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Food availability in developing countries

- new challenge for local producers or new export space for the EU exporters?

Diploma Thesis

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Declaration

I, Jiří Vlach do hereby solemnly declare that the work entitled „ Food availability in developing countries - new challenge for local producers or new export space for the EU exporters?“ and results reported here in were carried out solely by me under the guidance and supervision of Prof. Ing. Ladislav Kabát, CSc. of the Faculty of Tropical Agriculture and further declare that all the sources have been quoted and acknowledged by means of complete references.

In Prague, 23th April 2015

Signature……

Bc. Jiří Vlach

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Abstract

Food security is influenced by many factors, which are divided into four categories according to FAO. Food Availability is one of these categories. It is closely connected with domestic food production as well as with international trade with food and with free movement of commodities on the international market. Countries in South Africa joined together and established South African Development Community (SADC) in 1992, which significantly changed their trade policies and their economics opened to international trade.

The aim of this thesis was to evaluate, how these new conditions in international politics and trade affected the situation of food security and food availability in SADC countries. The research was based on common statistical analysis of secondary data developed by transnational organizations engaged in food security and international trade (FAOSTAT, WTO, World Bank).

Results showed that the index of imported food to domestic food production has been growing in the last 10 years and it reached 51% in 2011. The food exports value and domestic production value are increasing as well and the average food import tariffs are decreasing. Also I proved some dependency of food imports to average dietary energy adequacy as well as dependency of domestic food production to average dietary energy adequacy. However with the use of Revealed symmetric comparative advantage method (RSCA) it was shown that SADC countries lost their comparative advantage in trade with food. The correlation of index of selected food security indicators to regional political stability was not proved.

Keywords: food security, food availability, international trade with food, tariff barriers, food production, comparative advantage, SADC

Abstrakt

Potravinová bezpečnost je ovlivňována mnoha faktory, které se podle FAO dělí do čtyř kategorií. Jednou z těchto kategorií je potravinová dostupnost, jež úzce souvisí s domácí produkcí jídla, stejně tak ale i s mezinárodním obchodem a s volným pohybem komodit na mezinárodním trhu. Země jižní Afriky se v roce 1992 sjednotily do Jihoafrického rozvojového společenství (SADC) a jejich obchodní politiky prošly značnou změnou, jež se projevila výrazným otevřením jejich ekonomik mezinárodnímu obchodu.

Cílem této práce bylo zhodnotit, jak se tato situace promítla do situace s potravinovou dostupností a potravinovou bezpečností v zemích SADC. Výzkum byl založen na analýze sekundárních dat organizací zabývajících se potravinovou bezpečností a mezinárodním obchodem (FAOSTAT, WTO, Světová Banka) pomocí běžných analytických metod.

Výsledky ukázaly, že objem importovaného jídla vzhledem k domácí produkci jídla se stále zvyšuje a v roce 2011 dosahoval 51%. Stejně tak se zvyšuje i objem domácí produkce a exportu jídla ze zemí SADC. Podařilo se prokázat určitou závislost importu jídla ze zahraničí na indexu zásoby potravin na obyvatele, stejně tak i závislost domácí produkce jídla na indexu zásoby potravin na obyvatele. Také se použitím teorie o komparativní výhodě (RSCA) ukázalo, že země SADC ztratily komparativní výhodu v obchodu s jídlem. Naopak se nepodařilo prokázat vztah souboru vybraných indikátorů potravinové bezpečnosti s politickou stabilitou v regionu.

Klíčová slova: potravinová bezpečnost, potravinová dostupnost, mezinárodní obchod s jídlem, celní bariéry, produkce jídla, komparativní výhoda, SADC

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1. Introduction

Recent international politics is heading toward greater interconnection between the world's economies. Since the second half of 20th century it has become a new trend to create big multinational unions that can cooperate together in the international trade market and gain bigger negotiating power. Hand in hand with recent development goes reduction in trade barriers and freer international trade. It affects all kinds of trade and trade with food is no exception. Often we can see merging of several developing countries into bigger units in order to reach higher share of international trade and bring food security and economic prosperity to their people, such as ASEAN in Asia or COMESA, EAC or SADC in Africa.

SADC was established in 1992 with the aim to reach regional integration and poverty eradication within Southern Africa through economic development and ensuring peace and security. (SADC, 1992) Because the SADC community can still be considered as a new unit, and all of the new rules which the new members have to follow starts to make some impact now, it makes SADC an ideal candidate for research of changes in food security and food trade. The free trade zone within SADC was created in 2008 and tariffs on food imports were continuously brought down. Local farmers now have great opportunity to reach more customers with their products; however they have to face tough international competition at their own market, which is affecting the food availability situation in SADC and thus challenging the whole food security situation.

Food security is influenced by many factors, which are divided into four categories according to FAO: food availability, food access, food utilization and food stability. For the thesis purpose the most important one is the category of food availability. It is closely connected with domestic food production as well as with international trade with food and with free movement of commodities on the international market. The way how the free international trade with food affects the food security is not always clear and depends on the current situation and local conditions. Trade influences both world food availability, as well as production and food imports. Promoters of free trade also argue that, under competitive free market conditions (the stylized conditions of perfect competition) trade maximizes potential economic welfare internationally, by creating a situation where no country can be made better off without another being made worse off. (FAO, 2003) However, changes in trade structure and trade policies may also have an impact on the rate and

variability of economic growth and its quality (OECD, 2003). It can also affect the composition of domestic food production and value of food exports. According to Heckscher-Ohlin Theorem the labor-abundant country exports labor-intensive goods, whilst the capital-abundant country exports capital-intensive goods, while other things being equal. Arguably, this process could play an important role in food insecurity reduction in labor-abundant developing countries, by bidding up the price of labor and thus raising workers incomes (Appleyard, *et al.*, 2006).

Another variable which comes to play when considering the effects of international trade on food availability, are tariffs and other trade barriers. The essential organization dealing with tariffs and trade barriers is World Trade Organization (WTO) Their work has two levels: lowering trade barriers where they can be lowered, and writing rules for maintaining trade barriers and for other trade policies. Reduction in tariffs by developing countries, as well as by developed countries, is not always the best option. It can have mixed effects on the macroeconomic situation of states, because it can raise the prices of goods as well as bring them down. To make the right decision about tariffs is very complicated issue and it is necessary to fully understand local conditions and adjust the tariffs policy accordingly, otherwise it can have severe negative effect on food prices and food availability and can negatively influence food security situation in a region.

2. Literature Review

2.1 Food Security – Social and Economic Aspects of Food Availability

At the beginning of this thesis it is necessary to explain the definition of "Food Security" term using available literature concerning this topic. Food and Agriculture Organization (FAO) describes food security by this definition:

- "*Food security* exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". (World Food Summit, 1996)

This widely accepted definition points to the following dimensions of food security:

- *Availability*: The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid).
- *Access*: Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources).
- *Utilization*: Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.
- *Stability*: To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity). The concept of stability can therefore refer to both the availability and access dimensions of food security.

Concepts of food security have evolved in the last forty years to reflect changes in official policy thinking. The term first originated in the mid-1970s, when the World Food Conference (1974) defined food security in terms of food supply - assuring the availability and price stability of basic foodstuffs at the international and national level:

- "Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices". (FAO, 2006)

A similar definition is used in the United States, where the United States Department of Agriculture (USDA) defines food security as:

- "Access by all people at all times to enough food for an active, healthy life." (Coleman-Jensen *et al*., 2011)

The lack of food security is defined as food insecurity. Its symptoms are hunger, malnutrition and famine. Long-term lack of food security eventually becomes hunger, defined by the USDA as:

- "An individual-level physiological condition that may result from food insecurity."

On a population level, extreme lack of food security becomes famine.

2.1.1 Food Insecurity

The opposite condition to food security is food insecurity. There are two types of food insecurity, according to FAO (2008):

- *Chronic food insecurity* is long-term or persistent. It occurs when people are unable to meet their minimum food requirements over a sustained period of time. Chronic food insecurity results from inadequate access to productive or financial resources, lack of assets and extended periods of poverty. Successful means for overcoming chronic food insecurity are typically long term

development measures also used to access to productive resources, such as credit or address poverty, such as education. They may also need more direct access to food to enable them to raise their productive capacity.

- *Transitory food insecurity* is short-term and temporary. It occurs when there is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status. Results from short-term shocks and fluctuations in food availability and food access, including year-to-year variations in domestic food production, food prices and household incomes. Transitory food insecurity is relatively unpredictable and can emerge suddenly. This makes planning and programming more difficult and requires different capacities and types of intervention, including safety net programs and early warning capacity.

- *Seasonal food insecurity* falls between transitory and chronic food insecurity. It is similar to chronic food insecurity as it is usually predictable and follows a sequence of known events. However, as seasonal food insecurity is of limited duration it can also be seen as recurrent, transitory food insecurity. It occurs when there is a cyclical pattern of inadequate availability and access to food. This is associated with seasonal fluctuations in the climate, cropping patterns, work opportunities and disease.

2.1.2 Food Availability

Perhaps the most crucial segment of food security is food availability. Availability refers to the physical availability of food stocks in desired quantities (Swaminathan M.S., Bhavani R.S., 2013). It is influenced by domestic production as well as imports from abroad. The availability dimension of food security contains not only the quantity, but also quality and diversity of food. FAOSTAT uses indicators for assessing food availability that includes:

- the adequacy of dietary energy supply
- the share of calories derived from cereals, roots and tubers
- the average protein supply
- the average supply of animal-source proteins
- the average value of food production

Basically, food availability can be understood as statistical indicator composed of indicators of food production, food distribution and food exchange. Data on food availability are processed by FAOSTAT in their Food Balance Sheets. These data are discussed and analyzed later in the text.

Food Production

The basic purpose of agricultural sector, aside from making money, is the production of food supply. Food production is the core income source for farmers and the key food security assumption for each state in the world. It is influenced by variety of factors, such as weather, political stability, commodity prices or economic situation of farmers. The data on food production since 2000 are presented later in the thesis in the chapter 5.

2.1.3 Food Access

The food access segment of food security describes the physical access to food supply, such as the infrastructure (railway and road density), the economical access represented by the domestic food price index; and the prevalence of undernourishment. As long as there will be enough food available, but people will have no or limited access to it, there will be problems with hunger. Access to food from economical point of view is primarily determined by incomes, food prices and the ability of households and individuals to access social support.

2.1.4 Utilization

Utilization is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet, and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals (FAO, 2008).

2.1.5 Stability

Even if the food intake is adequate today, people can still be considered to be food insecure if they have inadequate access to food on a periodic basis, risking a deterioration

of their nutritional status. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on the food security status.

2.2 Crucial problems in food security and food availability

There are some crucial problems emerging when talking about food security. Some of them are presented in the following list:

2.2.1 Tariffs and other trade barriers

One of the most crucial factors causing high food prices and food availability are tariffs and other trade barriers. According to WTO tariffs are defined as:

- Customs duties on merchandise imports are called tariffs. Tariffs give a price advantage to locally-produced goods over similar goods which are imported, and they raise revenues for governments (WTO, 2014).

One of the results of the Uruguay Round was countries' commitments to cut tariffs and to "bind" their customs duty rates to levels which are difficult to raise. The current negotiations under the Doha Agenda continue efforts in that direction in agriculture and non-agricultural market access.

Non-tariff barriers may include any policy measures other than tariffs that can impact trade flows (Staiger, 2012). They can be described as different kinds of fees, minimum price laws, import restrictions or domestic products subsidies.

2.2.2 Political instability

It is obvious that political stability has crucial effect on production of food and thus on food availability and food security, respectively. In the time of war, people are often fleeing from their homes, leaving their farms abandoned and their crops and livestock stay unmanaged. There is also less trade during the time of conflict as some roads may be closed or inaccessible and some regions may be completely cut off from the rest of the

world. The lower food supply then causes price increase, which is another blow to food security situation.

Index of political stability and absence of violence is measured annually by Worldwide Governance Indicator. Data are provided by Brookings Institution, World Bank Development Research Group and World Bank Institute. FAOSTAT is using this index as an indicator for measuring stability of food security. Values vary from approximately -2.5 (weak stability) to 2.5 (strong stability). Data on Political Stability Index can be found in chapter 5.4.

2.2.3 Food Deficit

Food deficit is measured annually by FAOSTAT as one of the Food Security Indicators. The "depth of the food deficit" index indicates how many calories would be needed to lift the undernourished from their status, everything else being constant. The average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide an estimate of the total food deficit in the country, which is then normalized by the total population (FAO, 2014).

2.2.4 High food prices

It is not just the amount of available food that is crucial for food security. The availability of food itself is useless if the food prices are too high and people can't afford to buy it. This can happen especially in developing countries, where food costs forms significant part of household's expenditures.

Prices of internationally traded food commodities continue to decline since the August 2012 historical high. Yet, international prices are still not overly far from their historical peak. Domestic food prices show large variations across countries, with stable prices among a number of regions and mixed trends in East and South Asia as a result of seasonal factors, procurement policies, and localized production shortfalls (World Bank, 2014).

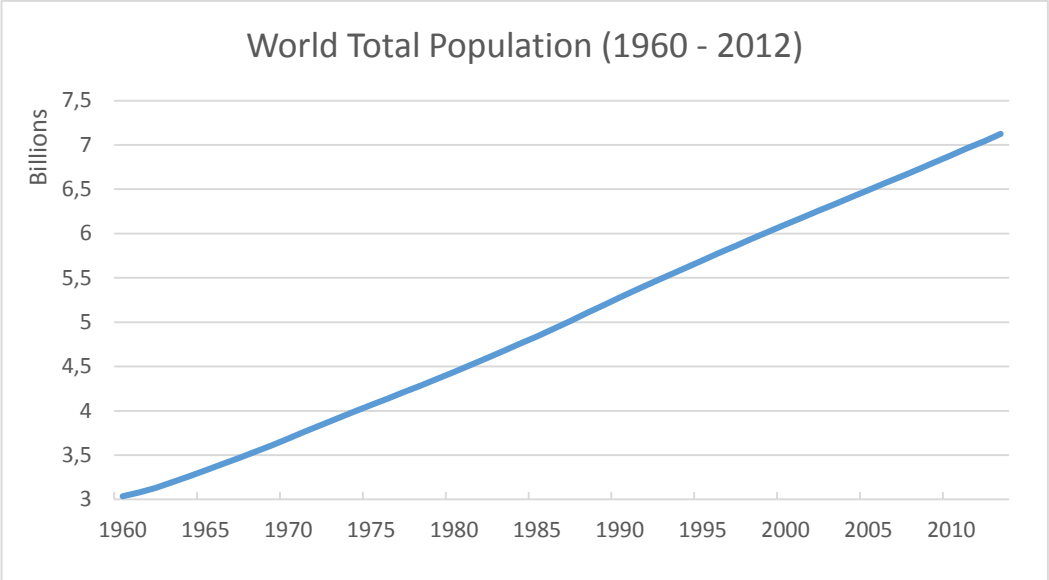
2.2.5 Food prices volatility

With the growing connection of the world international food market the food prices volatility had become important factor in food security situation and affects billions of people worldwide. Changing food prices can cause severe problems especially in developing countries, where the food expenses make significant part of household budgets. There are various causes of food prices changes. Radetzki (2008) says: "In general terms one can say that the price instability of agricultural commodities is more often caused by supply side disturbances, like weather or political instability."

According to OECD the impact of high agricultural commodity prices on developed countries is relatively modest, overall. The agricultural commodity price component of final food product prices is relatively small (often 35% or less), as is the proportion of disposable income spent on food (10-15% for most OECD countries). Of course these averages mask much more significant impacts on lower income consumers who spend a larger share of their expenditure on food. In addition indirect economic impacts might also be important, to the extent that high prices persist and thus do not reduce the future rate of inflation.

2.2.6 Population growth

The world's population had more than doubled since 1960 (Graph 1). According to World Bank's statistics the number of people living on our planet increase form 3,03 billion in 1960 to 7,12 billion in 2012. Bigger population means higher demands on the availability of food. In some places overpopulation may cause social unrest and decrease political stability.



Graph 1 – World Total Population (Source: World Bank)

2.2.7 Climate changes

Climate change will affect food security through its impacts on all components of global, national and local food systems. (FAO, 2008) Climate change may affect food systems in several ways ranging from direct effects on crop production (e.g. changes in rainfall leading to drought or flooding, or warmer or cooler temperatures leading to changes in the length of growing season), to changes in markets, food prices and supply chain infrastructure. The relative importance of climate change for food security differs between regions. For example, in southern Africa, climate is among the most frequently cited drivers of food insecurity because it acts both as an underlying, ongoing issue and as a short-lived shock. The low ability to cope with shocks and to mitigate long-term stresses means that coping strategies that might be available in other regions are unavailable or inappropriate. In other regions, though, such as parts of the Indo-Gangetic Plain of India, other drivers, such as labour issues and the availability and quality of ground water for irrigation, rank higher than the direct effects of climate change as factors influencing food security. (Gregory P.J., *et al*. 2005)

2.3 Recent Development in Food Security Situation

Situation in food security worldwide is statistically getting better every year. According to FAO the latest estimates indicate that global hunger reduction continues: about 805 million people are estimated to be chronically undernourished in 2012–14, down more than 100 million over the last decade, and 209 million lower than in 1990 - 1992. In the same period, the prevalence of undernourishment has fallen from 18,7 to 11,3 percent globally and from 23,4 to 13,5 percent for the developing countries (FAO, 2014).

Still, marked differences across regions persist. Around 25 percent of people in Africa remains undernourished. On the contrary, conditions are much more favorable in Northern Africa, where several countries show low levels of undernourishment. Asia still has the highest number of undernourished. Southern Asia has made slow progress in hunger reduction, while more rapid progress has been achieved in Eastern and South-Eastern Asia. Latin America and the Caribbean have recorded a very fast progress in reducing hunger, particularly the Southern countries of the continent (FAO, 2014).

According to recent edition of State of Food Insecurity (FAO, 2014) one of the reasons for lower prevalence of undernourishment is the result of a reduced inequality in food access among the population. Access to food has improved fast and significantly in countries that have experienced rapid overall economic progress, notably in Eastern and South-Eastern Asia. For example, Latin America has established itself as a major agricultural exporter, with the agriculture sector becoming an engine of domestic economic and employment growth for countries in the region. However, such growth has not been sufficiently inclusive to ensure access to food for all, underscoring that economic growth alone is not enough to ensure sustainable food security and nutrition. By contrast, access is still a challenge in sub-Saharan Africa, where income growth has been sluggish, poverty rates have remained high, and rural infrastructure remains limited and has often deteriorated (FAO, 2014). If the growth itself is not able to ensure sustainable food access and security, what else can save the situation? One of the possible answers is: trade.

2.3.1 Recent Changes in International Trade Policies

In the past decades there has been significant change towards global free trade. The arguments for trade liberalization are strong, and typically inform policy advice to governments from international institutions. These arguments are premised on Ricardian "conventional" or "neo-classical" trade theory, and in particular the theory of comparative advantage using general equilibrium models (for example the Heckscher-Ohlin theorem, RSCA), which will be explained later in the thesis. These deal with resource allocation in the whole economy under the stylized conditions of perfect competition.

The theory argues that differences in productivity and opportunity costs of production between countries form the underlying reasons why it is advantageous for countries to engage in trade. Many reasons explain why such differences occur. Climate is of obvious importance for agriculture as is the availability of extensive arable land and abundant water supply. The availability of other natural resources, such as large and easily accessible mineral deposits, and differential access to productive technologies give rise to varying labour productivities (FAO, 2003).

2.4 Trade liberalization and food security

Precisely how developing countries and the poor will be impacted by trade liberalization in agriculture under the Doha Round is a complex issue. Trade influences both world food availability, as well as production and food imports. Trade and trade policies may also have an impact on the rate and variability of growth and its quality (OECD, 2003).

The presumption that such liberalization will broadly benefit the poor countries, implicit in the allegations that agricultural subsidies in the rich countries hurt the poor in developing countries, is unlikely to be supported by closer in its unqualified form. In so far as such liberalization will raise food prices and the poor spend a disproportionately large amount of their income on food items, the opposite is entirely possible. The main share of benefits of such liberalization is likely to accrue to potential exporters of these products, which happen to be relatively richer developing countries. As such the case for agricultural liberalization must be made more on the grounds that the current system is hugely inefficient, resulting in very substantial deadweight losses and transfers to the relatively rich farmers in the OECD countries. Redirection of even a small fraction of these subsidies towards the poor in the Third World will go a long way towards alleviating poverty (FAO, 2003).

Trade policy reform involves a combination of:

- domestic support measures
- export subsidies
- tariffs

In each case, there are complications that must be taken into account. This is illustrated below starting with price supports:

The removal of domestic price support on, e.g., wheat will lower output of wheat and raise its price in the world markets. Wheat-exporting developing countries will benefit and wheat-importing countries that continue to be importers after the removal of the support will lose and those that switch from being importers to exports may benefit or lose.

In some cases, however, the support may be given to induce farmers not to cultivate some proportion of their land. In this case, the withdrawal of support could expand output, lower the price and have exactly the opposite effect: importers will benefit, exporters that remain exporters will lose and exporters who switch to being importers may benefit or lose. The critical question one must ask, therefore, is whether the removal of the support will increase or reduce the output of the supported product.

In the same vein, a reduction in tariffs by the developed importing countries will increase the world price of the product, benefiting exporters, hurting importers and leading to an ambiguous effect on those turning from importers to exporters. But this standard analysis is complicated by the presence of trade preferences. The reduction in the tariff cuts into the preference margin of the beneficiary countries and lowers the profitability of their exports. Liberalization can potentially hurt these exporters.

Finally, under normal circumstances, the reduction in export subsidies raises the world price of the product, benefiting developing country exporters, hurting importers and yielding ambiguous effect on those turning from being importers to exporters. Again, if the export subsidies were being countervailed, the net impact of the two measures is likely to be a transfer of the export subsidy from the exporting country government to the importing country government in the form of duty, without a significant effect on prices

and output. The removal of the export subsidy will also result in the removal of the countervailing duty and the world supply will be unchanged.

In all these cases, it is possible to consider one intervention at a time. But in practice these interventions have been used simultaneously in agriculture. An especially important case arises where a country is a potential importer of a product but domestic support measures, tariffs and export subsidies are combined in such a way as to turn it into its exporter. (Panagariya, 2002).

2.4.1 Infant Industry Theorem

Some economists say, that trade liberalization and free trade can have negative effects on the developing countries economics. They defend restricting trade measures as the tool of protection against more developed countries. First formulated by Alexander Hamilton and Friedrich List at the beginning of the 19th Century, the case for infant industry protection has been generally accepted by economists over the last two centuries - although some of the arguments supporting protection have come under successful attacks over the years (Melitz, 2005). According to Kicsi and Buta (2010) it can be defined as measures that allows infant industries to develop unhampered, protected against competition from more mature similar industries, from other countries (Kicsi and Buta, 2010).

Strong argument of infant industry theorem is that developed countries used protectionism in their history, therefore developing countries should be allowed to protect themselves too. The modern protectionist trend has been grown and been consolidated in USA, which is called by Paul Bairoch (1993) as "mother country and stronghold of modern protectionism". In 1791, Alexander Hamilton presented to USA Congress his famous Report on manufactures, being considered as the first drawing up of modern protectionism theory. This document remained in the history as an attempt to outline the idea, according to which the industrialization is not possible without the existence of a protection coming from the state (Bairoch, 1993).

The Infant Industry Theorem is often used in today's world. For example FAO in State of Food Insecurity (2014) states that several countries in Latin America have successfully addressed food security challenge with targeted social protection measures, which have significantly improved access to food. Without these measures, progress towards food security in the region would have been limited or possibly even reversed (FAO, 2014).

2.5 World Trade Organization

The World Trade Organization ("WTO") is the international organization whose primary purpose is to open international trade for the benefit of all countries. The WTO's work is to help trade flow more smoothly and predictably. Their work has two levels: lowering trade barriers where they can be lowered, and writing rules for maintaining trade barriers and for other trade policies. Both are the result of rounds of negotiations among governments since the 1940s.

The WTO provides a forum for negotiating agreements aimed at reducing obstacles to international trade and ensuring a level playing field for all, thus contributing to economic growth and development. The WTO also provides a legal and institutional framework for the implementation and monitoring of these agreements, as well as for settling disputes arising from their interpretation and application. The current body of trade agreements comprising the WTO consists of 16 different multilateral agreements (to which all WTO members are parties) and two different multilateral agreements (to which only some WTO members are parties).

The WTO was founded in 1995 and currently has 160 members, of which 117 are developing countries or separate customs territories. Decisions in the WTO are generally taken by consensus of the entire membership.

According to WTO's principles of trade the trading system should be:

- without discrimination — a country should not discriminate between its trading partners (giving them equally "most-favoured-nation" or MFN status); and it should not discriminate between its own and foreign products, services or nationals (giving them "national treatment")
- freer — barriers coming down through negotiation
- predictable — foreign companies, investors and governments should be confident that trade barriers (including tariffs and non-tariff barriers) should not be raised arbitrarily; tariff rates and market-opening commitments are "bound" in the WTO
- more competitive — discouraging "unfair" practices such as export subsidies and dumping products at below cost to gain market share
- more beneficial for less developed countries — giving them more time to adjust, greater flexibility, and special privileges (WTO, 2015).

2.5.1 Most Favored Nation

Under the WTO agreements, countries cannot normally discriminate between their trading partners. Grant someone a special favor (such as a lower customs duty rate for one of their products) and you have to do the same for all other WTO members.

Some exceptions are allowed. For example, countries can set up a free trade agreement that applies only to goods traded within the group — discriminating against goods from outside. Or they can give developing countries special access to their markets. Or a country can raise barriers against products that are considered to be traded unfairly from specific countries. And in services, countries are allowed, in limited circumstances, to discriminate. But the agreements only permit these exceptions under strict conditions. In general, MFN means that every time a country lowers a trade barrier or opens up a market, it has to do so for the same goods or services from all its trading partners — whether rich or poor, weak or strong (WTO, 2014).

2.5.2 WTO Doha Round

The Doha Round is the latest round of trade negotiations among the WTO membership. Its aim is to achieve major reform of the international trading system through the introduction of lower trade barriers and revised trade rules. The work program covers about 20 areas of trade. The Round is also known semi-officially as the *Doha Development Agenda* as a fundamental objective is to improve the trading prospects of developing countries.

The Round was officially launched at the WTO's Fourth Ministerial Conference in Doha, Qatar, in November 2001. The Doha Ministerial Declaration provided the mandate for the negotiations, including on agriculture, services and an intellectual property topic, which began earlier (WTO, 2014).

2.5.3 The Agricultural Negotiations in WTO Doha Round

The agriculture negotiations began in 2000, under a commitment members made in the 1986–94 Uruguay Round to continue reform in the trade. They were brought into the Doha Round when it was launched in 2001. Broadly, the objective is to reduce distortions in agricultural trade caused by high tariffs and other barriers, export subsidies, and some kinds of domestic support. The negotiations also take into account social and political sensitivities in the sector and the needs of developing countries.

2.6 South African Development Community (SADC)

The Southern African Development Community (SADC) is a Regional Economic Community comprising 15 Member States; Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. Established in 1992, SADC is committed to regional integration and poverty eradication within Southern Africa through economic development and ensuring peace and security (SADC, 2014).

Of SADC members, only Mozambique is not a member of another arrangement. Multiple memberships by SADC countries in existing or proposed customs unions (Tanzania in EAC, COMESA which includes all SADC members except for South Africa, Botswana and Mozambique) is inconsistent with the proposed formation of a SADC Customs Union. This dilemma of multiple memberships also extends to other areas such as infrastructure, where different harmonization options and strategies are being pursued (Kritzinger-van and Moreira, 2002).

2.6.1 History of SADC

The predecessor of the Southern African Development Community (SADC) was the Southern African Development Co-ordination Conference (SADCC), established in 1980 in Lusaka, Zambia. SADCC was formed to advance the cause of national political liberation in Southern Africa, and to reduce dependence particularly on the then apartheid era South Africa; through effective coordination of utilization of the specific characteristics and strengths of each country and its resources. SADCC objectives went beyond just dependence reduction to embrace basic development and regional integration.

In 1989, the Summit of Heads of State or Government, meeting in Harare, Zimbabwe, decided that SADCC should be formalized to give it an appropriate legal status an Agreement, Charter or Treaty. In 1992, Heads of Government of the region agreed to transform SADCC into the Southern African Development Community, with the focus on integration of economic development. This happened in Windhoek, Namibia, where the Heads of State and Government signed the SADC Declaration and Treaty that effectively transformed the SADCC into the Southern African Development Community (SADC, 2015).

2.6.2 Principles of SADC

The objectives of SADC, as stated in Article 5 of the SADC Treaty (1992) are to:

- Achieve development and economic growth, alleviate poverty, enhance the standard and quality of life of the people of Southern Africa and support the socially disadvantaged through Regional Integration;
- Evolve common political values, systems and institutions;
- Promote and defend peace and security;
- Promote self-sustaining development on the basis of collective self-reliance, and the inter-dependence of Member States;
- Achieve complementarity between national and regional strategies and programs;
- Promote and maximize productive employment and utilization of resources of the region;
- Achieve sustainable utilization of natural resources and effective protection of the environment;
- Strengthen and consolidate the long-standing historical, social and cultural affinities and links among the people of the Region.

2.6.3 SADC in International Trade

The countries in the Southern African Development Community are members of the WTO. These countries have also engaged in a variety of trade liberalization initiatives. For example, South Africa and the European Union (EU) negotiated a free trade agreement (FTA) in 1999 (Lewis *et al*., 2002). The EU concluded negotiations on an Economic Partnership Agreement (EPA) on 15 July 2014 with the SADC EPA Group comprising Botswana, Lesotho, Mozambique, Namibia, South Africa and Swaziland. Angola has an option to join the agreement in future.

The Economic Partnership Agreement countries in the Southern African Development Community constitute a very diverse group. Lesotho, Mozambique are least developed countries (LDCs), but countries like Namibia and Botswana hold upper middle income status. Botswana, Lesotho, Namibia South Africa and Swaziland form the Southern Africa Customs Union (SACU).

Trade between the EU and South Africa is currently governed by the Trade, Development and Cooperation Agreement between the EU and South Africa. Most of the Southern African Customs Union members have aligned their import regime to this trade

agreement. As the main point of entry into Southern African Customs Union, duties are mainly collected by South Africa, which then redistributes to the other members according to an agreed formula.

The Southern African Development Community EPA countries are strong in the exports of diamonds and in South Africa, Botswana, Lesotho and Namibia these constitute a large to dominant share of their exports to the EU. Other products from the region include agricultural products (beef from Botswana, fish from Namibia or sugar from Swaziland), oil from Angola or aluminum from Mozambique. South Africa's exports to the EU are much diversified and range from fruit to platinum and from manufactured goods to wine.

The EU exports a wide range of goods to the Southern African Development Community EPA countries, including vehicles, machinery, electrical equipment, pharmaceuticals and processed food.

The EPA has been construed so as to give asymmetric access to the partners in the SADC EPA region. Botswana, Lesotho, Mozambique, Namibia, and Swaziland (BLMNS) do not need to reciprocate the EU offer of 100% access. South Africa does not need to reciprocate the 95% access offered by the EU. Instead, they can shield sensitive products from full liberalization.

*Table 1 - Degree of Trade Liberalisation (*estimates*)*

EU offer to BLMNS	TARIFF LINES	TRADE VOLUME
Full liberalisation	100% (exc. CHP 93 arms)	100% (exc. CHP 93 arms)

EU offer to SA	TARIFF LINES	TRADE VOLUME
Full and partial liberalisation	98,1%	99,3%
Excluded	1,9%	0,7%

SACU offer to EU	TARIFF LINES	TRADE VOLUME
Full or partial liberalisation	97,7%	85,6%
Excluded	2,3%	14,4%

CHP 93 arms = Chapter 93: Arms and Ammunition (World Customs Org.) – Source: European Commission

2.7 The Heckscher-Ohlin theorem

The Heckscher-Ohlin theorem provides the most widely accepted explanation of the pattern of trade, based on countries' factor requirements of different kinds of goods and the differing factor endowments. The theory states that trade occurs because the cost of labor relative to that of capital is lower in the labor-abundant country, which means that the price ratio of labor-intensive goods to capital-intensive goods is lower in the labor-abundant country than in the capital-abundant country.

This provides a basis for comparative advantage and when trade begins each country exports commodities that use the relatively abundant factors and imports those that use scarce factors more intensively. This is the equivalent of exporting labor for capital, in the case of the labor-abundant country, but commodities have to move instead, as factors are not mobile internationally (Miberg, 1996).

It also implies that the labor-abundant country exports labor-intensive goods, whilst the capital-abundant country exports capital-intensive goods, while other things being equal. Arguably, this process could play an important role in food insecurity reduction in labor-abundant developing countries, by bidding up the price of labor and thus raising workers incomes. Promoters of free trade also argue that, under competitive free market conditions (the stylized conditions of perfect competition) trade maximizes potential economic welfare internationally, by creating a situation where no country can be made better off without another being made worse off. It is a situation where those that gain from trade could fully compensate those that lose and still be better off: the total gain will be greater than the total loss. This theory is widely used in WTO's policy.

However, there are a number of important assumptions to these predictions of the model that must be taken into consideration. First, the consequences described are dependent on the assumption of competitive markets. In the absence of these, countries may be better off intervening to restrict free trade. Second, there are no mechanisms in place to ensure that losers in the world market will be compensated by those that benefit, so the gains remain potential. Thirdly, countries will not necessarily gain equally from trade: the relative gains will depend on the terms of trade. Fourthly, the issue of redistribution also applies within countries, where there will also be gainers and losers from trade. Finally, any comparative static solution described by the conventional theory assumes that all external costs are internalized, including environmental externalities, a subject of some contemporary debate (FAO, 2003).

3. Objectives

The main goal of the thesis is to contribute to the ongoing discussion whether food availability in developing countries changes mainly because of higher domestic food production or rather because of open international trade with food. I based the research on the example of South African Development Community (SADC).

To derive the statistically significant conclusions, it was important to analyze the situation on the world food market in the last 15 years. I statistically analyzed secondary data collected and maintained by the international organizations, namely the Food and Agriculture Organization, World Bank and United Nations. Their databases are publicly available online. For data analysis and data processing I used Linear Regression method to determine relationships between the examined variables and the Revealed Symmetric Comparative Advantage method to describe trends in international food trade in the last 15 years. Based on the data analysis, the thesis examines:

- If food imports have some effect on food security;
- If food imports and import tariffs affect the value of domestic food production;
- If open international trade with food helps SADC countries to utilize their comparative advantage in food production.

4. Methodology

4.1 Main Hypothesis

To achieve the main goal of the thesis I chose to examine the following hypothesis:

- Hypothesis 1 – Import tariffs favor the local producers and restrict imports from abroad
- Hypothesis 2 – Average dietary energy supply adequacy is influenced by domestic food production rather than by food imports from abroad
- Hypothesis 3 – Open international market helps SADC countries to export more food
- Hypothesis 4 – Political stability is positively correlated with food security

4.2 Data Collection

To accomplish the goals of my thesis I had to use and statistically analyze the secondary data from several multinational organizations. The main statistical sources for my thesis were The Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), United Nations Conference and Development (UNCTAD) and World Trade Organization (WTO).

4.2.1 FAOSTAT

For the data about food production I used data from The Food and Agriculture Organization Corporate Statistical Database website (FAOSTAT). It is the statistical division of the Food and Agriculture Organization (FAO), of the United Nations. FAOSTAT data are provided as a time-series from the 1961 in most domains for 245 regions in English, Spanish and French.

Food Balance Sheets (FBS) provide essential information on the food system of a country. They look at:

- the domestic supply of food commodities
- the domestic food utilization
- the food supply available for human consumption

Food Balance Sheets are prepared by FAO using official statistics provided by the countries. They are updated annually and are available for nearly all countries. The Dietary Energy Supply (DES) derived from the Food Balance Sheets is also used for estimating the prevalence of undernourishment at national, regional and global levels.

The Food Security domain of FAOSTAT database covers food security indicators for all four parts of food security. I have chosen these specific indicators to measure their effect on the state of food security in SADC countries:

- Availability of food - measured through the
  - Average Dietary Energy Supply Adequacy
  - Average Value of Food Production
  - Average Protein Supply
- Access to food – measured by
  - Depth of Food Deficit
- Stability measured as
  - Political Stability and Absence of Violence/Terrorism

4.2.2 UNCTAD

For the evaluation of world trade with food I used data from United Nations Conference and Development (UNCTAD). "Being the United Nations' focal point for the integrated treatment of trade and development and the interrelated issues in the areas of finance, technology, investment and sustainable development, UNCTAD compiles, validates and processes a wide range of data collected from national and international sources." If some data for some regions are missing, UNCTAD uses its expertise and methodology to make estimates, which makes the set of data complete.

The commodity structure of SITC classification is divided into ten groups as following:

Food in broad sense (SITC 0 + 1 + 22 + 4):

0 – live animals, and all unprocessed and processed food products

00 – Live animals other than animals of division 03

01 – Meat and meat preparations

02 – Dairy products and birds' eggs

03 – Fish, crustaceans, molluscs, and preparations thereof

04 – Cereals and cereal preparations

05 – Vegetable and fruit

06 – Sugars, sugar preparations and honey

07 – Coffee, tea, cocoa, spices and manufactures thereof

08 – Feeding stuff for animals (not including unmilled cereals)

09 – Miscellaneous edible products and preparations

1 – beverages and tobacco

2 – inedible crude materials except fuels

22 – oil seeds and oleaginous fruits

4 – animal and vegetable oils and fats

SITC and HS comparison

The Standard International Trade Classification (SITC) and Harmonized System (HS) are two different trade classifications, the main difference being that the SITC is focused more on the economic functions of products at various stages of development, whereas the HS deals with a precise breakdown of the products' individual categories.

The SITC was developed by the United Nations with the intention of classifying traded products not only on the basis of their material and physical properties, but also according to which stage of processing, as well as their economic functions in order to facilitate economic analysis. The SITC was originally developed for statistical purposes and it has to maintain a correlation with the tariff nomenclature (classification) seeing as customs declarations are the principal source of trade data.

The HS was introduced in 1988, and has since then it has become an internationally accepted method of classification wherever products are traded. The HS classification is "harmonized" in relation to the classifications of the United Nations and the European

Communities. Goods are classified according to simple objective criteria and applications. (ITC, 2015)

4.2.3 World Trade Organization

The World Trade Organization's (WTO) work is to help trade flow more smoothly and predictably. Their work has two levels: lowering trade barriers where they can be lowered, and writing rules for maintaining trade barriers and for other trade policies. In the Hypothesis 1 I used the WTO database to extract data about tariffs on food imports into SADC. The WTO has the most comprehensive statistical database about tariffs and other trade barriers. This database contains comprehensive information on Most Favored Nation (MFN) applied and bound tariffs at the standard codes of the Harmonized System (HS) for all WTO Members.

4.3 Regression Analysis

Regression analysis is basic statistical instrument for data analysis. It is used for investigation of dependence between studied variable (dependent) and the explanatory variables (independent ones) of quantitative variables in a specific period of time. The simple regression analysis is called Linear Regression, as it consists of just two variables and can be presented by simple straight line. It attempts to model the relationship between two variables by fitting a linear equation to observed data. This does not necessarily imply that one variable causes the other, but that there is some significant association between the two variables. One of the variables is called dependent (explaining) variable y, while the other one is independent (explanatory) variable x. The simple linear regression equation is defined as:

$$y = \alpha + \beta x + \epsilon \quad (1)$$

The α is absolute member and β are regression coefficients – α is the y-intercept (the value of y when x = 0) and β is the slope of regression line. Epsilon (ϵ) is the residual and it stands for the distance between predicted theoretical and actually measured value of dependent variable.

It is also important to understand how much dependent the two variables are. This can be revealed by coefficient of correlation r and coefficient of determination r^2.

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2 - (\sum y)^2}} \quad (2)$$

The value of r is such that -1 < r < +1. The + and – signs are used for positive linear correlations and negative linear correlations, respectively. A correlation *greater than 0.8* is generally described as strong, whereas a correlation *less than 0.5* is generally described as weak.

Positive correlation: If x and y have a strong positive linear correlation, r is close to +1. An r value of exactly +1 indicates a perfect positive fit. Positive values indicate a relationship between x and y variables such that as values for x increases, values for y also increase.

Negative correlation: If *x* and y have a strong negative linear correlation, r is close to -1. An r value of exactly -1 indicates a perfect negative fit. Negative values indicate a relationship between x and y such that as values for x increase, values for y decrease.

No correlation: If there is no linear correlation or a weak linear correlation, r is close to 0. A value near zero means that there is a random, nonlinear relationship between the two variables

The coefficient of determination, r^2, is useful because it gives the proportion of the variance (fluctuation) of one variable that is predictable from the other variable variance. It is a measure that allows us to determine how certain one can be in making predictions from a certain model/graph. R^2 is the ratio of the explained variation to the total variation. It always has values from the interval $0 \leq r^2 \leq 1$, and denotes the strength of the linear association between x and y. It represents the percent of the data that is the closest to the line of best fit. For example, if r = 0.922, then $r^2 = 0.850$, which means that 85% of the total variation in y can be explained by the linear relationship between x and y (as described by the regression equation). The other 15% of the total variation in y remains unexplained. All together it means that the coefficient of determination is a measure of how well the regression line represents the data. If the regression line passes exactly through every point on the scatter plot, it would be able to explain all of the variation. The further the line is away from the points, the less it is able to explain.

For more complicated relationships the linear regression is not sufficient enough. If the relationship displayed by linear regression line doesn't fit the reality, we can use polynomial regression function. In general, we can model the expected value of y as an nth degree polynomial, yielding the general polynomial regression model:

$$y = \alpha_0 + \alpha_1 x + \alpha_2 x^2 + \alpha_3 x^3 + \cdots + \alpha_n x^n + \epsilon \quad (3)$$

The residual ϵ have to have the normal probability distribution. In some cases we get correlated residuals, for example when the two datasets have the same linear trend. To get rid of this trend we can use the 1st differences of variables, as displayed in equation 4. These modified variables now can be used in the regression model and their residuals should have the normal probability distribution. To check if they have normal distribution, we can use Durbin – Watson test. This test has values from interval <0;4> and it should have values close to 2, otherwise there is positive of negative correlation of residuals.

$$y' = y_n - y_{n-1} \quad (4)$$

4.4 Theory of Revealed Symmetric Comparative Advantage (RSCA)

The term of Revealed Comparative Advantage was first used in the 1960's by Bela Balassa. Since then this term has been used in numerous publications and scientific papers as a measure of international trade specialization.

The Revealed Comparative Advantage index can be defined as:

$$RCA = \frac{X_{ij}/\sum_i X_{ij}}{\sum_j X_{ij}/\sum_i \sum_j X_{ij}} \quad (5)$$

The numerator represents the percentage share of a given sector in national exports - X are ij exports of sector i from country j. The denominator represents the percentage share of a given sector in world exports. The RCA index, thus, contains a comparison of national export structure (the numerator) with the world export structure (the denominator). When RCA equals 1 for a given sector in a given country, the percentage share of that sector is identical with the world average. Where RCA is above 1 the country is said to be specialised in that sector and vice versa where RCA is below 1. However, since the RCA turns out to produce an output which cannot be compared on both sides of 1. Vollrath (1991) suggests to take the logarithm to the RCA, as a solution to this problem. However, in the case that a country exports zero in a sector, the index is not defined.

Measure that makes the index symmetric is labelled 'Revealed Symmetric Comparative Advantage' (RSCA) and is defined as:

$$RSCA = \frac{(RCA - 1)}{(RCA + 1)} \qquad (6)$$

This measure ranges from -1 to +1 and is fully comparable between all sectors and countries at all time. Furthermore, RSCA index can be used when comparing progress in trade specialization. Using simple linear regression analysis model, the equation is defined as:

$$RSCA_{ij}^{t_2} = \alpha_i + \beta_i RSCA_{ij}^{t_1} + \epsilon_{ij} \qquad (7)$$

The superscripts t_1 and t_2 refer to the initial year and the final year, respectively. The dependent variable, RSCA at time t_2 for sector i, is tested against the independent variable which is the value of the RSCA in the previous year t_1. α and β are standard linear regression parameters and ϵ is 1 a residual term. Basically, the size of β^* measures how stable the specialisation pattern of a country has been, between the two periods.

If β^* is low, one can talk about a high degree of turbulence, while the pattern can be said to be unchanged, if β^* is not significantly different from one. β^*/R^* (R^* is the correlation coefficient from the regression) measures whether the level of specialisation has gone up or down between the two periods (an increase or a fall in dispersion of specialisation). If $\beta^*/R^* > 1$, specialisation increases, while specialisation decreases, if $\beta^*/R^* < 1$. (Laursen, 1998)

5. Results

5.1 Hypothesis 1 – Import tariffs favor the local producers and restrict imports from abroad

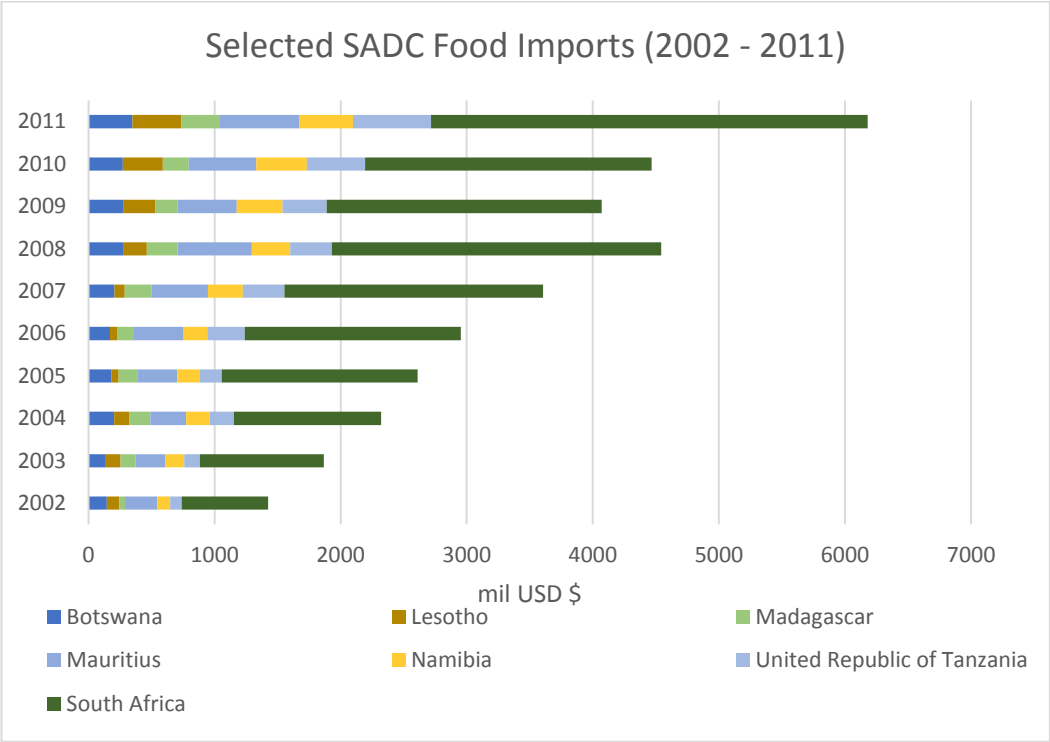
Through this hypothesis I wanted to study if imposed import tariffs have an effect on domestic production as well as on imports of food from abroad. To evaluate this assumption I chose five groups of food products in seven SADC countries (these countries were: Botswana, Lesotho, Madagascar, Mauritius, Namibia, South Africa and Tanzania) between the years 2002 and 2011. This selection was made mainly because of better data availability in the WTO and UNCTAD statistical databases.

In the Table 1 there is brief summary of selected commodities and evolution of their applied MFN import tariffs in 2002 – 2011. Data presented in the table are percentage values of MFN import tariffs according to WTO statistics. From the last row of the table it is visible that the average import tariffs on selected commodities were decreasing since 2002, especially tariffs on meat and sugar. On the other hand, imports on cereals have slightly increased, but since 2005 they have been decreasing as well as other tariffs.

Table 2 - Applied MFN Import tariffs on selected tariff lines in selected SADC countries (Source: WTO)

HS Code	HS Code Description	2002	2005	2008	2011
02	MEAT AND EDIBLE MEAT OFFAL	19,89	10,83	8,50	7,10
03	FISH AND CRUSTACEANS, MOLLUSCS AND OTHER	9,69	9,18	10,17	8,72
08	EDIBLE FRUIT AND NUTS; PEEL OF CITRUS FRUIT OR MELONS	11,29	12,98	11,50	9,83
10	CEREALS	2,46	4,70	4,53	3,67
17	SUGARS AND SUGAR CONFECTIONERY	11,97	12,12	7,98	6,10
	TOTAL AVERAGE	11,06	9,96	8,54	7,08

If the import tariffs are decreasing, there should be more imports from abroad as common sense says. I extracted the imports data from the UNCTAD statistics website. I chose to examine data about import values of meat, fishes, fruits, cereals and sugars to seven selected SADC countries in 2002 – 2011. Indeed, the Graph 2 shows that the value of imports corresponding to chosen selection significantly increased.



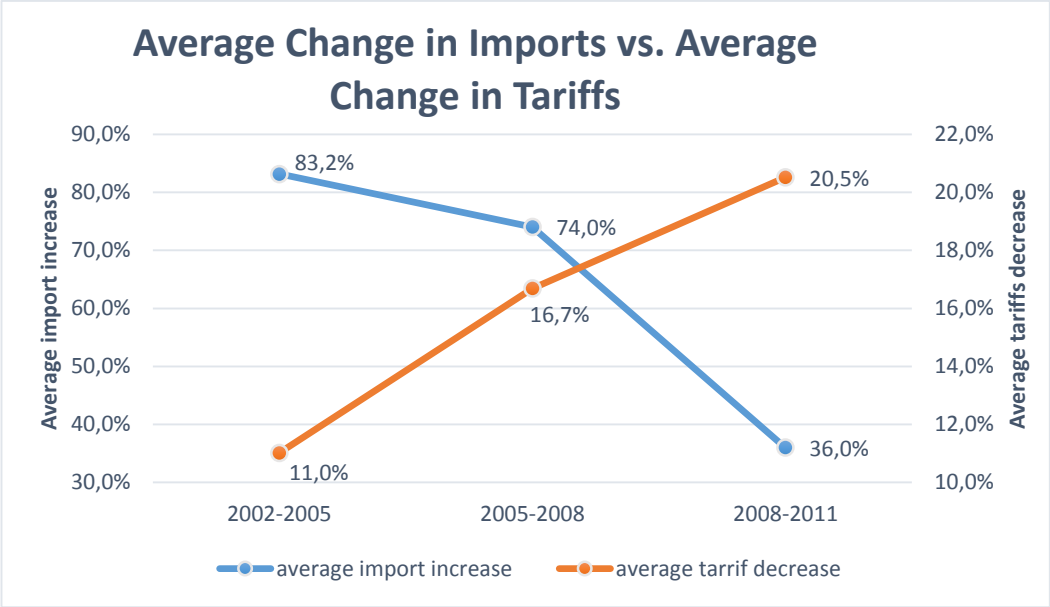
Graph 2 – Selected SADC import statistics (2002 – 2011) (Source: UNCTAD)

The value of imports into selected SADC countries have been increasing every year with the exception of year 2009, when the financial crisis hit the global economy. SADC food imports more than quadrupled from 1,42 billion USD in 2002 to 6,18 billion USD in 2011, setting an average increase rate of 19% every year. The main driving force in the import growth has been South Africa, whose imports raised by 405% to 3,46 billion USD in 2011. United Republic of Tanzania experienced another significant rise in imports from 92 million USD in 2002 to 621 million USD in 2011, which is increase about 571% in 11 years.

Table 3 - SADC selected food imports 2002 – 2011 in thousands of USD (Source: UNCTAD)

COUNTRY	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Botswana	144 641	136 864	203 842	179 621	169 776	204 886	278 016	273 809	272 099	347 206
Lesotho	98 985	117 424	120 682	58 237	56 929	82 561	184 548	254 649	316 837	387 842
Madagascar	46 472	119 242	165 676	153 150	134 202	211 760	241 870	176 570	204 767	299 588
Mauritius	254 824	233 057	283 392	311 345	388 330	447 455	590 803	471 406	536 754	638 409
Namibia	101 325	151 355	185 582	181 290	191 702	277 004	303 606	363 235	400 177	423 096
South Africa	686 256	982 799	1 166 644	1 553 712	1 715 063	2 050 717	2 614 399	2 180 365	2 273 610	3 462 763
Tanzania	92 595	124 875	194 361	173 170	296 855	330 515	330 068	349 275	462 762	621 505
TOTAL	1 425 099	1 865 615	2 320 180	2 610 526	2 952 857	3 604 896	4 543 310	4 069 308	4 467 006	6 180 409

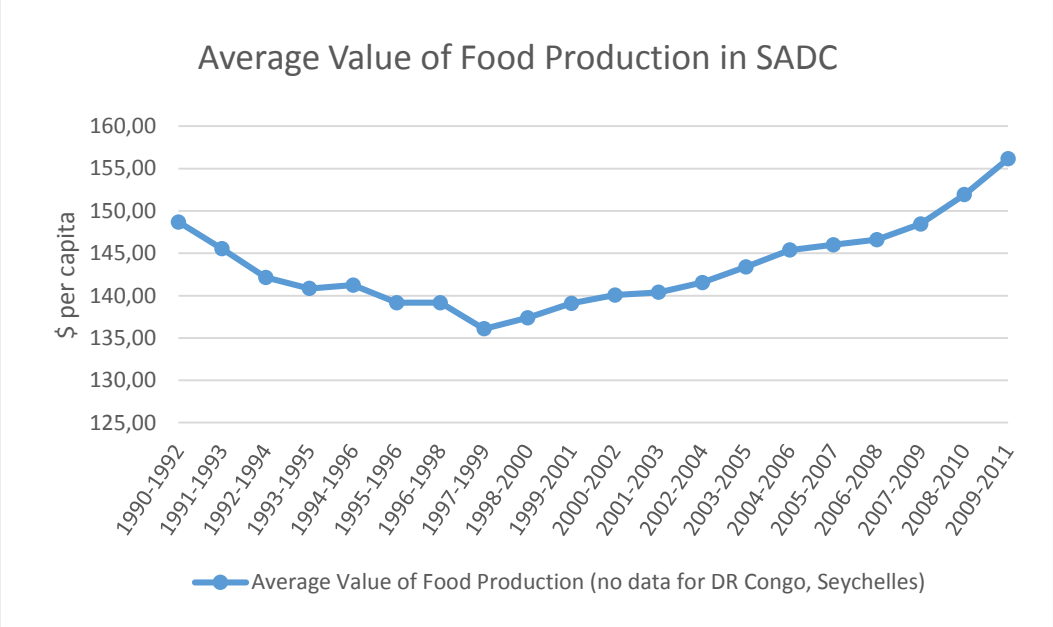
As is visible from Tables 3 and 4, while food tariffs decrease, food import value increases. However, the next Graph 3 shows interesting relation between the rate of the change in values of imports and tariffs respectively.



Graph 3 - Average Increase in Imports vs. Average Decrease in Tariffs (Source: based on data from WTO, UNCTAD)

The average tariff value is decreasing faster in time, while average import value increase is slowing down. That is very interesting – it shows, that average import value is increasing, however not as fast as tariffs are decreasing. This could mean that tariff rate is not fully responsible for the value of imports. More information about this result can be found in the Discussion chapter.

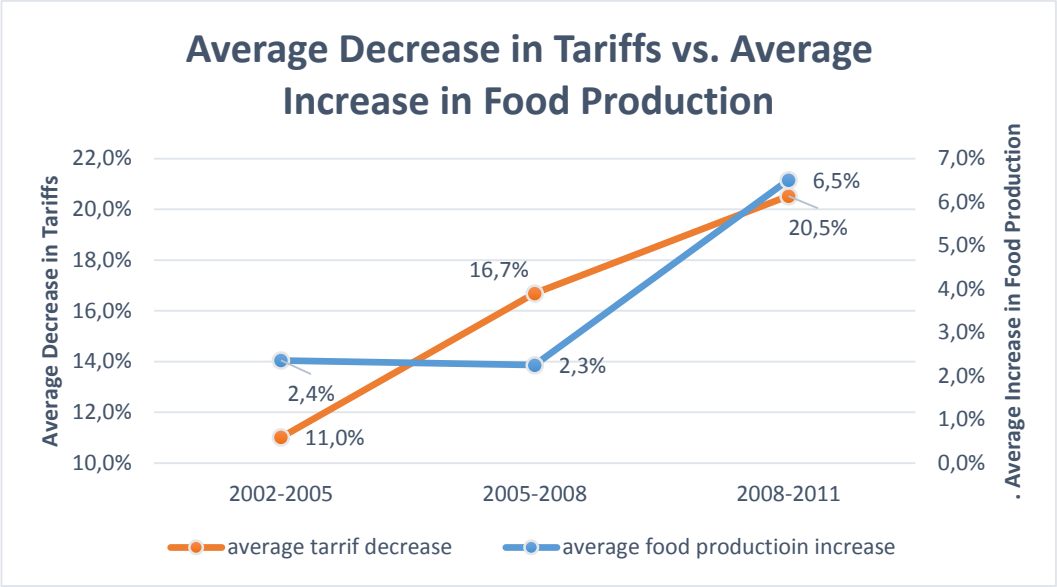
The next assumption of this hypothesis was that import tariffs help domestic production in SADC (excluding DR Congo and Seychelles). The indicator is compiled of three years average of $ value of food production per capita. Its progress since 1992 to 2011 in SADC countries can be seen in Graph 4. The indicator reached its bottom in the 1999 especially because of Botswana and Namibia which both lost about 25% of its food production value at that time. Since then it is steadily growing every year, reached the previous top value from 1992 in 2009 and is still growing.



Graph 4 - Average Value of Food Production in SADC (Source: FAOSTAT data)

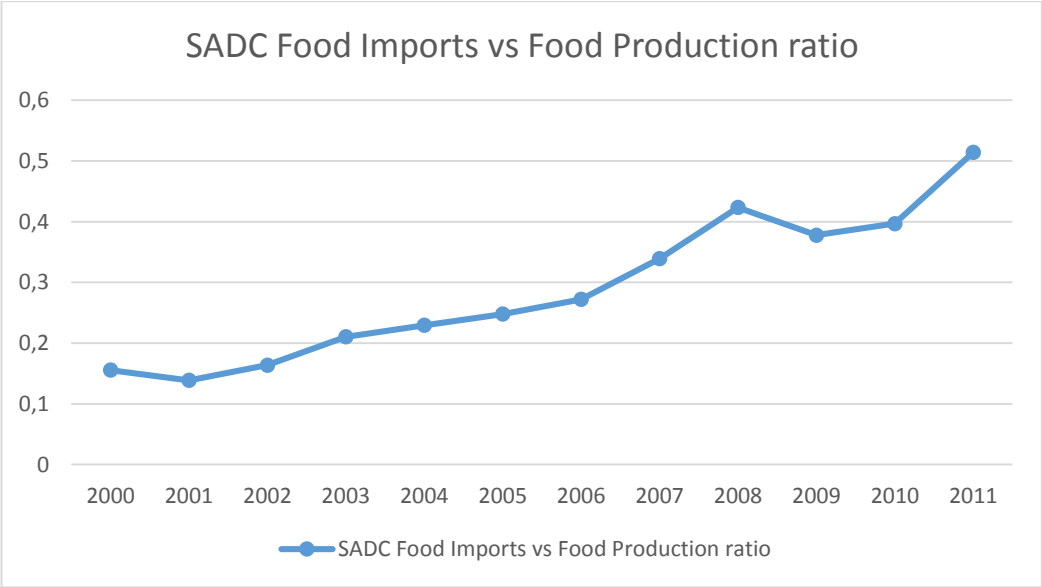
As it is visible from Graph 5, the average food production was increasing in slower rate than the value of imports. However in 2008 – 2011 the average increase of food production was about 4,2% higher than in 2005 - 2008, while the increase of imports was about 38% lower in 2008 – 2011 than in 2005 – 2008.

It means that despite lower tariffs on food items food production was growing even more than before, while the imports were growing slower. This hypothesis thus remain unproved.



Graph 5 - Average Decrease in Tariffs vs. Average Increase in Food Production (Source: based on data from WTO, FAOSTAT)

The graph 6 shows SADC food imports vs. food production ratio. It is clearly visible, that the ratio is growing at almost exponential way since 2001, with only two years of decline in 2009 and 2010 during the global financial crisis. To get this ratio I multiplied data about average food production with official SADC statistics about its population (excluding DR Congo and Seychelles) to get the total value of SADC food production and then I used it to divide the value of SADC food imports with it.

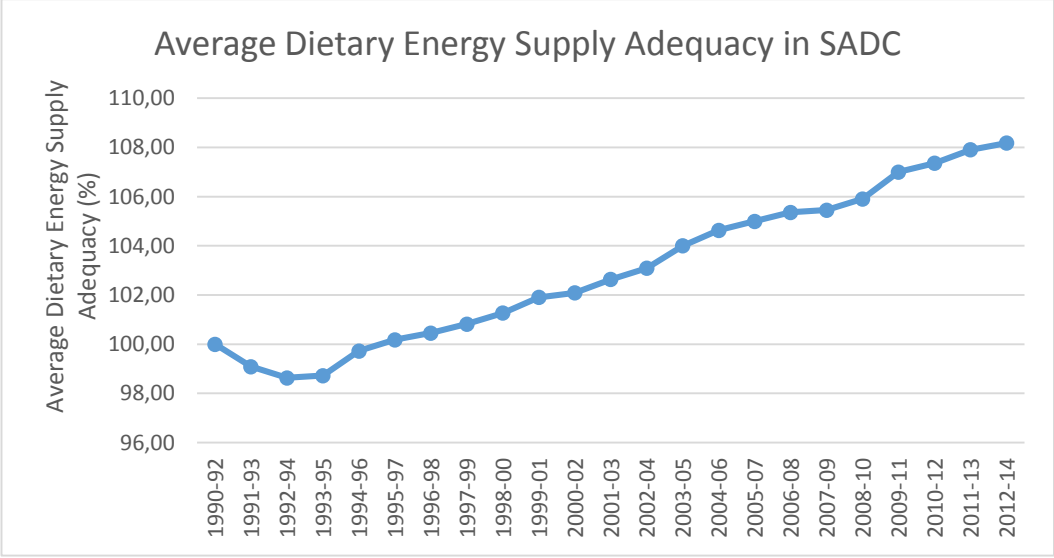


Graph 6 - SADC Food Imports vs. Food Production Ratio (Source: FAO, UNCTAD, SADC data)

5.2 Hypothesis 2 – Average dietary energy supply adequacy is influenced by domestic food production rather than by food imports from abroad

The second hypothesis was aimed at measuring the effect of food imports on the average dietary energy supply adequacy. I used data from 11 SADC countries with exception of DR Congo, Seychelles, Zimbabwe and Swaziland, because their data about these two indicators were not available.

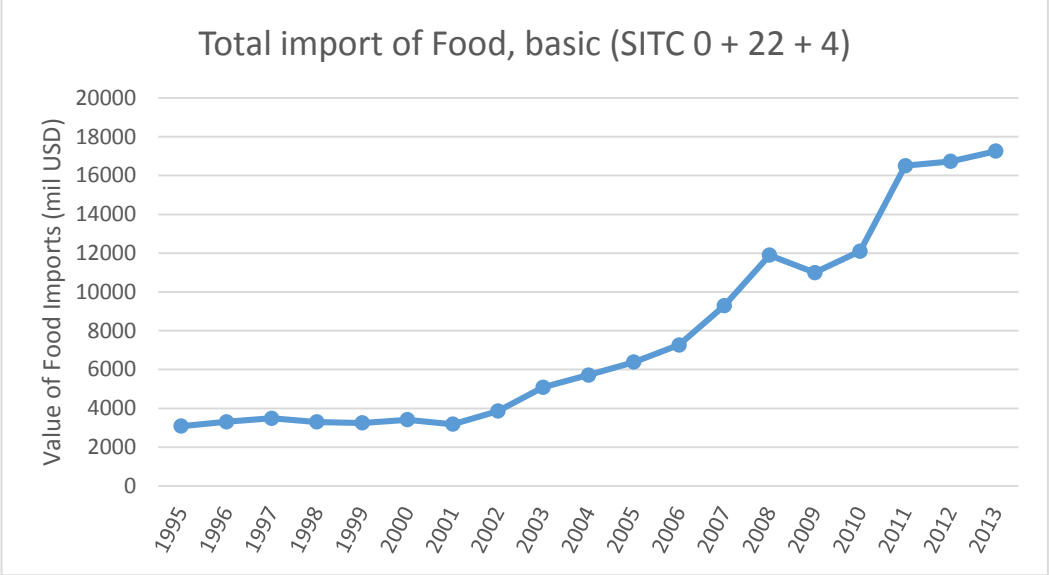
The indicator of average dietary energy supply adequacy expresses the Dietary Energy Supply as a percentage of the Average Dietary Energy Requirement in each country. Each country's or region's average supply of calories for food consumption is normalized by the average dietary energy requirement estimated for its population, to provide an index of adequacy of the food supply in terms of calories. The indicator is calculated as an average over 3 years to reduce the impact of possible errors in estimated Dietary Energy Supply, due to the difficulties in properly accounting of stock variations in major food. It thus provides an indicator of structural food supply adequacy. The index has been over 100% since 1996 for SADC countries. Since the 1994 the average dietary energy supply grew from 98,64% to 108,18%. The graph 7 shows steady positive growing trend.



Graph 7 - Average Dietary Energy Supply Adequacy in SADC (Source: FAOSTAT)

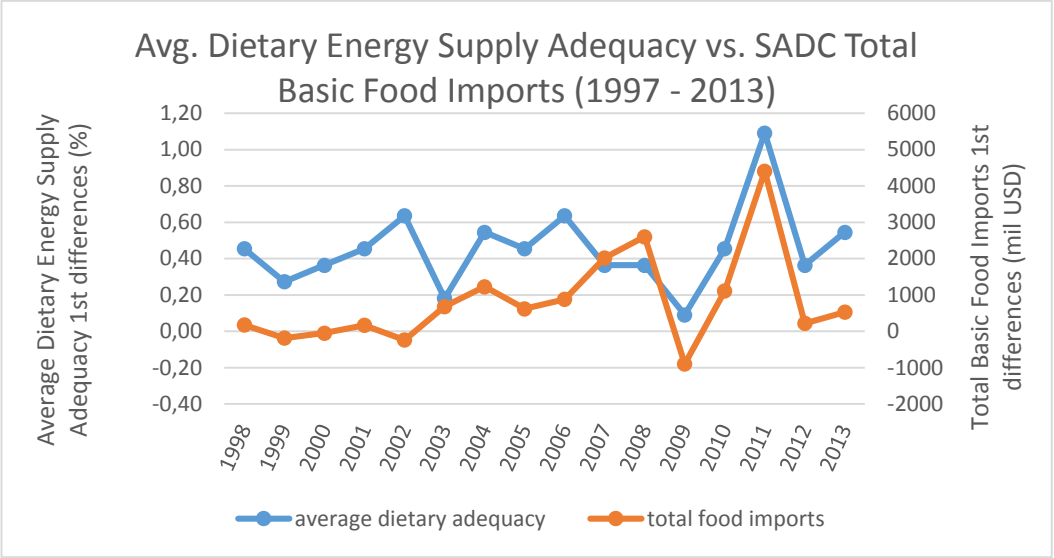
For the data about food imports I used data from UNCTAD about imports of basic food. This category is defined as compilation of SITC codes 0, 22 and 4, which are "Food and Live Animals", "Oil-seeds and Oleaginous Fruits" and "Animal and Vegetable Oils, Fats and Waxes". The food imports were growing steadily since 2001, with the exception of year 2009 and the global financial crisis (graph 8). The actual value of food imports from 2013 is 17 255 million USD which is more than five times more than in 2001.

SADC countries have been importing mainly cereals and cereal preparations followed by meat and meat preparations.



Graph 8 - Total import of Food, basic (SITC 0 + 22 + 4) (Source: UNCTAD)

To get rid of autocorrelation of residuals in the linear regression model, I used the 1st differences of their values. The graph 9 shows the 1st differences of variables since 1997 to 2013. Both lines are showing quite steady trend of growth before 2008. In 2009 both took its lowest point since 1997 and then rocketed to their maximums in 2011. The next year both lines fell back approximately to their average values. From this brief description it is obvious that both variables have some correlation of their 1st differences.

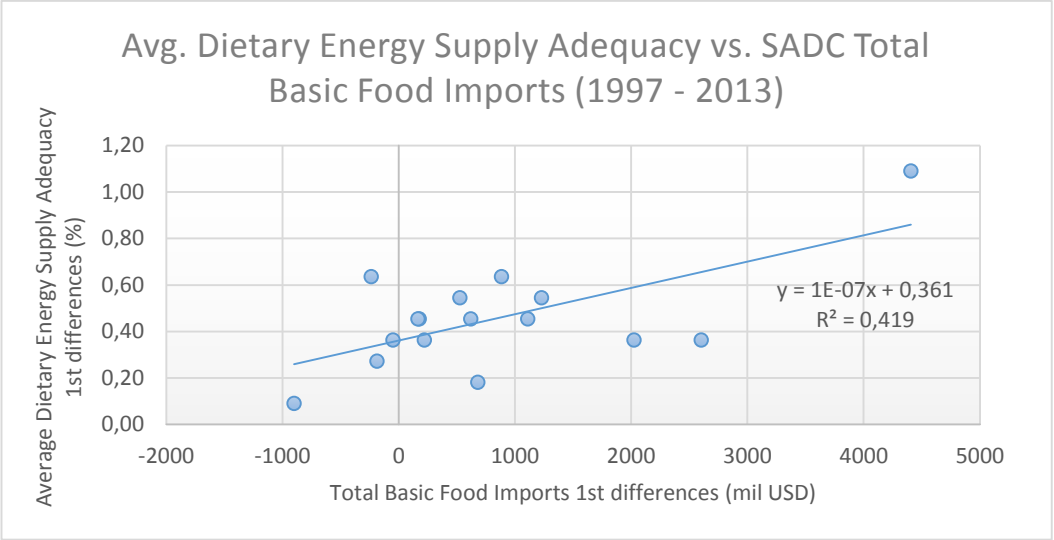


Graph 9 - Avg. Dietary Energy Supply Adequacy vs. SADC Total Basic Food Imports (1997 - 2013)

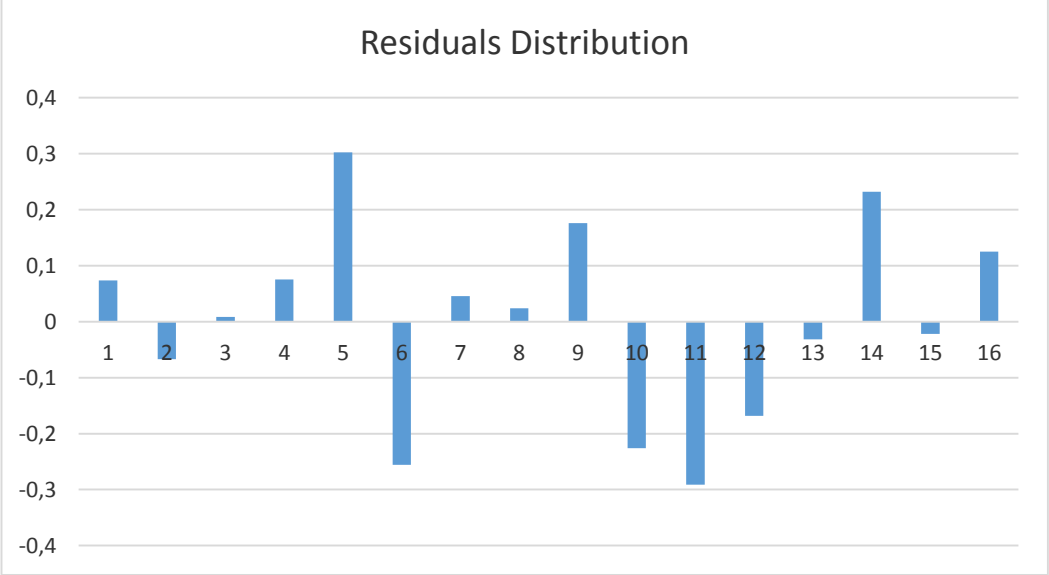
The regression analysis can be seen in the scatter graph 10. The coefficient of determination r^2 is 0,419 and the coefficient of correlation r is 0,648. The critical table value of r for n = 16 and $\alpha = 0{,}95$ is 0,497, and the p value is 0,006, therefore the measured value of r = 0,648 is sufficient and the SADC food imports level is related to average dietary energy supply adequacy with 95% level of probability. The detrended linear regression function (8) can be described as:

$$y = 0{,}361 + 0{,}1x + \epsilon \qquad (8)$$

Its meaning can be explained as: If the change in total food imports = 0, then the average dietary energy supply adequacy will increase about 0,36%. With every additional billion USD, the average dietary energy supply adequacy will increase about additional 0,1%.



Graph 10 - Avg. Dietary Energy Supply Adequacy vs. SADC Total Basic Food Imports (1997 - 2013)

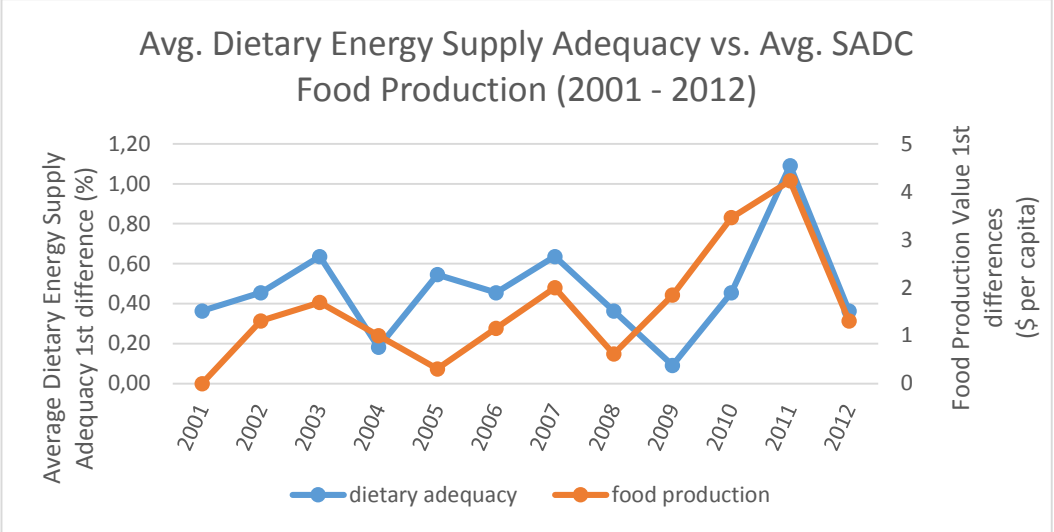


Graph 11 – Residuals Distribution 1

Durbin – Watson statistics of residuals is 1,955; that means that there is no autocorrelation of residuals. The graph 11 shows graphical residuals analysis, which confirms the statement about no autocorrelation of residuals.

The second half of hypothesis 3 examines the relationship between SADC Average Dietary Energy Supply Adequacy index and SADC average food production value. For the data about food production I used the same values as in the hypothesis 1, it means that the data are for 13 SADC states excluding DR Congo and Seychelles. The graphical

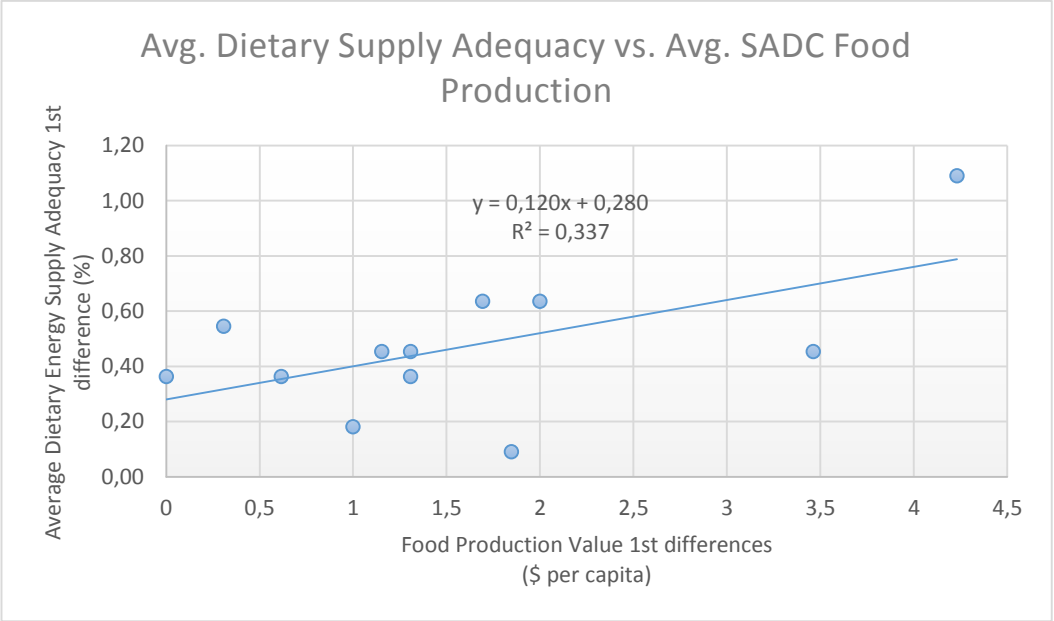
analysis of the 1st differences of both variables can be seen below in the graph 12. From this graph we can see some common patterns in the trend lines as they both keep above the 0 level in all measured years. Then we can see common tops in years 2003, 2007 and 2011 as well as the sharp decline in 2012. Hence, both variables have some common trends noticeable.



Graph 12 - Avg. Dietary Energy Supply Adequacy vs. Avg. SADC Food Production (2001 - 2012)

The next graph 13 shows the distribution of variables. The common trend is not very clear there, the value of distribution coefficient $r^2 = 0{,}337$, which doesn't show any strong relationship. The correlation coefficient r = 0,580. Critical r value for n = 12 is 0,532, so the r is still just above the low limit. The p value for variable x is 0,048, which is still in the sufficient range, although very close to the limit. The outliers visible in the scatterplot in the top right corner and near the bottom are the values from 2009, when SADC economies were slowed by the financial crisis and from 2011, when on the contrary the economies expanded.

Thus we can say that variable x (SADC food production) has some impact on variable y (avg. dietary supply adequacy) with 95% probability.



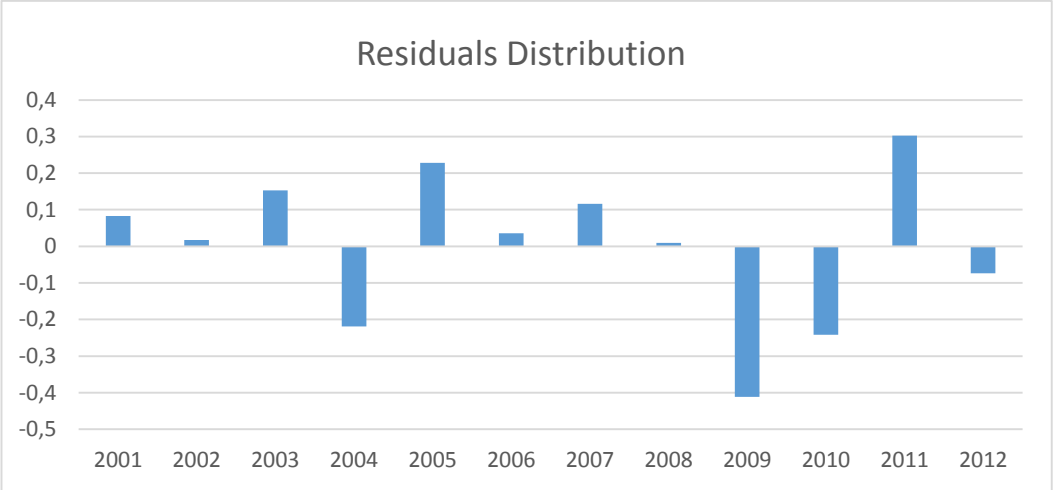
Graph 13 - Avg. Dietary Energy Supply Adequacy vs. Avg. SADC Food Production (Source: FOASTAT, UNCTAD)

The linear function for this model is:

$$y = 0{,}280 + 0{,}120x + \epsilon \qquad (9)$$

This equation can be explained for future prognosis in this way: If the change in food production value = 0, then average dietary energy supply adequacy increase by 0,28%. With every additional 1 USD of SADC domestic food production per capita the average dietary energy supply adequacy increase by additional 0,12%.

Also the residuals distribution went well. The Durbin-Watson statistics is 2,254, which indicates normal distribution of residuals with no autocorrelation. This is proved also by the graphical illustration of residuals distribution which can be observed in graph 14.

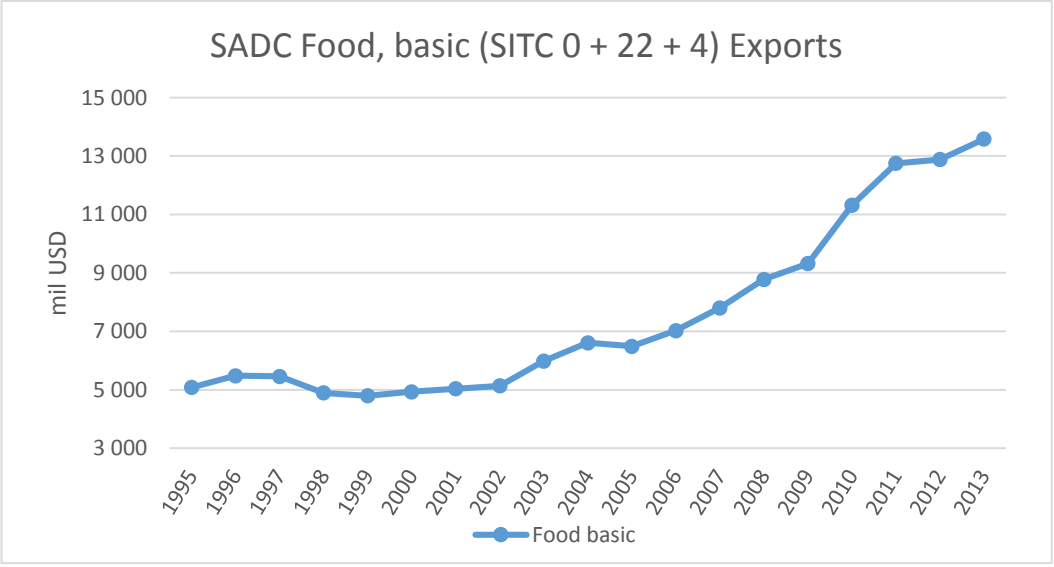


Graph 14 – Residuals Distribution 2

5.3 Hypothesis 3 – Open international market helps SADC countries to export more food

The aim of the third hypothesis was to prove whether there is correlation between open international trade market and better specialization of SADC in food industry. I used UNCTAD data about trade with aggregate indicator of basic food (SITC 0, 22, 4).

The Graph 15 shows that since 2002 the SADC basic food exports are growing at almost exponential rate. From this graph it looks clear, that the open international market had positive effect on SADC food industry and its exports.



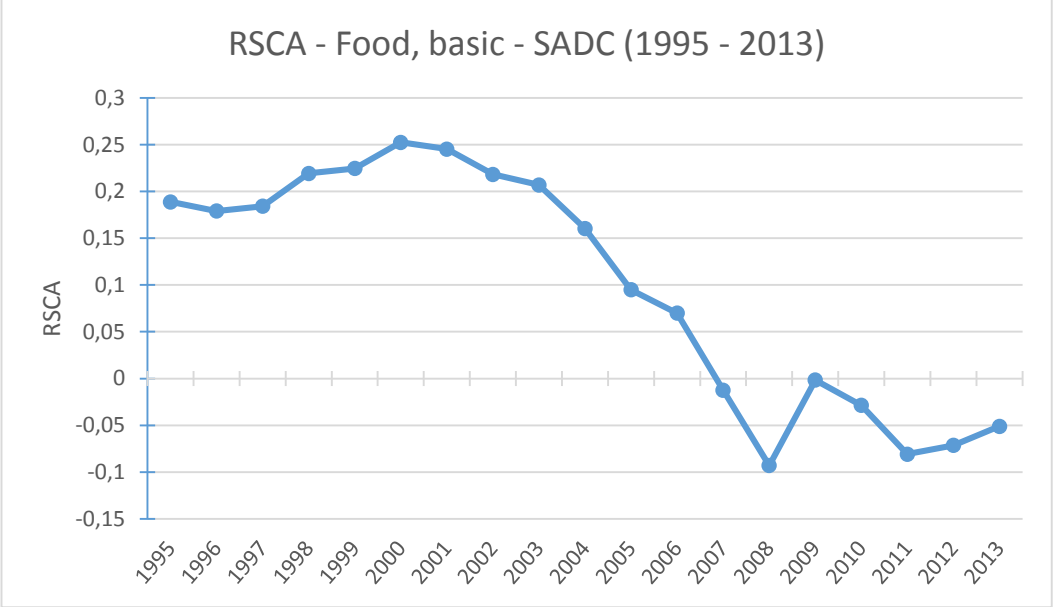
Graph 15 - SADC Food, basic (SITC 0 + 22 + 4) Exports

Among the most exported commodities we can find vegetables and fruits, with the export value of more than 4 billion USD in 2013, than fishes with 2,5 billion USD in 2013, crustaceans and molluscs, sugar and its preparations, cereals or coffee, all of it exported in value of 1 billion USD or more in 2013. Full summary of SADC food exports can be viewed in Table 4:

Table 4 - SADC Food Exports 2013 (Source of data: UNCTAD)

PRODUCT (thousands of USD)	2013
Vegetables and fruits	4 425 734
Fish, crustaceans, molluscs and preparations thereof	2 490 694
Sugar, sugar preparations and honey	1 713 719
Cereals and cereal preparations	1 524 622
Coffee, tea, cocoa, spices, and manufactures thereof	938 172
Feedstuff for animals (excluding unmilled cereals)	533 705
Miscellaneous edible products and preparations	404 146
Meat and meat preparations	398 525
Dairy products and birds' eggs	256 303
Fixed vegetable oils and fats, crude, refined	244 586
Live animals	142 799
Food, basic (SITC 0 + 22 + 4)	13 579 396

However, on the next Graph 16 almost completely opposite trend is evident. Using the Revealed Symmetric Comparative Advantage index, the graph shows that the SADC countries had lost its comparative advantage in trade with basic food products in the last decade. The coefficient was at its highest point in 2000 (0,25), in eight years it fell to -0,09 in 2008. Since then the index is still under the zero level.



Graph 16 - RSCA - Food, basic - SADC (1995 - 2013)

What these two graphs show is that even when value of food exports is growing, the SADC region lost its comparative advantage in this sector of economy. It is proved also by the regression analysis. The β coefficient was measured as β = 0,939, that means that the RSCA was slowly decreasing during the period from 1995 to 2013. Interestingly, the coefficient of correlation r was calculated also 0,939, so the β/r index is exactly 1; it means that the trend of decreasing was steady through all measured time. The regression equation is demonstrated as:

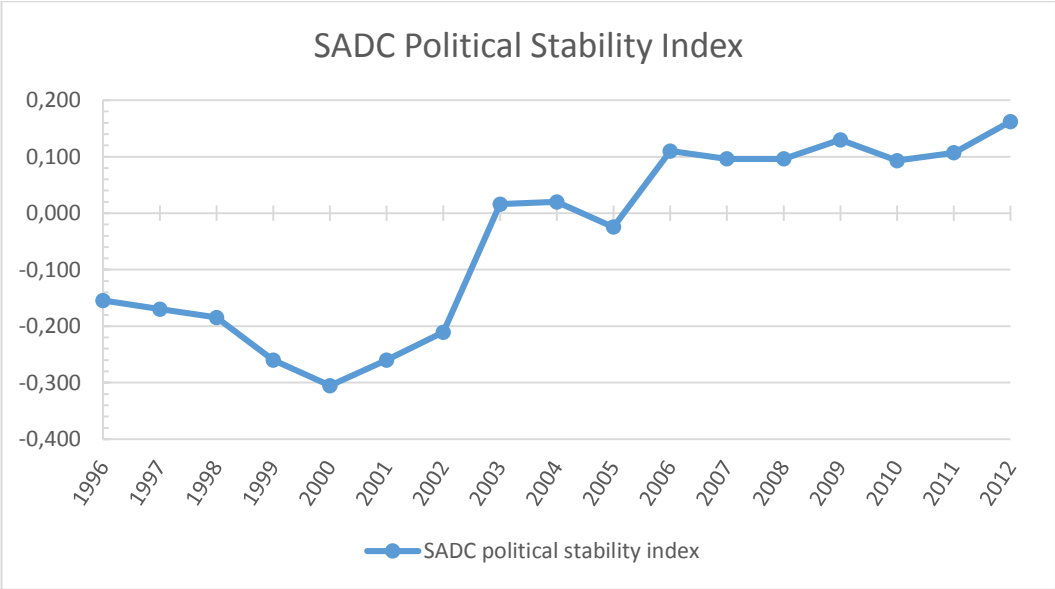
$$RSCA_{ij}^{t_2} = 0{,}023 + 0{,}939 * RSCA_{ij}^{t_1} + \epsilon \qquad (10)$$

The effects influencing the downward trend of RSCA index could be for example: higher growth in capital demanding sectors of economy, bigger competition from other developing regions, or some other reasons, which are discussed in the next chapter. Detailed results from regression analysis can be found in the Annex 3.

5.4 Hypothesis 4 – Political stability is positively correlated with food security

This hypothesis is based on assumption that during the times of peace and stability farmers have more opportunities to manage their farms properly. That should lead to higher yields which means higher average value of food production. At first, let's take a look at Index of political stability and absence of violence used by FAOSTAT as one of its food security indicators.

I've chosen available data from 1996 to 2012 for 13 of 15 SADC countries (excluding DR Congo and Seychelles as their data for average value of food production are not available, thus it was useless to include them). The index is very low and even decreasing before 2000. This is mainly because of civil war in Angola which lasted until 2002. In 2003 the index rises above 0 level when political situation improved in Angola, Namibia and Zimbabwe, just to get below 0 again in 2005, this time because of introduction of the current controversial Swaziland constitution. Since 2006 index is stable in the positive values around 0.1 value and slightly increasing during the last years.

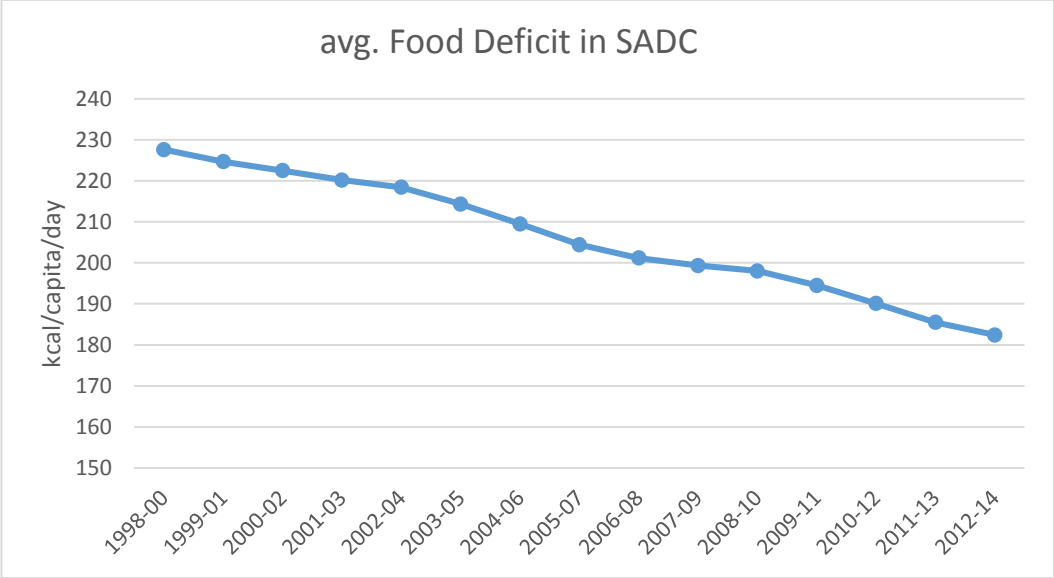


Graph 17 – SADC Political Stability Index (Source: FAOSTAT data)

To analyze if the Political Stability Index have some correlation with food security situation I made the Food Security Index, which I named "FSIndex". This index consists of average differences of 4 variables:

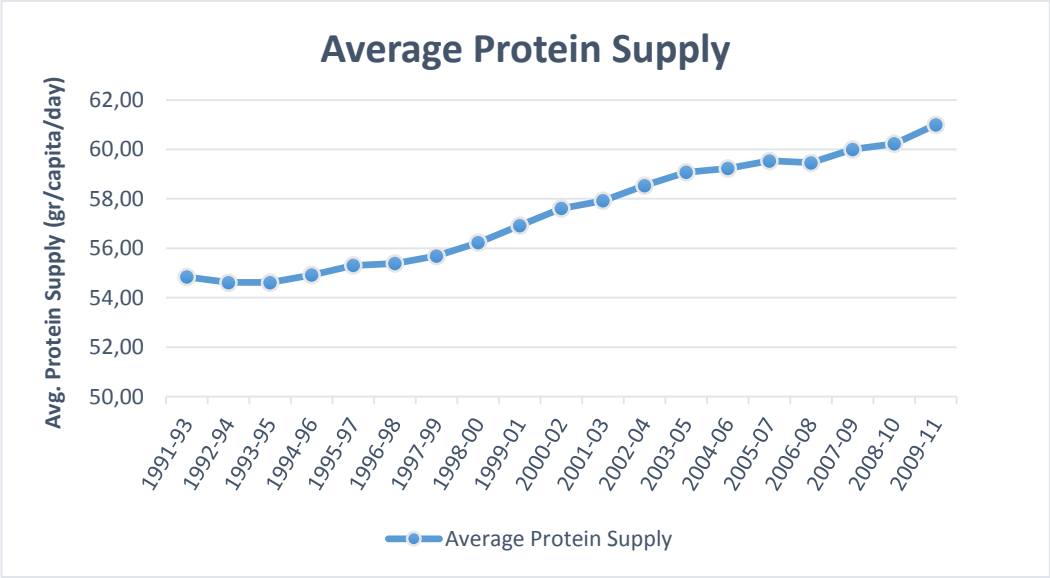
- Average value of food production
- Average protein supply value
- Average food deficit value
- Average dietary energy supply value

The depth of the food deficit is measured as 3-year average and indicates how many calories would be needed to lift the undernourished from their status, everything else being constant. As can be seen in the Graph 18 that the situation of depth of food deficit in SADC (excluding DR Congo and Seychelles) is improving since 1995. The value if food deficit indicator felt down by 21% between 1995 and 2014. Still, the value 182 kcal/capita/day is much higher than 10 kcal/capita/day for developed countries.



Graph 18 – Political Stability Index vs. Average Value of Production in SADC (Source: FAOSTAT data)

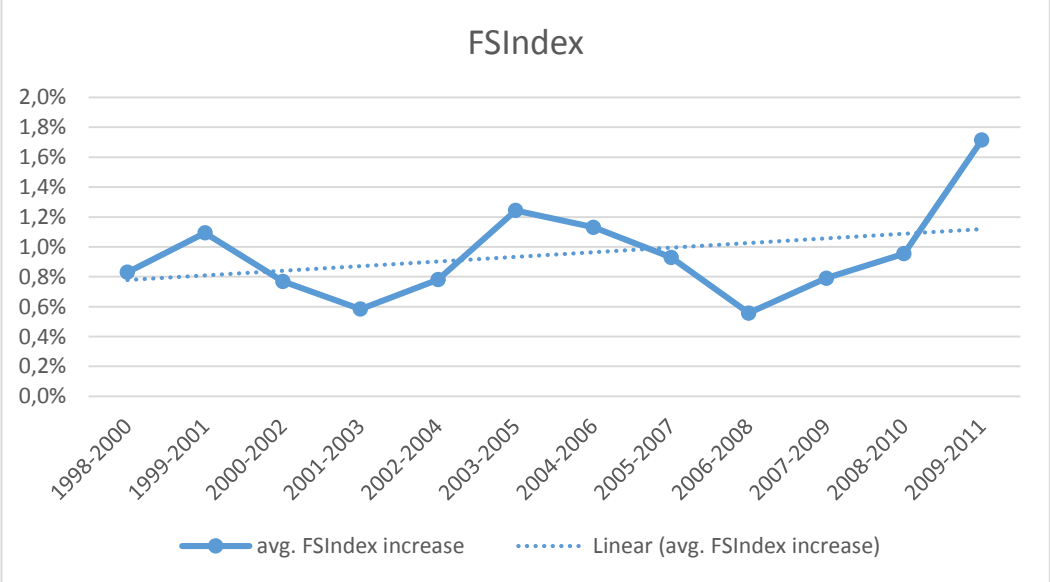
Average protein supply data are illustrated below in the Graph 19. Data about average protein supply are counted as 3-year average of the grams per capita per day. Since 1995 data about average protein supply steadily increased from the value 54,62 gr/capita/day to 61 gr/capita/day in 2011, which is 12% increase. However this number is still significantly lower than the values from developed countries, where the average protein supply index is above 100 gr/capita/day.



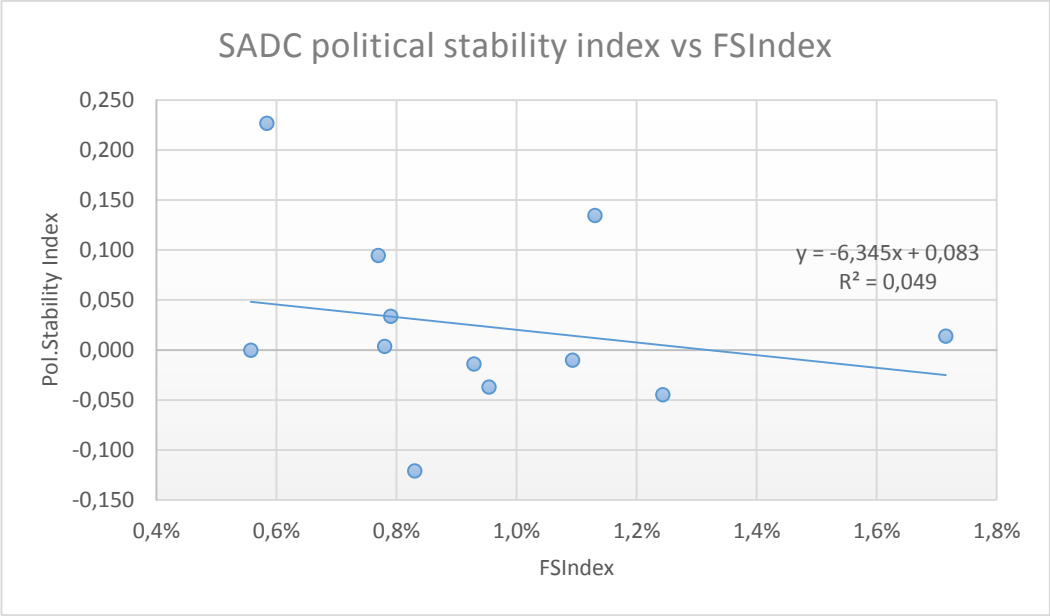
Graph 19 - Average Protein Supply (Source: FAOSTAT)

The average value of food production and average value of dietary energy supply are described in detail in the previous hypothesis.

I chose those 4 variables and made an index of them, called FSIndex. Graph 20 shows values of its average rate of increase since 2000 to 2011. The rate was moving on sinusoid line, but stayed all the time above 0 level.

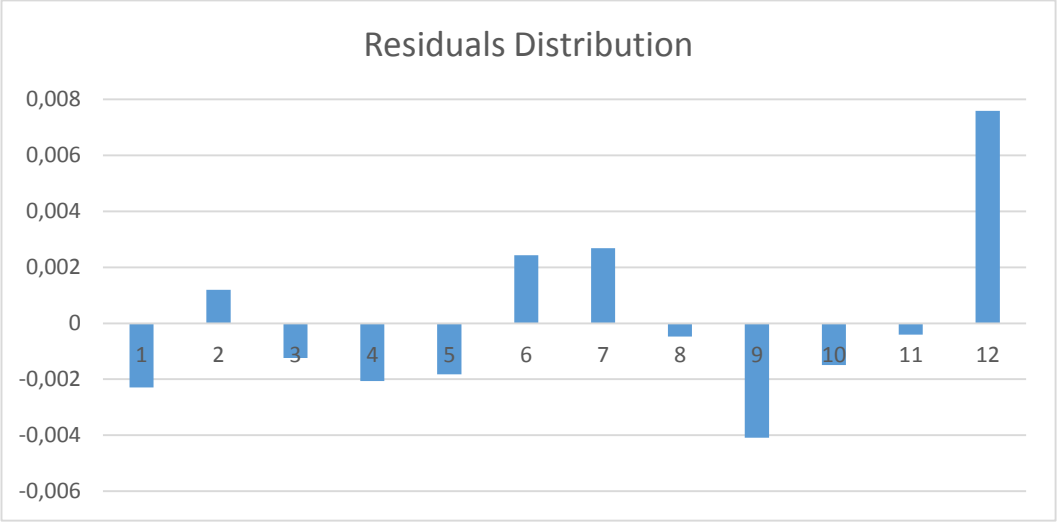


Graph 20 – FSIndex (2000 – 2011)



Graph 21 - SADC political stability index vs FSIndex

Graph 21 shows the linear regression of SADC Political Stability Index and created FSIndex from 2000 to 2011. As is clearly visible from the graph, I didn't find any strong correlation whatsoever. Value of the coefficient of determination $R^2 = 0,049$, which means that not even 5% of FSIndex is explained by Political Stability Index. Correlation coefficient r = 0,221. It is below the critical r value for 11 observations which is 0,553 for 95% level of probability. Also the P-value is very high, at 0,489. D-W statistics is 1,245 and the residuals analysis is presented in the graph 22. This model is not statistically significant and the changes in SADC Political Stability are not explaining the changes of FSIndex. Other results and outcomes of hypothesis 4 are discussed in the next chapter.



Graph 22 – Residuals Distribution 3

6. Discussion

The main objective of this thesis was to evaluate if food availability (as one of the main food security indicators) in SADC region improves mainly because of high domestic food production or rather because of open international food trade. To derive the statistically significant conclusions, it was important to analyze the situation on the world food market in the last 15 years. For this purpose I analyzed statistical data collected and maintained by the international organizations, namely the Food and Agriculture Organization, World Bank or United Nations. I formulated four hypothesis which I analyzed separately. The results are available in Chapter 5.

Hypothesis 1

The first hypothesis aimed at measuring the impact of food import tariffs on the level of domestic production and the amount of foreign food imports. I chose 5 groups of food products (meat, fish, crustaceans, mollusks and other, edible fruit and nuts, cereals and sugars and sugar confectionery) in seven SADC countries (these countries are: Botswana, Lesotho, Madagascar, Mauritius, Namibia, South Africa and Tanzania) between the years 2002 and 2011. This selection was made mainly because of better data availability in the WTO and UNCTAD statistics as well as the cross-section of the most important food sectors in SADC region.

Based on data from WTO I found that the level of average import tariffs (in most-favored nation regime) in selected groups of food products decreased about 36% between 2002 and 2011 as can be seen in Table 1. This result is consistent with the WTO politics of lowering tariffs and other trade barriers in international market.

In accordance with this finding the value of SADC food imports at the same time range more than quadrupled from 1,42 billion USD in 2002 to 6,18 billion USD in 2011, setting an average increase rate of 19% every year. The main driving force in the import growth has been South Africa, whose imports raised by 405% to 3,46 billion USD in 2011. United Republic of Tanzania experienced another significant rise in imports from 92 million USD in 2002 to 621 million USD in 2011, which is increase about 571% in 11 years.

However the graph 3 shows that the rate of imports increase declined from 83,2% in 2002 - 2005 to 74% in 2005 - 2008 and finally to 36% in 2008 - 2011, while the rate of average decrease in import tariffs was increasing faster in the same periods of time.

The assumption that the more import tariffs decrease the more goods is being imported turned out as wrong in this case.

There can be several reasons for this unexpected outcome. For example other factors than imports such as non-tariff barriers or global economic situation may come in play. During the period 2008 - 2011 when the food imports increased just about 36% the global financial crisis hit the markets around the world. It clearly affected the food imports in years 2009 and 2010 which were both below the 2008 level as can be seen in table 2. Also detailed regression analysis would be very useful in further examination of this case as I didn't conduct it because of lack of data about import tariffs for SADC region.

The second part of hypothesis 1 was aimed to evaluate the assumption that lower import tariffs are somehow affecting domestic food production. I compared data about the rate of decrease in food import tariffs with data about the rate of increase in domestic food production. From the graph 5 is visible, that the average food production was increasing faster in 2008 – 2011 (6,5%) than in the periods before (2,35%). This happened at the same time when import tariffs were decreasing by 20,5% and food imports increased by 36%. Therefore there is no evidence that the food import tariffs or food imports themselves are affecting the level of domestic food production. This result can be influenced by small size of dataset of just 5 food products group and 7 countries, which was caused by lack of data about import tariffs. Also there is inconsistence between the data about food imports and food production as the latter depicts data for 13 SADC countries instead of just 7. This can cause some deviations in given outputs of numbers.

Finally, I made calculation of food imports / food production index. I found out, that this index grew almost exponentially since 2001 to 2011. It can be explained by globalization of international trade with food, reduction in food imports tariffs, and by some barriers that protect domestic food production to grow faster, such as corruption or restrictive laws.

Further discussion is presented in FAO and OECD publications. According to Rakotoarisoa *et al*, (2011) Africa has become net food importer in the last decade. Also OECD (2003) argues that the ratio of food imports to food production in real terms is rising in time, especially in developed countries. As developing countries themselves becomes more developed, the ratio is starting to rise also there, which is in full compliance with my findings in food imports / food production ratio.

Hypothesis 2

In the second hypothesis I focused on measuring the effect of food imports on the average dietary energy supply adequacy. I used data from 11 SADC countries with exception of DR Congo, Seychelles, Zimbabwe and Swaziland, because their data about these two indicators were not available. This indicator of average dietary energy supply adequacy in SADC has been growing since 1994. It grown about 8,5% in total since 1994. It can be explained by various reasons. One of the most probable reasons is that people in SADC countries have higher amount of food available to eat. That can be caused either by higher domestic production of food or by bigger involvement in international trade and better access to imported food from abroad. How far the domestic production and foreign food imports influence dietary supply adequacy was subject to hypothesis 3.

In this hypothesis I used different dataset of imports. This time I went to UNCTAD statistics and chose data about "Food, basic" category, which are categories 0, 22 and 4 in SITC classification (live animals, all food products, oil seeds and animal and vegetable oils and fats; for more see chapter 3.2). Still, the result look very similar to the result in the graph 7 from the hypothesis 2. The food imports were steady during 1995 – 2001 period, then they started to rise quickly with exception in years 2009, 2010. As was discussed before, this growth in value of imported food can be probably explained by lower import tariffs as well as by higher purchasing power of SADC countries.

When these two variables were put together, I discovered some correlation in their behavior. I had to use 1st differences of their values to get rid of autocorrelation of residuals and to get more accurate statistical results. Graph 9 shows that both lines were quite steadily growing before 2008. In 2009 both took its lowest point since 1997 and then rocketed to their maximums in 2011. From the progress of chart it is clear, that there is some common relationship between the 1st differences of food import value and average dietary energy supply adequacy. The regression analysis proved this finding statistically, as the measured values were statistically significant on 95% level of probability. According to equation 8, if the level of food imports stays the same for two following years, the average dietary energy supply adequacy rise about 0,36%. With every 1 billion USD increase in food imports the average dietary energy supply adequacy rise by additional 0,1% (+/- 0,035%). The limitation of this equation is low amount of used data (16 years) and quite low value of coefficient of determination $r^2 = 0,420$, which means that only 42% of changes in avg. dietary energy supply adequacy are explained by the model.

The second half of the hypothesis examines the relationship between average dietary energy supply adequacy in SADC and average SADC food production value. For the data about food production I used the same values as in the hypothesis 1, it means that the used data are for 13 SADC states excluding DR Congo and Seychelles. Again, when the 1st differences of these two variables are graphically compared (see graph 11), some common trends in their progress is visible. The positive correlation trend has be also proven statistically, although not as convincingly as in the case of food imports. Value of the distribution coefficient was measured as 0,337, which is just 33,7% of dependent variable y explained by the model and explanatory variable x. Other statistical values as p-value and t-test were on their lower limits, but yet still statistically significant. From the linear regression equation is visible, that with every additional 1 USD per capita in food production the average dietary energy supply adequacy increase about 0,12% (+/- 0,05%). The limitations of the results are similar to the previous results – low amount of measured years (12 years) and low r^2 value.

From these results is evident, that both variables (food imports, domestic food production) have some impact on average dietary energy supply adequacy. Slightly higher influence was measured for SADC food imports, which can be explained by higher variability in imported food, which can have better effect on improving food security. Also the relative ratio of imports to production is growing as can be seen from graph 10. Compared to this finding, OECD in its book Agricultural Trade and Poverty (2003) says that food trade along with food stocks, contributed to reduce the variability of calorie consumption in developing countries to about 1/3 to 1/5 of that of food production. Further it is mentioned that food availability in developing countries comes mostly from domestic production.

Hypothesis 3

The third hypothesis was carried out to prove whether there is correlation between open international trade market and better specialization of SADC in food industry. For this analysis I used UNCTAD data about trade with aggregate indicator of basic food (SITC 0, 22, 4), which are explained in chapter 3. I found out, that as well as the SADC food imports, also the SADC food exports have been rising since the 2001, although not in such pace. The SADC food exports grew almost 3 times, compared to 4 times increased food imports.

More important, however, is the comparative advantage in food exports. It can be expressed as relative size of food exports to exports from other sectors of economy. In the hypothesis 4 I found out, that the comparative advantage of SADC countries in food exports, measured by RSCA index, is decreasing since 2000. This index is not only decreasing, but it has been even in negative values since 2007. That means, that even when food exports of SADC countries almost tripled in the last 15 years, SADC region lost its comparative advantage in food exports. The effects influencing the downward trend of food sector's RSCA index could be for example: higher growth in capital demanding sectors of economy, bigger competition from other developing regions, or some other reasons, such as urbanization and depopulation of urban areas.

Hypothesis 4

The last hypothesis was trying to prove if political stability has some impact on food security situation in SADC countries. To remove the autocorrelation in variables I used the 1st differences of their values. I put the SADC Political Stability Index in correlation with my own "homemade" index of four food security indicators called FSIndex, however contrary to the common sense I've found no correlation. The R^2 coefficient of determination was measured as 0,049, which signs almost no correlation. Also the graph 7 shows randomly displayed variables with no visible pattern in their occurrence.

This result thus did not prove many other experiments done in the past. It can be caused by variety of reasons. Perhaps the most significant will be small sample of countries and years. Even single country could make significant impact on whole SADC Political Stability Index. For example the Angolan civil war put the index into negative numbers before year 2000 and the introduction of the current controversial Swaziland constitution did it in 2005 as well. The index is vulnerable to extremes as it consists of just 13 states. Solution to this vulnerability can be for example to use the middle value of the variables. Also the created FSIndex does not have to correspond with the food security situation as closely as it was intended to.

Contrary to this result there are many findings that prove that the political stability is one of the cornerstones of the food security. Brinkman and Hendrix (2011) states that Food insecurity is both a cause and a consequence of violence, contributing to a vicious cycle or "conflict trap". Food security is critical for political stability. Food insecurity is linked to increased risk of democratic failure, protests and rioting, communal violence

and civil conflict Collier *et al*., (2003) in his paper says that "violent conflicts, create food insecurity, malnutrition and – in some instances – famine. Thus food insecurity can perpetuate conflict, although its effects depend on the context, with the strongest links evident in states that already have fragile markets and weak political institutions".

Further Recommendations

For the next research I recommend to give more emphasis to the question if SADC countries are net food importers or net food exporters. It was not answered in the thesis, although it has the crucial importance when considering effects of trade liberalization and evaluating changes in trade policy. I would also recommend to research which countries increased their food imports to SADC region the most during the last decade.

Summary

Hypothesis 1, 2 and 3 showed ambivalent results and cannot be proved. Hypothesis 4 was proved as statistically insignificant. Therefore the overall objective whether food availability in SADC changes mainly because of higher domestic food production or rather because of open international trade with food cannot be decided. The food availability is not influenced solely by food imports or domestic food production, but rather by mix of both and perhaps also by some other factors, which were not subject to this thesis.

7. Conclusion

The aim of this thesis was to evaluate, how the new conditions in international politics and trade affected the situation of food security and food availability in SADC countries. The research was based on common statistical analysis of secondary data developed by transnational organizations engaged in food security and international trade (FAOSTAT, WTO, World Bank).

In the Literature Review I summarized current knowledge about food security and its components as well as theory about international trade and its effects on developing countries and their trade structure. I tried to evaluate the effects of changes in trade policy on food availability situation by examination of four simple hypothesis, which were presented in the chapter 4.

In the Methodology chapter I established 4 hypothesis, which were about to be examined later in the thesis. I also presented the data sources from which I extracted the data, I described also their differences and different methods of gathering the data from WTO and UNCTAD. I briefly described several methods which I used to calculate the results, especially Linear Regression method (used in hypothesis 2 and 3) and method of Revealed Symmetric Comparative Advantage (used in hypothesis 4).

Results showed that the index of imported food to domestic food production has been growing in the last 10 years and it reached 51% in 2011. The food exports value and domestic production value are increasing as well and the average food import tariffs are decreasing. Also I proved some dependency of food imports to average dietary energy adequacy as well as dependency of domestic food production to average dietary energy adequacy. However with the use of comparative advantage method (RSCA) it was shown that SADC countries lost their comparative advantage in trade with food. The correlation of index of selected food security indicators to regional political stability was not proved.

Therefore, the overall objective cannot be proved as valid and the food availability is not influenced solely by food imports or domestic food production, but rather by mix of both.

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List of Annexes

Annex 1 - Hypothesis 2 – 1st regression

SUMMARY OUTPUT OF REGRESSION 2

Regression Statistics	
Multiple R	0,647834
R Square	0,419689
Adjusted R Square	0,378238
Standard Error	0,177528
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,319102	0,319102	10,125	0,006655
Residual	14	0,441228	0,031516		
Total	15	0,760331			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0,360649	0,053297	6,766811	9,07E-06	0,246339	0,474959
total food imports	1,13E-07	3,56E-08	3,18198	0,006655	3,69E-08	1,89E-07

DW 1,955815

RESIDUAL OUTPUT

Observation	*Predicted average dietary adequacy*	*Residuals*
1	0,380706	0,07384
2	0,339542	-0,06681
3	0,355091	0,008545
4	0,379463	0,075082
5	0,333849	0,302514
6	0,437773	-0,25596
7	0,499822	0,045633
8	0,430892	0,023653
9	0,460597	0,175767
10	0,589626	-0,22599
11	0,655044	-0,29141
12	0,258896	-0,16799
13	0,486246	-0,0317
14	0,859208	0,231701
15	0,385635	-0,022
16	0,420337	0,125117

Annex 2 - – Hypothesis 2 – 2nd regression

SUMMARY OUTPUT OF
REGRESSION 3

Regression Statistics	
Multiple R	0,580392
R Square	0,336855
Adjusted R Square	0,270541
Standard Error	0,216679
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,23849	0,23849	5,079658	0,047869
Residual	10	0,469499	0,04695		
Total	11	0,707989			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0,280333	0,104746	2,676304	0,02324	0,046944	0,513722
food production	0,120085	0,053281	2,25381	0,047869	0,001368	0,238801

DW 2,254031

RESIDUAL OUTPUT

Observation	*Predicted dietary adequacy*	*Residuals*
1	0,280333	0,083304
2	0,437367	0,017179
3	0,483553	0,152811
4	0,400417	-0,2186
5	0,317282	0,228173
6	0,418892	0,035653
7	0,520502	0,115862
8	0,354231	0,009405
9	0,502027	-0,41112
10	0,69601	-0,24146
11	0,788383	0,302526
12	0,437367	-0,07373

Annex 3 – Hypothesis 3 – regression

SUMMARY OUTPUT OF REGRESSION 3

Regression Statistics	
Multiple R	0,939162
R Square	0,882025
Adjusted R Square	0,87295
Standard Error	0,04695
Observations	15

B*/R* 1,000506

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,214247	0,214247	97,19296	2,12E-07
Residual	13	0,028656	0,002204		
Total	14	0,242903			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0,01238	0,015053	-0,82257	0,425583	-0,0449	0,020138
RSCAt	0,939637	0,095311	9,858649	2,12E-07	0,73373	1,145544

DW 1,87837

RESIDUAL OUTPUT

Observation	*Predicted RSCA(t+1)*	*Residuals*
1999	0,193783	0,030851
2000	0,198692	0,053881
2001	0,224946	0,020524
2002	0,21827	0,000108
2003	0,192815	0,014197
2004	0,182134	-0,02164
2005	0,138422	-0,04357
2006	0,076742	-0,00678
2007	0,053357	-0,06581
2008	-0,02408	-0,069
2009	-0,09984	0,098163
2010	-0,01396	-0,01477
2011	-0,03938	-0,04152
2012	-0,08839	0,016861
2013	-0,0796	0,028502

Annex 4 - Hypothesis 4 – regression

SUMMARY OUTPUT OF REGRESSION 4

Regression Statistics	
Multiple R	0,221362
R Square	0,049001
Adjusted R Square	-0,0461
Standard Error	0,003255
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5,46E-06	5,46E-06	0,515258	0,489301
Residual	10	0,000106	1,06E-05		
Total	11	0,000111			

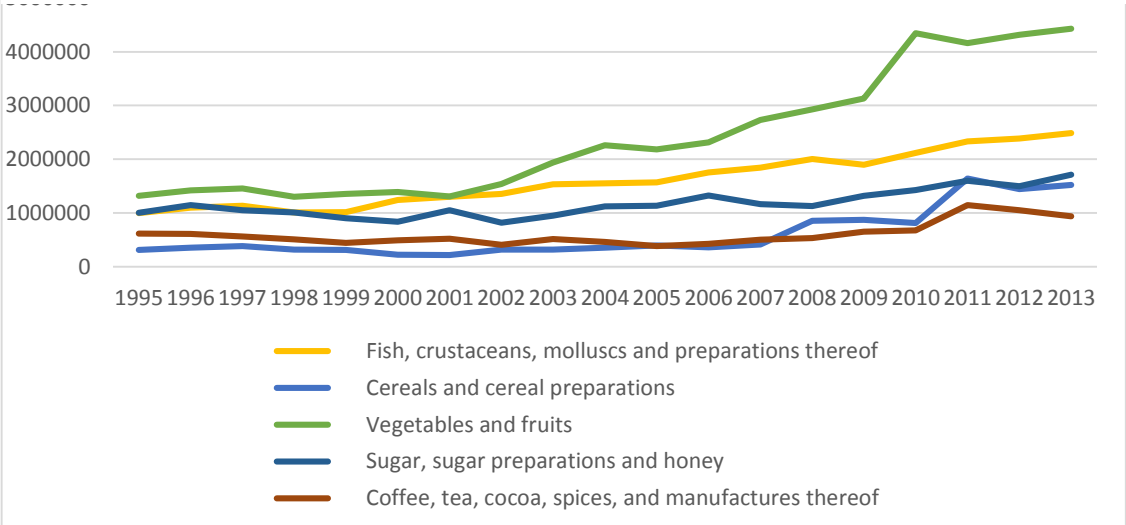
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0,009663	0,000973	9,931284	1,69E-06	0,007495	0,011831
pol.stability index	-0,00772	0,010758	-0,71781	0,489301	-0,03169	0,016249

DW 1,245518

RESIDUAL OUTPUT

Observation	*Predicted avg. FSIndex increase*	*Residuals*
1	0,010596	-0,00229
2	0,00974	0,001192
3	0,008932	-0,00124
4	0,007911	-0,00207
5	0,009633	-0,00183
6	0,010008	0,002431
7	0,008623	0,002682
8	0,00977	-0,00048
9	0,009663	-0,00409
10	0,009402	-0,0015
11	0,009948	-0,00041
12	0,009556	0,007593

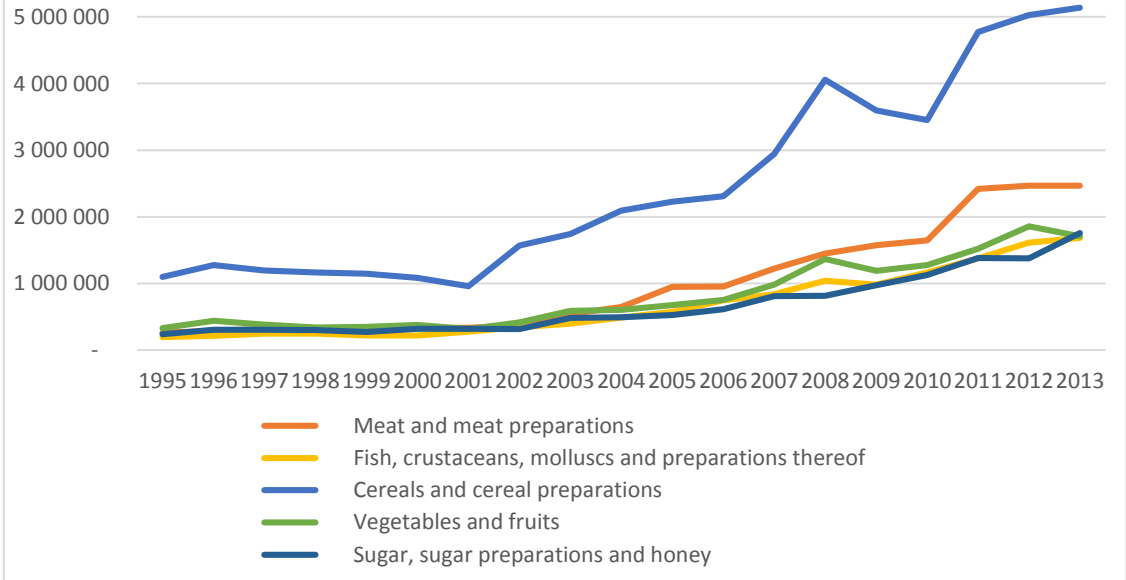
Annex 5 – Graph of SADC Top Food Exports (1995 - 2013)



Source: UNCTAD

Total food exports in 2013: 12 828 mil USD

Annex 6 – Graph of SADC Top Food Imports (1995 - 2013)



Source: UNCTAD

Total food imports: 17207416

Annex 7 – SADC Top Food Exports (2013)

Angola	15 mil USD	[036] Crustaceans
	6 mil USD	[034] Fish
Botswana	92 mil USD	[011] Beef meat
	19 mil USD	[062] Sugar confectionary
	10 mil USD	[047] Other cereals, flour
DR Congo	10 mil USD	[071] Coffee
	7 mil USD	[072] Cocoa
Lesotho	18 mil USD	[047] Other cereals, flour
	12 mil USD	[056] Vegetables, roots, tubers
Madagascar	199 mil USD	[075] Spices (1,9% of total world export)
	102 mil USD	[036] Crustaceans
	53 mil USD	[037] Fish, prepared
Malawi	96 mil USD	[061] Sugar
	77 mil USD	[074] Tea
	39 mil USD	[054] Vegetables
Maurititus	375 mil USD	[037] Fish, prepared
	314 mil USD	[061] Sugar
	98 mil USD	[034] Fish
Mozambique	146 mil USD	[061] Sugar
	51 mil USD	[057] Fruits
	38 mil USD	[036] Crustaceans
Namibia	621 mil USD	[034] Fish
	82 mil USD	[011] Beef Meat
	72 mil USD	[001] Live animals
	65 mil USD	[057] Fruits
Seychelles	264 mil USD	[037] Fish, prepared
	117 mil USD	[034] Fish
	82 mil USD	[035] Fish, dried
South Africa	2778 mil USD	[057] Fruits (2,8% of total world export)
	569 mil USD	[044] Maize, unmilled (2,2% of total world export)
	314 mil USD	[098] Edible products and preparations
Swaziland	249 mil USD	[061] Sugar
	49 mil USD	[057] Fruits
Tanzania	238 mil USD	[057] Fruits
	212 mil USD	[071] Coffee
	166 mil USD	[054] Vegetables
	162 mil USD	[034] Fish
Zambia	197 mil USD	[044] Maize, unmilled
	195 mil USD	[061] Sugar
	161 mil USD	[081] Feeding stuff for animals
Zimbabwe	75 mil USD	[061] Sugar
	54 mil USD	[057] Fruits
	24 mil USD	[054] Vegetables

Source: UNCTAD