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Faculty of Regional Development and International Studies

Impact of Foreign Direct Investments and Government Expenditures in Agri-food Sector to Food Availability in Ghana between 2001 and 2010

Diploma Thesis

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Abstract

PÁRAL, M. Bc. Impact of Foreign Direct Investments and Government Expenditures in Agri-food Sector to Food Availability in Ghana between 2001 and 2010. Diploma thesis,2016.

The diploma thesis concerns about the issue of food availability in Ghana. The aim of the thesis is to analyze which of the selected macroeconomic indicators have a statistically significant impact to increase of food availability in the country. Considering macroeconomic indicators, the thesis focuses on foreign direct investments to agriculture, government expenditures to agriculture, exchange rate and inflation. Food availability is formulated in three different manners as total amount of food available in domestic country per year, average food supply per capita per year and average available amount of kilocalories per capita per day. The aim of the thesis is fulfilled by testing of three hypotheses. 1) There is a correlation between selected macroeconomic indicators and variables representing food availability 2) Selected macroeconomic indicators as a whole cause the change in variables representing food availability 3) The volume of available food change, if there is a change in any of the macroeconomic indicators. Statistical methods of correlation analyses and multiple regression analyses have been used. Statistics have been calculated in Statistica software. Findings suggest that foreign direct investments to agriculture, government expenditures to agriculture and exchange rate do correlate with variables expressing food availability. Inflation does not correlate. Foreign direct investments to agriculture and government expenditures to agriculture together are associated with each of three variables for food availability by more than 98% and explain more than 97% of their variance. Change in both foreign direct investments to agriculture and government expenditures to agriculture cause significant change in all three food availability variables in case of Ghana. Increase in government expenditures to agriculture does not cause decrease in foreign direct investments to agriculture. Increase of both financial sources is necessary in order to satisfy growing demand for food as most of the annual agricultural production surpluses is consumed by newly borne population.

Keywords: Food security, food availability, Ghana, foreign direct investments to agriculture, government expenditures to agriculture, exchange rate, inflation, correlation analyses, multiple regression analyses.

Abstrakt

PÁRAL, M. Bc. Impact of Foreign Direct Investments and Government Expenditures in Agri-food Sector to Food Availability in Ghana between 2001 and 2010. Diploma thesis,2016.

Diplomová práce se zabývá problematikou množství potravin (food availability) v Ghaně. Cílem práce je analyzovat, které z vybraných makroekonomických indikátorů statisticky významně ovlivňují množství potravin v zemi. V rámci práce byly zkoumány následující indikátory: zahraniční investice do zemědělství, vládní výdaje do zemědělství, měnový kurz a inflace. Potravinová dostupnost je v rámci práce vyjádřena třemi různými proměnnými; celkové množství dostupného jídla v zemi za rok, průměrná zásoba jídla na obyvatele za rok a průměrné množství kilokalorií na obyvatele za den. Cíle práce je dosaženo otestováním tří výzkumných hypotéz. 1) Existuje korelace mezi vybranými makroekonomickými indikátory a určenými proměnnými pro potravinovou bezpečnost. 2) Vybrané makroekonomické indikátory jako celek ovlivňují změnu určených proměnných pro potravinovou bezpečnost. 3) Množství dostupného jídla vyjádřené určenými proměnnými pro potravinovou bezpečnost se mění v závislosti na změně jakékoli z vybraných makroekonomických indikátorů. K otestování daných hypotéz byly využity statistické metody korelační analýzy a vícenásobné regresní analýzy. Statistické výpočty byly provedeny v rámci programu Statistica. Dosažené výsledky korelační analýzy potvrzují, že proměnné; zahraniční investice do zemědělství, vládní výdaje do zemědělství a měnový kurz korelují se všemi třemi proměnnými, vyjadřujícími množství potravin v zemi. Inflace nekoreluje s žádnou z uvedených proměnných, vyjadřujících množství potravin v zemi. Podle výsledků vícenásobné regrese souvisí dohromady hodnoty indikátorů zahraničních investic do zemědělství a vládních výdajů do zemědělství z více než 98% s hodnotami proměnných pro množství potravin v zemi a vyjadřují více než 97% jejich změny. Výsledky dále ukazují, že změna jakéhokoli z obou indikátorů jak zahraničních investic do zemědělství tak vládních výdajů do zemědělství způsobí statisticky významnou změnu ve všech proměnných vyjadřujících množství potravin v zemi. Oba makroekonomické indikátory; zahraniční investice do zemědělství a vládní výdaje do zemědělství jsou důležité proměnné pro zvyšování množství potravin v zemi. Zároveň se ukázalo, že růst vládních výdajů do zemědělství nezpůsobuje pokles zahraničních investic. Růst obou zdrojů financování

zemědělství je zásadní podmínkou pro možnost uspokojení stále rostoucí poptávky po potravinách v Ghaně, neboť za současného populačního růstu připadá většina nově vyprodukovaného přebytku potravin nově narozenému populačnímu přírůstku.

Klíčová slova: Potravinová bezpečnost, množství potravin, Ghana, zahraniční investice do zemědělství, vládní výdaje na zemědělství, měnový kurz, inflace, korelační analýza, vícenásobná regresní analýza.

Content:

List of tables, figures and abbreviations **11**

1 Introduction **14**

1.1 Objectives of the thesis 16

2 Literature overview **18**

2.1 Food Security, food availability, food access and food use – concepts 18

2.2 Why focus on agriculture and food availability? 21

2.3 Factors affecting food availability 24

2.4 Ghana agricultural performance 25

2.5 Food Security in Ghana 27

2.6 Interventions of IMF and WB 28

2.7 Foreign Direct Investments 30

2.8 Government Expenditure to Agriculture 35

3 Data and methodology **39**

3.1 Data 39

3.1.1 Data sources 39

3.1.2 Sample size 40

3.1.3 Data constraints 41

3.1.4 Definition of variables 42

3.2 Methodology 56

3.2.1 Conceptual background 56

3.2.2 Determining methodology according to research objectives 56

3.2.3 Methodological Constraints 58

4 Results **63**

4.1 Hypothesis one results 63

4.2 Hypothesis two results 65

4.3 Hypothesis three results 68

4.3.1 FP variable 68

4.3.2 FSPC variable 70

4.3.3 ESPC variable 72

4.3.4 Hypothesis three summary 74

4.4 Summary of the results 75

5 Discussion 78

6 Policy recommendations 81

7 Conclusion 83

8 References 86

9 Sources 93

List of tables, figures and abbreviations

List of tables

Table 1: Agriculture production and food production from 1997 to 2012 27

Table 2: Crop production per ha from 1997 to 2012 27

Table 3: Subsec. division of GEA (in 2001 constant prices), GHC million 2001 - 2011....38

Table 4: Data sources.....40

Table 5: Variable acronyms.....44

Table 6: Input data for independent variables.....45

Table 7: Input data for dependent variables.....49

Table 8: Input data for sub-variables of dependent variables.....52

Table 9: Correlation matrix of FDIA, GEA, EXCHR, INFL, FP, FDSPC and ESPC 60

Table 10: Skewness and kurtosis coefficients for FDIA, GEA, FP, FSPC and ESPC.....62

List of figures

Figure 1: Countries facing food emergencies (1986 – 2005) 19

Figure 2: Interdependence of food security components.....21

Figure 3: Regional division of Ghana.....23

Figure 4: Ghana Land Use 25

Figure 5: Share of Agriculture value added in total GDP since 1995 to 2010 26

Figure 6: FDI inflows to agriculture - average 1991 – 2013 in US$ millions.....31

Figure 7: Average return asset classes – South Africa 32

Figure 8: Nominal and real GEA (in 2001 constant prices), GHC million, 2001-2011.....36

Figure 9: Gov. and agri. expenditures (in 2001 constant prices), GHC million.....37

Figure 10: Expenditure per capita (nominal GHC), 2010.....38

Figure 11: FDIA and GEA development from 2001 to 2010 46

Figure 12: Gross domestic product development of Ghana from 1995 to 2010.....46

Figure 13: Nominal annual country exchange rate to USD.....47

Figure 14: % inflation, GDP deflator.....48

Figure 15: Annual growth rate of dependent var. to preceding year from 2002 to 2010 50

Figure 16: Percentage cumulative growth of dependent variables from 2002 to 2011 51

Figure 17: Composition of sub variables.....53

Figure 18: Cumulative development of FP sub-variables, from 2002 to 2010.....54

Figure 19: Food availability composition in 2001 and 2011 55

Figure 20: Box Plot of the FDIA variable with extreme outlier.....61

Figure 21: Box Plot of the FDIA variable after outlier substitution.....61

Figure 22: Correlation beam graph of FDIA, GEA, EXCHR with FP, FSPC, ESPC 64

Figure 23: Correlation coefficients of FP, FSPC and ESPC model.....66

Figure 24: Coefficients of determination of FP, FSPC and ESPC model 67

Figure 25: Graph of standardized regression coefficient (b*) for FP model 69

Figure 26: Graph of standardized regression coefficient (b*) for FSPC model 71

Figure 27: Graph of standardized regression coefficient (b*) for ESPC model 73

List of abbreviations

ESPC – Energy Supply per Capita

EXCHR – Exchange Rate

FAO – Food and Agriculture Organisation

FDI – Foreign Direct Investments

FDIA – Foreign Direct Investments to Agriculture

FP – Food Production

FSPC – Food Supply per Capita

GEA – Government Expenditures to Agriculture

GHC - Ghana Cedi

GIPC – Ghana Investment Promotion Centre

IMF – International Monetary Fund

INFL – Inflation

LCU – Local currency unit

MoFA – Ministry of Food and Agriculture

UNCTAD – United Nations Conference on Trade and Development

USDA – United States Department of Agriculture

WB – World Bank

WTO – World Trade Organisation

1 Introduction

There are several reasons why to focus on food issues like food security, food availability or food sovereignty in current days. As there are limits in the ability to increase the quantity of land reserved to agriculture production or increase agricultural productivity of developed countries, most of the future potential to fight increasing world food demand lie in developing countries and emerging economies (Franz & Müller, 2015).

Historical experiences and also recent experiences from Africa and the rest of the developing world show that sufficient food supply is the primary prerequisite to achieving of peace, social justice, health, prosperity and development. Countries periodically suffering by hunger witness gradual social and economical decay, internal instability, increasing emigration, revolts and uprisings. Development of food security in developing countries is necessarily imperative for achievement of general stability of developing regions. That's why international community increasingly focuses on problems of food security and supports a number of developing countries in a number of food security programs like Community Food Project Competitive Grant Program, Food Insecurity Nutrition Incentive Grant Program, The Expanded Food and Nutrition Education Program, or Agriculture and Food Research Initiative, all led by United States Department of Agriculture (USDA, 2016) FAO's Special Programme for Food Security (FAO, 2002) or Global Agriculture and Food Security Program (World Bank, 2014).

Industrialization of agriculture, globalization of the food markets or spread of transnational retailers over the past 30 years has dramatically changed the way in which food is being produced, distributed, marketed and consumed (Franz & Müller, 2015). Nowadays, food security has complex multi-disciplinary and multi-sector nature. Disciplines as agriculture, economics, public policy, social anthropology, sociology or nutrition play a role (Jones et al., 2013).

Based on 1996 World Food Summit, three basic dimensions of food security have been identified and defined (1). There is physical food availability, or we may say "the supply side", determined by the level of food production (2). There is economic and physical access to food, determined by the level of incomes, expenditures, markets, prices and physical distance of available food from potential consumer (3). There is food utilization addressing the way the food is consumed and utilized within the household, determined by health state of

consumer, feeding practices, variety of food or intra-household distribution of food (FAO, 2008).

Food availability is the oldest and primary part of the food security concept as food has to be available first in order to be potentially accessible and later used, so food availability development is even today of a great importance. Moreover, it has also great economic potential, which has been already recognized by investors from all over around the world as can be seen on investment flow trends into African agricultural sector, where there is a constantly increasing amount of money invested into agriculture from both private investors and central governments (CNBC Africa, 2015; Hallam, 2009). However, together with these new and strengthening inflows a discussion about their collateral impacts occurs.

First, there are concerns about the impacts of overall investment patterns in developing countries on food security, access to food and also general food availability, especially when considering local poor rural populations of developing countries. As Dries & Swinnen (2004) claims: Some see foreign investments as beneficial factor that can be an important source of much needed capital, technology, knowledge etc. for poorer countries. Others point at dangers of multinational companies crowding out local companies as well as introducing imperfect competition. Outcomes of many private projects financed by FDIs are often frivolous or controversial when considering impacts to food availability, food access and food security. There are cases of grabbing agricultural land originally used by local population for food production and its usage for production of bio-fuels or fruits and crops for export, demolition of existing food production system and already fragile local environmental and economic balance. On the other hand, long-term lack of investments in agriculture is considered as the main factor standing behind stagnant production, continuing low productivity and recent food crisis in many developing countries.

At the same time, due to policies introduced by local governments, based on cooperation with organisations such as IMF or World Bank, there is a push on rationalization of economy and cancelling government support and subsidies for locals in order to increase competitiveness of the local market and attract foreign investors. So at the same time a discussion about impacts of state's subsidised agriculture and economy and attainment of Foreign Direct Investments on overall agricultural and economic fitness and performance is held.

Ghana is one of the developing countries that are very concerned about that topic. Agriculture sector of the Ghana is considered strategic for the country. It is, by a significant share, participating on domestic GDP, employment and apprehension of food security and poverty reduction. On the one hand, it is strongly subsidized by central government on the other hand, it is one of the biggest receivers of foreign direct investments into agriculture in Africa. Also in the last several decades Ghana witnessed a number of changes and turnovers in agriculture policy. For these reasons Ghana will serve as ideal case study for this thesis.

1.1 Objectives of the thesis

The objective of the thesis is to research impact of Foreign Direct Investments invested into agriculture (FDIA), government expenditures on agriculture (GEA), foreign exchange rate (EXCHR) and inflation (INFL) on Ghana's national food availability. Food availability is expressed by three manners: (A) as a total food production of Ghana for its own domestic market (B), as an amount of food available per capita in Ghana and (C), as kilocalories available per capita in Ghana.

The thesis will aim at testing 3 hypothesis.

First hypothesis is asking the following question: Is there a correlation between selected macroeconomic indicators (FDIA, GSA, EXCHR and INFL) and the above-mentioned (A) total food production of Ghana for its own domestic market, (B) amount of food available per capita in Ghana and (C) caloric energy available per capita in Ghana?

Second hypothesis reads: Do selected macroeconomic indicators (FDIA, GSA, EXCHR and INFL) as a whole directly cause the change in above mentioned (A) total food production of Ghana for its domestic market, (B) food available per capita in Ghana and (C) caloric energy available per capita in Ghana?

Third hypothesis aims at replying to the question: Does the volume of (A) total food production of Ghana for its domestic market, (B) food available per capita in Ghana and (C) caloric energy available per capita in Ghana change if there is a change in any of the above-mentioned macroeconomic indicators (FDIA, GSA, EXCHR and INFL)?

Given hypothesis have been chosen in order to assess the impact of private and public investments and other macroeconomic variables as inflation and currency exchange rate to food security in the specific and measurable manner and thereby contribute to the general

discussion about what is an eligible model of agricultural policies and an eligible model of capitalization of the agriculture in the developing countries.

Given variables have been chosen in order to cover a majority of financial inflows to the country's agriculture, to include other macro-economic variables which may have impact to food availability and last but not least to express food availability in several manners which would allow assessment of given results in more extensive and broader sense.

2 Literature overview

2.1 Food Security, food availability, food access and food use – concepts

Food is a basic biological need shared by all people around the globe. Constant struggle for abundance of food goes through human history since its beginnings. Such an unconditional dependence on food and vulnerability towards its lack is a human concern going beyond culture, race or ethnicity. From the legal perspective, the right-to-food or food security is recognized as a part of human rights (Blizkovski, 2016). Universal Declaration of Human Rights has been adopted on 10 December 1948 by the General Assembly of the United Nations. (Blizkovski, 2016) Article 25 of the Declaration says as cited by Blizkovski (2016) everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.

During the second half of the 20th century concept of food security evolved and became gradually more comprehensive. As generally accepted by 1996 World Food Summit, food security is defined as a stage 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 (FAO, 2003).

Even thought the number of undernourished people declined at global level from 18.9% in 1990–1992 to 12% in 2011–2013 (Blizkovski, 2016), food security still remain as an issue. As of 2006, about 39 countries in the world were experiencing serious food emergencies and required external assistance for dealing with critical food insecurity; 25 in Africa, 11 in Asia, 2 in Latin America and 1 in Europe (FAO, 2006). In 2014 there were still about 805 million people suffering by undernourishment. Number of food emergencies according to the continent and general causes can be seen in table 1 below. Generally, there are human and natural causes of food emergencies. Human causes prevail in Africa and Europe, while natural causes prevail in Asia.

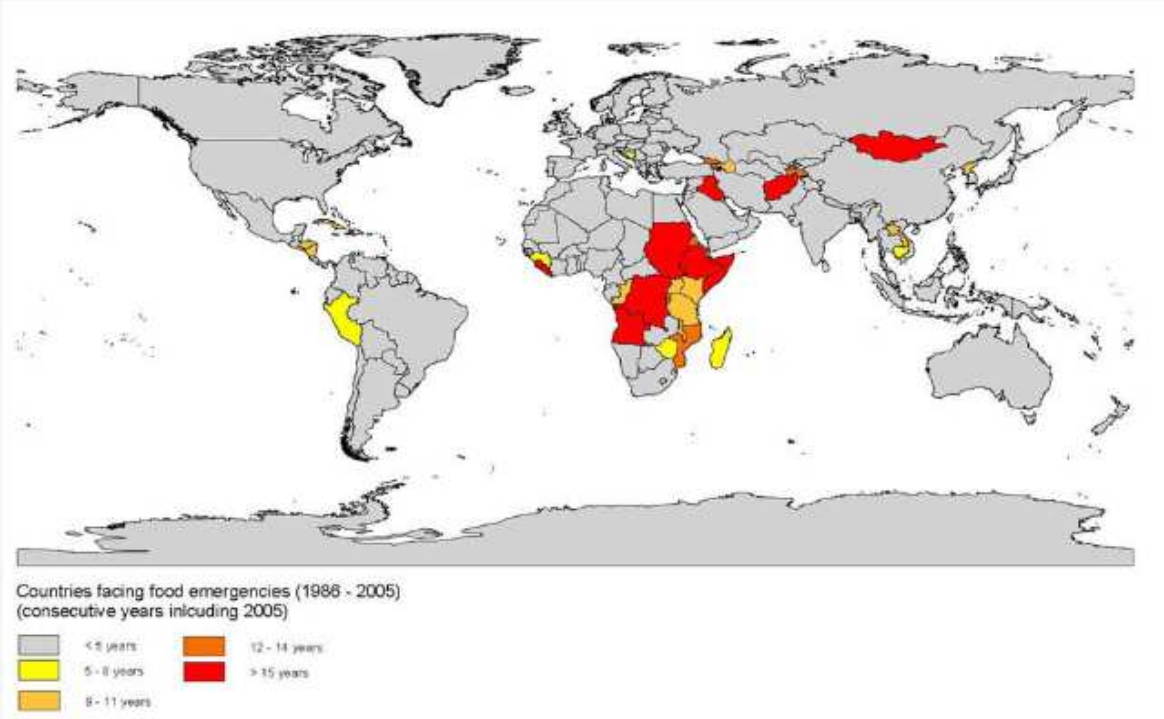
Table 1: Food Emergencies, 2005

Cause	Africa	Asia	Latin America	Europe	Total
Human	10	3	1	1	15
Natural	8	7	1	0	16
Combined	7	1	0	0	8
Total	25	11	2	1	39

Source: (FAO, 2006)

A world map with particular countries suffering by food emergencies from 1986 to 2005 is displayed in figure 1 below.

Figure 1: Countries facing food emergencies (1986 – 2005)



Source: (FAO, 2006)

As Fosu & Heerink point out, the food security concepts can refer to groups of people of different sizes. It may be those in a given region, national state, district, rural area or even family. In accordance to that, we speak about regional food security, national food security, district level food security, village-level food security or household-level food security (Fosu & Heerink, 2009).

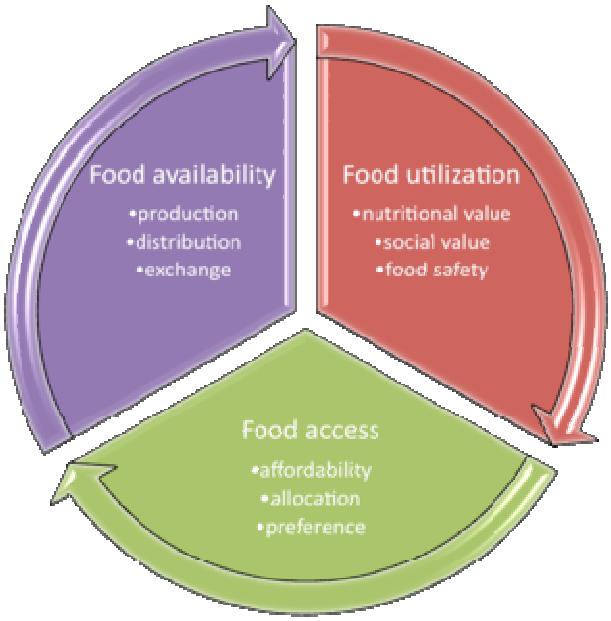
It is important to mention that apart from the spatial dimension of food security described above, there are two more dimensions of food security or we might say food insecurity; time dimension and magnitude. Considering the time dimension, food insecurity may occur over a short term, then it is called transitory food insecurity, or over a more persistent period of time, then it is called chronic food insecurity. It can also occur periodically, following a certain cyclical pattern; usually a seasonal one. It that case, we speak about cyclical food insecurity (Fosu & Heerink, 2009; FAO, 2008).

Magnitude, or in other words severity of food insecurity, is usually used when expressing an overall volume of lacked foodstuffs. According Fosu and Heerink (2009), there is a number of indicators for capturing the magnitude. Considering the basic indicators, there is a (1) measure of total food availability or we might say total supply of all food commodities in a given area (2). Measure of food availability per capita, taking into account size of the population living in a given area in relation to available food. And finally (3) measure of calories per capita which additionally capture nutrient value of available food into the model (Faostat, 2015).

Original views on food security, as an issue of pure supply, have been contested by Amartha Sen in his thesis Poverty and Famine. Sen brought to the forefront the importance of economic access to food rather than food supply itself in determining food security by highlighting historical examples of famine conditions in countries with sufficient national food supplies (Jones et al., 2013; Adom, 2014; Sen, 1981). Also according to Smith et al, (2000) there is little correlation between national food availability and food security, so we cannot put equal sign between food availability and food security. Nonetheless, food availability is still the necessary condition for food security, even thought food security is not based just on that.

Based on such discussions started by Sen, food security concepts started to be understood as composed of more than one aspect. Apart from the food availability, also economic access started to be counted in as an influencing factor in later food security definitions. Now food availability and food access are considered mutually interconnected aspects of food security and as Fosu and Heerink (2009) claim, both sides of the equation are equally important. If food is physically available, but families lack economical access to the food, food security will be threatened. Similarly, if households have adequate financial means for economic access to food, but food is not physically available, implication for food security will be the same as in the first case.

Figure 2: Interdependence of food security components



Source: (Medanth, 2016)

Finally, there are two more aspects of food security which started to be considered even later than food access; concepts of food utilization and food stability. Hjelm & Dasori (2012) define food utilization as an individual ability to obtain enough energy and nutrients from provided food to live a healthy life. Such a diet needs to respect cultural habits and practices while providing sufficient amount of energy and nutritional value. At the same time safe drinking water, adequate sanitation, knowledge of food storage and processing are essential to achieving adequate food utilization (Hjelm & Dasori, 2012). Food stability refers to continuation of both above-mentioned aspects of food security; food availability and food access. In that manner food stability denotes to time dimension of food security. To be food-secure, the households need to have access to food at all times and should not be at risk of becoming food insecure as a consequence of shocks or cyclical events, such as seasonal food shortages (Hjelm & Dasori, 2012).

2.2 Why focus on agriculture and food availability?

Strong agriculture production and sufficient food supply are the basic prerequisites needed for future development in most of the African countries. In the context of Ghana, focus on effective agriculture production and assurance of sufficient food supply plays positive and

indispensable role for the overall country's economic activity, improvement of trade balance, mitigation of unemployment or reduction of poverty.

Agriculture production stranded for about 30% of Ghana's GDP in 2010. (FAOstat, 2013) It represents about 35% of Ghana foreign exchange rate (OEC, 2016; Asante, 2004) and as there is a high percentage of self-subsistence farmers in Ghana, about 50.6% of the active population is employed in agriculture (Asante, 2004), increased agricultural output have direct impacts on provision of job opportunities and eradication of poverty (Edoumiekumo & Audu, 2009 as cited in Ani et al., 2015).

Beyond that, as Asante (2004) claims, increased availability of food has a positive impact to price reduction. About 20-30% of food production in Ghana is lost due to poor traditional post-harvest management of food crops (MoFA, 2000). Research conducted by Asante (2004) found out that loses of this magnitude in combination with supply issues caused by inadequate and sometime impassable road links between urban and rural areas have positive effects on increase of internal transaction costs and transportation costs. These high costs consequently influence final prices of food, especially in the most distant and the worst accessible regions, which consequently leads to restricted economic access to food in these regions (Asante, 2004).

Such regions are usually the least developed and have the highest poverty rates in comparison to country average. In case of Ghana, three most northern regions are such a case; Upper West Region, Upper East Region and Northern Region.

Figure 3: Regional division of Ghana

Source: (Ministry of Foreign Affairs & Regional integration of Ghana, 2016)

Asante in his research just recapitulated the rule of supply and demand explaining negative relationship between amount of supply (considering constant demand) and price of a given commodity. Increase in available amount of a given commodity causes decrease in prices, while decrease in available amount of a given commodity causes increase in prices. This is the manner by which food availability influences food access, as an amount of existing food in a given area influences prices, which consequently manifests in easier or harder economic access of local people to food.

Last but not least, according to Tombofa, (2004) the development of agriculture is a primary concern and condition for consequent development of other sectors. On the example of England Tombofa shows how increase in agricultural productivity and thus overall

primary resource availability laid the basis for development of secondary sectors and thus sustained the first industrial revolution in the world.

2.3 Factors affecting food availability

According to USDA (2015), developments in the macro economy have inevitable consequences for agriculture. Key factors linking agriculture of a given country to the global economy are exchange rates, international trade, foreign and domestic income, employment, interest rates, and energy costs. International and domestic macroeconomic shocks can cause major changes in the values of these indicators, resulting in changes in a country's agricultural prices, production, consumption, and trade (USDA, 2015).

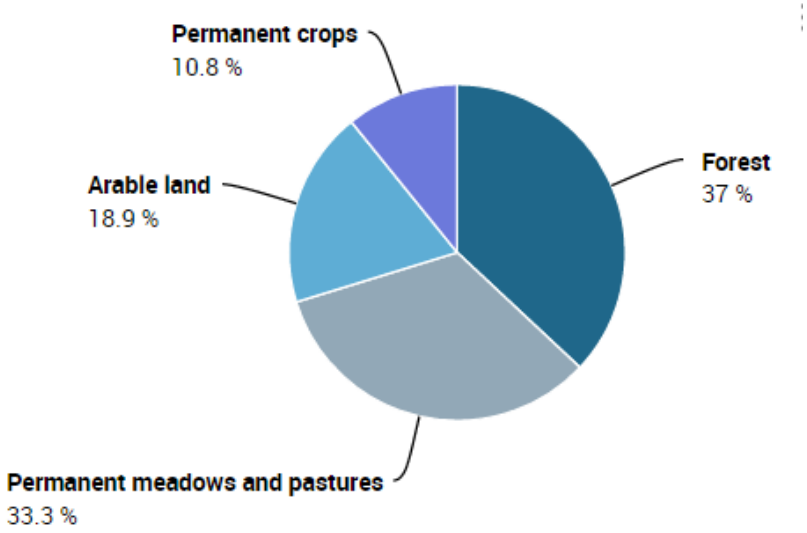
Laborde et al. (2013) considers the land available for food products and drivers behind land availability, the share of waste generated by food system and the normalized average yield which can be defined by production and consumption patterns or by climate change as main drivers of aggregated food supply within given country (Laborne et al., 2013). Laborne also emphasizes that in many cases drivers can have ambiguous effect as they may have ambiguous effect on food security.

Adom (2014) uses a theoretical model adopted from the study of Fosu & Heerink (2009). They both understand total food supply at the national level as the sum of domestic food production, food import, food aid and carryover stocks. According to Adom (2014) and Fosu & Heerink (2009) these aspects of national food supply are determined by factors as: domestic interest rate, world price of food, national income per capita of the importing economy, exchange rate of the domestic currency or level of foreign reserves, cost and availability of offshore financing using the proxy of the international interest rate, quantities of agricultural land, labour, capital, fertilisers and agro-chemicals, improved varieties of food crops and live stock, irrigation facilities, quantity of infrastructural services and weather (Adom, 2014; Fosu & Heerink, 2009). Adom consequently adds that while the effects of energy price, domestic and foreign interest rates, domestic prices and exchange rate on food availability are negative, the effects of crop yield, arable land, liberalisation of agricultural trade and real income are positive (Adom, 2014). Asante (2004) sees weather as the most important factor affecting agricultural yields and thus also overall food supply. Especially rainfall is considered a major determinant of the annual fluctuations of total household and national food output (Asante, 2004).

2.4 Ghana agricultural performance

Ghana has an area of 238.539 km^2 (Hjelm & Dasori, 2012) with rapidly growing population. The annual increase is about 500 000 people. In 2001 there were about 19 293 000 of Ghanaians. Ten years later, in 2011, the number increased to about 24 821 000 (FAOstat, 2013). According to FAOstat (2015), there was 63.8% of agricultural land in 2001 which increased to 69.1% of agricultural land in 2011. World Bank defines agricultural land as the share of land area that is arable, under permanent crops and under permanent pastures (World Bank, 2016).

Figure 4: Ghana Land Use



Source: (FAOstat, 2015)

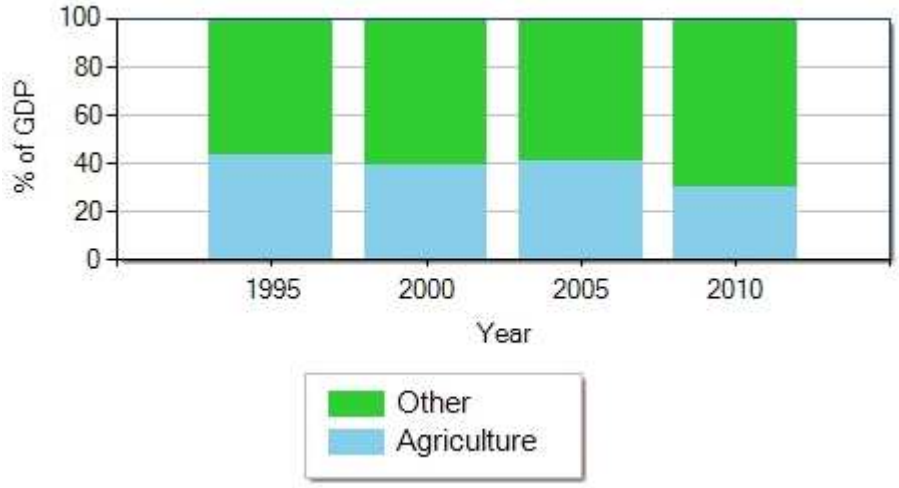
World Bank (2016) informs that arable land made about 17.8% in 2001. According to FAOstat, till 2015 the share increased to 18.9% of the total land area of Ghana as can be seen in figure 4 above.

According to World Bank, arable land includes land defined by the FAO as land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land

used for five or more years for forage, including natural and cultivated crops (World Bank, 2016).

According Asante (2004), during the period from 1988 to 2002, the agricultural growth rate averaged at about 3.1%. However, during the same period the average population growth rate was about 2.7% per year, which means that the real growth rate was only 0.4%. Considering the contribution of agriculture, there is an evidence of quite intense development of these numbers. In 2002 agriculture made about 35.8% of country GDP, 35.5% of foreign exchange earnings and directly employed about 50.6% of the total labour force (Asante, 2004). According to FAOstat (2013), till 2010 the agriculture share to GDP decreased to about 30%.

Figure 5: Share of Agriculture value added in total GDP since 1995 to 2010



Source: (FAOstat, 2013)

According to Hjelm & Dasori (2012 as cited in Adom, 2014), the share of agricultural sector to total GDP was about 26 percent, while employing about 41% of all workers in 2012. Decreasing governmental expenditures in agriculture between 1990 and 2000 from 4.1% to 0.7% (Global nutrition report, 2014 as cited in Adom, 2014), seasonal variability, constant high inflation rates (Trading Economics, 2016) negatively contributed to country's overall food security situation. On the other hand, in the next decade, as can be seen from table 1, the value of agricultural and food production constantly grew in the analyzed period from 2001 to 2011. From 1997 to 2012, the value of food production almost doubled. The highest growth has been registered within the period from 2007 to 2012 with average growth of agriculture production of 6.18% and average food production growth of 6.17%.

Table 1: Agriculture production and food production from 1997 to 2012

Evolution of the value of total agriculture production and food production							
	Value [milions of 2004-2006 Int$]				Annual growth rate [%]		
	1997	2002	2007	2012	1997-2002	2002-2007	2007-2012
Total agriculture production	3715	4805	5349	7220	5.28	2.17	6.18
Food production	3674	4783	5320	7175	5.42	2.15	6.17

Source: (FAOstat, 2013)

A significant increase has been registered also in crop production per ha of land in use. As can be seen in table 2, from 1997 to 2012, there has been about 30% increase from 641$ in 1997 to 908$ in 2012. The highest growth has been registered again within the period from 2007 to 2012 with the average growth of 5.43%.

Table 2: Crop production per ha from 1997 to 2012

Evolution of crop production value per ha							
	Value [2004-2006 Int$]				Annual growth rate [%]		
	1997	2002	2007	2012	1997-2002	2002-2007	2007-2012
Crop production per ha of land in use	641	704	697	908	1.89	- 0.2	5.43

Source: (FAOstat, 2013)

2.5 Food Security in Ghana

According to USDA, long-term consumer spending trends in most foreign markets indicate declining expenditure shares on staples (like rice and wheat) and increasing shares on higher valued food items (such as meat, dairy, fruits, and vegetables) (USDA, 2015). At the same time large multinational retailers have expanded in the developing countries, and top 15 companies account for more than 30% of global supermarket sales (USDA, 2015).

Trends in Ghana seem quite different. In Global Nutrition Report (2014), Ghana was ranked as the 33rd most undernourished country in the world. In the northern Ghana, which was the most food insecure region in Ghana in 2012, about 680 000 people are considered severely or moderately food insecure (Hjelm & Dasori, 2012). At the national level about 40% of Ghana population are small self-subsistence local farmers. According to Drafor et al.

(2013), those have little or no formal education and limited opportunities for non-farm income generating activities, so most of them produce rather than purchase staples for household consumption. According to Asante (2004), Ghana's domestic production of food in 2002 was in deficit. It covered just about 63% of its cereal consumption, 60% of its fish consumption and about 50% of meat production. Nonetheless, according to Drafour et al. (2013), it does not mean that these farmers are not dependent on the market. Many self-subsistence farmers are buying food, especially when facing household food insecurity during the lean seasons of production when their stocks are exhausted (Drafour et al., 2013). According to Asante (2004), the domestic shortfall of production is supplemented by commercial food imports and food aid. Mainly cereals, meat, fish, sugar, oil, tomatoes, milk and alcoholic beverages are such most common products. This focus on basic staple food helps farmers get through lean seasons with very limited financial sources (Drafour et al., 2013). The consumption survey indicates that the most important food consumption sub-groups, in terms of home consumption, are roots and tubers (22%), fish (16%), cereals and cereal products (15%), vegetables (9%) and meat (5%) (Asante, 2004). Due to the combined effects of local food production, commercial food imports and food aid, average daily calorie intake is about 2600 calories per capita (FAO, 2001 as cited in Asante, 2004). According to Curtis (2013), 45% of those living in the poverty, are represented by non-cocoa food crop farmers, while export producers, such as cocoa farmers represent less than 10%. The staple-led growth will reduce poverty and so food security and food availability more than export-led growth.

Geographically speaking, the highest concentrations of poverty are in three northern regions of Ghana. While average national poverty fell from 28% to 16% in 2015, in the north it fell from 63% to 49%.

2.6 Interventions of IMF and WB

When thinking about financial expenditures in agriculture of Ghana, there are three main sources of financing. Firstly, governmental expenditures, secondly, expenditures of foreign donors (Ghana's Ministry of Food and Agriculture, 2013) and thirdly Foreign Direct Investments (FDI) consisting of wholly owned foreign projects and joint ventures (GIPC, 2007).

Currently there is a discussion originating in 1980s, about who should invest to agriculture in developing countries and what shape and form agricultural production in these countries should have. Since the 1980s many countries under the pressure from the International Monetary Fund (IMF) and the World Bank have stopped subsidizing the food sector through supported prices, input subsidies and government credits for farmers (Kherallah et al., 2002; Stein, 1992; Swinnen & Maertens, 2007 cited in: Franz & Müller, 2015). Fosu & Heerink (2009) claim that such economic policy reforms initiated by international Monetary Fund and World Bank originate in 1980s and 1990s economic crises experienced by several developing economies. In this period, prices of major exports decreased, while prices of major imports increased, due to this, overall foreign trade decreased, which increased foreign interest rates. Economic growth started to decline, exports were falling, countries suffered by unstable balance of payments, high rates of inflation and low savings rates (Fosu & Heerink, 2009). As a response, IMF and World Bank provided these countries with financial facilities; Structural Adjustment Facility (SAF) and Enhanced Structural Adjustment Facility (ESAF) (Fosu & Heerink, 2009). Countries interested in having access to these loans from World Bank and IMF had to bind to fulfil a series of obligations and economic policy reforms (Stein, 1992 cited in: Franz & Müller, 2015). Those policy reforms affecting agricultural sector included: Liberalization of agricultural sector by deregulation of agricultural product market by abolishment of price controls, abolishment of reduced interest rates to agricultural credit and abolishment of delivery of agricultural technologies like agro-chemicals fertilisers and mechanical services by public sector. At the same time, lowering of import tariffs and non-tariff barriers together with nominal exchange rate depreciation was implemented (Fosu & Heerink, 2009; Stein, 1992 cited in: Franz & Müller, 2015).

Restricted fiscal policy together with rationalization of tariffs on consumption of utilities like electricity, potable water or telecommunications, cost rationalization of education and health care service and improved tax administration were implemented (Fosu & Heerink, 2009; Stein, 1992 cited in: Franz & Müller, 2015). These might limit the growth of public expenditures, provide savings to the national budget and thus mitigate an increase of the national debt. Restrictive monetary policy, causing reduction of growth of domestic credit and increased domestic interest rates (Fosu & Heerink, 2009) might on the other hand mitigate inflation, increase rating of the country and thus decrease foreign interest rates.

These changes might all together work towards an opening of the country to the world market and towards an increase of its competitiveness and attractiveness for the inflow of

foreign investments, if applied correctly. Nonetheless, at the same time there is a discussion about impacts of such a turnover from subsidized to private investment-based agricultural economy to food security, food availability and access to food for local populations. On the one hand, World Bank (2012 as cited in Franz & Müller, 2015) claims that the private sector is crucial to the increase of production, value chain inclusion and thus overall food availability. Also Borlaug (1997 as cited in Franz & Müller, 2015) insists on development of technologically optimized large scale industrial agriculture. However, on the other hand, academics like Ramakumar (2012) insist that it is public investments that have a significant poverty and hunger-reducing effect. Also Fosu & Heerink (2009) admit that such changes might have severe impacts on food security, job availability, national income, and human development index or poverty rate within the country (Fosu & Heerink, 2009). Varghese & Hansen-Kuhn (2013 as cited in Franz & Müller, 2015) push forward ideas of small-scale peasant agriculture with agro-ecological and organic principles.

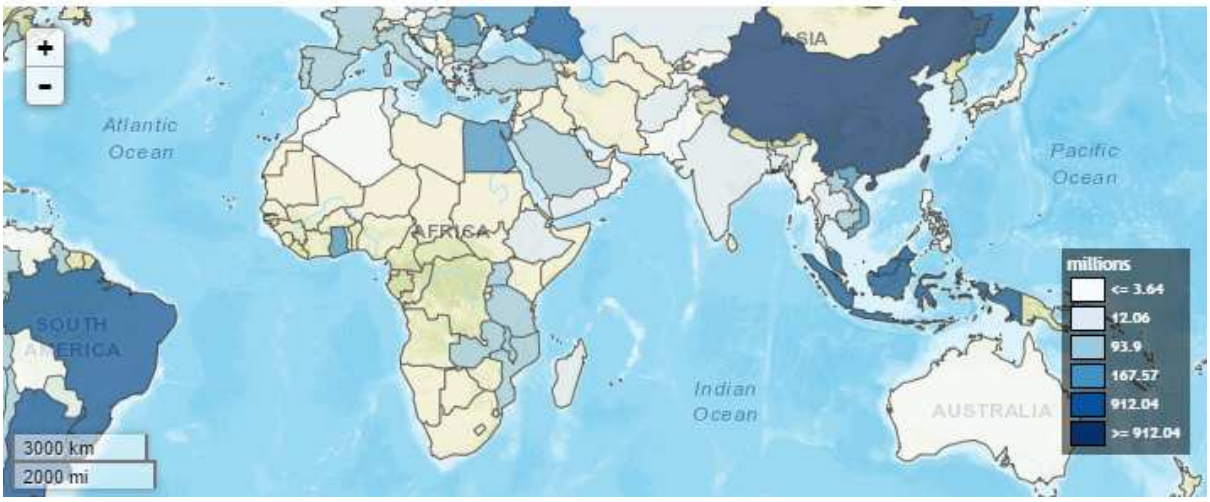
2.7 Foreign Direct Investments

According to UNCTAD (2002), FDI refers to an investment made to acquire lasting interest in an enterprise operating outside the economy of the investor. Rotjanapan (2005 as cited in Djokoto, 2011) defines FDI as an investment based on a long-term relationship, lasting interest and control of a entity resident in one economy by an enterprise resident in another economy. As Krugman & Obstfeld (2009) claim, its most distinctive feature is that it encompasses transfer of resources and acquisition of control. According to UNCTAD (2008), components of FDI are equity capital, reinvested earnings, and other capital.

The FAO, the World Food Programme (WFP) and the International Fund for Agricultural Development (IFAD) mentioned in 2012 that agricultural investment plays an important role in promoting agricultural growth, poverty and hunger reduction. According to UNCTAD (2013) and Slimane et al. (n. d.), the FDI inflows have grown greatly in developing countries, from 16.7% of global inflows in the early 1990s to 52% in 2012. Among them, the lowest share is directed to Africa and the biggest share is directed to the East and the Southeast of Asia. To draw a comparison, according to Sayek (2009), the share of net FDI inflows into GDP of middle-income countries rose from 0.74% in 1970s to 2.85% between 1995 and 2005.

Even though the interest of investors is increasing, between 1991 and 2013 FDI inflows to agriculture exceeded in its average the limit of 167 million just in two countries of Africa; Egypt and Ghana.

Figure 6: FDI inflows to agriculture - average 1991 – 2013 in US$ millions



Source: (FAOSTAT, 2015)

According Hallam (2009), there has been surge for agricultural land in Africa in the last three years. Investors from all around the world are interested in African land with various motivations. There are investors from China and Korea, investors from various Gulf States, interested especially in supporting their food security strategy, or investors from Europe and North America motivated by the possibility of bio fuel feedstock production or by potentially high expected returns on investment, partly caused by higher food prices (Hallam, 2009).

The last several years showed that investment into African agricultural land might be very profitable. Curtis (2013) for example claims that for every marginal GHC invested in agriculture of Ghana in average 16.8 GHC are returned. In addition, South African farmland has consistently yielded a higher return in comparison to local and international equity indices (FTSE/JSE and MSCI World), local bond index (ALBI – BEASSA) and local real estate (IPD index) over the medium – to long-term, in average exceeding 20% (CNBC Africa, 2015). See figure 7 below.

Figure 7: Average return asset classes – South Africa

Source: (CNBC Africa, 2015)

So what kind of impacts might be caused by FDIs? Several researches performed an analysis of impacts of FDI on economic growth. Karikari (1992) studied the causal relationship between FDI and economic output in Ghana from 1961 to 1988. He claims that FDI does not affect economic output. Afterward, Frimpong & Oteng-Abayie (2008) using data covering period from 1970 to 2002 have examined FDI in relation to GDP growth in Ghana. They found out that before implementation of Structural Adjustment Program (SAP) in 1983, there is no causality between FDI and GDP growth. FDI however cause GDP growth during the post-SAP period. According to Djokoto (2011), there is no clear empirical evidence resulting from studies about the causal link between FDI and economic growth. FDI may have a positive or negative effect or might have no link to GDP growth and vice versa (Mello, 1997). Obowa & Muwonge (2002 as cited in Djokoto, 2011) found out that there is an one-way relationship between FDI and GDP growth in Uganda. On the other hand, Kim & Seo (2003) found out insignificant effects of FDI on economic growth. McCloud & Khumbakar (2011) found out that there exists a heterogeneous relationship between foreign direct investment (FDI) and economic growth in developing countries. They argue that the effect of FDI to GDP depends on domestic policies and differences in institutional quality within individual countries. Wang & Wong (2009) using data from 69 countries from 1970 to 1989 claim that a positive relationship between FDI and economic growth under two economic conditions has been estimated. Those conditions are a sufficient level of human capital and well-developed financial markets. According to Oji-Okoro (2011 as cited in

Kareem at al., 2013), who studied impact of agricultural sector on the economic growth of Nigeria from 1986 to 2007, 81% of the variation of the GDP can be explained by domestic savings, government expenditures and foreign direct investments.

Considering impacts of FDI on agriculture and food security, Mihalache-O'Keef & Li (2011) analyzed the direct economic relationship between sector FDI and food security in 56 transition economies between 1981 and 2001. According their findings, manufacturing FDI improves food security, while primary-sector FDI reduces food security. Tondl & Fornero (2010) examined the relationship between FDI and productivity in different economic sectors in Latin America. According their results, positive effects of FDI to productivity can be found in all sectors, whereas highest productivity effects are intrinsic for primary sector. According to Hallam (2011), who studied relationship between FDI and food security in developing countries, and issues and policy implications connected, FDI is not the only instrument for promotion of food security, it can be harmful to food security when applied in legally undeveloped countries, but under certain circumstances, FDI may play a positive role via its effect on agricultural productivity. Kareem et al. (2013) supports that by finding out that FDI is in a positive relationship to overall agricultural output. Similarly also Tülüce & Doğan (2014), claim that FDI has a positive impact on growth of productivity within developed and developing countries. However, it is a question how much of this surplus really remains within the hosting country and how much of it is exported back to the country of origin. Aitken & Harrison (1999) found out, that on the one hand there is a productivity increase in companies with foreign equity, on the other hand foreign ownership negatively affects productivity of wholly domestically owned firms in the same industry.

Based on research between 1960 and 2008 in Nigeria, Akande & Biam (2013) partly disagree with the above mentioned researchers as they claim that FDI in agriculture has no long-run equilibrium influence on agricultural output, however there is a positive short-run causal effect of FDI in agriculture on agriculture production. Similarly, Djokoto (2011) who studied the relationship between FDI and agricultural GDP growth between 1966 and 2008 in Ghana, finds out that there is a positive but very insignificant relationship among these two variables. Based on that, Djokoto (2011) claims that in Ghana, FDI does not cause agricultural output growth and conversely, agricultural output growth does not cause FDI into this sector. On the other hand, Slimane et al. (n. d.) who examined direct and indirect effects of sector FDI on food security for 63 developing countries over the period 1995-2008, claims that FDI to agriculture sector and FDI to secondary sector have a statistically significant and

positive impact on food production, FDI to tertiary sector have a negative impact on food production and FDI to mining is not statistically significant for food production.

At the same time, Pritchard et al. (2010) argue, that FDIs may disrupt pre-existing right to land, water or natural resources. Moreover, according to Jenkins & Scanlan (2001) and Wimberley (1992), FDIs are also a source of economic and political dependency. Hallam (2011) points out, when considering agricultural FDI in developing countries, that some of the largest transactions coming from Gulf States consist in purchasing land in food insecure regions in order to grow food that will be exported back to the investing country. According to Halam (2011), what is typical for such an investment is the lack of joint venture and lack of community involvement. Such an investments are more acquisitive and resource seeking rather than market seeking, bringing economic, political, legal and ethical issues.

Similar standpoint is supported also by Wimberley (1992) who focused on the effect of exporting dependence on domestic consumption. Based on the analyses of 59 Third World Countries from 1967 to 1985, Wimberley (1992) claims that reduction of primary sector export dependence promotes domestic food consumption, and that transnational corporate (TNC) investment dependence has a strong harmful effect on consumption in a given country. In connection to that, Akande & Biam (2013), who explored relations of FDI inflows into agriculture and agricultural output from 1960 to 2008, found out that during the period from 1991 to 2002, around 95% of the changes to worldwide laws governing FDI were favourable to multinational firms' activities. In addition, Clark & Cason (2015) talk about harmful effect of FDI, now in terms of international trade negotiations, as they claim that foreign capital penetration leads to deterioration of terms of trade for penetrated country while countries occupying more core-like positions in the international trade network experience more favourable trade terms.

Another negative effect of FDI considering availability of food in a given country and food security of the local population, is connected to FDI to land. As population of rapidly developing countries like China and India constantly grows, these countries together with other like Saudi Arabia or United Arab Emirates which are in turn rich and short of fertile soil, started to buy cheap and fertile lands in Africa for food production aimed to export to investor's country (Franz & Müller, 2015).

So called „Land Grabs" are often initiated by foreign governments but carried out by transnational corporations (Zoomers, 2010 as cited in Franz & Müller, 2015). According to

Taylor & Bending (2009), land grabbing leads to a commercialisation of land and water resources. On the one hand, there can be an expected increase in agricultural production, provision of the limited number of jobs and overall positive impact on economic development of the country (Franz & Müller, 2015). On the other hand, it harms overall national food security and food availability as it limits the land which might be used for production for domestic markets. Even more harmful effects of such investments can be seen on a local level, as they cut local small-scale farmers off their land without any compensation due to the lack of formal land concessions (De Schutter, 2009 as cited in Frank & Müller, 2015).

On the other hand, analysis of Dries & Swinnen (2004) about Polish dairy sector shows that FDI does not cause a rapid consolidation of the supply base made by small-scale farmers. Instead of that, foreign companies introduced farm assistance programs to overcome market imperfections. Moreover, small local suppliers experienced vertical and horizontal integration through improved access to finance, increased investments, product quality improvements and overall growth (Dries & Swinnen, 2004). Similarly Slimane et al. (n. d) and Romers (1993 as cited in Akande & Biam, 2013) see the benefits for agriculture due to the agricultural FDI in terms of expertise and technology transfer. Nonetheless, according to Slimane et al. (n. d.), it also depends on the fact whether a country is able to absorb and use such a technology and know-how transfer. Similarly, Lucas (1988) claims that FDI spur long-term development through growth of research and development of human capital index.

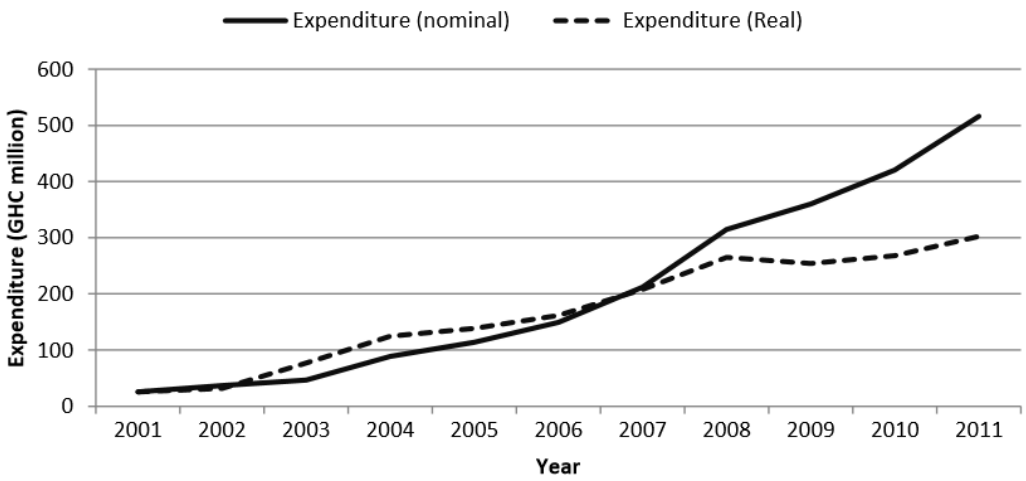
2.8 Government Expenditure to Agriculture

According to Hallam (2009), the share of public spending into agriculture generally dropped to about 7% and even less in Africa. Hallam (2009) further claims that also official development assistance to agriculture dropped to about 5%, while the share of commercial bank lending to agriculture in Sub-Saharan Africa is less than 10%. Also microfinance loans and private investment funds targeting at African agriculture are also quite insignificant in its amount (Hallam, 2009). According to World Bank (2013), the share of agricultural sector in the national expenditure over the period 2001-2011 averaged at 9.3% equalling to real average GHC 169 million (in 2001 constant prices), which is according to Curtis (2013) one of the highest government allocation to agriculture in Africa. Even though such numbers are above Africa's average performance, they do not fulfil 2003 Maputo commitment to allocate

at least 10% of national budgetary resources into agricultural sector, which should secure annual 6% sector growth, promote food security of the country and mitigate poverty in the country. Nonetheless, with the exception of the small decrease in real expenditures in 2009, both nominal and real expenditures in the agriculture sector have been constantly rising from 2001 to 2010 as can be seen in figure 8 below.

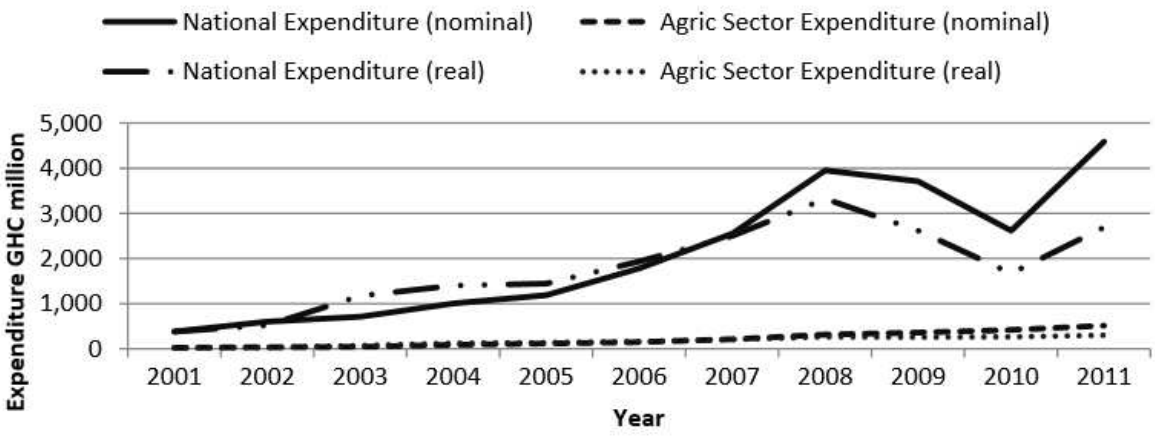
Nonetheless, it is also important to mention that the donor funds make a significant share of the overall volume of GEA. The World Bank (2013) claims that MoFA's budget is in average accounting for about 40% of overall agriculture expenditure between 2001 and 2011, whereas according to Curtis (2013), about 53% of MoFA's budget for year 2011 came from the donor funds. Thus, in total, about 20% of the overall agriculture expenditure in 2011 came from donor funds. For the purposes of this thesis, donor funds are accounted as a part of overall government expenditures into agriculture.

Figure 8: Nominal and real GEA (in 2001 constant prices), GHC million, 2001-2011



Source: (World Bank, 2013)

Figure 9: Gov. and agri. expenditures (in 2001 constant prices), GHC million



Source: (World Bank, 2013)

The structure of Ministries, Departments and Agencies responsible for individual agriculture subsectors is very fragmented in Ghana. MOFA, lead ministry of agriculture sector is responsible for non-cocoa crops, livestock and fisheries subsectors. COCOBOD, responsible for cocoa, coffee and nuts, is under responsibility of Ministry of Finance and Economic Planning (MOFEP). Ministry of Lands and Natural Resources takes care about forestry subsector. Ministry of Trade and Industry supports production of selected commodities for local markets and export, while Ministry of Local Government and Rural Development supports agriculture activities on district level. Agriculture research is under different agencies within National Agriculture Research System (NARS), which is under Ministry of Science and Technology. (World Bank, 2013)

When considering subsector division of government expenditures to agriculture, according to World Bank (2013), between 2001 and 2011, 57.8% of government expenditures to agriculture were allocated to non-cocoa subsector, 32.7% to cocoa subsector, 2.5% to livestock subsector, 6% to forestry subsector and 1.0% to fisheries subsector.

Nonetheless, expenditures were not always distributed as described above. As Curtis (2013) claims Ghana has long prioritized export crops over food crops. From 2002 to 2006, the government allocated twice as much money to Ghana Cocoa Board than to MoFA. Since 2008,the trend has been reversed (Curtis, 2013).

As can be seen in table 3 below, until 2003, the share of expenditures in cocoa sector was slightly higher than the share of expenditures in non-cocoa sector. Since 2004, more money is spent within non-cocoa sector.

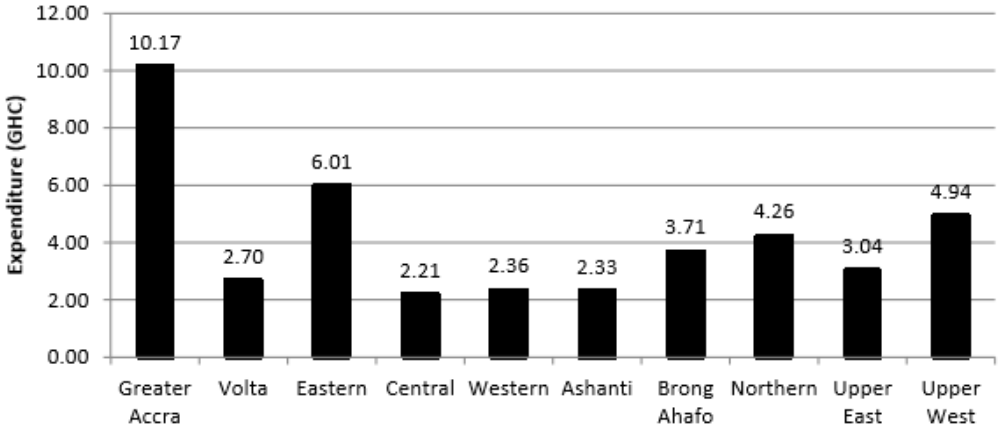
Table 3: Subsec. division of GEA (in 2001 constant prices), GHC million 2001 - 2011

Year	Non-cocoa crops	Cocoa	Live-sock	Fisheries	Forestry	Ag. Sector
2001	10.8	13.3	0.3		1.0	25.3
2002	14.7	16.0	0.3		0.9	31.9
2003	35.9	37.7	0.6		2.2	76.6
2004	67.9	43.6	0.9		12	124.4
2005	78.2	50.6	3.1	0.1	6.3	138.3
2006	84.2	62.7	3.8	0.1	11.1	161.9
2007	115.2	69.5	3.2	2.4	17.5	207.7
2008	144.5	98.9	4.1	1.6	15.9	265.0
2009	158.2	66.0	9.5	9.7	10.6	254.1
2010	162.5	68.9	11.6	2.4	22.6	268.0
Avg.	87.2	52.7	3.7	2.7	10.0	155.3

Source: (World Bank, 2013)

Considering allocation of the government expenditures to agriculture from the regional perspective, there is a strong investment centralism in Ghana. As can be seen in figure 10 below, the Greater Accra region has the highest agriculture expenditure per capita with an amount of GHC 10.17, while the Central region has the lowest agriculture expenditure per capita with an amount of GHC 2.21.

Figure 10: Expenditure per capita (nominal GHC), 2010



Source: (World Bank, 2013)

3 Data and methodology

3.1 Data

In general data in agriculture capital stock, government expenditure, research and development and especially data of agricultural FDI are weak, as they are very limited, inconsistent and incomprehensive (Lowder & Carisma, 2011; cited in: Franz & Müller, 2015). Hallam (2009) claims that it is difficult to assess the extent, nature and impacts of FDIs, nor it is possible to determine with precision whether the recent investments are totally new development or just a continuation of older projects, as the data are just not detailed enough. Considering government expenditures, there are problems with 1, how agriculture is defined, which influences what is included and what is not into this variable and about 2, diversity of spending agencies involved in the agriculture sector and their changing competences, which causes that statistical data are heterogeneous in a longer time period (Akroyd & Smith, 2007).

3.1.1 Data sources

Data about Foreign Direct investments in the agriculture sector in Ghana are obtained from Ghana FDI quarterly reports from 2001 to 2011 published by Ghana Investment Promotion Centre (GIPC). Data for each individual year have been calculated as the summarization of investments during all four annual quartiles. Data about Ghana's government expenditures in the agriculture sector from 2001 to 2011 are obtained from Final Report Basic Agricultural Public Expenditure Diagnostic Review published by Ghana's Ministry of Food and Agriculture with support of Bill and Melinda Gates foundation. Data about nominal annual average exchange rate of GHC (Ghanaian Cedi) to USD have been obtained from United States Department of Agriculture Economic Research Service. Data about annual inflation (GDP deflator) have been obtained from the World Bank. All data about the overall Ghana's agricultural production, agricultural import, stock variation, agricultural export, feed, seed, agricultural waste, processing, other utilization, population and energy supply per capita have been obtained from FAOSTAT Food Balance Sheets.

Table 4: Data sources

Data	Source	Link
Foreign direct investments to the agriculture sector of Ghana	Ghana Investment Promotion Centre (GIPC) - FDI quarterly reports 2001– 2011	http://www.gipcghana.com/press-and-media/downloads/reports.html
Government of Ghana expenditures in the agriculture sector	Ghana's Ministry of Food and Agriculture (MOFA) Final Report Basic Agricultural Public Expenditure Diagnostic Review	https://openknowledge.worldbank.org/handle/10986/16734
Nominal annual country exchange rate of Ghana Cedi (GHC) to US Dollar (USD)	United States Department of Agriculture Economic Research Service	http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx
Inflation, GDP deflator	World Bank	http://data.worldbank.org/indicator#topic-1
Agricultural production, agricultural import, stock variation, agricultural export, feed, seed, agricultural waste, processing, other utilization, population, energy supply per capita	FAOSTAT food balance sheets	http://faostat.fao.org/site/368/default.aspx#ancor

3.1.2 Sample size

The data limitations lead to the fact that it was not possible to make the sampling more frequent or extant. All the data in this paper have been sampled with an annual frequency between years 2001 and 2010, so the total number of sample size for each variable is 10. Hair et al. (2010) argues that for social science and business research reliability. Sample size is generally expected to be 7 and higher, ideally at least 10. Nonetheless, such a sample size can be considered low when using multiple regression (Hair et al., 2010). It is important to mention that the size of the samples has an impact on the generalizability and the statistical

power of the model (Hair et al., 2010). Considering statistical significances sample sizes that are small do not have to represent the regression appropriately, as only strong relationships can be detected with certainty, so there is a risk that small sample model can be evaluated as statistically insignificant (Hair et al., 2010). Very large samples have on the other hand tendency to result in statistical significance in all instances. Considering generalizability of the results, the ratio of observations to independent variables should be at least 5:1 (Hair et al., 2010). In cases where available sample do not meet these criteria, researcher should validate the results (Hair et al., 2010), however still such a narrow sample size might be considered as weakness of the model.

3.1.3 Data constraints

Originally, paper should have included data for 31 years from 1981 to 2010 as for this period FAOstat food balance sheets are available. After 2010, FAOstat stopped publishing food balance sheets and thus data about available food were not available any more, at least not in the same format needed for the statistics. Nonetheless, also the border of 1981 had to be shifted as there occurred a problem with finding data about foreign direct investments into agriculture older than 2001. The same problem occurred with finding data about Ghana's government expenditures into agriculture. Data since 1981 were not available, at least not on annual basis and in a coherent format. To the contrary, data about exchange rate or inflation in Ghana provided by USDA and World Bank were available for the whole intended period from 1981 to 2010. All the needed data, were available just for period since 2001 to 2010, so there is just a short 10-year overlap.

Several alternative solutions were considered. First, substitution of agriculture FDI by general FDI invested in all the sectors together. Such data are available in the needed extent, however, in that case, the aim of the thesis would not be fulfilled as the thesis centres its interest on the impact of agricultural projects and money invested into agriculture on food availability in the country. For this reason, the substitution of agricultural FDI with general FDI was condemned. Moreover, nor it was possible to increase the frequency of sampling as data for shorter than annual intervals do not exist for most of the variables involved, excluding FDIA.

Websites of FAOstat, UNCTAD, GIPC, World Bank, IMF, WTO, USDA, Ministry of food and Agriculture of Ghana (MoFA) and Ministry of finance of Ghana were searched for

data about agricultural FDI inflows to Ghana and data about Ghana agricultural expenditures before 2001, without success. Employees of GIPC and FAOstat were contacted via email in order to obtain the data needed. No response has been obtained.

3.1.4 Definition of variables

The variables used in the paper are defined as follows:

a) Foreign Direct investments to agriculture (further FDIA) for a given year are defined as the total estimated value of newly registered projects in the agriculture in given year, as published by GIPC, including wholly-owned foreign enterprises and joint ventures between Ghanaians and their foreign partners. FDIA is measured in million USD.

b) Ghana's government expenditures to agriculture sector (further GEA) are based on a definition of agriculture by UN's classification of the Functions of Government (COFOG) system. COFOG includes agriculture (crop and livestock), forestry, fishing, hunting, administration, conservation and reclamation of arable land and construction and operation of irrigation and flood control system (Ghana's Ministry of Food and Agriculture, 2013). Figures of GEA from 2001 to 2010 are presented in 2001 constant prices and involve the expenditures to agriculture funded by government of Ghana itself and the expenditures funded by foreign donors. The data have been obtained from Ghana's Ministry of Food and Agriculture Final Report about Basic Agricultural Public Expenditure Diagnostic Review (Ghana's Ministry of Food and Agriculture, 2013). GEA is measured in million Cedi.

c) Nominal annual average country exchange rate of GHC to USD (further EXCHR) can be defined as a number of units of the domestic currency (Cedi) that can purchase a unit of a given foreign currency (US$) (Czech National Bank, 2016). A value for each year has been derived from averaging 12 monthly nominal exchange rates (United States Department of Agriculture, 2016).

d) Inflation (further INFL) is measured by GDP deflator which is derived from dividing nominal GDP of the country by real GDP of the country, and then multiplied by 100. (Investopedia, 2016)

e) Food production for domestic market of Ghana (further FP) represents the total quantity of foodstuff available in the country in a given year. It is measured in 1000 tons.

f) Food supply per capita (further FSPC) refers to the food available per person. FSPC is measured in kg per capita per year.

g) Energy supply per capita (further ESPC) refers to the energy value of available food measured in kilo-calories (kcal) per person per day.

Two out of three indicators of food availability (Food Production and Food Supply per Capita will be calculated based on sub variables presented in FAO food charts. There are nine of them. First three sub variables; agricultural production, agricultural import and stock variation are positive. Their increase mean increase in overall food supply of the country. Six other sub variables; agricultural export, feed, seed, agricultural waste, processing and other use are negative. Their increase causes decrease in overall food supply of the country as these variables indicate looses taken on available food supply.

Agriculture production (further AP) represents the total quantity of foodstuff produced in the country in a given year. Agricultural import (further AI) represents the total amount of foodstuff imported into the country in a given year. Stock variation (further SV) refers to any change in stocks or supplies that may have occurred since the beginning of the reference period. Agricultural export (further AE) represents the total amount of foodstuff exported to foreign markets. Feed (further FE) represents the total amount of foodstuff used for feeding of cattle. Seed (further SE) represents the total amount of foodstuff used as seed. Agriculture waste (further AW) refers to the amount of foodstuff lost during storage and transportation. Processing (further PR) refers to the amount of foodstuff used for processing into another type of commodities which are then again accounted within agricultural production. Other utilization (further OU) refers to the amount of foodstuff used for industrial use. AP, AI, SV, AE, FE, SE, AW, PR and OU are all measured in 1000 tons. All variables, their acronyms and units are summarized in table 5 below.

Table 5: Variable acronyms

	Variable	Acronym	Units
Independent Variables	Foreign Direct investments to agriculture	FDIA	million USD
	Government expenditure to agriculture	GEA	million Cedi
	Nominal annual country exchange rate of GHC to USD	EXCHR	–
	Inflation, GDP deflator	INFL	%
Sub variables needed for calculation of dependent variables	Agricultural production	AP	1000 tons
	Agricultural import	AI	1000 tons
	Stock variation	SV	1000 tons
	Agricultural export	AE	1000 tons
	Feed	FE	1000 tons
	Seed	SE	1000 tons
	Agricultural waste	AW	1000 tons
	Processing	PR	1000 tons
	Other utilization	OU	1000 tons
	Population	POP	1000 persons
Dependent variables	Food production	FP	1000 tons
	Food supply per capita	FSPC	kg/capita/year
	Energy supply per capita	ESPC	kcal/capita/day

Variable values for individual years from 2001 to 2010 are noted in tables 6, 7 and 8. When we look at the table 6, we can see detailed numbers for the four independent variables used in the analyses; FDIA, GEA, EXCHR and INFL.

Table 6: Input data for independent variables

	Independent variables			
Year	FDIA [million USD]	GEA [million Cedi]	EXCHR [-]	INFL [%]
2001	6.03	25	0.716	34.818
2002	20.79	32	0.792	22.819
2003	8.37	77	0.867	28.704
2004	5.76	124	0.900	14.350
2005	4.28	138	0.906	14.964
2006	6.45	162	0.917	80.751
2007	35.61	208	0.935	18.630
2008	57.49	265	1.058	19.410
2009	102.42	254	1.409	15.665
2010	344.94	268	1.431	16.596

Source: (GIPC 2001-2011; World Bank, 2013; USDA, 2016; World Bank, 2016)

Where

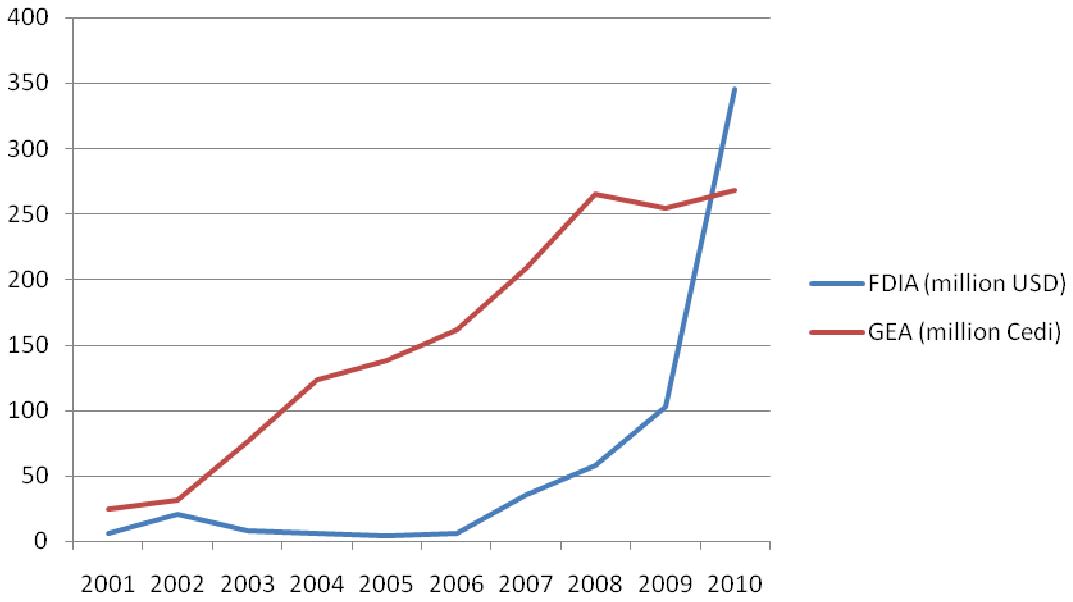
FDIA – Foreign Direct Investments into Agricultural sector

GEA – Government Expenditure in the Agricultural Sector

EXCHR – Nominal Annual Country Exchange Rate of GHC to USD

INFL – Inflation calculated by GDP deflator

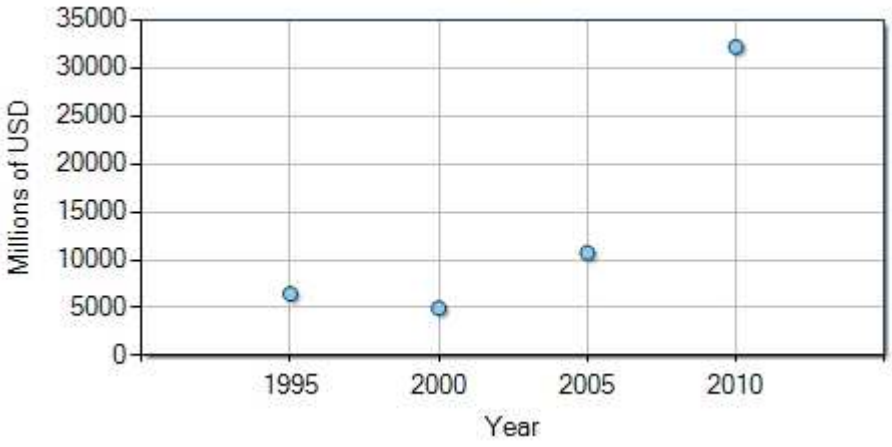
Figure 11: FDIA and GEA development from 2001 to 2010



Source: (GIPC 2001-2011; World Bank, 2013)

Figure 11 shows the annual increase of Foreign Direct Investments in agriculture in comparison to Government Spending to agriculture. As can be seen, FDIA till 2006 keep at about constant levels and then rise rapidly, reaching extreme values in 2010 in comparison to the previous years. GSA, on the other hand, keeps growing with a constant increase. As can be seen from figure 12, also GDP data make the similar pattern when expressed graphically as the FDIA, as can be seen when comparing figures 12 and 11.

Figure 12: Gross domestic product development of Ghana from 1995 to 2010



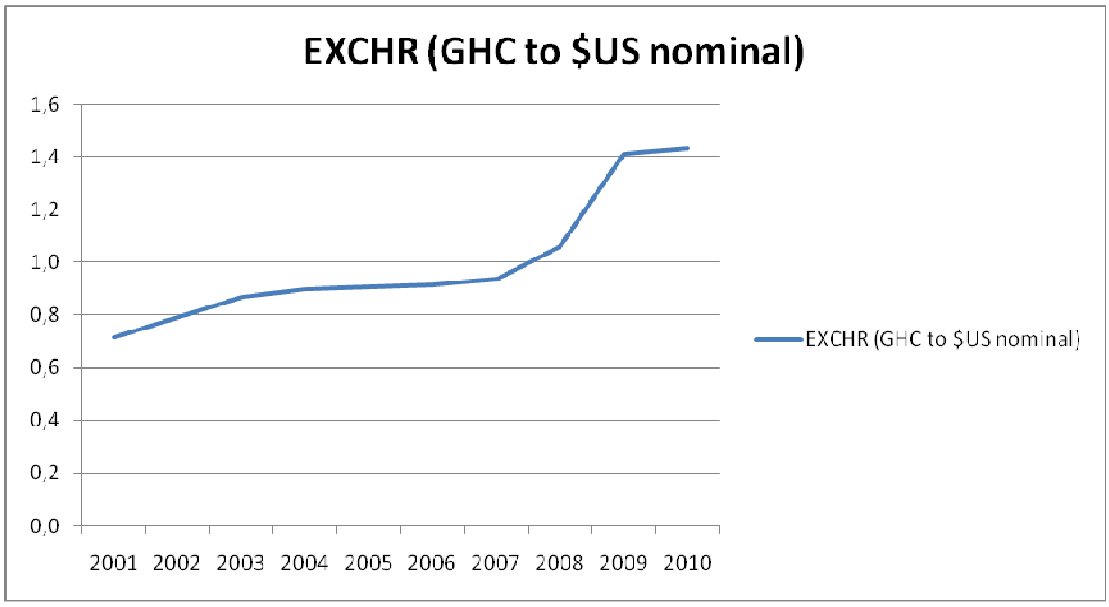
Source: (FAOstat, 2013)

The fact that the development of gross domestic product correlates with the development of FDIA might indicate mutual influence of those two variables. On the one hand, growth of the country's GDP may attract more investments, on the other hand, increasing investments have positive impact on GDP growth and thus also on food and agricultural production.

Besides FDIA and GEA, there are two other independent variables; nominal EXCHR and INFL.

Nominal EXCHR is gradually increasing, meaning more GHC is needed to cover the value of 1 $US. On the one hand, it might have a positive impact on revenues from export and thus also on the overall increase in domestic agricultural production. On the other hand, it has a negative impact on the accessibility of agriculture inputs and technologies imported from abroad. In consequence, it has an overall negative impact on economies with negative trade balance, where total value of all imports exceeds the total value of all exports, which is the case of Ghana between 2001 and 2010 (OEC, 2016).

Figure 13: Nominal annual country exchange rate to USD

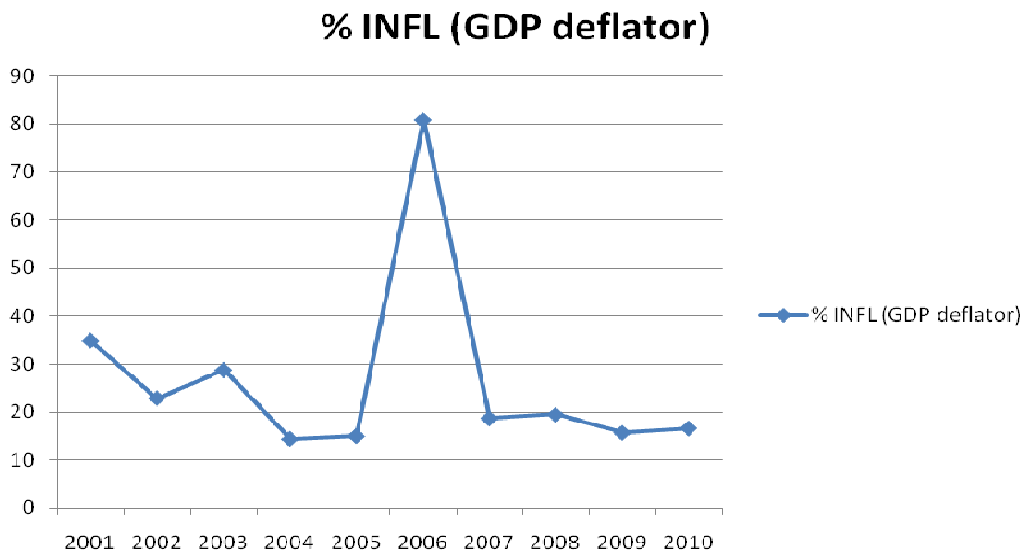


Source: (USDA, 2016)

The overall trend towards inflation was decreasing between 2001 and 2010. Within the period from 2001 to 2010, it fell from about 34.8% to about 16.5%. Nonetheless, the overall decreasing trend was harassed by an increase in prices in 2003 and extreme increase in prices in 2006, as can be seen in figure 14. Volatility in food prices may have an impact on local demand, local business environment and stability of the market. In consequence, it may have

an impact on production patterns in the agriculture sector and thus also on the overall volume of produced food.

Figure 14: % inflation, GDP deflator



Source: (World Bank, 2016)

Apart from the four independent variables, there are also three dependent variables. The table 7 shows detailed information about values of dependent variables of FP, FSPC and ESPC from 2001 to 2010.

Table 7: Input data for dependent variables

	Dependent variables		
	FP model	FSPC model	ESPC model
Year	FP [1000 tons]	FSPC [kg/capita/year]	ESPC [Kcal/capita/day]
2001	14 331	742.8	2 534
2002	14 885	752.2	2 589
2003	15 184	748.1	2 602
2004	15 767	756.5	2 616
2005	16 256	760.1	2 690
2006	16 792	764.9	2 750
2007	17 751	787.9	2 770
2008	18 594	805.2	2 867
2009	19 385	820.2	2 937
2010	19 813	818.1	2 976

Source: (FAO, 2015)

Where

FP – Food Production

FSPC – Food Supply per Capita

ESPC – Energy Supply per Capita

A graphical expression of the annual growth rate of the three dependent variables in comparison to the preceding year can be seen on figure 15. Annual cumulative growth rate of dependent variables can be seen on figure 16.

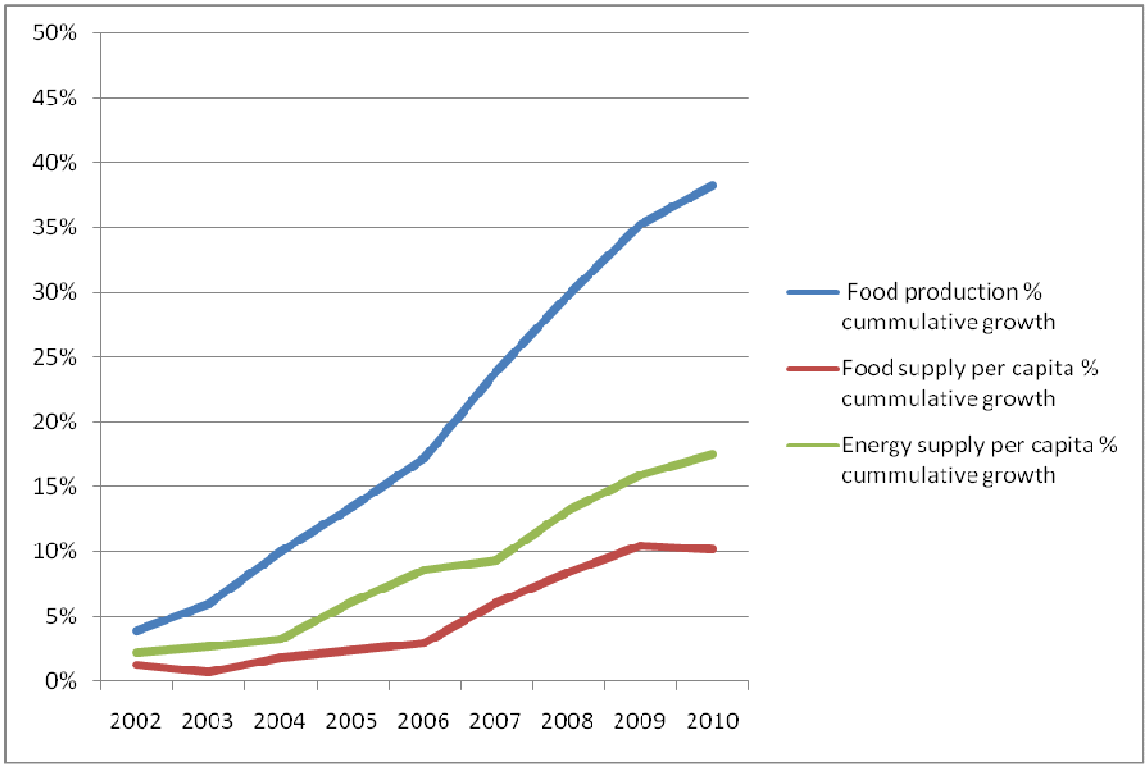
Figure 15: Annual growth rate of dependent var. to preceding year from 2002 to 2010

Source: (FAOstat, 2015)

As can be seen in the figure 15, all the three indicators of food availability fluctuate quite significantly when we measure their percentage change in comparison to the preceding year. Naturally, growth of food supply per capita as a function of food production growth follows more or less its development. It is however interesting that even though the overall food production is constantly growing for the whole period of 10 years by 2% or more per year, food production per capita actually decreases in 2003 and 2010 in comparison to the preceding years. Such a discrepancy is a consequence of a very rapid population growth within the country, due to which most of the overall additional surpluses achieved in agriculture production are consumed by newly born population. Then in years of poor production it may happen that there is actually less food per capita available than there was a year ago. This fact can be seen also in the figure 16. Till 2010, the overall food production increased by 38.25% in comparison to 2001, however food production per capita and energy production per capita increased just by 10.14% and 17.44% respectively. That means that about 28.00% of food supply growth is consumed by the newborn and just 10.14% of food supply is distributed among the existing population. Nonetheless, 10.14% increase in food

supply per capita equals to 17.44% increase in energy supply per capita, pointing to the fact that composition of new food supply surplus is energetically richer that the actual average.

Figure 16: Percentage cumulative growth of dependent variables from 2002 to 2011



Source: (FAOstat, 2015)

The data about two out of the three dependent variables were not obtained from FAOstat directly, but were additionally calculated based on the following formula:

Food production (FP) = Agriculture production + agricultural import + stock variation – Agricultural export – feed – seed – agricultural waste – other use

Food supply per capita (FSPC) = food production/ population

Detailed information about sub-variables used for the calculation are mentioned in the table 8.

Table 8: Input data for sub-variables of dependent variables

year	Sub variables for calculation dependent variable of FP									
	Sub variables for calculation dependent variable of FSPC									
	AP	AI	SV	AE	FE	SE	AW	PR	OU	POP
2001	21 445	1 346	-96	636	2 098	72	4 242	278	1 038	19 293
2002	23 748	1 584	-333	741	2 704	72	4 842	456	1 299	19 786
2003	24 180	2 077	-517	1 101	2 747	68	4 976	412	1 252	20 302
2004	23 880	2 668	-429	1 402	2 418	70	4 838	370	1 254	20 836
2005	24 322	2 300	-253	1 037	2 443	74	4 844	394	1 321	21 384
2006	24 863	2 504	67	1 253	2 502	66	4 944	478	1 399	21 948
2007	25 168	2 761	382	1 285	2 603	70	4 869	275	1 458	22 526
2008	28 122	2 548	221	1 127	3 306	75	5 676	396	1 717	23 110
2009	30 423	2 349	-284	894	3 656	78	6 113	418	1 944	23 692
2010	31 927	2 436	47	701	4 428	78	6 516	425	2 449	24 263
unit	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 population

Source: (FAOstat, 2015)

Where

AP – Agricultural Production

AI – Agricultural Import

SV – Stock Variation

AE – Agricultural Export

FE – Feed

SE – Seed

AW – Agricultural Waste

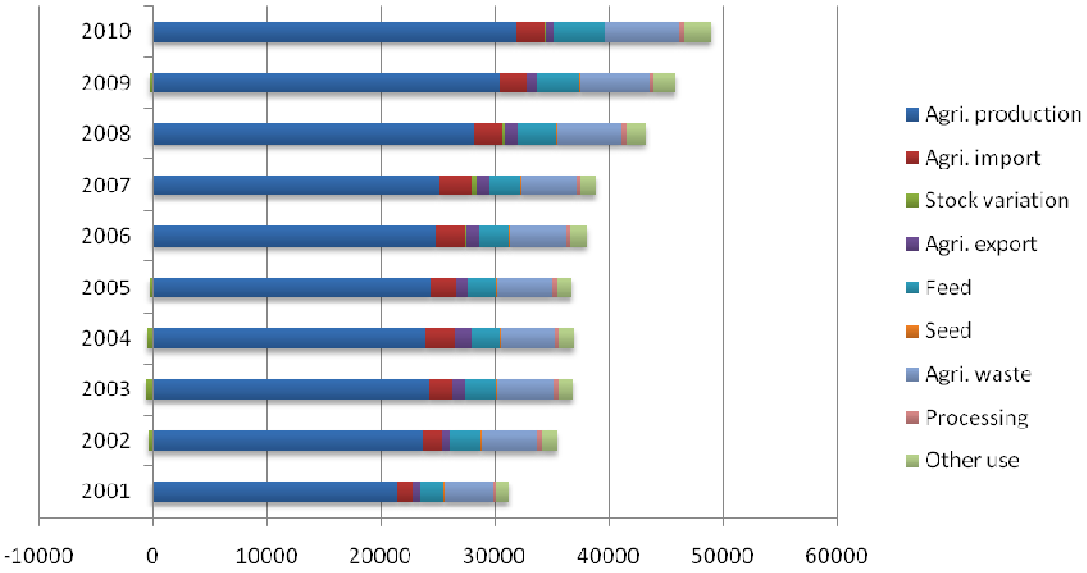
PR – Processing

OU – Other Utilization

POP – Population

A graphical display of the table 8 is expressed in the figure 17 below, showing a proportion of sub-variables for individual years.

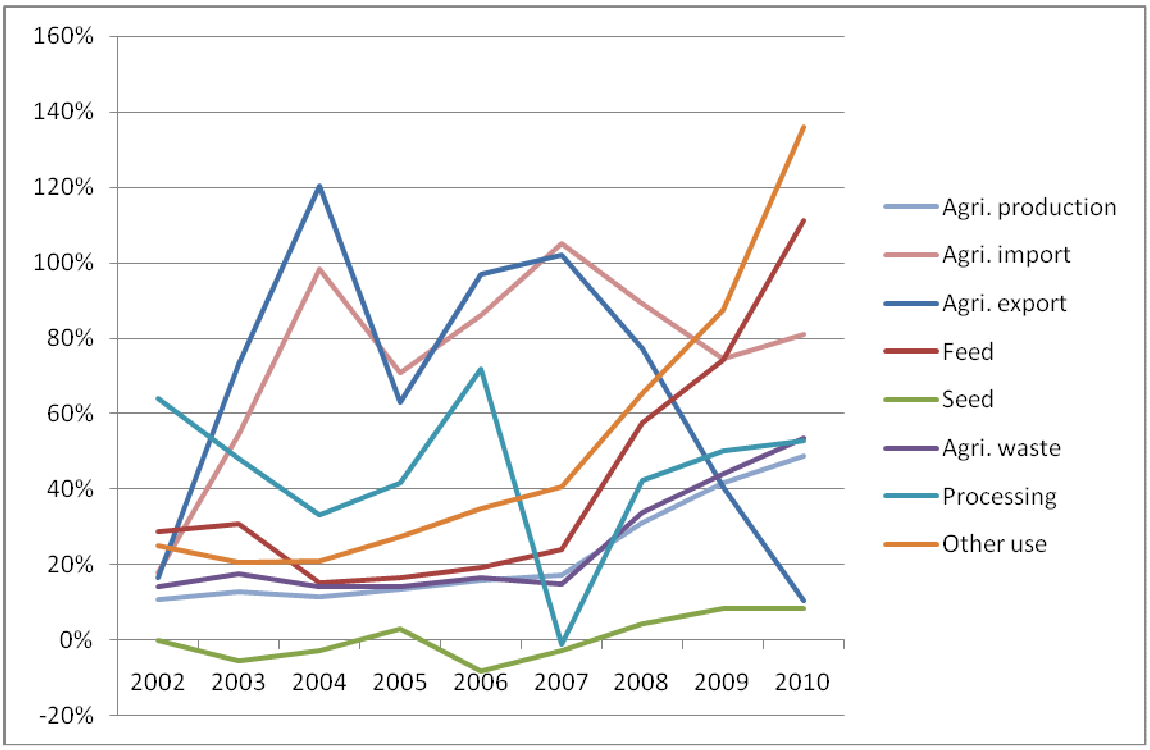
Figure 17: Composition of sub variables



Source: (FAOstat, 2015)

As can be seen, structures of sub-variables remain in all ten years more or less proportionally constant. The most significant increase in total numbers can be seen in agricultural production, waste and feed. As can be seen in the figure 18 below, agriculture production is highly correlating with agriculture waste, so when AP grows, AW grows too, as the sector generally operates in a larger scale. AP is also naturally highly correlating with Feed and Seed. Considering the percentage growth, very high increase in feed variable can indicate increasing development of animal production sector within the country, small increase in seed, on the other hand, reflects slow enlargement of arable land. Also, agriculture import and agriculture export are correlating, both generally dependent on the overall situation in foreign markets and common trade policy of Ghana.

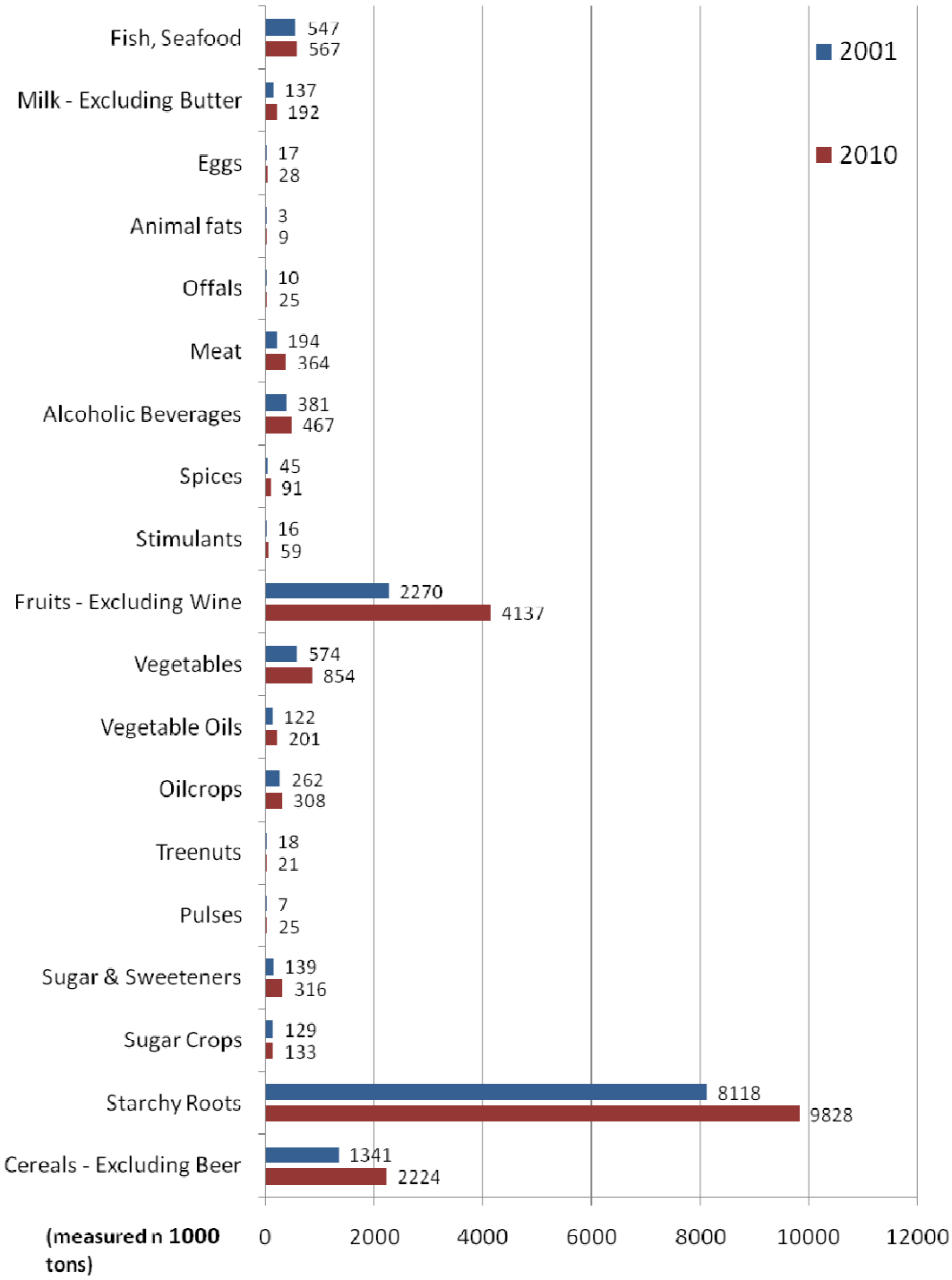
Figure 18: Cumulative development of FP sub-variables, from 2002 to 2010



Source: (FAOstat, 2015)

Contrary to the figure 17 and 18 displaying division of food production variable in accordance to its sub-variables like AP, AI, AE etc., the figure 19 shows how different sorts of food are substituted within the variable of food production. Data are displayed and compared for the outer years of data set; 2001 and 2010. As can be seen when talking about increase of available food within this period, the most significant increase was in fruits; about 1 867 000 tons, starchy roots; about 1 710 000 tons, and cereals; about 883 000 tons. These were followed by vegetable; about 280 000 tons, sugar & sweeteners; about 177 000 tons, and meat; about 170 000 tons.

Figure 19: Food availability composition in 2001 and 2011



Source: (FAOstat, 2015)

3.2 Methodology

The objective of the paper is to analyze whether the chosen macroeconomic indicators of foreign direct investments in agriculture, government expenditure into agriculture, exchange rate and inflation correlate and have statistically significant impact on change of three variables expressing food availability in Ghana; food production, food production per capita and energy supply per capita. This leads to testing three hypothesis in the paper.

3.2.1 Conceptual background

All the three hypothesis are applied to all the three above mentioned variables representing food availability; FP, FSPC and ESPC. The reason for this approach is that each of these variables will provide slightly different information. FP variable will be formulated as the total amount of available foodstuff used as food, measured in 1000 tons of food material and shall inform about the above-mentioned independent variables statistically significantly impact the total amount of food which Ghana is, as a state able to produce and provide for its domestic market. FSPC variable will be expressed as the total amount of available food per capita measured in kilograms of food material per person per one year and it will provide information about whether the above-mentioned macroeconomic variables statistically significantly influence the total amount of food available per capita in Ghana and thus impact of high natality on food availability will be involved within the results. ESPC variable will be formulated as the total amount of kilocalories available per capita per day and thus information about nutrient change will be involved within the model, allowing us to measure impacts of given macroeconomic variables on food availability in terms of nutrients, or compare how the change in available kilocalories responds to change in amount of food available per capita.

3.2.2 Determining methodology according to research objectives

First, a correlation matrix will be generated among all the variables involved. It will provide us an answer to the first question of the thesis, whether macroeconomic indicators of FDIA, GEA, EXCHR and INFL correlate or we may say relate to variables expressing food availability within the country, which are FP, FSPC and ESPC. Based on correlation results we will be able to say to which degree change of any single variable is associated with the

change of the others. Moreover, a statistically significant correlation is the fundamental prerequisite for further method.

If the correlation between given macroeconomic indicators and indicators of food availability will be found, mutual relations will be further researched by means of multiple regression analyses. By this method question number two: “Do the selected macroeconomic indicators (FDIA, GSA, EXCHR and INFL) as a whole directly cause the change in the above-mentioned (A) total food production of Ghana for its domestic market, (B) food available per capita in Ghana and (C) caloric energy available per capita in Ghana?” and question number three: “How do the volume of (A) total food production of Ghana for its domestic market, (B) food available per capita in Ghana and (C) caloric energy available per capita in Ghana change if there is a change in any out of the above-mentioned macroeconomic indicators (FDIA, GSA, EXCHR and INFL)?” will be answered.

As mentioned above, the statistical method of Multiple-linear Regression Analyses is used. Multiple-linear Regression analyses is a statistical dependence technique that can be used to analyze the relationship between a single dependent variable and several independent variables. Each independent variable is weighted by the regression analyses procedure. The weights denote a relative contribution of the independent variables to the overall prediction and facilitate the interpretation of the influence of each variable in making the prediction. (Hair et al., 2010) The general form of multi-linear regression analyses can be expressed as: $Y_1 = X_1 + X_2 + X_3 + ... + X_n$ (Hair et al, 2010) where Y represents a dependent variable and X represent independent variables. The exact equation of the multiple regression is then $Y = a + b_1*X_1 + b_2*X_2 + ... + b_n*X_n + e$ (Statsoft, 2016; Hair et al., 2010).

Where

a = Constant number of dependent variable without influence of all independent variables.

b_1 = change in dependent variable associated with change in the first independent variable.

b_2 = change in dependent variable associated with change in the second independent variable.

X_1 = value of the first independent variable.

X_2 = value of the second independent variable.

e = prediction error (residual)

Based on multiple regression results, correlation coefficient (R), coefficient of determination (R^2), standardized regression coefficient (b*) and unstandardized regression coefficient (b) will be calculated.

The multiple correlation coefficient (R) indicates the strength of the association between set of independent variables as a whole and a given dependent variable. The value can range from +1 to -1, where +1 indicates a perfect positive relationship (meaning as the independent variables grow, the dependent variable grows too), where 0 indicates no relationship, and where -1 indicates a perfect negative relationship (meaning as the independent variables grow, the dependent variable decreases) (Hair et al., 2010).

The coefficient of determination (R^2) measure the proportion of variance of the dependent variable that is explained by the independent variables set as a whole. The coefficient can vary between 0 and 1. The higher the value of R^2, the greater the explanatory power of the regression equation (Hair et al., 2010).

The standardized regression coefficient (b*) express the amount of change in dependent variable for one-unit change in the independent variable, when all of the variables have been standardized.

The unstandardized regression coefficient (b) express the amount of change in dependent variable for one-unit change in the independent variable in their original units.

3.2.3 Methodological Constraints

In order to be able to perform multiple regression analysis, several preconditions have to be fulfilled. Firstly, the correlation between independent variables and respective dependent variable has to exist, that indicates existence of mutual relationship. Secondly, the collinearity among individual independent variables should not be present, because each independent variable should express different dimension of impact to dependent variable. (Hair et al, 2010). Thirdly, the data have to have outliers and missing data treated and have to fulfill requirements for normality, linearity and homoscedasticity. Considering all those conditions, several problems occurred and so had to be dealt with.

3.2.3.1 Collinearity and Correlations

Firstly, as can be seen in figure 18 below, severe collinearity has been indicated between EXCHR and FDIA and between EXCHR and GEA. It has been indicated by creation of correlation matrix and consequently verified by calculation of tolerance. Correlation matrix showed that EXCHR correlated with FDIA and GEA by 82% and 84% respectively. Tolerance for EXCHR has been calculated by expressing the degree to which EXCHR is explained by the set of other independent variables. It is done in two steps 1, calculation of R^2 for EXCHR as dependent variable and INFL, FDIA and GEA as independent variable. 2, Tolerance is then calculated as 1 - R^2. High value of the tolerance means small degree of collinearity (Hair et al., 2010). In our case, tolerance for EXCHR = 1 – 0.858 = 0.142. It means that just about 14% of EXCHR variable is unexplained by other independent variables. That indicates high degree of collinearity.

Application of log transformation, power transformations, and Principal Component analysis were considered in order to deal with multicollinearity. Log and power transformations were not used, as they appeared as ineffective or more distortive then helpful for the model. Principal Component analysis was not used, as it would disallow interpretation of standardized and unstandardized regression coefficients, expressing the impact of single changing independent variable on dependent variable, which is the primary output of the paper. For these reasons, EXCHR variable has been omitted from the model. Otherwise, the multicollinearity among variables would deform the model by reducing any single independent variable's predictive power by an extent to which it is associated with the other independent variable. (Hair et al., 2010).

Secondly, INFL variable appeared as non-correlating with neither of dependent variables as can be seen in table 9 below, that indicates no relationship between INFL and dependent variables and thus INFL variable has been omitted from the model.

Table 9: Correlation matrix of FDIA, GEA, EXCHR, INFL, FP, FDSPC and ESPC

Variable	Marked correlations are significant at p < .05000 N=10						
	FDIA	GEA	EXCHR	INFL	FP	FSPC	ESPC
FDIA	1.000000	0.605032	0.816037	-0.267465	0.723231	0.719343	0.738397
GEA	0.605032	1.000000	0.839831	-0.193538	0.974945	0.939757	0.957548
EXCHR	0.816037	0.839831	1.000000	-0.289975	0.922512	0.921702	0.929489
INFL	-0.267465	-0.193538	-0.289975	1.000000	-0.221203	-0.303168	-0.159095
FP	0.723231	0.974945	0.922512	-0.221203	1.000000	0.983129	0.993579
FSPC	0.719343	0.939757	0.921702	-0.303168	0.983129	1.000000	0.974645
ESPC	0.738397	0.957548	0.929489	-0.159095	0.993579	0.974645	1.000000

When a number approaches to +-1 strong positive or negative correlation is indicated. When a number approaches to 0, there is no significant correlation. Correlations which are statistically significant are marked by red.

3.2.3.2 Handling missing data and outliers

Only one extreme outlier and no missing data have been found in all data set. The extreme outlier point has been identified in FDIA variable for specific year of 2010 as can be seen in figure 19 below, where we can see Box Plot of FDIA variable with median marked by small square, upper and lower quartiles displayed as the box around the square, uppermost non-outlier values marked by whiskers and extreme value marked by star. The extreme outlier has been identified as abnormality within the data set, disturbing the model and thus it was substituted by highest possible non-outlier range, which is number 102.42. In figure 20, we can see Box Plot for the same variable after extreme outlier substitution. No outliers neither extreme outliers can be found there.

Figure 20: Box Plot of the FDIA variable with extreme outlier

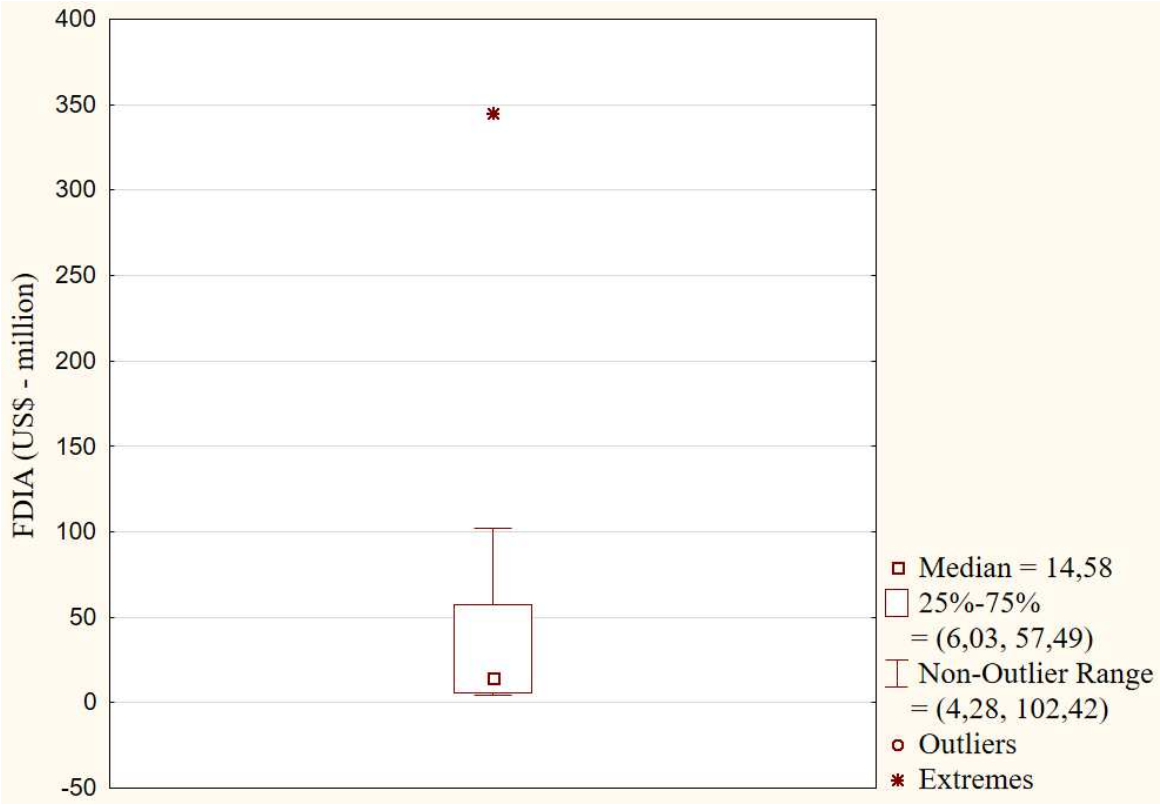
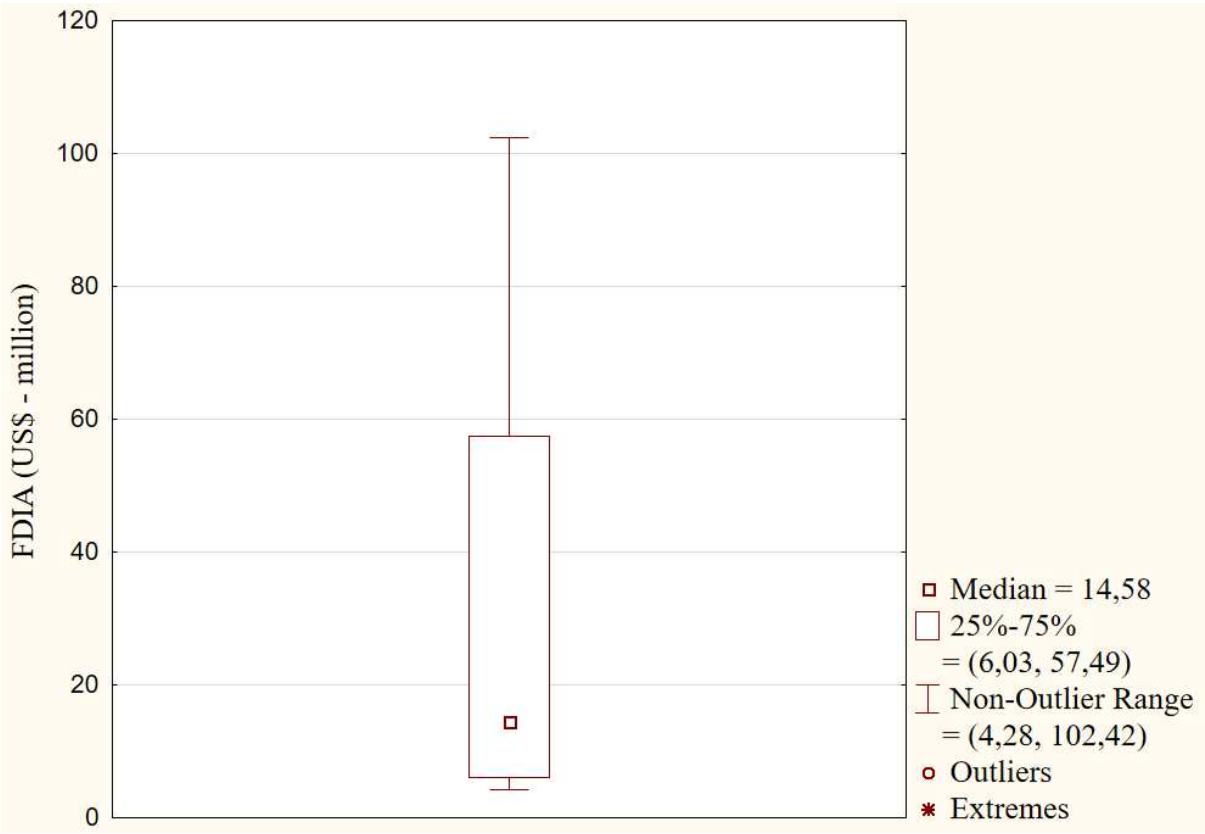


Figure 21: Box Plot of the FDIA variable after outlier substitution



3.2.3.3 Normality, linearity, homoscedasticity

As can be seen in table 10 below, data of FDIA, GEA, FP, FSPC and ESPC variables used in the thesis are not from its nature ideally distributed. Slightly higher skewness or kurtosis is present in each of these variables. Skewness and kurtosis analyses, is testing normality of data distribution of each variable. High skewness means lack of symmetry in the data set. High kurtosis refers to high degree to which the distribution is peaked. Both may deform the real impact of variables and so disturb the model. (Siegrist, 2015) The skewness and the kurtosis were analysed for all dependent and independent variables involved in the multiple regression analyses. Generally, skewness and kurtosis between values -1 and +1 is desirable. As can be seen in table 10 below, obtained values are slightly higher. Nonetheless, the data were not transformed, as the values between -2 and +2 are still considered as acceptable by some researchers in order to prove normal univariate distribution (George & Mallery, 2010 as cited in ResearchGate, 2014; Trochim & Donnelly, 2006 as cited in ResearchGate, 2014).

Table 10: Skewness and kurtosis coefficients for FDIA, GEA, FP, FSPC and ESPC

Variable	Skewness	Kurtosis
FDIA	1.142414	-0.24075
GEA	-0.130665	-1.44838
FP	0.323093	-1.33267
FSPC	0.598115	-1.45396
ESPC	0.397392	-1.22249

Considering linearity there is a linear dependency between dependent and independent variables. Considering homoscedasticity, all variables have been standardized within the multiple regression analyses by Zscore (Hair et al., 2010).

$Zscore= (x - x_m)/Sx$

Where x represents the value of the variable per individual year, x_m represents mean of the variable and Sx represents standard deviation of the variable.

Considering normality, linearity, and homoscedasticity, all expectations about the data set have been fulfilled.

4 Results

There were three hypothesis tested by methods of correlation analyses and multiple regression analyses in the diploma thesis.

4.1 Hypothesis one results

The first hypothesis is asking the following question: „Is there correlation between selected macroeconomic indicators (FDIA, GSA, EXCHR and INFL) with above mentioned (A) total food production of Ghana for its own domestic market, (B) amount of food available per capita in Ghana and (C) caloric energy available per capita in Ghana?"

To test this hypothesis, the correlations of four macroeconomic indicators (FDIA, GEA, EXCHR and INFL) with variables of FP, FSPC and ESPC were examined. According to the results FDIA, GEA and EXCHR are statistically significantly correlating with all three dependent variables; FP, FSPC and ESPC. Correlations of FDIA, GEA, and EXCHR with FP, FSPC and ESPC are in all 9 cases positive so when FDIA, GEA or EXCHR (nominal) grows, FP, FSPC and ESPC grows too. Contrary to that the macroeconomic indicator of INFL does not correlate significantly neither with FP or FSPC nor with ESPC, as correlation coefficients do not exceed value of 0.6 in any case. All correlation values can be seen in detail in the table 11 below.

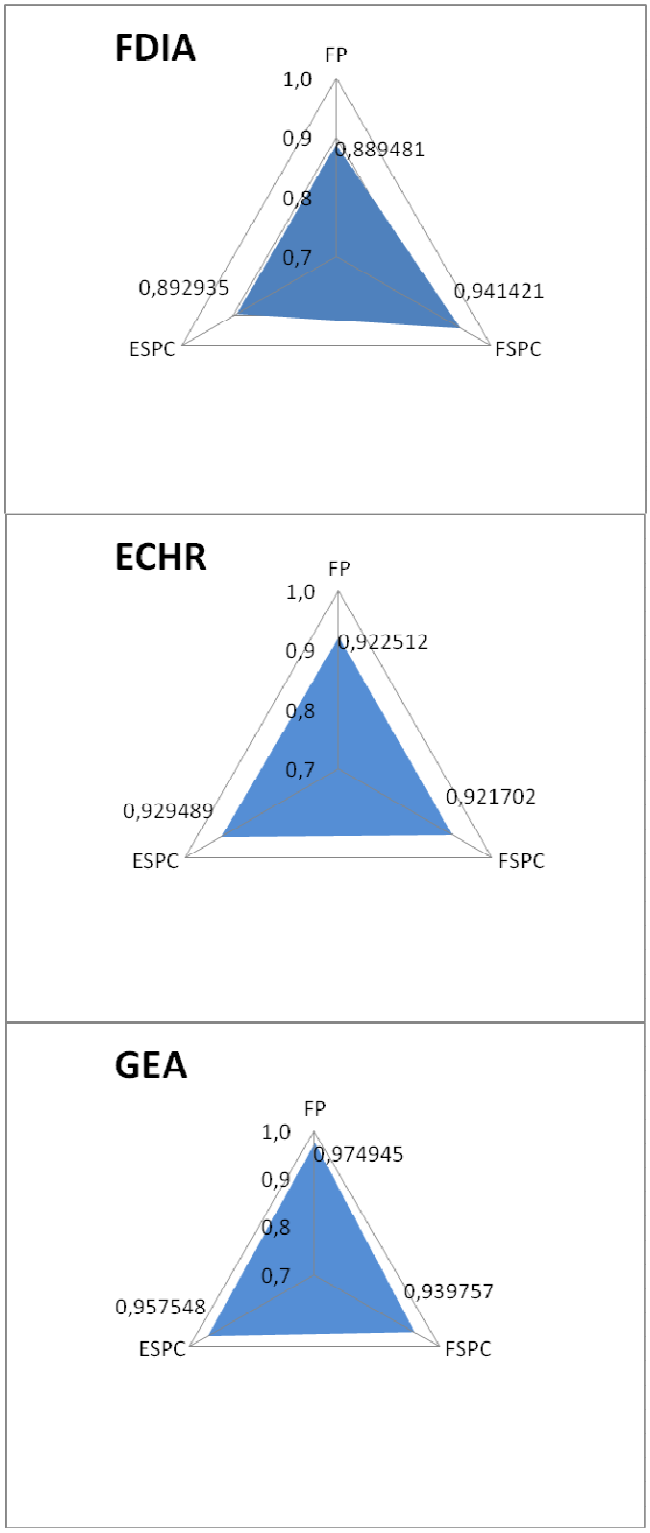
Table 11: Correlation matrix of macroeconomic indicators (FDIA, GEA, EXCHR, INFL) with food availability indicators (FP, FSPC, ESPC)

variable	FP	FSPC	ESPC
FDIA	0.889481	0.941421	0.892935
GEA	0.974945	0.939757	0.957548
EXCHR	0.922512	0.921702	0.929489
INFL	-0.221203	-0.303168	-0.159095

As can be seen from table 11 above FDIA correlate with each food availability variable by the value at least 0.88 in all three cases. GEA correlate with each food availability variable by the value at least 0.93 in all three cases and EXCHR correlate with each food availability variable by at least 0.92 in all three cases. In all 9 cases correlations are very strong.

All statistically significant correlations are graphically displayed at beam graphs in figure 22 below.

Figure 22: Correlation beam graph of FDIA, GEA, EXCHR with FP, FSPC, ESPC



The further the vertex of triangle is from the centre of graph, the more significant correlation of given macroeconomic indicator (FDIA, GEA, EXCHR or ESPC) with given

variable is present. Colours express the nature of correlation. Blue colour stands for positive correlation, red colour stands for negative correlation.

Obtained results indicate that the hypothesis number one has been confirmed for three out of four macroeconomic indicators (FDIA, GEA and EXCHR). Contrary to that, the thesis number one has been rejected for the fourth variable (INFL). In other words, hypothesis one confirms that changing volume of available food is interconnected to changing value of macroeconomic indicators of FDIA, GEA and EXCHR. Thus, when macroeconomic indicators grow, volume of available food grows too and vice versa.

4.2 Hypothesis two results

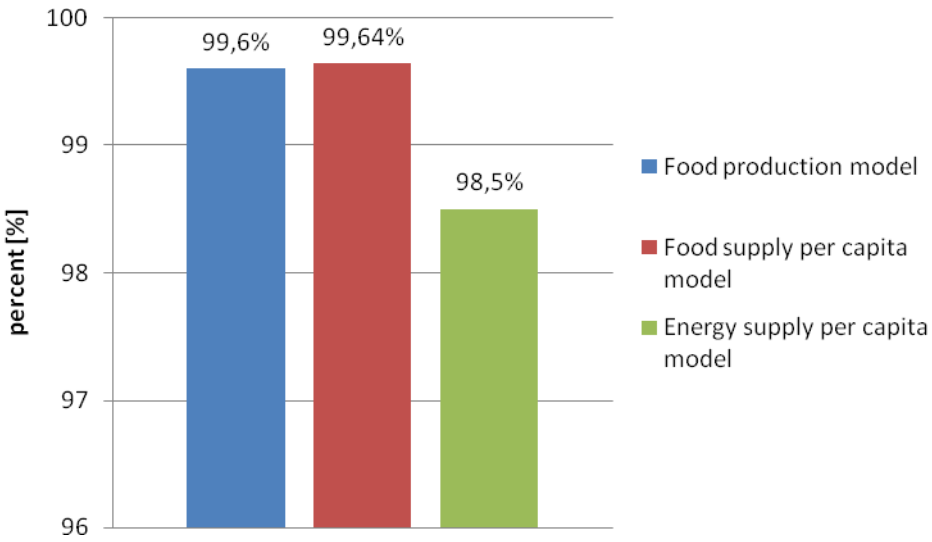
The second hypothesis articulates: „Do selected macroeconomic indicators (FDIA, GSA, EXCHR and INFL) as a whole directly cause the change in above mentioned (A) total food production of Ghana for its domestic market, (B) food available per capita in Ghana and (C) caloric energy available per capita in Ghana?"

To test this hypothesis, a multiple regression analysis has been used. Two macroeconomic indicators (FDIA and GEA) were stated as suitable for involvement in multiple regression analysis as independent variables. Other two (EXCHR and INFL) were excluded.

By method of multiple regression two coefficients were calculated. A) Correlation coefficient (R) has been calculated, measuring the strength of the association between set of independent variables and one dependent variable (Hair et al., 2010). B) Coefficient of determination (R^2) has been calculated, measuring proportion of the variance of the dependent variable that is explained by the set of independent variables (Hair et al., 2010).

Correlation coefficient (R) reached very high and positive values for all three dependent variables, exceeding 99% for FP and FSPC and 98% for ESPC. That indicates that independent variable set as a whole have a strong association to each of all three dependent variables. Detailed values of correlation coefficient for each of three dependent variables can be seen in figure 23 below.

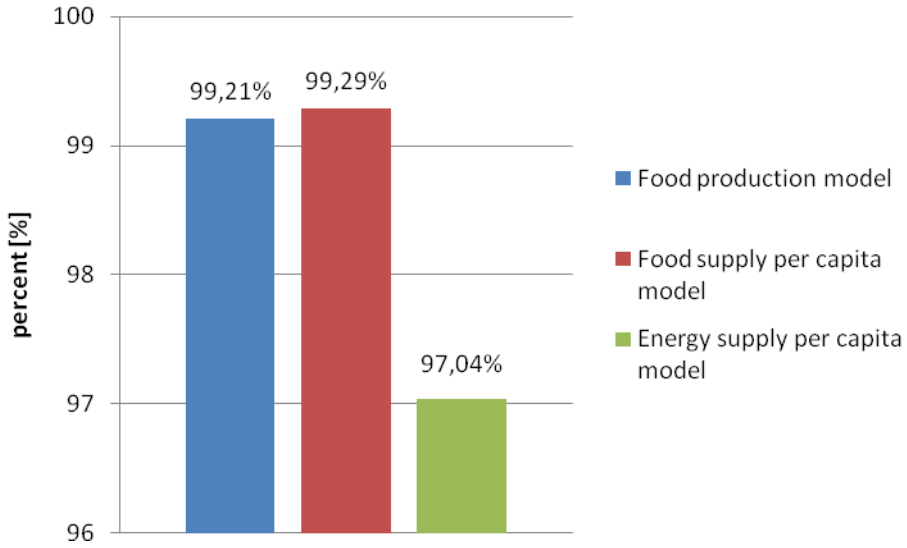
Figure 23: Correlation coefficients of FP, FSPC and ESPC model



Coefficient of determination (R^2) also reached very high values for each of three dependent variables. Values exceeded 99% for the FP and FSPC and 97% for the ESPC model. So more than 97% of variance of each dependent variable has been explained by the set of independent variables. Detailed values of coefficient of determination (R^2) can be seen in figure 24 below.

P-values, indicating whether coefficient of determination (R^2) is significantly different from 0, were in all cases lower than 0.05, which is the necessary condition needed to be fulfilled in order to have reliable model which is statistically significant and really predicting behaviour of corresponding dependent variable.

Figure 24: Coefficients of determination of FP, FSPC and ESPC model



Obtained results indicate that the hypothesis number two has been confirmed for two out of four macroeconomic indicators (FDIA and GEA). Other two macroeconomic indicators (EXCHR and INFL) could not be tested as they did not fulfilled preconditions for given statistical method. INFL did not correlate with dependent variables. Lack of correlation indicates that change in INFL variable is not associated with change in dependent variables and so INFL has no predictive power towards dependent variables. EXCHR on the other hand suffer by multicollinearity with other independent variables. The multicollinearity among independent variables would deform the model by reducing any single independent variable's predictive power by an extent to which it is associated with the other independent variable. (Hair et al., 2010).

Hypothesis number two has been confirmed for macroeconomic indicators of FDIA and GEA. It means that there is a causal relationships between FDIA and GEA as a whole and indicators of food availability. Changing amount of FDIA and GEA as a whole directly causes the change in the overall volume of available food.

4.3 Hypothesis three results

The third hypothesis is asking the following question: „Does the volume of FP variable, FSPC variable and ESPC variable change if there is a change in any macroeconomic indicators of (FDIA, GSA, EXCHR and INFL)?"

As already explained in previous chapter, only two macroeconomic indicators (FDIA and GEA) were stated as suitable for involvement in multiple regression analysis as independent variables. Other two (EXCHR and INFL) were excluded from the model.

The regression of FDIA and GEA in relation to FP, FSPC and ESPC are described in sub-chapters 4.3.1, 4.3.2, and 4.3.3 respectively.

Three coefficients were calculated for each dependent variable (FP, FSPC, ESPC).

a) Standardized regression coefficient marked as (b*) explaining the change of dependent variable when given independent variable change by 1 and when all other variables within the model are standardized.

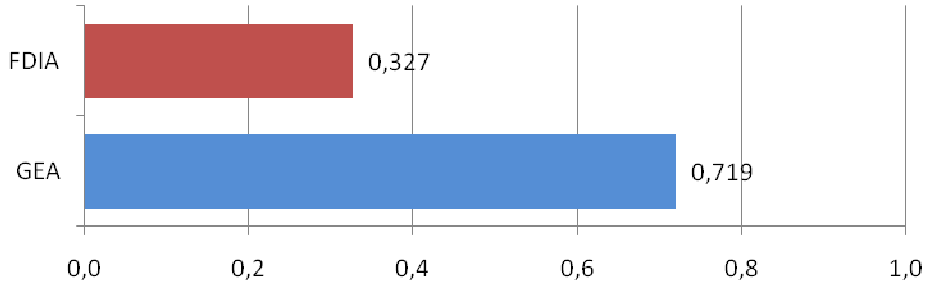
b) Unstandardized regression coefficient (b) explaining the change of dependent variable in its original units when given independent variable change by 1.

c) Intercept (b_0) explaining value of dependent variable if both independent variables would be eliminated.

4.3.1 FP variable

Considering FP variable, impact of two independent variables of FDIA and GEA has been analyzed by method of multiple regression. Both independent variables FDIA and GEA are significantly influencing FP variable. According standardized regression coefficient marked as (b*) explaining the change of dependent variable when given independent variable change by 1 and when all variables within the model are standardized, GEA have with the value of (b*) = 0.719106 the strongest and positive impact on the change of FP. FDIA with the value of (b*) = 0.327187 have the second strongest and also positive impact on the change of FP. Both values of standardized regression coefficient are graphically displayed in the figure 25.

Figure 25: Graph of standardized regression coefficient (b*) for FP model



According unstandardized regression coefficient (b) explaining the change of dependent variable in its original units when independent variable change by 1, when we increase FDIA by 1 in its original units, we get 16.16 increase in food supply measured in original units. So for every 1 million of USD invested into Ghana's agriculture there is in average 16 160 tons increase in country's available food stuff per year. According same coefficient when we increase GEA by 1 in its original units we get 15.14 increase in food supply measured in original units. So for increase of GEA by 1 million of Ghana's Cedi invested in agriculture by Ghana government we get in average 15 140 tons increase in available food supply per year.

The value of intercept (b_0) provides us information what will be the value of FP when both independent variables FDIA and GEA will be zero. As can be seen on table 12 below value of intercept is 13968.48. Therefore, if the value of FDIA and GEA would be zero, there would be still about 13968.48 thousand of tons of food available in Ghana per year.

Values of (b), (b*) and intercept, errors in their estimates and p-values for individual independent variables in relation to dependent variable of FP are shown in the table 12 below.

Table 12: Regression results for FP model

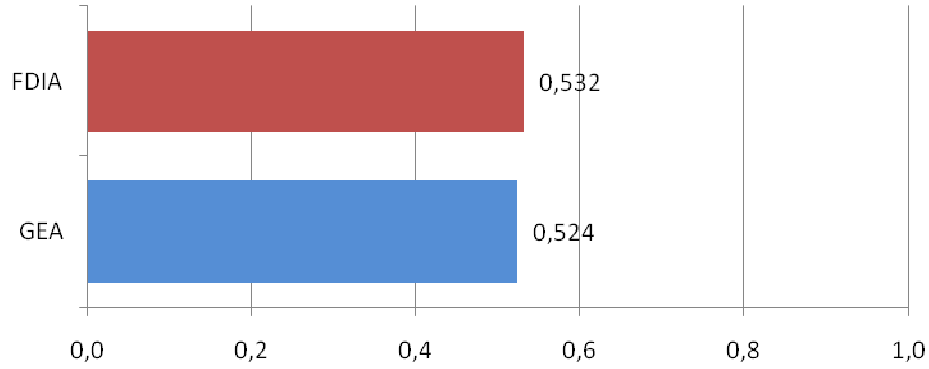
	Regression Summary for Dependent Variable: FP R= 0.99604995 R^2= 0.99211550 Adjusted R^2= 0.98986278 F(2.7)=440.41 p<0.00000 Std. Error of estimate: 195.90					
N=10	b*	Std. Err. Of b*	b	Std. Err. Of b	t(7)	p-value
Intercept			13968.48	133.6738	104.4968	0.000000
FDIA	0.327187	0.053839	16.16	2.6598	6.0771	0.000502
GEA	0.719106	0.053839	15.14	1.1334	13.3566	0.000003

Based on obtained results, the hypothesis three is confirmed for the relationships of FDIA and GEA towards FP. The volume of FP does statistically significantly change depending upon change of individual variables of FDIA or GEA. It means that FDIA individually and GEA individually, directly affect FP.

4.3.2 FSPC variable

Considering FSPC variable, impact of two independent variables of FDIA and GEA has been analyzed by method of multiple regression. Both independent variables FDIA and GEA are significantly influencing FSPC variable. According standardized regression coefficient marked as (b*) explaining the change of dependent variable when given independent variable change by 1 and when all variables within the model are standardized, both independent variables have about the same influence, nonetheless FDIA variable with value of (b*) = 0.531663 have slightly stronger and positive impact to change of food supply per capita (FSPC) variable then GEA. GEA with the value of (b*) = 0.524032 has slightly weaker and also positive impact to change of FSPC. All values of standardized regression coefficient are graphically displayed in the figure 26.

Figure 26: Graph of standardized regression coefficient (b*) for FSPC model



Considering unstandardized regression coefficient (b) explaining the change of dependent variable in its original units when independent variable change by 1; for every increase of FDIA by 1 in its original units we get about 0.4005 increase of food supply measured in original units. So for every 1 million of USD invested into Ghana's agriculture there is a 0.4005 kg per capita per year increase in country's available food stuff per person. Considering GEA, for every 1 unit increase in its original units, we get 0.1682 increase in food available per capita per year. So for every 1 million of Ghana's Cedi invested into Ghana's agriculture by its government there is a 0.1682 kg per capita per year increase in country's available food.

The value of the intercept (b_0) provides an information about what will be the value of FSPC when both independent variables FDIA and GEA will be zero. As can be seen on table 13 below value of intercept is 735.4756. Therefore, if the value of FDIA and GEA would be zero, there would be in average 735.4756 kg of foodstuff available per capita per year.

Values of (b), (b*) and intercept, errors in their estimates and p-values for individual independent variables in relation to dependent variable of FSPC are shown in the table 13 below.

Table 13: Regression results for FSPC model

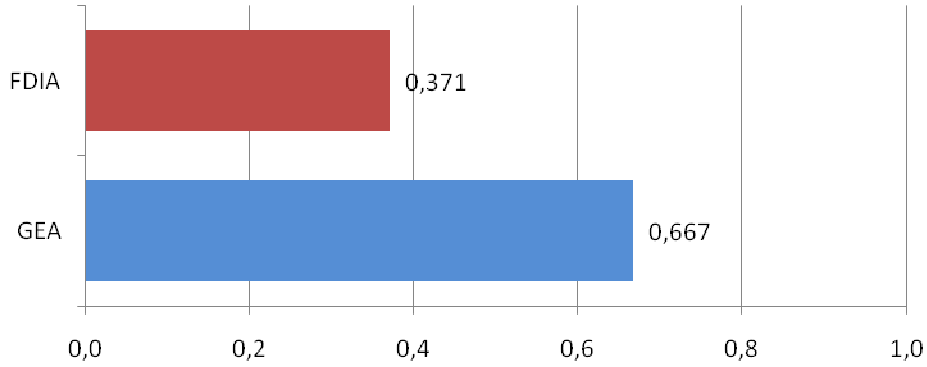
	Regression Summary for Dependent Variable: FSPC (List1 in Regression chart) R= 0.99648474 R^2= 0.99298184 Adjusted R^2= 0.99097665 F(2.7)=495.21 p<0.00000 Std. Error of estimate: 2.8183					
N=10	b*	Std. Err. Of b*	b	Std. Err. Of b	t(7)	p-value
Intercept			735.4756	1.923018	382.4591	0.000000
FDIA	0.531663	0.050795	0.4005	0.038263	10.4668	0.000016
GEA	0.524032	0.050795	0.1682	0.016304	10.3166	0.000017

Based on obtained results, the hypothesis three is confirmed for relationship of FDIA and GEA towards FSPC. The volume of FSPC does statistically significantly change depending upon change of individual variables of FDIA or GEA. It means that FDIA individually and GEA individually, directly affect FSPC.

4.3.3 ESPC variable

Considering ESPC variable, impact of two independent variables of FDIA and GEA has been analyzed by method of multiple regression. Both independent variables FDIA and GEA are significantly influencing FP variable. According standardized regression coefficient marked as (b*) explaining the change of dependent variable when given independent variable change by 1 and when all variables within the model are standardized, GEA with the value of (b*) = 0.667384 has the strongest and positive impact to change of ESPC. FDIA with the value of standardized regression coefficient (b*) = 0.371084 has second strongest and positive impact to change of ESPC. All values of standardized regression coefficient are graphically displayed in the figure 27.

Figure 27: Graph of standardized regression coefficient (b*) for ESPC model



Considering unstandardized regression coefficient (b) of the ESPC model explaining the change of dependent variable in its original units when independent variable change by 1; that for increase of FDIA by 1 in its original units, we get 1.451 point increase of dependent variable expressed in its original units. So for every one million USD invested into Ghana's agriculture there is a 1.451 kcal per capita per day increase in energy supply. For increase of GEA by 1 in its original units we get 1.112 kcal per capita per day increase in available food supply. So for every one million of Ghana's Cedi invested into Ghana's agriculture by its government there is a 1.112 kcal per capita per day increase in energy supply.

The value of intercept (b_0) provides an information what will be the value of ESPC when both independent variables FDIA and GEA will be zero. As can be seen in table 14 below value of intercept is 2509.755. Therefore, if the value of FDIA and GEA would be zero, there would be in average 2509.755 available kcal per capita per day.

Values of (b), (b*) and intercept, errors in their estimates and p-values for individual independent variables in relation to dependent variable of ESPC are shown in table 14 below.

Table 14: Regression results for ESPC model

N=10	Regression Summary for Dependent Variable: ESPC (List1 in Regression chart) R= 0.98509214 R^2= 0.97040652 Adjusted R^2= 0.96195124 F(2.7)=114.77 p<0.00000 Std. Error of estimate: 30.030					
	b*	Std. Err. Of b*	b	Std. Err. Of b	t(7)	p-value
Intercept			2509.755	20.49091	122.4814	0.000000
FDIA	0.371084	0.104306	1.451	0.40772	3.5576	0.009249
GEA	0.667384	0.104306	1.112	0.17373	6.3983	0.000368

Based on obtained results, the hypothesis three is confirmed for relationship of FDIA and GEA towards ESPC. The volume of ESPC does statistically significantly change depending upon change of individual variables of FDIA or GEA. It means that FDIA individually and GEA individually, directly affect ESPC.

4.3.4 Hypothesis three summary

According unstandardized regression coefficient (b) measuring the change of dependent variable when independent variable change by 1 in its original units, FDIA has higher performance than GEA in relation to all three dependent variables FP, FSPC and ESPC. The values are: 16.16 for FDIA while 15.14 for GEA towards FP; 0.4005 for FDIA while 0.1682 for GEA towards FSPC; and 1.451 for FDIA while 1.112 for GEA towards ESPC. Such results might be partly caused by the fact that FDIA is measured in US$ while GEA in Ghanaian Cedi, because US$ has higher exchange rate and purchasing power than Cedi (Quandl, 2016; USDA, 2016). Also the total volume of FDIA for examined 10 years is lower than overall volume of GEA, this may cause that FDIA in its original units come out as stronger variable.

According standardized regression coefficient (b*) measuring the change of dependent variable when independent variable change by 1 in standardized original units values of GEA were higher than values of FDIA in relation to FP and ESPC and on the about same levels in relation to FSPC. In the case of FSPC the difference between the impact of independent variables was within the scope of the standard error. The values are: 0.719 for GEA while

0.327 for FDIA to FP; 0.524 for GEA and 0.532 for FDIA (standard error = 0.05); and 0.667 for GEA while 0.371 for FDIA. Based on these results impact of GEA to food availability is generally higher than impact of FDIA when calculated in standardized units.

Anomaly in results between FDIA and GEA towards FSPC, where impact of GEA is not higher than FDIA as in other two cases, but is on about the same levels, might be caused by increased correlation between FSPC variable with FDIA variable. Such correlation may happened due to fact that there was rare decrease in values of FSPC variable in 2010 caused by massive increase of population in that year. Population growth in 2010 was so high that even there was large increase in overall amount of produced food, when calculated per capita there were less available food than in predecessor year. This reversed growth then better correlated with values of FDIA which has been in 2010 artificially decreased due to outlier and thus made FDIA more significant than in two other cases.

Based on given results from subchapters 4.3.1, 4.3.2 and 4.3.3, hypothesis three is confirmed. Change in FDIA or GEA is causing the change in FP, FSPC and ESPC. It means that FDIA individually and GEA individually, directly and positively affect overall amount of food available in Ghana, amount of food available in Ghana per capita and amount of kilocalories available in Ghana per capita.

4.4 Summary of the results

There were three hypothesis tested by methods of correlation analyses and multiple regression analyses in the diploma thesis. Obtained results indicate that:

a) The hypothesis number one has been confirmed for three out of four macroeconomic indicators (FDIA, GEA and EXCHR). These macroeconomic indicators are statistically significantly correlating with all three variables expressing food availability (FP, FSPC, ESPC). Thesis number one has been rejected for the fourth variable (INFL). INFL variable does not correlate with neither of food availability variable.

b) The hypothesis number two has been confirmed for two out of four macroeconomic variables (FDIA and GEA). These macroeconomic indicators as a whole have a strong (more than 98%) association to each of all three dependent variables FP, FSPC, ESPC. These macroeconomic indicators as a whole also explain most of the variance (more than 97%) of each of all three dependent variables FP, FSPC, ESPC. Other two

macroeconomic indicators (EXCHR and INFL) could not be tested as they did not fulfilled preconditions for given statistical method.

c) The hypothesis number three has been confirmed for two out of four macroeconomic variables (FDIA and GEA). The change in any of these variables have an impact to change in all three variables for food availability FP, FSPC and ESPC. According results GEA have more severe impact in regard to FP and ESPC and about same impact as FDIA in regard to FSPC, when considering standardized regression coefficient. When considering unstandardized regression coefficient, FDIA have more severe impact in all three cases.

Other two macroeconomic indicators (EXCHR and INFL) could not be tested as they did not fulfilled preconditions for given statistical method.

Given results mean, that national food supply is dependent on both sources of financing. FDIA and GEA, both significantly influence the overall volume of available food. In the framework of future agriculture and food security policy, overall volume of both FDIA and GEA should grow or at least remain on the same levels in comparison to previous years in order to keep country's ability to feed its rapidly increasing population. Attention should be focused especially to ratio of volume/performance of individual sources of financing. Fact that performance of FDIA per unstandardized unit is slightly higher than performance of GEA does not mean that overall impact of FDIA to food availability is also higher. According to results of standardized regression coefficient (b*), GEA is in average responsible for about 2/3 of overall food increase in Ghana.

FDIA are much more volatile than GEA. FDIA are more influenced by external factors than GEA. Central government can influence FDIA only indirectly, through artificial stimuli, tax reliefs or improvement of entrepreneurial environment. Contrary, GEA can be directly planned. All these factors have to be considered in the course of formulation of agriculture and food security policy.

According to results, GEA appear as more secure financial source, providing good and reliable financial base to agriculture of Ghana, more or less fairly distributed in individual regions, financing national subsidy projects like for example subsidized fertilizer program (Curtis, 2013), having impact to increased productivity of farmers and small-scale farmers across the whole country. On the other hand quite small portion of GEA goes for investments. According to Curtis (2013) the shares of recurrent and investment expenditure

were 66% and 34%, respectively. In order to back up increase of investments, back up inflows of new technologies, new businesses and new job opportunities, support of FDIA look like as advisable and most efficient approach.

5 Discussion

Results suggest that, among the factors determining food supply as defined by Adom (2014) or Fosu & Heerink (2009) capital invested into agriculture play an important role. Direct influence of FDIA and GEA to overall country food supply has been identified. FDIA and GEA at the national level represent two biggest sources of investments in the country's agriculture. Next to overall volume of investments also source of these investments is relevant as different institutions utilize their investments with different efficiency as can be seen on example of FDIA and GEA.

FDIA has been identified as statistically significantly influencing food availability. In that manner findings of the thesis confirm those of the World Bank (2012 as cited in Franz & Müller, 2015) private sector is crucial to increase food availability and to decrease hunger. Considering impacts of FDIA to increased agriculture output and overall food availability, positive impact of FDIA to food security can be stated in compliance with Kareem et al. (2013), Slimane et al. (n. d.), Tülüce & Doğan (2014), Franz & Muller (2015), or Asante (2004) increased food availability consequently results in reduction of staple food prices and thus have the positive effect to food accessibility. Contrariwise, results of the thesis are in opposition to findings of Djokoto (2011) who claims that FDI does not cause agricultural output growth.

However food availability is just one pillar of food security. So possible negative impact of FDIAs to other pillars should not be ignored and should be further researched. There is several possible negative aspects of FDIA, whose impact to food security were not assessed within the thesis, yet need to be considered in the discussion.

Next to well known „land grabs", there are such arguments as those of Hallam concerning about application of FDI in legally undeveloped countries, Pritchard et al. (2010) concerning about FDIs disrupting effect to pre-existing right to land, water or natural resources, Hallam (2011) concerning about impacts of large purchases of land in food insecure regions for production for export, Wimberley (1992) claiming that reduction of primary sector export dependence promotes domestic food consumption or Clark and Cason (2015) talking about negative effect of foreign capital penetration to country's bargaining position in international trade. All of these are serious arguments, which should be further researched when thinking about FDIAs.

Considering arguments of Akande and Biam that FDI in agriculture has no long run equilibrium influence on agricultural output and that there is just short run positive effect of FDI to agriculture production, the thesis cannot confirm neither disapprove such arguments as the thesis covers too short period.

In addition, GEA has been identified as statistically significantly influencing food availability in all three cases of expression of food availability (FP, FSPC and ESPC). In two out of three cases (FP and ESPC) it performed as more effective source of finance and so displayed more serious impact to food availability than FDIA. In one case (FSPC) impact of FDIA and GEA were equal. GEA impact to food availability in FP and ESPC model was almost twice as much significant as impact of FDIA. Such findings are consistent for example with Ramakumar (2012) talking about impacts of public sector expenditures to agriculture in the context of India or Fosu & Heerink (2009) identifying financial capital and products subsidized by GEA as important factors influencing food availability in Ghana.

At the same time, results did not revealed negative correlations between FDIA and GEA. Such findings are in contrast to arguments of IMF and WB that subsidized agriculture discourages investors to invest. Our findings suggest that no amount of government expenditures, but other factors like for example legal environment, tax regulations, custom barriers, economic progress of the country, country's security, or costs of doing business play more significant role in investors decision making whether to invest in given country or not.

Also correlation of EXCHR with food availability has been identified, which correspond to findings of Adom (2014) and Fosu & Heerink (2009). The direction of causation was not identified due to methodological constrains. According results of the thesis INFL has no statistical impact to food availability in the country.

The results of the thesis in most cases confirm the results from the literature for comparable African countries. Results of the thesis about FDIA confirm the results of Kareem et al. (2013), Asante (2004), Slimane et al. (n. d.), Fosu & Heerink (2009), Hallam (2011), Franz & Müller (2015) or FAO (2003). Contrariwise, results of Djokoto (2011) are in contradiction. The results of the thesis about GEA confirm the results of Fosu & Heerink (2009).

Considering impacts of GEA to food availability in comparable African countries, literature is not as widespread as in the case of FDIA, as most of the researchers do not study

the impact of the GEA as such, but rather focus on the impact of individual agriculture input components, which are on the national level by GEA financed.

It is also important to take in consideration that food security and food availability are complex topics. The manner how statistical models are formulated, which variables are involved and how extent periods are analyzed influence the final figures of the results.

6 Policy recommendations

Results of the paper suggest two important conclusions. First, both FDIA and GEA have statistically significant impact to change in food availability. Second, increase of GEA does not cause decrease of FDIA. We can therefore conclude that increasing amount of government spending to agriculture do not discourages potential agri-food sector investors. Based on these information government of Ghana should be increasing overall volume of both sources of investments and take actions leading to more effective spending and distribution of these financial means in order to promote their impact to food availability and overall food security.

Increase of GEA and its more efficient spending towards increase of food availability can be achieved through following actions:

- First, government of Ghana could each following year allocate to agriculture sector higher amount of funds in real terms than in previous year in order to keep up production of sufficient food supply for its growing population.
- Second, government of Ghana could keep agriculture expenditures on at least 10% of its national budget in long-range perspective. According World Bank (2013) such expenditures should lead to about 6% of annual growth of the agriculture sector, promotion of food security and reduction of poverty within the country.
- Third, budgetary allocations of underfunded subsectors like fisheries or livestock (World Bank, 2013) could be increased in order to be able to achieve its goals.
- Fourth, budgetary allocations to subsectors could be reconsidered in accordance to performance and contribution to national food supply.
- Fifth, government of Ghana could support central purchase of staple food for guaranteed prices, in order to assure basic income of farmers.
- Sixth, government of Ghana could support increase of credit accessibility for staple food farmers through decreased lending rates for staple food agriculture projects.
- Seventh, government of Ghana could support educational program for staple food farmers about efficient farming, plant protection and soil conservation.
- Eighth, government of Ghana could continue to financially support accessibility of basic agriculture inputs and technologies providing increased agriculture yields through

continuous subsidies programs on fertilizers, agro-chemicals, new generations of seed resistant to droughts, basic agriculture tools, machinery, or irrigation.

- Ninth, bigger share of GEA could be directed to three northern regions of Ghana in order to support basic agriculture inputs and technologies and credit accessibility, as these regions suffer the most by poverty and food security.

For increase of FDIA, creation of attractive environment for investments is a priority. Nonetheless as Halam (2009) claims, beneficial flows of FDIA are not automatic. Care must be taken in selection of suitable business models, formulation of investments contracts, and development of appropriate legislative policy. It can be done through following actions:

- First, government of Ghana could focus on eradication of the bureaucratic barriers like perplexity of retrieval of company registration, business licenses residence permits or tax registration and administration.
- Second, government of Ghana could increase its effort in eradication of long delays, corruption and uncertainty in its bureaucratic system.
- Third, government of Ghana could increase its expenditures on development of rural infrastructure in order to ease access to markets from rural areas.
- Fourth, government of Ghana could provide incentives and tax reliefs for companies investing in desired agriculture subsectors, investing in desired regions of Ghana or for companies supporting joint ventures with local farmers.
- Fifth, government of Ghana could conduct series of studies in order to decide what are the suitable business models for incoming FDIA with regard to their long-term impacts on food security, poverty reduction, unemployment and local environment.
- Sixth, government of Ghana could conduct regular monitoring based on clearly defined indicators about the impacts of FDIA to food availability, unemployment and reduction of poverty.
- Seventh, government of Ghana could pay increased attention within the negotiations to interests of all stakeholders influenced by FDIA projects. Land grabs could be avoided and substituted by appropriate compensations in the form of artificial agriculture land of the same quality and specific amount of financial means, which could be claimed by affected rural population.

7 Conclusion

The diploma thesis studied the issue of food availability in Ghana. The aim of the thesis is to analyze which of the selected macroeconomic indicators have a statistically significant impact to increase of food availability in the country. There were four macroeconomic indicators selected for the purpose of the; Foreign Direct Investments to agriculture (FDIA), government expenditures on agriculture (GEA), foreign exchange rate (EXCHR) and inflation (INFL). Ghana's national food availability was expressed by three different variables; as a total amount of food available in Ghana per year (FP), as an amount of food available in Ghana per capita per year (FSPC) and as a number of kilocalories available in Ghana per capita per day (ESPC).

The aim of the thesis has been fulfilled by testing of three hypotheses. 1) There is a correlation between selected macroeconomic indicators and variables representing food availability 2) Selected macroeconomic indicators cause the change in variables representing food availability 3) The volume of available food change if there is a change in any of the macroeconomic indicators. Statistical methods of correlation analyses and multiple regression analyses have been used. Statistics have been calculated in Statistica software.

All three hypotheses have been confirmed for macroeconomic indicators of FDIA and GEA. According to provided results these two macroeconomic indicators are connected with chosen food availability indicators and are significantly influencing their change.

FDIA and GEA do statistically significantly correlate with variables of FP, FSPC and ESPC. FDIA correlate with each food availability variable by the value at least 0.88 in all three cases. GEA correlate with each food availability variable by the value at least 0.93 in all three cases. FDIA and GEA together are associated with three food availability variables by more than 98% and explain more than 97% of their variance. Also, change in any single variable of FDIA and GEA cause significant change in all three food availability variables. According unstandardized regression coefficient (b) measuring the change of dependent variable when independent variable change by 1 in its original units, FDIA has higher performance than GEA in all three models. The values are: 16.16 for FDIA while 15.14 for GEA to FP; 0.4005 for FDIA while 0.1682 for GEA to FSPC; and 1.451 for FDIA while 1.112 for GEA to ESPC. This might be partly caused by the fact that FDIA are measured in US$ while GEA in Ghanaian Cedi. As unstandardized regression coefficient (b) measure the impact of independent variable in original units. Changing exchange rate can have impact to

this relationship. In addition, total volume of FDIA for examined 10 years is lower than overall volume of GEA this may cause that FDIA in its original units come out as stronger variable.

According standardized regression coefficient (b*) measuring the change of dependent variable when independent variable change by 1 in standardized original units values of GEA were higher than values of FDIA in relation to FP and ESPC and on the about same levels in relation to FSPC. In the case of FSPC the difference between the impact of independent variables was within the scope of the standard error. The values are: 0.719 for GEA while 0.327 for FDIA to FP; 0.524 for GEA and 0.532 for FDIA (standard error = 0.05); and 0.667 for GEA while 0.371 for FDIA. Based on these results impact of GEA to food availability is generally higher than impact of FDIA when calculated in standardized units.

Anomaly in results between FSPC and FDIA variable might be caused by increased correlation between FSPC variable with FDIA variable. Such correlation happened mainly due to fact that there was rare decrease in values of FSPC variable in 2010 caused by massive increase of population in that year. Population growth in 2010 was so high that even there was large increase in overall amount of produced food, when calculated per capita there were less available food than in predecessor year. This reversed growth then better correlated with values of FDIA which has been in 2010 artificially decreased due to outlier and thus made FDIA more significant than in two other cases.

For macroeconomic indicator of EXCHR only first hypothesis was confirmed. Due to too high collinearity with other independent variables of FDIA and GEA, which is undesirable in multiple regression analyses, EXCHR variable had to be excluded from the model. For those reasons hypothesis two and three were neither confirmed nor denied for EXCHR variable.

For macroeconomic indicator of INFL all three hypotheses have been denied. Methods used did not approve that INFL variable is significantly associated with any dependent variable, neither FP nor FSPC or ESPC.

The thesis evaluated influence of the macroeconomic indicators to food availability in Ghana. Special attention has been addressed to foreign and private investments, to their individual and common impact to food availability and to their mutual relation. It might be interesting to fasten to the thesis by examining the relationship between food availability and food prices or by analyses of impacts of FDIA and GEA to food accessibility.

The thesis might be understood as an alternative perspective to the issue of food availability and possible source of inspiration for policy makers acting in this field. The thesis would especially recommend to continue increasing of GEA in real terms, to keep GEA above at least 10% of national budget, to continue supporting the access to credits, agriculture inputs and technologies through subsidy programs, to reduce bureaucratic barriers for FDIA inflows, to increase expenditures for development of rural infrastructure and to provide tax reliefs and incentives for new progressive agricultural businesses.

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