

This collage illustrates the impact of agricultural pests on food security. It features a close-up of an elderly woman's face, a large beetle on a leaf, a person standing in a field, a healthy green cornfield, a grid of icons representing gender, family, health, and cooking, and a close-up of coins and a ruler.

# A SYNTHESIS REPORT

AFRICA

### Securing equity.

# **Hunger and Food Security in Southern Africa**

**A LONGER-TERM, REGIONAL ANALYSIS  
SYNTHESIS REPORT**

Martin de Wit

**INFORMATION FOR ADAPTATION SERIES**



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The Regional Climate Change Programme (RCCP) was established to help Southern Africa adapt to climate change across political borders, while simultaneously respecting the sovereignty of individual countries when planning adaptation measures.

The purpose of the RCCP is to enable transboundary adaptation to climate change, with equitable access to climate funding, in Southern Africa.

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# 1. Summary

Hunger is a large-scale problem in SADC. The latest available estimations from the FAO are that 95 million people in SADC are undernourished. Overall, the rate of increase in the number of people who are undernourished has slowed down from very high levels in the early 1990s. Countries that have made the least progress in this regard are the DRC and Tanzania, followed by Madagascar and Zambia. Countries that have made relatively better progress, but do still have large numbers of undernourished people, include Angola and Mozambique.

The objective of this study was to provide an integrated analysis of the current food, economic and policy context of southern Africa (for 14 SADC countries), at a regional, national and where possible sub-national level. Furthermore, this report puts this in the context of inter-annual variability and risk by referring to trends over the recent past and expected trajectories based on national and regional programmes and policies. Lastly, the projected patterns and impacts of increasing climate variability and longer-term climate change on the regional food economy and undernourishment were overlaid on the current situation. Potential response options were then formulated. The study forms part of the Regional Climate Change Programme (RCCP) for Southern Africa. This report is a synthesis of the full report prepared for the RCCP in 2009 (OneWorld Sustainable Investments, 2009).

The longer-term patterns and underlying reasons for widespread food insecurity across the SADC region were analysed. Trend analysis of supply and demand for food was conducted using FAO (mainly) datasets for the periods 1990-1992, 1995-1997, and 2003-2005. More detailed analysis on specific food groups was conducted. It was found that the main driver of undernourishment is a lack of food consumption, mostly carbohydrates and protein. This was further explored through the analysis of food trade, prices, household income and expenditure on food. Any response to undernourishment also needs to include a focus on the barriers to regional trade, lack of physical infrastructure, institutional failures, and distorting legislation and policies.

It is widely acknowledged that the region faces many challenges to its current agricultural and trade policies and strategies. The policies and strategies focusing on production of and access to food, improving nutrition and intentions of more liberalised trade within SADC, have as yet not booked notable success in terms of declining undernourishment. For example, regional trade agreements in Eastern and Southern Africa are characterised by their multiple and overlapping membership, complex structures, and eventually conflicting and confusing commitments (De La Roche, 2003). Furthermore, although liberalisation

in trade policy has progressed substantially, inconsistent policies with the SADC free trade protocol related to export and import licenses, as well as temporary import bans on agricultural commodities, are still evident (FANRPAN, 2003). An improvement in regional trade remains a preferred response option to absorb shocks in the food system.

It is within this context that climate risks need to be managed. It is expected that the region will suffer an overall decline in agricultural production (keeping all other factors constant). Particularly concerning is new research pointing to the possible negative impacts of elevated CO<sub>2</sub> on cassava production, which has rapidly become an important staple food in the region. Climate change impacts are also not expected to be homogeneous across the region, intensifying the need for investments which facilitate improved food trade between production surplus and deficit regions. Developing high temperature resistant crops and promoting irrigation are direct response strategies. It is suggested that the return on additional investment in irrigation systems can be high but several hurdles remain which poses several difficulties such as manipulating high technologies, having access to sufficient water resources, and to financial means of investments. An indirect response strategy is to diversify away from a largely subsistence agricultural economy and reduce a country's dependence on its agriculture, and increase wealth. This in turn will provide rising incomes that improves the ability to adapt at a household

level. Farmers can further be supported by promoting farmer education and improving their access to climate forecasting, through research on farm-level climate adaptation technologies, and by opening access to credit and market development.

The key determinants of food security for households and communities, and resulting improved nourishment, do not lie primarily in improved crop yields. Reduced crop yields due to, among others, climate changes may increase vulnerability, but economic and socio-political factors play a larger structural role in undermining households' and communities' coping abilities. The vulnerability of the farming sector and households to climate change will vary. Some regions or households have a larger adaptive capacity than others. Such regions may face a greater exposure to extreme events and climate variability, but with better access to resources and infrastructure they will be in a better position to cope and adapt. Reliable information on climate variability and climate change remains a problem. More accurate estimates of crop production are a sure way to reduce price volatility and resulting hardship and undernourishment caused by price spikes.

We conclude that addressing the underlying, systemic causes of food insecurity in southern Africa will go a long way towards absorbing shocks brought about by expected increases in climate variability, and longer-term climate changes.

## 2. Introduction

### Background and problem

In the latest State of Food Insecurity report from the FAO and the World Food Programme it is estimated that 1.02 billion people are undernourished worldwide (FAO/WFP, 2009). In SADC, 95 million people or more than 40% of the population are undernourished. Within the Southern African Development Community (SADC), most of the member states are not reaching the minimum calorie intake of 2100 kcal/person/day, and several other countries are dangerously close to this level. Worse still, daily calorie intake in almost half of all SADC countries have declined compared to the early nineties.

Food production per person has stagnated in SADC, with most countries reporting a notable decline in food production per person since the early nineties. Notable exceptions are Angola and Malawi, and also Namibia and Mozambique to some extent.

Food imports per person have risen in SADC over this same period. Tanzania, Madagascar and Swaziland have shown the largest increases in imports since the early nineties, while Mauritius, Swaziland, Botswana and Namibia have the highest dependence on imports to feed their populations. SADC countries are mostly reliant on the imports of cereals.

When measured in terms of weight (g/pp/day), only Swaziland and South Africa were consistent net exporters of food since the early nineties. More recently, Namibia also became a net exporter, while Mauritius and Zimbabwe became net importers of food. The main export food groups are sugar and sweeteners (mainly from Swaziland and Mauritius); fish and seafood (from Namibia and Mauritius); and fruits (from Swaziland and South Africa).

The value of SADC food exports and imports, both from and to the rest of the world and within SADC increased rapidly over recent years. Imports increased more rapidly than exports, and net exports turned negative in 2002 and have rapidly declined further since then. The terms of trade in food (the value of exports divided by the value of imports) also declined by an average of 2% pa from 2000-2006.

Food aid to this region has declined strongly compared to the early nineties, but increased again at the end of the nineties and at the start the new millennium.

With persistent high levels of undernourishment, stagnant production and consumption, increasing import dependence and a declining terms of trade, SADC countries have become increasingly vulnerable to shocks that

may disrupt food supplies or diminish the ability to increase food consumption. Such shocks can take many forms such as a decline in employment and income, volatile market prices, communication and transport breakdowns and delays, droughts, floods, conflicts and war, and many others. This report will not discuss all possible shocks in detail, but will focus mostly on the literature describing the impacts of climate variability and climate change on production.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern (FAO/WFP, 2009).

Food insecurity exists when people do not have adequate physical, social or economic access to food as defined above (FAO/WFP, 2009).

Undernourishment exists when caloric intake is below the minimum dietary energy requirement (MDER). The MDER is the amount of energy needed for light activity and a minimum acceptable weight for attained height, and it varies by country and from year to year depending on the gender and age structure of the population (FAO/WFP, 2009).

*Box 1 Definitions of food security, insecurity and undernourishment*

## Objective

The objective of this report is to provide an integrated analysis of the current food, economic and policy context of southern Africa (for 14 SADC countries), at a regional, national and where possible sub-national level. Furthermore, this

report puts this in the context of inter-annual variability and risk by referring to trends over the recent past and expected trajectories based on national and regional programmes and policies, and exposure to natural hazards. The projected patterns and impacts of increasing climate variability and longer-term climate change on the regional food economy and undernourishment are overlaid on the current situation. Potential response options are then formulated. The study forms part of the 5-year DFID- and SIDA-funded Regional Climate Change Programme (RCCP) for Southern Africa ([www.RCCP.org.za](http://www.RCCP.org.za)).

## Method and approach

Much has been published on food insecurity in recent years (FAO/WFP, 2009; Jayne et al., 2009; Hagglblade et al., 2008; Dorosh et al., 2007; Misselhorn, 2005). The following issues need further elaboration:

Specifically analyse SADC as a region, distinguishing from work focused on Africa, sub-Saharan Africa or southern Africa. [South Africa was excluded from most analyses to prevent distortion]

Focus on the number of hungry or undernourished people in SADC and the factors influencing this situation. This requires a holistic analysis on the most important links between undernourishment and other variables such as diets, consumption, production, trade and aid.

Include an explicit recognition of the huge variability between SADC countries. SADC is not a homogenous block and huge disparities between countries and regions occur.



Focus on historical data in the region from 1990 onwards to provide a more comprehensive picture on longer-term drivers and trends of hunger in SADC.

Overlay climate change projections on the outcomes to assess the vulnerability of the SADC food system to possible climate shocks, and to help inform priority adaptation responses

This report intends to set out the main connections between undernourishment in SADC and other variables such as food production, consumption, prices and trade. All data that is used is from the FAO, unless stated otherwise.

Levels and trends of key variables are discussed and correlations with levels and trends of undernourishment are tested. Guidelines for the interpretation of correlation coefficients are somewhat arbitrary. The following general rules of thumb are used:

- large negative correlation (-1.0 to -0.5)
- large positive correlation (0.5 to 1.0)
- medium negative correlation (-0.5 to -0.3)
- medium positive correlation (0.3 to 0.5)
- small negative correlation (-0.3 to -0.1)

- small positive correlation (0.1 to 0.3)

This report must be read as a scoping document, and more scientific work and statistical testing are required on the main drivers of undernourishment and the eventual success of alternative response options. It is hoped that this review will contribute by identifying the key factors that have influenced undernourishment in SADC in the past, and the possible impacts of climate variability and climate change on food security in the region. For the latter only a synopsis of the literature could be given, pointing the way to formulate further research questions.

The rest of the report is presented as follows: The next section gives an analysis on the state and trends in undernourishment in SADC, as well as other factors such as consumption, production, trade, aid, prices, policy context, risks and responses that affect undernourishment. Following an outline of projected climate change for the region, and the current trade and policy context, we then conclude with a brief integrated discussion on the main drivers and responses to undernourishment, the added stress of climate change, and possible response options.

### 3. Data and analysis

#### Undernourishment: Characterising the problem in SADC

Despite some notable gains in certain countries, the number of undernourished people in SADC is rising. In the time period 2004-2006 an average of 94.3 million people in SADC were undernourished, of which 43.9 million were in the DRC alone (Table 1). Almost 84% of undernourished people in SADC are found in only five countries: DRC, Tanzania, Mozambique, Angola and Madagascar. A total of 15% are found in Zambia, Zimbabwe and Malawi, and 1.5% in the rest of SADC.

In relation to population size, an average of almost half (48%) of all the people living in SADC (excl. RSA) were undernourished in the time period 2004-2006 (Table 2). The figures are heavily influenced by the fact that three-quarters of the population of the DRC are undernourished.

The rate at which the number of undernourished people changed decreased substantially between the periods 1990-1992 and 2004-2006 (Table 3). For the whole of SADC the rate of increase in undernourished people slowed down from 46% between the time periods 1990-1992 and 1995-1997 to 10% between the time periods 2000-2002 and 2004-2006. The only countries where the rate of increase in undernourished people have started increasing again between the periods 2000-2002 and 2004-2006 are Tanzania and Malawi. Namibia

moved backwards to no change from earlier absolute gains in the number of undernourished people, while Mozambique is still showing absolute gains, but at a slower rate.

In the short-term, using the latest numbers on the percentage of the population undernourished in the period 2004-6, compared to short-term change between the periods 2000-2 and 2004-6, there are at least four distinct groups within SADC countries (Figure 1):

- Very poor progress: Higher percentage of the population (>50%) and high growth factor (>0.2) in undernourishment (DRC)
- Poor progress: Relatively high percentage of population (30 to 50%) and moderate growth factor (0.05 to 0.2) in undernourishment (Tanzania, Zambia, Malawi, Madagascar)
- Good progress: Relatively high percentage of population (30 to 50%), negative growth (-0.04 to 50%), negative growth (-0.04 to

Figure 1: Percentage of population undernourished and shorter-term growth factors in undernourishment, SADC (excl. RSA)

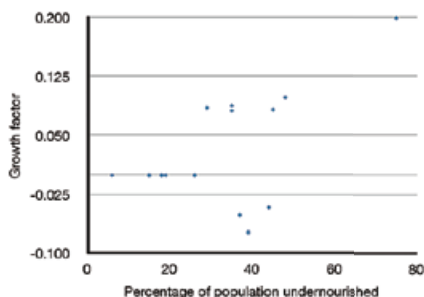


Table 1: Number of undernourished people in SADC, 1990–2006

| Country/Region                   | Undernourished,<br>1990–2, Mil | Undernourished,<br>1995–7, Mil | Undernourished,<br>2000–2 Mil | Undernourished,<br>2004–6, Mil |
|----------------------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|
| TOTAL SADC (excl. RSA)           | 51.1                           | 74.4                           | 85.8                          | 94.3                           |
| Democratic Republic of the Congo | 11.4                           | 26.5                           | 36.6                          | 43.9                           |
| United Republic of Tanzania      | 7.4                            | 12.1                           | 12.5                          | 13.6                           |
| Mozambique                       | 8.2                            | 8.6                            | 7.9                           | 7.5                            |
| Angola                           | 7.2                            | 7.3                            | 7.4                           | 7.1                            |
| Madagascar                       | 3.9                            | 5.4                            | 6.1                           | 6.6                            |
| Zambia                           | 3.3                            | 3.9                            | 4.8                           | 5.2                            |
| Zimbabwe                         | 4.3                            | 5.5                            | 5.5                           | 5.1                            |
| Malawi                           | 4.3                            | 3.7                            | 3.5                           | 3.8                            |
| Botswana                         | 0.3                            | 0.4                            | 0.5                           | 0.5                            |
| Namibia                          | 0.4                            | 0.5                            | 0.4                           | 0.4                            |
| Lesotho                          | 0.2                            | 0.2                            | 0.3                           | 0.3                            |
| Swaziland                        | 0.1                            | 0.2                            | 0.2                           | 0.2                            |
| Mauritius                        | 0.1                            | 0.1                            | 0.1                           | 0.1                            |

Table 2: Percentage of population undernourished, SADC countries (excl. RSA, 1990–2006)

| Country/region                   | % of pop<br>undernourished,<br>1990–2 | % of pop<br>undernourished,<br>1995–7 | % of pop<br>undernourished,<br>2000–2 | % of pop<br>undernourished,<br>2004–6 |
|----------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Democratic Republic of the Congo | 29                                    | 57                                    | 70                                    | 75                                    |
| TOTAL SADC (excl. RSA)           |                                       |                                       |                                       | 48                                    |
| Zambia                           | 40                                    | 41                                    | 45                                    | 45                                    |
| Angola                           | 66                                    | 58                                    | 52                                    | 44                                    |
| Zimbabwe                         | 40                                    | 46                                    | 43                                    | 39                                    |
| Mozambique                       | 59                                    | 52                                    | 42                                    | 37                                    |
| United Republic of Tanzania      | 28                                    | 40                                    | 36                                    | 35                                    |
| Madagascar                       | 32                                    | 37                                    | 37                                    | 35                                    |
| Malawi                           | 45                                    | 36                                    | 29                                    | 29                                    |
| Botswana                         | 20                                    | 24                                    | 27                                    | 26                                    |
| Namibia                          | 29                                    | 29                                    | 21                                    | 19                                    |
| Swaziland                        | 12                                    | 20                                    | 17                                    | 18                                    |
| Lesotho                          | 15                                    | 13                                    | 14                                    | 15                                    |
| Mauritius                        | 7                                     | 6                                     | 5                                     | 6                                     |

Table 3: Percentage change in undernourishment, SADC countries (excl. RSA, 1990–2006)

| Country/region                   | Undernourished, 1990–2 to 1995–7, m, % ch | Undernourished, 1995–7 to 2000–2, m, % ch | Undernourished, 2000–2 to 2004–6, m, % ch |
|----------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|
| Democratic Republic of the Congo | 132%                                      | 38%                                       | 20%                                       |
| TOTAL SADC (excl. RSA)           | 46%                                       | 15%                                       | 10%                                       |
| United Republic of Tanzania      | 64%                                       | 3%                                        | 9%                                        |
| Malawi                           | -14%                                      | -5%                                       | 9%                                        |
| Zambia                           | 18%                                       | 23%                                       | 8%                                        |
| Madagascar                       | 38%                                       | 13%                                       | 8%                                        |
| Swaziland                        | 100%                                      | 0%                                        | 0%                                        |
| Botswana                         | 33%                                       | 25%                                       | 0%                                        |
| Namibia                          | 25%                                       | -20%                                      | 0%                                        |
| Lesotho                          | 0%                                        | 50%                                       | 0%                                        |
| Mauritius                        | 0%                                        | 0%                                        | 0%                                        |
| Angola                           | 1%                                        | 1%                                        | -4%                                       |
| Mozambique                       | 5%                                        | -8%                                       | -5%                                       |
| Zimbabwe                         | 28%                                       | 0%                                        | -7%                                       |

-0.07) in undernourishment (Angola, Zimbabwe, Mozambique)

- No progress: Lower percentage of population (<30%), zero growth factor (0) in undernourishment (Botswana, Namibia, Swaziland, Lesotho, Mauritius)

In the longer-term, using percentages of population malnourished in the period 2004–2006 and comparing that to percentage changes in malnourishment in the period 1990–1992 to 2004–2006, it is clear that the DRC remains the country with the worst problem with both high percentages of the population affected and an increase in undernourishment over this time period (Figure 2). For all SADC countries (excl. RSA), the rate of increase in the percentage of the population undernourished is declining (from a 46% increase between the periods 1990–1992 and 1995–1997 to a 10% increase

between 2000–2002 and 2004–2006). This is also the case for the DRC, suggesting that the roots of the food crises in this country and SADC as a whole were established at least as early as the early nineties. Tanzania and Malawi are notable exceptions, as the rate at which undernourishment had changed increased again when rates for the period

Figure 2: Percentage of population undernourished and long-term growth factors in undernourishment, SADC (excl. RSA)

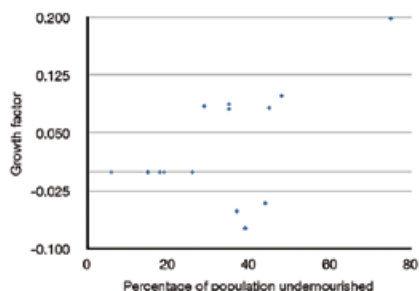




Table 4: Short- and long-term progress of SADC countries in terms of undernourished populations

|              | Very poor progress | Poor progress                           | No progress                                      | Good progress                                            |
|--------------|--------------------|-----------------------------------------|--------------------------------------------------|----------------------------------------------------------|
| Shorter-term | DRC                | Tanzania, Zambia, Malawi, Madagascar    | Botswana, Namibia, Swaziland, Lesotho, Mauritius | Angola, Zimbabwe, Mozambique                             |
| Longer-term  | DRC, Tanzania      | Madagascar, Zambia, Swaziland, Botswana | Lesotho                                          | Mozambique, Malawi, Namibia, Angola, Zimbabwe, Mauritius |

2000-2002 to 2004-2006 are compared to rates for the period 1995-1997 to 2000-2002 (Table 4). In Mozambique the rate at which undernourishment decreased has started to slow down and in Namibia the rate is zero after earlier decreases. This suggests a reversal of earlier gains, influenced by more specific factors at the end of the 1990s and the beginning of the 2000s in these countries.

In the longer-term, using the latest numbers on the percentage of the population undernourished in the period 2004-2006, compared to long-term change between the periods 1990-1992 and 2004-2006, the following, less distinct, groups are identified (Figure 2; Table 4):

- Very poor progress: Relative higher percentage of population (30 to 50%) and relatively high growth factors in undernourishment ( $>0.2$ ) (DRC, Tanzania)
- Poor progress: Relative higher percentage of population (30 to 50%) and relatively moderate growth factors in undernourishment (0.05 to 0.2) (Madagascar, Zambia)
- Poor progress: Relatively lower

percentage of population (15 to 30%) and relatively high growth factors in undernourishment ( $>0.2$ ) (Swaziland, Botswana)

- Good progress: Relative higher percentage of population (30 to 50%) and negative growth factors in undernourishment ( $<0$ ) (Mozambique, Malawi, Namibia, Angola, Zimbabwe)
- Good progress: Relative small percentage of population ( $<15\%$ ) and a negative growth factor in undernourishment ( $<0$ ) (Mauritius)
- No progress: Relative small percentage of population ( $<15\%$ ) and a zero growth factor in undernourishment (Lesotho)

Combining both the short- and long-term analysis, SADC countries (excl. RSA) are clustered according to levels of progress (Table 4). The following can be concluded:

- Consistently good progress: Angola, Zimbabwe, Mozambique
- Consistently poor and very poor progress: DRC, Tanzania, Zambia, Madagascar
- Consistently no progress: Lesotho
- No or poor progress: Botswana, Swaziland

- No or good progress: Namibia, Mauritius
- Poor or good progress: Malawi

It is noticeable that countries with large undernourished populations are either making good progress (Angola, Mozambique, Zimbabwe) or are making very poor or poor progress (DRC, Tanzania, Madagascar, Zambia). No progress is made in countries where the number of malnourished is relatively low, possibly suggesting a lack of easy additional gains.

Multiple factors influence progress in the various countries. Misselhorn (2005) analysed the drivers of food insecurity in southern Africa on a household level and concluded that socioeconomic issues feature prominently. Poverty, environmental stressors and conflict account for 50% of the identified indirect drivers of food insecurity. The study argued for the need to understand the multiple social and political dimensions of food insecurity, such as the breakdown in social capital associated with poverty, conflict and HIV/AIDS, that run deeper than environmental constraints to food production. The study also highlights that food shortages are determined less by local production failures than by failures to access food.

## The importance of balanced diets

Undernourishment is dependent on the dietary intake. Dietary consumption is usually expressed as the contribution of the macronutrients carbohydrates, proteins and fats, as well as several micronutrients, such as vitamins, minerals and certain acids. Carbohydrates are the main source of energy in a diet (55-75%) for most

people, and can be found in grain products, tubers, roots and some fruits. In developing country settings (which are predominantly vegetable-based, mixed diets) protein requirements can be met by providing roughly 10-12% of total energy from protein. For the elderly, where energy intake is lower, protein requirements are closer to 12-14% of total energy. Furthermore, at least 15% of the energy intake for adults should be obtained from dietary fats and oils. This increases to 20% for women of child-bearing age and up to 35% for non-obese active individuals.

The total dietary energy consumption for SADC countries over several time periods since 1990 to 2006 is illustrated in Table 5. In 2003-2005 the population of DRC, Angola, Zambia, Tanzania, Mozambique, Madagascar and Zimbabwe consumed less than the daily requirement of 2100 kcal per person per day, with Malawi and Botswana just above this level. Namibia, Lesotho and Swaziland are all a few hundred kcal above the daily requirement, with only Mauritius and South Africa comfortably above this level.

Dietary energy consumption declined the most in the DRC, followed by Tanzania, Zambia, Madagascar, Swaziland and Botswana as measured over the time period 1990-1992 to 2003-2005. Dietary energy consumption increased most in Mozambique and Angola, followed by Malawi and Namibia. In absolute terms dietary energy consumption is lowest in the DRC, Angola and Zambia.

Dietary protein consumption declined the most in the DRC (-28%), followed by Madagascar (-6%), Tanzania (-6%), Botswana (-6%), Zambia (-4%) and

Table 5: Dietary energy consumption (kcal/person/day)

| Country name                     | 1990–2  | 1995–7  | 2003–5  | % ch 1990–2 to 2003–5 |
|----------------------------------|---------|---------|---------|-----------------------|
| Mozambique                       | 1750.00 | 1850.00 | 2070.00 | 18%18%                |
| Angola                           | 1600.00 | 1700.00 | 1880.00 | 18%18%                |
| Malawi                           | 1880.00 | 2020.00 | 2130.00 | 13%13%                |
| Namibia                          | 2050.00 | 2060.00 | 2290.00 | 12%12%                |
| South Africa                     | 2770.00 | 2740.00 | 2900.00 | 5%5%                  |
| Mauritius                        | 2790.00 | 2860.00 | 2880.00 | 3%3%                  |
| Zimbabwe                         | 1980.00 | 1910.00 | 2040.00 | 3%3%                  |
| Lesotho                          | 2370.00 | 2450.00 | 2430.00 | 3%3%                  |
| Botswana                         | 2240.00 | 2200.00 | 2200.00 | -2%-2%                |
| Swaziland                        | 2380.00 | 2220.00 | 2320.00 | -3%-3%                |
| Madagascar                       | 2070.00 | 1980.00 | 2010.00 | -3%-3%                |
| Zambia                           | 1960.00 | 1940.00 | 1890.00 | -4%-4%                |
| United Republic of Tanzania      | 2100.00 | 1920.00 | 2010.00 | -4%-4%                |
| Democratic Republic of the Congo | 2130.00 | 1730.00 | 1500.00 | -30%-30%              |

Zimbabwe (-2%) as measured over the time period 1990-1992 to 2003-2005. Dietary protein consumption increased the most in Mozambique (+28%) and Angola (+20%), followed by Mauritius (+11%), Namibia (+10%) and Swaziland (+10%). Dietary energy intake increased marginally in Malawi (+6%), South Africa (+4%) and Lesotho (+2%). In absolute terms dietary protein consumption is lowest in the DRC, Mozambique and Angola.

Dietary fat consumption declined most in the DRC (-32%), followed by Botswana (-13%), Madagascar (-13%), Lesotho (-11%) and Mozambique (-11%) as measured over the time period 1990-1992 to 2003-2005. Dietary fat consumption increased most in Namibia (+50%), Swaziland (+19%) and South Africa (+17%), followed by Zimbabwe (+13%), Malawi (+12%) and Zambia

(+10%). Dietary fat consumption increased marginally in Mauritius (+5%) and no change was recorded in Angola over this period. In absolute terms dietary fat consumption is lowest in the DRC, Madagascar and Malawi.

Given the FAO/WHO guidelines of 55-75% of total energy from carbohydrates,<sup>1</sup> 10-12% from protein and around 15% from fats, it is clear that almost half of SADC countries have too many carbohydrates in their dietary energy consumption and all SADC countries are either below or just within the targets for dietary protein consumption. Carbohydrate-biased diets (more than 70% of energy intake from carbohydrates) are measured in the DRC, Madagascar, Malawi, Mozambique, Lesotho, Tanzania, Zambia and Angola.

1 The Institute of Medicine recommends 40-65% of dietary energy from carbohydrates for American and Canadian adults.

Protein deficits are most acute in the DRC, Mozambique, Madagascar and Angola, but at a minimum in Tanzania, Zambia, Zimbabwe and Malawi. Fat deficits are measured in Madagascar, Malawi, Lesotho, the DRC and Tanzania.

Micronutrients also need to play an important role in dietary consumption. These are the nutrients that are needed throughout life in much smaller quantities than macronutrients. Micronutrients include all vitamins, minerals (macro and trace) as well as organic acids. Micronutrient malnutrition is sometimes referred to as the “hidden hunger” (IFA, n.d.) and is a major underlying cause of numerous health problems, especially in developing countries (Bell & Dell, 2008).

Iron deficiency is the most common nutrient deficiency in the world. Dietary iron available for human consumption is highest in Malawi, Botswana and Lesotho, and lowest in Angola, Mozambique and Madagascar. The total amount of iron available decreased most rapidly over the period 1990-1992 to 2003-2005 in the DRC (-30%), Tanzania (-16%) and Zambia (-5%). Highest increases are in Mozambique (+29%), Malawi (+23%), Swaziland (+21%), Mauritius (+20%) and Angola (17%). Malawi clearly substituted iron from animal origin with iron from vegetal origin over this time period. Swaziland shows the highest growth in iron from animal origin of all SADC countries (41% growth from 1990-1992 to 2003-2005).

Vitamin A, commonly known as the anti-infective vitamin (Semba, 2001), that is available for human consumption is highest in Namibia and Angola,

and lowest in Malawi, the DRC, Zambia, Mozambique, Lesotho and Zimbabwe. The share of retinol, which is the animal form of Vitamin A, available for human consumption is highest in South Africa, followed by Mauritius, Zimbabwe, Swaziland and Lesotho.

Using linear regression analysis, the number of undernourished people per country and the share of retinol in countries have a medium negative relationship (-0.49). The relationship between the number of undernourished people per country and Vitamin A available for human consumption (-0.28) is small.

## Food consumption

Now that we have established what the state of undernourishment is in SADC, and what the main deficits are in dietary consumption, we need to know the amount and type of food that is consumed, produced, received as aid and traded in SADC.

Total food consumption (2003-2005) ranges from a low of 817 g/pp/day in Zimbabwe to 1617 g/pp/day in Mauritius. On average, food consumption in SADC remained unchanged (close to 1228 g/pp/day) over the periods 1990-1992 and 2003-2005. The strongest declines in absolute consumption between the periods 1990-1992 and 2003-2005 were in the DRC (-543 g/pp/day), Tanzania (-313) and Madagascar (-162). Malawi (+460 g/pp/day) increased consumption the most, followed by Namibia (+251), Mauritius (+254) and Angola (+140). The standard deviation (stddev) of average food consumption declined by 16% for the period 1990-1992 to 2003-2005.

There is a large negative correlation (-0.73) between the rate of increase in total food consumption and rate of decrease in the percentage of the population that is undernourished. This means that the quicker the rate of consumption increased, the faster the number of people who are undernourished decreased. Increasing absolute amounts of food consumed is largely correlated with a decrease in undernourishment. For the main macronutrients a large negative correlation between the rate of increase in protein consumption and rate of decrease in the percentage of population that are undernourished is measured (-0.81). A somewhat smaller, but still large correlation between the rate of increase in carbohydrate consumption and the rate of decrease in the percentage of population that are undernourished is measured (-0.72) and a medium to large negative correlation between the rate of increase in fat consumption and the rate of decrease in the percentage of population that are undernourished (-0.5).

Next, the focus is on the sensitivity of undernourishment to changes in the consumption of specific food groups in SADC. Average cereal and starchy root consumption in SADC during the period 2003-2005 are almost equal at approximately 350 g/pp/day. This compares to milk consumption of 100 g/pp/day, alcoholic beverages of 90 g/pp/day, fruit consumption at 85 g/pp/day, vegetable consumption of 60 g/pp/day, meat consumption of 50 g/pp/day, sugar and sweeteners at 50 g/pp/day, vegetable oils, pulses, and fish and seafood at 20 g/pp/day each, oil crops at 8 g/pp/day and offals of 4 g/pp/day. Aquatic products, spices,

stimulants and tree nuts make a small contribution to overall consumption.

The change in the consumption of cereals has a medium negative relationship to the percentage of population undernourished (-0.49) and to the change in the number of undernourished people (-0.41) over the period 1990-1992 to 2004-2006.

The change in the consumption of starchy roots has a much stronger negative relationship (-0.7) to the change in the percentage of population undernourished and to the change in the number of undernourished people (-0.61) over the period 1990-1992 to 2003-2005. This relationship is mostly evident where an increase in the consumption of starchy roots is associated with an absolute reduction in the number of undernourished people (Malawi and Angola), or a decrease in the consumption of starchy roots is associated with an increase in the number of undernourished people (the DRC and Tanzania).

**The strongest negative relationship between change in consumption and change in the percentage of population undernourished (-0.75) and the number of undernourishment (-0.79) is found for fruit.** The only two countries that have seen an increase in fruit consumption over the period 1990-1992 to 2003-2005, namely Malawi and Mauritius, have shown a reduction in or no change in the number of people undernourished respectively. All other countries, with the notable exception of Angola, have shown a trend of decreasing fruit consumption and increasing undernourishment.



The consumption of alcoholic beverages has a strong negative relationship with changes in the number of people undernourished (-0.53) and with changes in the percentage of the population that is undernourished (-0.57). **Countries that show a decrease in the number of people that are undernourished also show an increase in the consumption of alcoholic beverages** (Angola, Malawi and Mozambique).

Other medium negative correlations between the change in consumption and the change in the number of undernourished people are found for oil crops (-0.46), meat (-0.44) and pulses (-0.41). Small negative correlations are found for vegetable oils (-0.25), vegetables (-0.1), fish and seafood (-0.05), and eggs (-0.03), while small positive correlations are found for sugar and sweeteners (+0.05), offals (+0.03) and animal fats (+0.07). A large positive correlation was found for the consumption of milk (+0.53). The positive correlation with milk was also tested for shorter time frames. From 1990-1992 to 1995-1997 the consumption of milk was also positively related to undernourishment, although the correlation is weaker (+0.24). This is a counterintuitive result for which no possible explanations were found yet and further statistical testing is needed before final conclusions can be drawn.

**On the basis of this linear analysis it is suggested that longer-term changes in undernourishment is largely negatively correlated to changes in consumption of fruits, starchy roots and to some extent alcoholic beverages, with medium negative correlations to**

changes in the consumption of oil crops, meat, cereals and pulses.

Not only the food groups, but also the consumption of specific food items within a group, provide important information on the diversity of consumption and susceptibility to risks. Most of SADC is very dependent on cassava or maize. Botswana, Mauritius and Swaziland are the least dependent on one specific food item. Fruit consumption, as a percentage of total consumption in a specific country, is highest in Madagascar and Malawi, followed by Angola and Swaziland. Beverage consumption, as a percentage of total consumption in a specific country, is highest in Tanzania, Botswana, Swaziland and Zambia (Table 6).

## Food production

There are three sources of food for consumption namely own production, net imports (imports-exports) and food aid.

Average own production in SADC stagnated at approximately 1455 g/pp/day between the periods 1990-1992 and 2003-2005. Between 1990-1992 and 2003-2005, production increased the most in Angola (126%), Malawi (76%) and Mozambique (19%), and decreased most in the DRC (-44%), Tanzania (-23%) and Madagascar (-22%). The standard deviation of average food production also declined by 9% over the period 1990-1992 to 2003-2005 indicating some, but little, convergence in production between SADC countries.

There are relatively large negative correlations between the rate of

Table 6: Dependencies on food items (% of total consumption per country, based on the period 2003–2005)

|                                  | >50%    | 40–50% | 30–40%  | 25–30%       | 20–25%            | 15–20%      | 10–15%               | 6–10%                                            | 5%                         | 4%                                    |
|----------------------------------|---------|--------|---------|--------------|-------------------|-------------|----------------------|--------------------------------------------------|----------------------------|---------------------------------------|
| Angola                           |         |        | Cassava |              |                   |             |                      | Maize, Sweet Potatoes, Wheat                     | Beer                       | Bananas, Vegetables, Potatoes, Sugar  |
| Botswana                         |         |        |         |              |                   | Milk, whole | Maize, Roots other   | Wheat, Beer, Sorghum, Sugar, Beverages fermented | Vegetables                 | Potatoes                              |
| Democratic Republic of the Congo | Cassava |        |         |              |                   |             |                      |                                                  | Maize                      | Beverages, fermented;                 |
| Lesotho                          |         | Maize  |         |              |                   |             | Wheat, Potatoes      |                                                  | Milk, whole;               | Sugar                                 |
| Madagascar                       |         |        |         | Cassava      | Rice              |             |                      | Milk, whole                                      | Fruits, Sweet Potatoes     | Maize, Vegetables, Bananas            |
| Malawi                           |         |        |         | Maize        | Cassava, Potatoes |             |                      |                                                  | Bananas                    | Plantains;                            |
| Mauritius                        |         |        |         |              |                   | Wheat       | Milk, whole          | Maize, Vegetables, Milk, skimmed                 | Sugar, Beer                | Fruits, other: Poultry/Meat           |
| Mozambique                       | Cassava |        |         |              |                   |             | Maize                |                                                  | Wheat                      | Rice,                                 |
| Namibia                          |         |        |         | Roots, other |                   |             | Milk, whole          | Beer, Maize, Wheat, Millet                       |                            | Sugar                                 |
| Swaziland                        |         |        |         |              |                   |             | Maize, Milk whole    | Beverages, fermented; Roots, other; Wheat        | Sugar                      | Bovine Meat, Grapefruit, Beer, Fruits |
| United Republic of Tanzania      |         |        |         |              |                   | Maize       | Beverages, fermented |                                                  | Sweet Potatoes, Vegetables | Milk, whole; Rice;                    |
| Zambia                           |         |        | Cassava |              |                   |             |                      |                                                  | Vegetables, Wheat          | Sugar                                 |
| Zimbabwe                         |         |        | Maize   |              | Cassava           |             |                      | Beverages, fermented Sugar                       | Milk, whole; Cassava       | Beverages, fermented;                 |

Table 7: Food production per food group (g/pp/day)

|                          | 1990-2 | 1995-7 | 2003-5 | % ch 1990-2 to 2003-5 |
|--------------------------|--------|--------|--------|-----------------------|
| Alcoholic Beverages      | 24     | 29     | 34     | 42%42%                |
| Eggs                     | 1      | 1      | 2      | 35%35%                |
| Fish, Seafood            | 25     | 29     | 29     | 16%16%                |
| Starchy Roots            | 152    | 141    | 174    | 15%15%                |
| Pulses                   | 7      | 8      | 8      | 7%7%                  |
| Meat                     | 17     | 16     | 16     | -5%-5%                |
| Vegetables               | 22     | 22     | 20     | -7%-7%                |
| Cereals - Excluding Beer | 81     | 95     | 75     | -8%-8%                |
| Sugar & Sweeteners       | 97     | 83     | 85     | -12%-12%              |
| Offals                   | 2      | 2      | 1      | -18%-18%              |
| Milk - Excluding Butter  | 26     | 21     | 21     | -20%-20%              |
| Fruits - Excluding Wine  | 41     | 32     | 33     | -22%-22%              |
| Vegetable Oils           | 3      | 2      | 2      | -26%-26%              |
| Oilcrops                 | 14     | 13     | 10     | -27%-27%              |
| Animal Fats              | 1      | 1      | 1      | -44%-44%              |

increase in total own food production and the rate of decrease in the number of undernourished people (-0.57), as well as between the rate of increase in total own food production and change in the percentage of the population that is undernourished (-0.61). This means that **the quicker the rate of total own production increased/decreased, the faster the number of people undernourished decreased/increased in SADC.**

Most of SADC's own production (2003-2005) is starchy roots (174 g/pp/day) followed by sugar and sweeteners (85 g/pp/day), and cereals (excl. beer) (75 g/pp/day). The largest increases in production over the period between 1990-1992 and 2003-2005 occurred for alcoholic beverages (42%), eggs (35%), fish and seafood (16%), and starchy roots (15%). The largest decreases over the

same period were for animal fats (-44%), oil crops (-27%), vegetable oils (-26%) and fruits (-22%). Cereal production over the same time period declined by 8% (Table 7).

Changes in the own production per food group correlates strongly with changes in the number of undernourished people for pulses (-0.57) and fruits (-0.52). Medium correlations were found for starchy roots (-0.42), vegetables (-0.33), oil crops (-0.31), and sugar and sweeteners (-0.3). Only small correlations were found for meat (-0.29), cereals (-0.27), alcoholic beverages (-0.26), fish and seafood (-0.11), vegetable oils (-0.1), and eggs (-0.06). This means that an increase/decrease in own production of especially pulses and fruits have the highest impact on an increase/decrease in the number of people undernourished in SADC.

Table 8: Imports per food group (g/pp/day)

|                          | 1990-2 | 1995-7 | 2003-5 | % ch 1990-2 to 2003-5 |
|--------------------------|--------|--------|--------|-----------------------|
| Fish, Seafood            | 20     | 42     | 39     | 93%93%                |
| Vegetable Oils           | 22     | 28     | 41     | 85%85%                |
| Offals                   | 1      | 1      | 1      | 50%50%                |
| Meat                     | 14     | 18     | 21     | 49%49%                |
| Alcoholic Beverages      | 13     | 13     | 18     | 43%43%                |
| Starchy Roots            | 15     | 17     | 20     | 40%40%                |
| Eggs                     | 1      | 1      | 1      | 33%33%                |
| Fruits - Excluding Wine  | 37     | 42     | 47     | 25%25%                |
| Milk - Excluding Butter  | 72     | 85     | 89     | 24%24%                |
| Sugar & Sweeteners       | 48     | 57     | 54     | 12%12%                |
| Pulses                   | 9      | 9      | 10     | 4%4%                  |
| Cereals - Excluding Beer | 363    | 350    | 368    | 1%1%                  |
| Vegetables               | 28     | 27     | 26     | -9%-9%                |
| Oilcrops                 | 11     | 7      | 9      | -13%-13%              |
| Animal Fats              | 9      | 5      | 3      | -67%-67%              |

## Food imports

Imports (g/pp/day) increased by 13% for the whole of SADC from 358 g/pp/day in the period 1990-1992 to 405 g/pp/day in 2003-2005. The largest increases in imports were in Tanzania (+182%), Madagascar (+129%) and Swaziland (+89%), followed by Angola (+52%) and Mauritius (+51%). Imports declined fastest in Malawi (-51%), Lesotho (-43%) and Botswana (-32%) over this time period. The standard deviation of imports per country increased by 38% over the same time period, indicating a divergence in import dependence between SADC countries.

There is a small positive correlation (0.19) between the rate of change in total imports and the rate of change in the number of undernourished people. This suggests that **imports**

**on average have not contributed meaningfully to a decline in undernourishment in the region.**

Most (by far) of SADC's food imports are cereals, followed by milk, sugar and sweeteners, fruits, vegetable oils, as well as fish and seafood. The largest increases in imports over the period from 1990-1992 to 2003-2005 were fish and seafood, vegetable oils, offals, meat, alcoholic beverages, and starchy roots. The largest decreases in imports over the same period were animal fats, oil crops and vegetables (Table 8).

## Food exports

Exports (g/pp/day) increased by 22% for the whole of SADC from 303 g/pp/day in the period 1990-1992 to 369 g/pp/day in 2003-2005. The biggest exporters in relation to their populations

Table 9: Exports per food group (g/pp/day)

|                          | 1990–2 | 1995–7 | 2003–5 | % ch –2 to 2003–5 |
|--------------------------|--------|--------|--------|-------------------|
| Alcoholic Beverages      | 8      | 123    | 474    | 5667%5,667%       |
| Vegetable Oils           | 5      | 11     | 27     | 400%400%          |
| Fish, Seafood            | 345    | 734    | 915    | 165%165%          |
| Starchy Roots            | 16     | 16     | 36     | 117%117%          |
| Animal Fats              | 3      | 3      | 5      | 100%100%          |
| Milk - Excluding Butter  | 30     | 74     | 55     | 82%82%            |
| Pulses                   | 8      | 16     | 11     | 33%33%            |
| Fruits - Excluding Wine  | 318    | 326    | 403    | 27%27%            |
| Cereals - Excluding Beer | 282    | 362    | 304    | 8%8%              |
| Eggs                     | 0      | 0      | 0      | 0%                |
| Vegetables               | 22     | 16     | 22     | 0%0%              |
| Sugar & Sweeteners       | 2921   | 2603   | 2764   | -5%-5%            |
| Meat                     | 118    | 137    | 71     | -40%-40%          |
| Oilcrops                 | 96     | 66     | 44     | -54%-54%          |
| Offals                   | 3      | 3      | 0      | -100%-100%        |

are Swaziland, Mauritius and Namibia. The largest increases in exports were in Zambia (+733%) - although from a very low base - and Namibia (+150%), Malawi (+42%), and South Africa (+41%). Exports came to a standstill in the DRC and Lesotho, with substantial decreases in Botswana (-63%), Zimbabwe (-63%) and Madagascar (-58%). The standard deviation of imports per country increased by 19% over the same time period, indicating a divergence in exports between SADC countries.

There is a small negative correlation (-0.15) between the rate of change in total exports and the rate of change in the number of undernourished people. This suggests that exports on average have also not meaningfully affected the increase in undernourishment in the region.

Most of SADC's food exports are sugar and sweeteners (by far), followed by fish and seafood, alcoholic beverages, fruits (excl. wine) and cereals (excl. beer). The largest increases in exports over the period 1990-1992 to 2003-2005 were alcoholic beverages - from a very low base - and vegetable oils, fish and seafood, starchy roots, and animal fats (Table 9).

## Food aid

Cereal food aid (g/pp/day) decreased by 56% for the whole of SADC from 44 g/pp/day in the period 1990-1992 to 19 g/pp/day in 2003-2005. The largest increases in cereal food aid were in South Africa (+763%) - from a very low base - and Tanzania (+264%). Food aid declined fastest in Mauritius (-100%),



Table 10: Summary of food consumption, production, trade and aid, 2003–2005 (g/pp/day)

|                                  | Consumption | Own production | Food Imports | Food Exports | Cereal Food Aid | Stocks |
|----------------------------------|-------------|----------------|--------------|--------------|-----------------|--------|
| Angola                           | 1161        | 2025           | 337          | 3            | 21              | 1219   |
| Botswana                         | 1272        | 710            | 581          | 30           | 0               | -12    |
| Democratic Republic of the Congo | 1100        | 1082           | 47           | 0            | 4               | 33     |
| Lesotho                          | 1036        | 499            | 400          | 0            | 52              | -86    |
| Madagascar                       | 1111        | 1277           | 88           | 14           | 5               | 245    |
| Malawi                           | 1342        | 1641           | 47           | 47           | 24              | 323    |
| Mauritius                        | 1617        | 1712           | 1663         | 1447         | 0               | 312    |
| Mozambique                       | 1150        | 1408           | 164          | 22           | 20              | 421    |
| Namibia                          | 1387        | 1995           | 595          | 910          | 11              | 304    |
| Swaziland                        | 1438        | 2636           | 1178         | 2134         | 38              | 279    |
| United Republic of Tanzania      | 1335        | 1482           | 85           | 47           | 8               | 193    |
| Zambia                           | 945         | 921            | 88           | 68           | 27              | 22     |
| Zimbabwe                         | 817         | 830            | 140          | 63           | 42              | 132    |
| South Africa                     | 1483        | 2132           | 266          | 369          | 4               | 549    |
| SADC avg                         | 1228        | 1453           | 405          | 389          | 18              | 281    |
| Stddev                           | 222         | 613            | 477          | 664          | 17              | 323    |

Botswana (-100%), Mozambique (-84%) and Malawi (-75%). The standard deviation of food aid per country decreased by 57% over the same time period, indicating a divergence in food aid dependence among the SADC countries. Most food aid (per person) flows to Lesotho, followed by Zimbabwe and Swaziland. The DRC, Tanzania and Madagascar - countries with the highest prevalence of undernourishment - receive very little food aid per person.

There is a small positive correlation (0.23) between the rate of change in food aid and the rate of decrease in number of undernourished people. This suggests that changes in food aid have not contributed meaningfully to a decline in undernourishment in the region.

## Regional supply and demand for food

The regional supply and demand for food for the period 2003-2005 is summarised in Table 10. Similar tables were developed for the periods 1995-1997, and 1990-1992 (data not shown). ‘Stocks’ is the balancing figure between what is consumed or demanded and what is supplied through production, net imports (imports-exports) and food aid. Stock levels in SADC have declined from an average of 323 g/pp/day in 1990-1992 to 281 g/pp/day in 2003-2005.

In recent years negative stock levels have been recorded for Lesotho and Botswana. Net importers of food (Imports-Exports>0) are expected to be vulnerable to rising food prices (FAO/

Table 11: Change in food supply and demand, 1990 to 2005

|                                  | Consumption | Own production | Food Imports | Food Exports | Cereal Food Aid | Stocks |
|----------------------------------|-------------|----------------|--------------|--------------|-----------------|--------|
| Angola                           | 14%         | 126%           | 52%          | 100%         | -21%            | 884%   |
| Botswana                         | -9%         | -9%            | -32%         | -63%         | -100%           | -107%  |
| Democratic Republic of the Congo | -33%        | -44%           | 13%          | -100%        | -30%            | -90%   |
| Lesotho                          | -1%         | -6%            | -43%         | -100%        | -16%            | -138%  |
| Madagascar                       | -13%        | -22%           | 129%         | -58%         | -52%            | -37%   |
| Malawi                           | 52%         | 76%            | -51%         | 42%          | -75%            | 53%    |
| Mauritius                        | 19%         | -16%           | 51%          | -7%          | -100%           | 24%    |
| Mozambique                       | 7%          | 19%            | -14%         | -27%         | -84%            | 7%     |
| Namibia                          | 22%         | 24%            | 13%          | 150%         | -61%            | -54%   |
| Swaziland                        | 4%          | -10%           | 89%          | 31%          | -3%             | -52%   |
| United Republic of Tanzania      | -19%        | -23%           | 182%         | 31%          | 264%            | -30%   |
| Zambia                           | -5%         | -4%            | -20%         | 733%         | -61%            | -83%   |
| Zimbabwe                         | -3%         | -13%           | -18%         | -63%         | -47%            | -33%   |
| South Africa                     | 1%          | 3%             | -10%         | 41%          | 763%            | -8%    |
| SADC avg                         | 0%          | -0%            | 13%          | 22%          | -55%            | -13%   |
| stddev                           | -16%        | -9%            | 38%          | 19%          | -58%            | 82%    |

WFP, 2009:13). Such countries include especially Botswana, Lesotho, Angola, Mauritius and Mozambique, but also Zimbabwe, Madagascar, the DRC and Tanzania. The only two countries that were net exporters (at least until 2003-2005) were South Africa and Namibia.

The rates of change from 1990-1992 to 2003-2005 for food supply and demand in SADC is illustrated in Table 11. For SADC as a whole stocks declined (-13%), consumption and production stagnated, while both imports (13%) and exports (41%) increased and food aid decreased significantly (-55%). Within SADC and over this time period, there was convergence (as measured through standard deviation) in the amount of food aid received (-58%), consumption (-19%) and own production (-9%), but

divergence in stocks (82%), food imports (38%), and exports (19%).

## Value of trade

The value of SADC food exports and imports,<sup>2</sup> compared with both the rest of the world and within SADC increased rapidly over recent years. The value of imports increased more rapidly than exports though. Net exports turned negative in 2002 and have rapidly declined since then. **The terms of trade (ToT) also declined by an average of 1.9% pa from 2000-2006.** The ToT between SADC and the rest of the world declined more (-3.1% pa) than the ToT between SADC countries themselves (-0.9%) (Table 12).

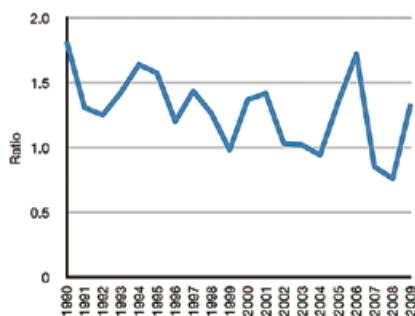
<sup>2</sup> Categories C02, H01-H15 in FAO Trade Statistics.

Table 12: Value of SADC food imports and exports, US\$bn

|                        | 2000 | 2001 | 2002  | 2003  | 2004  | 2005  | 2006  | average<br>%ch pa<br>2000–<br>2006 |
|------------------------|------|------|-------|-------|-------|-------|-------|------------------------------------|
| Exports - World        | 3.60 | 3.56 | 3.71  | 4.83  | 5.79  | 6.48  | 5.96  | 9.4%                               |
| Exports - intra SADC   | 4.44 | 4.10 | 4.35  | 5.54  | 6.91  | 8.13  | 9.21  | 15.4%                              |
| Imports - World        | 2.67 | 2.36 | 3.19  | 3.76  | 4.60  | 4.71  | 5.64  | 15.9%                              |
| Imports - intra SADC   | 5.19 | 5.06 | 5.41  | 6.65  | 9.53  | 10.70 | 11.51 | 17.4%                              |
| Exports minus Imports  | 0.18 | 0.24 | -0.54 | -0.04 | -1.42 | -0.79 | -1.97 | -170.0%                            |
|                        |      |      |       |       |       |       |       |                                    |
| Terms of Trade - all   | 1.02 | 1.03 | 0.94  | 1.00  | 0.90  | 0.95  | 0.89  | -1.9%                              |
| Terms of Trade - World | 1.35 | 1.51 | 1.16  | 1.29  | 1.26  | 1.38  | 1.06  | -3.1%                              |
| Terms of Trade - SADC  | 0.86 | 0.81 | 0.80  | 0.83  | 0.73  | 0.76  | 0.80  | -0.9%                              |

The highest value exports in SADC are sugar and sweeteners, fish and seafood, and fruits - together almost accounting for 77% of all food exports

Figure 4: Sugar-cereal exchange



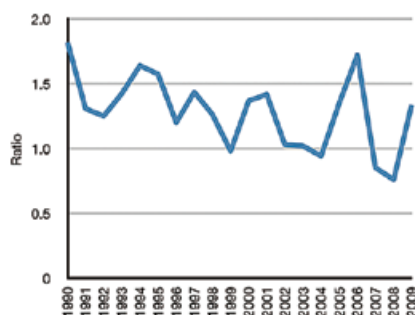
from SADC countries. These groups have also shown substantial growth in exports over the period 2000-2006. Despite specialisation in these higher value food groups, and as evident by the declining terms of trade, it was not enough to offset the increasing costs of food imports.

The main reason for this can be clearly seen in Figure 4, illustrating the declining ratio between the sugar price index and the cereal price index over time. This means that cereals (the main food import into SADC), have become more and more expensive in relation to sugar (the main export from SADC) over time.

## Prices

International food prices started rising rapidly in 2006, peaked in 2007 and dropped again in 2008 and 2009. Cereal and dairy prices peaked at a higher level, while meat prices peaked at much lower levels. Sugar prices peaked earliest (already in 2005), dropped again in 2006, and have risen since (Figure 5).

Figure 5: Price indices for various food groups (2002–2004 = 100)



In the period 1990–1992 to 1995–1997, food consumption per person in SADC decreased on average by 3.3%, while prices rose by 13%. In the period 1995–1997 to 2003–2005, food consumption increased on average by 4%, while prices decreased by 10%. Price elasticity of consumption for the period 1990–1992 to 1995–1997 is 0.26. For the period 1995–1997 to 2003–2005 price elasticity increased to 0.36. That means that for every one percent increase in the international food price, food consumption in SADC decreased by between 0.26% and 0.36%, depending on the time period. For SADC as a whole, consumption is still relatively inelastic to international food price changes, but there is evidence that this elasticity has increased in recent years (up to 2005). Price elasticities of

demand for food are typically between 0.85 and 0.6 in lower income countries.

The variation in international food price elasticities per country and per time period is large though. Malawi (3.00), Namibia (2.31), Swaziland (1.58) and the DRC (1.63) show relatively elastic consumption (a price elasticity  $> 1$ ), or a high sensitivity to changing international food prices. Higher price elasticities for food consumption are usually a reflection on the availability of substitutes, high percentages of expenditure on food, or relatively longer times of price changes.

The biggest change in price elasticity of consumption between the two time periods 1990–1992 to 1995–1997 and 1995–1997 to 2003–2005 is in Namibia, followed by Mozambique, Zambia, Botswana, Malawi and Swaziland. It is in these countries that consumption became much more responsive to price changes in recent years up to 2005. For the same time period, consumption became less responsive to price changes in Tanzania, but also to some extent in Zimbabwe.

To answer the question on how sensitive undernourishment is to changing prices we calculated the price elasticity of undernourishment – the percentage change in the number of undernourished people divided by the percentage change in international food prices. The results are presented in Table 13. From these numbers it is evident that undernourishment in all SADC countries became remarkably inelastic (0.35) to international prices (price elasticity of undernourishment  $< 1$ ) in recent years (up to 2006) when compared to the early nineties (3.51).

Table 13: Price elasticities of undernourishment

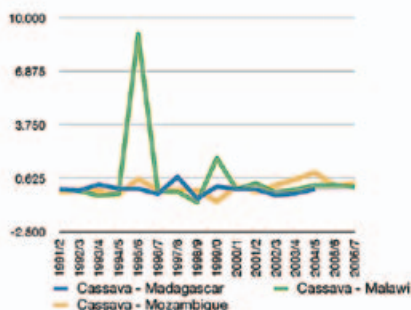
| %ch undernourished/%<br>ch food price | %ch 1990–2 to 1995–7 | % ch 1995–7 to 2000–2 | % ch 2000–2 to 2004–6 |
|---------------------------------------|----------------------|-----------------------|-----------------------|
| DRC                                   | 10.20                | 1.56                  | 0.71                  |
| SADC                                  | 3.51                 | 0.63                  | 0.35                  |
| Tanzania                              | 4.89                 | 0.14                  | 0.31                  |
| Malawi                                | 1.07                 | 0.22                  | 0.30                  |
| Zambia                                | 1.40                 | 0.95                  | 0.30                  |
| Madagascar                            | 2.96                 | 0.53                  | 0.29                  |
| Zimbabwe                              | 2.15                 | 0.00                  | 0.26                  |
| Mozambique                            | 0.38                 | 0.33                  | 0.18                  |
| Angola                                | 0.11                 | 0.06                  | 0.14                  |
| Lesotho                               | 0.00                 | 2.05                  | 0.00                  |
| Botswana                              | 2.57                 | 1.03                  | 0.00                  |
| Namibia                               | 1.92                 | 0.82                  | 0.00                  |
| Swaziland                             | 7.70                 | 0.00                  | 0.00                  |
| Mauritius                             | 0.00                 | 0.00                  | 0.00                  |

The highest sensitivity in more recent years (2000-2002 to 2004-2006) is still in the DRC - a 1% change in international prices leads to a 0.71% change in the number of undernourished people in this country.

According to a report on the state of food insecurity, the price of staples was pushed beyond the reach of millions of poor people in recent years (FAO/WFP, 2009). At the end of 2008, domestic staple food prices remained, on average, 17% higher than two years earlier and have led many poor families to sell assets or sacrifice health care, education or food just to stay afloat (FAO/WFP, 2009:4). Rice prices increased the most over the two years to the end of 2008 (mostly affecting Madagascar in SADC). Maize price increases were approximately 13% and cassava/potatoes approximately 7% over this time.

To test the question of what the main drivers of price changes were, we first analysed the domestic producer prices (US\$/t) of main staples in a few SADC countries for which data was available. The results show that changes in producer prices for staples in SADC are not necessarily closely linked to rising international food prices. For cassava the highest year on year increase was almost 1000% in Malawi from 1995 to

Figure 6: Domestic cassava prices in selected SADC countries, 1991–2007

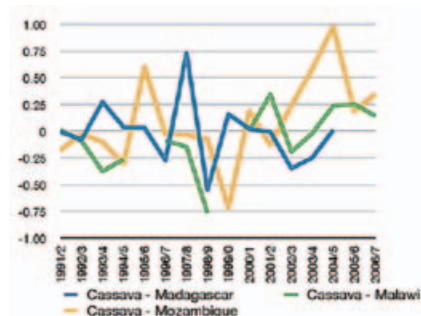


1996 and almost 200% in Malawi from 1999 to 2000 (Figure 6).

When omitting these two outliers, the highest increases in domestic cassava prices were in 2004 to 2005 in Mozambique (100%), followed by 75% in 1997 to 1998 in Madagascar. Cassava prices have increased by 15-35% in 2005-6 and 2006-7 (Figure 7).

Given this data, cassava prices do fluctuate largely, but seem to be primarily driven by specific local factors

Figure 7: Domestic cassava prices in selected SADC countries, 1991–2007, excl. outliers



and do not correlate well to rising international food prices.

The same applies to maize. For maize the highest year on year increase was almost 300% in Malawi from 1995 to 1996, and almost 120% in Namibia from 2002 to 2003 and in Zimbabwe 2000 to 2001. In more recent years maize producer prices have changed year-on-year from -9% in 2005-2006 in Mozambique to 47% in 2006-2007 in South Africa.

The next question is how domestic producer prices correlate to changes in international food prices. Only selected datasets were available. The correlation between year-on-year changes in domestic producer prices for the main staples cassava, maize and cereals, and the changes in the international food and cereals price indices do not show strong relationships. Domestic producer prices and international prices for food in general, and specifically cereals, are not strongly correlated in selected SADC countries with the notable

Table 14: Correlation between changes in domestic producer and international food and cereal prices

|                             | Food Price Index | Cereals Price Index |
|-----------------------------|------------------|---------------------|
| Maize - Mauritius           | 0.69             | 0.58                |
| Maize - South Africa        | 0.47             | 0.62                |
| Cassava - Malawi            | 0.36             | 0.39                |
| Cereals, nes - South Africa | 0.35             | 0.47                |
| Cassava - Mozambique        | 0.35             | 0.27                |
| Maize - Namibia             | 0.34             | 0.14                |
| Maize - Zimbabwe            | 0.26             | 0.15                |
| Maize - Mozambique          | -0.02            | 0.02                |
| Potatoes - Malawi           | -0.04            | 0.16                |
| Cassava - Madagascar        | -0.06            | 0.03                |
| Maize - Malawi              | -0.10            | 0.08                |
| Rice - Madagascar           | -0.21            | -0.12               |



exception of Mauritius and South Africa, which are also both relatively open economies (Table 14).

This provides some evidence that over the period 1990-2007 rising international food prices are only weakly correlated to domestic producer prices of main staples in selected SADC countries. These findings cast doubt on the thesis that domestic prices are mainly fueled by rising costs of imports for SADC countries. This may well be the case for Mauritius and South Africa, both countries which do not suffer from large undernourished populations. It seems that the reasons for undernourishment, at least over the longer-term, should be sought elsewhere and not so much in rising international food prices alone. A full analysis for all SADC countries was not feasible due to limitations of domestic food price time series though, and final conclusions cannot be drawn for SADC as a whole yet.

Further evidence is that the recent (2005-2007) average producer price changes in domestic staples for selected SADC countries were high (+17%), but they were in the same order as price spikes during the period 2000-2002 (+16-17%), and slightly higher than the price spike in 1995-1996 (+15%) (excluding extreme price spikes in Malawi in 1995-1996) (Figure 9). This observation supports the thesis that local production and distribution conditions had a larger influence on staple prices than international food prices.

What is telling from Figure 9 is that domestic staple food producer prices have now increased for seven years in a row, four of which increased with 15% per annum and more. These cumulative

price increases in staples would have had a large impact on poor households' ability to cope. According to the FAO/WFP (2009), higher food prices primarily hurt the rural landless, female-headed households and the urban poor, people who already have limited ability to cope. High food prices, no doubt, have an impact on undernourishment but the reasons for rises in domestic producer prices seems to be mainly driven by factors other than international food prices.

Figure 9: Average annual domestic producer price movements, selected SADC countries, 1991-2007



The next question is how domestic retail prices behaved. The FAO GIEWS database provides time series on retail prices for main staples, but only for more recent years. Using the datasets that were available for the main staples, the following are evident from the data analysed:

- The average domestic retail price for staples in 2007 was \$253/t compared to an average national producer price of \$188/t.
- The variation in domestic retail prices was higher than the variation in national producer prices. The national production price coefficient of variation (standard deviation divided by the mean)

is 0.22 compared to a domestic retail price coefficient of variation of 0.50. This signals large, mainly spatial, variation in the retail price of staples, and signals weak market integration in the region.

- Although domestic prices increased rapidly in 2008, they started decreasing in 2009, especially from July 2009 onwards. Domestic staple prices for the food products and markets analysed rose on average 86% in 2009, but with a very large variation across domestic markets - the domestic price coefficient of variation was 1.79. If maize in Harare is excluded, prices rose by 43% on average in 2009 with a domestic price coefficient of variation of 0.90, in both cases signaling weak market integration in the region.
- Maize prices in Zimbabwe climbed exceptionally fast in 2008 (563%) and the first half of 2009, but has since

started to come down rapidly.

- Cassava prices in northern Mozambique are still rising rapidly and have not decreased substantially in Brunia DRC, yet.

The recent price spikes seen in 2007 and 2008 have come to an end, most notably since the middle of 2009. In SADC, downward trends in inflation have already been recorded on the back of improvements in the supply of food in the region and an ease of oil prices (SADC, 2009). Not only are costs coming down, but production is also increasing. According to SADC (2009) the region is expected to record a cereal surplus of 476,000 tonnes in 2009 compared to a deficit of 1.78 million tonnes in 2008.

## Income

Per capita average income in SADC (data from Economywatch.com) was

Table 16: Per capita income growth, percentage

|              | GDP PPP<br>1990–2 to<br>1995–7 m,<br>% ch | GDP PPP<br>1995–7 to<br>2000–2 m,<br>% ch | GDP PPP<br>1995–7 to<br>2003–5, % ch | GDP PPP<br>2000–2 to<br>2004–6, m<br>% ch | GDP PPP<br>1990–2 to<br>2003–5 | GDP PPP<br>1990–2 to<br>2004–6, m<br>% ch |
|--------------|-------------------------------------------|-------------------------------------------|--------------------------------------|-------------------------------------------|--------------------------------|-------------------------------------------|
| Angola       | -5%                                       | 18%                                       | 48%                                  | 62%                                       | 40%                            | 82%                                       |
| Botswana     | 25%                                       | 44%                                       | 82%                                  | 36%                                       | 127%                           | 143%                                      |
| DRC          | -30%                                      | -18%                                      | -7%                                  | 21%                                       | -35%                           | -30%                                      |
| Lesotho      | 26%                                       | 15%                                       | 28%                                  | 18%                                       | 61%                            | 70%                                       |
| Madagascar   | 1%                                        | 10%                                       | 16%                                  | 11%                                       | 17%                            | 23%                                       |
| Malawi       | 25%                                       | 6%                                        | 16%                                  | 15%                                       | 45%                            | 53%                                       |
| Mauritius    | 40%                                       | 34%                                       | 54%                                  | 22%                                       | 115%                           | 128%                                      |
| Mozambique   | 31%                                       | 50%                                       | 89%                                  | 36%                                       | 148%                           | 168%                                      |
| Namibia      | 12%                                       | 14%                                       | 40%                                  | 37%                                       | 57%                            | 74%                                       |
| South Africa | 10%                                       | 15%                                       | 34%                                  | 25%                                       | 48%                            | 59%                                       |
| Swaziland    | 16%                                       | 18%                                       | 35%                                  | 21%                                       | 57%                            | 65%                                       |
| Tanzania     | 8%                                        | 20%                                       | 46%                                  | 31%                                       | 58%                            | 69%                                       |
| Zambia       | -15%                                      | 11%                                       | 27%                                  | 22%                                       | 8%                             | 15%                                       |
| Zimbabwe     | 7%                                        | -1%                                       | -17%                                 | -19%                                      | -11%                           | -14%                                      |

approximately 3700 PPP\$ over the period 2004-2006, up from an average of almost 2000 PPP\$ over the period 1990-1992. On this measure Botswana, Mauritius and South Africa were the most successful economies. Zimbabwe, the DRC, Malawi, Mozambique and Madagascar were the worst, with a per capita income of less than 1000 PPP\$.

Growth in per capita income over the period 1990-1992 to 2004-2006 was highest in Mozambique (168%), Botswana (143%) and Mauritius (128%). Both the DRC and Zimbabwe have shown negative growth in per capita income over this period. In more recent years (2000-2002 to 2004-2006), per capita growth was the highest in Angola (62%), Namibia (37%), Mozambique (36%) and Botswana (36%) (Table 16).

These changes in income are important for an analysis of food security. It is not only prices that affect demand (or consumption), but also

changing incomes. The income elasticity of consumption measures the change in consumption to a change in income. If the income elasticity is  $>1$ , the good is income elastic and can be classified as a luxury good. If income elasticity  $<1$  and  $>0$ , then the good is income inelastic and can be classified as a normal good. If income elasticity  $<0$ , the good is income inelastic or can be classified as an inferior good.

Countries where food consumption became a luxury item over the period 1990-1992 to 2003-2005 include Malawi (with income elasticities greater than one or, in other words, a good for which demand proportionally increases more if income rises) with the DRC close behind. Based on this analysis, countries where food consumption was an inferior good over the same period include Madagascar, Zambia, Tanzania, Botswana and Lesotho (all have income elasticities less than zero or, in other words, a good that decreases in demand when consumer income rises).

Table 17: Income elasticities of consumption

|              | 1990-2 to 1995-7 | 1995-7 to 2003-5 | 1990-2 to 2003-5 |
|--------------|------------------|------------------|------------------|
| Angola       | -1.57            | 0.12             | 0.34             |
| Botswana     | -0.13            | -0.08            | -0.07            |
| DRC          | 0.68             | 2.25             | 0.95             |
| Lesotho      | 0.12             | -0.15            | -0.02            |
| Madagascar   | -7.49            | -0.38            | -0.74            |
| Malawi       | 0.71             | 1.83             | 1.16             |
| Mauritius    | 0.24             | 0.15             | 0.16             |
| Mozambique   | 0.02             | 0.07             | 0.05             |
| Namibia      | -0.03            | 0.56             | 0.39             |
| South Africa | -0.37            | 0.15             | 0.03             |
| Swaziland    | -0.60            | 0.44             | 0.07             |
| Tanzania     | -1.86            | -0.12            | -0.33            |
| Zambia       | 0.06             | -0.17            | -0.66            |
| Zimbabwe     | -1.17            | -0.33            | 0.29             |

There is a discernible shift towards higher income elasticities over time. The biggest shifts in income elasticities between the periods 1990-1992 to 1995-1997 and 1995-1997 to 2003-2005 occurred in Madagascar (-7.49 to -0.38) (much less inferior), Tanzania (-1.86 to -0.12) (much less inferior), Angola (-1.57 to 0.12) (from inferior to normal good), the DRC (0.68 to 2.25) (much more luxury good) and Malawi (0.71 to 1.83) (much more luxury good) (Table 17).

How sensitive was the number of undernourished people to changes in income? We calculated the percentage change in the number of undernourished people divided by the percentage change in income. One would expect the sign to be negative, i.e. an increase/decrease in income would lead to a decrease/increase in the number of people undernourished.

This clearly happened in the DRC, Zambia, Malawi and Angola in the early nineties, in the DRC, Namibia, Malawi

and Mozambique in the mid- to end-nineties, and only to some extent in Mozambique and Angola in the period 2000-2002 to 2004-2006. A decoupling between changes in income and undernourishment occurred; therefore, income growth has less and less of an impact on undernourishment. More problematic, however, is that an increase/decrease in income tends to be associated more with an increase/decrease in undernourishment. This is counterintuitive, but does suggest that the gains of per capita income growth do not lead to a reduction in undernourishment in SADC, and may even reinforce it (especially in the DRC, Madagascar and Malawi). It is only in the very high growth economies of Angola and Mozambique where small positive changes (i.e. 1% change in income leads to a 0.07% reduction in undernourishment in Angola, and 0.14% reduction in Mozambique) between income growth and a reduction in undernourishment is observed from 2000-2002 to 2004-2006 (Table 18). Angola and Mozambique both displayed

Table 18: Income elasticity of undernourishment

|            | 1990-2 to 1995-7 | 1995-7 to 2000-2 | 2000-2 to 2004-06 |
|------------|------------------|------------------|-------------------|
| Angola     | -0.28            | 0.08             | -0.07             |
| Botswana   | 1.34             | 0.57             | 0.00              |
| DRC        | -4.44            | -2.09            | 0.93              |
| Lesotho    | 0.00             | 3.34             | 0.00              |
| Madagascar | 41.21            | 1.32             | 0.74              |
| Malawi     | -0.56            | -0.90            | 0.57              |
| Mauritius  | 0.00             | 0.00             | 0.00              |
| Mozambique | 0.16             | -0.16            | -0.14             |
| Namibia    | 2.08             | -1.45            | 0.00              |
| Swaziland  | 6.22             | 0.00             | 0.00              |
| Tanzania   | 8.22             | 0.16             | 0.29              |
| Zambia     | -1.24            | 2.19             | 0.38              |
| Zimbabwe   | 4.05             | 0.00             | 0.39              |

average growth rates of almost 16% and 10% pa respectively over the period 2000-2008. This suggests that **an average rise in per capita income does not benefit those affected by undernourishment most** and where it does, very high rates of income growth are required. It is concluded that **rising average income in SADC dissipates to other goals rather than addressing undernourishment.**

## Expenditure

Expenditure on food consumption varies a lot between SADC countries and within individual countries. Combining all FAO estimates on the share of food consumption expenditure in total household consumption expenditure, based on surveys from before 1990 to 2004, one finds a wide range from 16% in urban Namibia (2003) to 78% for rural Malawi (1998). No data was available for the DRC and Angola. The long-term average across all these countries and all the household expenditure surveys is that roughly between 47% and 53% of all household consumption expenditure in SADC is spent on food consumption. The countries clustering at the lower end are Namibia, Swaziland, South Africa and Zimbabwe, while those clustering at the upper end are Malawi, Zambia, Mozambique, Tanzania, Madagascar and Botswana.

When placing this in the context of the discussion on price elasticities (discussed in an earlier section), it can be clearly seen that the high price elasticity of consumption in Malawi is likely to be related to the fact that the cost of food constitutes a large part of total household expenditure. In Namibia

and Swaziland, where food consumption expenditure as a percentage of total household expenditure is much lower, it is more likely to be related to the availability of substitutes.

## Relative size of the agricultural sector

A larger share of economic activity regarding agriculture is no solution in addressing undernourishment. The agricultural sector varies in size in SADC countries from 2-5% of GDP in Botswana, South Africa and Mauritius, to 30-55% in Tanzania, Malawi and the DRC. There is a very strong positive correlation (0.82) between the size of the agricultural sector and the number of people who are undernourished; i.e. the bigger the size of the agricultural sector in relation to a country's economy, the larger the number of undernourished people, and the smaller the size of the agricultural sector in relation to the economy, the smaller the number of undernourished people. If the DRC is excluded, the correlation is still strong, but less so (0.56). Negative, medium relationships are found between the relative size of the industry and mining sectors and the number of undernourished people (-0.46) and the relative size of the services sector and the number of undernourished people (-0.36), which means that an increase in the relative size of these sectors is associated with a reduction in the number of undernourished, although the relationship is not that strong.

There is also a large negative correlation between the relative size of agriculture in the economy and income (GDP per capita) (-0.61). **The bigger the relative size of the agricultural sector, the smaller the income per capita.**

Table 19: Agricultural population per hectare of arable and permanent crops land

| Country name                     | 1990–2 | 1995–7 | 2003–5 |
|----------------------------------|--------|--------|--------|
| Angola                           | 2.3    | 2.6    | 3.1    |
| Botswana                         | 1.2    | 1.6    | 1.6    |
| Democratic Republic of the Congo | 3.4    | 3.8    | 4.5    |
| Lesotho                          | 2.1    | 2.2    | 2.2    |
| Madagascar                       | 2.9    | 3.1    | 3.7    |
| Malawi                           | 4.1    | 4      | 3.6    |
| Mauritius                        | 1.6    | 1.4    | 1.2    |
| Mozambique                       | 3      | 3.2    | 3.3    |
| Namibia                          | 1.2    | 1.1    | 1.1    |
| South Africa                     | 0.5    | 0.4    | 0.4    |
| Swaziland                        | 1.8    | 1.9    | 1.8    |
| United Republic of Tanzania      | 2.2    | 2.5    | 2.8    |
| Zambia                           | 0.7    | 0.8    | 0.9    |
| Zimbabwe                         | 2.4    | 2.4    | 2.3    |

Undernourishment is strongly related to those countries that are stuck in (mainly) subsistence agriculture and that have not diversified to more industry-, mining- and service-driven economies yet. The number of undernourished people is strongly positively correlated to the agricultural population per hectare of arable and permanent crops land (0.67) (Table 19). The DRC has an agricultural population of almost 4.5 people per hectare, followed by Madagascar with 3.7, Malawi with 3.6 and Mozambique with 3.3. Zambia, a country with a relatively high number of undernourished people, is an exception with an agricultural population of only 0.9 people per hectare.

### Risks to undernourishment: summary

The preceding analysis has shown where the main historical sensitivities were to the number of undernourished people in the region. It is clear from this analysis that an increase

in consumption, especially protein but also carbohydrates, is strongly associated with a decrease in undernourishment. The food groups mostly associated with a decrease in undernourishment since the early nineties up to 2006 are fruits and starchy roots, followed by alcoholic beverages. There is only a medium correlation between changes in cereal consumption and a decrease in undernourishment in the region. Based on this analysis, and assuming no major changes in production, consumption and distribution of food in the region soon, any threats to increasing consumption overall and the food groups fruits and starchy roots specifically are likely to have a large effect on undernourishment in future as well.

The effect of changes in own production on changes in undernourishment is less strong. Overall, changes in own production are



relatively strongly correlated to changes in undernourishment, but less so than for changes in consumption. The changes in the production of the food groups pulses and fruits have the highest correlation to changes in undernourishment. Changes in own production of cereals are only weakly correlated to changes in undernourishment.

Neither changes in imports, exports or food aid were meaningfully correlated with changes in undernourishment.

This seems to suggest that the main risks to undernourishment are mainly related to the threats and barriers to consumption, especially protein and carbohydrates and specifically fruits and starchy roots, followed by the threats and barriers to own production, more specifically pulses and fruits.

The risks of too little consumption include factors such as prices and income. Although there is some evidence of increased sensitivity of food consumption to international food prices, the elasticity of undernourishment to international food price changes have tended to come down since the early nineties. This means that international food price changes had a far larger effect on undernourishment in the early nineties than what is evident up to 2006.

One of the reasons for this is that domestic producer prices have also not been closely linked to international food prices. The price of staples, namely cassava and maize, has historically been

determined by local factors and not so much by international prices.

There is a large spatial variation in the retail price of staples, signaling weak market integration in the region. The recent price spikes seen in 2007 and 2008 have come to an end, most notably since the middle of 2009.

Income growth had increasingly less impact on undernourishment from the early nineties onwards. An average rise in per capita income does not benefit those most affected by undernourishment, and, where it does, very high rates of income growth are required. Average income growth in SADC dissipates to other goals rather than addressing undernourishment.

Many households remain highly vulnerable. The long-term average across all these countries and all the household expenditure surveys is that roughly between 47% and 53% of all household consumption expenditure in SADC is on food consumption. A wide range is recorded, from 16% for urban Namibia in 2003 to 78% for rural Malawi in 1998.

Based on this longer-term regional analysis, the main threat to undernourishment in SADC is a lack of food consumption. This is mainly influenced by a lack of own production, erratic local prices, a weak spatial integration of food markets, and very low penetration of average income growth to poorer household economies.

## 4. Climate change risk and vulnerability

### Climate change projections for Southern Africa

Climate change projections for Southern Africa include those for which there is a fair amount of certainty, and those which carry much more uncertainty (Christensen et al., 2007; OneWorld Sustainable Investments, 2007).

The best documented and undisputed aspect of climate change is the rising atmospheric carbon dioxide (CO<sub>2</sub>) concentration. Plants require CO<sub>2</sub> for the critical process of photosynthesis, and increasing CO<sub>2</sub> raises yields by between 0 and 30%. However, crops grown at or above their temperature optimum, as is the case for many crops grown in Africa, do not respond strongly to rising CO<sub>2</sub>. The belief that CO<sub>2</sub> fertilization could offset warming-induced losses in natural field and farm situations has been called into question (Long et al., 2006). Nevertheless, species which have a strong carbon demand (sink), such as young trees and plants with large underground storage organs, tend to exhibit a stronger and sustained CO<sub>2</sub> response. Thus, plant responses are species- and environment-specific. For example, the staple African crop maize does not respond to higher CO<sub>2</sub> concentrations, or only weakly.

Mean annual temperatures have increased across Southern Africa over the last 40-50 years, and the number of hot days per year has increased, whereas

the number of cold nights per year has decreased (Boko et al., 2007). Regional climate change projections (Christensen et al., 2007), for 2080-2099 relative to 1980-1999, indicate that during summer, warming will be in the range 1.8-4.7°C, depending on the emissions scenario (SRES) used, with a median projection of 3.1°C. For winter, warming will be 1.9-4.8°C, with a median of 3.4°C. Warming could be higher during late winter and early spring (OneWorld Sustainable Investments, 2007). Strong warming before the start of the planting season would significantly reduce soil moisture during this period. The extent of warming will increase with increasing distance from the coast, so that landlocked inland countries (e.g. Botswana, Zambia, Malawi) show the strongest potential warming. A well-understood consequence of warming is an increasing rate of evaporation (the loss of moisture from surface water bodies and soil) and transpiration (water loss through plants). Other impacts of warming include reduced crop fertility, and increased frequency and intensity of wildfires. The frequency and intensity of extreme temperature events is expected to increase during the course of the 21st century. The higher frequency of hot days and warm nights will increase heat stress and risk of water deficit for all living organisms (Battisti and Naylor, 2009).

Varying changes in rainfall over the region are predicted over the

long-term (Christensen et al., 2007). The projections show reduced rainfall for much of the region in winter (May-July). While this is less significant for the summer rainfall regions, it is highly significant for the winter rainfall south-western corner and western margins of the region. For the summer rainfall regions, small shifts in the tropical rain belts (the Inter-tropical Convergence Zone [ITCZ] in particular) will result in large changes in local rainfall. Rainfall is also strongly influenced by Pacific Ocean sea surface temperature (SST) anomalies (El Niño Southern Oscillation - ENSO), which may change with future climate change (Tadross et al., 2005). Modeled projections indicate increased annual rainfall in the tropical north-east portion of the region. However, there is still considerable uncertainty over annual rainfall changes in the sub-tropical summer rainfall regions.

Seasonal shifts in rainfall can be expected: the arrival of the first summer rains is likely to become more unpredictable and occur later than at present, but rainfall amount and intensity could be higher in mid- to late-summer. This disrupts traditional cropping cycles and access to fields during harvest periods, contributing to yield reductions or total losses and thus food insecurity. These trends are already apparent: monthly rainfall records in many parts of the region show recent increases in the wet months of December to March, but this is often offset by a drying in September and October, which are regarded as months when the rainy season starts. Important African crops which indicate high sensitivity to such predicted rainfall regime changes include maize and wheat (Lobell et al., 2009). The indigenous,

hardy crops such as millet and sorghum are expected to be less sensitive.

The Southern African region is prone to climatic extremes of prolonged droughts, dry spells, heavy rainfall and severe floods. Floods devastate crop and livestock production and thus escalate food insecurity, hunger and malnutrition. Floods also exacerbate water and energy insecurity, and soil losses and degradation. Physical damage to infrastructure during storms and floods, particularly roads and bridges, imposes a heavy cost. Models indicate that the region could experience an increase in the intensity of high-rainfall events (Tadross et al., 2005; Christensen et al., 2007), and that heavy rainfalls will make up an increasing proportion of total rainfall (McSweeney et al., 2008). Regardless of annual rainfall trends, the duration of dry periods is expected to increase, even during seasons with adequate total rainfall.

These changes are expected to be experienced as individual anomalous events interspersed with 'normal' years, rather than sudden permanent changes. Thus, an 'increase in variability' means that the range of weather conditions experienced on an inter-annual basis would be larger, thus exposing regions to a less predictable and more variable rainfall season.

## **Impacts on agricultural production and food security**

Climate change will almost certainly impact on own food production in SADC (Boko et al., 2007). The following is a brief synopsis (not comprehensive)

of literature on the topic of climate change and food insecurity in Africa, and specifically SADC where information is available:

**An overall decline in agricultural production is expected.**

- Jones and Thornton (2003) estimated a 10% aggregate reduction in maize production in Africa and Latin America, using climate data from the HadCM2 model to generate characteristic daily weather data for 2055.
- The World Resources Institute, based on Cline (2007), estimated that agriculture in SADC countries by 2080 will be negatively affected by approximately -15% to -50%. South Africa, Namibia, Botswana, Zimbabwe, Zambia, Malawi and Madagascar are expected to be the hardest hit.
- Recent research results indicate that elevated CO<sub>2</sub> in the atmosphere boosts cyanide levels in cassava leaves and reduces the size of the tubers (Gleadow et al., 2009).

**African farmers are sensitive to increasing climate variability.**

- The outcomes of a cross-sectional study surveying over 9000 African farmers show that African farms are sensitive to climate variation (Kurukulasuriya & Mendelsohn, 2006). Farmers' net revenue appeared to be lower in places with higher temperatures and temperature elasticity with respect to the net revenue of African farms is estimated to be -1.3, meaning that a 10% increase in temperature will lead to a 13% decline in net revenue.
- Akpalu et al. (2009) pointed out that a change in the amount of

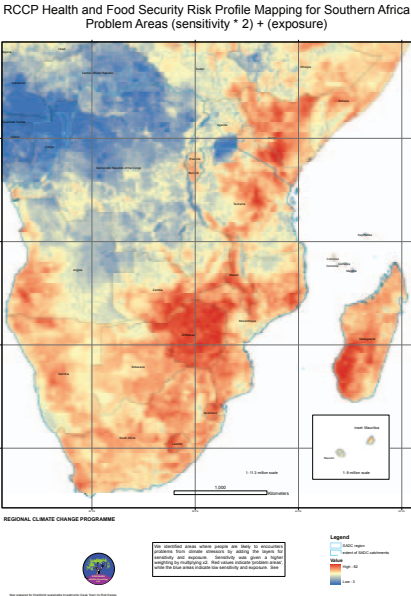
precipitation is the most important driver of maize yields. A 10% reduction in mean precipitation reduces the mean maize yield by approximately 4%. The results also suggest that changes in temperature affect maize yields: As the mean temperature increases from 21.4 to 21.6°C, the average maize yield increases by 0.4%, but only up to a point, as the gain in maize yields prompted by increased temperature begins to diminish as temperature increases further (Akpalu et al., 2009).

- Regarding the ability of African farms to absorb temperatures increases, it turns out that soil moisture is a decisive factor; i.e. dry land farms are faced with above average temperature and precipitation elasticities, while irrigated farms, by contrast, have appeared resilient to temperature changes and may even, potentially, increase in value (Akpalu et al., 2009).

**Climate change impacts are not expected to be homogeneous across the region**

- Climate change is unlikely to impact the continent evenly. Climate changes themselves are not likely to be uniform; some areas will get wetter while others, in contrast, will become dryer. The effects of changing rainfall patterns on soil moisture and crop production potential will be more serious in regions which are already marginal for rainfed agriculture. How many people will be affected depends on population pressure on arable land, and household and economic dependence on agriculture. These factors suggest that there

Figure 10: Map of current climate impact on food security and land-based livelihoods in Southern Africa, showing areas of strong combined climate exposure and sensitivity (red) and areas of lower combined exposure and sensitivity (blue) (OneWorld Sustainable Investments, 2010).



remains a wide range of plausible outcomes (Kurukulasuriya & Mendelsohn, 2006; OneWorld Sustainable Investments, 2010).

**Climate and climate change is only one driver of food insecurity.**

- Food security depends on livelihood security, which is sensitive to many different factors. Household factors such as health status and access to health services play an influential role in food security. Food security is not solely about food production and availability (Ziervogel et al., 2006).
- The same point was made by Gregory et al. (2005). Climate variation is

one of several interacting factors that affect food security. Referring to a meta-analysis on 49 household economy local-level studies done by Misselhorn (2005), Gregory et al. (2005) pointed out that in studies of household food security in southern Africa, climate/environment was only one of some 33 drivers mentioned as important by householders.

- Misselhorn (2005) pointed out that the direct causes of inadequate food access are poverty, environmental stressors and conflict, underscoring the need to understand the multiple social and political dimensions of food insecurity, such as the breakdown in social capital associated with poverty, conflict and HIV/AIDS, that run deeper than environmental constraints to food production. Food insecurity is largely driven by chronic, structural elements in the life of communities. Food shortages are determined more by the ability to access food rather than by a local production deficit.
- Even moderate climatic shocks on top of entrenched vulnerability resulting from political and socioeconomic factors (e.g. food prices, structural adjustments, policy response, conflicts, HIV/AIDS), can result in a food security crisis (Scholes & Biggs, 2004; Vogel & Smith, 2002).

**The vulnerability of the farming sector, taking into account adaptive capacity, is strongly differentiated across the region.**

- There are strong regional differences in the farming sector’s vulnerability to climate change, even within SADC. Social factors play a large role. For example, Gbetibouo and Ringler (2009) pointed out that regions

in South Africa most vulnerable to climate change do not always overlap with the most vulnerable populations. Rather, ... the overall vulnerability of the South African farming sector is characterized by a combination of medium-level risk exposure coupled with medium to high levels of social vulnerability. For example, the Western Cape of South Africa, will face great exposure to extreme events and climate variability. However, due to its wealth, level of development, and general access to resources and

infrastructures, the province will be able to cope and adapt. In contrast, because their adaptive capacity isn't supported by the same levels of development and wealth as that of the Western Cape, provinces such as Limpopo, KwaZulu-Natal and the Eastern Cape are likely to suffer greater consequences and impacts from a lower exposure to climatic events and climate variability. At a regional scale, similar patterns emerge (OneWorld Sustainable Investments, 2010).



## 5. Trade context and policy

As discussed in an earlier section, food exports increased by 22% for the whole of SADC over the period 1990-1992 to 2003-2005. The biggest food exporters in relation to their populations are Swaziland, Mauritius and Namibia and the largest increases in exports per capita were in Zambia, Namibia, Malawi and South Africa. Exports per capita came to a standstill in the DRC and Lesotho, with substantial decreases in Botswana, Zimbabwe and Madagascar. Food imports increased by 13% for the whole of SADC over the period 1990-1992 to 2003-2005. The largest increases in food imports were in Tanzania, Madagascar and Swaziland, followed by Angola and Mauritius. Food imports declined fastest in Malawi, Lesotho and Botswana over this time period. Overall in SADC, the value of food exports deteriorated in relation to the value of imports. The terms of trade for SADC declined by an average of 2% pa from 2000-2006.

These developments took place against the backdrop of a proliferation of regional trade agreements in Eastern and Southern Africa (ESA). In a World Bank policy research working paper, De La Rocha (2003) argued that the regional trade agreements in Eastern and Southern Africa are characterised by their multiple and overlapping membership, complex structures, and eventually conflicting and confusing commitments. It is concluded that regional organisations in Eastern

Southern Africa need to harmonise and rationalise their trade regimes. Similar conclusions are reached by others (e.g. Flatters, 2002).

Should the regional trade agreement (RTA) in the Eastern and Southern Africa region be well designed and effectively implemented, they could fulfill their potential to assist the member countries in increasing their current low trade links and integrating global markets. In this perspective, De La Rocha (2003) supports the argument that the Cotonou Agreement could serve as a solid basis for the region to organise itself and to harness the benefits stemming from future Economic Partnership Agreements.

The Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) also released a report on trade policies and agricultural trade in the SADC region in 2003 (FANRPAN, 2003). The report pointed out that liberalisation in trade policy has progressed substantially (at least for South Africa, Tanzania, Zambia, Malawi and Namibia), but policies inconsistent with the SADC free trade protocol related to export and import licenses as well as temporary import bans on agricultural commodities are still evident.

Some earlier studies argued that improved trade in the SADC region can contribute substantially to improved

food security (Maasdorp, 1999), but such hopes seemed not to have materialised so far.

Trade policies stretch further than the region only. The “Partnership Agreement between the members of the African, Caribbean and Pacific Group of States of the one part and the European Community and its Member States of the other part”, otherwise known as the ACP-EC Agreement was signed in Cotonou, Benin, in June 2000. This global agreement, concluded for a period of twenty years, is based on the following four principles:

- equality of the partners and ownership of the development strategies;
- participation (central governments as the main partners, partnership open to different kinds of other actors);
- a pivotal role of dialogue and the fulfillment of mutual obligations; and finally,

- differentiation and regionalisation.
- The partnership established through this Agreement is based on three complementary pillars, namely:
- development cooperation,
  - economic and trade cooperation, and
  - a political dimension.

No final conclusions on the possible linkages between trade and food security within SADC and between SADC countries and the rest of the world can be drawn at this stage. It is recommended that a comprehensive evaluation of trade policies on food security and undernourishment in SADC is done. At this stage it can be concluded that existing trade agreements, within and outside SADC, have not convincingly contributed to an increased terms of trade for food in the region. To understand how much these agreements have or have not contributed would require more specific analysis on the subject.

## 6. Integrated discussion

**Undernourishment is not only a cereal production and consumption problem.** Much of the work on food insecurity in the region is focused on cereals. A focus on cereals alone when analysing the potential risks of climate change on SADC agriculture would be a mistake. SADC farmers, on average, have already started to substitute their staples away from cereals towards cassava. Changes in cereals consumption and production are not strongly correlated to changes in undernourishment in the region while changes in consumption of starchy roots (mainly cassava) are strongly correlated. This means that the effectiveness and efficiency of cassava markets in the region needs much more attention. Domestic cassava prices, for example, show very large spatial and temporal variation. The possible effects of rising carbon dioxide, changing temperatures and changing precipitation on cassava production is a risk that needs to be quantified and managed appropriately.

**The consumption of fruits, although in relative small quantities when compared to the staples, had a very strong impact on undernourishment.** Fruit production as well as consumption declined in SADC as a whole, but in those countries where it declined the most, the rise in undernourishment was the worst. The impacts of climate and climate change on fruit production as well as the efficiency of fruit markets in SADC also need much more attention.

SADC, for example, remains a consistent net exporter of fruits. This begs the question whether barriers to trade within SADC have been sufficiently removed or whether access to fruit is “only” a problem of affordability on a household level. The risks of a changing climate on fruit production also need further attention on a SADC-wide level.

**Changes in imports and exports are weakly correlated to undernourishment, and the average positive net effects of food trade are declining.** The value of exports of mostly sugar and sweeteners, fish and seafood, and fruits - together almost accounting for 77% of all food exports from SADC countries - was not enough to offset the value of food imports. Prices of cereals, which is the main food group imported, rose faster than the price of sugar, which is the main food group exported. The exports of sugar did not have a negative impact on undernourishment (at least not directly), and the consumption of cereals (whether imported or produced) was not as strongly correlated with undernourishment as would have been expected. Countries that export sugar (mainly Mauritius and Swaziland) are not as undernourished as others, and countries that import the most cereals in relation to other SADC countries (Mauritius, Swaziland, Lesotho, Namibia and Botswana) are also not those with large undernourished populations.

It seems as if at least two major effects are at work that need to be tested further: First, the positive effects of trade have not yet reached those countries with large undernourished populations and, second, countries that have experienced such positive benefits have seen a decline over time as relative prices of export and import food products have changed.

**International food prices have had a relatively small effect on undernourishment. The sensitivity of changes in undernourishment to changes in the international food prices is relatively low and tends to decrease over time. Local staple prices also do not correlate well with international food prices, with the notable exception of Mauritius and South Africa, which are both relatively open economies.**

**Local conditions have had a bigger impact on food prices and put pressure on households' ability to cope.** Local production and distribution conditions had a far greater influence on staple prices than international food prices. Domestic staple food producer prices, for example, have now increased for seven years in a row, of which four years saw increases of 15% per annum and more. These cumulative price increases in staples have a large impact on poor households' ability to cope.

**Domestic prices vary enormously across time and space, but recent price spikes have come to an end.** There are large spatial variations in the retail price of staples, signaling weak market integration in the region. The recent price spikes seen in 2007 and 2008 have come to an end, most notably since the middle of 2009. Downward trends

in inflation have already been recorded on the back of improvements in the supply of food in the region and an ease of oil prices.

Not only prices, but also income affects demand. **The counterintuitive results are that rising income in SADC has not been associated with decreased undernourishment.** It is only in the very high growth economies of Mozambique and Angola that rising incomes have been associated with some decreases in undernourishment. More work is needed on the nature of this transmission mechanism and the reasons why it is failing, but it seems as if rising average income in itself is not a way to address undernourishment.

**Agriculture, where it demands a large share of economic activity, does not convincingly address undernourishment.** The bigger the size of the agricultural sector in relation to a country's economy, the greater the number of undernourished people and the smaller the size of the agricultural sector in relation to the economy, the fewer the number of undernourished people. Undernourishment is strongly related to those countries that are stuck in (mainly) subsistence agriculture and have not diversified to more industry-, mining- and service-driven economies yet. Addressing undernourishment cannot be done within the context of an economic diversification strategy that not only includes agriculture, but also secondary and tertiary activities in the economy.

**Effective agricultural and trade policy and strategic context appear to be lacking.** The many challenges that are acknowledged include the

absence of a regional food reserve facility, over-dependence on rain-fed agriculture, the need to promote private markets in agricultural products, and an improvement in rural infrastructure. Regional trade agreements in the region are characterised by their multiple and overlapping membership, complex structures, and eventually conflicting and confusing commitments. Existing trade agreements, within and outside SADC, have not convincingly contributed to an increased terms of trade for food in the region.

**Climatic variability has an impact on own food production in SADC.** It is generally believed that African farmers are especially sensitive to climate variation, acknowledging that climate change is only one, and certainly not the most important, driver of food insecurity. An overall decline in agricultural production is expected, but climate change impacts are not expected to be homogeneous across the region. The vulnerability of the farming sector, taking into account adaptive capacity, is strongly differentiated across the region.

## 7. Responses

Governments, the private sector and households have and can respond in various ways to food insecurity. We provide a non-exhaustive list of documented and recommended responses in the region. **Our rationale is that addressing the underlying, systemic causes of food insecurity in southern Africa will go a long way towards absorbing shocks brought about by expected increases in climate variability, and longer-term climate changes.**

### Improve regional trade

- Regional trade is one way absorb the shock of highly volatile domestic prices (Haggblade et al., 2008). It was found that regional trade flows can clearly help to soften supply deficits. Improved marketing and free cross-border trade is a way to address food security.
- The rationale is that not all areas in SADC are food insecure. Some areas, notably northern Zambia, northern Mozambique and southern Tanzania, regularly produce food surpluses (Govere, 2007; Haggblade et al., 2008). The existence of hotspots of surplus production and hotspots of food insecurity in the region suggest the need for more effective regional trade responses. This will have to be accompanied by an investment in transport infrastructure and a reduction in transport costs.
- In a Zambian case study it was

concluded that the closing of borders can easily lead to price volatility in the range of 100% from one year to the next. Uncertainties regarding government interventions such as export and import quotas and price subsidies, risk driving commercial traders out of the markets and exacerbates price volatility (Dorosh et al., 2007).

- Cross-border trade in staples is still restricted in many countries. Zambia, Malawi and Tanzania have all imposed export bans or trade restrictions on maize recently to protect domestic supplies (Jayne et al., 2009). South Africa and Mozambique, in contrast, have open border policies.

### Consumer substitution

- Another way to absorb domestic production and price shocks of maize is to substitute for other staples such as cassava (Haggblade et al., 2008). Production of cassava in SADC has increased substantially in recent years.

Invest in transport infrastructure and reduce transport costs

- Border delays and unreliable transport infrastructure lead to very high transport costs, impeding trade in the region (Venter, 2009; Foster & Briceño-Garmendia, 2009).

Better crop production estimates

- Unreliable crop estimates in some



countries is a contributing factor to price volatility (Jayne et al., 2008).

- More accurate estimates of crop production are a sure way to reduce price volatility and resulting hardship and undernourishment caused by price spikes.

#### Integrated, local policy responses

- Reducing food security will require that social, economic and environmental determinants of vulnerability be integrated in policies. Effective long-term agricultural policies must certainly be developed, but it must also be integrated within a wider sustainable development framework, according to local and national situations, and be grounded in the local context (Ziervogel et al., 2006; Gbetibouo & Ringler, 2009).

#### Agricultural adaptation and irrigation

- Developing high temperature resistant crops and promoting performing irrigation systems are direct strategies that can be joined with indirect strategies, such as developing other sectors of the economy in order to reduce the country's dependence on its agriculture and increase wealth, so that adapting to climate change becomes possible at a household level (Kurukulasuriya & Mendelsohn, 2006).
- Hassan and Nhemachena (2008) recommend that policy-makers support farmers' adapting efforts by promoting farmer education and improving their access to climate forecasting, by investing into research that target the development of farm-level climate adaptation technologies, and also

by opening access to credit and developing markets. Furthermore, these recommendations should be considered even more attentively in areas where dry land farming currently predominates.

- Svendsen et al. (2009) recommended that in Africa returns on additional investment in irrigation would be high, both in terms of greater food security for the continent and greater production of export-quality agricultural goods.
- Hassan and Nhemachena (2008) argued that resorting to irrigation poses several difficulties such as manipulating high technologies, having access to sufficient water resources, and to financial means of investments. Therefore, when switching from dry land to irrigation is not possible, alternative responses to climate change's negative impacts comes under the form of three major adaptation options: diversifying into multiple crops and privileging high temperatures resilient crops, mixing crop and livestock systems, or switching from crops to livestock.

#### Broader socio-political reform

- Misselhorn (2005) pointed out that interventions aimed at drought mitigation and increased agricultural output will not alone ensure food security for southern Africa's rural poor. The findings suggest that the future determinants of food security in southern Africa lie primarily outside the domain of agricultural production. A focus on improving crop yields would neglect those economic (e.g. poverty, lack of employment, inflation and market failures) and socio-political factors (e.g. conflict, property rights, education and HIV/

AIDS) that are undermining the coherence of the family unit and creating increasingly vulnerable and socially unstable communities.

#### Development of private agribusiness

- The development of private agribusiness can be a means to address food insecurity and undernourishment. The agricultural industry does not only include farmers, but also suppliers of inputs (e.g. feed, seed, fertilisers, machinery, etc.) and output companies (e.g. marketing, transportation, groceries, restaurants, etc.) (Louw, 2007). Access to food, as a key driver of food insecurity and ultimately undernourishment, can be improved by better connectivity between farmers and output companies. There is very little incentives

for rural farmers to produce surpluses that cannot be sold. In a study focused on South Africa and Zimbabwe, Van Rooyen et al. (2000) found that there is potential in certain agro-food chains for supply chain integration and co-operation between agribusiness. More recently, Vink et al. (2006) argued that a good case can be made for the high social returns that may be expected from foreign direct investment in agricultural and agribusiness. They also argue that 'the securing of supply chains' is a positive step towards better access to food, and thus food security. More empirical work, however, is needed on the specific role of agribusiness development to enhance food security and address undernourishment in the region.

## 8. Conclusion

An integrated analysis of the current and historical food situation within a broader socio-economic and agricultural and trade policy context is presented in this report. The problem was defined as the high level and growth in undernourishment in SADC. The analysis focused on identifying key drivers of undernourishment in all 14 SADC countries using data published by the FAO. A discussion on the economic and policy context and specific climate production risks to undernourishment was followed by a set of specific responses to the problem of rising undernourishment in the context of climate change.

The problem of undernourishment in SADC is very strongly associated with a lack of food consumption. Local markets are not well integrated resulting in ineffective food trade associated with very volatile domestic prices. Household poverty and conflict remain prominent drivers of food insecurity. Consumption patterns of specific food items are also important. Changes in the consumption of cassava and fruits are strongly associated with changes in undernourishment in the region.

The lack of consumption is not only driven by household poverty, conflict and a lack of market integration, but also by stagnation of production in the region. Average production per person in SADC remained constant since the early nineties, but this masks an increase in production in certain countries (Angola,

Malawi and Mozambique) and a decline in production in others (the DRC, Tanzania and Madagascar).

Although cereal consumption is associated with changing undernourishment, the effect is not as strong as for cassava, fruits and some other food groups. This is also reflected in the relatively low importance of international food imports (mainly cereals) in relation to undernourishment in the region. A fundamental challenge for SADC's balance of payments is that the value at which sugar and sweeteners (SADC's main food export group) is exchanged for cereals has shown a long-term decline. Increased cereal imports may be a way to address undernourishment, but long-term relative food price movements do not look favourable for SADC. However, countries in SADC that have relatively smaller agricultural sectors have historically been able to produce enough wealth elsewhere in the economy to finance such imports.

The effects of international food prices is less of a problem for undernourishment on a household level, as consumers have already started to substitute for other staples, such as cassava. Where this situation does become a problem with regard to undernourishment is with the persistently high increases and extreme volatility of domestic cassava and maize prices throughout the region. These

fluctuations are not correlated well with international food prices, with the notable exception of Mauritius and South Africa, which are both relatively open economies.

Local factors remain important in addressing undernourishment. Food markets, for example, are not well integrated in the region. The retail price of staples varies much more than producer prices in the region. The region has several net production and deficit hotspots which need to be integrated better to mitigate against any further shocks to the food system.

On national level, average income also plays lesser of a part in addressing undernourishment than what would be expected. Rising incomes on a national level, fueled by strong recent economic growth, only starts affecting undernourishment at very high levels of income growth. Economic growth has not convincingly 'trickled down' to better nourishment, and specific interventions on a household level are required. Households in SADC are already very vulnerable with approximately half of their income spent on food consumption.

This does not mean that all households should become better at (subsistence) farming. Some might and could start producing food surpluses. Generally, larger relative agricultural sectors and higher agricultural populations are associated with increased undernourishment in the region. Undernourishment need to be addressed within the context of economic diversification supported by better integrated markets to facilitate the exchange between increased income and food.

Based on a review of the literature it is concluded that climate and climatic variability could have a potential impact on own food production in SADC. It is expected that climate change will negatively impact on agricultural production, but that impacts are not homogeneous across the region. It is also widely acknowledged that climate and climate change is only one driver of food insecurity and that solutions to reduce overall vulnerability need to be sought in broader socio-political reforms. For agricultural production, specific response options include: better crop production estimates, irrigation, research in climate-adaptation technologies, access to credit, developing markets and multiple crop production systems. Improved regional trade, including improved marketing, free cross-border trade, investment in transport infrastructure and addressing border delays are all examples of how the increased risks in SADC food system can be better managed.

In summary, the main threat to undernourishment in SADC is a lack of food consumption. This is mainly influenced by a lack of own production, erratic local prices, a weak spatial integration of food markets, and very low penetration of average income growth to poorer household economies. The additional risks of climate change increase the vulnerability of the system, most directly on a household level. Direct response options to support farmers and households are important, but not sufficient. Broader reforms in regional and international trade, as well as a focus on socio-economic and political factors, are needed to improve the overall food system in SADC.

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