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Annual Trends & Outlook Report | 2013

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Agricultural Growth Trends and Outlook
for Southern Africa

Promoting Agricultural Trade to Enhance Resilience in Southern Africa

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Greenwell Matchaya, Sibusiso Nhlengethwa and Charles Nhemachena

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Acronyms and Abbreviations

AfDB	African Development Bank
AgGDP	Agricultural gross domestic product
AMU	Arab-Maghreh Union
ATOR	Annual Trends and Outlook Report
AUC	African Union Commission
CAADP	Comprehensive Africa Agriculture Development Programme
CGE	Computable General Equilibrium
CGIAR	Consultative Group on International Agricultural Research
CV	Coefficient of Variation
COMESA	Common market for eastern and southern Africa
DFID	UK Department for International Development
DRC	Democratic Republic of the Congo
ECA	East and Central Africa
ECOWAS	Economic Community of West African States
EMM	Economy-wide Multimarket Model
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database
FISP	Free Input Subsidy Programs
FRA	Food Reserve Agency
GDP	Gross domestic product
GBOT	Global Board of Trade
GNI	Gross National Income
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
LI	Low-income (countries)
M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
MFAN	Ministry of Foreign Affairs of the Netherlands
MI	Middle-income (countries)
MIS	Market Information System
MIRAGRODEP	Multi-sector computable general equilibrium model
NDVI	Normalized Difference Vegetation Index
NEPAD	New Partnership for Africa's Development
NPCA	NEPAD Planning and Coordinating Agency
NTB	Non-tariff Barrier
NTM	Non-tariff Measure
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
PAE	Public agricultural expenditure
PFP	Partial factor productivity
RCA	Revealed Comparative Advantage
R&D	Research and Development
REC	Regional economic communities
ReSAKSS	Regional Strategic Analysis and Knowledge Support System
ReSAKSS-AW	Regional Strategic Analysis and Knowledge Support System Africa-Wide
ReSAKSS-ECA	Regional Strategic Analysis and Knowledge Support System eastern and central Africa
ReSAKSS-SA	Regional Strategic Analysis and Knowledge Support System-Southern Africa
ReSAKSS-WA	Regional Strategic Analysis and Knowledge Support System-West Africa
RISDP	Regional Indicative Strategic Development Plan
SACU	Southern African Customs Union
SADC	Southern African Development Community
SIDA	Swedish International Development Cooperation Agency
SPEED	Statistics of public expenditure for economic development
SSA	Sub-Saharan Africa
SSA RCA	Sub-Saharan Africa Regional Comparative Advantages
TEL	Trade Expansion Indicator
TFP	Total factor productivity
TOI	Trade Overlap Indicator
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
WDI	World Development Indicators
ZAMACE	Zambian Commodity Exchange

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Executive Summary

Greenwell Matchaya, Charles Nhemachena and Sibusiso Nhlengethwa

Countries develop from one stage to another following a complex path that comprises many factors interacting with each other. While natural resource endowments, human capital, technological progress, politics and the general economic policy taken by a country, are important in determining the growth process, it cannot be overemphasized that trade has an important role. Of course, it is not uncommon that international and domestic trade can have varying effects on incomes and livelihoods of those involved, but many studies exist that appear to support the positive role of trade in economic development.

Indeed, some literature suggests that some forms of trade/exports are more developmentally beneficial than others. For example, countries that tend to specialize in the export of non-oil primary commodities tend to be exposed to highly volatile market prices, due to the lack of any pricing power and limited spillover benefits to the wider economy. Some studies exemplify this by discussing how the GDP of many African countries that specialized their exports following the pressure from neoliberal policies, is strongly correlated to volatility in prices of primary commodities, increasing their vulnerability to exogenously determined price shocks. However, evidence from literature and general observation supports that efficient and integrated markets save lives during crises in several ways including: (1) directly by increasing availability and reducing prices in deficit areas and (2) indirectly by reducing the scope and cost of the required emergency response. Understanding the nature and the importance of trade over time in the Southern African Development Community (SADC) is critical for enhancing regional potential for development.

Against the above background, the SADC 2013 Annual Trends and Outlook Report (2013 ATOR) assesses the structure and performance of trade by SADC countries in global and regional agricultural markets. It also evaluates the extent of integration of SADC countries in these markets, and the potential for greater integration. The implications for resilience of domestic food systems are also analyzed, including the potential impact of biophysical, budgetary, or weather shocks on the capacity to use trade as a stabilizing instrument. The findings and related policy and strategic implications are summarized below.

Major Findings and Recommendations

The world share of SADC trade is still low but has increased in the past two decades: SADC's share of world trade has been increasing since the 1980s and at present stands at about 1.2%, which is, in the authors' view, lamentably low considering that the SADC is home to Africa's most developed economy, South Africa. But indeed, SADC countries appear to be increasing intra-regional trade and although there is substantial trade between SADC countries and the outside world, it is dwindling over time. The share of trade in low-value but high-calorie products has intensified among African countries in recent years. SADC countries have increased their market shares through increased competitiveness, geographical specialization and sectoral specialization. The SADC's share of world imports ranged from lower than 1% in the 1990s to just about 1% around 2013.

SADC's trade has undergone slow diversification with other countries still relying on single commodities for exports, and single export-import markets, thereby rendering them vulnerable to external shocks.

Export Concentration: The SADC region's exports have been rapidly growing in value since 2000; this growth has been noted across the top of the regional exports, live trees, other plants, edible fruits, nuts, tobacco, aircrafts and their parts. However, we also find that the comparative advantage for many SADC member countries is the tendency to cluster amongst similar products such as tobacco, salts, ores, slags and ash, whose terms of trade appear volatile over time. In recent times, countries whose main exports are less diversified, including Malawi (tobacco), Zambia (copper), Mauritius (sugarcane), Angola (oil), and Botswana (diamond) have faced some amount of significant price volatility following sudden shocks in demand and price of their major exports. In each of these countries, demand shocks have also led to instability in export earnings. There is need for SADC to diversify exports by engaging in processing of some of the commodities before they can be exported. For countries, such as Malawi, where there is overreliance on tobacco for foreign exchange earnings, it would be useful to explore other alternatives within and outside agriculture including nontraditional crops of nutritive or medicinal value bacause of which the country could have a comparative advantage.

Geographic Export Concentration: We also find that exports from SADC countries are concentrated on destinations in the EU and other high OECD markets though this concentration is diminishing. Exports on nonagricultural products to BRIC (Brazil, Russia, India and China) countries have increased significantly, especially between 2005 and 2013.

Simulation results show that if current trends persist, SADC's agricultural trade will continue to expand: There is a glimmer of hope for southern Africa because trade is set to grow projecting into the future. Simulation results show that SADC's, especially Southern Africa Customs Union's agricultural imports per capita would grow by 72% by 2030. The growth is defined as the value of SACUs projected per capita agricultural net exports in a given (future) year minus SACU's per capita agricultural net exports in 2013. The SACU region is expected to experience a positive overall surplus in agricultural trade. The growth in SACU's agricultural trade would be driven mainly by trade in vegetables and fruits; sugar; processed food; and beverages and tobacco. These categories are expected to experience better performance in productivity and trade resulting in trade surpluses. Cereals and vegetable oils are projected to experience negative growth between 2013 and 2030. This indicates that the demand per capita for cereals and vegetable oils is projected to grow quickly probably due to population growth, resulting in trade deficits in these categories. Again, it appears that unless other unforeseeable factors come into play, SACU's trade with the world will continue to grow all the way to 2030, which could be ascribed to persistent African efforts towards intensifying regional integration.

There is significant potential to stabilize domestic markets by expanding regional trade: Price volatility in the SADC is an issue of concern, which has been discussed for long. Some of the common causes of price volatility in the SADC are: (a) seasonal variation in domestic production; (b) interannual variation in domestic production; (c) fluctuation in world prices; (d) changes in policy; and (e) other sources of price instability, including variation in demand, changes in closely linked markets, food stocks kept by a country, and market speculation.

Openness among SADC countries and between SADC and other African countries can broaden food markets and dilute the effects of local supply: In the SADC region, a number of countries including Malawi, Zambia and Zimbabwe keep grain reserves as a way of stabilizing maize prices over time. Others though possessing none rely on market forces to determine prices all the time. In Malawi, for example, the National Food Reserve Agency together with ADMARC plays a critical role in stabilization of food prices, particularly when prices soar beyond the reach of many consumers. Counterintuitively, it appears that markets with wider interventions including Zambia, Malawi, and Zimbabwe are associated with high price volatilities when compared with those with low interventions such as Tanzania and Mozambique. It would appear that the manner in which the interventions are executed do more harm than good to the markets so that those efforts are only partially successful in dampening volatility of prices.

In general, grain reserves in the SADC appear not to have been managed according to buffer stock principles: (1) the objectives of the reserves span beyond price stabilization, (2) the reserves are used ad hoc and a price is never defined for it, and (3) often, they are intervened in a myriad ways ranging from subsidies, to trade policy as well as marketing regulations. In any case, it would appear that grain reserves are likely to succeed in dampening price volatility if information imperfection is limited on the market.

In the medium term, trade policies should seek to reduce transaction and transport costs as well as increasing productivity: Transactions costs of trade, including transport costs play a key role in increasing price volatility domestically. In cases where transportation costs are low, markets are easily interlinked and areas of short supply can easily have food access through imports from neighboring markets.

International trade reduces price volatility so that economic integration will be good for price stability: Although it would appear that the effect of trade openness on price stability would be an empirical one as it would depend on the context, in most cases the net effect is likely to reduce price instability. For example, the world market prices are significantly lower than those of the domestic markets in the SADC, whereas volatility of prices of tradable commodities including wheat and rice is lower than that of non-tradables such as maize and millet. Again, there is evidence that price spikes in African markets including Malawi in the SADC have been above import parity prices. For example, Malawi has experienced a number of maize price spikes because the government has either delayed importing maize from outside, or has estimated the amount of stocks available, or stocks had lasted only for a short while. It can be argued that since the prices had risen above import parity prices, such spikes would have been dampened if the conditions allowed private sectors to trade, i.e., if their trading activities had not been crowded out.

Investing in market infrastructure will facilitate trade, stabilize markets and benefit SADC economies more: Imperfect information between trades or information disseminated to market participants with a lag, is partly the cause of volatility of prices. If information flowed perfectly some amount of instability would be removed. Market information systems purport to gather and disseminate information about prices and market conditions timely. The more effective these facilities are, the more likely some volatility can be removed from prices.

Contracts, safety-nets, futures markets and various other measures can reduce the impact of the volatility of food prices and hence protect livelihoods from external shocks: In the southern part of Africa, farming contracts are popular with cash crops, for example, tobacco farming in Malawi by Limbe Leaf and farmers, as well as tea, cotton and sugar contracts in Tanzania, Swaziland, Lesotho and Zambia. Although critics have argued that such contracts may trap farmers in unfair contracts and poverty, studies have shown that, in general, such farmers emerge well-off than comparable ones who did not choose contract farming.

Safety nets reduce consumption risk. This may be achieved through many ways including food handouts, guaranteed employment (food for work), cash transfers, school feeding programs as well as inputs subsidies. Where they are well designed, such safety-net programs could improve local infrastructure while providing assistance to the poorest of the households. In the SADC popular safety net programs include Food For Work programs, cash transfers and some levels of subsidies in Malawi, Mozambique, Zambia, and Zimbabwe, among others. Most of these are donor-funded although in some cases national governments have put forward some limited funding for the same. Safety net programs are helpful in the long run, but they can be associated with significant costs in the short term.

Biophysical, agroclimatic and budgetary shocks strongly affect trade performance through effects on agricultural production: It is also found that rainfall, temperature, Normalized Difference Vegetation Index (NDVI), tree covers, population, GDP, public funding on agricultural water development, and cropland are critical for determining net exports from a country. This implies that net exports can increase in the long run if population growth can be kept at bay, investments in water management technologies increase, and tree covers and the general agroecosystems are cared for through deliberate policy.

The findings herein suggest that SADC countries have made encouraging progress in strengthening global and regional trade. However, volatility of food prices resulting from climate change and other factors will likely continue to affect vulnerable households for the

foreseeable future. In order to further harness the potential of global and regional trade to reduce volatility of food prices and build resilience, both of food systems and of the poor and vulnerable, governments should invest in social safety net programs in addition to raising agricultural productivity, removing regional trade barriers, and making infrastructure improvements to reduce the overall cost of trading while promoting further integration.

1. Introduction

Greenwell Matchaya

Following the launching of the comprehensive African Agricultural Development Program (CAADP) there have been several efforts aimed at tracking the performance of the program at both national and regional levels. The Regional Strategic Analysis and Knowledge Support Systems (ReSAKSS) has focused on monitoring and evaluation of 30 core indicators defined for the CAADP annually, an exercise that culminates in regional- and country-level Annual Trends and Outlook Reports (ATORs) focusing on an issue of interest in a particular year. The 2011 ATORs focused on agricultural productivity whereas in 2012 these ATORs focused on public expenditure on agriculture, to try and explain the levels of performance in the agriculture sector. These reports form the basis for policy debates and feed into plans for policy implementation.

For the year 2013, the focus of the ATORs is on trade dynamics and resilience as one way of attempting to bring about the importance of trade in poverty reduction and vulnerability as well as resilience of economies. The reports for 2013 cover issues of intra and extra-regional trade, biophysical, budgetary and climatic shocks on trade and also consider trends in calorie trade among others.

In practice, all kinds of shocks, not just economic but also climate-related and social shocks have the ability to destabilize domestic markets and hence access to goods and services. Further, the effects of shocks on food systems can be far-reaching, affecting well beyond some of the most vulnerable members of society. The global and regional food price hikes of 2001/2002 and 2008 with their concomitant political consequences offer good illustrations of how far the effects of food supply shocks can reach. The knock-on/ripple effects of such shocks further highlight the pertinence of resilient domestic markets and market infrastructure in reducing their adverse effects on food availability and access in local markets. This is perhaps the rationale as to why all countries resort to the use of a myriad tools and instruments to control and mitigate the effects of shocks on domestic food markets.

Economic pundits and observers have noted that the 2010/2011 shocks to global food prices did not translate into serious impacts on global food markets than did earlier global shocks. There have not been significant follow-on effects that later end up disrupting market operations. One important lesson ensuing from that experience is that when markets are effective and somehow efficient, with fewer transaction costs, the magnitude of shocks and their impacts become more manageable (Caselli 2011). Trade stabilizes domestic markets by increasing the number of actors and their area of operation in the course of production and distribution of food, which in turn enhances the market capacity to absorb shocks. Trade in this regard links supply sources that are less likely to be affected to the same degree by a shock, so that the effect of a particular shock is then dampened by such remote suppliers. On the demand side, trade spreads effects of a shock thinly over a wider area owing to the fact that it links demand across a wider network of markets. This protects

individual markets which would have been affected too heavily in the absence of demand linkages across wider networks of markets.

Literature suggests that some forms of exports are more developmentally beneficial than others. It is argued for example, that countries that tend to specialize in the export of non-oil primary commodities tend to be exposed to highly volatile market prices, due to the lack of any pricing power and limited spillover benefits to the wider economy. Deaton (1999) discusses how the GDP of many African countries, that specialized their export following the pressure from neoliberal policies, is strongly correlated to volatility in prices of primary commodities, increasing their vulnerability to exogenously determined price shocks. An increase in the degree of trade openness leads to higher output volatility especially in developing countries (Loayza and Raddatz 2007; Krishna and Levchenko 2009).

However, many studies suggest that efficient and integrated markets save lives during crises in two ways, namely: (1) directly, by increasing availability and reducing prices in deficit areas and (2) indirectly, by reducing the scope and cost of the required emergency response (Chapoto and Jayne 2009).

Empirically, most studies find a consistent positive correlation between trade openness, growth and poverty reduction (Dollar and Kraay 2001; Cline 2004; Winters et al. 2004), and no significant relationship between trade openness and domestic macroeconomic volatility (Calderon et al. 2005; Kose and Yi 2006). Pervasive effects of trade openness on poverty and inequality are also acknowledged in the literature (McCulloch et al. 2001). It also appears that, irrespective of whether the effect of trade openness on output volatility is positive or negative, on average, openness lowers output volatility in sufficiently diversified economies, while it increases volatility in those with more concentrated export baskets (Haddad et al. 2012).

Idiosyncratic shocks to specific product markets are more likely to lead to large swings in a country's export volumes and terms of trade if its exports are concentrated on a few sectors. A higher degree of diversification would likely imply that a country is more involved in both implicit and explicit international insurance schemes to cushion it from the impact of external shocks and less involved in the price instability. This report delves into some of these relationships in order to understand the nexus between agricultural trade and volatility in the SADC region.

The choice of the ATOR 2013 topic focusing on trade and resilience has been motivated by the need to stimulate the debate on the potential of trade at all levels as a tool to enhance the resilience of food markets in African countries. The topic also focuses on an important dimension of Pillar II of the CAADP which deals with markets and trade-related areas as one way of endeavoring to reduce food insecurity, increase resilience to shocks and improve people's livelihoods. Also, in the newly signed Malabo Declaration, the Heads of State have agreed to treble the levels of trade by 2025 in order to meaningfully impact poverty. Understanding the interlinkages of trade and poverty/resilience of nations and households is critical to achieve the set goal.

The rest of the report is organized as follows: Chapter 2 provides an in-depth analysis of the competitiveness and outlook of SADC's trade patterns among the SADC countries going into the future. It reviews the performance of trade in goods and services as well as agricultural products mainly by the SADC countries and discusses the factors that explain some of the important patterns. The chapter closes with a discussion on the future of trade performance outlook among SADC countries by 2030.

Chapter 3 discusses the behavior of food markets in and outside the SADC and their implications for food systems in the SADC region, focusing on the extent, causes, and effects of volatility of food prices among SADC countries. It also highlights the experience of several countries in dealing with volatility of prices and its effects, and further examines various response and mitigation mechanisms.

Chapters 4 and 5 discuss the instability of the patterns of domestic supply and also examine the effects of biophysical, budgetary and agroclimatic conditions on trade dynamics in the SADC region. Chapter 6 closes with findings and conclusions of the report. The data for the analysis herein and the CAADP core indicators are included in the appendix in aggregated form.

2. SADC Trade Patterns, Competitiveness, and Growth Outlook

Greenwell Matchaya, Charles Nhemachena and Sibusiso Nhlengethwa

Chapter 2 analyzes the SADC region's trends and patterns in global and regional trade in goods and services with particular focus on trade in agricultural products. Specific issues examined include the performance of SADC's agricultural trade (exports and imports) and intra-SADC agricultural trade (in terms of value and calorie content). The product makeup and geographic characteristics of SADC's agricultural trade are also assessed including main drivers of the global market share of agriculture in member countries in terms of competitiveness, and geographic and sectoral specializations. The growth outlook of agricultural trade between 2013 and 2030 is projected using a multi-sector computable general equilibrium model (MIRAGRODEP).

Although it is often argued by sceptics that trade openness is harmful to the vulnerable in the short run, many economists generally believe that in the long run open economies fair better in aggregate terms than closed ones, and open policies contribute significantly to development (Winters et al. 2004). Among other goals therefore, this report purports to analyze the trends and patterns in agricultural trade emanating from, or coming in, the SADC region as a first step towards understanding the nexus between trade, resilience and livelihoods. Towards the end, a discussion on trade in agricultural commodities and outcomes of poverty, price stability, incomes, productivity and malnutrition is advanced. In the subsequent sections and chapters we present evidence which supports the notion that trade is good for economies.

Trends and Patterns in SADC's Global Trade in Goods and Services

Figure 2.1a presents the evolution of SADC's share of world exports in goods and services from 1980 to 2012. The results show that the region's shares of world exports have been declining or constant in terms of decadal shares. Further analysis across different SADC groupings (middle-income [SADC-MI] countries of the SADC, low-income [SADC-LI] countries and Southern African Customs Union [SACU; SACU includes South Africa,

Namibia, Swaziland, Lesotho and Botswana] as well as SADC without South Africa [SADC- excluding SA] shows that for the overall SADC region there was a marginal increase in the share of world exports in the period 2000 to 2012. The SADC excluding South Africa grouping recorded relatively the largest increase of the share of world exports from the 1990 -1999 period to the 2000 – 2012 period. However, this grouping's share is very low clearly indicating the influence of South Africa in the region's share of exports of goods and services. The SADC low-income grouping's performance has been very low compared to the rest of the other groupings over the period under study.

Figure 2.1 presents evolution of SADC's share of world imports in goods and services (1980 – 2012). The figure shows that SADC's share of world imports has been declining over time. This is the case across all groupings of the SADC, that is middle-income (SADC-MI) countries of the SADC, low-income (SADC-LI) countries and Southern African Customs Union (SACU-SACU includes South Africa, Namibia, Swaziland, Lesotho and Botswana) as well as SADC without South Africa (SADC-SA) which may signal that the SADC region is reducing dependence on consumption from the world markets. However, this may also signal problems related to the ability of the SADC countries to import from the world, rather than necessarily that SADC countries are doing this out of choice.

Figure 2.2 presents the evolution of the shares of SADC in world exports of goods and services between 1980 and 2012. The region's share of world exports has been generally declining from 1980 to the late 1990. This was followed by a slight increase from early 2000s and a deep decline in the year 2006. Thereafter, the SADC's share increased again reaching a peak in 2011 and a decline in 2012. The small decline in the year 2009 might have been an impact of the 2008 global economic crisis; however, it seems the impact was not that pronounced in the region.

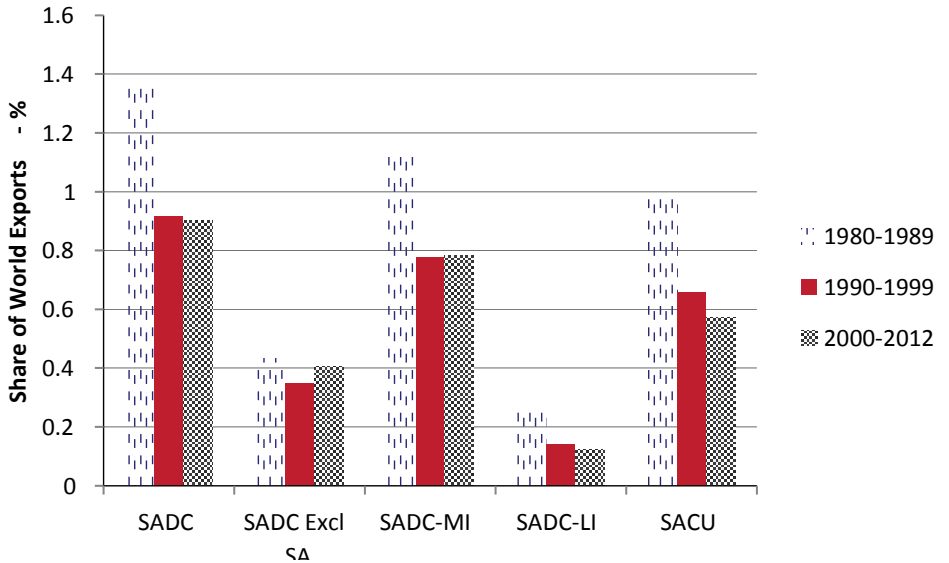


FIGURE 2.1. EVOLUTION OF SADC'S SHARE OF WORLD EXPORTS OF GOODS AND SERVICES (1980–2012).
Sources: UNCTAD and authors' calculations, 2014.

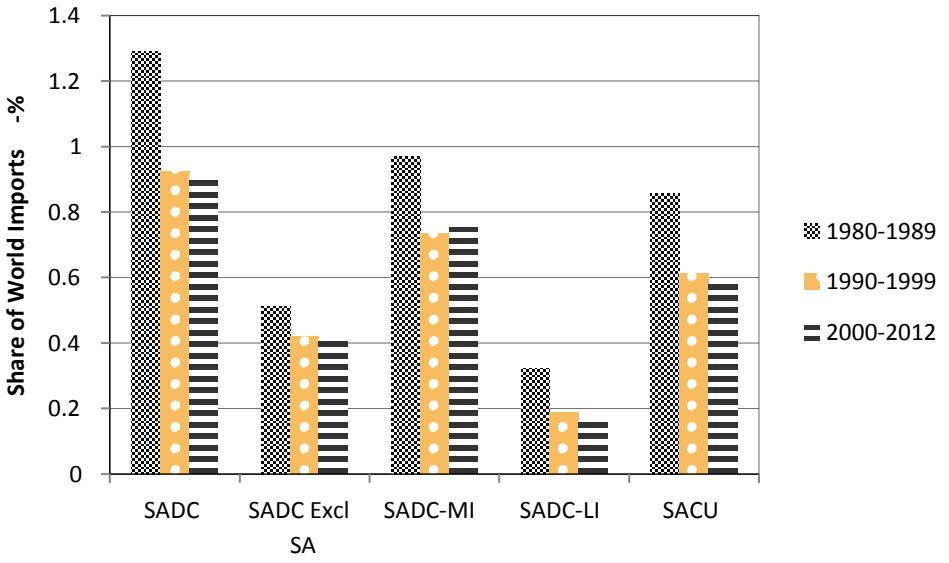


FIGURE 2.2. EVOLUTION OF SADC'S SHARE OF WORLD IMPORTS OF GOODS AND SERVICES (1980–2012).
Sources: UNCTAD and authors' calculations, 2014.

The evolution of SADC's share of world imports of goods and services between 1980 and 2012 is presented in Figure 2.3. In general, the share of SADC imports over time has been characterized by a U shape between 1980 and 2012. It is worrying that the general trend now is upward, when viewed annually. SADC countries like most African countries do not have to be importing goods and services more than before unless these imports constitute technology. Figure 2.4 shows that the SADC share of world imports of goods and services has hovered below 1.2% but this share has been increasing over time. A big chunk of these imports are attributable to SADC's middle-income countries including South Africa, Botswana, Mauritius, Angola, and Namibia, which reflects the importance of income in decisions to import. The SADC has to increase imports of productive goods and services to ensure long-run economic growth.

Intra-regional trade in SADC is mainly driven by South Africa in terms of both imports and exports. However, South Africa's regional importance is with respect to being a source of import to other members rather than a destination of their exports. Angola was a lesser player but has grown to be significant when it comes to the export of concentrated fuels and a recipient of imports of other secondary commodities. The same can be said about the significance of Zambia and Zimbabwe (landlocked countries); their export and import shares have been steadily increasing during the period 1980 – 2009.

With respect to trade intensity, landlocked countries like Zambia and Zimbabwe are expected to have a higher degree of dependence on regional partners for both imports and exports. In general, the region is vital as a destination for its members' exports rather than as a source of their imports. However, the level of imports sourced from the SADC region have held up compared to the rest of the world (as indicated by regional import trade diversity). Zimbabwe, Malawi and Mozambique have the highest regional export intensity. Zambia, Zimbabwe and Mozambique have the highest regional import intensity.

In the SADC region the export and import basket is more diversified than in most of the Sub-Saharan Africa Regional Comparative Advantages (SSA RCAs). SADC is an importer of large minerals, fuels and oil; other important imports include general goods such as electronic machinery and plastics.

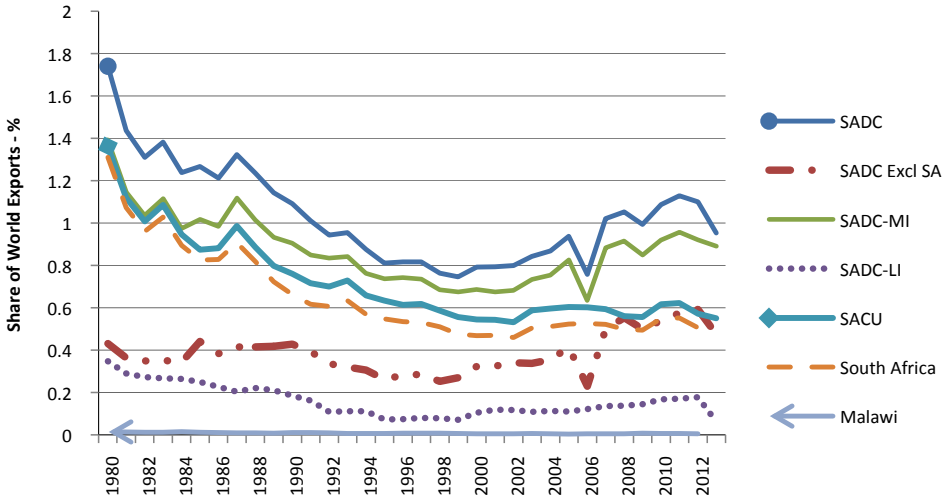


FIGURE 2.3. EVOLUTION OF SADC'S SHARE OF WORLD EXPORTS OF GOODS AND SERVICES (1980-2012).
Sources: UNCTAD and authors' calculations, 2014.

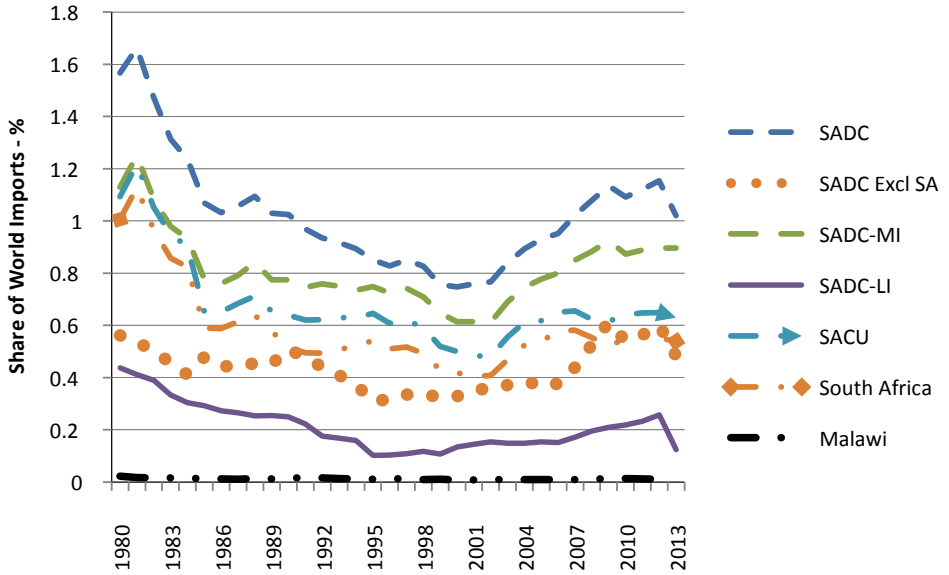


FIGURE 2.4. EVOLUTION OF SADC'S SHARE OF WORLD IMPORTS OF GOODS AND SERVICES (1980-2012).
Sources: UNCTAD and authors' calculations, 2014.

The SADC regions' exports have been rapidly growing in value since 2000; this growth has been noted across the top ten regional exports. SADC has an RCA compared to the rest of the world in a number of products. The ten group of products in which the region has been identified as having an RCA include live trees, other plants, edible fruits, nuts, tobacco, and aircrafts and their parts.

However, the RCA for SADC member countries tends to cluster amongst similar products such as tobacco, salts, ores, slags and ash. Moreover, these products tend to be traded within production networks and, as intermediate goods, they thus feature in imports and exports of these countries. Despite the region having an RCA in more technologically sophisticated products compared to East and Central Africa (ECA) and Economic Community of West African States (ECOWAS), the results of analysis of the complementariness of trade structures and therefore the potential for increased intra-regional trade in SADC appear less promising.

Exports from SADC countries are concentrated on destinations in the EU and other high OECD markets though this concentration is diminishing. Exports on nonagricultural products to BRIC countries have increased significantly especially between 2005 and 2010. The share of intra-regional SADC trade in the region's total trade has not changed much during the integration period and reached 11% in 2010 for both intra-SADC exports and imports. Mashayekhi et al. (2012) state that the share is quite higher than in the other regions, i.e., COMESA has a share of 6% and Arab-Maghreb Union (AMU) has only 5%.

Table 2.1 shows the destination of SADC's agricultural exports in value and content (calories) between 1996–2003 and 2004–2013. The results show increases in value of exports to Africa, SADC and SSA and decreases for the rest of the regions. In terms of kilocalories, the destination of SADC's exports to the rest of the world increases by about 50% and showed small increases to COMESA. Overall, the findings point to deepening on regional integration in the region and within Africa.

TABLE 2.1. DESTINATION OF SADC'S AGRICULTURAL EXPORTS (%).

	Destination of agricultural exports						
VALUE (USD)	Africa	COMESA	ECOWAS	ROW	SADC	SSA	WLD
1996-2002	23.9	11.0	1.2	80.4	19.6	23.8	100
2003-2007	26.9	11.3	1.5	77.6	22.4	26.8	100
2008-2013	36.7	16.2	1.6	68.4	31.6	36.6	100
CALORIES							
1996-2002	72.7	25.9	0.7	30.8	69.2	72.3	100
2003-2007	52.5	30.4	1.4	58.3	41.7	52.4	100
2008-2013	54.3	29.7	0.9	55.9	44.1	53.2	100

Note: In this Table and others, ROW=Rest of the world; WLD=World
Sources: UNCTAD and authors' calculations, 2014.

Specifically, it appears that in terms of value of agricultural trade, from the SADC, SADC's exports to African destinations have increased from 23.9% in the period 1996-2002, to 36.7% in the period of 2008-2013. However, in terms of calorific value of trade, the shares have decreased from 72.3 to 54.3 % over the same period. The SADC appears to be increasingly exporting calorie-rich products to destinations overseas perhaps in search for better prices. Whether it is, trade in terms of calories or in terms of value in USD, more than half of SADC trade with Africa takes place intra-regionally, i.e., with SADC countries. It should also be stated that there is a noticeable increase in SADC intra-regional trade in terms of value over the same period. In fact, intra-regional SADC trade understood this way, increased from just under 19.6% in the 1996-2002 period to an overwhelming 31.6% representing a growth of more than 12% over that period.

Table 2.2 shows that the SADC region gets most of its agricultural and calorie imports from outside the SADC. For example, between the two periods 1996-2002 and 2008-2013, SADC countries imported the bulk of their agricultural commodities from outside Africa. For example, over the said period, SADC countries have imported just about 30% from the African region and the rest of the agricultural imports (about 70%) from overseas. The story is almost similar with respect to imports of calories. In sum these figures indicate the dependency of SADC countries on overseas in terms of agricultural imports; this dependency is not consistent with the aspirations of African states elaborated under various agreements including the Maputo Declaration of 2003 and the Malabo Summit and its underlying commitments of 2014. In both declarations, Heads of African States were committed to increasing inter-African trade.

TABLE 2.2. ORIGIN OF SADC'S AGRICULTURAL IMPORTS (%).

	Origin of agricultural imports						
Value-USD	Africa	COMESA	ECOWAS	ROW	SADC	SSA	WLD
1996-2002	28.6	7.5	0.6	73.0	27.0	28.6	100
2003-2007	33.2	7.2	0.4	68.2	31.8	33.2	100
2008-2013	31.6	7.6	0.2	70.3	29.7	31.5	100
Calories							
1996-2002	23.6	4.5	0.4	77.3	22.7	23.4	100
2003-2007	28.2	5.1	0.3	72.8	27.2	28.0	100
2008-2013	26.9	6.4	0.1	74.2	25.8	26.3	100

Sources: UNCTAD and authors' calculation, 2014.

Table 2.3 shows that when we zero in on individual SADC countries, the details of SADC's calorie trade with individual countries and the region begin to emerge. For example, some of the countries including Botswana, Lesotho, Malawi, Namibia, Swaziland Zambia and Zimbabwe, export their agricultural products predominantly (>70%) to SADC countries whereas exports to ECOWAS countries are almost nonexistent with the exception of South Africa which exports at least 1.5% to ECOWAS in West Africa. The rest of the countries export to COMESA which overlaps with the SADC, and to the rest of the world. Island states of Madagascar and Seychelles predominantly export more than 83% of their agricultural commodities outside Africa.

Table 2.4 shows that SADC's agricultural trade in terms of value is different from the calorie trade across countries. The destinations of SADC agricultural goods in terms of value in USD are partitioned such that almost all the countries except Swaziland, Zambia and Lesotho, export most of their agricultural commodities (>50%) to overseas markets and not to-African markets. Again, this is symptomatic of problems ahead considering that Africa needs to integrate significantly if the continent is to secure its place as a significant player in the future of world trade. African countries need to do more to cut off their dependence on overseas markets for their agricultural trade. One possible key towards this rests in the revival of agricultural processing as one element of Africa's agricultural-led industrialization.

Figure 2.5 shows that SADC's intra-regional agricultural as well as general trade have been increasing steadily over time. The SADC intra-regional exports, for example, have reached over USD35 billion, whereas intra-regional agricultural exports totaled more than USD7 billion by 2013. This is significant and it should be noted that the actual figures in practice are likely more than these formally reported figures because some amounts of trade take place informally across borders. Some estimates predict that informal trade in agricultural products could account for more than 10% of total intra-regional trade.

TABLE 2.3.. BILATERAL AGRICULTURAL TRADE MATRIX: SHARE OF EXPORT CALORIES TO VARIOUS DESTINATIONS (1996-2013).

Share of agricultural export (million kcal)	Importer						
Exporter	Africa	COMESA	ECOWAS	ROW	SADC	SSA	WLD
Botswana	96.1	12.8	0.0	3.9	96.1	96.1	100.0
Lesotho	99.4	0.0	0.0	0.6	99.4	99.4	100.0
Madagascar	11.1	9.9	0.0	88.9	2.9	9.8	100.0
Malawi	91.6	32.0	0.0	8.4	89.6	91.6	100.0
Mozambique	52.2	11.6	0.0	47.8	50.3	52.0	100.0
Namibia	72.8	7.1	0.9	27.2	70.8	72.9	100.0
SADC	61.3	28.2	0.9	38.7	54.3	61.8	100.0
Seychelles	16.2	6.1	0.5	83.8	16.0	16.5	100.0
South Africa	64.3	22.4	1.4	35.7	57.6	64.7	100.0
Swaziland	77.0	21.5	0.4	23.0	65.8	76.9	100.0
Tanzania	38.6	35.4	0.0	61.4	12.1	37.2	100.0
Zambia	81.8	65.3	0.0	18.2	81.2	89.2	100.0
Zimbabwe	78.6	13.1	0.0	21.4	72.6	77.1	100.0

Sources: UNCTAD and authors' calculation, 2014.

Figure 2.6 shows SADC's world trade in all and agricultural goods (value) between 1996 and 2013. The results indicate that the SADC region is a net importer of goods from the world although the difference between SADCs imports from and exports to the world are not per se very significant. The exports from SADC to the world markets totaled more than USD126 billion against imports of more than USD153 billion implying a trade deficit of about USD27 billion. On the agricultural goods side, the SADC region exported goods worth about USD16 billion to the world markets against a total imports bill of USD13 billion implying an agricultural trade surplus of around USD2 billion. If the SADC region is to meaningfully reduce poverty through trade, there is need for the region to put in and/or enforce mechanisms that will increase agricultural production for trade.

The larger total trade deficit in general is responsible for most of the Balance of Payment (BoP) problems that the members of the region often experience, for example, Malawi, Madagascar, Tanzania, and Zimbabwe, among others.

Figure 2.7 presents SADC's world trade in all and agricultural goods (calories) between 1996 and 2013. The results show that the SADC intra-regional trade in calories has been rising slowly over time whereas SADC's calorie imports from and exports to the world have risen faster. As at 2013, the SADC's world exports stood at around (4 billion Kcal) and were by far outstripped by the SADC imports of the same which stood at an overwhelming (8 billion Kcal). If the SADC region is to reduce malnourishment sustainably, agricultural policy needs to aim for self-sufficiency at least in areas of comparative advantage (e.g., agriculture). The SADC region must endeavor to produce and export more nutritive products than they import. The current situation is symptomatic of an inefficient agricultural production and processing system, which needs to change for the betterment of the many poor, hungry and malnourished people of the SADC.

TABLE 2.4. BILATERAL AGRICULTURAL TRADE MATRIX: SHARE OF EXPORT VALUE TO VARIOUS DESTINATIONS (1996-2013).

Share of agricultural export value-million USD	Importer						
Exporter	Africa	COMESA	ECOWAS	ROW	SADC	SSA	WLD
Botswana	60.1	10.3	0.0	39.9	60.0	60.1	100
Lesotho	99.5	0.0	0.0	0.5	99.4	99.5	100
Madagascar	3.0	2.8	0.1	97.0	2.0	3.1	100
Malawi	26.1	14.7	0.3	73.9	16.5	20.1	100
Mozambique	23.5	12.1	0.0	76.5	22.2	23.5	100
Namibia	57.9	6.4	0.3	42.1	56.8	57.9	100
SADC	31.4	13.8	1.5	68.6	26.7	31.5	100
Seychelles	1.6	0.9	0.1	98.4	1.7	1.7	100
South Africa	34.0	14.5	2.6	66.0	29.3	34.6	100
Swaziland	77.0	21.2	0.9	23.0	61.6	76.7	100
Tanzania	19.9	16.6	0.1	80.1	7.5	19.3	100
Zambia	72.9	57.1	0.0	27.1	72.2	76.8	100
Zimbabwe	44.2	6.7	0.1	55.8	42.8	43.8	100

Sources: UNCTAD and authors' calculation, 2014.

Figure 2.8 shows the shares of SADC imports and exports of cereals as an indicator of food sufficiency. The graph shows that the SADC region is associated with a larger share of world cereal imports implying that it imports a substantial amount (generally above 25%) of cereals that are traded on the world market, compared to its exports of the same. SADC countries only account for less than 5% of world cereal exports. The trends however show that SADC's share of world cereal imports has been declining over time signalling that perhaps the SADC region is becoming more self-dependent in terms of cereal production, which is likely the case considering that at the same time, its share of world cereals exports is also on the rise.

Agricultural Trade Competitiveness of SADC Countries

The global share of SADC countries from 1995 to 2007 is broken down to evaluate each country's performance and underlying factors. According to Badiane; Makombe; Bahiigwa 2014, a country's increase in exports from period to period may reflect various factors:

(a) initially (in *t*), the country was exporting to countries which will significantly increase demand for imports between *t* and *t*+1 (indicating geographical specialization effect); or

(b) the demand for the products initially exported by the country (in *t*), will significantly increase between *t* and *t*+1 (sectoral specialization effect); or

(c) a residual factor that we attribute to domestic performance (or competitiveness).

The domestic performance factor is therefore defined as the portion of market share growth that is not attributable to increases in either sectoral or geographic demand and that is assumed to be the result of increased competitiveness (Cheptea et al. 2014) cited in Badiane et al. 2014).The measures of trade breakdown for the SADC region are estimated using the shift-share methodology described by Cheptea et al. (2014). Figure 2.9 presents the breakdown of SADC countries' global market share of agricultural products for the period between 1995 and 2007. The vertical axis measures the percent change in world market share, and each bar shows the breakdown by the three drivers: geographical specialization, sectoral specialization, and competitiveness.

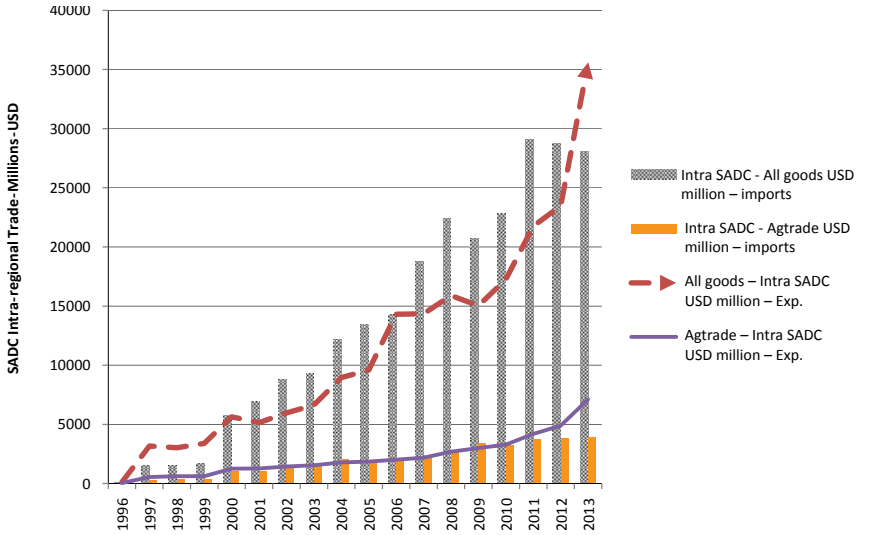


FIGURE 2.5. SADC'S INTRA-REGIONAL TRADE IN ALL GOODS (AGRICULTURAL AND NON-AGRICULTURAL) EXPORTS AND IMPORTS (1996-2013).
Sources: UNCTAD and authors' calculation, 2014.

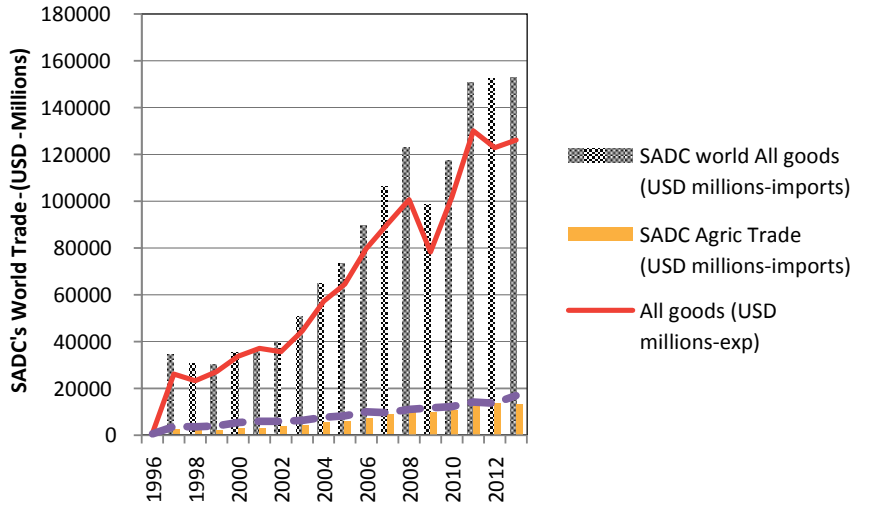


FIGURE 2.6. SADC'S WORLD TRADE IN ALL GOODS (AGRICULTURAL AND NONAGRICULTURAL) (VALUE) (1996-2013).
Sources: UNCTAD and authors' calculation, 2014.

Only six countries -- Zambia, Seychelles, Tanzania, Mozambique, Malawi and Mauritius -- reported increases in the world market share. The underlying factor has been the positive domestic performance (competitiveness) in most of these countries. Zambia which recorded the highest increase in the world market share also has a geographic specialization effect which outweighed decreases in sectoral specialization. In Seychelles, decreases in geographic specialization were outweighed by both sectoral specialization and domestic competitiveness. The rest of the countries experienced decreases in their share in the agricultural word market. The main driving factors for this have been poor domestic performance and negative geographic/sectoral specialization effects.

Outlook for SACU's Trade Growth: 2013 to 2030[1]

This section discusses the projections of SACU's[2] trade growth from 2013 to 2030 for a baseline (business as usual) scenario and an alternative scenario. The data came from IFPRI, based on a multicountry, multi-sector recursive dynamic computable general equilibrium (CGE) model, MIRAGRODEP, to project the outlook for trade between 2013 and 2030.[3] The baseline scenario has no reform in national agricultural trade policies and current trends continue for population growth (using "middle scenario" UN demographic projections), labor endowments, and total factor productivity (TFP), which has been relatively strong in recent years. The TFP for SACU is projected to grow at an annual rate of 2.5%. The alternative scenario assumes a worldwide increase in trade openness, through an ambitious 50% reduction in agricultural tariff barriers. While this scenario seems improbable, given the difficulties with the WTO Doha Round, it illustrates the potential challenges and opportunities of such a trend for SACU.

[1] This section draws on work by Bouët et al. (2014).

[2] The trade growth outlook analysis focused on SACU as data were not available for the whole SADC region.

[3] MIRAGRODEP is a new version of the MIRAGE model of the world economy, for which GAMS codes have been simplified and presented in a more compact and user-friendly way. MIRAGRODEP is devoted to trade policy analysis and operates in a sequential dynamic recursive setup. MIRAGRODEP was designed for the African Growth and Development Policy (AGRODEP) modelling Consortium. For more information about MIRAGRODEP see www.agrodep.org/model/miragrodep-model. For more information on MIRAGE, see the MIRAGE wiki-site at http://mirage.cepii.free.fr/miragewiki.

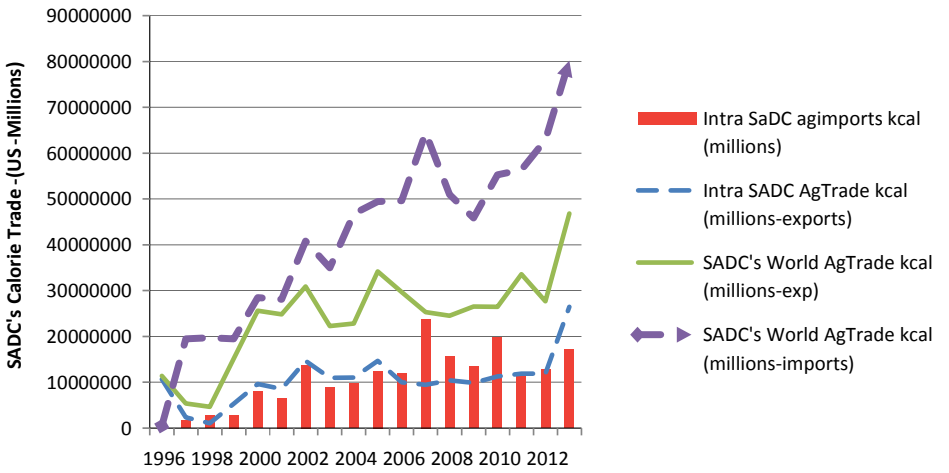


FIGURE 2.7. SADC'S WORLD TRADE IN ALL GOODS (AGRICULTURAL AND NON-AGRICULTURAL) (CALORIES) (1996-2013).
Sources: UNCTAD and authors' calculation, 2014.

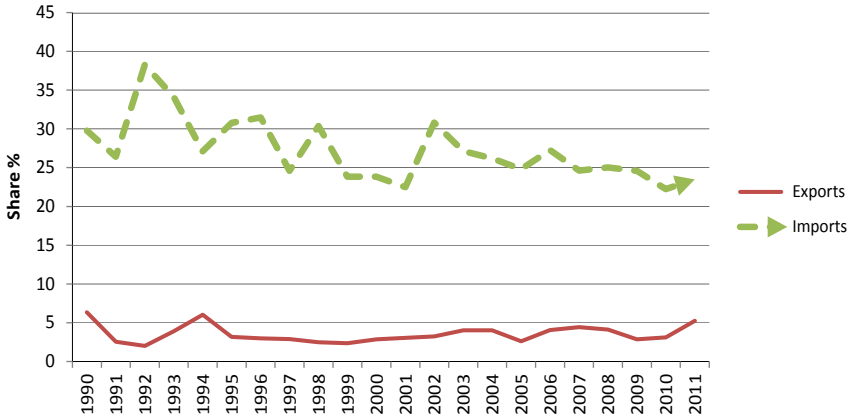


FIGURE 2.8. SADC'S SHARE OF IMPORTS AND EXPORTS OF WORLD CEREALS.
Sources: ReSAKSS (2014).

SACU TRADE OUTLOOK UNDER BASELINE SCENARIO

The projected growth in agricultural imports per capita for SACU from 2013 to 2030 is presented in Figure 2.10. The projections show that SACU's agricultural imports per capita would grow by 72% by 2030. Figure 2.11 shows the projected growth in SACU's overall agricultural net exports per capita (exports minus imports) by product. The growth is defined as the value of SACU's projected per capita agricultural net exports in a given (future) year minus SACU's capita agricultural net exports in 2013. The SACU region is expected to experience a positive overall surplus in agricultural trade. The growth in SACU's agricultural trade would be driven mainly by trade in vegetables and fruits; sugar; processed food; beverages and tobacco. These categories are expected to experience better performance in productivity and trade resulting in trade surpluses. Cereals and vegetable oils are projected to experience negative growth between 2013 and 2030. This indicates that the demand per capita for cereals and vegetable oils is projected to grow quickly probably due to population growth resulting in trade deficits in these categories.

MIRAGRODEP projections of intra-Africa agricultural trade (Figure 2.12) show that SACU would experience substantial increases in trade within Africa. The largest increases in African trade with SACU are projected for ECOWAS (137%) and COMESA (166%). Intra-trade within SACU member states is also projected to increase by 111%. These increases are projected without any trade reform or new regional trade agreements in the SACU region.

TRADE OUTLOOK UNDER ALTERNATIVE SCENARIO

The effect of a hypothetical 50% average global reduction in agricultural tariffs is presented in Figure 2.13. The percentage change in SACU agriculture is computed by comparing the projected outcomes in year 2030 to the baseline implying the changes are only attributable to the policy reform.

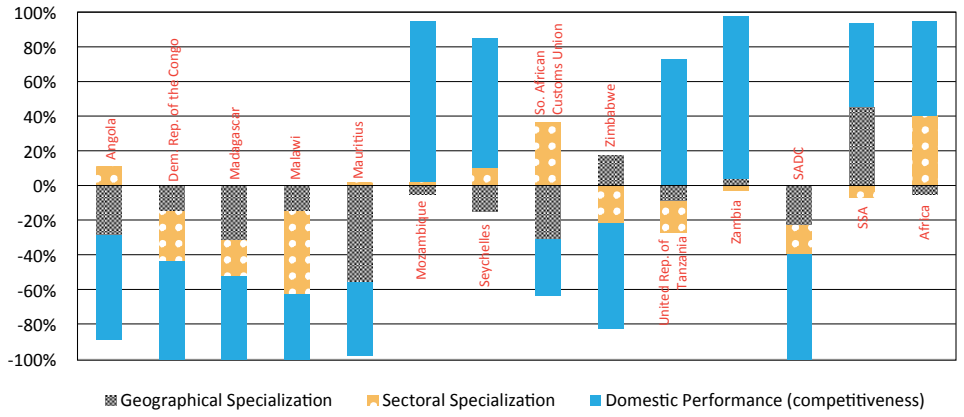
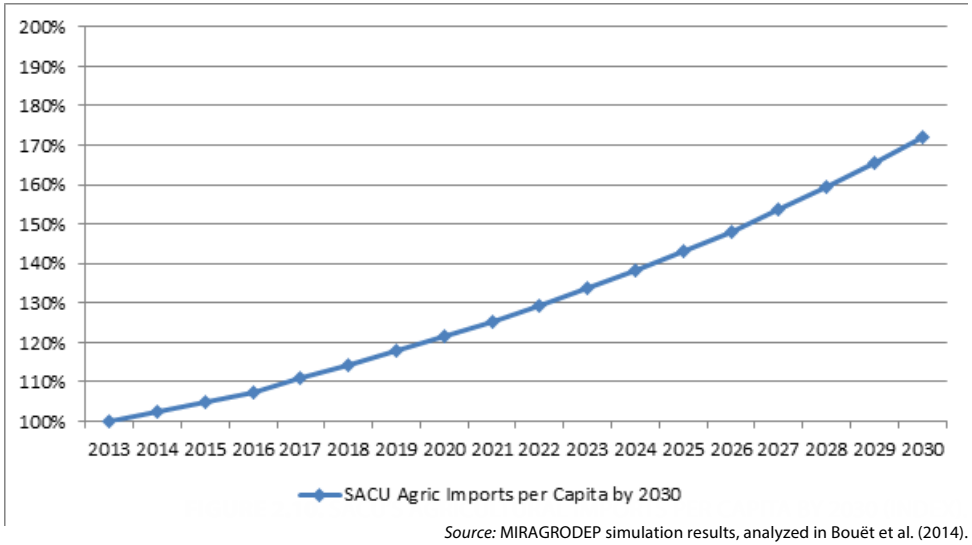


FIGURE 2.9. EVOLUTION OF SADC COUNTRIES' GLOBAL MARKET SHARE OF AGRICULTURAL PRODUCTS (1995–2007).
Sources: BACI and authors' calculations based on analyses by Bouët et al. 2014.



Source: MIRAGRODEP simulation results, analyzed in Bouët et al. (2014).

The results show that SACU's agricultural imports and exports would increase by 12.1 and 9.9%, respectively. This implies a projected negative agricultural trade balance for SACU as agricultural imports would grow more than agricultural exports. The findings also indicate high initial custom duties on agricultural products in SACU than in the rest of the world. Agricultural value added for SACU would also increase by 1.8% as a result of the trade liberalization reform. In addition, this liberalization reform would result in consumer benefits through increases in real incomes and unskilled wages both by 0.14%. Overall, the alternative scenario shows benefits of trade integration through trade liberalization both in terms of increased trade and real incomes; and unskilled wages.

Findings and Conclusions

Trade liberalization affects poverty primarily through its impact on economic growth and income distribution. There is a wide range of conflicting views with regard to the trade-growth-poverty linkages, and these conflicts spillover to the links both between open trade policies and growth, and between economic growth and poverty reduction (Dodd and Cattaneo 2006). Behar and Edwards (2011) asserted that international trade is regarded as one of the key aspects that contribute immensely to the success of the fastest-growing economies, yet many countries remain isolated and have failed to achieve this integration. SADC in particular has continued to experience a decline in its share of world trade over the past decade and a half. It is however with great enthusiasm we note that the SADC region has experienced an increase in openness over the past decade that is comparable to other developing countries.

There is a clear indication that most SADC members export more products to the region than to the rest of the world. However, the product composition exported within the region differs from that to the rest of the world. Growth in exports from SACU and the rest of the SADC was mediocre during the 1990s relative to the rest of the world and other developing countries but it rose strongly from 2002. Growth in dollar value of exports

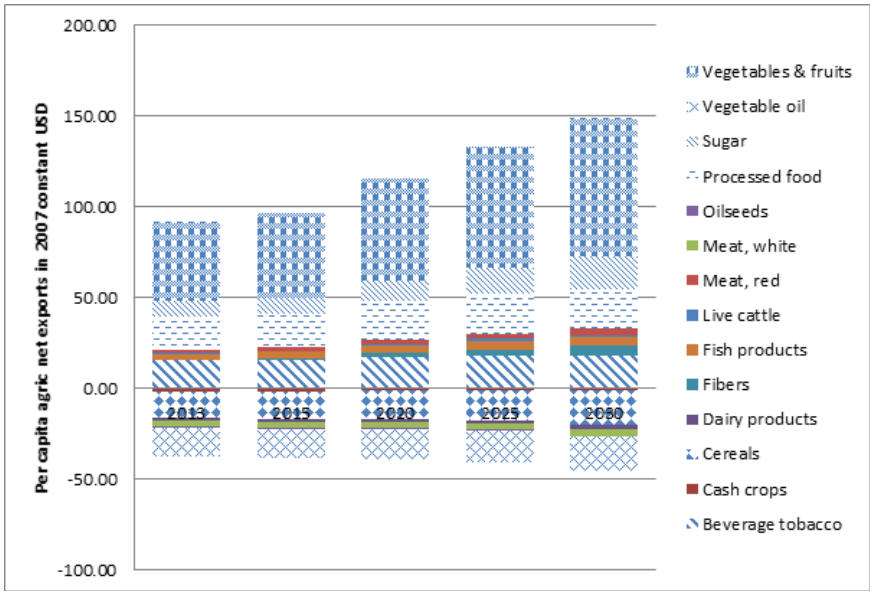


FIGURE 2.11. PRODUCT BREAKDOWN OF SACU'S PER CAPITA AGRICULTURAL NET EXPORTS (2013-2030, IN 2007 CONSTANT USD).
Source: MIRAGRODEP simulation results, analysed in Bouët et al. 2014.

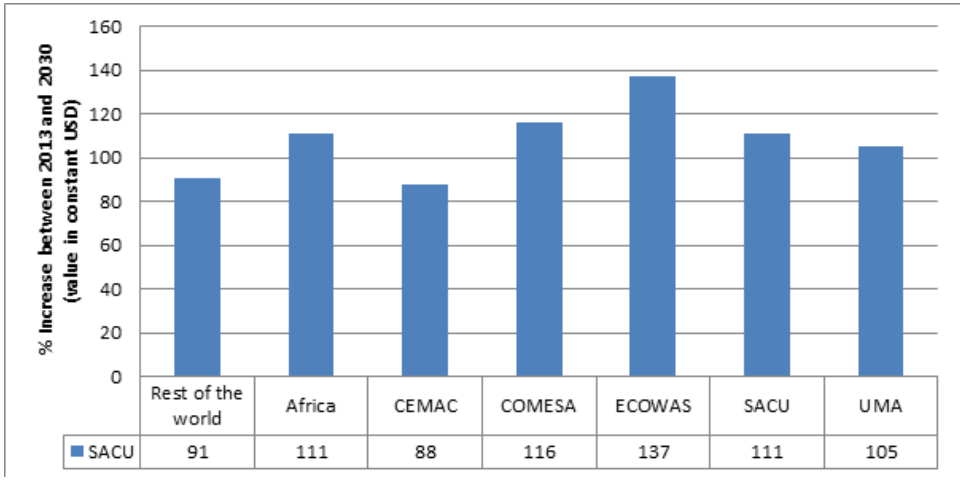


FIGURE 2.12. INTRA-AFRICAN AGROFOOD TRADE OUTLOOK (2013–2030, EXPORT VALUE, IN 2007 CONSTANT USD).
Source: MIRAGRODEP simulation results, analyzed in Bouët et al. 2014.

was particularly strong and can be attributed to improved terms of trade associated with the boom in the commodity prices.

There is considerable variation across SADC members but notably the SADC region is relatively open to trade compared to the rest of the world. This is epitomized by the fact that the world ratio of exports was about 20% compared to the 30% and above of SACU and the rest of SADC.

According to Mashayekhi et al. 2012, there are strong indications that regional integration could impact on structural change in the SADC region; these can be noted through the provision of large markets that attract FDI and foster greater competition which consequently improves the quality of products traded. This could have a positive impact on growth which in turn could contribute to create productive employment.

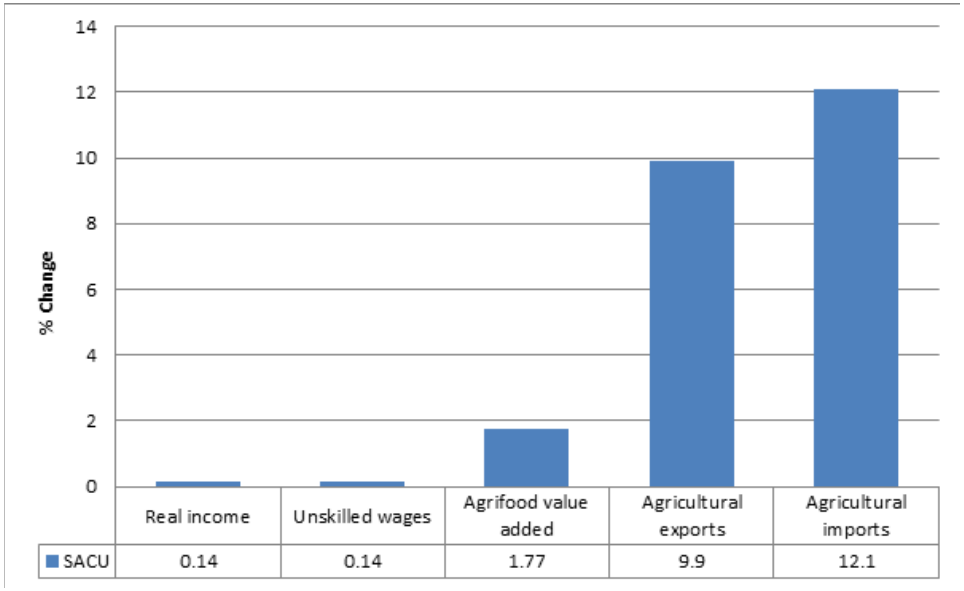


FIGURE 2.13. EFFECT OF A 50% AVERAGE GLOBAL TARIFF REDUCTION IN SACU AGRICULTURE (% CHANGE).

Sources: MIRAGRODEP simulation results, analyzed in Bouët et al. (2014).

3. Volatility of Food Prices: Effects and Response Mechanisms in the SADC Region

Greenwell Matchaya, Sibusiso Nhlengethwa, Charles Nhemachena

Trade openness is good for economic growth and for food access, price stability, and poverty reduction, although, commonly, research assumes that openness to trade is associated with economic instability (see for example, Rodrik 1998). Others have argued that trade openness increases the variability of existing income and prices thereby increasing household level of national-level variability. For example, it has been established in some cases that trade liberalization (either domestic or international) may eliminate institutions or policies that actually smoothen domestic prices. For example, abolishing official purchasing has increased cocoa price variances in West Africa (Gilbert et al. 2005). On the other hand, Dollar and Kraay (2001) found that one way through which trade impacted on people was through economic growth. Dollar and Kraay (2001) found that an increase in trade between countries lead to a proportionate increase in incomes of the poor. It would appear that in some though, trade on its own is not bad for resilience in income growth. This chapter discusses the volatility of food prices focusing on effects and response mechanisms in the SADC region.

Causes of Volatility of Food Prices

If policy interventions against price volatility are to be effective, it is important to understand the causes of volatility. For instance, if the underlying causes of volatility are domestic rather than external, interventions that appear to target external factors will be impotent in reducing price volatility. Some of the common causes of price volatility are: (a) seasonal variation in domestic production; (b) interannual variation in domestic production; (c) fluctuation in world prices; (d) changes in policy; and (e) other sources of price instability, including variation in demand, changes in closely linked markets, food stocks kept by a country, and market speculation (see Badiane, Makombe; Bahiigwa 2014). Although it is not often possible to rank these factors in order of importance as far as their influence on price volatility is concerned, it is widely agreed that most of them exert upward pressure on prices.[4]

[4] This chapter partly draws on the work by Deason et al. (2014).

SEASONAL VARIATION IN DOMESTIC PRODUCTION

In most of the SADC countries, irrigation technologies cover land that is less than 3.5% of the total arable land (see Matchaya et al. 2014) such that a huge chunk of agriculture is rain-fed and hence the supply of most agricultural products follows seasons. For example, the supply of maize, soybean, bean, groundnuts and rice production is characterized by seasonal variation. Supply is high after the rainy season when most of these are harvested and it becomes extremely low as the next rainy season approaches. As demand for these products is often constant, the huge supply during harvest seasons leads to a depression of general food prices whereas the low supply in lean seasons increases food supply significantly.

This seasonal variation is related not only to perishability of commodities but to the tradability or otherwise of goods. In general, highly perishable agricultural products including fruits and vegetables have prices that are highly seasonal as producers are desperate to sell them in times of high production. Again, commodities that are tradable are associated with lower seasonal variation compared to non-tradable ones because imports are generally scheduled for periods of local scarcity. Table 3.1 shows results of analysis of 280 prices of African cereals. The results indicate that maize, sorghum and millet, which are not highly tradable, are highly seasonal unlike prices of wheat and rice which are highly traded by African countries. The average seasonal variation in wheat and rice ranges between 15 and 17% of the average price, compared to 24–32% for maize, millet, and sorghum. The same analysis suggests that seasonality accounts for about 10% of the variation in local grain prices (Deason et al. 2014).

INTERANNUAL VARIATION IN DOMESTIC PRODUCTION

It is also interesting to note that for countries that pursued Free Input Subsidy Programs (FISP) between 2003 and 2009, such as Malawi and Zambia, price variations appeared to follow variations in production. The changes in the size of annual harvest, whether due to changes in policy, or changes in environmental and general agroclimatic situations, are often characterized by huge changes in prices. This is often true for commodities that are

TABLE 3.1. SEASONALITY OF LOCAL PRICES IN AFRICA, SOUTH OF THE SAHARA BY COMMODITY.

Commodity	Number of price series	Seasonal price index
Maize	94	0.32
Sorghum	69	027
Millet	49	0.24
Rice	58	0.15
Wheat	10	0.17

Source: Deason et al. (2014).
Note: Seasonality index is the average difference between the highest and the lowest month as a ratio of the mean price, based on regressing prices (converted to USD) on monthly dummy variables.

not highly tradable, those that are produced in landlocked countries and those that are hard to transport or store. Under such conditions, surpluses are not easily transported to areas of deficit leading to high prices in deficit areas and very low prices in surplus areas. Because transportation costs are important in determining whether commodities are easily traded, nearness to the sea as a proxy for low transport costs may be critical for price variations. However, in practice it appears that local price variation is predominantly determined by local, and not external, conditions such that coastal countries are not necessarily well integrated into the markets (see Minot 2012). In some cases, of course for traded commodities including rice and wheat, it is observed that there is a huge tendency for prices to suffer from outside shocks, but on the whole it is clear that the effects of exogenous shocks on volatility of prices pale in comparison to endogenous obstacles; for example, Table 3.2 shows that volatility is higher among coastal areas than among landlocked areas for the products listed below:

It is clear from the volatility indexes that the landlocked countries are associated with low volatility. It is seen from Minot (2014) that volatility of prices regardless of the commodity, is lower in the larger cities than in the smaller cities of the same country perhaps because larger cities get their supplies from diverse sources and are likely well connected to other supply points, whereas smaller cities may not be and hence rely more on local supply making them vulnerable to changes in local supply. And Geyser and Cutts (2007) note that, on the South African commodity exchange, the volatility of prices of yellow maize, which is internationally traded is lower than that of white maize which is only locally or regionally traded.

FLUCTUATIONS IN WORLD PRICES

As the world is increasingly becoming more and more integrated, it is also becoming inevitable that, in some cases, domestic prices are becoming susceptible to world prices. For commodities that are regularly traded, or characterized with lower transaction costs of production and exchange, world prices have a larger effect. In general, it is a smaller proportion of domestic prices of commodities in Africa that are significantly influenced by world prices. Most price variations in African commodities are explained by domestic factors.

TABLE 3.2. VOLATILITY OF PRICES ON COASTAL AND LANDLOCKED COUNTRIES, BY PRODUCT.

Product	Volatility						
	N	Number of price series	Coastal	Landlocked	F-Stat	*ρ*	
Beans	878	12	0.134	0.121	1.23	0.28	
Bread	149	2	0.029	0.027	1.14	0.56	
Cooking oil	592	8	0.105	0.098	1.16	0.20	
Cowpea	369	5	0.246	0.218	1.27	0.10	
Maize	3,450	47	0.116	0.161	0.52	0.00	*
Millet	2,224	30	0.125	0.100	1.55	0.00	*
Rice	2,202	30	0.141	0.084	2.82	0.00	*
Sorghum	1,914	26	0.144	0.115	1.56	0.00	*
Wheat	224	3	0.122	0.076	2.60	0.00	*

Source: Analysis of price data from FEWS-NET cited in Minot (2012); N is the number of observations.

TABLE 3.3. VOLATILITY OF PRICES TRADABLE AND NON-TRADABLE PRODUCTS.

Product	*N*	Number of price series	Volatility	F-Stat	*ρ*
Non-tradable products		9280	126	0.133	
Tradable products	3018	41	0.106	1.57	0.00
Total	12,298	167	0.127		

Source: Minot (2012); N is the number of observations.

Table 3.3 shows that price variations are higher for non-tradable commodities than for tradable commodities and non-tradable commodities are also the main contributor to overall variations in prices owing to their larger share on consumption and production.

CHANGES IN POLICY

Significant changes in food prices can sometimes stem from actions or declared intentions of government policies. For instance, in cases where governments impose import or export bans on commodities the effects can be felt domestically or even internationally depending on the country's position in trade for that commodity. An export ban on maize in a country can lower domestic prices while a ban on imports of the same, in times of scarcity can increase domestic prices substantially. If the private sector anticipates a ban on exports of a commodity in the years to come, they are unlikely to invest more in production of the same as a way to minimize losses as the government's intention in this case would lead to oversupply and low prices domestically (see Chapoto and Jayne 2009).

Trade policies affect the rate of economic growth and the variability in food prices, which in turn may affect the vulnerability of low-income households. In the SADC region, trade policy in Zambia has largely remained the same since the country's policy reforms which came into effect in the 1990s. These reforms included removal of exchange controls and introduction of a number of export incentives to encourage trade in agricultural products and the participation of the private sector. Zambia is therefore more open to trade than an average sub-Saharan Africa country but in terms of customs operations it is one of the world's least efficient countries. Zambia is a signatory to a number of agreements and thus enjoys preferential tariffs. These agreements include: (1) the EU's Everything-but-Arms (EBA) market initiative, (2) the USA's African Growth Opportunity Act (AGOA) market initiative, (3) Canadian Market Access Initiative, (4) Chinese Market Access Initiative and (5) Japanese Market Access Initiative. Despite these efforts, the Zambian maize market is associated with constant interventions from time to time, which in some cases contribute to volatility of prices.

EXPORT CONCENTRATION

Export concentration is a case where a country relies on a limited number of commodities for exports. It results from a high degree of specialization in outputs and exports, leading to an undiversified portfolio of exports of goods and services (Read 2010). This exposes an economy to a greater risk of exogenous shocks as well as increasing the likely magnitude of their impact. Instability of export prices refers to changes in the simple commodity or net barter terms of trade – that is the proportionate change in the prices of imports expressed in terms of export prices. Therefore, it measures the price effects of exogenous shocks in export (and import) markets as the prices of traded goods and services change (Read 2010). The principal cause of instability of export prices is export concentration, particularly in primary commodities, and the principal solution therefore remains diversification. In recent times, countries whose main exports are less diversified, such as: Malawi (the case of tobacco), Zambia (the case of copper), Mauritius (the case of sugarcane), Angola (the case of oil), and Botswana (the case of diamond), have faced some amount of significant volatility of prices following sudden shocks in demand and price of their major exports. In each of these countries, demand shocks have also led to instability in export earnings.

GEOGRAPHIC EXPORT CONCENTRATION

Geographic export concentration refers to the dependence of many developing economies on a limited number of key trading partners for their principal export markets. This gives rise to vulnerability to demand shocks in key export markets, leading to additional instability in prices and earnings. Within the SADC region, the major export destination for Mauritius sugar, for example, was the EU under an agreement that promised better prices. Once this agreement was annulled effectively around 2011, the Mauritius economy has suffered due to loss in export earnings.

DEPENDENCES UPON STRATEGIC IMPORTS

The effects of trade shocks in the strategic imports feed through to the domestic economy via changes in import prices – and possibly supply shortfalls – leading to instability in earnings (Read 2010). An example of this in agriculture is a case of fertilizer imports. Whenever imports of fertilizer are delayed for some reason at the source or in transit, agricultural output suffers in Malawi because it is a major input in agriculture owing to the fact that soils have become less fertile over time.

REMOTENESS AS A SOURCE OF TRADE INSTABILITY

Remoteness is regarded as being an additional source of vulnerability, primarily because of the risk of disruption to transport and communications, including infrastructure, that prevent efficient economic and social coordination (Read 2010). Malawi and Zambia which were served by the Nacala corridors from the Port of Nacala in Mozambique suffered heavily during Mozambique's 17-year old war as a result of disruption by military activity in Mozambique.

CONTAGION EFFECTS BETWEEN MARKETS (OR SPILLOVERS FROM NEARBY MARKETS)

Instability in markets in one part of the region can affect instability in another part due to trade. For example, instability of prices in Malawi often impacts on Nampula and Beira as these markets are somewhat integrated (contrasted with Maputo). This also implies that a regional focus in trade policy is useful (see Chapoto and Jayne 2009).

OTHER SOURCES OF DOMESTIC PRICE INSTABILITY

The list of sources of domestic price instability discussed above is not exhaustive and, as explained earlier, the importance of each of the discussed factors varies from one market to another and over time. Some of the factors that can help explain the volatility of domestic prices include changes in demand for a good. However, because, in most cases, the changes in demand occur gradually, the effect of this on volatility is often unnoticeable. Changes in prices of substitutes can potentially impact on prices significantly as consumers relocate resources in favor of the cheaper alternatives. This is likely to be the same with respect to prices of complements and also prices of goods in closely linked markets. For example, an increase in oil prices likely reduces the consumption of some goods as the prices soar following an increase in transportation costs.

Within the SADC region, other sources of volatility in prices are related to the many trade impediments that exist. The major impediments to the movement of goods across borders include institutional, infrastructural and regulatory burdens. These impediments encompass market regulations that restrict competition in transport, poor structure and weak micro-level institutions (including port efficiency, customs environment, regulatory environment and policies affecting cost of entry). In the SADC region's context, micro-level institutional effects are often greater impediments to trade than tariff barriers. For instance, an analysis conducted by Keane et al. (2010) suggests that when South Africa imposes at least one Non-Tariff Barrier (NTB) on a sector, its imports from other SADC countries drop on average 60% while its imports from non-SADC countries rise, on average, by 6%.

It has been found that it costs more than twice as much to clear a standard 20-foot container for exports or imports in SADC countries as in East Asia. These costs are particularly high in Zimbabwe, Botswana, Zambia and Democratic Republic of Congo. It is critical to note that the time taken to export and import is also high in SADC compared to other regions, more than three times that of the OECD and twice that of Latin America and the Caribbean. Due to their level of development SADC countries face obstacles to trade that are usually severe (conditions on geography, population and income) relative to the rest of the world. SADC performs poorly in terms of the timeliness with which their shipments reach the consignee. Angola, Botswana, Namibia, Mauritius and Zambia have obstacles associated with logistics. Furthermore, the SACU members, Angola, Zambia and Malawi perform poorly relative to their peers in the region in terms of required documents, time and cost of exporting and importing. In contrast, Madagascar, Mauritius, Mozambique and Tanzania perform well relative to their income levels

NTBs have been found to be important to intra-regional trade for SADC countries to the extent that they divert imports away from the region towards nonregional partners. The presence of NTBs seems to stifle intra-regional trade (Keane et al. 2010).

NTBs are unnecessarily restrictive non-tariff measures (NTMs) which affect trade in goods. The presence of NTBs undermines gains from trade liberalization of existing and new entrants; and impedes diversification efforts across products as well as markets. Keane et al. (2010) found that intra-regional trade grew faster for SADC and ECOWAS than the rest of Africa's RECs (COMESA, ECCAS [Economic Community of Central African States], UMA [Arab Maghreb Union] and WAEMU [West African Economic and Monetary Union]).

The World Bank's 'Ease of Doing Business' ranking encompasses the 'trading across borders' component. In this index there are six subcomponents namely (i) documents to export (total number), (ii) documents to import (total number), (iii) time to export (in days), (iv) time to import (in days), (v) cost to export (USD/container), and (vi) cost to import (USD/container). In the SADC region Mauritius is ranked the highest (21st in the world) followed by Seychelles (33rd in the world). On the other hand, Zimbabwe is at the bottom (172nd in the world). A close inspection reflects that the requirements for exporting and importing in the SADC region are very diverse (World Bank 2014). More SADC countries require more documents to import goods than to export; it also takes them longer (number of days) to import than to export. All these NTBs do little to reduce price instability over time.

Country Experiences with Volatility of Prices

In the SADC region, a number of countries including South Africa, Malawi, Zambia and Zimbabwe operate grain reserves as a way of stabilizing maize prices over time. Others possess none and instead rely on market forces to determine prices all the time. In Malawi, for example, the National Food Reserve Agency together with ADMARC plays a critical role in the stabilization of food prices, particularly when prices soar beyond the reach of many consumers. Perhaps owing to the fact that maize is the most critical staple food in Malawi, there is significant political interest as maize scarcity can make or break political regimes. Owing to this fact, the maize market in Malawi remains one of the most controlled markets in the SADC region. For example, the annual Free Input Subsidy Programs target maize production as a way to achieve food sufficiency and reduce maize prices. On the other hand, it is not uncommon in Malawi for the government to impose export bans on maize to ensure food availability. Despite all this, Minot (2014) found that the volatility of maize prices in Malawi is one of the highest in the SADC region. Chirwa (2010) also found that, in Malawi, the size of maize harvest was an important factor that determined the volatility of prices, and further it appeared that the instability of prices was exacerbated by lack of transparency in maize stocks held by the reserves, overestimates of the maize harvest, incorrectly – timed procurement campaigns by ADMARC - and delays in implementing government-announced imports.

Zambia has a similar situation where the Food Reserve Agency (FRA) plays an active role in international and domestic trade for maize and for purposes of stabilizing maize prices. The FRA also distributes subsidized maize to remote areas affected or likely affected by maize deficits, but the unpredictability of these actions creates uncertainly among the private sector leading to volatility of prices. For the private sector, this serves to limit their participation on the market as suppliers of grain thereby increasing volatility of prices even further (see Chapoto and Jayne 2009). Despite these efforts towards stabilization of maize prices using grain reserves, maize prices in Zambia exhibit volatilities that rank among the highest in the African Continent (Minot 2014). The situation in Mozambique is quite different from that of Malawi and Zambia. In Mozambique no state grain reserves exist and maize prices have often been dictated by the market forces. Prices of maize have generally been stable in Mozambique, although recently, following the global food price increases in 2007/2008, the government has been encouraged to embark on a public-private food reserve program.

Counterintuitively, it appears that markets with wider interventions including Zambia, Malawi, and Zimbabwe are associated with volatilities of high prices when compared with those with low interventions such as Tanzania and Mozambique. It would appear that the

manner in which the interventions are executed do more harm than good to the markets so that those efforts are only partially successful in dampening volatility of prices (see Deason et al. 2014).

In general, grain reserves in the SADC region appear not to have been managed according to buffer stock principles: 1) the objectives of the reserves span beyond price stabilization, 2) the reserves are auctioned ad hoc and a price band is never defined, and 3) they often intervene in a myriad ways ranging from subsidies, to trade policy as well as marketing regulations (see Badiane; Makombe; Bahiigwa 2014). In any case, it would appear that grain reserves are likely to succeed in dampening volatility of prices if information imperfection is limited on the market.

Effects and Response Mechanisms to Volatility of Prices

EFFECTS OF VOLATILITY OF PRICES

In general, high and persistent volatilities negatively affect incomes and consumption at household level and further stifle investment decisions for farmers and producers. Volatility implies uncertainty and few risk-taking investors continue investing in resources in times of uncertainty. Moreover, households may reduce consumption of some nutritive products in favor of less-nutritive and cheaper products at the expense of their well-being in the short to the medium run. Again, some farmers may, under regimes of high volatility of prices start reducing investments in cash crops in favor of food crops to cushion themselves from fluctuations of food prices. These decisions likely tax the household and, hence, the economy from higher levels of utility to lower ones, compromising welfare inter-temporally.

Efforts geared towards price stabilization in the SADC date back to the time of Africa's decolonization. For example, as early as the 1960s to the 1970s most countries in the SADC region had state institutions and laws that almost gave some parastatals charged with importation and exportation of staple foods some legal monopoly (see Deason et al. 2014). However, as the cost of such state-sponsored monopolies soared and the winds of World Bank- and IMF-supported liberalization blew across the SADC region, emphasis on the use of such state institutions declined (see Kherallah et al. 2000). Owing to the political sensitivity of staple foods including maize in the SADC, liberalization of their respective markets has been slow and haphazard, and characterized by reversals (see Jayne et al. 2002). Obviously, the role of grain reserves as a means of price stabilization has critics and protagonists; however, it ought to be said here that owing to the manner in which markets for maize work, it is likely that as the region forges into the future, countries are likely to expand their grain reserves to minimize the negative impact of supply shocks.

THE SPECIFIC ROLE OF TRADE POLICIES

Although the influence of international markets on domestic markets is likely low compared to the effects of domestic factors, trade policy is still potent in regularizing prices and food supply at the domestic level. For example, the famine that struck the SADC region in the 2001/2002, and the 2007/2008 periods led to highly affected governments imposing export bans of maize, for example, in Malawi and Tanzania with the intentions of ensuring steady availability of food in those countries. In that regard an export ban disconnects the domestic market from other external markets and hence the action dictates the level of domestic prices. In cases where the government has not announced an outright export ban on a commodity, there will still be some sort of an increase in the export taxes as a way of discouraging exports. This of course benefits consumers in the domestic markets but it is at the expense of producers. However, as Chapoto and Jayne (2009) have suggested, in some cases, such interventions yield the opposite effects. Overall, trade policy is capable of ameliorating supply and demand in a market, especially in the shorter run.

Trade Integration as a Way to Mitigate Weather Shocks: Potential and Limits

To the extent that trade can make food available in areas of deficit, it has some potential to cushion consumers from extreme weather shocks. For example, it is clear from the foregoing discussions that, in some cases, trade has helped economies participate in larger and more diversified and resilient markets leading to some level for stabilization of prices. This implies that encouraging intra-regional trade in the SADC region is likely going to stabilize regional prices and benefit consumers in the longer run.

Chauvin and Gaulier (2002) state that the progress on African regional integration has been slow due to several factors, such as, overlapping membership, lack of authority, bureaucratic sophistication to deal with bigger powers, and political turmoil in some countries. However, this has favored more intra-regional trade than trade liberalization with the rest of the world (or out of the trade bloc). Thus, protectionism has been easy to justify insofar as less-developed and less-diversified economies are also less-able to weather the transition to free trade. The SADC region faces the same challenges where many of the members are party to more than one trading block; for example, Malawi, Zambia, Zimbabwe are members of both SADC and COMESA whereas Swaziland is a member of SACU and SADC, as well as of COMESA.

Nevertheless, as SADC member countries have been increasing their trade with each other since the 1980s, the share of exports within the block increased. South Africa continues to dominate trade in the block by supplying more than half of the block's trade. Other major contributors include Botswana, Namibia and Zimbabwe. However, the island states of Seychelles, Madagascar and Mauritiu do not export much to the region because of high costs of shipping small volumes of cargo.

Malawi, Mozambique, Zambia and Zimbabwe are immensely reliant on SADC for imports; and they purchase more than 50% of their total imports from other member states of SADC. These countries also trade more than 20% of their exports within the region. The other countries in the region still maintain much stronger trade relationships with the rest of the world, i.e., intra-regional trade makes up 10% of the country's imports and exports and SACU only buys 5.6% of its imports from the region. SACU trade, which is predominantly made up of South Africa's trade flows, dominates intra-regional trade flows. SADC trades 60 to 70% of her exports to SACU, while 80 to 90% of SADC's imports are sourced from SACU. The implication of the above is that the region is heavily reliant on South Africa as a source of imports than as a market for exports.

There is substantial heterogeneity in the product composition of each SADC member country's exports across destinations. This actually implies that SADC countries export different products to different countries. However, the average number of distinct products exported by SADC members to other members is low relative to the total number of products exported by each country to the region (this excludes South Africa).

What is pivotal to draw out of this is that most of the SADC member countries export a more diverse range of products to the SADC region than to the rest of the world, which is indicative of the regionalization of the SADC trade.

Within the SADC region, internal tariff barriers were largely eliminated by SADC's Free Trade Agreement which was launched in 2009. However, in sub-Saharan Africa there is a problem of overlapping regional integration arrangements. One member can fall under different arrangements, i.e., Zambia is part of SADC and COMESA, Swaziland is part of SACU, SADC and COMESA. This therefore leads to the problem of harmonization of tariff obligations, and it also renders the structure of tariffs to be complex inhibiting product market integration, thereby reducing the potency of regional integration efforts to eliminate price instability.

REDUCING TRANSPORT COSTS

Transactions costs of trade, including transport costs play a key role in increasing price volatility domestically. In cases where transportation costs are low, markets are easily interlinked and areas of short supply can easily have food access through imports from

neighboring markets. Again, lower transport costs generally imply that trade will take place over larger areas and it is now known that the wider the markets, e.g., the larger the cities, the lower the price instability (see Minot 2014). In Africa, transport costs are still higher than in other markets, e.g., Brazil, Asia and North America. For instance, a World Bank study found that transport costs ranged from 0.06 to USD0.11 per ton-km in Africa compared to 0.04 to USD0.05 in emerging and developed markets of Brazil, Asia and North America. The huge disparities in transportation costs between Africa and the aforementioned markets can be ascribed to poor road infrastructure, monopolies in trucking business, complicated border crossings, and high costs of energy (see Deason et al. 2014). It is hence not surprising that some studies have concluded transport costs to be larger impediments to trade than tariff barriers (see Limao and Venables 2001).

International Trade and Stability of Prices

Although it would appear that the effect of trade openness on stability of prices would be an empirical one as it depends on the context, it appears that the net effect is likely to reduce instability of prices. For example, the world market prices are significantly lower than those of the domestic markets in Africa, whereas the volatility prices of tradable commodities including wheat and rice in Africa are lower than those of non-tradables such as maize and millet. There is evidence that price spikes in African markets including Malawi in the SADC region have been above import parity prices. For example, Malawi has experienced a number of maize price spikes because the government has either delayed importing maize from outside, or has overestimated the amount of stocks available, or stocks had given way abruptly (see Deason et al. 2014) It can be argued that since the prices had risen above import parity prices, such spikes would have been dampened if the conditions allowed private sectors to trade, i.e., if their trading activities had not been crowded out (see Jayne et al. 2008).

Commodity Exchanges

The term commodity exchange often refers to markets where a standardized contract to deliver a specified quantity of a ommodity (usually crops or minerals) can be bought and sold. The transparency inbuilt in these markets may reduce volatility associated with information asymmetries between the sellers and buyers and again such markets may offer futures contracts, which provide opportunities for participants to manage agricultural price risk (see Deason et al. 2014). These are highly efficient platforms where buyers and sellers meet, in an effort to principally manage their price risks better, and further to improve the marketing of their physical products. Commodity exchanges have significant, well-documented development benefits. For instance, they make economies more inclusive and they boost the links between agriculture and finance while making the commodity sector more efficient and competitive (see Mezui et al. 2013). The warehouse receipts systems that are emerging in the SADC region are an attempt towards developing better commodity exchanges in the future.

Since the opening of a few commodity exchanges following the onset of liberalization in Africa in the 1990s, many new ones have emerged. The first "modern" commodity exchanges created in the continent were in Zimbabwe and Zambia in 1994 and in South Africa in 1995 (Mezui et al. 2013). Today, in the southern Africa region, the South African Futures Exchange (SAFEX) offers a number of spot and futures products based on wheat, maize, soybean, sunflower and metals markets.

At least one Exchange in the SADC region has reached reasonable volumes in futures trade (SAFEX in South Africa) trading over 210 million tons (mostly grains) in 2012. Moreover, the Global Board of Trade (GBOT) in Mauritius is endeavoring to become an offshore destination for global exchange trade whereas the Agricultural Commodity Exchange for Africa (ACE) in Malawi is developing from a small volume of trade to a more ambitious reach, trying to build a regional market on the back of warehouse receipts sponsored by development partners (Mezui et al. 2013). In Zambia and Zimbabwe the commodity

exchanges that were founded in the 1990s were later suspended due to poor performance and inability to attract large volumes of trade. The limited volumes of cereals undermined the sustainability of these markets and moreover since grading systems are never often followed in the other countries outside South Africa, buyers consider it risky to purchase from such markets where buyers do so without inspection. Finally, in southern Africa, cereals are politically sensitive and subject to price controls or trade restrictions from time to time (Deason et al. 2014). Despite the above, the Zambian Commodity Exchange (ZAMACE) in Zambia is trying to build trade on the basis of electronic warehouse receipt systems, but the largest threat is the donor reliance in financing the initiative.

Market Information Systems (MISs)

Imperfect information between trades or information imparted to market participants with some delay is partly the cause of volatility of prices. If information flowed perfectly some amount of instability would be removed. Market information systems (MISs) purport to gather and disseminate information about prices and market conditions timely. Often, these MISs disseminate such information over the radio, TVs and now mobile phones. The more effective these facilities are, the more likely some volatility can be removed from prices. In Malawi, the commodity exchange took on the functions of MISs and evolved to providers of agricultural market price information (see Galtier 2013).

Reducing the Impact of Volatility of Food Prices

CONTRACTS

Contract farming involves an agreement between a farmer and the buyer. To make it worthwhile, often the farmer provides land and some labor whereas the buyer can provide a wide range of inputs including seeds, fertilizers, pesticides, further funds for buying extra labor, credit, technical training in the management of the crop, etc. Such an arrangement has the potential to reduce the effect of the pervasive market imperfection in inputs, outputs and credit markets facing the farmer. In the southern part of Africa, such contracts are popular with cash crops, for example, tobacco farming in Malawi by Limbe Leaf and farmers, as well as tea, cotton and sugar contracts in Tanzania, Swaziland, Lesotho and Zambia. Although critics have argued that such contracts may trap farmers in unfair contracts and poverty, studies have shown that, in general, such farmers emerge well-off than comparable ones who did not choose contract farming (see Minten et al. 2009). Of course, contract farming can also turn out badly for the buyer if the farmer resorts to side-selling, i.e., where they decide to sell their crops to other more competitive buyers despite getting credit and other inputs from someone else. Where contract farming works, prices facing farmers are less volatile.

FUTURES MARKET

Futures markets are one way of helping market participants manage agricultural price risk. A commodity futures market organizes the purchase and sale of standardized contracts to deliver some specified quantity and quality of a commodity at some specified time in future ranging from a month to several years later (see Deason et al. 2014). In the event a trader does not want to tie himself to the transaction, he may instead buy an 'option' which gives him the right, but not an obligation, to carry out the transaction in the future. A 'call option' to buy a commodity puts an upper limit on the price the trader will pay, while a 'put option' to sell, puts a lower limit on the price. For example, the Government of Malawi purchased two call options on the SAFEX market in 2005 for a total of 60,000 tons of maize, including delivery to Malawi. Although the price of maize did not rise, the cost of transportation rose and Malawi saved a whopping USD2 million in import costs (Rohrbach 2010). The downside of using options to manage risk is that it costs almost 8-10% of the value of the contract to buy an option, whether or not the option is exercised (Deason et al. 2014).

SAFETY NETS

Safety nets help reduce consumption risk. This may be achieved through many ways including food handouts, guaranteed employment (food for work), cash transfers, school feeding programs as well as inputs subsidies (see Gentilini and Omamo 2009). Where they are well designed, such safety net programs could improve local infrastructure while providing assistance to the poorest of households. In the SADC region, popular safety net programs include Food for Work programs, cash transfers and some levels of subsidies in Malawi, Mozambique, Zambia, and Zimbabwe, among others. Most of these are donor-funded although in some cases national governments put forward some limited funding for the same. Safety net programs are helpful in the long run, but they can be associated with significant costs in the short term.

Conclusion

Volatility in prices the SADC region is an issue of concern and has been discussed for long. It appears that there are many options available to governments to reduce price fluctuations and their effects on their economies. In general, improving market infrastructure will likely improve the predictability of prices as domestic markets will get integrated into the main markets. Trade bans and general non-tariff and tariff trade barriers should be discouraged as they often do more good than harm in terms of price stabilization. At least where they are used for market stabilization care should be taken to avoid yielding the exact opposite as has been the case in maize markets in Malawi, Kenya and Zambia. Furthermore, there is a role for the futures markets to play in managing price risks, and governments in the SADC region should explore how they may use these options on the Commodity Exchange markets including the SAFEX in South Africa. In general, intra-regional trade will likely improve price stability and cushion households from supply shocks.

4. More Resilient Domestic Food Markets through Regional Trade

Charles Nhemachena, Greenwell Matchaya, Sibusiso Nhlengethwa

Trade Performance by African Countries in Regional Agricultural Markets[5]

Geographic location and resource endowment have considerable effects in enhancing competitive advantage of countries when it comes to agricultural production. The competitive advantage combined with specialization has an impetus to spur regional trade and, in turn, global trade. Countries that have diversified production and specialized to their competitive advantage have often enhanced employment and incomes, consequently making these countries much more resilient to economic shocks. The efficiency that results from specialization enables these countries carve market niches and, hence, increasing their market share in both regional trade and global trade. Accordingly, this enhances security for, and access to, food, and reduces the unit cost of supplying food thus lowering the food prices. Globally, countries are now relying more on trade to enhance resilience thus reducing the risks encountered by vulnerable groups. If we follow the idiom "charity begins at home" it is imperative that countries embrace regional trade/integration before proceeding to global trade. This is mainly due to the inclinations associated with global trade especially for developing countries; these inclinations include items such as transport costs, availability of foreign exchange, responsiveness of the import sector, and dietary preferences. Regional and global trade should therefore be seen as complementary to each other rather than as substitutes.

This chapter will focus on regional trade. Its objectives are to: (i) analyze the current performance of African countries in regional agricultural markets; (ii) assess the potential contribution of regional trade to the stabilization of the local food market; and (iii) examine the scope to expand cross-border trade within the three main RECs.

[5] This chapter draws heavily on Azzarri et al. (2014).

Regional Potential for Stabilization of Domestic Food Markets through Trade

Competitiveness of country products in regional and global trade markets has, to a certain degree, the potential to enhance the contribution to resilience and to reducing market volatility. A market breakdown model will be used in this section to analyze the performance of the SADC countries; this model breaks down the change in a given country's share in the total region's trade into a "competitive effect and a market effect" for various agricultural products and export destinations. The competitive effect evaluates the extent to which SADC countries have been able to raise their competitiveness in regional markets and how this has contributed to raising their share in global trade. The market effect measures the extent to which trading with regional partners has boosted countries' overall trade performance and raised their share in global trade. In view of the importance of access to sufficient food for resilience, agricultural trade needs to be measured in terms of both caloric content and monetary value. The results for a few SADC countries and the SADC region are shown in Table 4.1, based on data for the period from 2000 to 2011. For SADC, the results show the competitive and market effects for her member states as a group. A competitive effect greater than 1.00 suggests that the considered group of countries has succeeded in raising its level of competitiveness in the considered market, by expanding its exports to that market faster than the group of competitors. As can be seen from Table 4.1, SADC countries have experienced rising competitiveness in trade for agricultural goods in all four markets during the period under consideration. SADC members, in particular, have raised their competitiveness in regional markets considerably.

SADC countries have, as a group, also grown more competitive in intra-regional agricultural trade. Amongst the countries in the SADC region, Zimbabwe experienced the strongest gains in competitiveness.

TABLE 4.1. BREAKDOWN OF EXPORT GROWTH: COMPETITIVE EFFECT (2000–2011).

	Initial regional share market share % (2000)	Competitive effect	Final regional share market share % (2011)
	Agriculture (%)	Agriculture (value)	Agriculture (%)
SADC	7.2	1.59	42.2
Botswana	46.3	0.93	46.4
Malawi	7.9	0.97	8.2
South Africa	13.3	0.97	9.6
Swaziland	61.7	0.98	61.7
Zambia	18.8	0.99	19.1
Zimbabwe	20.6	1.00	20.6

Source: Authors' calculations based on data from FAO (2014).

The increased competitiveness has in general translated into higher shares of regional markets in total exports, for each of the countries. For instance, the SADC region has translated its strong gains in competitiveness into higher regional market shares in the agriculture sector; this trend is also noted for Botswana and Swaziland as well. It is worth noting that Botswana and Swaziland are directing a significantly larger share of their agricultural exports in agricultural value terms to the regional markets. This can however be explained by the fact that these two countries subscribe to the Southern Africa Customs Union (SACU) and that hence they modestly trade within the union. In contrast, South Africa's exports of agricultural products to the region show a decline, from 13.3 to 9.3% in value terms.

Table 4.2 shows the results of the market effect, that is, the impact of relative growth of demand in regional markets on agricultural export performance. A market effect greater than one (1) indicates that demand for the product in question has increased relatively faster in the considered market than it has globally. The market effect expresses the extent to which relatively faster growth in intra-regional markets has contributed to raising the export performance of the countries and the region. The idea behind the market effect is that, assuming unchanged competitiveness or constant market shares, the contribution of a given intra-regional market to the overall (global) trade performance of the corresponding group of countries will rise or decline depending on whether that market expands faster or slower than world trade on average. The market effect thus measures the change, during the study period, in the importance of intra-regional markets as destinations for exports by SADC countries (as a group and member states, respectively). The values suggest slightly positive market effects (> 1.00) associated with intra-SADC markets as destinations of regional exports.

To paint a vivid picture of the contribution of the SADC region and country markets to the performance of exports by SADC countries, the market effects are expressed in terms of the absolute change in the value of exports (shown in the last column of Table 4-2). The numbers illustrate the actual change in the value of exports of the agricultural products

TABLE 4.2. BREAKDOWN OF EXPORT GROWTH: MARKET EFFECT (2000–2011).

	Market effect	Initial regional share market share % (2000)	Value of market effect
	Agriculture (value)	Agriculture (%)	Agriculture (USD millions)
SADC	1.03	7.2	38.11
Botswana	0.98	46.3	-11454969.44
Malawi	0.94	7.9	-28524718.58
South Africa	0.91	13.3	-544661386.40
Swaziland	0.93	61.7	-93620806.35
Zambia	0.92	18.8	-57531244.59
Zimbabwe	0.91	20.6	-119081548.50

Source: Authors' calculations based on data from FAO (2014).

by the different countries, compared to the scenario with intra-regional market growing at the same rate as the global average and maintaining constant shares in the exports of their respective country groupings over the entire period. The faster-growing intra-SADC markets have increased the value of agricultural exports by at least USD38.11 million, reflecting the initially very low share of intra-SADC markets in total SADC exports, at less than 7%. However, Botswana, Malawi, South Africa, Swaziland, Zambia and Zimbabwe as destinations have contributed negatively to exports from SADC member countries, with their market effect values denoted in negative millions, which is mainly due to slower expansion of demand compared to the global average.

From the above analysis it can be derived that there is relatively strong agricultural trade performance in general by SADC during the period under consideration. Countries have gained in competitiveness, and the regional market has boosted export growth. Countries are also, in general, directing larger shares of their agricultural exports to the regional market. There are indications, therefore, that trade among SADC countries is contributing to competitiveness, growth, and increased food supplies. Hence, the longer-term impact pathway from trade to resilience seems to be working. Another impact pathway of trade, in the shorter run, is to make domestic food and agricultural markets more resilient to shocks, the subject of the next section.

Volatility of food prices is more of a ubiquitous scenario among low-income countries and that is a consequence of unpredictability and instability of domestic production. In the SADC region, variability in domestic production is prevalent in the low-income countries that mainly do not have the Farmer Input Support Programme (FISP) (in short input subsidy programmes). When analysis of the food balance sheet is conducted at regional level, it depicts that food production is much more stable but that cannot be said about the individual countries. Deeper regional integration is therefore seen as the main solution that would curb the volatile food supply and food prices in the region and consequently improving food supply in the region as well. The capacity of domestic markets to cushion local price risks can be increased through deeper regional integration (increased trade)

and this can be attained through (i) increasing the areas of production and consumption, which will increase the demand and supply and consequently absorbing the price shocks effects; (ii) helping sharpen marketing services provided and also enhancing the marketing activities through increased capacities to respond to prospective shocks; and (iii) reducing the costs and size of needed carryover stocks, thus lowering the costs of supplying the markets during periods of shortage and hence the likely amplitude of price variation.

It is worth noting that comparing the variability of cereal production between regional averages and local (in-country) averages depicts that there is a need for deeper market integration to stabilize local markets. To paint a clear picture of the production variability both at country and regional level a trend-corrected coefficient of variation is used. Country coefficients are then normalized, by dividing by the respective regional coefficients. Figure 4.1 shows the normalized coefficient of variation, the bars indicating by how much a country's production is either volatile (>1) or less volatile (<1) with respect to that of the region. SADC has the highest level of aggregate volatility, with a coefficient of variation of 18.58, or more than twice that of ECOWAS and thrice that of COMESA. A majority of the countries in the SADC region have national production volatility levels that are larger than the regional volatility level with Democratic Republic of Congo (DRC) as the only exception in the SADC region. Most of the countries in the SADC region have moderate national production volatility. Botswana and Mauritius exhibit volatility that is thrice higher than the SADC region's volatility level; this actually implies that these countries would benefit the most from increased regional integration because it would ensure more stability in domestic food supplies and prices.

The difference between a country's volatility level and that of the region actually suggests that there is a trade stabilization potential, and that individual countries ought to benefit from this potential if its fluctuation in production shows a weaker correlation with that of other countries in the region. The Coefficients of correlation for the SADC region are depicted in Figure 4.2, which further presents the distribution of correlation coefficients among individual country production levels of the SADC region. For

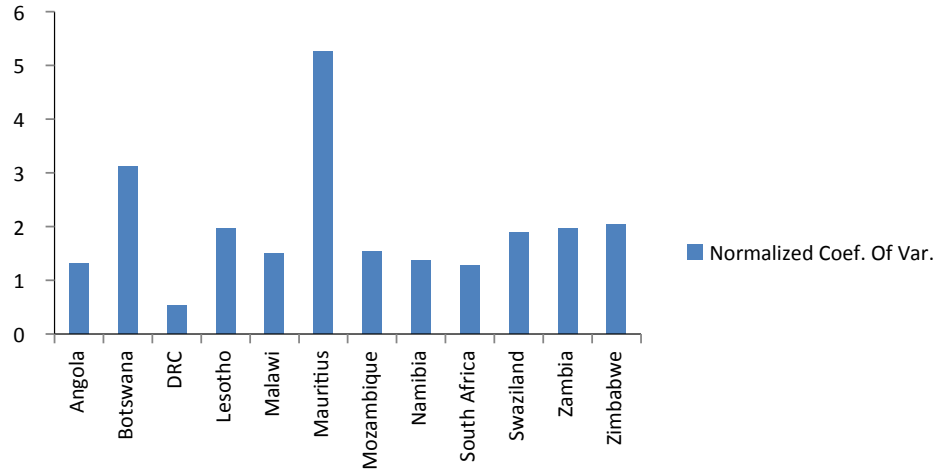


FIGURE 4 1. SADC CEREAL PRODUCTION INSTABILITY (NORMALIZED).
Source: Badiane; Odjo; Jamaneth (2014), based on FAO data for the period 1980–2010.

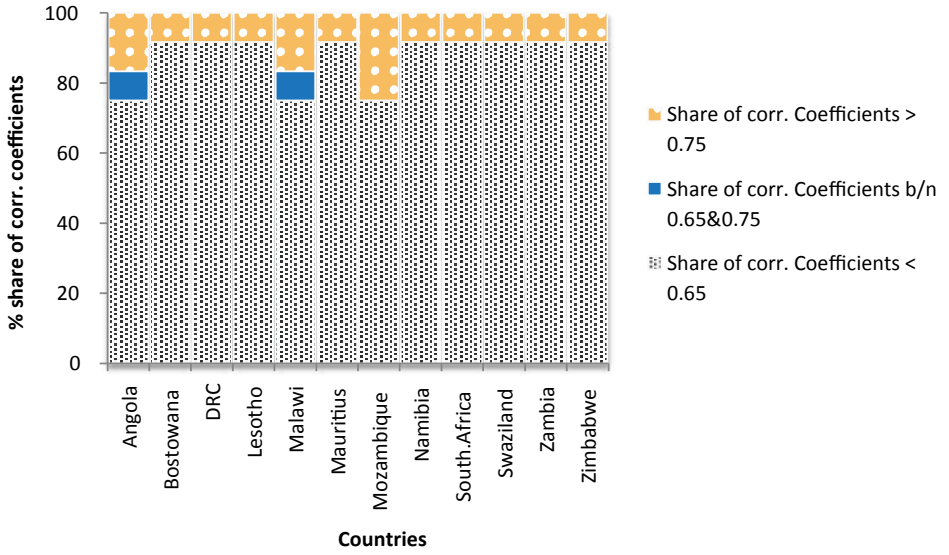


FIGURE 4.2. DISTRIBUTION OF PRODUCTION CORRELATION COE¬FFICIENTS, SADC.
Source: Badiane; Odjo; Jemaneh (2014), based on FAO data for the period 1980–2010.

each country, the lower segment of the bar shows the percentage of correlation coefficients that are 0.65 or less—that is, the share of its regional partner countries whose production fluctuations are relatively weakly correlated with the country's own production movements. The top segment represents the share of countries with highly correlated production fluctuations, with coefficients that are higher than 0.75. The middle segment is the share of moderately correlated country productions, with coefficients that fall between 0.65 and 0.75.

When using these criteria, member states of the SADC region (the most volatile region) have the highest concentration of weakly correlated country production levels. As seen in Figure 4.2, all but three of the countries have a greater than 80% share of correlation coefficients below 0.65. The combination of high volatility and weak correlation suggests that countries in this region would reap the highest benefit from increased regional trade in terms of domestic market stabilization. In general, however, the patterns and distribution of production fluctuations across countries in the SADC region are such that increased trade could be expected to contribute to stabilizing domestic agricultural and food markets.

Scope for Specialization and Regional Trade Expansion in Agriculture: Outlook for Regional Cross-Border Trade among Leading RECs

Table 4.1 presented intra-regional trade shares. These shares are higher than what they were a couple of decades ago; they are however still very low with respect to all traded goods. SADC has the highest shares of intra-regional trade compared to the other trade regions in Africa. With respect to intra-regional SADC agricultural trade the member countries still account for far less than half of the value of agricultural trade within the region.

There are several factors that contribute to low intra-regional trade, making trading with extra-regional partners more attractive while raising the cost of supplying regional markets from intra-regional sources. In order for regional stabilization to be attained measures are required to be made to lessen barriers to cross-border trade, to stimulate the expansion of regional supply capacities—assuming there is sufficient scope for specialization between the subregions. It is assumed, ceteris paribus, that neighboring developing countries have similar production and trading patterns, because of similarities in their resource bases. However, several factors have been found to lead to differences in specialization patterns among these developing countries: (i) differences in historical investments in technologies, and thus the level and structure of accumulated production capacities and skills; (ii) the economic distance to distant markets; and (iii) differences in dietary patterns and other consumer preferences that affect the structure of local production.

A chain of indicators is used to assess the actual degree of country specialization in agricultural production and trade. These indicators can depict whether cross-border trade might effectively exploit the regional divergence in national production levels, to enhance the resilience of domestic food markets to shocks. The first two indicators are the production index and export similarity index, which measure (and rank) the importance of the production and export of individual agricultural products for each country. The level of importance of each product is then compared for all relevant pairs of countries within each subregion. Each of the two indices has a maximum value of 100, which would reflect complete similarity of production or trade patterns between the pairs of countries. It should however be noted that the lower the value of the indices, the greater the degree of specialization between the two countries. Index values of around 50 and below indicate patterns of specialization that are considered compatible with higher potential trade expansion. The results of the calculations for the three regional groupings, covering 150 products, are presented Figure 4.3 and Figure 4.4, each bar of which represents the number of country pairs that falls within the corresponding range of index values. The graph shows that for the SADC region, the vast majority of country pairs fall within the 0-50 range.

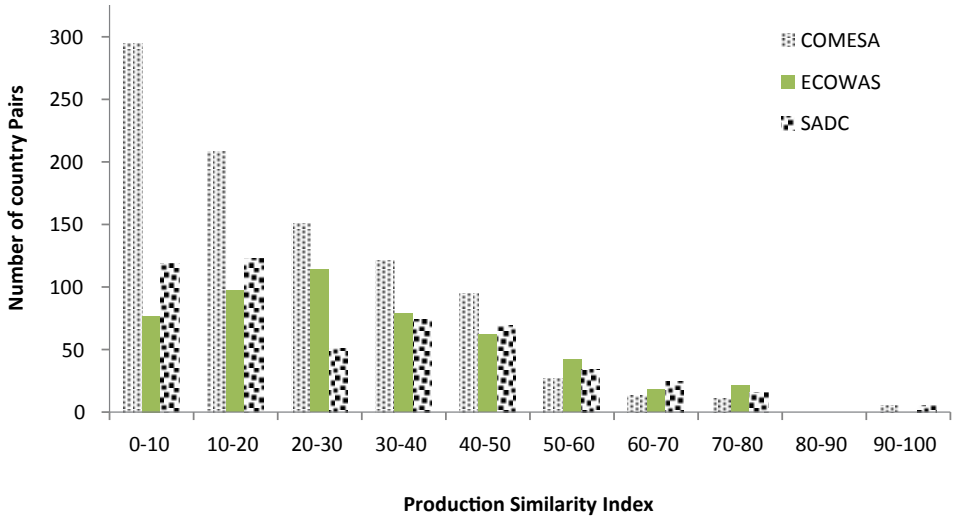


FIGURE 4.3. SIMILARITY OF PRODUCTION PATTERNS (2007–2011).
Source: Badiane; Odjo; Jemaneh (2014), based on FAO data for the period 2007–2011

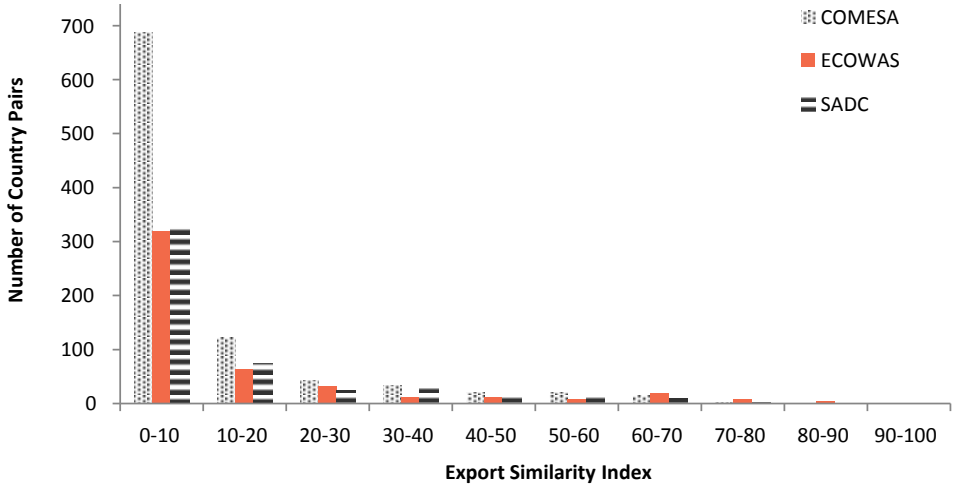


FIGURE 4.4. SIMILARITY OF TRADE PATTERNS (2007–2011).
Source: Badiane; Odjo; Jemaneh (2014), based on FAO data for the period 2007–2011.

In other words, the current variation in country production and trading patterns indicate that scope exists for cross-border trade expansion in the region. The third indicator is the revealed comparative advantage (RCA) index; the RCA index is aimed at further evaluating the degree of country specialization in production and trade. The index compares the share of a given product in a country's export basket with the share of the same product in total world exports. A value greater than 1 indicates that the country performs better than the world average; the higher the value, the stronger the country's performance in exporting the product.

Table 4.3 shows 20 products with the highest normalized RCA index value. Normalized RCA values are positive for RCA indicators that are greater than 1 and negative otherwise. For very high RCA indicators, the normalized value tends towards 1. All the products listed in Table 4.3 have normalized RCA values above 0.98. The rankings reflect the degree of cross-country specialization within each REC. SADC has the highest number of products in that category—a total of 14, produced by only five of its 15 countries.

The degree of specialization across all the countries in the region can be noted by looking at the RCA values for the entire set of products and countries. When two or more countries have patterns of specialization that are alike for a product, this product is ranked equally high, and the values of the RCA indicator for the product would not vary significantly across countries. However, for countries with different patterns of specialization, exports by individual countries would be concentrated around a few products, with a substantial variation of the indicator value across products. An analysis of the variance of the RCA index is used to indicate the relative weight of these two possibilities. The results of the analysis, presented in Table 4.4, show that, for the entire sample of African countries, nearly two-thirds (63%) of the total variation of the RCA index across countries and commodities is accounted for by country-to-country variation. The balance of variation is explained by variation across products. The RCA index, like the previous two indicators, thus confirms the existence of dissimilar patterns of trade specialization in agricultural products.

TABLE 4.3. PRODUCTS WITH HIGHEST REVEALED COMPARATIVE ADVANTAGE (RCA) INDICES (AVERAGE 2007-2011).

SADC	
Country	Commodity
Madagascar	Vanilla
Madagascar	Cloves
Tanzania	Coffee husks and skins
Malawi	Tobacco, unmanufactured
Malawi	Cotton carded, combed
Tanzania	Cashew nuts, with shell
Zimbabwe	Cake of cottonseed
Tanzania	Cake of cottonseed
Tanzania	Cotton carded, combed
Tanzania	Cloves
Malawi	Coffee
Tanzania	Sesame oil
Mozambique	Cashew nuts, with shell
Zimbabwe	Hides
Zimbabwe	Cotton (linter)
Zimbabwe	Tobacco, unmanufactured
Malawi	Cotton (linter)
Malawi	Tea
Malawi	Cotton waste
Zimbabwe	Peas, green

Source: Badiane; Odjo; Jemaneh (2014), based on FAO data for the period 2007–2011.

At IWMI. The last two indicators are the Trade Overlap Indicator (TOI) and the Trade Expansion Indicator (TEI). These are calculated to examine the potential to expand trade within the three blocks of countries, based on current trade patterns. They measure how much of a given product a particular country (or region) exports and imports at the same time. TOI measures the overall degree of overlapping trade flows for a country or region as a whole, while TEI measures the overlapping trade flows at the level of individual products for a country or region. Results of these measures are presented in Figure 4.4 and Table 4.4. Figure 4.5 indicates a substantial degree of overlapping trade flows; 40% for the SADC region.

Regional indicators are meaningfully higher when the regional TOI values in Figure 4.5 and the TOI values of individual countries are compared. Table 4-5 shows the normalized TOI, obtained by dividing country values by the value for the respective region. The numbers express country TOI as a fraction of regional TOI, which in the vast majority of cases is found to be significantly less than 1. The overlapping regional trade flows must therefore be from different importing and exporting countries. On the other hand, some countries are exporting (importing) the same products that are being imported (exported) by other member countries in their respective groupings, but trade with countries outside the region. By redirecting such flows, countries should be able to expand trans-border trade within each of the groupings. The TEI indicates which products have the highest potential for increased trans-border trade, based on the degree of overlapping trade flows. Table 4.5 lists the 20 products with the highest TEI value for each of the three regions. Only chocolate products in SADC have RCA values less than 1. The fact that products with high TEI also have high RCA indicator values points to real scope for trans-border trade expansion in all three subregions.

In the previous analysis, the results depicted that SADC countries still need deeper regional integration in order to enhance the resilience of domestic markets to volatility in food supply. The analysis also showed that, even with current production and trade patterns, there is real scope to expand cross-border trade beyond the levels shown in Table 4.1. The high cost of

TABLE 4.4. ESTIMATION OF RCA VARIABILITY ACROSS COUNTRIES AND PRODUCTS.

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Years	367 906,8	5	73 581,35	0,556278	0,733187	2,310 225
Products	1,33E+08	19	6 990 113	52,84558	4,9E-42	1,69707
Error	12566061	95	132 274,3			
Total	1,46E+08	119				

Sources: Authors' calculations based on FAO (2014) and Badiane; Odjo; Jemaneh (2014).

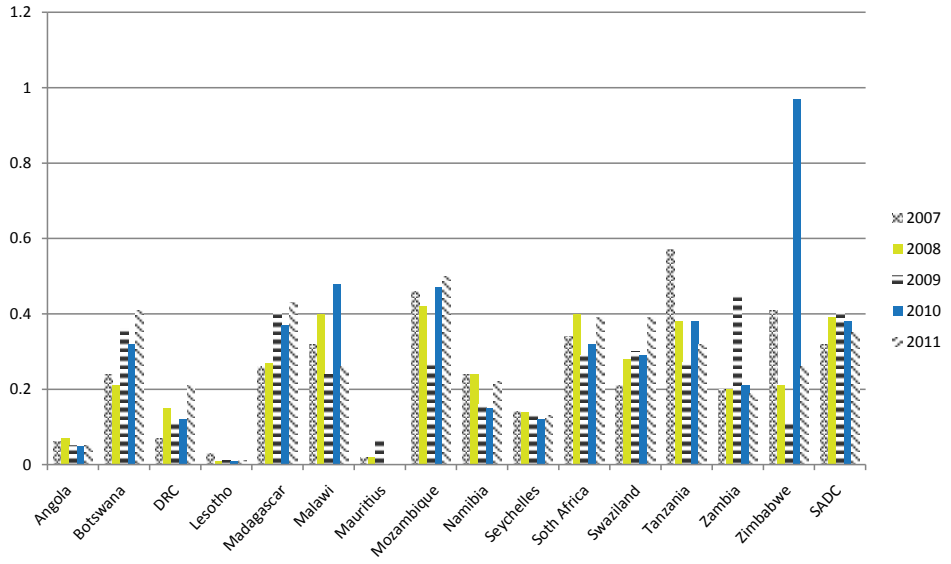


FIGURE 4.5. TRADE OVERLAP INDICATORS (AVERAGE 2007–2011).
Source: Authors' calculations based on FAO (2014) and Badiane; Odjo; Jemaneh (2014).

moving goods across domestic and trans-border markets and an outwardly biased trading infrastructure are major determinants of the level and direction of trade among African countries. Lowering the general cost of trading and eliminating additional barriers to cross-border trade constitute a succinct strategy that should be devised and enacted to exploit SADC's regional stabilization potential, which in this section, is a simulation of the impact on regional trade flows. The simulations of these changes are carried out using IFPRI's regional Economy-wide Multimarket Model (EMM) (see Diao et al. 2007 and Nin-Pratt et al. 2010).

The original multi-market model is augmented in this study to account for intra- versus extra-regional trade sources and destinations, as well as informal versus formal trade costs in intra-regional trade transactions. In its original version, the EMM solves for optimal levels of supply, demand, and net trade (either import or export) of different commodities in several interlinked crop and non-crop markets. In the version used in this study, the net export of any commodity is an aggregate of two output varieties based on the intended market outlet (regional or extra-regional), while assuming an imperfect transformability between these two export varieties. Similarly, the net import of any commodity is composed of two varieties differentiated by their origins (regional or extra-regional), while assuming an imperfect substitutability between the two import varieties.

The model is then calibrated so as to replicate production, consumption, and net trade data as observed for disaggregated agricultural sub-sectors as well as two aggregate nonagricultural sectors for individual countries in 2007–2008. Baseline trend scenarios are constructed so that, until 2025, changes in crop yields, cultivated areas, outputs, and GDP reflect changes observed in historical data. Although the model is calibrated to the state of national economies seven years earlier, it closely reproduces the countries' current growth performances.

Four different scenarios are simulated using the EMM model. The first is a baseline scenario that assumes a continuation of current trends up to 2025; this is later used as a reference to evaluate the impact of changes under the remaining three scenarios. The latter scenarios

TABLE 4.5. TRADE EXPANSION INDICATORS (AVERAGE 2007–2011).

SADC	
Commodity	Trade expansion index
Pepper (piper spp.)	0.919
Cake, cottonseed	0.856
Cottonseed	0.849
Cigarettes	0.815
Hair, fine	0.811
Bran, wheat	0.797
Waters, ice, etc.	0.783
Bran, maize	0.782
Fruit, dried	0.776
Sugar	0.774
Cider, etc.	0.762
Molasses	0.759
Yoghurt, concentrated or not	0.755
Juice, fruit	0.749
Cherries	0.747
Onions, dry	0.743
Flour, cereals	0.730
Chocolate products	0.723
Meat, pig, preparations	0.715
Cauliflower and broccoli	0.712
Ice cream and edible ice	0.708
Oil, coconut (copra)	0.705
Juice, tomato	0.703
Vegetables, frozen	0.697

Source: Badiane et al. 2014, based on FAO data for the period 2007–2011.

introduce three different sets of changes to examine their impacts on regional trade levels: (1) a reduction of 10% in the overall cost of trading across the economy; (2) a removal of all cross-border trade barriers, that is, a reduction of their tariff equivalent to zero; and (3) an across-the-board 10% increase in yields. These changes are to take place between 2008, the base year, and 2025. The projected change in cross-border exports is used as an indicator of the impact on intra-regional trade.

The results for the different regions are presented in Figure 4.6. The values on the top present the results of the baseline scenarios for the three regions from 2008 to 2025. Assuming a continuation of current trends, intra-regional trade in SADC is expected to expand rapidly but with marked differences between crops. In the aggregate, the volume of intra-regional trade in staples would approach 1.5 million tons in the case of SADC, if the current rates of growth in yields, cultivated areas, and income growth are sustained to 2025. In the SADC region, the rise of Angola as a main exporter of roots and tubers (starting in 2013) mainly accounts for the strong boost in regional trade for that commodity. The sole exporter before was Zimbabwe, with very modest quantities and, hence, the high rates of growth of overall regional exports.

Figure 4.7 depicts the cumulated changes in intra-regional export levels by 2025, compared to the baselines, that would result from a reduction in total trading cost, removal of cross-border trade barriers, and an increase in yields. The bars represent the proportional changes in percent, and the numbers on top of the bars indicate the corresponding absolute changes in 1,000 metric tons. The results invariably show considerable increases in intra-regional trade in cereals and roots and tubers, the main food crops, in response to changes in trading costs and yields. Cereals seem to respond better than other products in general. It also appears that removal of trans-border barriers to trade would have the strongest impact on trade flows across the board.

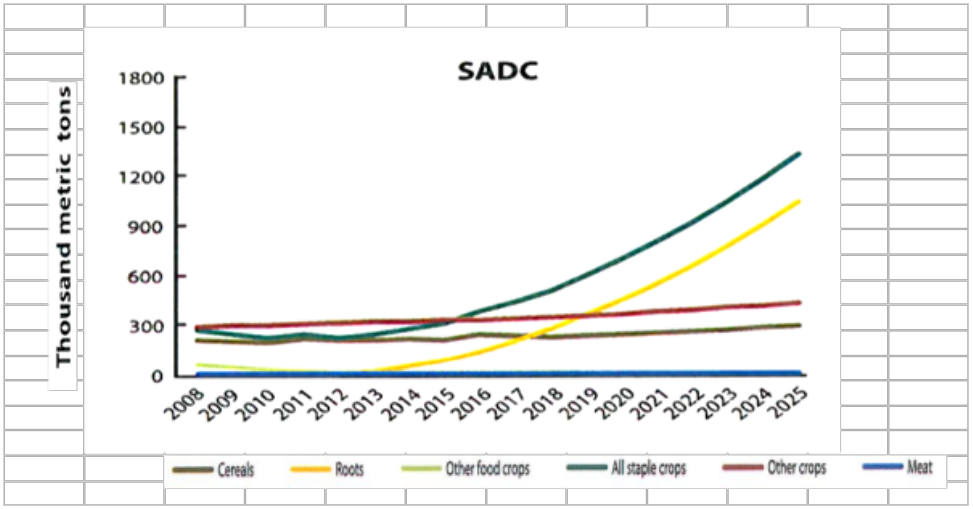


FIGURE 4.6. SADC REGION EXPORTS OUTLINE, BASELINE.
Source: Odjo; Jemaneh (2014).

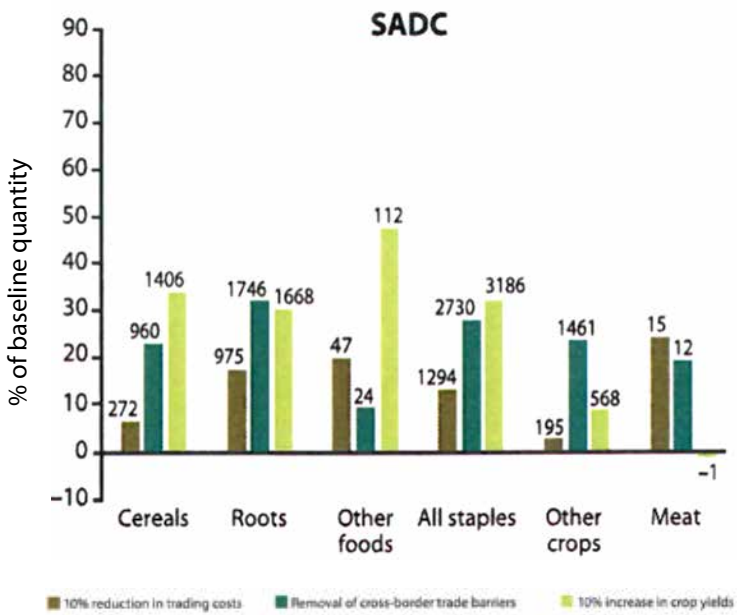


FIGURE 4.7. THE IMPACT OF CHANGES IN TRADING COSTS AND YIELDS ON SADC EXPORTS.
Sources: Badiane; Odjo; Jemaneh (2014); Authors' calculations.

Conclusions

It is worth noting that the SADC region has a potential to increase intra-regional trade which would in turn increase domestic food market resilience against price shocks. The distribution and correlation of production volatility, as well as the current country patterns of specialization in production and trade of agricultural products, suggest that it is indeed possible to raise cross-border trade to address the instability of local food markets. The fact that countries, in general, have been able to improve export competitiveness in regional markets and raise regional trade shares is encouraging in this regard. The results of the baseline scenario indicate that continuation of recent trends would sustain the expansion of intra-regional trade flows in the SADC region. The findings also reveal that it is possible to significantly boost the pace of regional trade expansion, and thus its contribution to creating more resilient domestic food markets, through a modest reduction in the overall cost of trading, a similarly modest increase in crop yields, or the removal of barriers to trans-border trade.

5. Regional Trade Flows and Resilience in SADC Countries

Greenwell Matchaya, Charles Nhemachena, Sibusiso Nhlengethwa

This chapter discusses agricultural trade flows and resilience in the SADC region. The relationship between agricultural trade flows, biophysical conditions and climate variability is affected by the production landscape and its characteristics. For example, export levels in any given country and in the region directly depend on agricultural production levels which determine excess levels available for export after meeting domestic needs. Alternatively, agricultural production levels determine the levels of imports a country and/or region needs for a given time period such as a calendar year. To maintain domestic consumption requirements, countries and the SADC region need to import food from both regional and international agricultural markets. The interplay between agricultural export and import needs of a given country and the region are influenced by a host of factors such as biophysical conditions, changes in climate and associated variability; institutional factors, etc. The interactions of these factors bring shocks in production, consumption, and exports and imports; and households, countries, and the region need to adapt to these unexpected changes. The resilience and/or ability of households to adapt to or manage the shocks is influenced by various local-level resources and conditions.

Production-related shocks in one country and/or the region as a whole create supply shortages inducing the need for the affected country and/or region to import food. In the same way, when there are production surpluses in a given country, this necessitates the need to export the surpluses. Either way, households and countries have to adapt to shocks in both agricultural exports and imports and this depends on their resilience. This chapter makes efforts to explore the ripple effects associated with changes in agricultural trade flows in the SADC region. The chapter explores the relationship between biophysical factors and trade flows focusing on the impact of biophysical factors on agricultural import and export flows in the SADC region. The extent to which trade flows are dependent on households' resilience to shock is also examined.

The historical trends and projected changes in climatic variables (temperature and rainfall) and extreme events indicate that the region is generally becoming hotter and drier with declining trends, increased variability and unreliability in rainfall including increasing frequency of extreme climatic events, particularly droughts and floods (Nhemachena 2009; ECA 2013; IPCC 2014). These changes in climate and variability are expected to have detrimental effects of the region's agriculture sector which remains a priority sector for most of the poor who rely on natural systems and agriculture for their livelihoods. Furthermore, climate-related shocks on production would affect agricultural exports for most of the region's countries. Shocks induced by climate change on both production and agricultural import and export trade flows will disproportionately affect the poor in the region as they have the least capacity to adapt and rely on agricultural markets for food and their livelihoods. The additional stresses caused by climate change and extreme events would also influence the resilience of households to adapt to the shocks.

Data Sources and Description

AGRICULTURAL PRODUCTION, IMPORTS AND EXPORTS[6]

The data on agricultural production, imports and exports for the SADC region were obtained from the statistical website of the FAO, which is FAOSTAT. The FAOSTAT database provides comprehensive trade statistics for all countries, collected from national authorities and international organizations. The data for the SADC region were collected from 1990 to the latest year available. Additional data were obtained from the International Food Policy Research Institute (IFPRI) based on the IFPRI/Harvest Choice's Spatial Production Allocation Model (SPAM), relating to the extent of total cropland area, production, and yield (You et al. 2014). The SPAM model starts with production statistics by subnational administrative (geopolitical) units, and analyzes the land cover imagery as cropland or non-cropland. SPAM then integrates crop-specific suitability information based on local climate and soil conditions, at the pixel level. SPAM utilizes all these input data and applies a cross-entropy approach to obtain the final estimation of crop distribution across the globe. SPAM output reveals differences in yield according to technology practices as well as emergent patterns between geography and agriculture.

VARIABLES

Biophysical Risk

The chapter also examines the effects of agroecological variables (such as temperature, rainfall, vegetation, land degradation and forest coverage) on agricultural trade. Climatic data (monthly temperature and rainfall data – 0.5 degree grids; 60 km resolution) were obtained from the University of East Anglia CRU-TS database. The data were collected for the time period 1993 to 2010.

Data on vegetation trends measured using Normalized Difference Vegetation Index (NDVI) were obtained from NASA based on two products: AVHRR for 1993 to 2009 and MODIS for 2010. The NDVI is one of the widely used vegetation indices to identify vegetated areas and assess their conditions based on the detection of live green plant canopies in multispectral remote sensing data (Running et al. 1995 cited in Badiane; Makombe; Bahiigwa 2014. The NDVI summarizes the effect of soil characteristics, rainfall, temperature, length of growing period, and irrigation (see literature in Badiane; Makombe; Bahiigwa 2014).

Data on low soil nutrients were obtained from CIESIN, Columbia University, 2000. The CIESIN, one of the standard products from the fertility capability soil classification (FCC) system, has been widely used to interpret soil taxonomy and additional soil attributes in a way that is directly relevant to plant growth.

The data on tree coverage were provided by the University of Maryland, 2000. The tree cover continuous field product is offered at 1 kilometer resolution, and vegetation is represented as continuous fields of land cover, so that every pixel has a percentage value for tree cover.

[6] This chapter draws heavily on Azzarri et al. (2014).

CROP AND LIVESTOCK DISEASE RISK

The data on crop disease, pest, and weed prevalence came from IFPRI. Rosegrant et al. (2014) compiled the agroclimatic prevalence of regionally representative crop diseases, insect pests, and weed species, at 0.5 degree grids for maize, rice, and wheat. The data were aggregated across the three crops as weights, using the gridded harvested area from SPAM (You et al. 2014).

SOCIOECONOMIC SETTING

Two socioeconomic variables (population growth and GDP per capita) are considered in the analysis. Human beings provide important sources of labor and energy in African agriculture and, hence ,population is an important variable in the socioeconomic context. Shocks in the population of a country or region (e.g., boom or bust) have implications for all aspects of society including agricultural production and trade flows. Population data for SADC countries were obtained from the World Development Indicators (WDI) from the World Bank (2014); capita measured in purchasing power parity (PPP) was also obtained from the World Bank WDI database (World Bank 2014).[7]

Descriptive Analysis of Data

The descriptive analyses of the variables described above and their relationship with agricultural trade flows are presented in this section. The focus is on the spatial distribution of both time-invariant factors (soil quality, vegetation coverage, insect pests, prevalence of diseases and weeds) and time-varying factors (trade flows of imports and exports, agricultural production, population, GDP per capita, rainfall, temperature, NDVI). The analysis is presented for the whole SADC region, SADC excluding South Africa, SADC middle-income countries (Lesotho, Swaziland, Angola, Namibia, Botswana, South Africa) and SADC low-income countries (Malawi, Madagascar, Zimbabwe, Mozambique and Zambia).

AGRICULTURAL PRODUCTION, IMPORTS AND EXPORTS

The trends in total agricultural production (constant USD) from 1990 to 2012 for the SADC region are presented in Figure 5.1. The overall trends for the SADC region show an overall growth in total agricultural production of 67% between 1990 and 2012. Further analysis indicates that despite the overall growth, there are some years when total agricultural production declined sharply, for example, in 1992, 1995, 2001 and 2003. These years were associated with extreme drought conditions in most parts of the region contributing to the observed decline in total agricultural production. Separate analyses for SADC excluding South Africa, SADC low-income and SADC middle-income countries show similar patterns. However, within individual countries many other factors contributed to observed trends in each country.

Despite the 2007/08 global economic and financial crises total agricultural production in the SADC region continued to increase. However, excluding South Africa from the analysis indicates that during the 2007-2008 period some negative impacts were experienced on total agricultural production in the SADC region. The same applies to SADC low-income countries, trends which show a decline in total agricultural production between 2007 and 2008. The experiences of the global economic and financial crises saw more emphasis being focused on revitalizing the role of the agriculture sector. Since the publication of the 2008 World Development Report: Agriculture for Development, substantial resources have been invested in agriculture globally. In addition, the African CAADP was entering its second phase with further emphasis on governments to increase investments in agriculture. Trends of total agricultural production for the SADC region show a steady increase between 2008 and 2011 (increasing by 14%); however, the growth slowed down in 2012. The increasing global and regional (through CAADP) emphasis and support on agricultural investments in the post-2008 period can be argued to have contributed to the observed growth in total agricultural production in the SADC region.

[7] An international dollar has the same purchasing power relative to GDP as the US dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (World Bank 2014a). It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

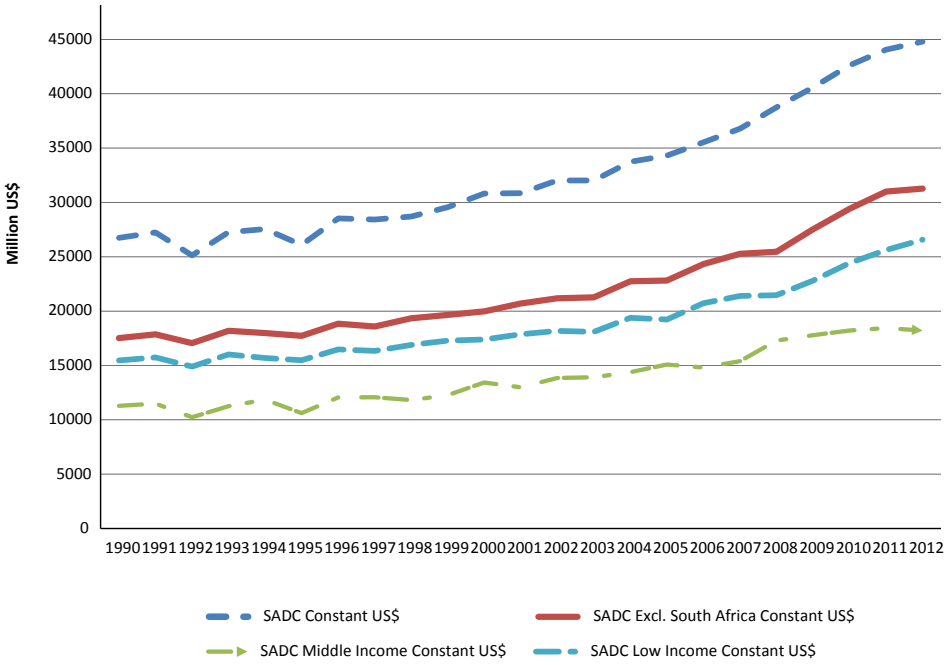


FIGURE 5.1. GROSS PRODUCTION VALUE (TOTAL AGRICULTURAL PRODUCTION), SADC.
Source: Calculations based on FAO 2014.

The analysis was further broken down by three sub-periods linked to CAADP: 1995-2002 (baseline); 2003-2008 (initial CAADP timeline) and 2009-2013 (post-initial CAADP timeline). The findings show that for the SADC region total agricultural production increased by 23% (1993-2002); 21% (2003-2008) and 9% (2008-2011). The analysis excluding South Africa shows that total agricultural production in the SADC region increased by 19% (1995-2002); 20% (2003-2008) and 13% (2009-2011). The SADC low-income country trends indicate that total agricultural production increased by 18% (1995-2002); 19% (2003-2008) and 12% (2009-2011) while SADC middle-income country trends increased by 30% (1995-2002); 24% (2003-2008) and 4% (2009-2011).

The results show that only the SADC excluding South Africa and SADC low-income countries recorded a unit percentage increase in total agricultural production between the baseline period and initial CAADP timeline. The rest of the graphs show that between these two time periods total agricultural production was increasing at a decreasing trend dropping by 2% for overall SADC trend and 6% for SADC middle-income countries. The analysis of the increase in total agricultural production in the post-initial CAADP timeline indicates that although production increased in general, the percentage increases were less than both the baseline and initial CAADP timeline. The SADC middle-income countries registered the least increase of 4% compared to 12% for SADC low-income countries. Also SADC without South Africa recorded a higher increase in total agricultural production (13%) compared to overall SADC trend (9%). Overall, the findings show that total agricultural production in the SADC region has been increasing at a decreasing trend. This might call for a closer look at the efforts aimed at improving agricultural production in the region.

Figure 5.2 shows the total value of agricultural exports in the SADC region for the period 1990 to 2011 in constant USD. For the time period of analysis, the total value of agricultural exports in the SADC region increased between 37% (SADC middle-income countries) and 66% (SADC low-income countries). Overall, SADC trends registered a growth in total value of agricultural exports of 49% both with and without South Africa. However, year to year analyses show that there are years when exports sharply declined such as in

1992, 1995, 1999, 2002, 2006 and 2008. These years also correspond to years of decline in total agricultural production discussed above. Clearly, there is a direct relationship between agricultural production output and exports in the region. Agroecological and socioeconomic factors that affect agricultural production would also have an impact on agricultural exports.

Analyzing the trends using the same sub-periods as discussed above shows that in the baseline period total agricultural exports increased by 5% (SADC) and 16% (SADC middle-income countries). The trends for SADC excluding South Africa and SADC low-income reported decreases of 6 and 16%, respectively in the baseline period (1995-2002). During the initial CAADP timeline period (2003-2008) total agricultural exports increased in the SADC region by 11%. Excluding South Africa in the analysis shows that total agricultural exports of SADC increased by only 4%; while SADC middle-income and SADC low-income reported increases of 12 and 10%, respectively. In the post-initial CAADP timeline (2009-2011), the SADC region experienced growth in total agricultural exports of 22 and 45% (SADC excluding South Africa).

The SADC low-income countries experienced the highest growth in total agricultural exports (56%) while SADC middle-income countries reported only 3% increase in the post-initial CAADP timeline period. For the SADC low-income countries most of the growth in total agricultural exports was driven by increases in exports from Malawi (112%); Zambia (95%) and Mozambique (60%) and Zambia (95%). These countries are also leading in terms of implementation of the CAADP commitments to invest at least 10% of the national budgets on agriculture. Although further analysis would be required, it can be argued that increased investments in agriculture supported by CAADP process in these countries to some extent contributed to increases in total agricultural exports in the region.

Total agricultural imports (in constant USD) for the SADC region during the period 1990– 2011 are presented in Figure 5.3. The results show that from 1990 to 2011 total agricultural imports increased by 234% for the SADC region. Further analysis shows that total agricultural imports increased by 244% for SADC middle-income countries; by 218%

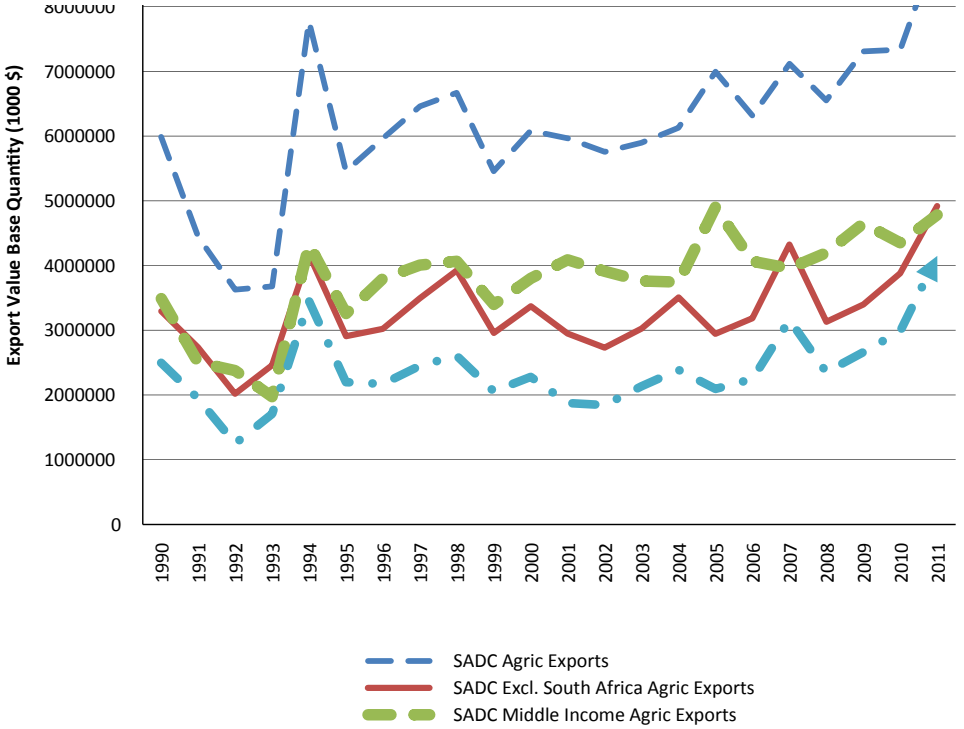


FIGURE 5.2. TOTAL AGRICULTURAL EXPORTS, SADC.
Source: FAOSTAT 2014

for SADC low-income countries and by 215% for SADC excluding South Africa. The trends show spikes of growth of total agricultural imports in some years such as in 1992, 1995, 1998, 2002, 2004 and 2006. Although various factors contribute to the observed growth in total agricultural imports, in some of these years the growth in imports was experienced in the same years in which agricultural production significantly declined in the region. Again, some of these years such as 1992, 1995 and 2002 experienced some of the worst droughts in the region resulting in sharp declines in total agricultural production. The reduced agricultural production together with increasing demand from the growing population and other demands were some of the driving factors explaining the observed spikes in imports in these years. On the other hand, total agricultural imports in the region also declined in some of the productive years during this time period. The findings indicate that some relationship exists between agricultural production and imports in the region and generally the better the production in a given year the lower the demand for agricultural imports. However, the growing demand for agricultural products for various purposes might result in high demand for imports despite good agricultural production in some years.

In the baseline period (1995-2002) total agricultural imports of SADC increased by 46% while excluding South Africa the imports increased by 66%. During the same period, total agricultural imports increased by 34% for SADC middle-income countries and 86% for SADC low-income countries. In the initial CAADP period (2003-2008) total agricultural imports in the SADC region increased by 27% (SADC) and 26% (SADC excluding South Africa) while SADC middle-income and SADC low-income countries experienced increases of 27 and 21%, respectively. Although, it is difficult to directly attribute the observed trends to CAADP activities during this period, it is evident that the increase in imports during this period was less than during the baseline period. In addition, the growth in total agricultural imports is even less (averaging 7%) in the post-CAADP initial timeline period (2009-2011). Analysis of the trends in agricultural production, exports and imports indicates that, generally, agricultural production and exports have been increasing in the region and this might be contributing to the decreasing growth of agricultural imports. However, many

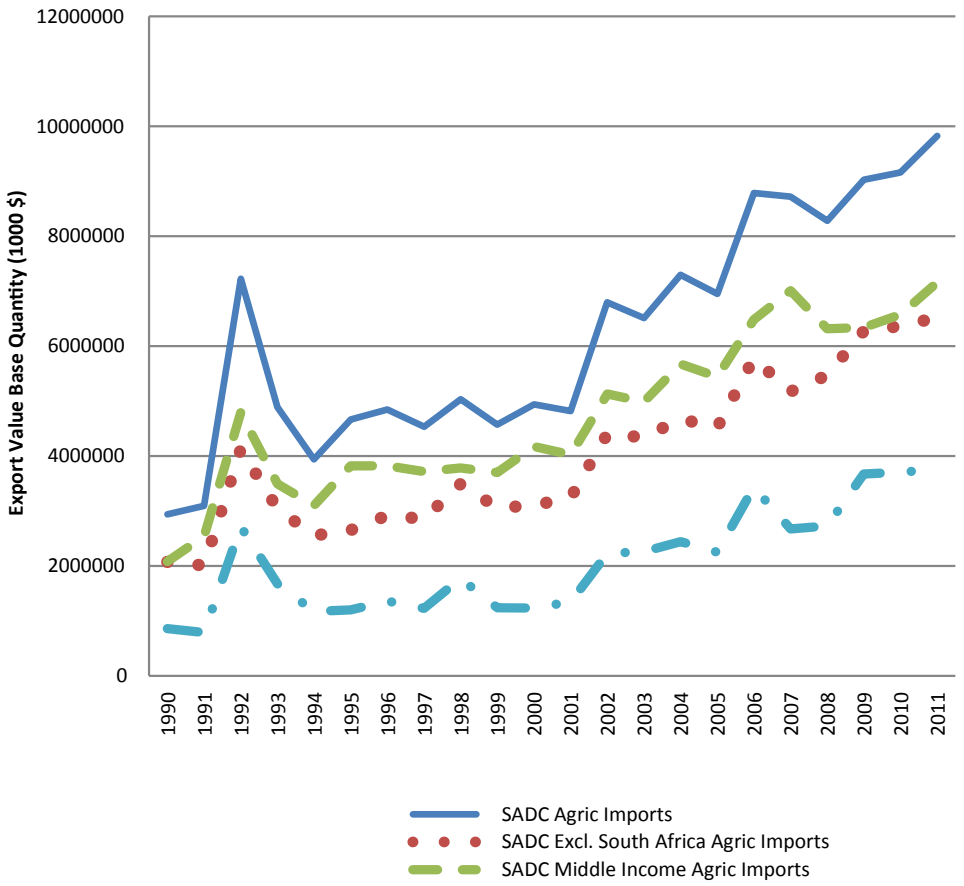


FIGURE 5.3. TOTAL AGRICULTURAL IMPORTS, SADC.
Source: FAO (2014).

other factors might be contributing to these trends but the general link between agricultural production, exports and imports in the region points to the importance of efforts aimed at enhancing performance of the agriculture sector.

BIOPHYSICAL RISK

The analysis of biophysical risk of crop cultivation compiled seven indicators at 30 arc-minute resolution (temporal variability of NDVI; rainfall and temperature represented as a coefficient of variation; prevalence of diseases, pests and weeds; and the area of low soil nutrient capital). For each of the indicators, grid cell-level values across the continent were feature-scaled for the 0–100 range. The seven indicators were used to construct two biophysical risk of crop cultivation indices at grid-cell level: a growing conditions risk index and a disease risk index, aggregated at country level, using the remote sensing-estimated cropland area data as a weight. The two country-level indices were used to describe the biophysical risks to agriculture in southern Africa. Figure 5.4a presents the growing conditions risk index, including temporal variability of NDVI, rainfall, temperature and a low soil-nutrient capital indicator. The disease/pest/weeds prevalence index is shown in Figure 5.4b. Although the figures present the full African maps the discussion for this chapter focuses on the SADC region.

The findings from growing conditions risk index (Figure 5.4a) show that in the SADC region, the countries experiencing the highest levels of growing conditions risk include: Angola, Botswana, Democratic Republic of Congo, Namibia and Zambia (81-90% risk) as well as Lesotho and South Africa each with a 71-80% risk. Analysis of diseases/pests/weeds prevalence risk indicates that the worst-affected countries include: Malawi, Mozambique and Swaziland (91-100% risk); Tanzania, Zambia and Zimbabwe (81-90% risk) and Angola and Democratic Republic of Congo (71-80% risk). Three countries Angola, Democratic Republic of Congo and Zambia are exposed to both growing conditions and diseases/pests/weeds prevalence risks.

FIGURE 5.4. BIOPHYSICAL RISKS, BY COUNTRY.

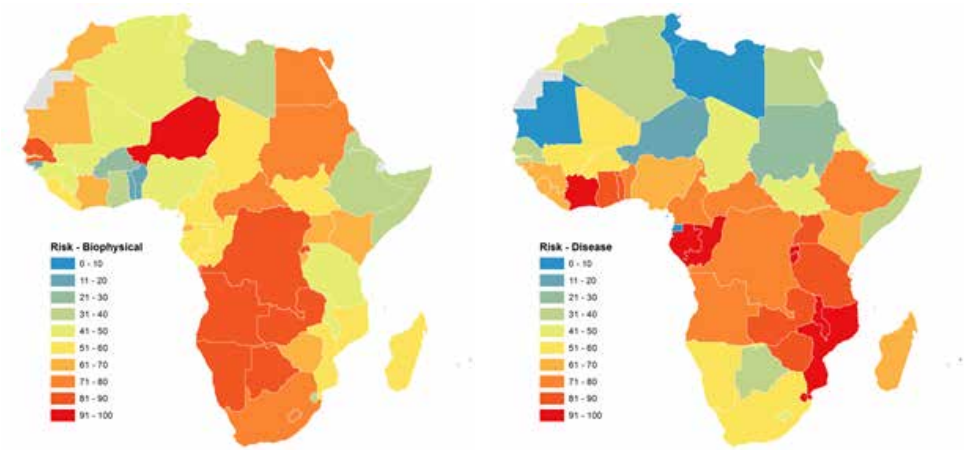


FIGURE 5.4A. GROWING CONDITIONS RISK INDEX.

FIGURE 5.4B. PESTS/DISEASE/WEEDS PREVALENCE INDEX.

Source: Azzarri et al. 2014.

Further analysis of the results from the two figures shows that growing conditions risks are mainly prominent in the western parts of the SADC region which are usually dry and marginal. On the other hand, diseases, pests and weeds present more challenges in the eastern parts of the region which are relatively wetter. The interactions of these biophysical risks of crop production with various socioeconomic factors compound agricultural production challenges faced especially by smallholder farmers in the region. These have a direct impact on the local total agricultural production that would indirectly affect both agricultural imports and exports.

Spatial Pattern and Frequency of Droughts

To illustrate the spatial pattern and frequency of droughts in the SADC region, the analysis is based on evidence from IFPRI (Badiane et al. 2014). It is based on historical rainfall data obtained for the areas under maize production dating back to 1979. Drought was defined as an amount of rainfall below 75% of the long-term mean, for the first two months of the maize-growing season. The total rain-fed maize-growing area was calculated according to SPAM 2005 and You et al. (2014) which is assumed to be constant over the time period. This area was disaggregated into three classes: i) normal; ii) less than 75% of normal, drought; and iii) more than 125% of normal; see Badiane; Odjo and Jemaneh (2014) for details.

The spatial pattern of drought and non-drought areas constitute an important factor in gauging readily available trade across the region. Although in reality many factors affect trade (e.g., trade policies, regional and national economic dynamics, and the total production capacity of each area), we compare the size of above-normal and below-normal rainfall areas to illustrate the above hypothetical assumption. The underlying assumption is that if the area with above-normal rainfall is larger than that experiencing below-normal rainfall in a given year, then production loss (or deficit) from drought is mitigatable by transporting additional production (or surplus) from above-normal rainfall areas assuming there are no trade restrictions. Alternatively, if the area drought is greater than the area of surplus rains, the drought in that year is considered unmitigable.

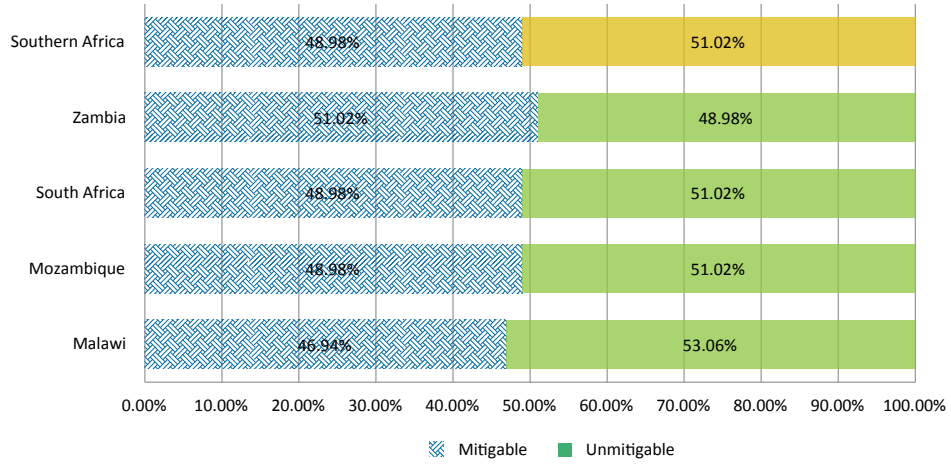


FIGURE 5.5. MITIGATION POSSIBILITY THROUGH TRADE, SOUTHERN AFRICA.
Source: Azzarri et al. (2014).

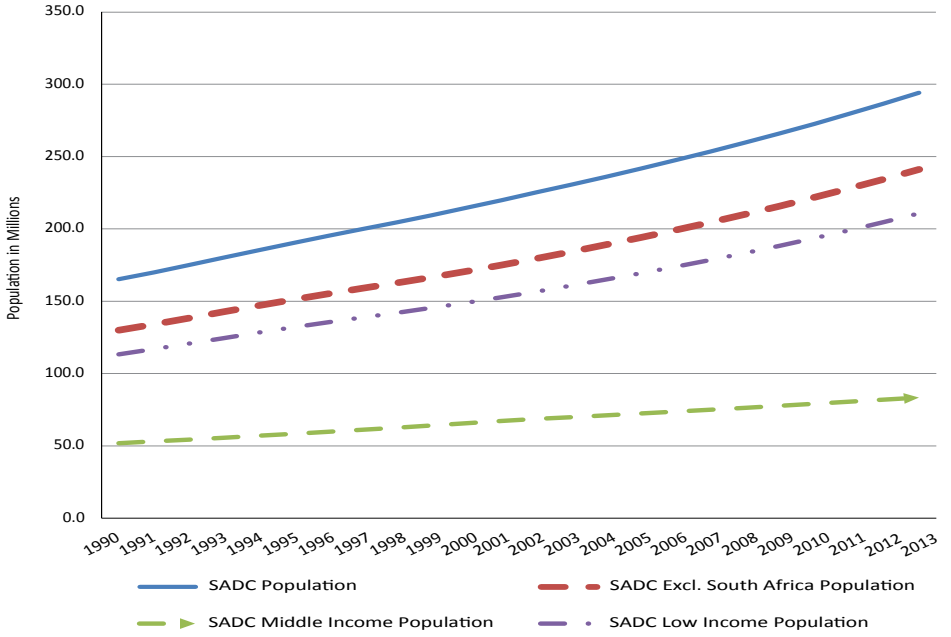


FIGURE 5.6. POPULATION, SADC (MILLIONS).
Source: World Bank (2014).

Figure 5.5 shows an analysis for top maize-producing countries in southern Africa (Malawi, Zambia, Mozambique and South Africa) based on the above assumptions. The results show that the drought mitigation potential for the region is 49%. Within the selected countries, Zambia (51%) has the highest drought mitigation potential through trade and Malawi (47%) has the lowest. The findings indicate that there is potential for mitigating losses in maize production through trade flows at the country and regional levels if trade limiting factors are addressed.

SOCIOECONOMIC ENVIRONMENT

The socioeconomic factors such as population and size of the economy (usually measured by GDP) are important determinants of agricultural production and consumption as well as trade. For example, population not only impacts on the potential of the economic system through labor and human capital but also exerts pressure on the agricultural and consumption system. For example, increases in population lead to increases in demand for agricultural products which also impact on agricultural exports and imports. Figure 5.6 shows population trends for the SADC region for the period 1990-2013. The findings show a steadily rising population for the region and there are no evident shocks that could have erratic effects on agricultural production and trade.

Figure 5.7 presents the GDP per capita (in PPP constant 2011 international USD) for the SADC region for the period 1990-2012. The GDP per capita was used as a measure of the size of the economy for the region. The trends show a relative rise in GDP per capita between 1995 - 1997; 2003 – 2007; and 2009 – 2012. The period 2007 – 2009 evidently shows that the regional economy did feel some of the impacts of the 2007/08 global economic and financial crisis. During this period GDP per capita did slow down and dropped in 2009 before a steady rise again between 2009 and 2011 and a further slowed growth in 2012. Despite these notable trends in the GDP per capita the overall trend shows a steady increase in GDP per capita over the years for the SADC region.

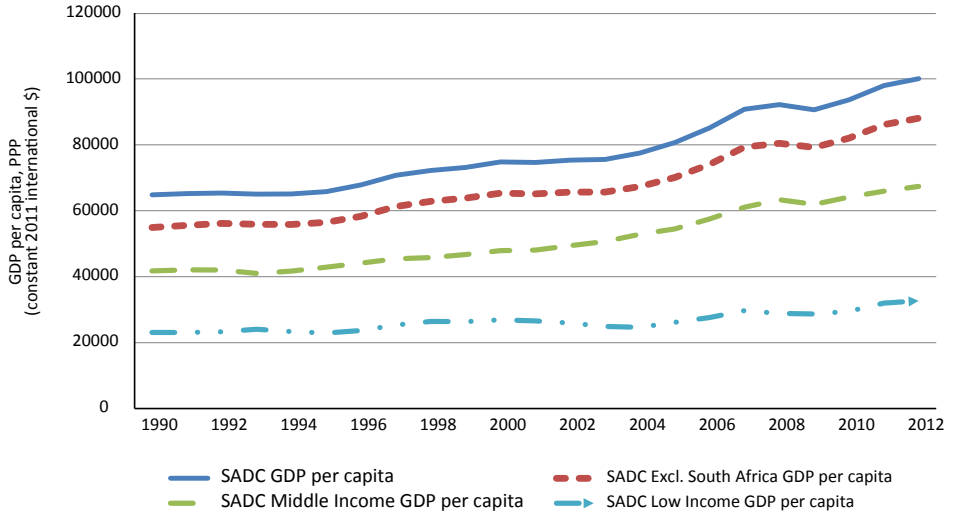


FIGURE 5.7. GDP PER CAPITA, SADC (PPP, CONSTANT 2011 INTERNATIONAL USD).
Source: World Bank (2014).

FIGURE 5.8. TOTAL CEREAL PRODUCTION AND CONSUMPTION IN SADC COUNTRIES IN 2011.

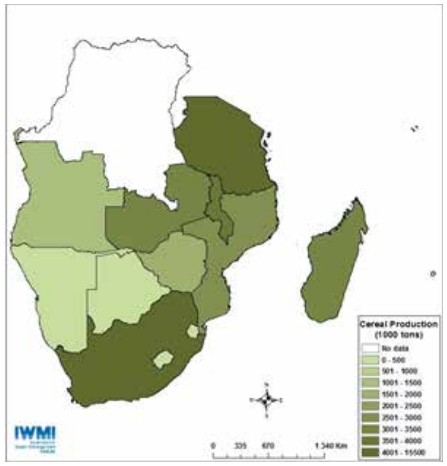


FIGURE 5.8A. SADC TOTAL CEREAL PRODUCTION.

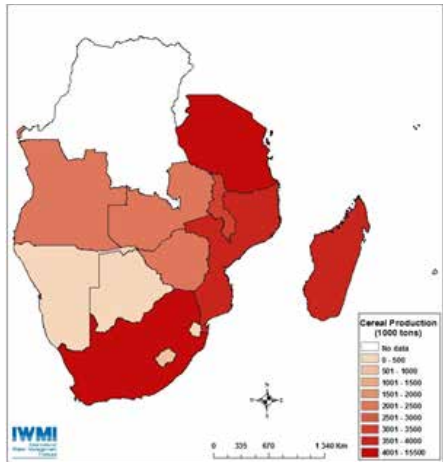


FIGURE 5.8B. SADC TOTAL CEREAL CONSUMPTION.

Source: FAO (2014).

Figure 5.8 shows the total quantity of cereal production and consumption in SADC countries in 2011. The figures help identify cereal-surplus and -deficit countries in the region since consumption of cereals constitutes an important part of the food system. In terms of cereal production, South Africa, Malawi, Zambia and Tanzania are the top producing countries in the region. In the western parts of the SADC region, which are characterized by low to medium agroecological potential, overall production of cereals is low. Projected changes in climate and variability are expected to worsen crop-growing conditions, especially in these western parts of the region (IPCC 2014). This means that future cereal and food production in the region requires concerted efforts to invest in cereal and food production measures that address limiting agroecological factors such as water and soil fertility. Although the eastern parts of the SADC and South Africa are the main cereal-producing areas, consumption figures indicate that these are also hot spots, particularly in South Africa, Tanzania, Mozambique and Madagascar.

Figure 5.9 combines the cereal production and consumption to present cereal food balance in the SADC region (production – consumption). The results show that Angola and Zimbabwe are the main deficit countries in the region followed by Botswana, Namibia, Lesotho and Swaziland. Overall, the western parts of the SADC region face cereal deficits compared to the high-producing eastern parts. One particular fact to note is the performance of Zambia, Malawi and Mozambique, the three countries that have progressed well in terms of implementing CAADP commitments, especially in increasing investments in agriculture to at least 10% of the national budget.

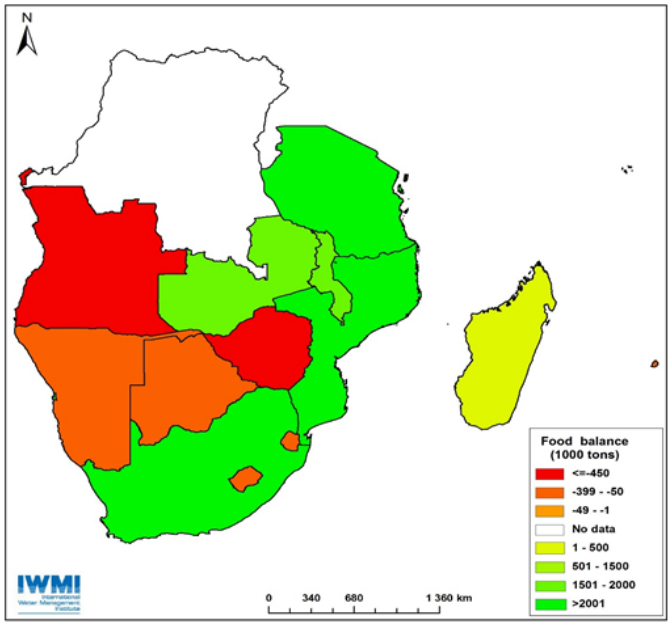


FIGURE 5.9. FOOD BALANCE FOR CEREAL CROPS IN SADC COUNTRIES (2011).
Source: FAO, 2014.

AGRICULTURAL WATER INVESTMENTS

Water investments are critical for agricultural production in Africa, especially because the potential contribution of well-managed water systems to agricultural productivity has not been exhausted. African and, especially, SADC countries are far from meeting the SADC RISDP targets of doubling irrigation areas from 3.5 to 7% of arable land. By contrast, Asian countries irrigate almost more than 30% of their arable land. Figure 5.10 shows

the proximate shares of agricultural budgets that are allocated to water developments for agriculture over time for a selected number of SADC countries.

Figure 5.10, in general, shows that water expenditure as a share of agricultural expenditure is volatile and generally below 10% when the countries under study are considered as a collective. There is spatial and intertemporal variation though, so that with the exception of Mozambique where these shares increased in the 2009-2012 period, there has been a general decline across the board. This is a worrisome trend because rainfall in the SADC is, more than ever, proving erratic, with the consequence that yields and production are volatile, threating many of the agro-based livelihoods of the region. The ideal is that African and indeed SADC governments must invest more in Agriculture and within Agriculture, significant portions of the budget must be consistently channeled to agricultural water development. We demonstrate, below, why this is necessary by linking water investments to agricultural exports.

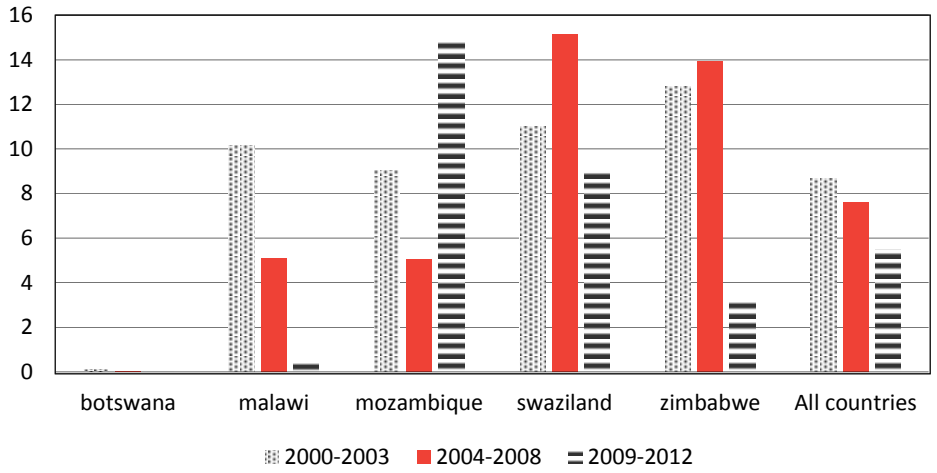


FIGURE 5.10. SHARE OF WATER INVESTMENTS IN THE AGRICULTURAL BUDGET.
Source: ReSakSS (2014).

Econometric Specifications and Methods

MODEL DESCRIPTION

The main purpose for fitting the econometric models below is to be able to obtain parameters that are later used in simulations to show the linkages between the biophysical characteristics and net exports while controlling for other variables that influence net exports. In so doing, the study is designed to investigate the effect of extreme weather shocks (excessive rain, prolonged drought, soil depletion, deforestation, waterlogging periods, etc.) and public financing shocks of agricultural water on exports and imports among countries of the SADC region (see Azzarri et al. 2014).

In the econometric model that follows, the dependent variable is net exports (exports-imports), whereas the independent variables are a set of exogenous variables—mostly linked to biophysical characteristics—and country-level investments in agricultural water infrastructure that are categorized as follows (see Azzarri et al. 2014): biophysical risk

(proxied by long-term rainfall, long-term temperature, long-term NDVI, soil-nutrient reserves, and tree coverage).

- crop and livestock disease risk (proxied by crop disease, insect pest, and weed prevalence)
- socioeconomic factors (proxied by population, GDP per capita (PPP), and total cropland area)
- amount of agricultural budget that is allocated to agricultural water development
- amount of arable land under irrigation

Most of the data are available in FAOSTAT and are arranged per country over time thereby allowing for possibility of panel data methods to be employed in analysis. A linear panel data model can be expressed as follows:

$$Y_{it} = N_{it} + C_{it} + S_{it} + W_{it} + u_{it} + e_{it}$$

where Y is the net exports in country i at time t; N_{it} is a matrix of biophysical risk variables in country i at time t; Cit is a matrix of crop and livestock disease risk variables in country i at time t; and Sit are the variables related to socioeconomic risk in country i at time t and W_{it} is a matrix of agricultural water development indicators in country i and at time t. The fixed effects (μ_{it}) control for the heterogeneity among countries, and e_{it} is the common error term.

Following Azzarri et al. (2014) we also note that identification for this class of regressions stems from the understanding that variables related to the biophysical environment as well as those related to climate and possibly investments in agricultural land, affect net exports only through their influence on total agricultural production. So, these regressors could be considered as proper instruments in a regression system that links net exports to total agricultural production. Owing to paucity of complete data on agricultural production at crop level for most countries under study, the fixed- and random-effects version of the instrumental variables estimator was considered only on total agricultural production.

For the empirical model, the set of biophysical variables include: soil quality, percentage of tree coverage, long-term net vegetation index and prevalence of crop diseases, weeds, and insect pests. Climate is proxied by rainfall and temperature and temperature squared as a control for any nonlinearities that may be inherent in this variable (temperature). The assumption is that rising temperatures are less favorable for agricultural production; however, the negative effect of rising temperature on production increases at a decreasing rate, in turn affecting net exports. The rationale for including the other controls in the model is discussed as follows:

Population growth rate that outstrips the rate of growth of agricultural production undermines the ability of a country to export its agricultural products outside as, generally, it can be expected that an increase in population over time is negatively related to net exports. The southern African region is home to some of the faster-growing populations, for example, Malawi, Mozambique, Zambia, the DR Congo and Tanzania are all growing at more than 2.3% per annum (see FAO 2014). Nevertheless, the SADC region also has a fair share of the continent's middle-income countries, and is home to Africa's most developed economy -- South Africa, associated with low population growth and a larger ability to export owing to well-mechanized farming systems. When all these factors are accounted for, the net effect of population growth on net exports remains an empirical question, so the sign for the population coefficient cannot be determined by theory.

Income per capita can influence a household's choices and quantities of agricultural goods consumed. In this model, income per capita is proxied by the GDP per capita in constant international dollars. An increase in per capita income implies an increase in disposable income that can be used for food purchase domestically or internationally, so that the coefficient of income per capita is likely to be negative. It should be noted that depending on stages of economic development an increase in income per capita may spur an increase in agricultural inputs that could also lead to an increase in net exports.

The population of the largest city is included to account for urbanization. Increasing urbanization itself may imply that many people will be demanding food of various kinds as they get exposed to city life; however, some immigrants into the city may be coming in response to employment opportunities which emerge to exporting companies that are part of the urbanization. So the coefficient for population of the largest city can take any sign.

The geographical coordinates (longitude and latitude) of the major city are used to suggest some trend of surface analysis. The coefficients of total cropland area, total land equipped for irrigation as well as public finance to the water sector for agricultural water development are all expected to be positive.

ECONOMETRIC METHODOLOGY

To achieve the goals set out in this chapter, largely two estimation approaches are considered. The first approach entails estimating a static panel data model by both random and fixed effects, while assuming nonexistence of any endogenous variable in the model. The second approach is essentially an extension of the first in that it allows for the presence of endogenous variables. Baltagi (2008) as well as Woodridge (2002) discuss the application of these methods at length. Endogenous linear regression models produce inconsistent estimates if they are estimated using Ordinary Least Squares (OLS) method without instrumentation. For proper instrumentation of an endogenous variable, it is important that it should be highly correlated with the regressors but it should have a covariance of null with the errors (see Green 2003).

In this analysis, rainfall, temperature, temperature squared, NDVI, soil quality, percent of tree coverage, crop disease prevalence, weed prevalence, insect pest prevalence, and total cropland area are used as instruments. The use of the same variables directly in a regression on value of agricultural production admittedly violates one of the assumptions on the instruments. Nevertheless, given the problem of data availability, there is no other appropriate instrument available.

ECONOMETRIC RESULTS

Table 5.1 presents the results from three econometric model specifications for the net exports and various explanatory variables.

Results from the models estimated (presented in Table 5 1) generally show that temperature, the biophysical environment, and agricultural water development indicators are all

TABLE 5.1. CORRELATES OF TOTAL NET EXPORTS AND VARIOUS ECONOMETRIC METHODS.

	OLS		Random effects		Fixed effects	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Rainfall	0.00*	0.00	0.00*	0.00	0.00	0.00
Temperature	-0.91	0.94	-0.91	0.94	-0.07	0.96
Temperature squared	0.02	0.02	0.02	0.02	0.00	0.02
NDVI	0.99	0.85	0.99	0.85	1.59	0.75
Soil quality	-0.09*	0.02	-0.09*	0.02		
Tree coverage	0.01*	0.01	0.01*	0.01		
Prevalence of crop disease	5.00*	1.18	5.00*	1.18		
Prevalence of weeds	2.22	1.06	2.22	1.06		
Prevalence of pests	5.29	3.65	5.29	3.65	-0.01*	0.01
Total population (millions)	-0.03*	0.01	-0.03*	0.01	0.00	0.00
GDP per capita, PPP (in constant 2011 international USD)	0.00*	0.00	0.00*	0.00		
Latitude of largest city	-0.03*	0.01	-0.03*	0.01		
Longitude of largest city	0.03*	0.01	0.03*	0.01		
Population of largest city (million)	0.39*	0.21	0.39*	0.21		
Total cropland area	0.00*	0.00	0.00*	0.00		
Constant	3.09	10.13	3.09	10.13	-0.94	12.36
Number of observations	107					
Adjusted R-squared	0.84					

Note: * = Significant at 10% level.
Source: Authors' calculation. Note: OLS=Ordinary least squares.

important in determining net exports. Specifically, the OLS results are chosen for generating simulations based on the fit of the model that, in the present case, is recommended by the Hausman tests.

The coefficient of rainfall is positive implying that rainfall limits the amount of net exports by the SADC region yearly. The more the rainfall that is received the higher the likelihood that the SADC region will increase net exports. This is perhaps not surprising considering that irrigation investments are low in the SADC region and the bulk of agriculture is rain-fed.

The coefficients of temperature and tree coverage are also important. The amount of net exports is negatively affected by high temperatures, so that global warming has the potential to destabilize net exports presumably through its negative impacts on production. Tree coverage is positively related to net exports and so is Normalized Difference Vegetation Index (NDVI). The coefficient of population is negative underscoring the positive impact of population on consumption leading to low net exports. The coefficient of income per capita is close to zero perhaps because, while high incomes are good for consumption and therefore bad for net exports, they can also encourage exports and these effects can in some cases cancel each other. The coefficient of the population of the largest city is positively related to net exports, perhaps because high urban populations can be a catalyst for export industries. The coefficient of total land area allocated to crops is positive underscoring the importance, and perhaps scarcity, of cropland in the SADC region. If land is easily created for example, this would imply that allocating more land to agriculture would have the potential to increase net exports.

These results are corroborated even in the random effects and fixed effects models where applicable. Of importance is also to note that the authors fitted other models with water investment expenditure and irrigation areas as regressors and their coefficients were significant and positive signifying the importance of water investments as well as irrigation in determining net exports for the SADC region. Although the authors experimented with a number of specifications and functional forms, it should be reported here that in general

the OLS model presented in the first columns proved better as also supported by the high explanatory power and the simulations performed below are based on this model.

SIMULATIONS

In order to understand the impact of biophysical, budgetary and agroclimatic shocks, various scenarios have been simulated and their impact assessed using the linear regression coefficients discussed previously. By looking at the sensitivity of shocks on aggregate net exports they are assumed to hit all countries in the SADC. The goal is to assess how the shock in each region would impact aggregated trade flows. The scenarios considered are:

Total annual rainfall decrease by 50 percent (drought)

- 50% irrigation funding increase
- 50% rainfall decrease and 25% NDVI decrease
- 50% decrease in irrigation funding, 100% increase in population and an increase of 1 °C in temperature
- 50% decrease in irrigation funding, 25% decrease in NDVI and an increase of 1 °C in temperature

Figure 5.11 shows the impact of 50% decrease in rainfall on net agricultural exports. When rainfall is reduced by 50% from the actual levels, net exports for the SADC take a hit of a couple of millions of dollars (Figure 5.10). This confirms the earlier finding that rainfall is critical for SADC's net exports mainly because irrigation investments are low in the SADC such that little rain inevitably translates to low production and low net exports.

The impact of a 50% decrease in rainfall accompanied by a 25% decrease on NDVI is presented in Figure 5 12. When the reduction in rainfall is accompanied by a contemporary reduction in NDVI, the reduction in net exports becomes more pronounced implying that the combined impact deforestation and a drought can be even more catastrophic for economic development, leading to loss of millions of dollars. Nations need to endeavour to prevent either or all of these to avoid suffering a larger hit on the SADC's trade balance.

Figure 5.13 shows the impacts of 50% reductions in irrigation investments on net

FIGURE 5-11. IMPACT OF RAINFALL DECREASE OF 50% ON NET AGRICULTURAL EXPORTS.

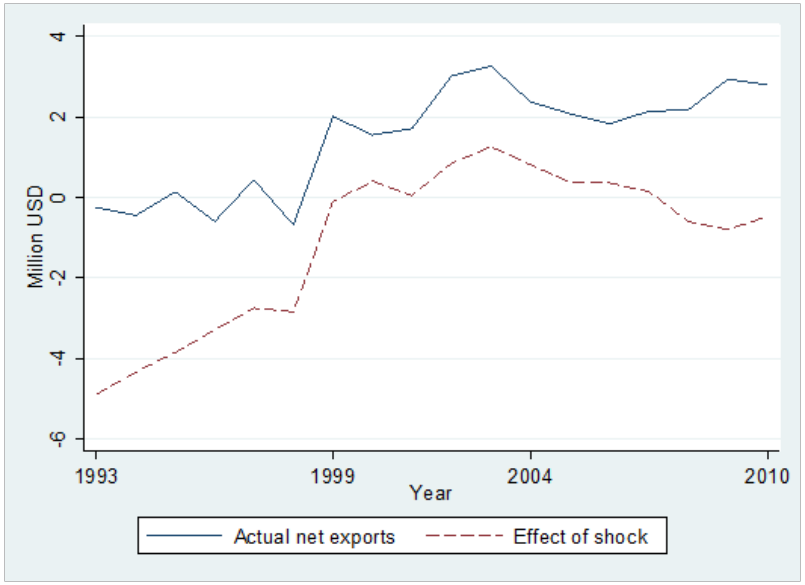


FIGURE 5-12. SHOCK: 50% RAINFALL DECREASE AND 25% NDVI DECREASE.
Source: Authors' calculations.

agricultural exports. An important factor in the success in agriculture is the extent to which the agriculture sector has invested in water resources, especially considering that rainfall is erratic and often insufficient. For the most part, a reduction in the public finance to agricultural water development leads to a reduction of net exports by substantial amounts. Agricultural water development is critical for the growth of the agriculture sector and any agricultural development program must consider funding for water development.

Figure 5.14 shows the impact of a 50% decrease in irrigation funding, 100% increase in population, and an increase of 1 °C in temperature. When the irrigation funding reduction is considered together with population increase and local warming, the reduction in net exports for the SADC become more pronounced and the loss in net exports increases by millions of dollars (see Figure 5.13). This implies that efforts to control population growth can potentially have wider positive impacts than are normally thought. In this case, by slowing down consumption, a reduction in population growth has the potential to increase net exports for the SADC region, which is pertinent for economic growth and poverty reduction.

Figure 5.15 presents the impacts of a 50% decrease in irrigation funding, 25% decrease in NDVI and an increase of 1 °C in temperature. A 50% decrease in irrigation funding, coupled with a 25% decrease in NDVI and an increase of 1 °C in temperature, also reduces net exports substantially for reasons explained previously.

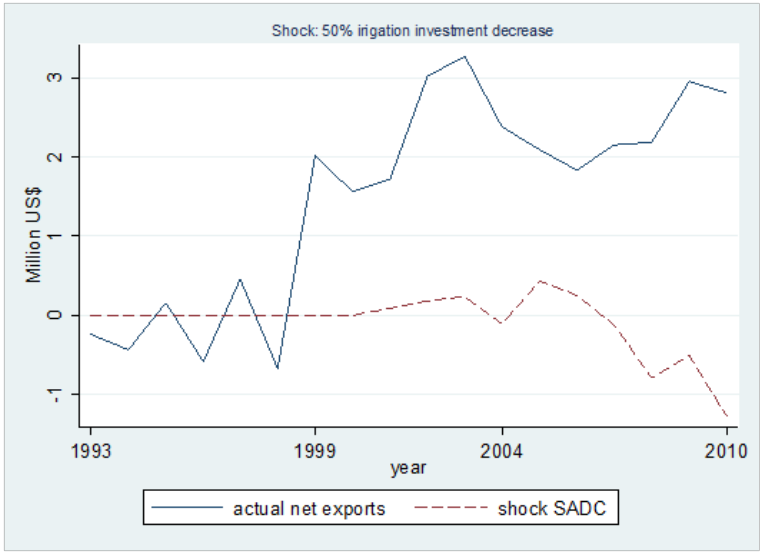


FIGURE 5.13. THE IMPACT OF 50% IRRIGATION INVESTMENTS REDUCTIONS
Source: Authors' calculation.

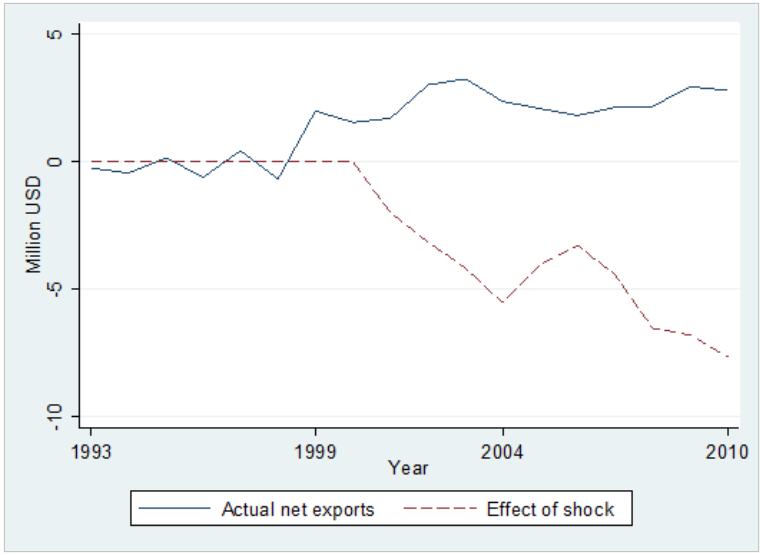


FIGURE 5.14. THE IMPACT OF A 50% DECREASE IN IRRIGATION FUNDING, 100% INCREASE IN POPULATION AND AN INCREASE OF 1 °C IN TEMPERATURE.
Source: Authors' calculation.

CONCLUSIONS

This chapter examined determinants of net exports using OLS regression and simulations. The findings are clearly in support of Azzarri et al. 2014 who establish the importance of biophysical and general agroclimatic conditions on net exports. The results show that rainfall, temperature, vegetative cover, population, GDP, public funding on agricultural water development, and cropland are critical for determining net exports.

The ideal is that African and indeed SADC governments must invest more in agriculture; and within agriculture, significant portions of the budget must be consistently channeled to agricultural water development and mitigation of climate change owing to the fact that water shortages have on production and hence on net exports. It is also noted that population growth, and incomes of people are critical for determining agricultural consumption and hence net exports. In general, it appears that high population growth coupled with increased incomes is at odds with net exports as most production ends up consumed domestically. Thus, policies and efforts that aim at reducing population growth can increase the growth of agricultural trade.

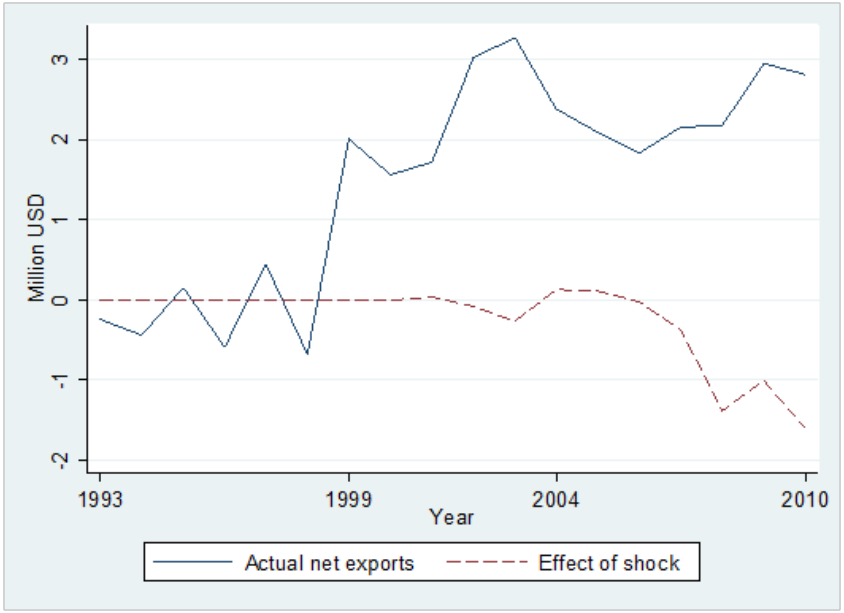


FIGURE 5.15. THE IMPACT OF A 50% DECREASE IN IRRIGATION FUNDING, 25% DECREASE IN NDVI AND AN INCREASE OF 1 °C IN TEMPERATURE.
Source: Authors' calculations.

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Annexes: Core CAADP Monitoring and Evaluation Indicators

Annex A. Enabling Environment

TABLE A1. TOTAL ODA PER CAPITA, GROSS DISBURSEMENTS (CURRENT USD).

Country Name	Average level : 1990-1995	Annual average percentage change (1990-1995) level	Average level : 1995-2003	Annual average percentage change (1995-2003)	2003	Average level : 2003-2008	Annual average percentage change (2003-2008)	Average level : 2008-2014	Annual average percentage change (2008-2014)	2014
Angola	30.15	7.07	27.50	-2.40	32.02	28.07	-26.81	11.50	-2.59	9.55
Botswana	78.48	-12.06	35.86	-20.09	15.20	103.52	82.80	69.69	-19.20	44.88
Congo DR	10.18	-27.69	19.00	51.23	106.27	32.93	-7.48	49.21	-7.76	32.03
Lesotho	77.47	-5.31	36.33	-4.27	41.54	52.30	14.28	110.11	-1.41	49.12
Madagascar	29.17	-10.42	29.60	-5.19	31.68	50.19	-10.57	21.32	1.18	24.74
Malawi	51.82	-4.63	38.91	-1.89	42.34	51.70	12.42	61.86	1.85	55.72
Mauritius	40.81	-29.73	23.62	-9.65	11.65	42.96	35.25	111.78	-14.24	38.80
Mozambique	79.15	-2.04	60.51	3.70	52.73	73.26	10.44	83.74	-0.78	77.29
Namibia	99.98	1.40	85.48	-6.70	73.78	85.22	8.43	120.96	-7.16	94.31
South Africa	8.25	-	11.50	2.26	14.21	16.47	12.56	22.25	-0.42	19.80
Swaziland	60.53	-0.45	27.51	-2.78	36.85	40.26	22.33	76.58	5.74	67.65
Tanzania	38.52	-8.87	33.63	6.10	46.94	51.27	9.35	60.96	-3.05	51.10
Zambia	118.42	17.50	64.16	3.21	71.09	100.15	-4.38	75.63	-5.44	63.26
Zimbabwe	45.86	5.24	19.68	-11.20	14.75	30.27	29.75	57.78	-0.90	49.71
SADC	56.83	-3.71	36.66	-1.49	42.22	54.18	14.11	66.67	-5.08	48.43
SADC-excl. SA	58.50	-2.16	38.60	-1.57	44.37	57.09	14.14	70.09	-5.19	50.63
SADC-LI	53.30	2.25	37.93	3.88	52.26	55.68	3.27	58.64	-2.47	50.55
SADC-MI	61.00	-9.19	35.40	-7.14	32.18	52.69	24.95	74.70	-7.39	46.30

Source: Authors' calculations based on World Bank 2016.

TABLE A2: GDP PER CAPITA (CONSTANT 2005 US$)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2015	Average % change 2008-2015	2015
Angola	1 256,10	2,70	1 421,60	2 029,6	15,40	2 625,20	1,50	-
Botswana	4620,65	2,59	5108,21	5602,46	4,58	6406,14	2,97	7095,63
Congo, Dem. Rep.	232,18	-5,10	200,78	215,51	2,69	249,95	3,68	283,47
Lesotho	629,33	2,00	685,95	732,44	3,16	898,68	3,71	988,33
Madagascar	275,72	-0,51	265,40	280,96	2,53	277,76	-1,48	271,59
Malawi	217,59	-0,65	211,32	220,96	2,28	260,84	1,83	274,35
Mauritius	4279,72	3,70	4837,35	5295,90	3,72	6475,81	3,30	7116,59
Mozambique	269,79	6,64	330,66	377,34	5,26	476,03	4,02	535,73
Namibia	2993,29	1,02	3185,11	3681,69	4,60	4270,36	2,75	4674,63
Seychelles	10771,81	1,51	10481,99	11537,98	4,93	13918,12	4,71	15697,59
South Africa	4871,29	0,62	5076,97	5553,77	3,57	5995,46	0,57	6087,90
Swaziland	2175,12	0,74	2252,61	2361,51	1,76	2466,20	0,54	2526,46
Tanzania	360,49	2,41	405,28	448,90	3,74	533,83	3,22	588,32
Zambia	587,19	1,28	635,32	713,52	4,78	929,16	4,26	1032,80
Zimbabwe	661,58	-2,46	507,29	429,53	-7,53	399,87	6,45	458,10
SADC	2353,27	1,61	2441,73	2669,33	4,06	3111,30	3,13	3402,25
SADC excl S. A	2159,57	1,79	2239,02	2450,10	4,13	2889,44	3,54	3195,66
SADC-MI	4334,46	1,74	4518,31	4909,51	4,40	5775,82	3,10	6312,45
SADC-LI	372,08	0,11	365,15	383,82	2,04	446,78	3,53	492,05

Source: Authors' calculations based on World Bank 2016

TABLE A3. GDP PER CAPITA (ANNUAL PERCENTAGE GROWTH)

Country Name	Average level : 1990-1995	Average level : 1995-2003	2003	Average Level : 2003-2008	Average level : 2008-2015	2015
Angola	-6.14	3.74	1.60	13.29	0.93	-0.26
Botswana	2.12	2.75	3.28	4.43	1.65	-2.13
Congo DR	-10.36	-3.98	2.56	3.14	3.88	3.61
Lesotho	2.67	2.23	3.96	3.17	3.38	0.38
Madagascar	-2.72	-0.35	6.54	2.64	-1.44	0.23
Malawi	2.31	0.13	2.81	2.51	1.97	-0.28
Mauritius	4.13	3.65	2.91	3.95	3.30	3.33
Mozambique	0.15	5.14	3.07	4.49	4.34	3.71
Namibia	0.26	1.17	3.03	4.89	2.79	2.90
South Africa	-1.42	0.82	1.65	3.39	0.18	-0.39
Swaziland	3.51	0.88	1.70	1.71	0.12	0.45
Tanzania	-0.57	2.54	4.12	3.95	3.37	3.67
Zambia	-2.58	1.68	4.30	4.81	3.46	-0.19
Zimbabwe	0.04	-2.63	-17.21	-7.42	4.72	-1.82
SADC	-0.61	1.27	1.74	3.50	2.33	0.94
SADC-excl. SA	-0.55	1.30	1.74	3.51	2.50	1.05
SADC-LI	-2.67	0.40	0.57	1.94	3.06	1.53
SADC-MI	0.73	2.18	2.59	4.98	1.77	0.61

Source: Authors' calculations based on World Bank 2012.

TABLE A4. INFLATION, GDP DEFLATOR (ANNUAL PERCENTAGE)

Country Name	Average level : 1990-1995	Annual average percentage change (1990-1995)	Average level : 1995-2003	Annual average percentage change (1995-2003)	2003	Average level : 2003-2008	Annual average percentage change (2003-2008)	Average level : 2008-2015	Annual average percentage change (2008-2015)	2015
Angola	952.70	354.04	861.51	-23.39	84.89	22.39	-19.44	6.19	-	-4.02
Botswana	7.97	9.33	9.03	-20.34	3.26	8.54	-23.34	6.63	-	2.54
Congo DR	5880.09	48.61	506.00	-31.09	13.42	17.36	19.58	10.19	-52.27	0.64
Lesotho	12.46	-6.44	8.22	-7.44	1.90	7.86	-9.51	5.11	60.34	3.81
Madagascar	22.94	33.82	9.48	-11.33	2.76	12.56	-14.38	7.16	-4.71	7.55
Malawi	27.70	46.39	38.95	-2.77	10.35	12.32	-13.02	17.29	18.25	21.08
Mauritius	7.54	-9.25	5.64	-1.92	5.71	7.03	5.45	1.61	-	0.95
Mozambique	51.07	1.54	12.72	-11.98	4.92	7.26	2.08	4.13	8.46	4.43
Namibia	9.77	11.03	9.03	-16.55	1.01	6.90	44.98	6.07	-	-0.18
Seychelles	2.29	-	3.21	-	5.95	14.67	48.36	6.68	-	2.14
South Africa	13.68	-9.42	8.14	0.13	5.79	7.19	11.51	5.99	-7.32	3.96
Swaziland	15.89	-5.28	9.87	-0.90	5.92	5.67	9.76	7.23	-6.88	5.80
Tanzania	26.41	3.40	13.32	-17.73	8.45	14.37	1.46	8.58	-9.05	6.56
Zambia	103.26	-17.62	22.44	-2.13	17.61	14.90	-13.79	8.49	-5.13	6.66
Zimbabwe	-4.41	-	-0.12	-	8.80	2.59	-	12.98	-40.73	1.09
SADC	475.29	60.40	101.16	-22.52	12.05	10.77	-4.05	7.62	-14.48	4.20
SADC-excl. SA	508.26	61.34	107.81	-22.69	12.50	11.03	-4.75	7.74	-14.86	4.22
SADC-LI	872.44	35.98	86.11	-16.74	9.47	11.62	-6.51	9.83	-14.39	6.86
SADC-MI	127.79	97.02	114.33	-23.49	14.30	10.03	-1.05	5.69	-15.11	1.88

Source: Authors' calculations based on World Bank 2016

Annex B. CAADP Implementation Processes

TABLE B1: PROGRESS IN CAADP IMPLEMENTATION PROCESS AS OF JULY 2015

Country	Focal point appointed	Technical Committee (TC) Appointed	Experts Engaged for Stocktaking	Stocktaking Final Report Completed	Experts Engaged for Growth and Investment Report	Growth and Investment Options Final Report Completed	Experts Engaged for Brochures and Briefs for Roundtable	Brochures and Briefs for Roundtable Final Report Completed	CAADP Stakeholder Validation Workshop Held	CAADP Compact Signed	Investment Plan Developed	Technical Review Completed	Business Meeting Held
Angola	2012	2012							2012				
Botswana	March 2011	November 2014		July 2014									
Lesotho	2010	2010	March 2013	November 2013	August 2014	November 2014			2011	September 2013			
Madagascar	October 2011	October 2011	May 2012	February 2013						June 2014			
Malawi	May 2008	May 2008								April 2010	August 2010	September 2010	2011
Mauritius	2014	2014											
Mozambique	November 2009	April 2009	June 2010	December 2011	June 2008	June 2008			November 2010	December 2011	February 2013	December 2012	April 2013
Namibia	2014	2014											
South Africa	August 2011	October 2011	July 2012						2014				
Swaziland	2008		May 2013	September 2013	April 2014				December 2014	March 2010			
Tanzania	February 2004	March 2010	April 2010	April 2010	April 2010	April 2010	May 2010	May 2010	November 2010	July 2010	September 2013	May 2011	November 2011
Zambia	August 2006	July 2011	March 2006	September 2006	2007	2007	2008	2008	March 2008	January 2011	February 2013	May 2013	May 2013
Zimbabwe	August 2009	August 2009	April 2009	August 2010	July 2012					July 2013	November 2013		

Source: Authors' calculations based on ReSAKSS 2016.

Annex C. Agricultural Financing

TABLE C1: PUBLIC AGRICULTURE EXPENDITURE (MILLION, CONSTANT 2005 USD)

Country Name	Average level: 2000-2003	Average % change 2000-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2015	Average % change 2008-2015	2015
Angola	75,86	-0,60	84,29	241,93	44,83	311,17	-3,64	291,81
Botswana	149,55	8,22	158,60	140,04	-1,93	143,52	0,83	197,61
Lesotho	26,85	1,20	27,06	24,36	-5,27	18,46	-0,50	21,69
Madagascar	34,86	-14,54	28,79	56,46	24,20	88,35	-16,61	43,81
Malawi	31,38	-9,28	27,04	87,41	52,22	222,10	1,26	236,30
Mauritius	51,20	-9,40	43,20	43,44	-7,40	60,54	5,71	81,18
Mozambique	59,83	46,26	82,00	104,95	1,49	258,83	33,44	747,08
Namibia	101,74	0,44	102,79	101,27	1,03	162,13	5,90	158,82
South Africa	954,85	13,30	1135,08	1469,48	10,33	1728,24	3,42	2588,68
Swaziland	26,92	9,46	31,37	27,77	-9,76	32,15	11,24	38,93
Zambia	74,20	6,65	91,05	155,31	26,17	277,55	9,18	9,18
Zimbabwe	45,11	-29,68	12,82	3,25	-87,80	163,74	28,46	452,01
SADC	136,03	8,84	152,01	208,54	14,43	290,15	4,75	405,59
SADC excl. S.A	61,59	2,86	62,64	91,78	18,56	157,82	6,69	207,13
SADC-MI	198,14	9,72	226,06	292,61	11,05	350,89	2,54	482,67
SADC-LI	49,08	3,94	48,34	87,45	26,44	202,58	10,50	297,67

Source: Authors' calculations based on ReSAKSS 2016.

TABLE C2: SHARE OF AGRICULTURE EXPENDITURE IN TOTAL PUBLIC EXPENDITURE (%)

Country Name	Average level: 2000-2003	Average % change 2000-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2015	Average % change 2008-2015	2015
Angola	0,88	-4,83	0,91	1,75	23,85	1,34	-17,14	0,54
Botswana	4,02	0,01	3,92	3,58	-3,93	2,55	-5,77	1,93
Lesotho	4,17	1,73	4,24	3,37	-11,64	2,21	3,04	4,04
Madagascar	4,88	-16,57	3,45	5,84	24,32	11,04	-25,69	1,36
Malawi	5,39	-2,76	4,14	10,19	40,10	18,88	-2,51	18,96
Mauritius	3,66	-9,95	3,14	2,70	-9,58	2,60	-2,63	2,23
Mozambique	4,31	35,15	5,82	6,20	-5,42	7,28	17,94	11,69
Namibia	5,26	-3,31	4,97	4,61	-3,86	4,97	2,34	4,44
South Africa	1,86	12,55	2,12	2,18	-0,01	1,67	-4,35	1,37
Swaziland	3,73	5,45	4,09	3,55	-11,21	3,33	13,46	7,19
Zambia	5,78	1,06	6,12	9,07	19,22	8,78	-4,39	9,34
Zimbabwe	6,25	56,85	10,35	17,03	23,28	13,91	-15,94	4,63
SADC	4,18	5,91	4,44	5,84	16,34	6,55	-6,61	5,64
SADC excl. S.A	4,39	5,67	4,65	6,17	16,86	6,99	-6,65	6,03
SADC-MI	3,37	-0,60	3,34	3,11	-4,90	2,66	0,69	3,11
SADC-LI	5,58	8,39	6,02	10,53	32,94	13,15	-12,16	8,57

Source: Authors' calculations based on ReSAKSS 2016.

TABLE C3: PUBLIC AGRICULTURE EXPENDITURE AS A SHARE OF AGRICULTURAL GDP (%)

Country Name	Average level: 2000-2003	Average % change 2000-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2015	Average % change 2008-2015	2015
Angola	5,13	-22,51	4,11	8,59	31,19	6,40	-12,56	3,86
Botswana	65,75	5,71	62,99	60,26	-7,02	39,46	-7,02	26,35
Lesotho	20,80	7,07	22,70	21,66	-3,81	11,55	-15,01	5,89
Madagascar	2,86	-15,35	2,35	4,31	22,03	5,40	-29,64	0,90
Malawi	3,67	-7,63	3,21	9,96	49,47	18,72	-5,33	15,33
Mauritius	15,46	-7,50	13,41	14,24	-1,93	22,72	2,47	20,67
Mozambique	4,92	23,76	5,81	6,16	-7,10	6,89	16,08	8,36
Namibia	16,83	-1,71	15,97	14,67	-0,05	23,38	8,65	27,52
South Africa	13,47	8,63	15,88	20,84	6,57	21,90	1,15	21,52
Swaziland	13,20	16,80	16,72	16,16	-7,23	13,92	1,21	15,17
Zambia	7,08	2,25	8,03	13,05	25,47	19,04	3,49	29,42
Zimbabwe	4,01	-20,09	1,34	0,28	-88,17	15,51	11,21	23,58
SADC	14,43	3,27	14,38	15,85	2,45	17,07	-0,55	16,55
SADC excl. S.A	14,52	2,78	14,24	15,39	1,97	16,64	-0,75	16,10
SADC-MI	21,52	3,71	21,68	22,35	-1,91	19,90	-2,17	17,28
SADC-LI	4,51	0,42	4,15	6,75	22,62	13,12	2,49	15,52

Source: Authors' calculations based on ReSAKSS 2016.

Annex D. Agricultural Output, Productivity and Growth

TABLE D1: AGRICULTURE, VALUE ADDED (CONSTANT 2005 US$)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola	-	-	-	-	-	-	-	-
Botswana	0,19	-2,75	0,19	0,20	5,78	0,25	0,00	0,25
Congo, Dem. Rep.	2,81	-2,68	2,53	2,68	2,80	3,15	3,04	3,45
Lesotho	0,13	0,74	0,11	0,11	-0,68	0,12	2,62	0,14
Madagascar	1,15	1,99	1,22	1,31	2,49	1,45	-0,08	1,44
Malawi	0,74	5,63	0,86	0,87	1,49	1,16	6,16	1,41
Mauritius	0,34	-0,33	0,32	0,33	-0,77	0,36	2,11	0,38
Mozambique	1,33	4,76	1,62	1,94	7,88	2,63	3,45	2,87
Namibia	0,62	3,64	0,72	0,69	-4,96	0,63	1,05	0,62
Seychelles	0,03	2,82	0,03	0,03	0,71	0,03	0,44	0,03
South Africa	5,44	2,81	5,94	6,18	2,55	7,19	1,00	7,65
Swaziland	0,16	2,21	0,17	0,18	0,74	0,19	2,05	0,20
Tanzania	3,65	3,79	4,25	4,85	4,80	6,10	3,40	6,71
Zambia	1,25	-0,21	1,24	1,20	-2,22	1,19	2,20	1,27
Zimbabwe	1,40	1,06	1,14	0,92	-11,63	0,72	7,30	0,92
SADC	1,37	1,94	1,45	1,53	2,37	1,80	2,51	1,95
SADC excl S. A	1,06	1,61	1,11	1,18	2,27	1,38	3,13	1,51
SADC-MI	0,99	2,51	1,07	1,10	1,78	1,25	1,06	1,32
SADC-LI	1,76	1,63	1,84	1,97	2,69	2,34	3,30	2,58

Source: Authors' calculations based on World Bank 2016.

TABLE D2: GDP (CONSTANT 2005 US$)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola	-	-	-	-	-	-	-	-
Botswana	7886618931,77	4,37	9248092806,78	10578734751,90	6,34	13431865661,06	5,06	15751847182,56
Congo, Dem. Rep.	10826981352,94	-2,50	10561222014,87	12335514534,61	6,05	17126738843,78	7,05	21225130578,15
Lesotho	1155817377,29	3,00	1302470248,18	1417641920,55	3,95	1833155570,83	4,88	2084575824,63
Madagascar	4213565270,59	2,63	4576936482,67	5228721972,38	5,54	6020141740,28	1,31	6401902939,94
Malawi	2368766073,20	2,05	2554962931,61	2869130049,20	5,19	3988866764,38	4,99	4580268123,83
Mauritius	5024790513,05	4,74	5869498633,69	6517719357,40	4,24	8115443147,33	3,53	8973555682,44
Mozambique	4869543796,68	9,64	6589579188,93	8126470566,91	8,32	11980866266,29	6,99	14580462755,46
Namibia	5513145733,62	3,36	6308216546,63	7537530472,43	5,99	9626778915,87	4,97	11232470553,10
Seychelles	859552821,46	2,84	867908764,61	972098654,01	6,00	1236237111,37	5,43	1434759771,27
South Africa	208803437832,45	2,79	234185681957,24	265274749482,88	4,97	309511850486,10	2,09	328758657196,06
Swaziland	2259031660,27	2,32	2450730147,33	2636285157,45	2,97	2990175912,31	2,15	3206363954,57
Tanzania	11695554744,67	5,09	14514543573,06	17386963152,73	6,90	24574284492,53	6,55	29600491692,49
Zambia	6073331150,32	3,99	7259191743,54	8765174925,76	7,71	13424441120,01	7,46	16237054897,62
Zimbabwe	8132831930,65	-1,37	6480145788,65	5609231020,83	-6,51	5749766134,95	8,65	6984170451,44
SADC	19977354942,07	2,77	22340655773,41	25512705988,29	5,00	30686472297,65	3,13	33646550828,83
SADC-excl. SA	5452271642,81	2,71	6044884528,50	7282231355,52	4,62	9238366283,15	5,88	10945619569,81
SADC-LI	6882939188,43	2,17	7505225960,48	8617315174,63	5,52	11837872194,60	6,53	14229925919,85
SADC-MI	33071770695,70	2,90	37176085586,35	42052215251,83	5,05	49535072400,70	2,35	53063175737,80

Source: Authors' calculations based on World Bank 2016.

TABLE D3: LABOUR PRODUCTIVITY (AGRICULTURE VALUE ADDED PER WORKER (CONSTANT 2005 US$)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola								
Botswana	729,16	-4,93	662,02	704,70	3,91	779,84	-1,43	734,33
Congo, Dem. Rep.	243,18	-4,19	203,65	204,87	0,80	217,96	1,30	226,88
Lesotho	367,85	-0,48	318,79	304,99	-0,87	338,70	1,86	365,38
Madagascar	225,39	-0,69	215,78	205,84	-0,92	194,37	-3,19	175,80
Malawi	191,49	3,66	208,82	198,31	-0,83	227,83	2,95	252,89
Mauritius	5251,52	1,14	5324,04	6174,14	2,33	7797,10	5,63	9120,94
Mozambique	190,69	2,45	213,77	248,82	5,80	295,62	1,29	302,89
Namibia	2498,36	2,33	2807,05	2642,69	-5,49	2328,57	0,33	2264,68
Seychelles	1011,35	1,96	985,85	982,54	-0,07	873,61	0,44	923,48
South Africa	3634,33	4,34	4219,03	4756,66	4,94	6252,83	3,93	7238,05
Swaziland	1103,89	2,14	1215,14	1260,94	1,47	1371,33	2,43	1449,97
Tanzania	273,53	1,79	295,70	323,64	2,49	350,45	0,67	356,18
Zambia	476,05	-1,87	443,34	404,87	-3,97	358,61	-0,43	353,48
Zimbabwe	430,50	1,01	353,44	278,27	-10,88	224,65	5,92	274,35
SADC	1187,66	1,66	1247,60	1335,09	1,35	1543,68	3,42	1717,09
SADC excl S. A	999,46	0,94	1019,03	1071,89	0,09	1181,43	3,21	1292,40
SADC-MI	2085,21	1,90	2218,85	2403,81	1,66	2820,28	3,64	3156,69
SADC-LI	290,12	-0,01	276,36	266,37	-1,42	267,07	1,11	277,50

Source: Authors' calculations based on World Bank 2016.

TABLE D4: LAND PRODUCTIVITY (AGRICULTURE VALUE ADDED PER HECTARE OF ARABLE LAND (CONSTANT 2005 US$)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola								
Botswana	7,40	-2,69	7,19	7,91	5,75	9,69	0,38	9,51
Congo, Dem. Rep.	109,33	-2,54	98,97	104,76	2,68	119,51	2,54	127,47
Lesotho	54,03	0,83	48,98	47,15	-1,06	52,66	3,06	57,92
Madagascar	29,48	0,30	29,99	31,96	2,39	35,12	-0,15	33,75
Malawi	158,35	3,70	173,05	169,79	0,17	199,06	4,41	229,19
Mauritius	3335,54	0,16	3280,47	3484,35	1,04	4005,30	3,42	4287,21
Mozambique	27,50	4,55	33,16	39,36	7,49	51,86	3,57	55,66
Namibia	15,86	3,64	18,44	17,67	-4,95	16,14	1,80	15,28
Seychelles	6971,76	2,82	7147,45	8019,89	7,55	13614,38	18,93	19830,88
South Africa	55,49	2,76	60,66	63,49	2,75	73,44	0,41	74,84
Swaziland	131,89	2,19	142,96	143,99	0,74	152,74	2,35	163,57
Tanzania	107,71	3,41	123,91	136,50	3,54	156,65	1,80	163,76
Zambia	56,23	-0,94	54,15	52,22	-2,40	49,79	1,66	50,09
Zimbabwe	94,70	-0,41	72,95	57,37	-12,38	42,04	6,59	46,01
SADC	49,94	1,62	52,30	54,97	2,18	62,55	2,02	65,42
SADC excl S. A	47,22	1,20	48,65	51,28	1,97	58,07	2,73	61,41
SADC-MI	35,22	2,50	38,22	39,50	1,86	44,33	0,49	44,92
SADC-LI	65,35	0,93	66,65	70,44	2,21	80,18	2,76	85,11

Source: Authors' calculations based on World Bank 2016.

TABLE D5: AGRICULTURE PRODUCTION INDEX (API)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola	61,83	8,45	86,72	105,15	7,70	169,96	7,48	211,55
Botswana	94,50	-1,69	92,94	99,97	1,88	124,38	4,37	129,82
Congo, Dem. Rep.	103,44	-1,31	98,70	100,38	0,67	109,19	3,06	116,98
Lesotho	99,67	0,38	91,03	98,35	1,44	103,72	2,32	111,48
Madagascar	88,00	-0,19	88,16	101,03	4,76	121,24	1,71	118,88
Malawi	81,80	6,11	94,66	110,39	8,86	161,96	5,79	186,61
Mauritius	95,89	0,74	100,83	98,34	-1,62	97,36	-0,86	93,90
Mozambique	83,79	3,34	95,92	102,58	2,99	140,35	7,60	156,59
Namibia	85,24	0,06	87,92	96,41	0,73	89,92	0,09	89,79
Seychelles	143,16	-3,05	118,33	102,83	-3,25	99,33	3,29	109,86
South Africa	88,86	2,64	95,88	102,74	3,34	118,61	0,77	122,31
Swaziland	89,69	1,10	94,18	98,77	0,97	105,76	2,44	112,13
Tanzania	74,24	3,21	82,14	99,73	5,35	131,86	7,84	153,83
Zambia	76,50	3,50	91,42	101,41	3,88	157,68	9,61	178,56
Zimbabwe	111,90	1,19	102,93	99,28	-1,89	100,95	3,05	107,04
SADC	91,90	1,14	94,78	101,16	2,39	122,15	4,30	133,29
SADC excl S. A	92,12	1,04	94,71	101,04	2,32	122,40	4,55	134,07
SADC-MI	94,86	0,46	95,98	100,32	1,38	113,63	2,86	122,61
SADC-LI	88,52	2,01	93,42	102,11	3,53	131,89	5,75	145,50

Source: Authors' calculations based on FAOSTAT 2016.

TABLE D6: CEREAL YIELDS (Kg/Ha)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2014	Average % change 2008-2014	2014
Angola	596,4	2,7	646,1	547,3	-1,1	681,7	5,5	888,8
Botswana	426,4	7,9	1213,5	550,6	-10,0	361,3	-2,6	398,3
Congo, Dem. Rep.	784,8	-0,1	771,5	771,6	0,0	765,5	-0,2	762,8
Lesotho	925,5	-4,9	610,5	540,9	-9,4	598,4	7,2	754,9
Madagascar	1987,8	0,7	2202,1	2511,1	4,6	2651,1	-2,0	2437,3
Malawi	1325,3	-1,2	1209,0	1419,6	14,3	2009,7	3,6	2187,8
Mauritius	6029,8	8,3	6555,6	7559,5	5,5	5235,7	-15,2	3765,1
Mozambique	820,5	1,0	817,9	758,4	1,3	817,0	-4,5	702,6
Namibia	333,2	4,9	327,9	466,3	8,2	424,4	-1,9	421,0
South Africa	2340,1	5,1	2537,1	3107,9	6,8	4053,7	-1,0	4320,4
Swaziland	1599,4	-8,8	1012,7	1085,8	-6,7	1175,5	1,5	937,8
Tanzania	1512,1	-1,3	859,6	1236,6	7,4	1410,8	3,3	1660,0
Zambia	1488,5	0,7	1701,9	1943,9	5,4	2498,3	4,3	2755,4
Zimbabwe	1046,3	-2,3	803,3	713,3	-15,5	655,6	15,2	788,7
SADC	1515,4	2,2	1519,2	1658,1	3,7	1667,0	-2,6	1627,2
SADC excl S.A	1452,0	1,9	1440,9	1546,5	3,2	1483,5	-3,0	1420,0
SADC-MI	1750,1	4,0	1843,3	1979,8	3,3	1790,1	-6,2	1640,9
SADC-LI	1280,8	-0,2	1195,0	1336,4	4,4	1544,0	1,9	1613,5

Source: Authors' calculations based on World Bank 2016.

TABLE D7: TOTAL FERTILIZER USE (Kg/Ha)

	Average level: 2002-2005	Average % change 2002-2005	2003	Average level: 2003-2008	Average % change 2003-2008	Average level: 2008-2015	Average % change 2008-2015	2015
Angola	2.55	20.33	1.79	4.37	46.01	8.62	5.62	10.27
Congo, Dem. Rep.	0.18	-	0.28	0.52	127.59	1.19	7.60	1.52
Madagascar	2.97	33.57	2.15	3.81	-5.50	3.32	5.16	4.35
Malawi	31.42	1.81	31.08	35.98	5.41	38.53	6.43	49.16
Mauritius	319.42	3.35	299.45	280.25	-11.34	206.85	-2.31	186.32
Mozambique	2.60	-27.20	0.74	5.04	76.49	8.28	4.69	10.59
Namibia	2.61	-12.38	1.41	1.88	-44.23	4.55	41.20	7.39
Seychelles	23.00	-	24.00	27.25	10.55	42.93	4.31	49.48
South Africa	55.99	-6.59	55.15	56.75	5.12	58.00	0.28	58.08
Swaziland	50.16	-18.88	49.94	87.93	42.31	180.74	9.70	239.07
Tanzania	4.80	16.14	4.46	5.23	-6.62	6.35	-6.05	4.13
Zambia	27.53	3.51	26.17	31.16	12.75	38.61	6.30	48.85
Zimbabwe	30.06	-18.50	40.01	25.80	-1.52	32.65	7.73	41.57
SADC	44.09	-4.75	41.28	43.54	1.09	48.51	3.46	54.68
SADC-excl. SA	43.06	-4.51	40.12	42.43	0.75	47.72	3.79	54.39
SADC-LI	14.83	-8.20	14.98	15.36	7.53	18.42	5.70	22.88
SADC-MI	78.51	-4.37	71.96	76.40	-0.28	83.62	2.91	91.77

Source: Authors' calculations based on World Bank 2016.

Annex E. Agricultural Trade

TABLE E1: AGRICULTURAL EXPORTS TO AGRICULTURAL IMPORTS RATIO

Country Name	Average level : 1990-1995	Annual average percentage change (1990-1995) level	Average level : 1995-2003	Annual average percentage change (1995-2003)	2003	Average level : 2003-2008	Annual average percentage change (2003-2008)	Average level : 2008-2014	Annual average percentage change (2008-2014)	2014
Angola	0.01	-9.40	0.01	-20.60	0.00	0.00	8.16	0.01	10.77	0.01
Botswana	0.33	-0.71	0.28	-7.00	0.17	0.21	9.53	0.22	-14.81	0.15
DRC	0.45	-2.66	0.22	-23.21	0.07	0.07	-5.04	0.07	-1.17	0.06
Lesotho	0.08	-3.13	0.03	-20.08	0.01	0.01	-13.37	0.02	28.76	0.03
Madagascar	2.68	-0.96	1.51	2.62	1.13	0.71	-16.54	0.68	10.81	0.85
Malawi	3.40	-13.19	5.94	-10.13	2.96	3.81	-1.40	3.16	-3.03	2.95
Mauritius	1.61	-6.92	1.17	-3.24	1.05	0.80	-16.45	0.43	-5.44	0.36
Mozambique	0.17	-2.16	0.25	2.94	0.35	0.48	20.44	0.75	19.39	1.08
Namibia	1.69	4.12	0.97	0.86	1.33	0.81	-12.72	0.68	2.42	0.72
South Africa	1.42	-9.20	1.52	3.66	1.58	1.18	-6.92	1.08	-5.79	0.95
Swaziland	3.05	-4.37	1.59	-10.74	1.00	1.15	4.84	1.22	7.42	1.41
Tanzania	2.37	-5.58	1.52	-7.40	1.29	1.19	0.34	1.22	0.94	1.27
Zambia	0.46	-6.03	0.89	5.14	0.80	1.62	-9.21	2.57	18.64	3.78
Zimbabwe	6.99	-6.97	5.34	-2.38	3.28	1.15	-19.70	0.82	5.95	0.90
SADC	1.22	-3.97	1.17	-1.92	1.05	0.82	-7.80	0.76	-0.43	0.77
SADC excl SA	1.13	-1.08	1.00	-5.53	0.79	0.61	-8.92	0.59	4.70	0.67
SADC-MI	1.04	-4.48	0.98	0.24	0.97	0.78	-8.72	0.66	-5.45	0.59
SADC-LI	1.74	-3.25	1.70	-6.60	1.24	0.91	-5.56	0.98	8.01	1.19

Source: Authors' calculations based on FAO 2016

TABLE E2: TOTAL EXPORTS PER CAPITA (USD)

Country Name	Average level : 1990-1995	Annual average percentage change (1990-1995) level	Average level : 1995-2003	Annual average percentage change (1995-2003)	2003	Average level : 2003-2008	Annual average percentage change (2003-2008)	Average level : 2008-2014	Annual average percentage change (2008-2014)	2014
Angola	0.37	-15.74	0.24	-19.59	0.14	0.36	31.32	0.85	24.66	1.33
Botswana	65.05	5.50	60.68	-10.61	33.85	47.28	36.00	79.47	-10.91	60.48
DRC	2.63	-3.84	1.14	-22.94	0.42	0.76	8.30	1.11	0.85	1.15
Lesotho	6.79	-3.22	2.52	-22.90	0.84	1.10	-4.62	1.59	35.24	2.82
Madagascar	13.94	2.18	8.75	7.70	11.13	8.23	10.81	13.27	16.13	17.46
Malawi	37.17	-5.11	38.88	-4.62	38.21	43.69	16.10	63.77	-9.56	50.34
Mauritius	351.19	0.06	313.52	-5.88	305.66	313.10	-3.46	288.51	4.81	310.37
Mozambique	3.23	1.69	3.31	6.56	5.19	11.35	29.17	22.96	14.90	30.67
Namibia	124.63	3.90	110.76	-3.76	138.15	116.77	1.59	212.79	38.55	390.79
South Africa	49.79	2.08	54.87	-1.03	63.96	85.63	8.68	128.57	5.16	144.11
Swaziland	331.98	-6.59	266.92	-7.37	220.74	261.97	-7.27	199.53	-0.78	190.28
Tanzania	11.33	7.73	13.19	-7.43	10.47	15.43	13.48	29.00	18.51	41.63
Zambia	3.49	-3.49	9.94	9.79	13.70	29.29	-1.00	81.51	41.28	157.16
Zimbabwe	68.79	4.88	74.32	-7.84	58.03	49.24	-7.54	90.15	15.93	128.72
SADC	24.36	0.91	24.19	-4.04	24.15	29.24	6.18	44.83	9.21	55.59
SADC excl SA	19.82	0.42	18.49	-6.28	16.32	18.25	4.39	29.93	14.14	41.14
SADC-MI	51.60	0.78	51.68	-2.91	56.08	69.86	6.40	97.75	5.81	111.40
SADC-LI	14.62	1.63	14.59	-5.76	12.79	15.06	6.83	28.03	14.93	39.17

Source: Authors' calculations based on FAO 2016

TABLE E3: TOTAL IMPORTS PER CAPITA (USD)

Country Name	Average level : 1990-1995	Average % change 1990-1995	Average level : 1995-2003	Average % change 1995-2003	2003	Average level : 2003-2008	Average % change 2003-2008	Average level : 2008-2014	Average % change 2008-2014	2014
Angola	46.17	-7.00	42.41	1.27	55.98	90.49	21.41	158.21	12.54	199.78
Botswana	201.06	6.26	210.23	-3.89	193.79	209.02	24.17	370.25	4.59	410.23
DRC	5.77	-1.21	5.18	0.35	6.45	10.69	14.05	17.04	2.05	18.28
Lesotho	87.49	-0.09	81.28	-3.54	73.29	76.45	10.10	98.18	5.03	111.38
Madagascar	5.28	3.18	6.12	4.96	9.84	13.44	32.77	19.22	4.80	20.54
Malawi	12.73	9.30	8.35	6.14	12.90	11.89	17.75	20.26	-6.73	17.08
Mauritius	221.65	7.49	267.43	-2.73	290.98	414.44	15.56	684.56	10.84	853.51
Mozambique	18.67	3.93	12.99	3.52	14.72	23.51	7.25	31.36	-3.76	28.44
Namibia	74.31	-0.21	124.28	-4.58	104.18	151.34	16.39	307.32	35.28	541.71
South Africa	36.95	12.43	36.78	-4.52	40.46	74.48	16.76	121.50	11.63	151.29
Swaziland	108.76	-2.32	179.73	3.78	219.68	237.05	-11.55	166.82	-7.63	135.02
Tanzania	5.00	14.10	9.20	-0.02	8.11	13.35	13.10	23.81	17.41	32.71
Zambia	8.87	2.70	12.16	4.42	17.22	18.73	9.04	29.26	19.09	41.61
Zimbabwe	15.86	12.74	16.23	-5.59	17.67	54.34	15.15	113.20	9.42	143.30
SADC	20.31	5.08	20.80	-2.16	23.04	36.65	15.16	59.07	9.68	72.18
SADC excl SA	17.74	1.51	18.56	-0.79	20.72	30.81	14.62	50.25	9.02	61.22
SADC-MI	50.65	5.51	52.96	-3.14	57.82	92.11	16.56	150.81	11.91	190.05
SADC-LI	8.77	5.04	8.80	0.90	10.32	17.01	13.12	28.19	6.41	33.01

Source: Authors' calculations based on FAO 2016

TABLE E4: TOTAL AGRICULTURE EXPORTS AS A SHARE OF TOTAL MERCHANDISE EXPORTS

Country Name	Average level : 1990-1995	Average % change (1990-1995)	Average level : 1995-2003	Average % change 1995-2003	2003	Average level : 2003-2008	Average % change 2003-2008	Average level : 2008-2014	Average % change 2008-2014	2014
Angola	0.33	-2.78	0.20	-7.34	0.16	0.14	-7.42	0.15	10.12	0.18
Botswana	0.16	11.22	0.18	-3.04	0.15	0.10	11.20	0.11	-5.42	0.10
DRC	0.24	21.36	0.27	-0.96	0.22	0.20	-1.15	0.20	-6.45	0.18
Lesotho	0.17	-5.74	0.16	0.28	0.12	0.09	3.92	0.09	2.93	0.10
Madagascar	0.12	4.83	0.11	0.30	0.13	0.11	11.24	0.14	5.97	0.15
Malawi	0.22	17.81	0.14	7.67	0.20	0.12	0.41	0.13	-11.26	0.10
Mauritius	0.14	3.65	0.14	-1.73	0.15	0.14	2.50	0.17	2.57	0.19
Mozambique	0.31	9.40	0.22	-6.11	0.17	0.18	-6.04	0.13	-19.50	0.07
Namibia	0.09	-3.61	0.14	-2.60	0.10	0.10	1.49	0.10	23.93	0.15
South Africa	0.06	4.81	0.05	-4.03	0.05	0.05	0.50	0.06	1.33	0.06
Swaziland	0.12	-8.03	0.17	2.73	0.16	0.14	-6.51	0.11	-5.53	0.09
Tanzania	0.09	10.11	0.20	-2.86	0.14	0.12	-9.92	0.11	4.48	0.12
Zambia	0.09	16.96	0.12	-0.14	0.12	0.07	-9.72	0.05	-2.00	0.05
Zimbabwe	0.08	9.09	0.09	4.60	0.13	0.28	7.92	0.38	3.41	0.44
SADC	0.10	2.08	0.09	-1.91	0.08	0.07	-0.85	0.08	1.07	0.09
SADC excl SA	0.16	3.74	0.16	-1.33	0.15	0.14	-2.62	0.14	1.19	0.14
SADC-MI	0.09	0.18	0.08	-2.99	0.07	0.07	0.07	0.08	3.43	0.09
SADC-LI	0.15	9.94	0.15	0.97	0.15	0.15	-3.76	0.15	-5.27	0.13

Source: Authors' calculations based on FAO 2016

TABLE E5: TOTAL AGRICULTURE IMPORTS AS A SHARE OF TOTAL MERCHANDISE IMPORTS

Country Name	Average level : 1990-1995	Average % change 1990-1995	Average level : 1995-2003	Average % change 1995-2003	2003	Average level : 2003-2008	Average % change 2003-2008	Average level : 2008-2014	Average % change 2008-2014	2014
Angola	0.0011	-11.2045	0.0006	-25.6830	0.0002	0.0002	-6.3686	0.0048	66.6809	0.0004
Botswana	0.0518	5.3811	0.0417	-9.8720	0.0221	0.0192	26.3211	0.0394	-14.3147	0.0145
DRC	0.0664	8.4309	0.0431	-17.7511	0.0156	0.0151	-8.0084	0.0267	10.4515	0.0114
Lesotho	0.1171	-19.7431	0.0221	-31.6522	0.0034	0.0029	-10.2601	0.0327	81.8336	0.0068
Madagascar	0.4625	-3.9247	0.2153	4.2789	0.2243	0.1449	3.9477	0.1822	2.2192	0.1973
Malawi	0.9197	-0.5714	0.9482	-1.0454	0.8904	0.8612	0.5638	0.7267	-19.6028	0.6657
Mauritius	0.2931	-3.3199	0.2183	-6.0312	0.1954	0.1751	-6.8189	0.1457	-2.5936	0.1288
Mozambique	0.3211	1.3501	0.1583	-14.9132	0.0988	0.1110	14.9243	0.1567	1.2351	0.1660
Namibia	0.1512	2.8025	0.1640	0.6934	0.2169	0.0984	-10.7744	0.1002	26.1229	0.1818
South Africa	0.0750	0.9701	0.0796	-1.0362	0.0809	0.0681	-4.4292	0.0663	-6.8322	0.0755
Swaziland	0.4570	-12.6669	0.2790	-11.5546	0.1466	0.1715	-2.4553	0.1291	-3.0468	0.1198
Tanzania	0.7022	-3.3824	0.5966	-11.3887	0.3165	0.3035	-1.8241	0.2494	-1.6488	0.3688
Zambia	0.0310	3.2427	0.1022	13.3482	0.1523	0.1273	-26.7626	0.0974	-1.3154	0.1863
Zimbabwe	0.4434	1.9762	0.4787	-0.7886	0.4403	0.3084	-12.4900	0.3345	3.8739	0.4723
SADC	0.1107	1.3393	0.1042	-4.5712	0.0900	0.0618	-10.9101	0.0605	-1.7151	0.0718
SADC excl SA	0.1930	2.3959	0.1612	-7.8924	0.1189	0.0655	-17.4054	0.0631	2.8253	0.0780
SADC-MI	0.0849	0.2384	0.0783	-3.9461	0.0721	0.0497	-11.4601	0.0458	-3.1238	0.0484
SADC-LI	0.3212	4.9715	0.3303	-3.9326	0.2678	0.1896	-8.5417	0.1769	-2.8531	0.2256

Source: Authors' calculations based on FAO 2016

Annex F. Poverty and Hunger

TABLE F1: PREVALENCE OF UNDERNOURISHMENT (% OF POPULATION)

Country Name	Average level: 1995-2003	Average % change 1995-2003	2003	Average level: 2003-2008	Average % change 2003-2008	2008	Average level: 2008-2014	Average % change 2008-2013	2014
Angola	52,53	-4,48	41,70	33,17	-9,00	25,90	20,92	-7,28	18,00
Botswana	33,17	2,75	35,10	33,17	-1,55	32,50	29,58	-4,20	26,60
Lesotho	14,09	-4,75	11,70	11,15	-1,29	11,10	11,30	0,51	11,50
Madagascar	35,11	1,64	38,40	35,72	-4,10	31,90	31,27	-0,91	30,50
Malawi	32,68	-6,15	27,30	26,20	-3,29	23,40	22,40	-1,31	21,80
Mauritius	6,80	-1,33	6,10	5,57	-3,11	5,20	5,05	-0,73	5,00
Mozambique	43,83	-3,60	39,00	36,48	-2,36	34,30	30,67	-4,17	27,90
Namibia	32,98	-6,39	25,30	26,68	3,54	30,50	36,22	4,06	37,20
South Africa	5,22	-1,18	5,00	5,00	0,00	5,00	5,00	0,00	5,00
Swaziland	20,98	-3,09	16,30	17,63	6,15	21,30	23,78	3,88	26,10
Tanzania	36,03	1,64	37,40	35,48	-2,22	33,80	34,88	0,41	34,60
Zambia	40,29	5,11	47,80	50,15	2,34	53,20	50,65	-2,14	48,30
Zimbabwe	44,16	-1,11	42,30	40,07	-2,78	37,00	34,10	-3,15	31,80
SADC	30,61	-1,55	28,72	27,42	-1,63	26,55	25,83	-1,34	24,95
SADC excl S. A	32,72	-1,55	30,70	29,29	-1,65	28,34	27,57	-1,36	26,61
SADC-MI	23,68	-3,07	20,17	18,91	-1,42	18,79	18,84	-0,45	18,49
SADC-LI	38,68	-0,48	38,70	37,35	-1,76	35,60	33,99	-1,92	32,48

Source: Authors' calculations based on World Bank 2016.

TABLE F2: PREVALENCE OF UNDERWEIGHT, WEIGHT FOR AGE (% OF CHILDREN UNDER 5)

Country Name	Average level: 1995-2003	Average level: 2003-2008	Average level: 2008-2014
Angola	32,25	15,60	-
Botswana	12,90	11,20	-
DRC	32,15	28,20	23,80
Lesotho	15,00	16,60	11,90
Madagascar	32,95	36,80	-
Malawi	24,77	16,95	14,20
Mauritius	13,00	-	-
Mozambique	24,05	19,75	16,95
Namibia	20,30	17,50	13,20
Seychelles	-	-	3,60
South Africa	10,10	10,63	8,70
Swaziland	9,10	6,70	6,55
Tanzania	26,10	16,70	15,23
Zambia	20,83	14,90	14,80
Zimbabwe	11,50	14,00	11,33
SADC	23,57	15,62	12,44
SADC excl S. A	23,81	16,40	12,63
SADC-MI	18,09	10,91	9,07
SADC-LI	24,70	19,09	15,93

Source: Authors' calculations based on World Bank 2016.

TABLE F3: PREVALENCE OF STUNTING, HEIGHT FOR AGE (% OF CHILDREN UNDER 5)

Country Name	Average level: 1995-2003	Average level: 2003-2008	Average level: 2008-2014
Angola	56,25	29,20	-
Botswana	32,10	31,40	-
DRC	47,70	45,80	43,05
Lesotho	53,00	45,20	36,10
Madagascar	55,35	52,80	49,20
Malawi	57,33	52,85	46,33
Mauritius	13,60	-	-
Mozambique	50,45	45,35	43,40
Namibia	29,50	29,60	23,10
Seychelles	-	-	7,90
South Africa	30,90	29,83	23,90
Swaziland	36,60	34,95	35,70
Tanzania	49,00	44,40	40,10
Zambia	54,27	45,80	40,00
Zimbabwe	33,70	35,80	31,67
SADC	49,16	40,09	33,56
SADC excl S. A	49,59	41,88	34,42
SADC-MI	36,15	32,70	27,73
SADC-LI	51,83	45,90	40,75

Source: Authors' calculations based on World Bank 2016.

TABLE F4: PREVALENCE OF WASTING, WEIGHT FOR HEIGHT (% OF CHILDREN UNDER 5)

Country Name	Average level: 1995-2003	Average level: 2003-2008	Average level: 2008-2014
Angola	8,15	8,20	-
Botswana	9,60	7,20	-
DRC	16,15	14,00	8,30
Lesotho	6,70	5,60	3,35
Madagascar	9,60	15,20	-
Malawi	8,77	5,25	3,23
Mauritius	15,70	-	-
Mozambique	8,58	4,80	5,15
Namibia	10,00	7,50	7,10
Seychelles	-	-	4,30
South Africa	4,40	6,50	4,70
Swaziland	1,70	2,00	0,95
Tanzania	7,05	3,50	4,73
Zambia	5,77	5,60	6,30
Zimbabwe	8,50	7,30	3,40
SADC	8,64	5,96	4,54
SADC excl S. A	8,71	5,84	4,44
SADC-MI	8,96	5,47	3,63
SADC-LI	8,64	6,54	4,87

Source: Authors' calculations based on World Bank 2016.

TABLE F5: POVERTY GAP AT NATIONAL POVERTY LINES (%)

Country Name	Average level: 1995-2003	Average level: 2003-2008	Average level: 2008-2014
Angola	-	12,70	12,70
Botswana	11,70	11,70	-
DRC	-	-	26,10
Lesotho	28,90	-	29,50
Madagascar	35,90	32,00	33,90
Malawi	23,40	17,80	18,90
Mauritius	-	-	-
Mozambique	24,90	21,20	21,20
Namibia	12,90	12,90	8,80
Seychelles	-	12,20	12,60
South Africa	-	35,60	-
Swaziland	32,40	-	30,40
Tanzania	-	-	6,70
Zambia	-	-	28,00
Zimbabwe	-	-	34,10
SADC	25,61	18,61	20,54
SADC excl S. A	25,61	18,25	20,54
SADC-MI	21,67	18,20	18,60
SADC-LI	27,28	23,67	23,66

Source: Authors' calculations based on World Bank 2016.

TABLE F6: POVERTY GAP AT $1.90 A DAY (2011 PPP) (%)

Country Name	Average level: 1995-2003	Average level: 2003-2008	Average level: 2008-2014
Angola	14,65	9,64	9,64
Botswana	11,41	-	5,78
DRC	-	59,26	39,25
Lesotho	31,99	-	31,83
Madagascar	30,06	31,70	40,32
Malawi	24,92	31,68	33,29
Mauritius	-	0,07	0,11
Mozambique	44,41	31,41	31,41
Namibia	10,17	10,17	6,65
Seychelles	0,11	0,05	-
South Africa	13,56	5,70	4,53
Swaziland	17,49	-	16,64
Tanzania	44,54	18,95	14,35
Zambia	16,69	28,68	31,59
Zimbabwe	-	-	-
SADC	21,69	20,78	17,66
SADC excl S. A	23,06	21,80	19,70
SADC-MI	12,19	6,51	10,69
SADC-LI	30,14	30,31	30,02

Source: Authors' calculations based on World Bank 2016.

TABLE F7: GLOBAL HUNGER INDEX (GHI)

Country Name	2013 Global Hunger Index				
	1990	1995	2000	2005	2013
Angola	39.5	38.5	31.6	22.7	19.1
Botswana	16.8	17.0	17.8	16.3	13.9
Lesotho	13.2	14.6	14.6	14.9	12.9
Madagascar	25.5	24.6	25.9	24.4	25.2
Malawi	30.6	27.6	21.6	18.7	15.1
Mauritius	8.5	7.6	6.5	5.9	5.2
Mozambique	36.0	32.0	28.5	25.1	21.5
Namibia	22.1	21.9	17.5	17.1	18.4
South Africa	7.2	6.5	7.4	7.7	5.4
Swaziland	10.4	12.9	12.7	12.5	14.4
Tanzania	23.4	26.9	26.1	20.5	20.6
Zambia	24.9	24.5	26.3	25.3	24.1
Zimbabwe	20.0	22.0	21.7	20.5	16.5
SADC	21.4	21.3	19.9	17.8	16.3
SADC excl SA	22.6	22.5	20.9	18.7	17.2
SADC-MI	16.8	17.0	15.4	13.9	12.8
SADC-LI	26.7	26.3	25.0	22.4	20.5

Source: Authors' calculations based on World Bank 2016.

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