conditions, the DRC has faced major challenges in producing maize to its full potential, with the DRC producing on average of 1 152 685MT of Maize in the period 1995-2010 (WFP, 2012). Accordingly, there has been a steady flow of maize aid, a trend that was more pronounced in the 1993-1994 period that was immediately followed by a sharp decline that bottomed out in 1998. In 1999 the maize aid that came into the DRC began a after a continuous steady rise peaking at 207 434MT in 2009, as depicted in Figure 2.11. The DRC possesses the potential to become a force in the region, particularly in maize production, but continues to be hampered by civil unrest and a severe infrastructure backlogs that hinder the unlocking of that potential.

⁴⁸ Examples of popular fruit include papaya, banana and passion fruit.

⁴⁹ Examples of popular vegetables include pumpkin, eggplant, cucumber, and other cucurbits, tomatoes and leafy vegetables; and are produced in most instances in plastic green houses and open fields, with the leafy vegetable grown in shade houses.

⁵⁰ Some of the main root crops that are also grown include: cassava, sweet potatoes and a small amount of yams.

In Madagascar, rice is the most commonly cultivated crop, although maize production has been introduced in an attempt to diversify production, and it is gaining popularity. Figure 2.11 illustrates the maize production trend for the period 1995–2010. In the period 1995–2002, maize production oscillates around 172 193MT ending with a maize production figure of 171 950 in 2002. The following year maize production takes a major leap of 145 910MT to achieve a maize production output of 317 860MT, and continues on an upward trajectory till 2009, followed by a slight decline in 2009 and 2010 (see Figure 2.11). Maize production in Madagascar is expected to increase considerably following the signing of a 99 year lease by the Madagascan government and Daewoo in 2008 (Jung-a, Oliver and Blas, 2008). The deal will see 1.3m hectares of land on the island, dedicated for maize production, and with it the development of southern Madagascar- a portion of the country with virtually no transport infrastructure⁵¹ (Jung-a *et.al.* 2008). The amount of maize aid delivered to Madagascar summed up to 630 441MT over the entire period, and the annual disbursements did not exceed 70 000MT (WFP, 2012). This can be attributed to the fact that rice is the preferred staple food as opposed to maize.

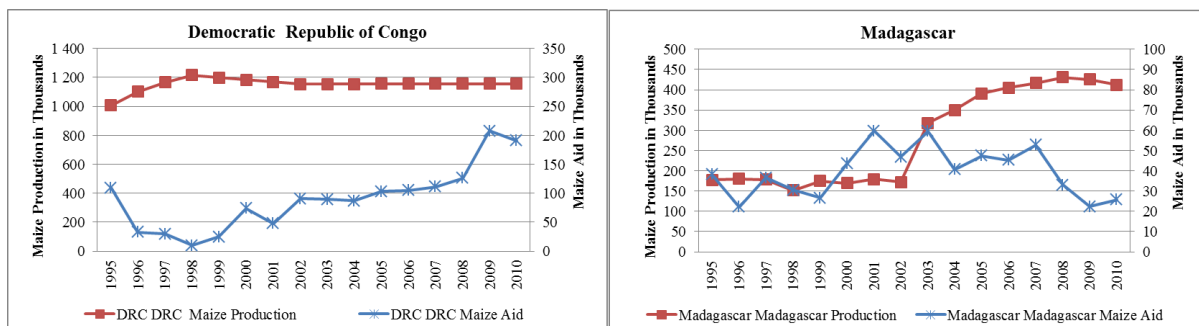


Figure 2.11: Madagascar and the Democratic Republic of Congo: Maize production and yearly total import and food aid trends, 1995–2010.

Source: FAO (2012); WFP (2012).

2.2.7 Summary of SADC Maize Production Trends

The above gave a detailed description of the various SADC countries’ maize production trends revealing the considerably changes in the structure of grain food supplies in the SADC region that occurred in the 1990s. In previous years, Angola, Malawi, Zambia, Zimbabwe, and South Africa were all net grain-exporting countries. South Africa continued as a net exporter of maize, and as of 2001, Malawi and Zambia have also achieved net grain

⁵¹ The deal to date has faced some challenges particularly after the *coup d’état* that ousted Marc Ravalomanana and gave Andry Rajoelina presidency of Madagascar in 2009 (Burgis and Blas, 2009). As of December 2012 the deal had not been finalised.

exporting status. A cause for concern lies in the failure by some governments to generate sufficient foreign reserves, leading to some countries becoming progressively reliant on food aid, particularly in the early 2000s. Figure 2.12 reveals the average contribution of individual SADC countries to total SADC maize production in the 1990–2010. From Figure 2.12, South Africa’s dominance as a maize producer in the region is apparent, while Tanzania and Malawi combined produce on average just more than quarter (27%) of the SADC region’s maize in the period in question. The remaining 23% of average production is shared by the remaining SADC countries.

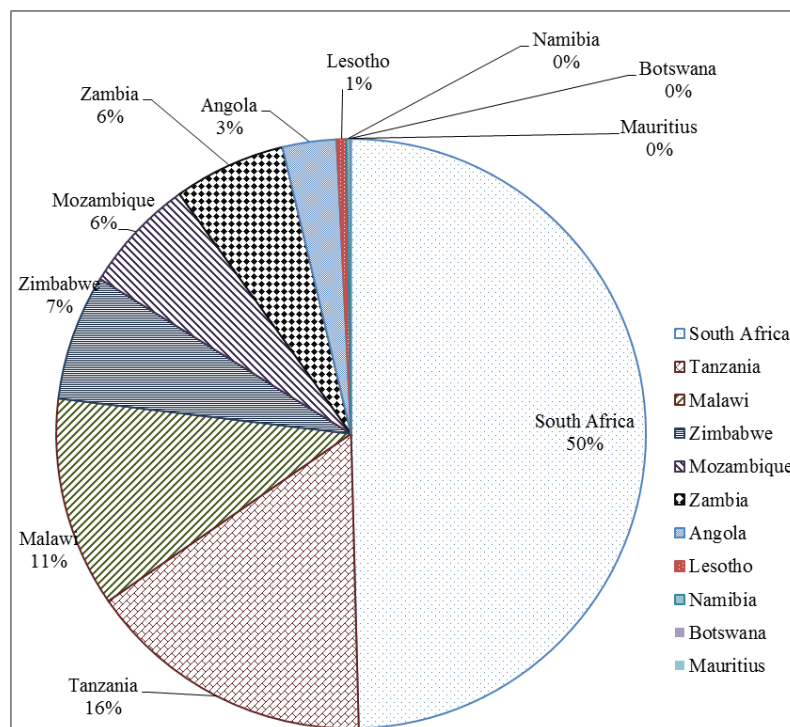


Figure 2.12: Average contribution of individual SADC countries to total SADC maize production, 1990–2010.

Source: FAO (2012).

2.3 Role of Transport Infrastructure in the SADC Region

International trade is defined as exchange of capital, goods, and services across international borders or territories. A key component of trade is transportation of the purchased item from the territory of sale across borders to the point of use. This leg of any international trade transaction relies heavily on a country’s infrastructure. Infrastructure consists of three elements: transportation systems, communication systems and energy. Transportation systems are critical for the purposes of moving goods and labour to facilitate production and trade, while communication systems transfer information and finance across borders. Energy

is required in the production and transportation of labour and goods to production and trade points. These elements and related services contribute towards the cost of trade, global competitiveness of a country and any efforts towards fulfilling developmental goals.

Africa is characterised by inefficient infrastructure and related services, resulting in increased production and transaction costs, reduced competitiveness and stunted economic growth (United Nations Economic Commission for Africa, 2010). It is estimated that the infrastructural deficit in a number of African countries reduces yearly economic growth rates by up to 2 (two) percentage points and productivity by 40% (World Bank, 2009 in United Nations Economic Commission for Africa, 2010).

Sound infrastructure facilitates the mobility of the means of production and traded goods, thereby improving productivity and reducing costs. United Nations Economic Commission for Africa (2010), reports that Africa's surface infrastructure severely limits intra-African trade growth potential mainly because it is inadequate as illustrated by the following figures:

- Surface transport (road) is the dominant mode of transportation across Africa accounting for 80% - 90% of passenger and freight transport and yet the road access rate in Africa is only 34%.
- Africa has sparse rail networks and limited interconnectivity; and
- Transport costs are among the highest in the world with transport costs in landlocked African countries accounting for up to 70% of the value of exports.

When compared to the rest of the developing world surface transport of goods in Africa is significantly slower and costs significantly more than in any other developing region. According to Ranganathan and Foster (2011) freight in the developing world can typically be moved at rates of between US\$0.01 and US\$0.04 per tonne-km. Africa's road transport costs and prices were found to range between US\$0.05 and US\$0.13 per tonne-km - rates that are well above the global benchmark (Table 2.1). Although Africa's transportation rates were significantly higher, freight movements within Africa's surface transport network were relatively slower (Table 2.1) when all delays were taken into account⁵². This is in spite of the relatively good condition of the road corridors (Table 2.1), although the delays are mainly attributed to the delays at borders (Ranganathan and Foster, 2011).

⁵² Measured in implicit velocity, Table 2.1

According to Ranganathan and Foster (2011), southern Africa’s economy grew by 1.2 percentage points per capita per year during 1995–2005, following infrastructure improvements. This growth was driven mostly by improvements in southern Africa’s communication systems, (growth of mobile telephony) with improvements in the transport system making a relatively smaller contribution. Ranganathan and Foster (2011) suggest that an improvement of southern Africa’s infrastructure to the levels of the strongest-performing country in Africa – Mauritius a SADC member state – regional per capita growth performance would be boosted by some 3 (three) percentage points.

Table 2.1: Relative performance of regional transport corridors in Africa, reported in 2009.

Regional Corridor	Length (km)	Road in good condition (%)	Trade density (US\$ Millions/km)	Implicit velocity* (Km/h)	Freight tariff (US\$/tonne-km)
Western	2050	72	8.2	6.0	0.08
Central	3280	49	4.2	6.1	0.13
Eastern	2845	82	5.7	8.1	0.07
Southern	5000	100	27.9	11.6	0.05

**Implicit velocity is the total distance divided by the total time taken to make the trip, including time spent at stationary ports, border crossings and other stops.*

Source: Teravaninthorn and Raballand (2009) in Ranganathan and Foster (2011).

The economic geography of the SADC countries is diverse, and has first world developed, globally connected economies, as well as small least developed and isolated economies. In between these two extremes is a healthy mix of low- and middle income countries. Because six of the 15 member countries are landlocked, sound transport infrastructure plays a critical role in facilitating intra-SADC trade in the region⁵³. In comparison to other African regional groupings, SADC has an extensive and relatively well-developed regional road network (as depicted in Table 2.2). In fact, nearly all road corridors in SADC’s road network are paved and are in relatively good condition; with the Lobito (Angola) – Nacala (Mozambique) corridor as the exception (Ranganathan and Foster 2011)⁵⁴.

⁵³ Transportation by road is the most dominant mode, accounting for between 80% - 90% of all freight and passenger movements among economic production areas and internal and international markets.

⁵⁴ The Lobito corridor, many years since the early parts of the twentieth century, was an important gateway for industrial and agricultural goods produced in Angola, DRC and Zambia. It provided a shorter route for exports and imports to Europe. All that ended with the commencement of the civil strife in two of the countries through which the corridor passes, namely, Angola and the DRC. This inevitably led to the neglect of that corridor, and has since left the corridor in a state of disrepair. The signing of the peace accord in Angola in 2002, has brought

According to Ranganathan and Foster (2011) most land locked SADC countries have at least two routes to access a port and that is usually through an east to west branch from the North-South corridor, for example, Lubumbashi has access to Dar es Salaam⁵⁵ while Lusaka has access to Dar es Salaam, (with 9.8% of the latter route in poor condition as depicted in Table 2.2). Lilongwe has access to Nacala in northern Mozambique, Harare has access to Beira in central Mozambique, and Gaborone has access to Walvis Bay in Namibia. That being said, most of these secondary options are rarely used, with Durban chosen as the preferred primary port.

Durban's status as the port of choice can be explained in part by the sheer size of the Durban port allowing the port to receive the bulk of the traffic from international shipping lines, while the smaller ports in the comparison corridors fail to receive as many direct calls from the international shipping lines. In addition to this the poor condition of the corridors through Mozambique and Angola serve as a disincentive to use the ports to get the freight to landlocked SADC states⁵⁶(Ranganathan and Foster 2011).

Table 2.2: Road conditions along major transit corridors in SADC countries, reported 2011.

Corridors	Condition (%)				Type (%)		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Gaborone to Durban*	97.1	0.5	0.0	2.0	99.5	0.0	0.5
Botswana	90.5	0.0	0.0	10.0	100.0	0.0	0.0
South Africa	97.4	0.5	0.0	2.0	99.5	0.0	0.5
Harare to Durban*	72.9	25.3	0.5	1.0	100.0	0.0	0.0
Zimbabwe	0.0	100.0	0.0	0.0	100.0	0.0	0.0
South Africa	95.8	2.0	7.0	2.0	100.0	0.0	0.0
Lusaka to Durban*	62.0	34.6	2.4	1.0	100.0	0.0	0.0
Zambia	26.1	31.3	42.5	0.0	100.0	0.0	0.0

new hope to the resuscitation of this once vibrant corridor. As of 2011, Ranganathan and Foster (2011) report that the Angolan portion of Lobito – Nacala corridor is still unpaved and is in bad condition.

⁵⁵ Lubumbashi does not have access to Lobito but as of 2011 Ranganathan and Foster (2011) report that there are plans underway to have the link restored.

⁵⁶ This may be about to change as there has been significant investment efforts are directed towards the improvement of infrastructure on the Walvis Bay route, that will see a marked improvement in the transport infrastructure.

Corridors	Condition (%)				Type (%)		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Zimbabwe	0.0	100.0	0.0	0.0	100.0	0.0	0.0
South Africa	95.8	2.0	0.7	2.0	100.0	0.0	0.0
Lubumbashi to Durban	59.0	35.3	4.9	1.0	100.0	0.0	0.0
Congo DR	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Zambia	46.2	28.4	25.4	0.0	100.0	0.0	0.0
Zimbabwe	0.0	100.0	0.0	0.0	100.0	0.0	0.0
South Africa	95.8	2.0	0.7	2.0	100.0	0.0	0.0
Lilongwe to Nacala	27.2	60.2	12.5	0.0	61.0	39.0	0.0
Malawi	78.4	18.5	3.0	0.0	100.0	0.0	0.0
Mozambique	0.0	82.4	17.6	0.0	40.2	59.8	0.0
Harare to Beira*	0.0	72.4	0.0	28.0	100.0	0.0	0.0
Zimbabwe	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Mozambique	0.0	46.4	0.0	54.0	100.0	0.0	0.0
Gaborone to Walvis bay	59.2	17.3	0.1	23.0	100.0	0.0	0.0
Botswana	50.7	5.1	0.0	44.0	100.0	0.0	0.0
Namibia	68.8	31.0	0.2	0.0	100.0	0.0	0.0
Lusaka to Dar Es Salaam*	68.9	19.1	9.8	2.0	100.0	0.0	0.0
Zambia	70.1	19.3	10.6	0.0	100.0	0.0	0.0
Tanzania	67.5	19.0	8.9	5.0	100.0	0.0	0.0

*Denotes portions of the TansAfrica highway in SADC countries.

Source: AICD calculations in Ranganathan and Foster (2011).

The development of road infrastructure may be measured in terms of total length in kilometres (km), density (km/1,000km), distribution (km/1,000 population) and quality (% paved). For purposes of this study, infrastructure is measured in terms of total length of paved roads. The length of paved roads for the various SADC member states are listed in Table 3.2 found in Chapter 3.

2.4 Sub-Regional Groupings within the SADC Region

As previously mentioned in Section 1.2, a clause in the GATT agreement permits WTO members to participate in RTAs under the guidelines specified in Article XXIV of the GATT 1994. As of December 2012, the WTO reports that there are a total of 242 RTAs that are currently in force, with over 50% participating in more than four RTAs (WTO, 2012).

A chief attribute of the wider southern Africa and east African trade setting is the comparatively substantial number of regional arrangements, groupings and organisations with similar objectives and common participants. It is because of this that the term “spaghetti bowl” has been often used to describe the nature of sub Saharan Africa agreements.⁵⁷ Chacha (2009) attributes the proliferation of numerous agreements to the advent of decolonisation, and the school of thought that regional blocks promote conditions for greater economic growth, by way of creating larger markets, improve competition and create economies of scale. This particular section discusses some of the various regionalism activities that SADC countries are party to. Lee (2004:53) defined regional integration or regionalism, as “the adoption of a regional project by a formal regional economic organisation designed to enhance the political, economic, social, cultural, and security integration and/or cooperation of member states.” Lee (2004) goes on to state that the integration process in sub Saharan Africa has been through three main avenues namely: market integration, regional cooperation, and development integration. Less developed nations in sub Saharan Africa sought to unite with the hope of improving the welfare of their citizens (Chacha, 2009). Table 2.3 lists the various regional integration initiatives that SADC states currently participate in.

⁵⁷Also see the work by the following Kose and Riezman, (2000); McCarthy, (1999) and Tsikata, (1999)

Table 2.3: Sub-Regional Integration Initiatives of SADC countries as of 2012*.

Country	EPA [†]	CMA	COMESA	EAC	ECCAS	EPA ^{††}	IOC	IOR-ARC	RIFF	SACU
Angola					X					
Botswana	X									X
D.R.C			X		X					
Lesotho		X								X
Madagascar			X			X	X	X	X	
Malawi			X						X	
Mauritius			X			X	X	X	X	
Mozambique	X							X		
Namibia	X	X							X	X
Seychelles			X			X	X		X	
South Africa		X						X		X
Swaziland	X	X	X						X	X
Tanzania	X			X				X	X	
Zambia			X						X	
Zimbabwe			X			X			X	

* To the Author's knowledge there have been no new RTAs signed by SADC outside of these mentioned above [†]SADC EPA ^{††}ESA EPA

Source: Adapted from Oosthuizen (2006) and updated to 2012.

As indicated in, Table 2.3 SADC has a number of different types of trade integration initiatives that include: Economic Partnership Agreements negotiated with the European Union, that is SADC EPA and the EAS EPA, (see EC, 2011); Free Trade Areas (COMESA, EAC, ECCAS); a customs union (SACU) and a number of non-binding regional trade initiatives that have been instituted to improve trade (IOC, IOR-ARC and RIFF). This is by no means an exhaustive list⁵⁸. Unfortunately, these agreements tend to overlap with each other, and additionally, contain a complex network of bilateral agreements resulting in conflict between the different organisations. A clear example of such a conflict is the implementation of the free trade area in COMESA and in SADC (Hess 2004). This causes problems, as a number of SADC members are also members of other regional initiatives.⁵⁹ Figure 2.13 gives a diagrammatic representation of the regional groupings and how they intersect. These trade initiatives are discussed at greater detail in Chapter 5.

⁵⁸ There is a range of bilateral trade agreements that SADC countries have entered into amongst themselves as well as Preferential Trade Arrangements that SADC countries fall under. These can be found at the WTO (2012) website (http://www.wto.org/english/tratop_e/region_e/region_e.htm). For more information on the SADC EPA

⁵⁹ An OAU study carried out to bring to light the possible problems of country participation in both SADC and COMESA revealed that countries that belong to both regional groupings simultaneously will face problems. The study goes on to state these problems are costs (human and financial) associated with membership, discord in policies particularly in the areas of rules of origin and customs procedures, and large information asymmetries at policy making and implementation levels (Geda and Kebret 2008).

Although all these regional integration initiatives are likely to have an impact on trade, this study focuses only on COMESA and SACU. As stated earlier in Section 1.7, the focus on these regional subgroupings is driven by the on-going negotiations aimed at creating a tripartite FTA that encompasses the three FTAs; i.e. EAC, COMESA and SADC⁶⁰. It is envisioned that the tripartite FTA will provide a seamless economic space of substantially greater magnitude which should support higher volumes of trade and investment. In addition to this SACU and COMESA are the only fully functional FTAs that involve at least two SADC countries for which the SADC TIPS database has is reliable reporter country data.

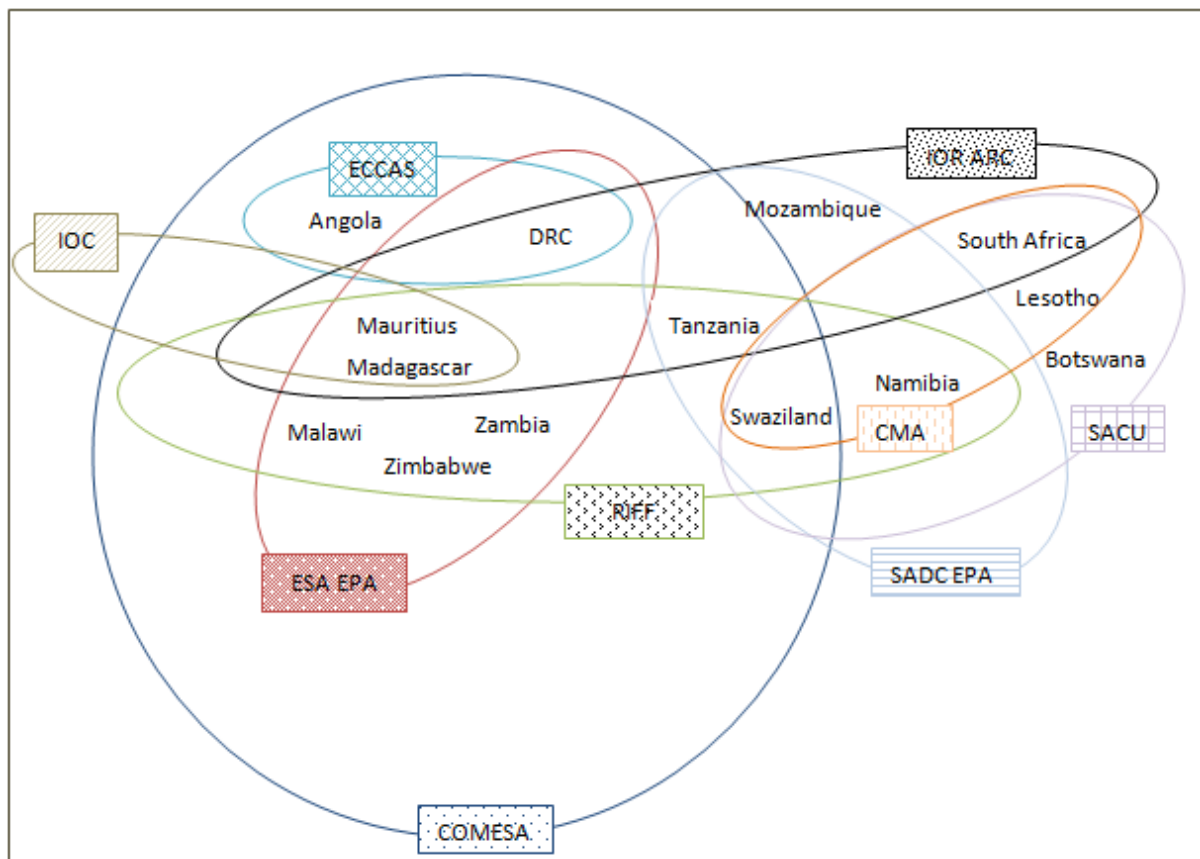


Figure 2.13: Diagrammatic representation of some of SADC regional groupings, 2012*.

**To the Author's knowledge there have been no new RTAs signed by SADC outside of these depicted above*

Source: Adapted from Oosthuizen (2006) and updated to 2012.

⁶⁰ By including SADC it *de facto* includes the SACU region as all SACU members belong to SACU. Tanzania is the only member of the EAC that is also a member of the SADC region, and as a result the model would not have been able to assess if being a member of the EAC would have had an impact on intra-SADC trade.

2.5 Summary

In summary, the description of the various SADC countries' maize production trends reveal that for the most part, grain production in the SADC region is severely hampered by a number of factors that include; climatological shocks (droughts and floods), the occurrence of civil unrest, political instability and limited arable land. The limitations in production have led to a greater reliance on imports and food aid. The maize production description also brings to the fore the shift in the centre of production in the SADC region with South Africa, Malawi and Zambia emerging as the major maize producers, who currently produce maize surpluses for the region. The discussion also revealed other potential producers namely; Angola, DRC, Madagascar, Mozambique and Zimbabwe. These could contribute towards the region's maize production, provided the production limiting factors are dealt with. Some examples of such limiting factors include infrastructure backlogs, civil unrest, political instability, the use of dated agricultural technology and a lack of investment in agriculture. Concerted, sincere effort, (by the respective countries leadership), to deal with these limitations in these countries could go a long way towards unlocking maize production potential in these countries.

SADC countries are party to numerous sub-regional agreements and these tend to overlap with each other, creating a complex network of bilateral and plurilateral agreements. Even in the face of all these regional agreements, the bulk of African trade is still North-South, with relatively paltry exchanges between African countries. This gives the sense that “real” integration on the African continent has not occurred and one would think a key cause of the stunted trade growth could chiefly be attributed to the infrastructure backlog that Africa is currently experiencing. However, there have been on-going negotiations that will see the creation of a tripartite FTA that encompasses the three FTAs, the EAC, COMESA and SADC. The harmonisation amongst these three regional groupings could see the development of a truly integrated eastern and southern Africa. Incidentally, high on the tripartite FTA agenda is the development infrastructure across the regional groupings, which should improve regional trade.

The next chapter introduces the Gravity Model (GM) and will develop the specification for a GM to estimate trade flows for regional maize trade.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 Introduction

This chapter concentrates on the gravity model (GM) and develops the specifications for a GM to estimate trade flows for regional maize trade. This chapter shows the available specifications of a GM, and takes the reader through the thought processes that led to the chosen model specification used in the study. The development of the model specification will begin with the GM model in its cross-sectional form and discuss the shortcomings of this model. Following this, the panel specification is introduced, and its shortcomings and advantages are also discussed. The chapter then focuses on the debate of using fixed and random effects in the model.⁶¹ Finally the chapter then discusses some the properties of the data used in the model.

3.2 Development of a Commodity Specific Gravity Model

The GM of international trade, comparable to other gravity models in social science, forecasts bilateral trade flows based on the economic sizes and distance between two trading units. Stated differently, the gravity model relates bilateral trade flows to the GDP levels of the countries and their geographic distance (Linders and Groot, 2006). Anderson (1979; 2011) praises the GM as probably one of the most successful trade analysis tool. Findings from Eichengreen and Irwin (1996) support this idea, concluding that the GM is the primary methodology for empirical studies of regional integration. Although Newton's gravity equation in physics inspired this model, its theoretical underpinnings is in fundamental economic theory⁶² as well as empirical specification have been proven and are well known.

The *log-linear equation* is the simplest and most often applied form of the gravity model:

⁶¹ This chapter relies on the work that was done by Augilar (2006) in her MSC thesis titled “*Trade Analysis of Specific Agri-Food Commodities Using a Gravity Model*” at Michigan State University. The full text is available at: http://www.aec.msu.edu/theses/fulltext/aguilas_ms.pdf.

⁶² For more detailed surveys on these theoretical works and recent contributions, the reader may wish to consult the studies of Anderson (1979); Helpman and Krugman (1987); Deardorff (1995), Evenett and Keller (1998); Harrigan (2001); Feenstra, (2004) for their theoretical relevance; and Anderson and van Wincoop (2000); Haveman and Hummels (1997); Santos Silva and Tenreyro (2005) for their empirical specification.

$$\ln Y_{ij} = \beta_0 + \beta_1 \ln(x_i) + \beta_2 \ln(x_j) + \beta_3 \ln(d_{ij}) + \sum_h w_{hij} + \varepsilon_{ij} \quad (1)$$

Where:

Y_{ij}	=	Trade volume from region <i>SADC</i> to region <i>j</i>
x_i and x_j	=	Distance from country <i>SADC</i> to country <i>j</i>
w_{ijh}	=	Dummy variables
ε_{ij}	=	Error term.

In Equation 1, the GDP is used as a proxy for the size of the country in question's economy, while the distance between two trading units proxies the importance of relative economic relationships and contiguity factors between the two trading countries. The inclusion of dummy variables in the model caters for the array of categorical variables such as the presence of special trade agreements, or other characteristics such as sharing of common borders. As Egger (2000) noted, Equation 1 is specified for cross-sectional data, and it excludes the effects of changes over time. As a result, the interpretation of the coefficients in the equation will be the combined effect within and between trading units (Egger, 2000).

Generally, *panel data* is preferred to cross-sectional data, mainly because panel data is richer and allows for the analysis of unobserved countries' effects, temporal aspects of trade and foreign trade dynamics, factors that would otherwise be collectively lumped in the error term and yet are the cause of variation (Greene, 2007). Földvári (2006) contends that Equation 1 is likely to suffer from omitted variable bias. A better specification of Equation 1 (in the presence of panel data) would be as follows:

$$\ln Y_{ij} = \beta_0 + \beta_1 \ln x_i + \beta_2 \ln x_j + \beta_3 \ln d_{ij} + \sum_h \gamma_h w_{ijh} + \sum_h \lambda_{tk} t_{tk} + c_{ij} + \varepsilon_{ij} \quad (2)$$

Where

t	=	Dummy variables for each period of time
c	=	Unobservable variable.

This specification of the model is able to clearly depict the relationship between variables over time and quantify the impact of business cycles – captured by the yearly dummy variables. The parameters in Equation 2 are elasticities of influence of the predictor variables, on the criterion variable, that is to say that, β_2 is the income elasticity of the j^{th} country (Aguilar 2006).

The introduction of variable c into the model is to capture time-invariant effects between countries. The treatment of time-invariant effects has been the subject of great debate between different scholars taking different approaches with no clear consensus on the appropriate treatment, which is whether to use fixed or random effects.⁶³ Random effects mean that c_i is perceived to be a random variable and becomes part of a composite error. The composite error term consists of two elements: the random intercept that is specific to a country pair or a specific time period, and the normal error term.⁶⁴ SADC trading partners vary quite significantly by their culture, religion, political philosophy, distance from one another, and many other factors, and it may be quite reasonable, therefore, to assume that the differences between them are randomly distributed, in a fashion similar to that of Mcpherson, Redfearn and Tieslau. (2000).

In *commodity-specific analysis* over a period of time it is not unusual that there will be instances where no trade occurs between two countries. This reality presents a complication that appears if significant proportions of zeros are present in the dependent variable. This complication is overcome by making use of a *censored regression model*, specifically the Tobit model, which is an empirical specification preferred in a number of GM studies.⁶⁵

⁶³ Fixed-effects estimation is defined as a method of estimating parameters from a panel data set. The fixed-effects estimate is applicable when one expects that the averages of the dependent variable will be different for each country pair/time period, but the variance of the errors will not (Greene 2004). Aguilar (2006) states that research in the GM context on the treatment of fixed and random effects is at best scanty.

⁶⁴ The random intercept that is specific to a country pair or a specific time period, and the normal error term has been found to be due to the presence of autocorrelation (Kennedy, 2003) and is a major disadvantage of the random effects model that shows that not all the off-diagonal entries in the variance-covariance matrix are zero.

⁶⁵ The Tobit model is often used to analyse data sets in which a substantial fraction of the observations cluster at zero (Linders and Groot, 2006). From the very definition, a Tobit model describes a situation in which part of the observations on the dependent variable is censored (unobservable) and represented instead by mapping them to a specific value, generally zero (Linders and Groot, 2006). Several studies have used the standard Tobit model to estimate the gravity equation with zero flows, including Soloaga and Winters (2001); Anderson and Marcouiller (1999); Rose (2004) and Aguilar (2006).

Aguilar (2006) identifies the solution of the occurrence of zero values as of primary importance to countries' maximisation problem, implying that no trade between the countries is the optimal choice. The use of Ordinary Least Squares (OLS) will lead to biased and inconsistent estimates. Gujarati (2003) suggests the use of the maximum likelihood estimation method. The model then takes the form:

$$\ln Y_{ijt} = \left(0, \beta_0 + \ln x_{ijt} \beta \sum_h \gamma_h w_{ijh} + \sum_h \lambda_{tk} t_{tk} + \varepsilon_{ij} \right) \quad (3)$$

where $t = 1, 2, 3, 4 \dots T$; $\varepsilon_{ij} | x_{ijt}, \varepsilon_{ij}, \beta_{ijl} \sim \text{NORMAL}(0, \sigma)$

The variables are defined as in preceding equations, but the term x_{ijt} consists of a vector of GDP and distance, while composite error term ε_{ij} consists of two elements: the random intercept that is specific to a country pair or a specific time period, and the normal error term.

Scholars such as Hsiao (1996), Abrevaya, (1997), Hahn and Newey (2002) and Wooldridge (2002) have argued that MLE in nonlinear models (such as the Tobit), would result in inconsistent and biased estimates. They believed this was amplified particularly when T is small and fixed. Greene (2004) maintains that if certain prerequisites are achieved, the Tobit model MLE is an adequate estimator.⁶⁶ Greene's (2004) study revealed that for the parameter estimates to be consistent and unbiased, the minimum time period must be longer than 5 (five) years, the number of countries to be included in the analysis should exceed ten and the proportion of zeros in the dependant variable must be at least 40%. Additionally, the explanatory variable can follow a normal Chi- squared or an auto regressive distribution with a single lag (Auto-Regressive 1).

3.3 Empirical Methods for Maize Trade Analysis

This section will give a brief discussion regarding the data utilised, highlighting the basic statistics trends and values of the independent variables, after which the empirical methods that were used in the study are reviewed.

⁶⁶ Greene (2004) used Monte Carlo simulations where there are different levels or forms of the critical characteristics of the model (length of period, the number of limited dependent variables and the distribution associated with the dependent variable).

3.3.1 Data

According to Greene (2004) the minimum requirements essential for the MLE of a specific commodity GM using panel data with some confidence are as follows:

- The data must cover a period longer than five years;
- More than ten countries are included in the analysis;
- The proportion of zeros in the dependent variables is greater than 40% (meeting the pre-requisite number of zeros to use a censored regression model); and
- The explanatory variables included in the model follow a normal Chi-Squared or AR (1) distribution.

This study analyses data for the period from 2000 until 2010 (a total of 11 years) and is based on trade data from a combination of data sources, namely TIPS SADC trade database as well as UN COMTRADE data. A total of 14 countries are included in the study with only eight countries considered as reporters countries.⁶⁷ The share of zeros in the dependent variable is a little over 63.7% and as such, the data meets the minimum requirements to use the Tobit model MLE as an estimator. The data set has a total of 1 430 observations.

The specific trade name of the commodity used in this study was “Maize (Corn)” (HS 1005) which excludes maize seed. The value of trade is measured in nominal US dollars (\$US). The dataset used in this study is compiled from a variety of sources which include Trade and Industrial Policy Strategies (TIPS) SADC trade database⁶⁸ as well as UN Comtrade⁶⁹. The World Bank database⁷⁰ was the source of population data and the agricultural sectors contribution to GDP. The maize aid grain data was sourced from the WFP online database⁷¹, and included in the study was both maize grain and maize meal. For maize meal, the grain equivalent was used. Distances from capital cities were sourced from the great circle distances between capital cities’ web page and are presented in Addendum 2 Table 1.

⁶⁷ The reporter countries that were the focus of the study were Botswana, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, United Rep. of Tanzania, Zambia and Zimbabwe. The decision was made based on the limited availability of reliable import/export data with other SADC countries over the specified period.

⁶⁸ <http://data.sadctrade.org/st>.

⁶⁹ <http://comtrade.un.org/db>

⁷⁰ <http://data.worldbank.org/data-catalog/world-development-indicators>

⁷¹ <http://www.wfp.org/fais/quantity-reporting>

The explanatory variables included in the model are agricultural GDP, reporter and partner population, maize aid, distances between capital cities of the trading partners, and total paved road (proxy for infrastructure). The model also included a number of dummy variables that captured the presence of a common border between the pair of trading countries, deficit net grain position and dummy variables for the pair of bilateral sub-regional groupings SACU and SADC.

Table 3.1 gives a summary of the population data, giving indication of the country's populations as of 2010 (World Bank, 2012). Included in Table 3.1 is the population's Annual Average Growth Rate (AAGR). From the table only Lesotho and Zambia experienced a negative AAGR in the period 2000-2010.

Table 3.1: Summary of SADC Population data for 2010 and the Average Annual Growth Rate between 2000 and 2010.

Countries	Population	
	AAGR in 2000-2010 (%)*	2010 ('000)
Angola	2.8	16 600
Botswana	1.3	1 858
D. R. Congo	2.8	60 600
Lesotho	-1.1	1 823
Madagascar	2.9	19 200
Malawi	2.8	13 600
Mauritius	1.0	1 253
Mozambique	2.5	21 000
Namibia	1.6	2 047
South Africa	1.6	47 400
Swaziland	1.5	1 145
Tanzania	2.5	39 500
Zambia	-0.1	9 986
Zimbabwe	0.8	13 200

*AAGR: *Average Annual Growth Rate.*

Source: World Bank (2012).

Traditionally, the GM uses the GDP as a proxy for output capacity in the exporting country, which would be perfect for studies that are interested in the aggregated total export data. However, for the purposes of this study the total GDP would actually overvalue the output capacity of the country in that particular commodity (Aguilar, 2006). In line with a precedent study by Aguilar (2006), an accurate proxy for the sectors' output capacity is the sectors' contribution towards total GDP, thus agriculture's contribution towards GDP would aptly be

a proxy for output capacity. The larger the agricultural sector's contribution towards GDP, the more likely it will have a positive synergistic effect on the sub-sectors and thus its associated variable will be positive (Aguilar, 2006).

The WFP (2012) reports aid in terms of quantities and not value, and all the other monetary terms in the GM are in nominal US\$. This necessitates the conversion of maize quantities into values, and in order to reflect the local value of the maize aid, the regional product price of grain⁷² and grain quantities were used in the model. Seeing that South Africa is southern Africa's largest white maize producer and is a major player in the SADC maize market and consequently has the ability to influence regional prices, the South African maize commodity price was used to reflect the regional price. The idea was to attach a value to the aid that would represent what the cost of that particular commodity would have been if sourced locally. For the purposes of this study, both maize grain aid and maize meal aid was used, in order to account for all the aid distributed to the countries. The maize meal was converted to the actual grain equivalent using a specific conversion factor calculated by the WFP (WFP, 2012). In addition to this the value of maize aid received for each country was subtracted from the maize import data for that country in order to avoid a case of double counting.⁷³

Distance between capitals was measured in kilometres and has been used in the past as a proxy transaction costs. Work done by Frankel (1997) suggests that the distance coefficient measures the relative importance of economic relationships between the reporter countries and those partner countries that are located far away, as opposed to those located nearby. The largest distance in this particular dataset was that of Mauritius and Angola, some 4 910 kms apart. The shortest distance between capital cities was between those of Swaziland and Mozambique, at 152 kms apart. Contained within Addendum 2 Table 1 are the distances between all the capitals within the SADC region. The assumption is that there is an inverse relationship between the distance between trading countries and the value of trade that occurs; put simply, the further apart a reporter and a partner country are, the less likely they are to have a relatively important economic relationship (in comparison to a partner country that is relatively closer to the partner country).

⁷² The commodity price data was sourced from FAO commodity price database.

⁷³ This was done because maize trade data does not differentiate maize imports that were purchased at market rates and imports that are brought into the country as maize aid.

As stated previously, transport infrastructure is a critical element of trade and a key component of trade is transportation of the purchased item from the territory of sale across borders to the point of use. This leg of any international trade transaction relies heavily on a country's infrastructure. Transportation systems are critical for the purposes of moving goods and labour to facilitate production and trade. For the purposes of this study, infrastructure is proxied by the average total length of paved roads that member states have. Table 3.2 lists the average value of paved roads for SADC member states in the period 2000-2010.

Table 3.2: The average length of paved roads in SADC member States (2000-2010).

Reporter Countries	Average length of paved road (2000-2010)
<i>Angola</i>	5 348.62
Botswana	8 410.03
<i>Democratic Republic of Congo</i>	2 793.65
Lesotho	1 041.13
<i>Madagascar</i>	5 779.93
Malawi	3 004.30
Mauritius	2 014.99
Mozambique	5 709.92
Namibia	6 031.25
<i>Seychelles</i>	478.28
South Africa	74 570.48
<i>Swaziland</i>	1 077.84
Tanzania	4 329.90
Zambia	6 459.00
Zimbabwe	17 419.75

The shaded cells reflect the values that were used in the model⁷⁴, while the italicised countries were excluded from the model.

Source: World Bank (2012).

An average total length of paved road was used because there was relatively no significant change in the road infrastructure over the 10 year period. One expects that as the road infrastructure network improves, so will trade. As such the infrastructure coefficient is expected to have a positive sign.

Incorporated into the model was the size of reporter and partner countries' population. This variable is meant to cater for the capacity of each of the countries to consume the maize

⁷⁴ The reporter countries that were the focus of the study were Botswana, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, United Rep. of Tanzania, Zambia and Zimbabwe. The decision was made based on the limited availability of reliable import/export data with other SADC countries over the specified period.

domestically. The assumption is that there is a positive relationship between the population and maize consumption; put simply, the larger the partner population, the more it will consume and will trade in years of limited maize production.

Following Coulibaly (2004), dummy variables RTA_{1t} and RTA_{2t} are introduced for the two RTAs that are under consideration in this study. These variables will give insight into the impact of the RTA on individual member countries. This method allows one to focus specifically on intra-bloc export trade creation (diversion) and net export trade creation (diversion) as a result of the RTA.

$$RTA_{1t} = \begin{cases} 1, & \text{If both reporter and partner country are member of } RTA_1 \text{ at time } t \\ 0, & \text{Otherwise} \end{cases}$$

$$RTA_{2t} = \begin{cases} 1, & \text{If reporter country is a member of } RTA_1 \text{ at time } t \\ 0, & \text{Otherwise} \end{cases}$$

As an illustration, suppose that the country pair under consideration is Namibia (reporter) and Zimbabwe (partner), the value of the dummy variable $RTA_{1COMESA_t}$ will take on a value of 1, as both the exporting country and the importing country are members of SADC over the period 1998–2003 (Namibia withdrew from SADC in 2003), and will take on a 0 value from 2004 to 2010. Similarly a dummy variable for Namibia under $RTA_{2COMESA_t}$ is included in the model, which takes the value of 1 (one) when Namibia was a member of SADC, (i.e. from 1998-2003) and a 0 value for the period 2004-2010. A positive coefficient RTA_{1t} measures intra-bloc export creation and a negative coefficient shows intra-bloc export diversion. A positive coefficient RTA_{2t} measures net export creation while a negative coefficient measures net export diversion.

As previously mentioned in Chapter 1, Section 1.7, this study will only focus only on SADC and SACU and the reason for choosing to focus only on SACU and SADC lies in the planned formation of the tripartite FTA that, if successful will, provide a seamless economic space of substantially greater magnitude capable of supporting substantially higher volumes of trade and investment than the status quo. The other reason for including only SACU and SADC in the model is the fact that these two RTAs are the only fully functional FTAs that involve at least two SADC countries for which the SADC TIPS database has is reliable reporter country data.

The net grain position is thought to be a key factor driving the decision to trade. In the model this attribute is captured by a dummy variable that takes on the value of 1 (one) if the reporter country has a net grain deficit in a specific year⁷⁵. Should a country find itself in a net deficit, intuition would suggest that the country would be inclined to engage in some form of trade, in this case import maize, presumably from the nearest most accessible surplus state. As such it is expected that the parameter associated with this variable should be positive. Table 3.3 gives a summary of other dummy variables that were introduced to capture a range of different attributes that were deemed to possibly impact trade.

Table 3.3: Definition of dummy variables that were used in the study, 2010.

Dummy variable	Definition
Border	Takes on value of 1 if the reporter and partner country share a common border and a value of 0 otherwise
Grain deficit	Takes on value of 1 if the reporter country has a net grain deficit at time t
RTA1_COMESA	Takes on a value of 1 if both exporter and reporter and partner are members of SADC at time t and a value of 0 otherwise
RTA2_COMESA	Takes on a value of 1 if reporter country is a member of SADC at time t and a value of 0 otherwise
RTA1_SACU	Takes on a value of 1 if both reporter and partner countries are members of SACU at time t and a value of 0 otherwise
RTA2_SACU	Takes on a value of 1 if reporter country is a member of SACU at time t and a value of 0 otherwise

Source: Author's selection.

3.3.2 The Empirical Model

The value of maize trade was estimated using the Tobit model with random effects by Maximum Likelihood Estimation which takes the form:

$$\ln Y_{ijt} = (\beta_0 + \ln x_{ijt} \beta + w_{ijt} + d_{ijt} \delta + \varepsilon_{ij}) \quad (4)$$

$$t=1,2,3,4 \dots T; \quad \varepsilon_{ij} | x_{ijt}, \varepsilon_{ij}, f_{ijl} \sim \text{NORMAL}(0, \sigma)$$

Where:

Y_{ijt} = trade value expressed in US dollars from reporter country SADC to partner country j in the period t

⁷⁵ What is deemed to be the deficit is the negative difference between what is domestically available and the sum of the gross domestic demand and the desired carryover stocks. These figures were sourced from the maize balance sheets (various reports) produced by the SADC secretariat (1995-2007; 2009 and 2010).

x_{ijt} is a vector that contains the following variables expressed in logarithms:

- R_gdp_{it} = Agriculture GDP (US\$) of reporter country *SADC* in period t
 P_gdp_{jt} = Agriculture GDP (US\$) of partner country j in period t
 R_pop_{it} = Population in reporter country *SADC* in the period t
 P_pop_{jt} = Population in Partner country j in period t
 $maize_aid$ = Maize aid distributed to the reporting country *SADC* in period t
 $Infrastructure$ = the length of paved road in the reporter country *SADC*
 $Dist$ = the distance between the reporting and partner capital cities

d_{ijt} is a vector that contains the following dummy variables:

- $Grain\ deficit$ = vector that contains a dummy variable if a reporter country *SADC* has a maize grain deficit at time t ⁷⁶.
 $Border$ = vector that contains a dummy variable if a country pair shares a border
 $rta1$ = vector that contains a dummy variable if both reporter and partner countries are members of RTA l at time t
 $rta2$ = vector that contains a dummy variable if the reporter country is a member of the RTA l at time t

The independent variable, *Maize_aid* and the dependent variable (Total trade) Y_{ijt} had a unit added to them, in order to be able to estimate the logarithm when:

$$Maize_aid_{it} = y_{it} = 0.$$

This monotonic transformation does not affect the estimated results but can have misleading results and as such requires special consideration when calculating the expected value of y_i .

3.4 Summary

The GM of international trade – inspired by Newton’s gravity equation in physics – relates bilateral trade flows to the GDP levels of the countries and their geographic distance and a number of contiguity factors. For the purposes of this study the GM specification that is chosen employs panel data. The study focuses on specific commodity maize, and as expected, there are significant instances where no trade occurs between country pairs. To cater for the occurrence of a significant number of zeros in the dependant variable, a censored regression

⁷⁶ For example if Zimbabwe experienced a grain deficit in 2000, the value for the grain dummy variable in 2000 would be 1

model, specifically the Tobit model with random effects was found to be the GM specification ideal to analyse intra-maize trade in the SADC region in the period 2000-2010.

The key variables that were thought to influence intra-maize trade and were included in the GM were purchasing power and market sizes of the two trading countries, net maize grain position of a SADC member state; the importance of relative economic relationships and contiguity factors between the two trading countries; the road infrastructure; and the distribution of maize aid influence intra-SADC maize trade. The GM also included variables to test the influence of belonging to SADC and SACU on SADC maize trade.

It is important to note –as in the case of Aguilar (2006) and the recent work of Jordaan and Eita (2012) – the coefficients presented in the following chapters *cannot* be read directly as elasticities; however, the sign and significance of the coefficients indicate the direction of impacts. Addendum 3 contains the actual output of the model that was run in Stata 11[®].

The following chapters aim to discuss the result of the model in the context of the research questions, hypotheses and objectives set out in Section 1.6, 1.7, and 1.8 respectively. The guiding rules of the process were to identify the key result that answers the specific research questions as stated in the first chapter which are listed here as follows: “*How can SADC members improve intra-maize trade relations?*” As stated in Section 1.5, for one to answer this research question one must also answer the following sub-questions:

1. To what extent do the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure; purchasing power and market sizes of the two trading countries; and the distribution of maize aid influence maize trade?
2. Do SADC members’ sub-regional groupings have an effect (either positive or negative) on maize trade?

Chapter 4 presents the results in the context of the first research question while Chapter 5 will present the results in a manner that will speak to the second research question. The final chapter brings the entire study into perspective bringing together the study objectives and the findings from Chapters 4 and 5 and ends with the study conclusions and recommendations.

CHAPTER 4

FACTORS DETERMINING INTRA-REGIONAL MAIZE TRADE

4.1 Introduction

This chapter presents the findings of the GM with respect to the following research question: “*How can SADC members improve intra-maize trade relations?*” This chapter will speak to the first of the sub-questions stated in Section 1.5 that states:

To what extent do the following have an effect on intra-SADC maize trade:

- a. The purchasing power and market sizes of the trading entities;
- b. The net maize grain position of a SADC country;
- c. The distribution of maize aid;
- d. Infrastructure and;
- e. The importance of distance and contiguity factors between the two trading countries?

In effect this chapter will present the results that tested the first hypothesis stated in Section 1.7 which reads: “Intra-regional maize trade in the SADC region is determined by the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure, purchasing power and market sizes of the two trading countries; and the distribution of maize aid.”

As alluded to earlier it is important to note that the coefficients presented in the following chapters *cannot* be read directly as elasticities; *however, the sign and significance of the coefficients indicate the direction of impacts*-as in the case of Aguilar (2006); and a recent publication by Jordaan and Eita (2012). The results from the model are presented in Table 4.1 and the following sections will focus on the various factors that are thought to influence maize trade related to the first research question. Specifically these are: the purchasing power and market sizes of the trading entities; the net maize grain position of a SADC country; the distribution of maize aid; Infrastructure and; the importance of distance and contiguity factors between the two trading countries.

Table 4.1: Influence of various GM variables on the value of intra-SADC maize trade^a, 2010.

Determinants of trade	Coefficients
Reporter country agriculture GDP [†]	0.098 (0.09) ^b
Partner country agriculture GDP [†]	-0.015 (0.09)
Reporter country Population [†]	0.423 (0.52) ^a
Partner country Population [†]	0.749** (0.29)
Grain Deficit	1.345*** (0.37)
Maize Aid [†]	0.190*** (0.04)
Infrastructure (length of paved roads km) [†]	1.478*** (0.40)
Distance (km) [†]	-1.670* (0.40)
Presence of a common border between bilateral countries	2.741** (0.98)
RTA1_COMESA ^c	-0.789 (1.17) ^a
RTA2_COMESA ^d	0.365 (1.31)
RTA1_SACU ^e	-2.188 (1.53) ^a
RTA2_SACU ^d	0.883 (1.52)

^a Unless otherwise stated the period referred to is from 2000 to 2010, ^b *t*-statistics in parentheses. **p*<0.1, ***p*<0.05, ****p*<0.01; [†] Variables presented are in log form.

^c This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of COMESA in a specific year.

^d This categorical variable is “switched on”, i.e. takes the value of 1 (one), only if the reporter country is a member of COMESA in a specific year.

^e This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of SACU in a specific year.

^d This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of SACU in a specific year.

Source: Model results.

4.2 Influence of Purchasing Power and Market Size on Intra-SADC Maize Trade

In line with the true gravity model fashion, the study focused on a number of economic variables that were thought to be factors that impacted on maize trade. The proxies for the

purchasing power and market sizes that were used in the model were: reporting and partner country agricultural sector's contribution to the GDP (agricultural GDP) as well as the population of the reporter and partner country. The premise is that bilateral trade between any two countries is positively related to their economic size, represented by Agricultural GDP. In this instance Agriculture GDP, for both the reporter and partner countries were found to have no statistically significant influence on intra-SADC maize trade as shown in Table 4.1. Only the market size (population) of the partner country was found to have a statistically significant coefficient (Table 4.1: coefficient 0.749) at 5% level of significance.

4.3 Influence of Maize Grain Position of a SADC Country on Intra-SADC Maize Trade

As referred to in the preceding chapters, the net grain position (defined as the negative difference between what is domestically available and the sum of the gross domestic demand and the desired carryover stocks), is thought to be a key factor influencing intra-SADC maize trade. In the model this attribute is captured by a dummy variable that takes on the value of one if the reporter country has a net grain deficit in a specific year. In line with intuition, there seems to be a positive statistically significant relationship (at 0.01 alpha level) between trade and a net grain deficit position, (Table 4.1: coefficient 1.345) suggesting that SADC member states are likely to engage in intra-SADC trade should they themselves be in a deficit trade position, presumably from the nearest most accessible surplus state.

4.4 Influence of the Distribution of Maize Aid on Intra-SADC Maize Trade

The additional element included in this study is Maize aid. This variable was included in the model because of the perverse incentives that are thought to be associated with in-kind food aid. When food aid was considered amongst the set of regressors, a Hausman test was conducted to test for exogeneity of the regressors (no misspecification)⁷⁷. The test revealed that there was insufficient evidence to support the null hypothesis, implying exogeneity of the X-regressors. Thus, there was no correlation between unobserved individual effects and food aid, and insufficient evidence was found for misspecification.

⁷⁷ The Hausman specification test contrasts the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model (Hausman, 1978).

The study failed to find evidence that supports the claim that Maize aid has a negative effect on intra-SADC maize trade, in fact the study revealed that maize aid was found to have a statistically highly significant positive effect (Table 4.1: coefficient 0.190 significant at 1% level) on maize trade. This would imply that aid distribution in the SADC region in the period 2000-2010 seems to foster regional maize trade.

4.5 Influence of Infrastructure on Intra-SADC Maize Trade

As stated previously, transport infrastructure is a crucial element of trade. As a key component of trade is transportation of the purchased item from the territory of sale across borders to the point of use. It is this component that relies heavily on the presence of sound infrastructure. Transportation systems are critical for the purposes of moving goods and labour to facilitate production and trade. For the purposes of this study, the average total length of paved roads that member states have is used as a proxy for infrastructure. An average total length paved was used because there was relatively no significant change in the road infrastructure over the period under investigation. As Table 4.1 shows, there is a statistically significant positive relationship between intra-SADC maize trade and the presence of sound paved roads. The coefficient of infrastructure (Table 4.1: 1.478) was found to be significant at 1% significance level. This suggests that quality of infrastructure greatly improves the likelihood of SADC countries trading, asserting the supposition that road infrastructure is a key factor that influences intra-SADC maize trade.

4.6 Influence of Distance and Contiguity Factors on Intra-SADC Maize Trade

The gravity model pre-supposes that further away a partner country is from a reporter country the less likely that economic relationship is likely to influence trade. The distance between capitals is used as a proxy of the importance of economic relationships between the reporter and the partner countries. In addition to this the gravity model also pre-supposes that trade is influenced by a number of contiguity factors. Of particular interest to this study the contiguity factor of sharing a common border; the premise being: the propensity to trade between two countries increases if the two trading countries share a common border.

The sharing of a border is positive and statistically significant at $p < 0.05$ in influencing intra-SADC maize trade (Table 4.1 common border coefficient: 2.741), and the proxy for the importance of relative economic relationships and contiguity factors between the two trading

countries (distance between the capital cities) impacts negatively on maize trade (-1.670) and was statistically significant at 10% level (Table 4.1). The negative sign of this coefficient suggests that countries that are closer to each other tend to trade with one another, and by extension the further apart countries are from each other, the less bilateral trade will occur between those particular countries. Ease of access seems to be a critical factor when it comes to bilateral trade in SADC, and from this result it is apparent that the importance of relative economic relationships and contiguity factors between the two trading countries play a pivotal role in determining bilateral trade.

4.7 Summary

In response to sub-research question 1, the study establishes that the statistically significant determinants of trade as defined by the gravity model were:

- The partner country population has a positive effect (Table 4.1: coefficient 0.749) on maize trade at 5% level of significance. This suggests that maize trade between countries with bigger populations tends to be greater than trade between countries with smaller populations. This seems a sensible result given that maize is a staple food through most of the SADC countries, and consequently larger populations constitute larger maize markets in this particular instance.
- *Maize aid* distribution was found to be a statistically significant determinant of intra-regional maize trade to the extent that it encourages regional maize trade, evidenced by the significant positive parameter (Table 4.1: coefficient 0.190) on maize trade that proved significant at 1% level.
- Infrastructure influences trade, and infrastructure transportation systems are critical for the purposes of moving goods and labour to facilitate production and trade as evidenced by the positive sign (Table 4.1: coefficient 1.478), and significant at the 1% level.
- The premise that bilateral maize trade between any two countries is negatively related to the importance of relative economic relationships between the two trading countries, is supported by the negative impact distance has on maize trade (Table 4.1: coefficient -1.670 at 10% level significance). On the other hand, the propensity to trade increases if the two trading countries share a common border (Table 4.1: coefficient 2.741 at 5% level of significance)

- The net grain position of member states influences intra-SADC maize trade as shown by the statistically significant positive relationship between trade and a net grain deficit position (Table 4.1: coefficient 1.345 at 1% level of significance). This positive relationship suggests that SADC member states are likely to engage in intra-SADC trade should some find themselves in a deficit trade position.

As mentioned earlier at the beginning of this chapter, the coefficients presented in the following chapters *cannot* be read directly as elasticities; however, the sign and significance of the coefficients indicate the direction of impacts. That being said with respect to Hypothesis 1, the study revealed that the partner country population has a positive effect, so does the distribution of maize aid; the net grain position of member states; the presence of sound transport infrastructure; and the sharing of a common border. The proxy for the importance of relative economic relationships between the two trading countries (distance in kilometres) was deemed to have a negative impact on maize trade.

It is on this basis that Hypothesis 1 which states: “Intra-regional maize trade in the SADC region is determined by the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure, purchasing power and market sizes of the two trading countries; and the distribution of maize aid”, ***cannot be rejected***.

CHAPTER 5

SUB-REGIONAL GROUPINGS AND INTRA-SADC MAIZE TRADE

5.1 Introduction

Based on the existing regional trading arrangements in southern and eastern Africa, multiple memberships could possibly pose a challenge for liberalisation of trade in the SADC region and make the implementation process burdensome. The SADC Trade Protocol intends to remove 85% of all intra-SADC tariffs and eventually liberalise the final 15% by 2012⁷⁸ in order to achieve full FTA status (SADC, 2008). Unfortunately, membership of multiple and varied trade agreements which are not harmonised (as was the case with SADC, COMESA and EAC) would restrict free trade in the region. The lack of harmonisation on issues concerning rules of origin and SPS measures has proven to be a continuing impediment to trade. Overlapping membership between the groupings has the potential to cause conflict and certainly impose greater transaction costs on the business community and governments⁷⁹ (Hess and Hess 2008). However, negotiations are underway that seek to form a single tripartite FTA that encompasses the three FTAs, namely EAC, COMESA and SADC.

This chapter presents the findings of the GM with respect to the following research question: “*How can SADC members improve intra-maize trade relations?*” This chapter will speak to the second of the sub-questions stated in Section 1.5 that states: “Do SADC members’ sub-regional groupings have an effect (either positive or negative) on maize trade?”

In effect this chapter will present the results that tested the second hypothesis stated in Section 1.7 which reads: “Bilateral and plurilateral agreements between/amongst SADC members (in the sub-regional groupings SACU and COMESA) have an influence on SADC maize trade.”

This discussion is prefaced by brief background on the various regional groupings introduced in the Chapter 2, namely the Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Economic Community of Central African States (EACCS),

⁷⁸ At the time of writing (that is 2012) achieving full FTA status during 2012 seems doubtful.

⁷⁹ See Jakobeit, Hartzenberg and Charalambides (2005).

Indian Ocean Commission (IOC), Indian Ocean Rim Association for Regional Cooperation (IOR ARC), Multilateral Money Area (MMA), and Regional Integration Facilitation Forum.

5.1.1 Common Market for Eastern and Southern Africa (COMESA)

COMESA's roots can be traced back to the Preferential Trade Area for Eastern and Southern African states – PTA (ESA) that was founded in 1983. The PTA (ESA) then transformed into COMESA in 1994 and to date, COMESA consists of 19 member states. In total 11 SADC member states were once members of COMESA at one time or the other, but as of 2012 there are 8 (eight) states that are party to both COMESA and SADC⁸⁰. COMESA countries within eastern Africa, are, Burundi, Comoros, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, and Uganda (Ngwenya, 1999; COMESA, 2011). As of 2000, an FTA was instituted amongst nine COMESA members⁸¹. The idea behind this is was to prepare the transition to a COMESA customs union by 2004, this was then delayed substantially, and was only launched at the Victoria Falls COMESA summit in 2008, although the actual operationalization of the customs union (which had not begun at the time of writing, that is 2012) is set to begin once the final preparatory work has been concluded (Shayanowako, 2011).

5.1.2 East African Community (EAC)

The EAC is an intergovernmental organisation comprising the five east African countries Burundi, Kenya, Rwanda, Tanzania, and Uganda. Of the SADC countries, only Tanzania belongs to this sub-grouping. It must be noted that Kenya, Tanzania and Uganda have had a history of partnership stretching as far back as the early 20th century. The EAC was originally founded in 1967, but collapsed in 1977, due to political differences amongst the member states. Following the disbanding of the organisation, former member countries thrashed out their differences and reached a Mediation Agreement for the Division of Assets and Liabilities, which they signed in 1984. As part of this agreement, the three states agreed to explore areas of future cooperation and had to make solid arrangements for such future co-

⁸⁰ Of the 19 COMESA member states, all but 7 (seven) SADC countries are members with some of these countries choosing to leave COMESA between 1990 and 2008. These 7 (seven) states are listed below which include some former members such as Lesotho, Mozambique (both left in 1997), Tanzania (2000) and Namibia, (2004) and Angola suspended itself in 2007. Botswana and South Africa were never members of COMESA.

⁸¹ These countries were Djibouti, Egypt, Kenya, Madagascar, Malawi, Mauritius, Sudan, Zambia and Zimbabwe. In November 2012 Uganda ratified its membership to the COMESA FTA as it assumed COMESA leadership in 2012, and became the 10th FTA member, (COMESA, 2012)

operation. The end of 1993 saw the three heads of state signing an Agreement for the Establishment of the Permanent Tripartite Commission for East African Cooperation, which led to the commencement of full east African cooperation efforts in the first quarter of 1996 when the Secretariat of the Permanent Tripartite Commission was launched.

That being said, there have been negotiations amongst the three FTAs, namely the EAC, COMESA and SADC, that could see the formation of a tripartite FTA. The idea is that the tripartite FTA will provide a seamless economic space of this magnitude which should support higher volumes of trade and investment, and assist the achievement of important social economic development objectives in the region, especially peace and wealth creation for the poor (COMESA, 2011).

5.1.3 Economic Community of Central African States (ECCAS)

The Economic Community of Central African States (ECCAS) is an Economic Community of the African Union that was instituted for the promotion of regional economic cooperation in Central Africa. It was established with the aim of achieving collective autonomy, raising the standard of living of its populations and maintenance of economic stability through harmonious cooperation. The roots of this organisation can be traced back to the Central African Customs and Economic Union (UDEAC).

UDEAC leaders who attended a summit meeting towards the end of 1981 agreed in principle to form a wider economic community of central African states (CEEAC, 2009). ECCAS was instituted in 1983 by the UDEAC members and the members of the Economic Community of the Great Lakes States (CEPGL), namely: Burundi, Rwanda and the then Zaire, including both São Tomé and Príncipe. Angola maintained observer status until 1999, when it became a fully-fledged member (CEEAC, 2009). ECCAS began functioning in 1985, but has been inoperative since 1992 as a result of financial difficulties stemming from the non-payment of membership fees, and conflict in the Great Lakes area (CEEAC, 2009). In February 1998, the heads of state attended the second Extra-Ordinary Summit of CEEAC in Libreville and committed to its resurrection, which has since seen its participation in the formation of Central African Economic and Monetary Community (CEMAC).

5.1.4 Indian Ocean Commission (IOC)

The Indian Ocean Commission (IOC) is a regional organisation consisting of four ACP states (Comoros, Madagascar, Mauritius, and Seychelles) and Reunion (IOC, 2003). Instituted in 1984, the IOC is one of the pioneering formal occurrences of regional cooperation in the Indian Ocean (IOC, 2003). The founders of the IOC had missions and objectives in mind which primarily were strengthening ties between the citizens of member states and improving standards of living (IOC, 2003). They also sought to promote cooperation in a number of areas, namely, agriculture, diplomacy, economy, fishing, trade, natural resource and ecosystem conservation, culture, science and education (IOC, 2003).

5.1.5 Indian Ocean Rim Association for Regional Cooperation (IOR-ARC)

IOR-ARC is an international organisation comprising of 20 member states, and was established for the purposes of enhancing economic cooperation among countries in the Indian Ocean Rim (Department of Foreign Affairs, 2009). To this end, it seeks to provide maximum opportunities to develop shared interests and garner mutual benefits as well as information exchanges on trade, investment regimes and opportunities with the hopes of expanding intra-regional trade among countries in this regional grouping. Initially known as the Indian Ocean Rim Initiative, it was first instituted in Mauritius in early 1995 and formally launched the following year. It is based on the informal understanding that has been in existence for many centuries, to the extent that the countries, economies and peoples of the Indian Ocean had an informal cooperative economic community.

5.1.6 Multilateral Monetary Area (MMA)

The Multilateral Monetary Agreement (MMA), established in February 1992 amongst Lesotho, Namibia, South Africa, and Swaziland creates a Common Money Area (CMA) amongst these countries. All the countries that belong to the CMA also belong to SADC as well as SACU. This agreement is founded on an informal arrangement that preceded the formation of the then Union of South Africa in 1910 (van Zyl, 2003). After the establishment of the South African Reserve Bank (SARB) in 1921, the South African pound⁸² became the sole circulating monetary medium and legal tender in the geographical area that is known as

⁸² The South African Rand was introduced in 1961 with the independence of South Africa and replaced the South African pound.

the CMA, with the addition of the then Bechuanaland (Botswana) (van Zyl, 2003). Following extensive dialogue and negotiations, a formal monetary agreement (Rand Monetary Area – RMA) was signed at the end of 1974 with three signatories, namely, South Africa, Lesotho, and Swaziland, with the Rand remaining as legal tender in these countries. Botswana opted to pursue an independent monetary stance with its own national currency and central bank, as opposed to the route that fellow SACU states had taken (Van Zyl, 2003). July 1986 saw the dawn of the CMA governed by the terms of a Trilateral Monetary Area Agreement between the three countries. The CMA accommodated changes in the position of Swaziland. This trilateral agreement was replaced by the current MMA in 1992 when Namibia formally joined the CMA of which it had been, to all intents and purposes, a member from the beginning (van Zyl, 2003). As a consequence of the MMA, there is free movement of capital, with each of the smaller countries relying on the Rand (Cattaneo, 1998).

5.1.7 The Regional Integration Facilitation Forum (RIFF)

The origins of the RIFF can be traced to the July 1990 Maastricht Conference on African Development that led to the formation of the Cross Border initiative (CBI). The CBI was a response to a request from various African heads of state for added assistance in achieving effective cross-border integration in Africa. The International Monetary Fund, the World Bank, the Commission of the European Communities and the African Development Bank (AfDB), took it upon themselves to respond to this request and recommended the formation of the Cross Border Initiative (CBI) to help improve cross border relations in eastern and southern Africa as well as the Indian Ocean countries (Mutai, 2003).

Basically, the CBI was a skeleton of harmonised policies to smooth the progress of regional integration, based on the market-driven concept. RIFF was instituted in 2000 and is meant to sustain the achievements of its predecessor CBI. Over and above this RIFF also aims to foster investment flow into member state economies, as well as the development of the most suitable trade regimes. A significant proportion of its policy programmes deal with issues that are on the agendas of other sub-regional RTAs. This includes the SADC, EAC and IOC.

5.1.8 Southern African Customs Union (SACU)

SACU comprises of Botswana, Lesotho, Namibia, Swaziland (jointly referred to as the BLNS countries) and South Africa. Officially, SACU has been in existence in some form or another

since 1889, making it the oldest customs union in the world.⁸³ The core of the agreement is centred on free trade of manufactured goods, the maintenance of a common external tariff against non-SACU countries, and compliance of the BLNS nation states to South Africa's tariff laws, albeit this has been altered under the new SACU Agreement (McCarthy, 2003; Cattaneo, 1998).

The issue of industrial development of the BLNS countries is a top priority on the SACU agenda and as proof of this a development fund that was established with a view towards the development of a common industrial policy (McCarthy, 2003). McCarthy (2003) further argues that a prosperous SACU serves as an incentive for further RTAs in southern Africa, specifically for SADC. The SACU agreement is a fine example to the rest of southern Africa on how smaller economies (in this case the BLNS countries) can successfully achieve high levels of integration with the relatively larger economies (in this case South Africa).

As previously mentioned in Chapter 1, Section 1.7, the study focuses only on COMESA and SACU sub-regional groupings. The reason for choosing to focus only on SACU and COMESA in the model for analysis purposes is the on-going negotiations in creating a tripartite FTA that encompasses the three FTAs; i.e. EAC, COMESA and SADC (and *de facto* SACU). The tripartite FTA will provide a seamless economic space of substantially greater magnitude which, in principle, should support higher volumes of trade and investment. In addition to this SACU and COMESA are the only fully functional FTAs that

⁸³ SACU had three major agreements. The earliest agreement, the 1910 agreement, created *i*) a CET on all goods imported into the Union from the rest of the world; and with it a common pool of customs duties *ii*) Unrestricted movement of SACU manufactured products within SACU, and *iii*) A Revenue Sharing Formula (RSF) for the distribution of customs and excise revenues collected by the Union of South Africa. South Africa retained the sole decision-making power over customs and excise policies.

The 1969 SACU Agreement, signed by the sovereign states of Botswana, Lesotho, and Swaziland (BLS) and South Africa, provided two major changes: The inclusion of excise duties in the revenue pool and a multiplier in the revenue sharing formula that enhanced BLS revenues annually by 42%. The RSF was amended in 1976 to include a stabilisation factor that ensured that the BLS received at least 17%, and at most 23%, of the value of their imports and excise duties after a number of issues were raised by the BLS countries.

The four major sticky points in the 1969 Agreement were: 1) The lack of decision making power in the BLNS countries; 2) the Revenue Sharing Formula (RSF); 3) which determined each country's share of the Common Revenue Pool; and 4) South Africa's consistent preferential agreements negotiation that only benefited South Africa with no consultation of the other SACU states.

The 2002 SACU Agreement addressed the following three outstanding issues: it ensured a joint and consultative joint decision making process and the setting up of institutions in Namibia that oversee the union. Secondly, the agreement instituted a new Revenue Sharing Formula that included a customs excise and development component. Finally the 2002 agreement, states that the union needs to develop strategies that enhance regional integration in political, economic, social, and cultural spheres, without compromising the economies of the smaller states.

involve at least two SADC countries for which the SADC TIPS database has is reliable reporter country data. These regional groupings were captured through the use of dummy variables RTA_{it1} and RTA_{it2} respectively, following earlier work that was done by Coulibaly (2004).

As described in Chapter 3, dummy variables RTA_{it1} and RTA_{it2} are introduced for the two RTAs (COMESA and SACU) that are under consideration in this study and these variables will give insight in the effects that these sub-regional groups have on maize trade, specifically intra-bloc export trade creation (diversion) and net export trade creation (diversion) as a result of the RTA. A positive and statistically significant coefficient RTA_{it1} measures intra-bloc export creation and a negative statistically significant coefficient shows intra-bloc export diversion. A positive and statistically significant coefficient RTA_2 measures net export creation while a negative and statistically significant coefficient measures net export diversion.

5.2 Influence of COMESA on Intra-SADC Maize Trade

COMESA consists of 19 member states and 8 (eight) of these member states also belong to the SADC region. These are the Democratic Republic of Congo, Malawi, Mauritius, Madagascar, Seychelles, Swaziland, Zambia and Zimbabwe. The COMESA sub-regional grouping was found to have no statistically significant influence on SADC intra-regional maize trade. That is the COMESA sub-regional group within SADC did not have any effect on intra-bloc export diversion and did not result in net export creation amongst member states that belong to both SADC and COMESA (Table 5.1).

5.3 Influence of SACU on Intra-SADC Maize Trade

The SACU sub-regional grouping was found to have no statistically significant influence on SADC intra-regional maize trade (Table 5.1). From the estimation results, the SACU sub-regional group within SADC did not have any effect on intra-bloc export diversion and did not result in net export creation amongst member states that belong to both SADC and COMESA (Table 5.1).

Table 5.1: Influence of various GM variables on the value of intra-SADC maize trade^a, 2010.

Determinants of trade	Coefficients
Reporter country agriculture GDP [†]	0.098 (0.09) ^b
Partner country agriculture GDP [†]	-0.015 (0.09)
Reporter country Population [†]	0.423 (0.52) ^a
Partner country Population [†]	0.749** (0.29)
Grain Deficit	1.345*** (0.37)
Maize Aid [†]	0.190*** (0.04)
Infrastructure (length of paved roads km) [†]	1.478*** (0.40)
Distance (km) [†]	-1.670* (0.40)
Presence of a common border between bilateral countries	2.741** (0.98)
RTA1_COMESA ^c	-0.789 (1.17) ^a
RTA2_COMESA ^d	0.365 (1.31)
RTA1_SACU ^e	-2.188 (1.53) ^a
RTA2_SACU ^d	0.883 (1.52)

^a Unless otherwise stated the period referred to is from 2000 to 2010, ^b t-statistics in parentheses. *p<0.1, **p<0.05, ***p<0.01; [†] Variables presented are in log form.

^c This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of COMESA in a specific year.

^d This categorical variable is “switched on”, i.e. takes the value of 1 (one), only if the reporter country is a member of COMESA in a specific year.

^e This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of SACU in a specific year.

^d This categorical variable is “switched on”, i.e. takes the value of 1 (one), if both the reporter and the partner countries are members of SACU in a specific year.

Source: Model results.

5.4 Summary

In response to sub-research question 2, the study found that there is no statistically significant influence of sub-regional groupings on intra-regional maize trade. This could be attributed to the staple nature of maize in the SADC region.

The second hypothesis postulated in Section 1.7 which states; bilateral and plurilateral agreements between/amongst SADC members (in the sub-regional groupings SACU and COMESA) have an influence on SADC maize trade, was revealed by the study to not hold true. In fact the study finds that the sub-regional groups COMESA and SACU do not have any influence on SADC maize trade. On this basis that Hypothesis 2 which states; “Bilateral and plurilateral agreements between/amongst SADC members (in the sub-regional groupings SACU and COMESA) have an influence on SADC maize trade”, ***is rejected***.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 Summary

Maize is considered to be a very important crop in Africa, given its status as a staple crop in most African countries. Moreover, maize is of great significance to the people in the SADC region. Given the importance of white maize to SADC countries' food security, intuition dictates that maize trade in the region should be abundant and unrestricted in order to mitigate against commonplace volatility in maize production.

Unfortunately, the region battles to strengthen intra-regional trade, as evidenced by the relatively low value of trade and persistent localised pockets of food insecurity within the SADC region. In fact one could argue leadership in the region, lacks the political will to concretize and implement the many FTAs and CUs that have been initiated throughout the region. Understandably there are many other salient issues at play within the region⁸⁴ and could be the causes for the lack of traction in fulfilment of regionalism. Notwithstanding, these salient issues, a true committed effort from SADC policymakers would move the region towards the dissolution of trade barriers and usher in an era of "true regionalism" that would leave all the citizens of the SADC region better off.

The purpose and the general objective of the study was to identify the determinants of intra-SADC maize trade with the understanding that once the relevant elements are known and appreciated, they will contribute towards developing relevant solutions that will strengthen intra-SADC maize trade relations.

The sub-objectives of this study are as follows;

1. The study seeks to determine the extent to which the: net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries; infrastructure, purchasing power and

⁸⁴ These salient issues include but are not limited to; regional politics; various member states sovereignty with regards to revenue collection authorities; financial constraints; as well as latitude to control strategic crops such as maize and wheat.

market sizes of the two trading countries; and the distribution of maize aid influence intra-SADC maize trade.

2. Determine the effect of being party to a number of other regional trading arrangements specifically COMESA, SACU.

In light of the study's objectives the first part of the study gave the background and the setting of the SADC maize trade scenario. The subsequent chapters provided a detailed overview of the SADC region and a general description of the maize trade, focussing on a number of elements which are deemed key to regional maize trade⁸⁵. The study subsequently went into detail concerning the development of the GM model for the maize sub-sector analysis in the SADC region. The fourth chapter addressed the first research question posed in Section 1.6. The fifth chapter spoke to the findings of the analysis in the context of the second research question. This chapter is meant to bring together the findings of the study, draw out the conclusions, suggest recommendations and propose areas of further study.

6.2 Conclusions and Recommendations

The starting point of augmenting intra-SADC maize trade entails the need for the region to improve regional maize production. The description of the various SADC countries' maize production trends revealed that there is potential for increased maize production in most states. However, the region remains vulnerable to a number of factors which include; climatological shocks (droughts and floods), the occurrence of civil unrest, political instability and limited arable land.

In addition, the region suffers from infrastructure⁸⁶ backlogs, the delay in the transfer and adoption of high yield agricultural technologies, limited agricultural extension service provision, limited funding for agricultural research and development, and most importantly the general lack of investment in agriculture. These failures will need to be addressed in the short to medium term in order to allow the realisation of the region's agricultural potential as a whole. A redress of these institutional failures and limitations forms a vital step to

⁸⁵ These were: global, African and southern African maize production characteristics; the state of SADC transport infrastructure in the region and its influence on intra-SADC trade; and the impact of regional sub-groupings on intra-SADC trade

⁸⁶ The term infrastructure refers to transportation systems, communication, energy which includes research and development, extension services and support and investment in agriculture.

unlocking the SADC region's agricultural production potential, and ultimately, intra-regional trade.

The study focused on a number of economic variables that are defined by traditional gravity theory and are thought to be factors that impact trade. The proxies for the purchasing power and market sizes that were used in the model were: reporting and partner country's agricultural GDP as well as the population of the reporter and partner country. In this instance agricultural GDP, for both the reporter and partner countries were found to have no statistically significant influence on intra-SADC maize trade while, the study found that the statistically significant determinants of trade as defined by the gravity model were; partner country population; maize aid; infrastructure; distance and the net grain position of that country. The following subsection will focus on the factors (variables) that were found to have a statistically significant influence on trade, and interpret the findings in a manner that can contribute to the discourse of improving intra-SADC maize trade relations.

6.2.1 Influence of Market Size (The Partner Country Population) on Intra-Regional Maize Trade

The partner country population has a positive effect (Table 4.1: Coefficient 0.749) on maize trade at 5% level of significance. This suggests that maize trade between countries with bigger populations tends to be greater than trade between countries with smaller populations. This seems a sensible result given that maize is a staple food for most of the SADC countries, and consequently larger populations constitute potentially larger maize markets in this particular instance⁸⁷.

6.2.2 Influence of Maize Aid Distribution on Intra-Regional Maize Trade

The study revealed that maize aid promoted maize trade within the SADC region. This finding suggests that maize aid distribution encourages maize trade, a finding that is counter intuitive. A plausible explanation for this could lie in the mode of delivery of maize aid. As indicated in Section 1.9, there are three main ways by which all aid is delivered from the donor to the recipient country, that is maize aid in kind (direct transfer delivery) and cash

⁸⁷ The reason countries with larger populations are deemed potential markets is based on the fact that the population, *and* GDP plus domestic production in relation to total maize demand determine trade (i.e. imports and exports)

based aid purchases within country (local purchases) and regional purchases (triangular purchases).

The direct transfer delivery method is the most distortionary type of aid as it upsets the local maize markets and can be perceived to be a form of subsidy that is given to the farmers in the donor countries. From the result, it would seem that maize aid in the SADC region has been of the delivery modes that are cash based. Further interrogation of the food aid trade flows over the period 2000-2010, support this position as the proportion of aid that is delivered by way of direct transfers has declined significantly from 46% in 2000 to 1% in 2010 with the most drastic change from direct maize aid transfers to the cash based methods occurring between 2004 and 2005⁸⁸. The cause of the decline could be a result of increasing pressure from civil rights groups and the international community against direct transfers further compounded by the global economic recession that has hit the United States and the European Union, two of the largest food donors.

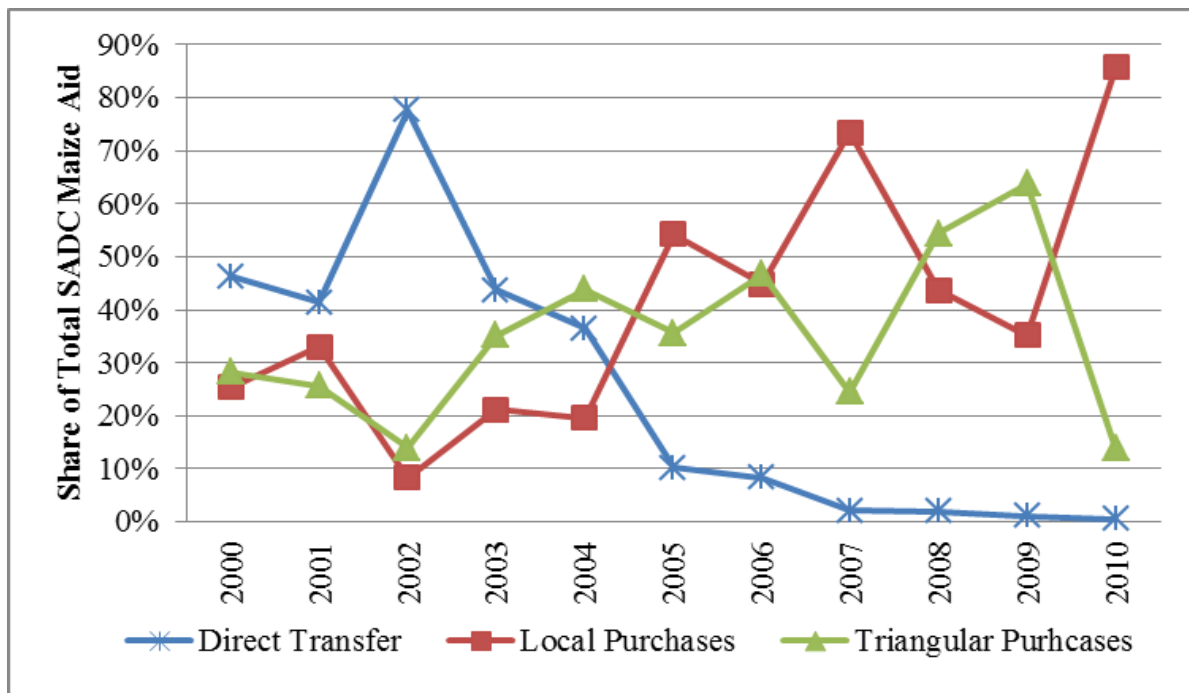


Figure 6.1: Share of direct maize transfer and cash based delivery of maize aid, in the SADC, 2000-2010

Source: WFP (2012).

⁸⁸ The year 2002 should be considered an outlier year as a result of the occurrence of a major drought that left most of the SADC countries in need of aid. This explains the big bump between 2001 and 2002. Outside of the occurrence of the drought direct transfers seemed to be on a downward trend.

This finding suggests that the relationship between maize trade and maize aid distribution is complex, and the **recommendation** is that further research needs to be carried out to further investigate and unpack this relationship and nuances therein.

6.2.3 Influence of Infrastructure on Intra-Regional Maize Trade

The SADC region consists of 15 member countries, and of those 15, 6 (six) are landlocked, and 6 (six) have small markets (as determined by populations below 10 million people) and most critically, 10 of these countries have a GDP of less than US\$10 billion per annum as of 2011 (Ranganathan and Foster, 2011). South Africa currently is the economic anchor of the region, but half a dozen of the SADC's member states are large or potentially large economies (including Angola, the Democratic Republic of Congo, Mozambique, Tanzania, Zambia, and Zimbabwe). Knitting these emerging economies more closely together, by development of sound infrastructure, would help to create a larger market, creating more opportunities for trade, and give rise to greater economic opportunities in the region.

As was expected, infrastructure transportation systems have a positive impact on trade. Infrastructure is critical for the purposes of moving goods and labour to facilitate production and trade. This finding makes a case (and provides empirical evidence) for the combined concerted effort from all SADC member states to work towards an infrastructure development that will see quality road and rail networks built throughout the SADC region.

6.2.4 The Influence of Distance on Intra-Regional Maize Trade

As expected bilateral maize trade between any two countries was found to be negatively related to the importance of relative economic relationships between the two trading countries. Put simply the further apart two countries are from each other the less likely those countries are to engage in trade. This is further compounded by poor infrastructure as this pushes up the cost of moving the goods, from the point of production to the final market. This finding supports the case of improving the road network in the SADC region.

The study also revealed that countries that share a common border experience greater trade. This finding is particularly important for countries that experience localised food security crises and also have relatively poor road infrastructure linking major centres of production to the rest of the country. Examples of such vast countries include Angola, the DRC and Mozambique. Informal cross border traders could contribute towards alleviating food security

concerns, provided that they are granted an enabling environment that facilitates the development of cross border trade. The **recommendation** is that further research ought to be carried out to understand the extent to which informal cross border trade occurs within the SADC region and explore the potential this has in alleviating both poverty and food insecurity.

6.2.5 The Influence of Net Grain Position on Intra-Regional Maize Trade

The net grain position was found to have a positive influence on intra-SADC maize trade as shown by the statistically significant positive relationship between trade and a net grain deficit position (Table 4.1: Coefficient 1.345 at 1% level of significance). This positive relationship suggests that SADC member states are likely to engage in intra-SADC trade should some find themselves in a deficit trade position, to trade presumably from the nearest most accessible surplus state. This is an indication that SADC member countries do see the region as a market for maize trade and have shown a propensity to trade, and makes the case for the creation of an environment that promotes trade and allows the unimpeded movement of maize within the region.

6.2.6 Influence of Sub-Regional Groupings on Intra-Regional Maize Trade

The study found that bilateral and plurilateral agreements amongst SADC members (in the sub-regional groupings SACU and COMESA) have *no* influence on SADC maize trade. As mentioned earlier, maize is a basic staple for the SADC region, and is considered to be a basic food commodity. It is therefore expected that SADC countries will trade with anyone regardless of a trade agreement or trade agreements, in order fulfil the demand for the staple commodity.

In conclusion with respect to Hypothesis 1, the study revealed that the partner country population has a positive effect on intra-regional maize trade, so does the distribution of maize aid; the net grain position of member states; the presence of sound transport infrastructure; and the sharing of a common border. The proxy for the importance of relative economic relationships between the two trading countries (distance in kilometres) was deemed to have a negative impact on maize trade. It is on this basis that **Hypothesis 1** postulated in Section 1.7 which states; *Intra-regional maize trade in the SADC region is determined by the net maize grain position of a SADC country; the importance of relative economic relationships and contiguity factors between the two trading countries;*

*infrastructure, purchasing power and market sizes of the two trading countries; and the distribution of maize aid **cannot be rejected.***

Hypothesis 2 postulated in Section 1.7 which states; *Bilateral and plurilateral agreements between/amongst SADC members (in the sub-regional groupings SACU and COMESA) have an influence on SADC maize trade*, was revealed by the study to not hold true. In fact the study finds that the sub-regional groups COMESA and SACU do not have any influence on SADC maize trade. It is on this basis that **Hypothesis 2 is rejected.**

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ADDENDUM 1: AGRICULTURAL STATISTICS FOR SADC COUNTRIES

Addendum 1 Table 1: Net surplus SADC maize states agricultural labour, agricultural value add and growth in agricultural value add

	Malawi			Mozambique			South Africa			Zambia		
	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)
1990	36.00%	45.00%	-0.24%	38.45%	37.12%	1.10%	4.59%	4.63%	-7.14%	28.18%	20.60%	-8.90%
1991	36.08%	43.72%	12.80%	38.54%	39.14%	-4.00%	4.47%	4.56%	4.47%	28.27%	17.43%	5.17%
1992	36.00%	38.82%	-25.12%	37.42%	34.51%	-19.28%	4.28%	3.80%	-27.26%	27.41%	23.81%	-33.07%
1993	36.01%	48.90%	52.98%	37.75%	38.27%	23.02%	4.18%	4.17%	24.01%	27.24%	34.10%	68.11%
1994	35.78%	25.08%	-28.92%	38.13%	33.25%	-1.15%	4.08%	4.60%	7.87%	26.97%	15.49%	-18.90%
1995	35.41%	30.40%	39.59%	38.40%	34.80%	15.35%	3.96%	3.86%	-19.93%	26.73%	18.41%	33.35%
1996	35.03%	34.69%	25.51%	38.48%	35.22%	8.89%	3.83%	4.19%	23.99%	26.52%	17.57%	-0.63%
1997	34.65%	32.59%	0.13%	38.41%	34.85%	8.76%	3.69%	4.01%	0.85%	26.32%	18.66%	-5.13%
1998	34.32%	35.58%	10.34%	38.28%	30.84%	7.54%	3.56%	3.77%	-5.31%	26.09%	21.14%	1.24%
1999	34.10%	37.84%	10.12%	38.11%	28.56%	5.83%	3.42%	3.54%	6.18%	25.89%	24.18%	10.08%
2000	33.89%	39.54%	5.30%	37.94%	24.01%	-11.79%	3.30%	3.27%	4.72%	25.69%	22.31%	1.56%
2001	33.65%	38.78%	-5.98%	37.71%	22.51%	9.74%	3.20%	3.51%	-3.25%	25.48%	22.12%	-2.56%
2002	33.38%	36.74%	5.89%	37.53%	27.82%	11.19%	3.11%	4.15%	6.53%	25.25%	22.07%	-1.72%
2003	33.09%	35.74%	3.94%	37.35%	28.04%	5.42%	3.02%	3.43%	0.68%	25.00%	22.57%	5.05%
2004	32.80%	34.63%	2.77%	37.15%	27.41%	4.76%	2.91%	3.11%	2.11%	24.78%	23.03%	4.23%
2005	32.54%	32.63%	-7.65%	36.95%	26.96%	6.47%	2.81%	2.67%	1.55%	24.54%	23.32%	-0.55%
2006	32.30%	31.17%	-2.52%	36.77%	27.86%	10.20%	2.71%	2.88%	-5.46%	24.33%	22.44%	2.21%
2007	32.21%	30.30%	10.78%	36.62%	27.71%	8.23%	2.64%	3.37%	3.54%	24.21%	21.76%	0.43%
2008	32.09%	30.11%	8.11%	36.47%	30.47%	11.31%	2.54%	3.22%	10.87%	24.08%	18.95%	-0.10%
2009	31.99%	30.53%	14.38%	36.35%	31.46%	10.68%	2.44%	3.04%	-3.20%	24.27%	21.55%	-0.07%
2010	31.92%	-	1.51%	36.25%	31.85%	8.49%	2.35%	2.48%	4.98%	23.86%	9.16%	0.08%
2011	32.90%	-	6.79%	37.01%	31.96%	7.79%	2.28%	2.40%	0.74%	24.48%	20.72%	24.91%
Average (1990-2011)	33.92%	35.64%	6.39%	37.55%	31.12%	5.84%	3.33%	3.58%	1.43%	25.71%	20.97%	3.85%

Source: Author's calculations based on World Bank (2012) and UNCTAD (2012).

Addendum 1 Table 2: Minor deficit SADC maize states agricultural labour, agricultural value add and growth in agricultural value add

	Botswana			Mauritius			Namibia			Swaziland		
	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)
1990	14.90%	4.85%	3.01%	7.08%	12.85%	9.60%	15.48%	11.72%	11.07%	16.11%	10.40%	-2.34%
1991	14.75%	4.82%	2.73%	7.01%	11.70%	-1.58%	15.29%	12.44%	11.68%	15.89%	11.45%	7.39%
1992	14.41%	5.20%	1.05%	6.74%	11.63%	6.25%	14.57%	9.27%	-7.95%	15.33%	8.99%	-18.32%
1993	14.42%	5.01%	-2.45%	6.65%	10.65%	-5.88%	14.40%	9.47%	5.27%	15.14%	10.19%	-7.07%
1994	14.51%	4.43%	-3.06%	6.50%	9.94%	-5.78%	14.17%	12.76%	15.52%	14.84%	13.39%	4.59%
1995	14.35%	4.37%	2.45%	6.08%	10.38%	7.46%	13.76%	12.11%	-2.57%	14.62%	12.01%	-1.96%
1996	14.15%	4.01%	-0.65%	5.92%	10.19%	5.69%	13.41%	11.93%	9.10%	14.40%	14.22%	13.78%
1997	15.10%	3.68%	-1.06%	5.69%	9.43%	3.63%	13.15%	10.90%	-6.46%	14.48%	12.99%	1.84%
1998	15.91%	3.31%	-1.04%	5.53%	9.26%	-0.77%	13.13%	10.97%	6.11%	14.56%	13.18%	-0.15%
1999	15.81%	2.82%	-0.21%	5.39%	6.10%	-25.49%	13.08%	11.37%	6.23%	14.64%	13.40%	8.78%
2000	15.75%	2.70%	-4.59%	5.25%	6.97%	33.83%	13.07%	11.82%	8.23%	14.62%	12.20%	0.78%
2001	15.04%	2.26%	-4.67%	5.12%	7.31%	7.01%	12.87%	10.51%	-6.80%	14.51%	10.47%	-8.40%
2002	15.08%	2.01%	-6.77%	5.15%	6.29%	-16.32%	12.70%	10.94%	10.15%	14.39%	10.30%	5.32%
2003	15.12%	2.45%	15.15%	4.95%	6.28%	1.58%	12.48%	10.94%	4.14%	14.17%	9.35%	4.88%
2004	15.14%	2.03%	-8.90%	4.50%	6.45%	8.08%	12.26%	9.74%	1.11%	13.96%	8.89%	-2.85%
2005	15.20%	1.82%	-4.60%	4.39%	6.04%	-5.43%	12.04%	11.33%	5.45%	13.84%	8.79%	5.37%
2006	15.25%	1.83%	-0.96%	4.28%	5.57%	0.56%	11.86%	10.47%	-0.72%	13.63%	7.83%	-2.43%
2007	15.35%	2.03%	8.91%	4.18%	4.48%	-5.38%	11.82%	9.36%	-9.31%	13.47%	7.97%	2.63%
2008	15.44%	1.98%	5.69%	4.00%	4.09%	3.02%	11.69%	9.33%	0.17%	13.32%	7.89%	-0.07%
2009	15.55%	2.95%	10.06%	3.90%	3.90%	8.84%	11.61%	9.35%	-3.09%	13.07%	8.65%	-0.95%
2010	15.61%	2.47%	3.91%	3.73%	3.65%	-1.35%	11.49%	7.50%	-43.93%	12.92%	7.97%	6.75%
2011	15.86%	2.46%	7.80%	3.65%	3.52%	0.82%	11.57%	7.33%	3.92%	12.83%	7.85%	-1.90%
Average (1990-2011)	15.12%	3.16%	0.99%	5.26%	7.58%	1.29%	12.99%	10.53%	0.79%	14.31%	10.38%	0.71%

Source: Ibid.

Addendum 1 Table 3: Severe deficit SADC maize states agricultural labour, agricultural value add and growth in agricultural value add

	Angola			Lesotho			Tanzania			Zimbabwe		
	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)
1990	32.15%	17.94%	-0.52%	18.36%	24.95%	1.27%	41.42%	45.96%	0.00%	27.41%	16.48%	12.14%
1991	32.01%	24.03%	-1.68%	18.27%	18.03%	-29.64%	41.35%	48.14%	3.57%	27.45%	15.27%	1.04%
1992	30.89%	10.14%	-27.20%	17.86%	18.95%	26.27%	39.92%	48.00%	1.24%	26.84%	7.41%	-23.19%
1993	30.69%	11.56%	-46.60%	17.77%	19.47%	0.98%	39.88%	48.11%	3.11%	26.86%	15.04%	27.12%
1994	30.73%	6.65%	9.90%	17.66%	18.70%	1.23%	39.86%	44.98%	2.11%	26.88%	18.97%	7.31%
1995	30.56%	7.31%	21.90%	17.60%	19.04%	-4.65%	39.81%	47.14%	5.84%	26.86%	15.24%	-7.59%
1996	30.53%	7.03%	14.70%	17.59%	19.08%	-1.07%	39.71%	48.03%	3.87%	26.86%	21.77%	19.81%
1997	30.47%	9.00%	10.20%	17.52%	18.00%	-1.16%	39.57%	46.80%	2.45%	26.87%	18.93%	3.21%
1998	30.40%	13.03%	5.20%	17.53%	18.08%	27.73%	39.37%	33.76%	1.91%	26.48%	21.79%	5.08%
1999	30.30%	6.29%	1.30%	17.52%	18.49%	8.75%	39.11%	34.13%	4.06%	26.05%	19.18%	4.46%
2000	30.14%	5.66%	9.30%	17.50%	12.34%	-4.39%	38.83%	33.48%	4.46%	26.00%	18.26%	2.00%
2001	30.01%	8.16%	18.00%	17.46%	13.19%	12.94%	38.51%	32.87%	4.93%	25.90%	17.31%	14.00%
2002	29.94%	7.85%	12.10%	17.40%	10.34%	-29.39%	38.26%	32.46%	5.04%	25.80%	14.03%	-24.00%
2003	29.87%	8.33%	12.10%	17.29%	10.22%	3.42%	38.00%	32.53%	3.22%	25.64%	16.59%	-15.00%
2004	29.85%	8.63%	14.10%	17.23%	9.62%	-0.91%	37.75%	33.33%	5.91%	25.48%	19.58%	-9.00%
2005	29.85%	8.49%	17.00%	17.12%	9.01%	1.41%	37.50%	31.76%	4.42%	25.34%	18.58%	-5.00%
2006	29.85%	7.66%	9.80%	17.00%	7.89%	-10.31%	37.26%	30.41%	3.88%	25.21%	20.28%	-4.00%
2007	29.94%	7.86%	26.68%	16.78%	7.66%	-0.92%	37.08%	29.97%	4.05%	25.03%	21.60%	-7.00%
2008	29.96%	6.64%	1.71%	16.66%	8.01%	16.19%	36.88%	29.71%	4.58%	24.87%	19.40%	-39.30%
2009	29.97%	10.20%	27.75%	16.58%	7.74%	-5.05%	36.69%	28.79%	3.21%	24.67%	17.21%	22.01%
2010	29.96%	9.84%	5.89%	16.50%	8.63%	10.92%	36.52%	28.06%	4.06%	24.45%	16.00%	13.60%
2011	30.77%	10.06%	11.40%	16.64%	7.76%	-5.85%	37.49%	27.11%	3.63%	24.74%	12.76%	13.86%
Average (1990-2011)	30.40%	9.65%	6.96%	17.36%	13.87%	0.81%	38.67%	37.07%	3.61%	25.99%	17.35%	0.53%

Source: Ibid.

Addendum 1 Table 4: Data constrained SADC maize states agricultural labour, agricultural value add and growth in agricultural value add

	Democratic Republic of Congo			Madagascar			Seychelles		
	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)	Agricultural Labour (% of Population)	Agriculture Value Added (% of GDP)	Agriculture Value Added (Annual % growth)
1990	25.98%	30.96%	2.61%	35.72%	28.58%	2.08%	35.71%	4.81%	13.15%
1991	25.72%	41.67%	2.80%	35.58%	29.68%	0.51%	36.75%	4.78%	-4.09%
1992	24.36%	49.42%	3.12%	34.38%	29.10%	1.71%	35.76%	3.83%	-14.65%
1993	24.18%	51.72%	1.88%	34.22%	28.71%	3.22%	35.17%	4.17%	-7.49%
1994	24.10%	57.00%	-0.82%	34.05%	23.81%	-0.45%	34.53%	4.13%	7.59%
1995	24.05%	57.00%	11.60%	33.88%	26.69%	1.87%	35.33%	4.17%	-3.76%
1996	23.89%	33.55%	2.10%	33.72%	27.20%	2.50%	34.92%	3.90%	4.56%
1997	23.71%	48.14%	-2.72%	33.55%	31.55%	1.88%	34.24%	3.49%	4.36%
1998	23.50%	47.48%	-1.45%	33.39%	30.58%	2.14%	33.58%	2.63%	0.00%
1999	23.24%	52.72%	2.30%	33.24%	30.03%	3.41%	33.28%	3.10%	12.09%
2000	22.93%	49.97%	-11.70%	33.09%	29.21%	1.13%	34.48%	3.00%	4.25%
2001	22.68%	59.74%	-3.90%	32.95%	27.89%	4.02%	33.45%	3.00%	-2.27%
2002	22.45%	51.01%	0.50%	32.85%	31.68%	-1.29%	33.82%	3.00%	1.21%
2003	22.27%	51.01%	1.20%	32.71%	29.20%	1.30%	35.15%	3.00%	-5.89%
2004	22.15%	47.26%	0.60%	33.64%	28.80%	3.07%	34.98%	3.00%	-2.85%
2005	22.01%	45.52%	2.87%	34.29%	28.29%	2.50%	34.28%	2.36%	1.21%
2006	21.84%	45.67%	2.53%	34.15%	27.48%	2.15%	34.10%	2.28%	5.30%
2007	21.55%	42.47%	3.00%	33.60%	25.69%	2.24%	34.50%	2.14%	6.30%
2008	21.35%	40.21%	3.01%	33.75%	24.81%	2.95%	34.37%	2.02%	5.96%
2009	21.15%	42.91%	3.00%	33.90%	29.11%	8.54%	34.67%	1.83%	4.98%
2010	20.95%	-	-	34.04%	-	-	34.88%	-	-
2011	21.31%	-	-	35.15%	-	-	34.88%	-	-
Average (1990-2011)	22.97%	47.27%	1.13%	33.90%	28.40%	2.27%	34.67%	3.23%	1.50%

Source: Ibid.

ADDENDUM 2: SADC COUNTRIES DISTANCES

Addendum 2 Table 1: Great Circle Distances

Great Circle Distances Between Capital Cities (Kms)														
	Angola	Botswana	DR Congo	Lesotho	Madagascar	Malawi	Mauritius	Mozambique	Namibia	South Africa	Swaziland	Tanzania	Zambia	Zimbabwe
Angola	0.00													
Botswana	2 224.07	0.00												
Congo	549.60	2 539.90	0.00											
Lesotho	2 793.70	530.59	3 061.43	0.00										
Madagascar	3 857.11	2 317.25	3 853.01	2 332.04	0.00									
Malawi	2 304.88	1 449.14	2 288.25	1 820.99	1 567.07	0.00								
Mauritius	4 910.44	3 275.73	4 889.83	3 184.43	1 054.46	2 613.32	0.00							
Mozambique	2 720.96	682.85	3 030.10	624.85	1 720.34	1 336.97	2 622.97	0.00						
Namibia	1 584.37	929.37	2 039.00	1 279.21	3 181.26	1 995.04	4 176.76	1 612.20	0.00					
South Africa	2 456.28	251.95	2 749.58	402.00	2 125.95	1 430.50	3 057.99	442.28	1 175.96	0.00				
Swaziland	1 791.71	547.49	2 966.38	488.53	1 870.89	1 395.78	2 774.88	152.54	1 474.89	299.20	0.00			
Tanzania	2 875.88	2 449.50	2 666.64	2 790.57	1 613.96	1 002.28	2 461.39	2 245.03	2 950.80	2 413.22	2 333.57	0.00		
Zambia	2 706.59	1 066.04	1 881.26	1 546.74	2 077.47	607.02	3 131.72	1 254.32	1 417.42	1 148.30	1 244.07	1 533.69	0.00	
Zimbabwe	2 213.10	961.38	2 316.38	1 339.67	1 692.73	489.85	2 741.22	910.63	1 590.14	944.39	941.72	1 488.14	435.19	0.00

Source: Eden (1997).

ADDENDUM 3: STATA OUTPUT

```
. xttobit total_trade r_agric_gdp p_agric_gdp r_pop p_pop mz_aid Infrastructure dist Net_Grain border sacu1 sacu2 comesa1 comesa2
```

Obtaining starting values for full model:

```
Iteration 0: log likelihood = -4180.7216
Iteration 1: log likelihood = -4142.0757
Iteration 2: log likelihood = -4138.6264
Iteration 3: log likelihood = -4138.5933
Iteration 4: log likelihood = -4138.5933
```

Fitting full model:

```
Iteration 0: log likelihood = -4138.5933
Iteration 1: log likelihood = -4138.5933
```

```
Random-effects tobit regression      Number of obs   =   1430
Group variable: id                  Number of groups =    130
```

```
Random effects u_i ~ Gaussian      Obs per group: min =    11
                                      avg   =   11.0
                                      max   =    11
```

```
Log likelihood = -4138.5933        wald chi2(13)   =   118.05
                                      Prob > chi2     =    0.0000
```

total_trade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
r_agric_gdp	.0978868	.0859197	1.14	0.255	-.0705127	.2662863
p_agric_gdp	-.0146991	.0852108	-0.17	0.863	-.1817092	.152311
r_pop	.4231034	.5213175	0.81	0.417	-.5986601	1.444867
p_pop	.7490816	.2894656	2.59	0.010	.1817394	1.316424
mz_aid	.1902969	.0416828	4.57	0.000	.1086001	.2719937
Infrastruct~e	1.477758	.5016811	2.95	0.003	.4944811	2.461035
dist	-1.670357	.7107318	-2.35	0.019	-3.063366	-.2773486
Net_Grain	-1.344539	.3727668	-3.61	0.000	-2.075148	-.6139294
border	2.740921	.979184	2.80	0.005	.821756	4.660087
sacu1	-2.188397	1.531734	-1.43	0.153	-5.190542	.813747
sacu2	.8832005	1.523875	0.58	0.562	-2.103539	3.86994
comesa1	-.7894902	1.169317	-0.68	0.500	-3.081309	1.502328
comesa2	.3645537	1.314971	0.28	0.782	-2.212741	2.941849
_cons	-18.62622	10.85091	-1.72	0.086	-39.89362	2.641175
/sigma_u	3.963172	.2813944	14.08	0.000	3.411649	4.514695
/sigma_e	3.899638	.0768783	50.72	0.000	3.74896	4.050317
rho	.5080797	.0373606			.4351283	.5807611

```
Observation summary:      0 left-censored observations
                          1430 uncensored observations
                          0 right-censored observations
```